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On Wargaming

How Wargames Have Shaped History and How They May Shape the Future

Matthew B. Caffrey Jr.

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To my wife Gail and our very adult children:
Kathleen, Kelly, Matthew, and Kristine

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Preface

This book answers questions you've probably never thought to ask—such as:

- What do Ronald Reagan and Bobby Kennedy have in common? (They both participated in top-secret wargames.)
- How many times was Pearl Harbor attacked by air on a Sunday morning? (At least three times; first in 1932 by the U.S. Navy during a live wargame, then in October 1941 by the Imperial Japanese Navy during an operations planning wargame, and finally on 7 December 1941 by "naval and air forces of the Empire of Japan.")[1]
- Which came first, civilization or wargaming? (A trick question: it appears that civilization and wargaming began at the same time and place.)

This preface answers three more-serious questions about this book: why you should read it, why I wrote it, and how it was created.

Why Should You Read This Book?

If you are simply interested in reading something that is both entertaining and "time well spent," that's a good enough reason to read this book. Along the way you will learn about H. G. Wells's least accurate (or, we hope, most premature) prediction. You will meet military mavericks and learn the rest of the story on historical events you probably think you already know.

If you are serving in the military and are looking to discharge your duties at a lower cost in blood, time, and treasure, you should read this book. If you are a new private, a senior general, or a political appointee, you will find in this book insights relevant at your level.

If you are a parent concerned about the level of violence in video games and the increasingly competitive world your children live in, this book is for you. I describe how parents can use wargaming to help their children develop their ability to think strategically and compete effectively.

If you are a voter looking to have a better understanding of national defense, this book shows you how many key decisions are made.

If your business is business, this book describes the increasingly widespread use of wargame-like techniques in that world. At a time when businesses are competing with not only companies down the street but also government-owned companies halfway

around the world, businesspeople need every edge they can get. The techniques described in this book can provide an important one.

If you are interested in helping to build a more prosperous, peaceful world, you'll find in my conclusion an assertion that while wargames have long been used to make victory more likely, they have the potential to help make peace more enduring as well.

Why Did I Write the Book?

I started this book for a utilitarian reason: in 1997, I needed a text for my Air Force Air Command and Staff College elective on wargaming. I kept working on it for different reasons. As I researched the history of wargaming, I became more and more convinced that wargaming was an exceptionally powerful tool. Wargaming has had a huge impact, for good and for ill, on the shape of the world in which we live today. Unfortunately, the people who had a major impact on wargaming itself are unknown not only to the general public but also, largely, to today's military. This struck me as both unjust and dangerous. I also observed that the art, science, and application of wargaming are not always passed on to the next generation. History seems to show that, when used effectively, wargaming provides a powerful advantage, while wargame amnesia contributes to higher casualties.

This led to another realization—that it would not be enough simply to tell the story of wargaming. Even if the story convinced readers to wargame, gaming in itself would not ensure success. It was clear from my research that wargaming had become global, that our adversaries would almost inevitably be wargaming too. I needed to write a book to help our side gain greater value from wargaming than that gained by our adversaries.

As I worked to complete the book, I developed a final motive. I became convinced that wargames—or, more broadly, simulation gaming techniques—could be valuable tools for other purposes. Wargame-like techniques could help us compete more effectively economically, ultimately enabling us to afford a more effective defense. Ultimately, wargames could also help develop strategists committed to, and strategies for, a more peaceful and prosperous world.

How Was This Book Developed?

If success has a thousand fathers, this book should be very successful. I gave my first talk on the history of wargaming at the Origins wargaming conference in 1990.[2] I've given an updated version of that talk several times every year since, at venues ranging from the German War College to the Pentagon. I frequently picked up leads from my listeners.

Further, from 1997 until 2005 I taught the wargaming elective at the Air Force's Air Command and Staff College. My fellow instructors, guest lecturers, and students

provided many remarkable insights that have shaped my current thoughts on the potential of wargaming and on game techniques in general.

I have received the most valuable insight and encouragement, however, from participants at the wargaming community's annual gathering, Connections. Since 1993 Connections has brought together academic and recreational wargame practitioners and military people from every service, from across the United States and around the world. Finally, my colleagues throughout the U.S. and allied militaries—especially Headquarters, U.S. Air Force, the Air Force Materiel Command, and the Air Force Research Laboratory—have taught me much about wargaming and its applications.

So, while the acknowledgments section thanks many who helped over the decades, the real list is much longer. This book is truly the work of the wargame community. Still, any misquotes or misinterpretations are mine alone.

So, What's Next?

The introduction starts with a description of a fairly recent wargame, one that shaped the world we live in today. Next there is a quick "Wargaming 101" description of wargaming, for a basic understanding of principles and vocabulary. It concludes with my case for the systematic use of history.

Part 1, "The History of Wargaming," takes up the bulk of the book and is its heart. It traces the impact of wargames on history from the earliest civilizations to the time of this writing. Along the way it introduces the men who have had impact on wargaming and also wargames that, in turn, have influenced history.

Part 2 is the payoff—how to get the most value from wargaming. It explains why wargaming is effective and how leaders, practitioners, and participants can increase that effectiveness. Finally, it describes how people, from parents to presidents, can use wargames to support their specific needs.

The conclusion begins with a brief look back and then asks, How do we *want* wargaming to evolve in the future? It then suggests a way wargaming *could* evolve, from a tool to help win wars to one to help avoid war in the first place. The book closes with an illustration of such a use of wargaming, to help achieve the highest form of victory—a just and lasting peace.

MATT CAFFREY
Dayton, Ohio
2017

Notes

1. In addition, such an attack was described in several books written before 1941, including one by Billy Mitchell.
2. Origins is an international gaming conference overseen by the Game Manufacturers Association.

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No one who works on a book for twenty-five years can remember all who helped. It is even more difficult in my case because I have received so much help from so many. Here is a partial list.

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Finally, my thanks to all who came up after my talks on wargaming and told me something I did not know.

List of Acronyms, Abbreviations, Terms, and Jargon

A

A2/AD	antiaccess / area denial
A5SW	Wargaming Division (Headquarters, U.S. Air Force)
AAM	air-to-air missile
AAN	Army After Next
AB	air base
ABACUS	Advanced BAttlefield CompUter Simulation (United Kingdom)
ABCA	American, British, Canadian, Australian, and New Zealand Armies Program
ABSG	Army Battle Simulation Group (Australia)
ACC	Air Combat Command
ACE	Advanced Concepts Event
ACES	Air Force Command Exercise System
ACSC	Air Command and Staff College
ACTS	Air Corps Tactical School
ADFWC	Australian Defence Force Warfare Centre
adjudication	Determination of the net effect of Blue and Red actions during a wargame
AETC	Air Education and Training Command
AFAMS	Air Force Agency for Modeling and Simulation
AFB	Air Force Base
AFGSC	Air Force Global Strike Command
AFMC	Air Force Materiel Command
AFRL	Air Force Research Laboratory

AFSAA	Air Force Studies and Analysis Agency
AFSPC	Air Force Space Command
AFWC	Air Force Wargaming Center
AFWI	Air Force Wargaming Institute
AH	Avalon Hill Games Inc.
AI	artificial intelligence
alt force	Alternative force, i.e., different from a baseline/programmed force structure
AMC	Air Mobility Command
AMD	antimissile defense
AMSO	Army Models and Simulation Office
analysis	In wargame context, the effort to derive insights from wargame outcomes through quantitative means
analytical wargame	Wargame designed and conducted in such a way to maximize its contribution to a larger analytical effort
AOR	area of responsibility (often the theater of combat)
AOSI	Army Office Staff Instruction (Australia)
AP	airport
APS	Air and Space Power Symposium
ARGUS	Advanced Real-Time Gaming Universe Simulation
ARPA	Advanced Research Projects Agency
ASM	air-to-surface missile
assessment	Qualitative process of drawing lessons from wargame outcomes. Distinct from adjudication
ASW	Army Simulation Wing (Australia)
attrition	Loss of personnel or equipment. Losses are typically either permanent (death/sinking) or temporary (sickness, wounds/breakdowns, battle damage)
attrition warfare	Style of warfare that focuses on gaining an advantage by inflicting disproportional attrition of the adversary

AWGC	Army War Gaming Centre (Australia)
AWL	Airborne Weapons Layer (developmental air-launched layer of AMD)

B

BBS	Brigade/Battalion Battle Simulation
BCTP	Battle Command Training Program
BDA	Battle Damage Assessment (estimate of physical damage—not indirect effects)
BEF	British Expeditionary Force
BGWG	Battle Group Wargame
Blue team	Friendly forces
board wargame	Wargame conducted using a map (often mounted), counters (typically cardboard), printed rules/tables, manual random-number generators (dice), and a live opponent (almost always)
BOGSAT	"Bunch of Guys Sitting around a Table," i.e., adjudication through judgment
branch plan	Supplement to the main plan that is activated if anticipated but not expected conditions are met
break points	Conditions (mainly casualties) that cause a unit to cease its current function. Units on attack go over to the defense, units on defense run

C

C2	command and control
C4ISR	command, control, communications, computers, intelligence, surveillance, and reconnaissance
CAA	Center for Army Analysis
CAD	Conflict Analysis Division
CADRE	College of Aerospace Doctrine, Research and Education
CAMMS	Computer Assisted Map Maneuver System
CAPE	Cost Assessment and Program Evaluation (OSD)

CAS	close air support (a.k.a. joint counterland operations)
CASL	Center for Applied Strategic Learning
CAST	Command and Staff Training (United Kingdom)
CATT	Combined Arms Tactical Trainer (United Kingdom)
CCTT	Close Combat Tactical Trainer
CENTCOM	U.S. Central Command
CFACC	combined forces air component commander
CFC	combined forces commander
CFLCC	combined forces land component commander
CFMCC	combined forces maritime component commander
CFSOCC	combined forces special operations component commander
CGSC	Command and General Staff College
CIA	Central Intelligence Agency
CJCS	chairman of the Joint Chiefs of Staff
CJTF	commander, joint task force
closed game	Wargame in which Blue and Red teams know only what they would know under similar real-world conditions
CM	cruise missile
CNO	Chief of Naval Operations
COA	course of action (typically basic strategy options)
COA wargame	Relatively "quick and dirty" wargame conducted to explore, typically, three COAs to clarify the likely outcomes of each before a final strategy is selected
COCOM	combatant commander
combined	Force, operation, or commander with elements of multiple countries
complexity	In wargame terms, the breadth of factors considered
computer wargame	Wargame conducted using a computer. Adjudication rules and random-number generation are programmed.

	Opponents are either directed by an artificial-intelligence routine or live via network
CONARC	Continental Army Command
CONOPS	concept of operations
Control cell	Element of the White team that is in charge of the wargame
COSS	Center for Operational and Strategic Studies (Soviet)
COTS	commercial-off-the-shelf
CPX	command-post exercise
CRES	Command Readiness Exercise System
CRT	Combat Results Table (used in stochastic determination of outcomes)
CS21	"A Cooperative Strategy for 21st Century Seapower"
CSE	Central Studies Establishment (Australia)

D

DARPA	Defense Advanced Research Projects Agency
DCA	defensive counterair (the defense of friendly airspace)
DDWSA	Deputy Director for Wargaming, Simulation and Analysis
DEAD	destruction of enemy air defenses
decision cycle	Process followed to make and implement a decision during armed conflict
decision-support wargame	Wargame designed and conducted in such a way as to maximize relevance, accuracy, and timeliness of insights provided to decision makers
design	Basic architecture of a wargame; typically reflects decisions on type, scenario, complexity, granularity
design elegance	Extent to which game design maximizes accuracy while minimizing difficulty of execution
deterministic	Method of adjudication that attempts to establish the single most likely outcome and does not vary it

DMSO Defense Modeling and Simulation Office

DoD Department of Defense

Dstl Defence Science and Technology Laboratory (United Kingdom)

DVTE Deployable Virtual Training Environment

DWG Divisional Wargame (United Kingdom)

E

EADSIM Extended Air Defense Simulation

EBO effects-based operations

EBW Entropy Based Warfare (game)

educational wargame Wargame designed and conducted in such a way as to maximize effectiveness of the wargame as an aid to education. Effectiveness depends on the optimum trade-off between relevance, accuracy, and time needed

ENWGS Enhanced Naval Wargame System

epoch year Year in which the scenario of a wargame is set

EW electronic warfare; Expeditionary Warrior (game) [followed by two-digit year]

EWR early-warning radar

exercise Military maneuver or simulated wartime operation. May or may not also be a wargame depending on the presence of a Red team and adjudication of outcomes

experiment Test under controlled conditions intended to prove or disprove a hypothesis. Wargames are *not* experiments, as they are not controlled—Blue and Red can choose options that they decide best serve their interests

experimentation Multifaceted program that explores options for innovation. Wargaming can be one element of experimentation

F

facilitator Individual assigned to a team or cell to improve its effectiveness. A facilitator may be an individual who is an expert on the software the team/cell will use or an individual to mentor the team lead

FASOC	Future Air and Space Operating Concepts (RAF wargame) [or with two-digit year]
FCC	functional combatant commander (joint functional command, e.g., USTRANSCOM)
FFRDC	federally funded research and development corporation
FG	Futures Game (Aerospace Future Capabilities Wargame) [or followed by two-digit year]
fidelity	Degree to which the modeling, simulation, and wargaming reproduce the real world (*see* realism)
FOB	forward operating base
fog of war	Uncertainty about friendly, adversary, and environmental conditions experienced by leaders in armed conflict
friction	Propensity of unexpected delays to occur during armed conflicts
G **game**	Multisided competition governed by preestablished rules
game director	Individual responsible for the execution of a wargame
game truth	Current actual situation within a wargame, as distinct from the Blue or Red perception of it
GCC	geographic combatant command (joint theater command, e.g., USCENTCOM)
GHQ	General Headquarters
GLOMO	Global Mobility Exercise
GLOMO/ACS	Global Mobility and Agile Combat Support Exercise
GO/FO	general officer / flag officer
granularity	Degree of detail at which the considered aspects of warfare are depicted
grognard	Longtime wargamer
H **HALE**	high-altitude, long-endurance

hexes Six-sided shapes (hexagons); both map/board and computer wargames sometimes overlay the depicted conflict area with a grid of hexes to make the calculation of movement and ranges easier

HLA high-level architecture

hot wash Discussion by wargame participants on both insights into warfighting and ideas for improving future wargames; typically held with all participants at the end of the wargame, though during larger wargames they are sometimes held by individual teams daily

hybrid wargame Wargame that uses multiple adjudication methods, e.g., stochastic for combat outcomes, expert panel for diplomatic outcomes

I

IAP international airport

IDA Institute for Defense Analyses

IED improvised explosive device

IPL Integrated Priority List (list of needs compiled by GCCs and FCCs through wargaming)

ISC Integrated Security Construct (set of scenarios for hypothetical future conflicts; among other uses ISC must be used as the basis for the scenarios for each service's Title 10 wargames)

ISR intelligence, surveillance, and reconnaissance

ITEM Integrated Theater Engagement Model

J

JCS Joint Chiefs of Staff

JLASS Joint Land Air Sea Simulation

JOA joint operating area

joint Force, operation, or commander with elements of multiple services

JRTC Joint Readiness Training Center

JSCP Joint Strategic Capabilities Plan

	JSIMS	Joint Simulation System
	JTASC	Joint Training, Analysis, and Simulation Center
	JTLS	Joint Theater Level Simulation
	JWARS	Joint Warfare System
	JWD	Joint Wargames Division
	JWFC	Joint Warfighting Center
	JWID	Joint Warrior Interoperability Demonstration
K	**KORA/OA**	Simulation Model for Officer Training at Corps Level (Germany)
	Kriegsspiel	German for "wargame." Early wargames used around the world were often called *Kriegsspiel*s
L	**laydown**	Actual location of forces, especially at the outset of a game or move
	LCWI	LeMay Center Wargaming Institute
	levels of war	Concept that divides all warfare into three levels: strategic, operational, and tactical. In general a single wargame can only depict one of these levels, as the time required for both decision cycles and events varies by level
	live wargame	Wargame that involves the actual maneuver of forces, e.g., Red Flag
	LVC	A live, virtual, and constructive wargame combines all three methods of wargaming—e.g., brigade training at the Army's National Training Center involves two battalions in live maneuver, a third battalion and forces on flanks participating virtually
M	**M&S**	modeling and simulation
	MAD	**M**ilitary **A**ssessment of **D**isruptive Technologies (Canada)
	MAGTF	Marine Air-Ground Task Force
	maneuver	Movement of military forces, typically to gain an advantage over an adversary

maneuver (warfare)	Style of warfare where the principal method used to gain an advantage over the adversary is maneuver
manual wargame	Any wargame not requiring the use of computers
MCMSMO	Marine Corps Modeling and Simulation Management Office
MCWAC	Marine Corps Wargaming and Analysis Center
MEB	Marine expeditionary brigade
MEF	Marine expeditionary force
miniatures wargame	Type of wargame played on a 3-D model of terrain with 3-D representations of the engaged forces
MIT	Massachusetts Institute of Technology
MoD	Ministry of Defence (United Kingdom)
model	Static, scaled representation of reality; examples include equations, scale maps, a small 3-D version of a larger object
Monte Carlo	Method of adjudication that attempts to replicate the range of outcomes plausible in the real world (*see* stochastic)
morale	Willingness of a force to continue its assigned missions; may or may not be addressed in a specific wargame
MORS	Military Operations Research Society
move 0	First move of some wargames, used to deploy forces and otherwise prepare for the beginning of hostilities. Move 0s can also familiarize participants with procedures, software, and each other
MTM	McClintock Theater Model
MTR	military technical revolution

N

NASM	National Air and Space (Warfare) Model
NATO	North Atlantic Treaty Organization
NAVMSMO	Navy Modeling and Simulation Management Office

NCO	noncommissioned officer
NDU	National Defense University
NEWS	Navy Electronic Warfare Simulator
NMSG	NATO Modelling and Simulation Group
NSGC	National Strategic Gaming Center
NTC	National Training Center
NWC	Naval War College
NWGS	Naval Warfare Gaming System

O

OB	order of battle (the forces available)
objective	Purpose for which an activity is conducted
OCA	offensive counterair
OEF-A	Operation Enduring Freedom–Afghanistan
OIF	Operation Iraqi Freedom
OKH	Supreme High Command of the Army (Germany)
OODA	observe, orient, decide, act
OPEC	Organization of the Petroleum Exporting Countries
open game	Game where everything is visible to all players. Chess and checkers are open games
operational art	Military concept holding that the skillful orchestration of forces can improve the outcome of campaigns
OPFOR	opposition forces (also known as Red or enemy forces)
OPLAN	operations plan
OPR	officer of primary responsibility
OR	operations research
ORI	operational readiness inspection
OSD	Office of the Secretary of Defense
OSD/NA	Office of the Secretary of Defense / Net Assessment Office

outbrief	Formal presentation of wargame outcomes and initial insights conducted at the conclusion of the wargame, typically to the wargame's sponsor
P	
PACAF	Pacific Air Forces
participant	Anyone who works in a wargame, in any capacity
PED	processing, exploitation, and dissemination (bridge between sensors and users)
PFE	Programmed Force Extended (future force if all programs remain unaltered)
playability	Relative ease with which a wargame can be conducted, a function of time to learn and convenience and intuitiveness of execution
player	Person assigned to a team that makes decisions on the employment of forces, typically a member of the Red or Blue team (or other decision-making team, if used)
PME	professional military education
policy game	Wargame played typically at the strategic level designed not for insight into specific situations but for exploring broad policies
pol-mil	political-military
PPBS	Planning, Programming, and Budgeting System
PSOM	Peace Support Operations Model
PSWG	Policy and Strategy Wargame
Q	
QDR	Quadrennial Defense Review
QJMA	Quantified Judgment Method of Analysis
R	
RAC	Research Analysis Corporation
RAF	Royal Air Force
RAND Corporation	Nonprofit research and analysis organization originally formed by Douglas Aircraft to support the Air Force, independent since 1948. Its name is a

	portmanteau of (rather than stands for) "research and development," or "R&D"
RARDE	Royal Armament Research and Development Establishment
real time	A real-time wargame is one in which one minute of game time takes one minute of actual time to elapse. Sometimes any wargame that runs continually at whatever relation to real time
realism	Degree to which a model, simulation, or wargame matches the real-world entity of interest (*see* fidelity)
Red team	In military usage, adversary forces (*see* OPFOR); in business usage, an exercise of playing devil's advocate, asking "What if?" and reviewing plans for gaps
RFI	In gaming, a formal request to Control for information or clarification
RMA	revolution in military affairs
RMAS	Royal Military Academy at Sandhurst
road to war	Element of the scenario that describes how a situation developed that would make the outbreak of hostilities reasonably plausible to the players
role play	When a player is assigned to perform the functions of a particular position, e.g., commander of Pacific Air Forces, chief of an air operations center
RPA	remotely piloted aircraft
RSIOP	Red Single Integrated Operational Plan

S

S&T	*Strategy & Tactics* (magazine); science and technology
SACLANT	Supreme Allied Commander Atlantic
SAGA	Studies, Analysis and Gaming Agency
SAGD	Studies, Analysis and Gaming Division
SAM	surface-to-air missile
SAS	Strategic Analysis Simulation

scale	Characteristics of games: time depicted by one turn, the number of systems/people in one unit, the area represented by one hex. Some wargames (most pol-mil games) do not use a specific scale
scenario	"At start" situation of a wargame, including Blue and Red orders of battle
SEAD	suppression of enemy air defenses
seminar wargame	Wargame organized into either one seminar or a seminar for each major team or player cell. Seminar wargame moves usually consist of the players receiving a move brief, discussing specified questions, issues, and tasks, then sending their decisions to game control or outbriefing to an umpire. Individuals participating in seminar wargames may be appointed to role-play specific positions, but all deliberations are conducted by the entire cell. When a seminar wargame is organized as a single seminar, developing Blue and Red moves as well as adjudication is accomplished through a discussion of the entire seminar
senior mentor	Typically a retired flag officer or equivalent with experience relevant to a wargame's objectives; provides mentoring, insight, advice, and analysis
SF	Special Forces
showstopper	Event that would likely cause the Blue or Red team to want to adjust its move, e.g., casualties much heavier or much lighter than expected
Simnet	Simulation Network
SimoF	Simulation Model for Operational Command and Control Exercises (Germany)
simulation	Model operated on over time, to a scale representation of a real-world process
SIOP	Single Integrated Operational Plan
SME	subject-matter expert (on any team/cell, though most often in adjudication)

SOF	special operations forces
sortie	Single flight by a single aircraft
SPI	Simulations Publications Inc.
SSCW	Scientific Support in Crisis and War
SSG	Strategic Studies Group (U.S. Navy); Strategic Studies Group (Australian commercial game publisher)
SSM	surface-to-surface missile
STAG	Strategy and Tactics Analysis Group
stochastic	Method of adjudication that attempts to replicate the spectrum of outcomes plausible in the real world (*see* Monte Carlo)
strategy	Basic idea for how a goal is to be obtained

T

TACAIR	tactical air
tactics	Methods of fighting effectively
TAM	Theater Analysis Model
TCRP	Tactical Command Readiness Program
technology game	Wargame designed not to gain insight into a specific situation but to help explore technology options
TES	Tactical Engagement Simulator (United Kingdom)
TEWT	tactical exercise without troops
THAAD	Terminal High Altitude Area Defense
TIB	*Training Information Bulletin* (series; Australia)
Title 10 wargame	Any of a series of wargames conducted by each of the U.S. armed services addressing its duties under Title 10 of the U.S. Code to organize, train, and equip its forces
TPFDD	time-phased force and deployment data (the schedule of when units and supplies will be deployed and to where)
TRADOC	Training and Doctrine Command
TSG	Technology Seminar Game

turn-based	Game in which Blue and Red can affect the progress of the game only at discrete times, ideally at the same interval as real-world decision cycles. Strategic and operational wargames are typically turn based
TWX	Theater War Exercise
U	
UAV	unmanned aerial vehicle
UE	Unified Endeavor [or followed by two-digit year]
UN	United Nations
UQ	Unified Quest [or followed by two-digit year]
USA	U.S. Army
USAAF	U.S. Army Air Forces
USAF	U.S. Air Force
USAFE	U.S. Air Forces in Europe
USCENTCOM	[*see* CENTCOM]
USEUCOM	U.S. European Command
USJFCOM	U.S. Joint Forces Command
USMC	U.S. Marine Corps
USN	U.S. Navy
USPACOM	U.S. Pacific Command
USSOCOM	U.S. Special Operations Command
USSR	Union of Soviet Socialist Republics (the Soviet Union)
USSTRATCOM	U.S. Strategic Command
USTRANSCOM	U.S. Transportation Command
V	
vignette	Mini-scenario, often used to jump ahead to game key moments in less actual time than it would take to play out the entire campaign
W	
war game	Application of game theory, typically by an operations-research professional, to gain insight into an armed conflict

WARCON	Wargame Construction Kit
wargame	Simulation game depicting armed conflict. Decisions made by contending parties affect the future state
WARS	Warfare Analysis and Research System
White team	Players in a wargame responsible for control, assessment, adjudication, playing roles of higher headquarters, management, RFI response, and analysis
WISE	Wargame Infrastructure and Simulation Environment (United Kingdom)

My thanks to Mr. William "Bill" Simpson, a civilian employee of the U.S. Marine Corps, for contributing some of the above definitions and significantly improving others.

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Introduction
The Road Not Taken

The line of armored vehicles snaked for miles through the streets of the city. The invasion had started well. Resistance along the border had been light, many enemy units surrendering or simply melting away. Many of the soldiers had yet to fire their weapons in anger.

Still, something was not right. Many had predicted that the invaders would be welcomed as liberators, pelted by flowers and kisses from pretty girls, much like the liberation of Paris. A few skeptics had predicted sullen crowds, resentful of any foreign troops in their country. That had not happened either. The streets were empty—not a pretty girl, not a resentful man, not a waving kid, not a stray dog in sight. It was enough to make you nervous.

Meanwhile, a second group of soldiers crouched and waited. They could hear the sound of the armored vehicles in the streets below but they were under strict orders not so much as to look out a window. They had deployed more than twenty-four hours earlier along the route their commanders had calculated the Americans would take through the city—and the commanders had been right! Now the waiting was almost over. From one end of the city to the other, young men checked their weapons one last time and waited for a specific song to be played on the local radio station.

On the north side of town, an officer of the Saddam Fedayeen lay in a well-concealed position. His job was to see the first American vehicle emerge from the northern edge of the city. He was then to call a fellow officer standing by at the radio station. This second officer would have the station personnel immediately play the song that would signal soldiers hidden all along the American column to open fire.

The American soldiers in the lead vehicles were beginning to feel a bit better. It was clear that they had left the most built-up part of the city. Soon they would be back into the open desert. It was not good to drive tanks through cities. American tanks could outrange any opponent, but in a city almost all fighting would be at short range. It

would be like bringing a rifle to a fight in a phone booth—a knife would be more effective. Still, just a little bit farther, the lead tank commander thought to himself, and his vehicle would be back in its element.

The first casualties were soldiers sitting on open hatches. From the city's southern entrance to its northern exit, the long convoy was ambushed all at once. Most of the Fedayeen were armed with rifles and submachine guns, but some had rocket-propelled grenades and other weapons capable of damaging or even destroying the "softer" American vehicles. They also focused their firing as best they could on vehicles with extra antennae. They had been taught that these would probably be command vehicles and that knocking them out would delay an American counterattack. Improvised explosive devices stopped the lead vehicles, making it hard for those behind them to get out of the city. Larger numbers of Fedayeen on the southern edge of the city slowed any American reinforcements. The Fedayeen believed the longer they could keep the Americans stopped, strung out through the city in a thin line, the more Americans they would be able to kill.

Suddenly the American soldiers found themselves in personal fights for survival, without orders or direction. At first few even knew where to fire, as most of the Fedayeen had done a pretty good job of concealing their positions. But some had hidden themselves poorly, and they were the first to receive return fire. Then, with the speed of veterans, American soldiers—first in pairs, then in four-man fire teams, then squads, then platoons—started attacking their ambushers. When a city block was cleared they established small rear areas where the wounded could be brought and cared for in relative safety.

The American army's headquarters in the theater, that of V Corps, was also quick to respond. The urban environment limited the use of artillery and airpower somewhat, but ground forces not already committed started pushing into the city from the south on a broad front, to surround and kill or capture the ambushers. They met some resistance at the city's edge, but they soon started rolling up the ambush.

Then, as suddenly as they had begun firing, the Fedayeen stopped. Their orders were now to slip away to fight again another day.

Lt. Gen. William S. Wallace, V Corps commander, stood listening to the casualty estimates. The dead and wounded were bad enough, but all the soldiers listed as missing . . . Most would be prisoners of the enemy, an enemy with a track record of torturing prisoners for intelligence, then using them for propaganda purposes. Then there were the destroyed and damaged vehicles, as well as the ammunition that had been expended or destroyed. On top of all that was the loss of time. The strategy to achieve regime change

required a fast dash to the capital. But it would take some time to reorganize after such an attack.

"OK," General Wallace announced to his staff, "I'm ending this wargame now. I think we have established which plan of attack we will *not* be using. I want my G-3 [the staff operations officer] along with the rest of our strategy team to bring me three new COAs [courses of action] by 1600 this afternoon. I want the rest of you to reset the wargame so we can run through the COA I pick starting at 0630 tomorrow morning."

This battle never took place. But it might well have, but for a tool used by military establishments around the world—a tool called *wargaming.*

Strengths and Limitations

As this book will make clear, wargaming is literally as old as civilization. For the last two hundred years, wargames have been preparing strategists, as well as strategies, for specific battles. Modern wargaming has grown from the pastime of princes in one medium-sized European country to a tool that supports decision makers, develops strategies, communicates, and entertains worldwide. Along the way wargames have shaped the world in which we live, providing an edge, sometimes a decisive edge, to sides in conflict that wargamed or that gamed more effectively than their opponents. Today some wargames involve over six hundred participants and budgets in the millions, while others run on your phone, for free.

Here is a demonstration of the power and the benefits of wargaming, as well as its limitations. I first learned of this wargame from then–lieutenant general Wallace.[1] At the time, I was the professor of wargaming and campaign planning at the Air Force's Air Command and Staff College (ACSC). General Wallace had come to talk to our students about his recent experiences in Iraq. We all remembered a statement—it was probably the only one anybody remembered from the first phase of the Second Gulf War—that was attributed to General Wallace. It had been widely reported that when our advance slowed a little south of Baghdad General Wallace had said, "This was not the enemy we wargamed against."

At the time, ACSC had a nonattribution policy. To encourage our guests to speak candidly, students (and faculty members) were not allowed to quote speakers without their explicit permission. But General Wallace began his remarks, "Please quote me." He was furious at the press, not so much for getting the quote a little wrong, as it had, but for taking what he did say so out of context as to turn a compliment into a criticism. He wanted our help to get the word out on what he had really told the reporters, and he told us what that was.

General Wallace observed that we in the military all too often, when things go wrong, point to an intelligence failure but when things go right are slow to give the intelligence community the credit it deserves. To do his part to correct this tendency, General Wallace had gone out of his way to praise the work of his intelligence folks. Before the big wargame described above, those folks had identified a paramilitary force called the "Saddam Fedayeen." Intelligence had correctly estimated its size, level of training, arms, and loyalty to Saddam—yes, they would fight. During his wargame, his team of "Red players" had deployed the Saddam Fedayeen along what they guessed was the most likely route of the U.S. advance—through southern Iraq's cities. (In Iraq, most highways, like those of the old U.S. highway system, run through the centers of cities and towns.) As Red anticipated, the first COA devised by V Corps strategists called for a rapid advance along the shortest route to the capital Baghdad, straight through the cities along the way.

When the wargame brought the "Red" plan and the "Blue" (V Corps) plan together, the adjudicators determined that the most likely outcome would be the carnage described above. Taking warning, General Wallace approved a new plan, one that bypassed all Iraqi cities, by cutting across the desert to their west.

When the invasion actually took place, intelligence confirmed that large numbers of Saddam Fedayeen were waiting to ambush our forces in the cities south of Baghdad. But the United States, going around those cities instead of through them, suffered very few casualties for the first several days. In fact, one of the only times we suffered heavy casualties was when a convoy took a wrong turn, entered a city, and finally gave the Saddam Fedayeen someone to shoot at.

So why did General Wallace say, "This is not *exactly* the enemy we wargamed against"? As the general later told the story, sometime between day fourteen and day sixteen of the war Saddam figured out that we were not going to fight the way he had hoped we would. He then contacted his Fedayeen commanders and told them to attack out from the cities against the American lines of supply. General Wallace felt he could almost hear the conversation:

Fedayeen commander: "But my men are equipped with short-range weapons; they have not been trained to fight in the open country!"

Saddam: "What part of 'attack out from the cities' don't you understand?"

General Wallace was particularly upset with the pundits, the talking heads, who described the new attacks as brilliant on Saddam's part. Obviously, these "experts" had said, Saddam had cunningly waited until our combat units had passed by before attacking their supply lines. But there was no "brilliant plan," Wallace said. We had made his

original plan ineffective, and he had come up with the best "plan B" he could. Still, the Iraqis were now executing a new strategy, and in that sense they were no longer exactly the enemy we had wargamed against.

I picked this wargame to open the book with because of how well it illustrates the strengths and limitations of contemporary wargaming. The great strength of such games should be self-evident: without this one there is no reason to believe V Corps would have changed its plan. Scores of young Americans would have died, and our entire campaign would have been slowed.

But this game also indicates some of wargaming's current limitations. Obviously, the excellent job the intelligence community did in assessing the Saddam Fedayeen was a prerequisite for the game's effectiveness. Just as obviously, there came a time when Saddam decided his strategy was not working and changed it: How can intelligence anticipate that or what "plan B" will be? The final limitation is hidden in plain sight: this wargame covered only the first twenty-two days of the war. Those twenty-two days represented a tiny fraction of our combat operations in Iraq; the casualties we suffered then were a tiny fraction of all we were to suffer over years of fighting. Yet the members of General Wallace's staff were justly proud that they devised a wargame capable of looking as deep as twenty-two days into the campaign. There were no techniques then available to help them to look months ahead in the little time they had available.

The above is something of a microcosm of the rest of this book. I'll describe wargames throughout history and then propose conclusions that I hope you will judge to be consistent with that history. I'll then propose techniques that may help a spectrum of individuals gain greater value from wargaming. Actually, this book is organized a little bit like what I'll call later on the "Caffrey Loop"; we start with the history of wargaming, progress to some general theories, and then make some more-specific recommendations. While we will later discuss how that history informs how wargaming should be defined, for now our working definition of "wargame" will be any multisided simulation of armed conflict in which the decisions of the participants influence the outcomes. Up next, a quick defense of the proposition that we can learn from history to begin with.

Applied History

> *It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so.*
>
> MARK TWAIN

How do we know that what we know is so?

If we lived during medieval times, the answer would probably have been "authority." If two positions were in disagreement, the correct one would be the one citing the higher authority. So if a priest and a bishop differed, the bishop must be correct, all the way up to the ultimate authority, the pope.

With the dawn of the modern age, the answer becomes "science." Today the scientific method is used to determine truth far beyond the bounds of the hard sciences. The scientific method is an iterative process. A hypothesis is formed, and an experiment is conducted; if the outcome is consistent with the hypothesis, the hypothesis gains strength, and if not, scientists construct a new hypothesis that is consistent with all known facts—at least, as of the last experiment. Hence, ideally, human understanding advances as wrong hypotheses are replaced by less-wrong hypotheses.

The scientific method has served us well, providing the foundation for the engineering and technological advances that allow us to live longer, more prosperous lives. There is one problem with it: you cannot put Jupiter in a test tube. In other words, there are certain areas of knowledge that do not lend themselves to experimentation. We cannot create the solar system in a lab and then vary one element (such as the universal constant of gravitational attraction) and observe the result. There are several fields—such as astronomy, meteorology, and, especially, the "softer" sciences, such as economics and sociology—in which experiments are impossible or impractical. So how does science advance in these fields?

Astronomers test their theories against observations. Meteorology got its start using weather data that had been collected years earlier. Economists look for natural experiments, past economic occurrences where all the variables are the same as those in question—save one. In each case scientists use the scientific method of hypothesis testing, but with observed data, not data generated for their exact purposes in a laboratory.

FIGURE 1
The Cycle, a.k.a. Strategy Cycle, Caffrey Loop, Innovation Cycle

The next section of the book provides the "observed data" on wargaming. I will then propose a hypothesis on wargaming. You will not have to take my word for any of my assertions; you will be able to compare those assertions with the track record of wargaming.

In 1994 I envisioned a similar method, one designed to apply something like the scientific method to the design of military campaigns. The method—which is sometimes called the "Caffrey Loop," more often the "Strategy Cycle"—occurred to me during a faculty meeting. The commandant of the Air Command and Staff College, Col. John Warden at the time, had been given a mandate by the Chief of Staff, U.S. Air Force to shift the main focus of the school's curriculum to planning joint air campaigns. The question was asked: If we were to educate *future* air strategists, why were we still covering so much military, naval, and airpower *history*? I thought I knew why but felt I could better express my thoughts on a whiteboard. As I spoke, I drew figure 1 for the first time.

I started off by stating that history provided the air strategist an enormous tool kit of examples. These examples included successes but also, perhaps even more importantly, failures. The principal problem with using history as a tool for developing strategy is that there is just so much of it. It may not be possible in a lifetime to learn all history, or even just the airpower element of military history. Brevity, I argued, is the principal value of theory. Even the longest book on military theory is brief compared with the huge scope of military history. Theorists have, between them, read, and typically lived, much of the history of war. Just as a hypothesis needs to be checked against data, so theories of war need to be checked against the history of warfare. When that is done and the theories have been validated or confirmed, they can be invaluable tools for strategists.

However, the principal shortcoming of theory is that individuals may adopt different theories. Military organizations require the coordinated efforts of many individual decision makers at different levels of command and, typically, geographic locations. How can they work together as a team if they accept different theories? They can't. That is why military organizations develop and promulgate doctrine. At its simplest level, doctrine is a collection of those theories an organization accepts as valid.

Still, because doctrine is intended for an entire organization, it must be kept general. When military organizations address specific contingencies, they develop specific plans. Of course, most contingencies never come to pass, and most military plans are never executed. As the great American philosopher Yogi Berra said, "I've been through some terrible things in my life, and some of which actually happened."[2] Sometimes events similar to an anticipated contingency have occurred, and a little bit of new history is made.

I conclude by cautioning that new history, however, needs to be viewed in the context of all previous history. Too often, recent events have been either dismissed as anomalous or thought to make all previous history irrelevant. Both extremes have at times contributed to decisions that had tragic consequences.

Finally, if this book is to serve as part of a cycle to improve wargaming, that cycle must be completed by you the reader. Only you can take wargame history that occurs after this book goes to press and consider it in the context of the previous history of wargaming. Then you will be in a position to replace my incorrect theories of wargaming with your own less incorrect theories.

Notes

1. General Wallace went on to receive his fourth star and to command the Army Training and Doctrine Command from 2005 until his retirement in 2008.
2. Per *The Yale Book of Quotations*. Mark Twain earlier made a similar point, though uncharacteristically he was less succinct.

PART ONE

The History of Wargaming

CHAPTER ONE

The Rise of Modern Wargaming
Prehistory to 1913

Wargames are as old as civilization—and perhaps older.[1] In his informative and entertaining Public Broadcasting series *Connections,* James Burke argued that the first invention, the one that enabled all later inventions, was the plow.[2] It allowed agriculture, and as agriculture permitted denser populations, the frequency of inventions increased, due either to "connecting" with new applications or combining with other inventions to create one that was greater than the sum of its parts.

First-Generation Wargames: Prehistory until 1810

I would argue that the first invention actually came long before the plow. Humans' development of language allowed them to pass on skills, inventions, and beliefs to succeeding generations. This ability both made it more likely that advances would travel from their places of origin and also permitted advances made in one generation to connect with advances made in succeeding generations.[3] While language leaves no direct archaeological record, we can guess the time of its appearance through the appearance of—of all things—toys. These miniature versions of adult tools and weapons were the first models. They could serve no "serious" practical purpose, but they were "training aids," enabling the first simulations of adult tasks to help each generation pass on survival skills to the next. For thousands of years, all toys remained miniature versions of adult tools.[4]

In the Beginning: To 1660

When society itself became more sophisticated and more specialized, a new type of "toy" emerged among the rulers: abstract strategy games—that is, the first generation of wargames. It is not difficult to understand why.[5] While a miniature bow could help the son of a hunter learn to shoot, a very different type of toy was needed to help the child of a chief, king, or pharaoh learn to outthink the child of the neighboring opposite number. Cultures separated by thousands of miles and hundreds of years appear to have

developed strategy games independently, as all felt the same necessity to prepare their future rulers to outthink other cultures' future rulers. Through abstract depictions of warfare, such wargames did (and do) teach "down-board" thinking—that is, the ability to anticipate the consequences of one's possible moves and the opponent's possible responses, an essential skill in the deadly game of war.

Hence, it would seem reasonable that early wargames date from the very birth of civilization. Do they actually? It appears they may, but the evidence is slim. Most historians fix the beginning of civilization to the birth of cities. One of the finalists for the title of "first city" is Ur, in today's Iraq. There, archaeologists have found an intact abstract (first-generation) game in the ruins.[6] As the site of Ur was inhabited prior to 3000 BC, this could mean that wargaming evolved at the same time as cities. However, the specific stratum in which the game was found dates from "only" 600 BC.[7] So the Ur wargame was probably not created at the dawn of civilization, but early as it is, even it may not be the first. A mural in the tombs at Beni Hasan, in Egypt, appears to depict two men playing an abstract game. The tombs were built in roughly 2000 BC, and later written records describe two Egyptian wargames—Senet and T'au.[8] The earliest Chinese wargame may even be older, the earliest estimate being 2300 BC.[9] The game—its name transliterated as *Wei-chi, Wei-ch'i,* and *Weiqi*—spread to Korea in the 400s AD; there it was called Baduk. Sometime during the 600s, it spread to Japan, where it was called Igo and Go. In all these nations wargaming appears to have been used only by the rulers.

One telling exception to the elite monopoly on gaming was ancient Greece. In her whimsically titled article "Ancient Greek Board Games and How to Play Them," Leslie Kurke at the University of California at Berkeley makes a persuasive case that the Greeks held the invention and use of games in high regard. In fact, she demonstrates that the Greeks believed certain types of games prepared the young for their responsibilities as citizens.[10] It may also be argued that in the Olympic Games the Greeks developed the first "live" abstract wargames, emphasizing competitions in skills relevant to military success without actually simulating warfare. With the eclipse of democracy in the region, wargaming again became a pursuit of elites.

Among the spoils carried off by Rome following the conquest of Greece in 168 BC was the wargame Petteia. Renamed Latrunculi (Rome renamed a lot of Greek stuff), the game became popular with the Roman elite. Rome was also the first civilization from which writings have survived that document training methods simulating warfare. Contemporary writers gave training techniques much of the credit for the effectiveness of Roman soldiers.[11] Martin van Creveld dedicates a significant portion of a book to the question whether gladiatorial contests should be considered the earliest instances of what we call "live simulation wargames."[12] While the deaths of gladiators were real, not simulated, Van Creveld points to evidence that specific gladiators survived many

contests. Even more convincing, some games consciously attempted to re-create land, and even naval, battles.

Roman officers carried Latrunculi to the frontiers of the empire. Centuries after the fall of Rome, the Vikings too played an abstract game, Hnefatafl. While the earliest hard evidence of Hnefatafl's existence is from 925, oral tradition suggests that the game is much older. In fact, some point to similarities with Petteia and suggest that the Viking wargame may have evolved from the Roman. Whatever its origin, by 1100 Hnefatafl had been carried by Viking raids and conquests across Europe.

Meanwhile, however, a second wargame was entering Europe. Developed in India sometime around AD 550, this game, originally called Chaturang, was somewhat less abstract than those just discussed.[13] Chaturang, a four-player game with playing pieces that clearly depicted elephants, cavalry, chariots, and infantry, soon spread to Persia, today's Iran. Following the Arab conquest of Persia in 644, Chaturang spread throughout areas that Muslims either controlled or traded with. Over time Chaturang evolved, its originally realistic depiction of forces becoming very stylized, perhaps "due to Islamic aniconism, discomfiture with depicting the human form."[14] It appears Chaturang first entered Europe during the 800s and that by 1000 it had reached most of the continent. Sometime during the 1400s Chaturang evolved into our current game of chess, which in turn seems to have eclipsed Hnefatafl. But however the game changed, its players remained the nobility.[15]

The earliest unambiguous live simulation wargame too was reserved for Europe's nobility. While most if not all abstract board wargames originated from outside, this new game appears to have developed in medieval Europe. We're speaking of tournaments and jousts, and, as for so much else medieval, their origins are unclear. Like so many other innovations we associate with the Middle Ages, they may actually have arisen in the late Roman period.[16] True, tournaments often resulted in injury, and sometimes death, but unlike in gladiatorial contests, death was not a feature of the enterprise. In fact, over the centuries progressively more-stringent rules made tournaments and jousts, if not safe, at least less deadly. Medieval tournaments could be huge affairs. They began to decline as noble knights began to give way to masses of longbowmen and infantry armed with pikes. However, what truly killed tournaments and sent live simulation wargaming into a several-hundred-year eclipse was the rise of firearms, since fights with such weapons could not, with the technology of the day, avoid being deadly.

On the Brink: 1664–1810

The first generation of wargames, abstract strategy games, seems to have developed independently in various civilizations as each evolved a specialized ruling class.

Second-generation wargames—simulations of movement, attrition, and sometimes logistics—emerged only in Europe, specifically in Prussia. Why? The answer is probably a combination of opportunity and need.

The opportunity grew from Europe's increasing emphasis on, first, quantification and then the scientific method. Alfred Crosby in an insightful, readable book makes the case that much of Europe's "rise" in comparison with the other civilizations of the globe can be traced to this quantification.[17] The spread went beyond precision measurement and double-entry bookkeeping to embrace the quantification of chance.[18] This trend had direct military impacts, from the rationalization (hence acceleration) of the process of loading muskets to the building and besieging of fortifications.[19]

The need was met by the first modern "models" with military utility, increasingly accurate maps and charts. The value of accurate maritime charts was obvious, if only for finding again newly discovered territories to make them colonial conquests. On land, Frederick the Great, king of Prussia 1740–86, was responsible for the first accurate terrain maps commissioned specifically for military use.[20] Later Napoleon would use such maps, planning his campaigns phase by phase before he ever began operations.

The first military simulation occurred in late 1781, when a Mr. Clerk of Great Britain developed a method of using model ships to gain tactical insights.[21] He used his ships to step through battles, analyzing the influence the disposition of the combatants, their "geometry," had on their combat power and vulnerability. Mr. Clerk's simulations, however, were not wargames, as it appears his work did not explicitly depict a thinking, reacting enemy.

However, traditional wargames were also becoming less abstract.[22] In 1664 the German Christopher Weikhmann introduced a variant of chess he called "the Kings Game." While the expanded list of pieces reflected the composition of contemporary armies, the game was still closer to chess than to later second-generation games.[23] In 1780, Helwig, master of pages at the court of Brunswick, introduced a game that used a playing board of 1,666 squares, with squares of various colors representing different types of terrain. A fixed fortification replaced the king, but most other features were similar to chess. Several chess variants then appeared, collectively called "war chess." The most notable of these was developed in 1798 by the noted military writer and tactician Georg Vinturinus. His *Neues Kriegsspiel* (New *Kriegsspiel*) featured a board of 3,600 squares depicting a section of the Franco-Belgian border.[24] Helwig came closer still in 1803 to a modern simulation wargame with a new edition in which he introduced several elements that would later become features of modern simulation wargames. Examples included artillery attacks from a distance and the effect on combat effectiveness of the relative orientation of units.[25]

But for all these advancements, these were first-generation games, largely abstract and still used as aids in educating sons of the nobility. Apparently, "need" had to join "opportunity" for modern wargaming to be born. One of the triggers for that need came from the New World, where Benjamin Franklin had the audacity to say that all men should play chess, as it would help them learn to think through ways to achieve their interests.[26] In Europe too, Voltaire encouraged the common people to play chess. The nobility was scandalized. If mere commoners played chess, where could it lead?

Well . . . such thinking, among many other factors, led to the French Revolution and then to Napoleon.[27] Today we think of Napoleon as a great military genius.[28] True, but to ascribe his success simply to "genius" misses many contributing elements. Worse, it offers no insight into how that success was achieved and how it was, in time, reversed. Napoleon conquered most of Europe with a power base that had in the past enabled French kings (some very able in their own rights) only to conquer, occasionally, a province. How did he do it?

Napoleon enjoyed three advantages over his royal predecessors. In addition to his undeniable genius, he could draw on both a meritocracy and a willing population. The French Revolution produced that meritocracy. Previously, only children of officers could become officers; now, half of Napoleon's marshals had once been private soldiers. His adversaries still had to name lofty aristocrats to command whether competent or not. With a willing population, Napoleon could call on every French "citizen" to defend the revolution and his liberties.[29] Napoleon's adversaries could field only as many soldiers as they could pay. Genius, meritocracy, and numbers: Prussia would invent modern simulation wargaming as a key element of its efforts to overcome these French advantages.

The growth of both warfare and democracy brought about by the French Revolution seems also to have increased civilian use of strategy games. Chess became more widely played, and as early as 1790 adaptations of earlier abstract wargames and also entirely new games were published for the civilian market.[30] The competition not of war but of the marketplace would over the next century and a half push commercial wargames toward modern simulation games.

Prussia's Sixty-Year Monopoly, 1811–1871

> *Historians agree, a Prussian named Reisswitz invented modern wargaming.*
>
> ALFRED H. HAUSRATH

In 1811, Baron Leopold von Reisswitz, the Prussian war councilor at Breslau, invented a wargame that finally broke with the grid and alternating-move conventions of chess.[31]

This new-generation game could truly be called a "simulation," modeling actual space and time with a consistent scale. First, Reisswitz constructed a table with a 3-D model of actual terrain. Then to represent units he prepared blocks, painted in regimental colors and taking up space that matched the units' actual frontages on the scale of the table. Each side would give its orders to an umpire, who updated the terrain table, resolved combat, and told each side only what it would actually know. To determine casualties, umpires first consulted complex tables that indicated an envelope of likely attrition based on range, terrain, and other factors. Exact losses were determined by dice rolls, to account for the uncertainties of the battlefield.

The Birth of Second-Generation Wargaming: 1811–1827

This breakthrough wargame so impressed the princes of Prussia that they asked Baron von Reisswitz to demonstrate it to their father, King Friedrich Wilhelm III. The baron worked for a year turning his game into something fit to be shown a king. He replaced his sand table with ceramic squares that could be arranged to depict a variety of battlefields. He then had built a beautiful cabinet for all the wargame components.[32] The king was greatly impressed and for many years thereafter used the wargame with his sons and sometimes a few army officers. In 1820, Friedrich Wilhelm III brought the game with him during a state visit to Saint Petersburg and the court of Tsar Alexander I. That winter the future king of Prussia (as Friedrich Wilhelm IV) and the future tsar of the Russian Empire (Alexander II) played Baron von Reisswitz's game against each other.

Arguably, not since Gutenberg had one man made so many interlocking breakthroughs at the same time. Yet some historians do not credit Herr von Reisswitz with initiating modern wargaming. Why? For all its innovativeness, they reason, Reisswitz's invention was used for the same old purpose—educating princes in warfare.

But times were changing. To counter Napoleon's advantage in numbers the crowned heads of Europe increasingly attempted to mobilize nationalism. Now, instead of costly mercenaries, an increasing number of young men joined royal armies willingly (more or less) to defend their nations. Even after defeating Napoleon, the armies of most European powers continued to grow. This growth was motivated by dynastic rivalries and made possible by the agricultural and industrial revolutions. Prussia soon found it had too many soldiers if only the sons of officers were to command them. Even conservative Prussia began allowing the sons of mere bankers, industrialists, and government officials to become officers.

One of these new officers was Lt. Georg von Reisswitz. He soon realized that he and his fellow "outsiders" simply did not know as much about war as those who had been taught it by their fathers. He believed his father's game could help. In 1824 he adapted it so that

instead of an expensive ceramic three-dimensional terrain table, a relatively inexpensive paper topographic map could be used. He also eliminated regimental colors; instead, blocks (of proportionate scale size) representing forces of one side were red, the other side blue. The result was a cheaper, more convenient (you cannot roll up a sand table), and more flexible game.[33]

Later that year Lieutenant von Reisswitz demonstrated his innovation to the Prussian army's Chief of Staff, Gen. Karl von Müffling. After initial bored skepticism, General von Müffling became excited. Finally he exclaimed, "It's not a game at all, it's training for war. I shall recommend it enthusiastically to the whole army." General von Müffling did indeed write an article strongly praising it;[34] in fact, he ordered all garrisons to conduct wargames. For this achievement the king awarded Lieutenant von Reisswitz the Order of Saint John and promoted him to captain. This broader applicability is why some historians credit the junior Reisswitz with perfecting the first truly modern wargame. Still, there is at least one other contender. In 1819 Lt. Col. J. A. Messmer, an engineer in the Dutch army, produced a topographic map–based game that found wide use within his service. Hence his wargame was produced after Baron von Reisswitz's but before Lieutenant von Reisswitz created his map-based version.[35]

But with Captain von Reisswitz's promotion came a transfer out of Berlin, a move that he saw as banishment. Also, General von Müffling's order mandating the game's use did not make the new captain popular. Many of his fellow officers resented the time his cumbersome wargame required. It did not help that as its inventor he was repeatedly called on to umpire games that sometimes saw senior officers go down in defeat. He was shunned and isolated, so intolerably that in 1827 Captain von Reisswitz took his own life.[36] His father died two years later, a broken man. The captain had been so unpopular in life that even junior officers who advocated the use of wargaming scrupulously avoided using his name for decades, until games had become an established part of the Prussian way of war. By then many of the young advocates were themselves senior officers.[37]

Wargaming Comes of Age: 1828–1871

So even in the early years support for wargaming was uneven. It was soon to grow dramatically. As early as 1828 Lt. Helmuth von Moltke advocated the use of games.[38] He even founded a *Kriegsspiel* (wargame) society, in Magdeburg.[39] In 1837 Moltke, now a general, became Chief of Staff of the Prussian army and ordered increased wargaming.[40] Moltke overcame initial resistance by sensing what motivated his subordinates and devising a strategy to make them *want* to wargame.

Prussia was appealing to nationalism and broadening the pool of candidates to overcome France's advantage in officer recruiting, but nullifying its superiority in the average officer's ability due to its meritocratic system was more problematic. Prussia's solution was to pair aristocrat commanders selected for their "quality of birth" with chiefs of staff selected for their merit.[41] There came to be two ways to become a general officer in the Prussian army. First, your dad could be king or at least a member of the high nobility. Second, you could be a trained staff officer chosen to serve as chief of staff of a major formation. Hence, the only chance even members of the petty nobility, let alone the commoners, had of attaining high rank was early selection to the staff-officer corps. However, only graduates of the Prussian war college were eligible for that. Moltke now required that each application to the college enclose a letter from the applicant's commander evaluating his performance as the senior umpire in a unit-wide wargame. It worked.

Moltke saw to it that when the successful applicants became war college students, they did a great deal more wargaming. It was already part of the curriculum;[42] Moltke, however, added several innovations, collectively called the "staff ride." Each year between 1858 and 1881 Moltke would personally take the entire student body of the war college, and much of the General Staff, to one of Prussia's actual invasion corridors.[43] Moltke would then describe the most likely first clash between invading and Prussian forces. He would then ask each officer present for his plan of battle (starting with the most junior and concluding with the most senior, to overcome the possible reluctance of junior officers to criticize a senior's plan). The discussion would evolve until a consensus battle plan emerged.

On the basis of that plan, they would then play a map-based game. Moltke named the senior general present (aside from himself—he was always the senior umpire) to command the invading forces and the next-ranking general the Prussian forces. He continued thus until the officers were split into two equal teams. Why? Moltke believed that if the plan being played could succeed against some of Prussia's smartest strategists, it would probably also succeed against any enemy's. Also, with equal-sized teams more officers could participate meaningfully. After the map-based wargame he would contact the local garrison. (Remember, since this was all taking place in an actual invasion corridor, there was always a garrison.) He would direct its commander to march a few hundred soldiers (representing thousands) to where the plan called for. (Could this be the origin of modern field exercises?) This was to test the marching times and other details of the plan. When all this was done the gamed plan went on the shelf as the actual plan for countering an invasion along that corridor. Over the decades the staff rides gradually grew in number of participants and the situations in the wargames changed from individual avenues of invasion to entire fronts, such as the Russian or French front.[44]

Now, let us think about all this for a minute. Moltke started with an "off-site." He then brainstormed to reach a consensus plan, evaluated that resulting plan in a wargame against a world-class adversary (his own officers), and finally tested the plan with a field exercise. Here was the capstone of a well-thought-out effort that used wargames in an overall plan intended to help Prussia win battles even if opposed by another Napoleon. Applying many smart people and effective procedures, Prussia created plans worthy of a genius, eliminating Napoleon's final advantage. In doing so, Moltke had expanded the application of wargaming from its task of millenniums, developing strategists, to developing strategies for specific contingencies.

Still, it is important to understand that the mission of the Prussians' war college was to produce war planners. Wargaming was a key element in the training of staff officers, but it was only one element. The war college curriculum also included the critical examination of military history, strategy, and logistics; the formulation and communication of effective and clear plans; and the conduct of wargames. Wargames both developed the students' abilities as strategists and taught them how to conduct games in the standard planning process. Knowing that all major units would have war college graduates as their chiefs of staff, the high command started issuing orders describing what subordinate units were to accomplish—not how. These "mission orders" could be shorter, could be issued more quickly, and encouraged greater speed and flexibility in execution. War college graduates would then (time permitting) conduct their own wargames to help determine how best to achieve their assigned objectives.

While the focus of Prussian wargaming remained at the battle level of war, as early as 1848 the world's first strategic wargame was conducted, in Berlin, by Lt. Col. (later general) Vogel von Falckenstein. The game depicted the entirety of a war—a war between Prussia and Austria.[45]

At this time, Prussia had a monopoly on second-generation simulation wargames, but first-generation abstract games were becoming increasingly popular. The wars of the French Republic and of Napoleon had produced more citizens who both needed to think through how they would vote and had a greater interest in things military. While most citizens now played recycled abstract games, their boards decorated with military images, a few published wargames edged closer to second-generation simulation types. For example, The Peninsula, published in 1813, was played on a highly abstracted map of Portugal.[46]

Wargaming Goes Global, 1866–1913

For nearly half a century, modern second-generation simulation wargaming remained almost exclusively a Prussian technique. But Prussia made no effort to keep wargaming secret; rules were published commercially, and wargaming was even demonstrated to nations with which Prussia had good relations. The Swedish military adopted wargaming shortly after its creation. The Netherlands followed in 1836 and Austria in 1866.

Europe and Beyond: 1866–1905

The spread of wargaming accelerated after Moltke and Prussia won a series of wars, mostly against opponents with larger forces and equivalent technology. Both inside Germany and without, that success was credited in part to wargaming.[47] Soon the rest of the world started copying Prussia's (now Germany's) military methods—including wargaming.[48] The table lays it all out in brief.

DATE OF ADOPTION	NATION
1820s	Sweden
1836	Netherlands
1866	Austria-Hungary
1872/1883/1902/1905	United Kingdom
1873	Italy
1829/1874/1889	France
1820/1875/1905	Russia
Secondary diffusion: Japan, Turkey, Latin America	

Note: Multiple dates indicate adoption occurring in phases. For example, slants may separate years of "first advocated / officially adopted / date reemphasized."

There were similarities and differences in the ways various countries adopted wargaming. The Prussian General Staff first tried to teach wargaming to the Austrian General Staff, but the Austrians were not interested—one imagines they did not see how the game could be used for gambling. After being defeated by Prussia they seem to have reconsidered.

A young officer in England and another in France translated German manuals, advocated their adoption, and met initial opposition. However, in time both saw wargaming institutionalized in their militaries.

As for England, Aldershot (named for the site of Britain's first, and main, training facility) was the first wargame officially issued by the British War Office. In 1883 the British army's commander in chief, the Duke of Cambridge, issued an official order on

wargaming.[49] Official acceptance was short-lived; following the Boer War (1899–1902) the army dropped wargaming, on the grounds that it had not predicted, nor could have (given the capabilities of the then-current generation of wargames), the decisiveness of the psychological or economic aspects of that war.[50] It is therefore more than a bit ironic that England was to lead the world both in the application of gaming to naval affairs and in the evolution of civilian first-generation abstract games into second-generation simulation wargames. It was Capt. Philip Howard Colomb, RN, who developed the first clearly second-generation naval wargame, The Duel, in 1879.[51] The Royal Navy officially adopted wargaming in 1878. Naval wargaming quickly spread to Russia, Italy, and Austria.[52]

In Italy's case, not only was there no initial opposition to wargaming but Italy appears to have been the first nation whose games reflected the impact of logistics.[53] Of all the European powers, Russia appears to have had the most difficulty getting wargaming to stick. As mentioned earlier, in 1820 the imperial family played Reisswitz's wargame, but that occasion appears to have been a one-off. Only in 1875 did the Russian army order the use of Lieutenant von Reisswitz's version, but the order seems to have been ignored. The Russian navy adopted wargaming from the British, but apparently as purely an educational tool. Still, during the 1902–1903 academic year the Russian naval war college gamed the naval elements of a future war with Japan. The game's Red team accurately anticipated the Japanese strategy in the actual conflict, which was to begin the next year, and that Japan would initiate hostilities with a surprise attack prior to a formal declaration of war. The game's adjudicators correctly assessed that such an attack would be devastating. "Lessons learned" were compiled, but none were acted on—in 1904 the real Japanese would achieve the same results.[54] On previous form, it is likely that after Russia's defeat a panel determined that one of Japan's advantages had been that its army wargamed while the Russians' did not. If so, the panel would have recommended, to whatever effect, that Russian forces do likewise in their planning and professional development.[55]

Soon wargames spread beyond Europe. Typically a non-European state would take on the practices of its leading arms supplier. For instance, Japan acquired naval assistance from Great Britain; in turn, the Japanese navy adopted English methods, including naval wargaming. Japan's army, however, accepted assistance from the German army; accordingly it too adopted military wargaming, but with German methods.

Australia is an interesting case. As Australia gradually moved toward independence from Great Britain it gradually began taking over a larger portion of its own defense. Australian wargaming began with the birth of that transition. Australian wargaming began in this context, and it started at officers' clubs. Many Americans think of officers'

clubs as like the place in the movie *Top Gun* where Tom Cruise's character meets Kelly McGillis's. Early Australian clubs were just a bit different.

In the United States, "O'clubs" are basically membership-supported bars/restaurants on military and naval bases. Australia's early officers' clubs were typically the first nationally owned military building in each Australian colony (as today's Australian states then were). Generally located in the colony's (later state's) capital, they were more like British gentlemen's clubs than American O'clubs. They not only served to socialize Australia's early part-time and volunteer officers but also provided professional development opportunities. The Naval & Military Club was formed in Melbourne in 1881; the United Services Institution of Victoria quickly followed, meeting at the Naval & Military Club premises. While records from this period are few, an 1893 recommendation by (then) Lt. John Monash lists wargaming as one of the principal professional-development activities of the clubs.[56]

Coming to America: 1776–1912

Like so much that is American, our wargaming is partly homegrown and partly imported from overseas. The U.S. Army was the first to consider wargaming and the U.S. Navy the first to adopt it officially, but there was, remarkably, significant early interservice cooperation and even a nineteenth-century joint game.

U.S. Army. The first known informal use of wargaming within the Army occurred in 1867;[57] most historians, however, credit Maj. (later colonel) W. R. Livermore of the Corps of Engineers with bringing modern wargaming to America two decades later, when his book *The American* Kriegsspiel (1883) was published.[58] In it Livermore freely admitted that he had started by simply translating German game rules. However, he had gone on to compare the German attrition tables with actual statistics from the U.S. Civil War and Prussia's own wars in 1866 and 1870–71. He had found that the historical record indicated higher casualties, and he adjusted his own tables accordingly. He also significantly streamlined the calculation of combat outcomes.

Despite this historical foundation and reduction of the time needed, wargaming did not really catch on within the Army for a decade or more. There are four possible explanations, all or none of which may be correct. Some individuals (including your author) blame the Army's then Chief of Staff, Gen. William T. Sherman. In his 1869 address to the graduating class at West Point he said, "I know that there exist many good men who honestly believe that one may, by the aid of Modern science, sit in comfort and ease in his office chair and with little blocks of wood and algebraic symbols, master the great game of war. I think this an insidious and most dangerous mistake. . . . You must understand men, without which your past knowledge were vain."[59] A reading of his full speech

shows that his point was that the graduates should spend time with troops, to learn their capabilities and limitations, and also study war, but it would have been easy to miss the "and also study war" part. Given General Sherman's stature and his office at the time, his remarks could not have helped.

A second explanation was advanced by Maj. Farrand Sayre in an excellent 1911 book.[60] Major Sayre argued that even with its streamlined tables, (by then) Colonel Livermore's wargame was too hard to learn. Major Sayre pointed out most of the Army was then spread across many small posts, with few officers assigned to each. The odds of even one officer at a fort, say, being capable of learning Livermore's game and then running it for his comrades were not good. Sayre asserted wargame use had greatly expanded when, in 1897, Capt. Eben Swift translated and modestly simplified Gen. Julius von Verdy du Vernois's book on Free *Kriegsspiel* (about which more presently).[61] Third, it is possible that the victorious Army of the Republic felt no need to improve its effectiveness, until its rather close-run victory over Spain in 1898 demonstrated some dangerous shortcomings.

Finally, the whole bodies of Major Sayre's and Captain Swift's writings were very persuasive and may well have had decisive influence on the adoption of wargaming. Captain Swift published first and influenced Sayre.[62] Of course, Swift would have had an important impact on Army wargaming if all he did was translate General von Verdy du Vernois's book and get it published. However, he also wrote an article, "The Lyceum at Fort Agawam," which argued that without any new legislation or supplemental appropriation, wargaming could enable every Army post to produce "veterans of forty years of peace time service [who can] take the field with the confidence of men who fought in a hundred battles" (p. 277)—because in effect they would have.[63]

Orders, a published 1905 lecture in which he advocated a standard format for Army orders, appears to have been influential, inasmuch as its format is close to what is used today.[64] He also demonstrated through numerous historical examples the perils of unclear orders—pertinent here because in doing so he reinforced Major Sayre's point that a principal value of wargaming is experience in making and communicating decisions. Swift continued to advance wargaming over a long and successful career. He was to be commandant of the U.S. Army's Command and General Staff College and attain the rank of major general.

Major Sayre's contribution was his book, *Map Maneuvers and Tactical Rides*. In it he asserts:

> Map Maneuvers [i.e., the term used by the U.S. Army for constructive wargames until sometime after 1962] can teach lessons in peacetime that cost far more to learn in time of war.

> It is not practical to conduct field maneuvers with the frequency officers need to be ready for command in war.
>
> You can do things on a map that are too expensive or disagreeable to do during field maneuvers, for example blow up bridges, burn towns, dig trenches across a farmer's field.
>
> They teach map reading and geography.
>
> Perhaps most importantly it gives participants experience in making decisions.[65]

How much influence did his book have? One indication of the book's popularity, hence probable influence, was that it was printed in five editions. Major Sayre was also an effective advocate of "tactical exercises without troops," which could be outdoor planning exercises or live wargames, depending on how conducted. This practice has survived in the U.S. Army into the twenty-first century under the same name, or TEWTs.

If it is difficult to say why Army wargaming began, it is also difficult to say where and when. Certainly, one candidate for place of origin is the Army school today called the Command and General Staff College (CGSC).[66] The proto-CGSC was established in 1881. Some assert wargaming was an integral part of CGSC's curriculum from the start, while Peter Schifferle asserts that it was not used until 1893–94, when it was introduced by Arthur L. Wagner and Eben Swift.[67] In either case, it became one element of a shift in the school's overall method of teaching from rote memorization to what came to be called the "application method."

In this approach subjects were first taught in conventional lectures, then discussed in relatively small groups (this alone was an innovation at the time), then individually applied by each student in a map problem. In that problem he would draft orders to respond to a described battlefield challenge (there was no Red countermove). Next, a group of students would participate in a map exercise (again writing orders and again no Red countermove), and finally a group of students would participate in a wargame called a "map maneuver" (again writing orders but now against thinking, reacting opposition). By 1896 there were eighty such application events within the CGSC curriculum, mostly map problems, map exercises, and map maneuvers. There were also some "tactical rides" (recalling Moltke's "staff rides"); these included field problems, field exercises, and possibly field maneuvers—that is, live wargames.[68] This method of instruction would remain the foundation of instruction at CGSC at least through World War II.[69]

The first official use of wargames by the Army may have involved field maneuvers. There seems to be no source that explicitly states the year the Army began conducting field maneuvers. In a 1906 publication Major Swift commented on "maneuvers over the last 17 years," which would mean the Army was holding maneuvers in 1889.[70] We know for certain that they predate 1910, for in that year a regulation on maneuvers appeared.[71]

This regulation demonstrated a maturity of concept that suggests both the existence and the sophistication of previous maneuvers. For example, the regulation calls for both general and specific scenarios, the German practice. It fixes the place of maneuvers in the Army's training cycle: instruction, drill, exercise, then maneuvers. It provides guidance on minimizing cheating. Most impressively, it specifically states that if an umpire determined that the conditions in the field would cause a unit to change its posture (i.e., from attack to defense, or from defense to withdrawal), the umpire had authority to tell the unit to do so.[72]

A final candidate for the place and date of the U.S. Army's adoption of wargaming is the Army War College, established at the turn of the twentieth century. The college was created as a solution to failings uncovered during the Spanish-American War.[73] Work began over 1899 and 1900, and the Navy's William McCarty Little worked to ensure wargaming was included in its curriculum, which it has been ever since 1900.

Whichever date you pick, by the early 1900s wargaming was firmly established in the Army. Then it became the Army's turn to innovate: for instance, Farrand Sayre's *Map Maneuvers* advocates transparent overlays instead of blocks, so that a permanent record of each move would be made. At about this time the Army also started to standardize the format of the move forms (i.e., player decisions) given to the umpire. It devised a format for the "operation order," the father of the joint orders format still used today.[74]

U.S. Navy. Just as one living legend may have been blocking wargaming in the Army, another was advancing it in the Navy. William McCarty Little was one of those historical anomalies who shape the world far more than rank or title would suggest. McCarty Little, though medically retired (he lost an eye in a shooting accident ashore) in the middle of a promising naval career, went on to help found the Naval War College and to father naval wargaming in America. For years he did so as a volunteer, receiving no pay beyond his retirement stipend.[75] Among his tasks in 1886 was to write and deliver the earliest known lecture on wargaming given to a professional audience in the United States. In it he drew on conversations with Major Livermore and the writings of Captain Colomb, but many of its insights were his own.[76] The next year he and Livermore conducted the first joint Army-Navy wargame-driven field exercise.[77] (The Army high command promptly forbade any future joint exercises.)[78] In 1889 McCarty Little ran a game at the Naval War College. Wargames have been conducted there every year since 1894.

McCarty Little's selfless labors gradually paid off. As early as 1894 and 1896, wargames influenced the Navy's budget.[79] In 1895, a game played a decisive role in convincing Congress to fund the Cape Cod Canal.[80] In 1913, Capt. (later admiral) William S. Sims introduced wargaming to the fleet.[81]

While success was gradual, we can use a remarkable 1912 article in *Proceedings* to declare wargaming's victory.[82] In it McCarty Little described concepts that are considered new today. For example, he argued wargaming had shaped and should shape national policy; that wargames were the cure for peacetime "stovepipe" mentality; and that wargaming could not only produce better plans but condition its practitioners to think and react more quickly than their enemies, an important advantage.[83] The clarity, persuasiveness, and confidence of this visionary article clearly indicate that wargaming had come to America—and like earlier immigrants, had become truly American.[84]

McCarty Little served until 1915, and his work serves us still. He received little recognition during his lifetime, yet the techniques he brought to America have been further developed and continue to enhance the effectiveness of the U.S. armed forces. Americans yet to be born will be more likely to come home from war alive and sound of limb because of McCarty Little.

As for civilian wargaming in the United States, chess remained popular throughout this period, and board games, some with war themes, became so just before and during the American Civil War.[85]

German Wargaming: 1872–1905

At least one German was not pleased by the wide adoption abroad of German wargaming and other practices. In a speech to the German legislature to mark his retirement in 1888, now–field marshal Moltke advised Germany to keep the peace. He cautioned the legislators that other nations had largely caught up with Germany's staff training and procedures;[86] hence, any future war would be far more costly.

But even if wargaming was spreading throughout the world, it was not standing still in Germany. Three areas of innovation in processes and applications allowed Germany to maintain something of a net lead in the field through the end of the century, arguably until the end of World War II. Unfortunately (for Germany), not all of this evolution in wargame procedures was in a forward direction.

The newly unified Germany's first wargame innovation was to optimize gaming for different levels of warfare. Though at least one such game (at strategic level) had been conducted much earlier, it was not until the 1870s that Germany really began tailoring its wargaming processes to what we today would call the "strategic," "operational," and "tactical" levels.[87] The German army had a specific name for each. Its strategic wargames were *Strategische Kriegsspiele,* depicting entire wars. They called their operational games *Grosse Kriegsspiele*—that is, large wargames. These games were designed to play large battles (and later, thanks to their third innovation, below, entire campaigns). The German army's tactical games were *Kleine Kriegsspiele,* small wargames, focused on

small-unit combat. Over time the procedures evolved to meet optimally the command challenges at each level of warfare. In contrast, it appears that other militaries initially conducted only operational-level wargames.

The combat experience Prussia/Germany gained during its wars of unification and with France had a powerful influence on its wargaming. One of the first things its soldiers learned was that though wargame units fight until wiped out, in real wars they do not fight to the last man—something Sherman could have told them. In 1877 a captain from Saxony (a small kingdom that had recently become a part of Germany) named Naumann published rules to cover what today we would call "break points"—that is, the rules provided criteria for determining at what casualty level units would cease to function.[88]

The third innovation came to be called "Free *Kriegsspiel*."[89] Between 1873 and 1876 a series of books, the most influential of them by Verdy du Vernois, argued persuasively for a radically different type of wargame.[90] Wargames have always had their detractors, principally owing to cumbersome, time-consuming adjudication rules. Verdy du Vernois and others thought they had a simple solution: to substitute the military judgment of combat-experienced officers for many of these rules. This would result in games that were faster, hence more popular, and thus more often played.

At first Free *Kriegsspiel* seemed to work well. At its best, the professional judgment of combat veterans could produce more-accurate outcomes in less time. This in turn facilitated the gaming of larger formations over longer periods of time—approaching entire campaigns. There were two problems, though. First, Germany's veterans of 1871 gradually aged, retired, and died. Their replacements could not adjudicate with the same authority. The second problem is today called "command influence": players who outrank the umpires tend to value their own professional judgment over that of the umpires.

Nowhere was this problem more visible or more damaging at the time than in the person of Kaiser Wilhelm II.[91] Thinking himself a great military genius, Kaiser Wilhelm never missed a staff ride. The rides still started on hills overlooking possible invasion corridors. Just when Moltke would have asked the most junior officer for his opinion, the kaiser would immediately announce the "perfect" battle plan. You can imagine the liveliness of debate. Then during the actual game, the group didn't split evenly; everyone wanted to be on the kaiser's team. The results were predictable. The kaiser's side always won; the result was Germany's loss. Instead of trying to stop the travesty, Field Marshal Alfred von Schlieffen, Chief of Staff from 1891 to 1906, added an annual *Kaisermanöver*—emperor's maneuver—with staged movements and predetermined outcomes.[92] Might these easy, consistent victories not have served to decrease whatever wariness the kaiser had about going to war?

One element of wargaming that remained relatively unchanged (aside from the kaiser's pontificating) was regular staff rides. Given Germany's friendly relations with Sweden and Austria none went to the northern or southern borders; the rides rotated between Germany's eastern and western borders. During his tenure Schlieffen held two staff rides a year. Each lasted ten to fourteen days and involved twenty-five to thirty-five staff officers of all ranks. The rides kept their educational and planning purposes; they were also seen as ways of ensuring that the staffs at each command level thoroughly understood the plans.[93]

It may be these staff rides that led to the return of live simulation wargames. You will recall that firearms had killed tournaments, the danger of which could no longer be kept to acceptable levels. During the mid-1700s Prussia began drilling its troops in large formations, to get them into position more quickly on the battlefield than their adversaries. These "maneuvers" were much copied after the victories of Frederick the Great, but they do not appear to have simulated the clash of opposing forces. A century later, as we've seen, Prussian staff rides typically concluded by having local garrisons verify the time estimates for key troop movements. In these ways staff rides produced the key to live gaming despite the lethality of firearms—to use wargame adjudication techniques to resolve "combat" between live units—that is, represented by real soldiers. All this suggests Prussia may have begun holding modern live wargames as early as the 1850s; the earliest hard evidence, however, is a 1908 manual.[94]

There was both continuity and change at the German War College. Training to enable the students to conduct wargames upon graduation, typically as an integral part of their planning processes, remained at the core of the curriculum. Now instruction culminated in the *Abschlussreise,* the final journey. Student performance during this days-long wargame impacted graduation and future assignment.

The Birth of Second-Generation Civilian Wargames: 1890s–1913

While many of the citizens of what would be the Western democracies had played chess since the time of Franklin and Voltaire, they had missed out on the second generation of simulation wargames, initiated by Reisswitz.[95] For over a century civilian abstract first-generation games did not reach the level of true simulations of warfare. Perhaps not surprisingly, the "technology transfer" that led to civilian wargaming started with a couple of reservists, one British and one German.

Until that happened, a typical game would have a military-sounding name and military illustrations on the box but have recycled game mechanics inside. The board used for play was decorated with scenes but play consisted of counters moving along paths and capturing each other as in chess, checkers, or Go. A few were a bit less abstract. Some

used counters that looked like army or naval forces; examples were Polemes (published in England in 1885, which used sets of six soldiers in colorful uniforms to represent units) and Modern Naval Warfare (1891, also in England, with model ships).[96] Other published games contained fairly realistic maps for playing surfaces. Waterloo Campaign, published in the United States by Parker Brothers in 1895, was played on an accurate depiction of the road net actually used; *Kriegsspiel der Weltkrieg* (Wargame of the World War) in Germany in 1914 was played on a map of Europe.[97] A few had both models of combatants and playing surfaces that represented real terrain; one such was Naval Maneuvers, published in England in 1890.

Still, all these used traditional abstract "game mechanics" to resolve moves. One wargame during this period did introduce a feature that moved closer to modeling war (not just ships). It appeared in 1906 in both France and England. The playing board was rather abstract, but playing pieces were blank toward the opponent, simulating the fog of war, and victory always went to the stronger piece—simplistic but still a step away from chess and toward realism.[98] It had several names, of which L'Attaque seems to have sold best. Today the game is known as Stratego.

It appears that a motive was needed before wargames published for a civilian would become more realistic. Before civilians would buy a game that was serious about depicting war accurately, at least some would have to *want* to study war seriously. Spenser Wilkinson helped to create such interest. In 1873, while on summer vacation in Germany while attending college, he glanced through a pamphlet on the military balance of power and was shocked to learn that Britain's army was among Europe's smallest. He began a campaign to get his peers to pay more attention to war. One of Wilkinson's many initiatives was organizing England's first wargaming club.[99] In 1900, presumably through Wilkinson's efforts, a member of Parliament listed wargaming as a hobby.[100] As a member of the British Territorial Army, Wilkinson promoted wargaming within that body as well.

The German reservist's contribution to civilian wargaming was more indirect. As in England, the problem was that before civilians could be interested in complex simulation wargames, they needed to be motivated to study war itself; Hans Delbrück contributed to that motivation.[101] His family had advised Prussian kings on matters of war for generations. "It was vital that the King understood war, for it is on the outcomes of war that the nation prospers or dies," Delbrück said. "Now Germany is evolving toward a democracy, the people are becoming the sovereign, and it is just as important that they understand war." To help them do so he became the foremost military historian of his time.[102] A prolific and influential author, he founded the first chair of military history at a civilian university and edited the first defense-affairs journal aimed at a civilian audience.

Interestingly, both the first modern naval wargame intended for a civilian audience and the first for land warfare were originally published in England. The first naval game created for a civilian market was Lieutenant Chamberlains's Game of Naval Blockade in 1888, though arguably it should be considered an abstract first-generation wargame rather than a true second-generation simulation game.[103] The second naval wargame for a civilian market, however, was clearly a second-generation simulation game—Jane's Naval War Game, named for its lead designer, the English writer and miniatures-gaming enthusiast Frederick T. Jane. It was really two games in one. There was a strategic wargame (which edged toward the third-generation category) and a tactical/battle wargame. When it appeared in 1898, the tactical rules for naval engagement required very detailed ship profiles. But the rules gave data on only four ships, and customers were soon clamoring for more. A supplement soon followed with the needed profiles for all British ships. Still, playing wargames between British ships was less than gripping; the next offering provided the needed data for the entire German navy. Immediately there was an uproar in the press, something like this: "The Germans are our friends. How dare he imply our navies may someday fight!" A wiser Fred Jane responded with the first edition of *All the World's Warships*. Thus, the entire Jane's Information Group, which under a succession of corporate owners has contributed so much to the reference sections of libraries worldwide, as well as to the British balance of payments, started with a wargame.

Fred Jane's game was ahead of its time in many ways. It was developed by an international team that included naval officers from Britain, Russia, and Japan.[104] In the strategic game within it each side bought its forces from a menu of fortifications and combatants—a bit beyond second-generation, force-on-force wargaming. Finally, Jane's wargame was apparently the first designed for a civilian marketplace that was adopted by navies around the world.[105] The movement of innovation from the civilian market to military applications was to become increasingly marked—but not for another half-century.

The counterpart civilian game for land warfare was the product of the author H. G. Wells. Many consider him the inventor of second-generation wargames for a civilian audience, but this is debatable on several levels. First, Jane's game, though on naval warfare and used by both military and civilians, does predate Wells's. Second, there is evidence games with toy soldiers had been conducted in the United Kingdom decades before. There were several small-print-run books of rules for ground-combat wargames for civilians in England shortly after the turn of the twentieth century. Wells simply wrote another such rulebook, but his, *Little Wars* (1913), was by far the best known.[106] Finally, as with the French board game that became Stratego, whether Wells's game was truly of the second-generation simulation type is debatable. For instance, casualties

were produced by firing a spring-powered miniature cannon, and only by the cannon. This was hardly an accurate depiction of contemporary reality.

Still, it is important not to underestimate the importance of Wells's work. *Little Wars* was actually written with pacifist intent. His set of rules, to be used with toy soldiers, was designed to help civilians better understand how terrible war was. If the citizens of democracies—and he predicted that more countries would over time become more democratic—truly understood how terrible war was, they would ensure their governments would never again start them.[107] H. G. Wells made many correct predictions in his long career, but this one was, at best, premature.

It would be almost half a century before an unambiguously second-generation set of ground-combat rules would be published for a civilian market; another Englishman would be among the first to do so.

While both Jane's and Wells's works were fairly popular, the number of civilians playing second-generation simulation wargames would remain modest for many decades. Rather complex rules deterred some, but the main problem was the cost of the metal soldiers or ships. Only the affluent could afford full sets of such "miniatures." Still, this is not to say that early civilian simulation games had no impact. They had an impact on one young British aristocrat, who enjoyed wargaming with miniatures well into his adult years—Winston Churchill.[108]

Notes

1. Martin van Creveld argues in *Wargames: From Gladiators to Gigabytes* (Cambridge, U.K.: Cambridge Univ. Press, 2013) that since many of the remaining hunter-gatherer societies conduct "sham wars," it is likely that such live wargames took place throughout the world before the development of agriculture and the rise of civilization.
2. The TV series also appeared in book form: James Burke, *Connections* (Boston: Little, Brown, 1978).
3. See Steven Roger Fischer, *A History of Language* (London: Reaktion Books, 2005), and Nicholas Ostler, *Empires of the Word: A Language History of the World* (New York: Harper Perennial, 2006).
4. Dolls were also found at early human sites. While dolls are not strictly miniature tools, it is believed that like other toys they served as training aids for skills needed as adults—in this case, the care of young children.
5. See Sanu Kainikara, *Effective Wargaming: Impact of the Changing Nature of Warfare* (Fairbairn, ACT, Austral.: RAAF Aerospace Centre, 2003), p. 7, available at www.raaf.gov.au/airpower/publications/papers/apdc/APDC13_Effective_Wargaming.pdf. Early civilizations known to have developed strategy games independently include Egypt, China, and India. Greece is a possible fourth, though there is some indication its wargame was an adaptation of an Egyptian game.
6. In fact, in 2006 a re-creation of that wargame was on sale at the British Museum for sixty pounds—a lot of money, but I have regretted not buying it ever since.
7. According to the description of the original game on display at the British Museum.

8. Ed Halter, *From Sun Tzu to Xbox: War and Video Games* (New York: Thunder's Mouth, 2006), p. 11.
9. My favorite source is a briefing by Rodger D. Smith; there are numerous others, the most convenient being a good piece on Wikipedia.
10. Leslie Kurke, "Ancient Greek Board Games and How to Play Them," *Classical Philology* 94, no. 3 (July 1999), p. 267.
11. The Jewish historian Flavius Josephus explains that "their drills are bloodless battles, their battles bloody drills" *(The Jewish War)*.
12. Van Creveld, *Wargames*.
13. Jon Peterson asserts that Chaturang was a fairly accurate depiction of the formal style of Indian warfare common at the time of its appearance. Should Chaturang be considered the earliest second-generation—that is, simulation—wargame? One indication not is that Chaturang appears to have been used only for the education of princes. See Jon Peterson, *Playing at the World,* 2nd ed. (n.p.: Unreason, 2012), p. 207.
14. Ibid., p. 8.
15. A placard in the Tower of London comments on the popularity of chess among late medieval royalty and asserts that Elizabeth I played chess very well.
16. Van Creveld, *Wargames,* p. 111, cites a Byzantine chronicle describing what seems to have been a tournament directed by an emperor who reigned in the early 600s.
17. Alfred W. Crosby, *The Measure of Reality* (Cambridge, U.K.: Cambridge Univ. Press, 1997).
18. Dr. John Arbuthnot published in 1692 a book on quantifying chance, *On The Laws of Chance.* James Burke, *The Knowledge Web* (New York: Simon & Schuster, 1999), p. 232.
19. Rationalization was first applied to musketry during the Dutch war for independence, also known as the Eighty Years' War. The higher rate of fire possible with standardized loading provided a significant military advantage. For these methods generally see Trevor N. Dupuy and R. Ernest Dupuy, *The Encyclopedia of Military History* (New York: Harper & Row, 1977), pp. 524–25.
20. The first accurate maritime maps (usually called "charts") had appeared several centuries earlier.
21. Peter P. Perla, *The Art of Wargaming* (Annapolis, MD: Naval Institute Press, 1990), pp. 19–21.
22. For the wargames of this transitional period see John P. Young, *History and Bibliography of War Gaming* (Washington, DC: Department of the Army, 1957), pp. 2–5.
23. For Weikhmann's game see Peterson, *Playing at the World,* pp. 210–12.
24. A more detailed description appears in Andrew Wilson, *The Bomb and the Computer: Wargaming from Ancient Chinese Mapboard to Atomic Computer* (New York: Delacorte, 1969), p. 3.
25. Peterson, *Playing at the World,* p. 216.
26. While Franklin's autobiography does not mention his advocacy of chess, many of the numerous biographies on him do, as does, most recently, a History Channel special on his life and contributions.
27. Certainly a chicken-or-egg relationship can be argued: Did commoners begin thinking for themselves politically because of strategy games, or did strategy games become more widely popular because commoners were grasping the importance of thinking for themselves? Or, in a democracy, did they realize they had to learn to think strategically if the democracy was to survive?
28. Indeed, Napoleon may have invented the first operational war simulation. He would "walk through" his campaigns in advance, using colored pins on maps to help him visualize where his units and those of his enemies would be, when.
29. While it became increasingly evident that Napoleon was no democrat, revolutionary zeal took time to fade.
30. Christopher George Lewin, *War Games and Their History* (Oxford, U.K.: Fonthill Media, 2015), p. 65.
31. The epigraph is from Alfred H. Hausrath, *Venture Simulation in War, Business, and Politics* (New York: McGraw-Hill, 1971), pp. 5–8.
32. This wargame, arguably the first modern simulation wargame, still exists. It can be seen in Berlin at the Charlottenburg Palace and pictured on page 41 of Lewin's *War Games and Their History.*
33. It still was not cheap. All equipment needed came in a box not much bigger than a shoebox

and cost, in today's currency, a little less than five hundred dollars. Peterson, *Playing at the World,* p. 238.

34. Lewin, *War Games and Their History,* p. 43.
35. Ibid., p. 42.
36. This is not an encouraging precedent for those of us trying to inculcate an appreciation of wargames in our fellow officers.
37. Peterson, *Playing at the World,* p. 239.
38. Staff of *Strategy & Tactics* Magazine, *Wargame Design* (New York: Simulations, 1977), p. 4.
39. Young, *History and Bibliography of War Gaming,* p. 9.
40. Apparently this advocacy did not harm Moltke's career—lieutenant to general and Chief of Staff in nine years is not shabby.
41. Trevor N. Dupuy argues, in *A Genius for War: The German Army and General Staff, 1807–1945* (Stamford, CT: History Book Club, 1977), that the intent behind the creation of the Prussian General Staff was specifically to counter an opposing genius like Napoleon with an equivalent collective intelligence, one that would not depend on producing a similar genius at just the right moment.
42. In fact it appears one of the defining characteristics of war college graduates was the ability to set up and umpire games for their future units.
43. Milan Vego, "German War Gaming," *Naval War College Review* 65, no. 4 (Autumn 2012), p. 110.
44. According to Dave Ross, chief of wargaming at the Air Force Research Laboratory (AFRL), initially these larger staff rides also explored invasions along the Austro-Hungarian and Danish fronts, but as relations with those powers improved, staff rides to their borders became less frequent, then ceased.
45. Rudolf Hofmann, *War Games,* MS P-094 (Washington, DC: Office of Chief of Military History, 1952), p. xi.
46. Lewin, *War Games and Their History,* p. 67.
47. For an example within Germany, General Kraft, Prince of Hohenlohe-Ingelfingen, wrote, "The ability to quickly arrive at decisions and the cheerful assumption of responsibility which characterized our officers in the Franco-Prussian War of 1870–71 was in no small measure due to war games." Vego, "German War Gaming," p. 110.
48. The list that follows was derived from several sources but principally Young, *History and Bibliography of War Gaming,* pp. 11–13.
49. *Operational Analysis* (Shrivenham, U.K.: Royal Military College of Science, n.d.).
50. M. R. J. Hope Thomson, "The Military War Game," *Journal of the Royal United Service Institution* (February 1962), p. 50.
51. Just as chess evolved into what is clearly a second-generation simulation wargame, so in England several early attempts at naval simulation wargaming contributed to the development of the Duel. See John Curry, ed., *Over Open Sights: Early Naval Wargaming Rules 1873–1904* (n.p.: lulu.com, 2014), for information on, and reprints of, these precursors.
52. Francis J. McHugh, "Eighty Years of War Gaming," *Naval War College Review* 21, no. 7 (March 1969), p. 88.
53. While I have been unable to find a source for the year Italy started including logistics in its wargames, Gen. Helmuth von Moltke, sometime between his becoming Chief of Staff in 1906 and the outbreak of war in 1914, cited the Italian ability to do so as evidence that logistics could also be incorporated into German wargames.
54. Lewin, *War Games and Their History,* p. 63.
55. That a Russian panel did just that is widely believed in the Western wargaming community, but evidence is elusive. I would be very glad to hear where it can be found. In the meantime, for more on such missed opportunities, see James Sisemore [Maj.], "The Russo-Japanese War: Lessons Not Learned" (thesis, U.S. Army Command and General Staff College, 2003).
56. Todd Mason, e-mail, 8 January 2015.
57. Farrand Sayre, *Map Maneuvers and Tactical Rides,* 5th ed. (Springfield, MA: Springfield, 1911), p. 22.
58. Some believe that Lt. C. A. L. Totten was first. While advocates of both make good cases, Livermore is generally considered first, because he was the first to publish. See Young, *History and Bibliography of War Gaming,* p. 16.
59. William T. Sherman, *Address to the Graduating Class of the U.S. Military Academy, West Point* (New York: D. Van Nostrand, 1869), p. 8. See also Matthew Caffrey Jr. [Lt. Col., USAFR], "Toward a History-Based Doctrine for Wargaming," *Aerospace Power Journal* (Fall 2000), p. 36.

60. Sayre, *Map Maneuvers and Tactical Rides.*
61. Verdy du Vernois [Gen.], *A Simplified War Game,* trans. Eben Swift [Capt.] (Kansas City, MO: Hudson and Kimberly, 1897).
62. Mike Dunn, battle simulations specialist, Digital Leader Development Center, Command and General Staff College, Fort Leavenworth, KS, e-mail, 7 January 2015.
63. Eben Swift [Capt.], "The Lyceum at Fort Agawam," *Journal of the Military Service Institution of the United States* (March 1897).
64. Eben Swift [Maj.], *Orders* ([Fort Leavenworth, KS]: Staff College Press, for the Infantry and Cavalry School and Staff College, November 1905), available at archive.org/details/OrdersbyMAJEbenSwiftNovember1905.
65. Sayre, *Map Maneuvers and Tactical Rides.*
66. The school was to change several times; we will refer to it as CGSC throughout.
67. Peter J. Schifferle, *America's School for War* (Lawrence: Univ. Press of Kansas, 2010), p. 101.
68. Ibid.
69. Ibid., throughout.
70. Eben Swift, *Maneuver and the Umpire* (27 June 1906; repr. n.p.: Bibliogov, 2012).
71. *Regulations for Field Maneuvers, United States Army* (Washington, DC: U.S. Government Printing Office, 1910), available at cgsc.cdmhost.com/cdm/ref/collection/p4013coll9/id/323.
72. In the late 1980s I was told by an individual with a PhD in operations research that it would probably be another twenty years before we could determine when units would involuntarily change posture—and here is a 1910 Army manual assuming that umpires could make that very determination.
73. Sayre, *Map Maneuvers and Tactical Rides.*
74. Young, *History and Bibliography of War Gaming,* p. 18. For operation orders, William McCarty Little, "The Strategic Naval War Game or Chart Maneuver," U.S. Naval Institute *Proceedings* (December 1912), p. 1223. (Offered the same year by the Naval Institute as an offprint.) The institute is a nonprofit organization not formally associated with the Navy. *Proceedings* is an open forum for members of the naval service, especially the U.S. Navy, Marine Corps, and Coast Guard. "About USNI," *U.S. Naval Institute,* www.usni.org/.
75. Anthony S. Nicolosi, "The Spirit of McCarty Little," U.S. Naval Institute *Proceedings* (September 1984), p. 77.
76. Captain Colomb appears to have designed the world's first true naval wargame. See McHugh, "Eighty Years of War Gaming," pp. 88–90.
77. He also gave six lectures on wargaming that year. Ibid., p. 88.
78. Nicolosi, "Spirit of McCarty Little."
79. One indication of that influence is an 1897 letter from Theodore Roosevelt to the Naval War College arranging that a planned visit would coincide with "one of your big strategic games." Perla, *Art of Wargaming,* p. 66.
80. At the time the British navy was significantly larger than the U.S. Navy, so the latter prudently planned for war with Great Britain. McCarty Little's game showed that without the Cape Cod Canal, the British could defeat our fleet based at Boston and then the one in New York. McCarty Little then replayed the game with a Cape Cod Canal in place: the two American fleets were able to combine, improving their odds against the British.
81. J. S. Hurlburt, "War Gaming at the Naval War College, 1969–1989," *Naval War College Review* 42, no. 3 (Summer 1989), pp. 46–51.
82. McCarty Little, "Strategic Naval War Game or Chart Maneuver," pp. 1213–33.
83. The similarity of some of the concepts in this article and those espoused by Col. John Boyd, USAF, over six decades later are striking. My suspicion is that both came to the same truth by different routes. For Boyd's concepts see David S. Fadok, *John Boyd and John Warden: Air Power's Quest for Strategic Paralysis* (Maxwell Air Force Base, AL: Air Univ. Press, 1995), pp. 13–20.
84. There would be periods of decline, especially in the Army (see below), but from 1900 to this writing, wargaming within the American military has never disappeared.
85. Milton Bradley's first big hit came in 1860, with The Checkered Game of Life. See Peterson, *Playing at the World,* p. 254.
86. Most major European powers had established war colleges. Curricula varied but most included the training of future staff officers in planning/wargaming techniques.
87. Vego, "German War Gaming," p. 111.
88. In the late 1980s this author was told by a senior Air Force wargaming official that it

was impossible to depict break points in contemporary USAF games. Germany, then, had been doing the impossible 110 years earlier: see Wilson, *Bomb and the Computer,* p. 12.

89. Perla, *Art of Wargaming,* pp. 31–34.

90. Interestingly, Verdy du Vernois argued that his proposals were not radical but simply extensions of how Moltke resolved the initial brainstorming element of staff rides. See Vego, "German War Gaming," p. 111.

91. Roger Harris Hill [Lt.], "The Influence of War Gaming on the Schlieffen Plan" (MA thesis, Georgetown Univ. Graduate School, Washington, DC, 1967). Hill was to be promoted to lieutenant colonel in 1983.

92. Jörg Muth, *Command Culture: Officer Education in the U.S. Army and the German Armed Forces, 1901–1940, and the Consequences for World War II* (Denton: Univ. of North Texas Press, 2011), p. 37.

93. Vego, "German War Gaming," p. 112.

94. Van Creveld, *Wargames,* p. 192.

95. During the early and middle 1800s a number of war-chess games were published in the United States, but these had more in common with earlier war chess than with modern wargaming. See George Gush, with Andrew Finch, *A Guide to Wargaming* (New York: Hippocrene Books, 1980), p. 24.

96. Lewin, *War Games and Their History,* pp. 78, 88.

97. Ibid., pp. 92, 131.

98. Ibid., p. 113.

99. The Oxford Kriegsspiel Club was founded in 1873; Gush, *Guide to Wargaming,* p. 24.

100. James F. Dunnigan, e-mail, late 1990s. Dunnigan is the "dean" of contemporary commercial wargame designers.

101. Hans Delbrück is considered by many the father of modern scholarly military history. A reserve member of the General Staff, he pioneered the staff estimate of the accuracy of historical military accounts. See Gordon A. Craig's chapter in Peter Paret, ed., *Makers of Modern Strategy* (Princeton, NJ: Princeton Univ. Press, 1986).

102. A century later, English translations of many of his books are still in print.

103. See Curry, *Over Open Sights*.

104. As John Curry informs me (e-mail, 17 November 2017), both a Russian and a Japanese naval officer were cited on the front cover of Fred Jane's Wargame of 1905–1906.

105. Lewin, *War Games and Their History,* p. 59.

106. See John Curry, *The Wargaming Pioneers including* Little Wars *by H. G. Wells,* The War Games for Boy Scouts *and* The War Game *by Captain Sachs 1898–1940,* vol. 1 of *Early Wargames* (n.p.: History of Wargaming Project, 2011).

107. This point has been made by Dr. Peter P. Perla on several occasions. Wells himself is less direct, but the sentiment can be easily read between the lines at several points in his book, most easily in its conclusion. H. G. Wells, *Little Wars* (London, 1913), p. 100.

108. See Winston S. Churchill, *My Early Life: 1874–1904* (1930; repr. Scribner, 1996).

CHAPTER TWO

Wargaming and the World Wars
1905–1945

Arguably the two most decisive wargames of all time were played in 1905. The outcomes were broadly similar, but the reactions of the governments involved could not have been more different.

Gaming the Great War, 1905–1918

In 1905, Count von Schlieffen conducted his last staff ride before his retirement. Virtually all present were on the kaiser's team (i.e., playing the Blue, or German, side); two first lieutenants played the armies of Russia, France, Britain, and Belgium. In the scenario, the bulk of German forces were deployed in the east. The lieutenants playing the Russians advanced the same two armies that actually attacked nine years later. Both armies followed their future routes.

Prewar Wargaming, 1905–1914

The officers playing the Russians made the same mistake the real Russian general would later make. Following a German counterattack, the umpires assessed that the Germans had destroyed the Russian force. (The location was roughly the same as that of Russia's real defeat nine years later—in the battle of Tannenberg.) The German side decided the Russians were too badly hurt to conduct offensive operations for some time, so it used its rail net to move the bulk of its army to the western front. In the meantime, French forces had conveniently entered Belgium—conveniently in that Germany could now attack westward without violating Belgian neutrality. The wargame concluded with the destruction of the French army.[1] Caught out of their fortifications, the French were defeated so quickly that the British army was unable to come to their aid in force.[2] The kaiser, leading the Blue team, certainly must have been pleased.

It was after this wargame that Schlieffen repeatedly advocated from retirement the plan that bears his name. It called for minimal defense in the east and a strong attack through Belgium and the Netherlands immediately at the opening of hostilities. During

the remaining years of peace Germany stopped alternating the staff rides between east and west. Thus Schlieffen's was the only plan developed. This would have strategic consequences in 1914.[3]

Also in 1905, Spenser Wilkinson urged the British to play a wargame examining the consequences of a new war between Germany and France. They did, and their wargame envisioned the German main effort as a thrust into neutral Belgium to force the French to fight out of their border fortifications. Like the German wargame, the British wargame indicated the Germans would destroy the French army before the British Expeditionary Force (BEF) could intervene in strength.

Wilkinson and his colleagues were not nearly as pleased with that outcome as the kaiser likely was. This wargame appears to have led to a host of actions, in no small part because Wilkinson ensured that its results came up on the floor of Parliament. They ranged from reworking mobilization and cross-Channel plans to informal staff talks with the French.[4] This British ground-power wargaming did not fully reverse wargaming's decline in popularity after the Boer War (see chapter 1). Still, inasmuch as the Germans lost the critical first campaign of World War I in part because the BEF was in the right place at the right time (delaying the Germans enough to create the conditions for the "Miracle" of the Marne), the impact on world history of Britain's partial resurrection of military wargaming would be hard to exaggerate.

The professional British military also conducted wargames to anticipate the shape of a potential future war. After becoming director of military operations at the British War Office in 1910, Brigadier (later field marshal sir) Henry Hughes Wilson spent the winter of 1910–11 conducting, with his staff, a "great strategical War Game" to indicate what the great powers would do if war broke out.[5]

In addition, the British used live naval and army wargames to help them discern the most effective use of aircraft in warfare. During their 1913 Fleet Maneuvers a Red radio-equipped seaplane was able to report valuable information on the location of enemy forces. A year earlier the army had used aircraft in a reconnaissance role during autumn maneuvers. The Blue commander soon discovered that his own aircraft could provide him with the location, movement, and strength of enemy forces far deeper and faster than his traditional means (horse cavalry).[6]

During the decade before World War I, Germany enjoyed something of a wargaming renaissance, thanks to another General von Moltke. This nephew of the "Great Moltke" assumed the position of Chief of the German High General Staff in 1906. "Moltke the Younger" has received much abuse over the years for "ruining" Schlieffen's master plan. While the wisdom of his execution can be debated, he clearly did much to improve planning and wargaming methods before the war.[7] Moltke started by going to the kaiser, a

childhood friend thanks to his famous uncle. Moltke privately told the emperor that his personal strategizing during the staff rides was closing off rigorous debate; the kaiser agreed to desist. Next, Moltke examined the wargames themselves. He discovered that machine guns were not being depicted. He was told that insufficient data existed to calculate their impact on attrition precisely; Moltke saw to it that data were acquired from the Russo-Japanese War. He then asked why logistics were not included. Told that wargames could not account for logistics, he pointed out that the Italian games had included logistics for decades.[8] Sure enough, the next major German wargame included logistics.

Moltke used his now more objective and comprehensive methods in a wargame that tested the Schlieffen Plan. The game indicated the two armies on the outside of the "great wheel" (as the intended massive movement of the German right flank was known) would run out of ammunition two days before the campaign ended. Moltke saw to it that Germany organized the first two motorized units of any army, anywhere in the world—two ammunition supply battalions.[9]

When war came, the plan did not work as well as the Germans had hoped. Why? The problem wasn't Moltke's efforts to make the wargames more authentically depict contemporary combat results. That produced positive effects: Germany was less surprised by the nature of the early fighting, and its equipment and tactics were generally less inappropriate than the allies'. What got the Germans into trouble was not what they wargamed but what they failed to.

Their wargames did not address the diplomatic and political consequences of their actions. Spontaneous attempts by Belgian civilians to destroy their own railroads caught the Germans by surprise; there were no such "units" in German wargames. Even more seriously, they did not consider the diplomatic consequences of their invasion of Belgium—which brought the British Empire into the war;[10] that empire in turn eventually brought in the United States, and the additional weight of U.S. forces ultimately defeated Germany. The Germans' wargames got most of the details right but failed to warn that the most decisive consequences of their invasion of Belgium would not be purely military.

One wargame that did not shape history but should have took place in Saint Petersburg, one of the capitals of the Russian Empire, in April 1914.[11] The generals who would command Russia's two most modern armies in the event of war directed the Russian side. Both armies advanced into East Prussia against little opposition. They found themselves in an area of lakes, which made cooperation between them difficult. The German side placed a thin screening force in front of the Russian army to the north and shifted the bulk of its forces south. This augmented German force surrounded and destroyed the

southern Russian army.[12] The Russian players took note and after the wargame recommended a simple change to the war plan to prevent this situation from developing. The armies' bases were different distances from the border; they simply needed to start their movements on different days, so as to reach the border at the same time and remain in contact during the advance.

Just four months later the two Russian generals commanded the same two armies, the real ones, and implemented what appears to have been exactly the same plan.[13] Again, both armies started moving on the same day and both made good initial progress. Again they reached the area of lakes that mutually isolated them. As if on cue, the real Germans placed a light screening force before Russia's northern army and moved the forces thus freed up to the right, where they surrounded and destroyed the southern army—near the town of Tannenberg. It would be difficult to exaggerate the results. While the cost in trained manpower and morale was significant, Russia's most serious loss was the equipment and weapons of one of its only two truly modern armies. Russia never fully recovered.

In the United States, both services conducted wargames in the years immediately preceding World War I. The Navy's wargaming occurred at the Naval War College, in Newport, Rhode Island. While a range of navies, including that of Japan, were cast as the opposition in various games, Great Britain was usually the adversary. This did not reflect any anticipation that Great Britain actually would be a future adversary but simply that at the time Britain had the largest navy and so provided the most challenging adversary.[14]

With the coming of war in Europe, the American people, hence the American press, began paying more attention to things military. Most reports dealt with fighting, but one periodical, *Scientific American,* began devoting upward of 40 percent of its pages to the technology of the new war. In December 1914 it ran a story on the technology of preparing military strategists for war.[15] With words and pictures its article described wargaming at the Army War College—for us, a rare glimpse into the equipment, procedures, and assumptions for the U.S. Army at the time. The article ended on a very positive note: "To the layman, it might appear ridiculous to watch the seriousness and concentration of these student officers, poring over the map," but they "strive their mightiest to learn how to hold the enemy at bay."

The next mention in the press of Army wargaming would not be as positive. In 1916 an Army wargame at the still-new Army War College in Washington, DC, attracted some unwanted presidential attention. The Army Staff was even newer, having been founded in 1903. Both organizations were still very small. So when the Army Staff wanted to use wargames to explore options should the United States become involved in the Great

War, it turned to the Army War College for help. When these wargames were reported in the press, President Woodrow Wilson was furious—in his eyes such planning violated the spirit of neutrality.[16]

During the Great War, 1914–1918

Little has been discovered about wargaming during the war itself. It is not now possible to say whether records of wartime games were destroyed or have yet to be found or few wargames took place. Given German prewar doctrine, which made wargaming an integral part of the planning of any major operation, it seems likely the Central Powers in fact played many wargames during the war. It is harder to estimate the volume of wargaming on the allied side, given the allies' on-again, off-again interest in wargaming and the low number of American army officers trained in it by 1918. Still, we do know of one British and two German wargames, as well as a U.S. Army and an Australian army instance.

During late December 1917 and January 1918, Sir Henry Wilson directed a wargame to look ahead to Germany's expected spring offensive, based on the current situation on the western front. The wargame designers concluded that (owing to the defeat of Russia) the Germans could soon conduct an offensive with a hundred divisions on the western front; the game explored the likely consequences of a German offensive of that magnitude. It ended with the Entente's front along the Somme River broken at the juncture of the Anglo-French armies. It appeared that had play continued, the Channel ports, on which the BEF depended for logistical support, might have been lost.

Sir Henry, now a full general and the British representative to the allied Supreme War Council, made a number of recommendations to the BEF commander, Field Marshal Douglas Haig, who dismissed them. On 21 March 1918 the Germans unleashed Operation Michel, the first attack of the *Kaiserschlacht* (kaiser battle), a series of offensives intended to end the war that spring. It was aimed at precisely the point and in almost the strength played in Wilson's wargame. The real offensive stalled at roughly the point the British wargame had ended.[17]

We have records of that same offensive's being wargamed by the Germans. Ironically, records of these wargames survive *because* they ignored the political consequences of the offensive. Germany's defeat of Russia had freed up most of its forces on the eastern front, producing a "window of opportunity." If it could transfer those forces and launch an offensive before many Americans had reached the continent, it might yet win the war. However, if the German army failed, Germany's prospects were bleak. Hence this "Peace Offensive" was quite possibly the most carefully planned, wargamed, and prepared-for operation of the war. When it was executed, it achieved spectacular (by

World War I standards) advances but did not reach any truly strategic objectives and ultimately failed. What went wrong?

Hans Delbrück thought he knew. Writing in his defense journal *during* the war, he criticized the General Staff, declaring that the wargames had roughly predicted the ultimately indecisive, however impressive, outcomes that actually took place but that the General Staff went ahead anyway. He claimed that if representatives of the Foreign Office had been present at the wargames, they would have realized that Germany's initial advances would cause panic in allied capitals. If Germany had offered generous peace terms (like giving back, oh, most of Belgium) before the offensives had lost momentum, Delbrück asserted, the offer would probably have been accepted. Now Delbrück feared Germany was likely to receive far worse terms.[18] He was right.

The other wartime German wargame we know of was conducted by the High Command as part of its planning/preparation cycle for an earlier spring offensive. The game was conducted at the headquarters of the army group of Prince Rupert.[19] It seems likely that it was typical of German preparation for all major operations.

During the Great War the U.S. Army continued to educate and train officers at the CGSC using its application method—capped with wargaming. The American Expeditionary Force set up a forward staff school at Langres, France. By war's end it had graduated five hundred officers.[20] Thanks to Major Sayre, the course had proportionately less lecture and more application than at CGSC, and especially more fieldwork.[21]

During World War I, Maj. Gen. John Monash commanded the Australian 3rd Division. He conducted in Britain long field training events that culminated in a week deployed in a purpose-built trench system. The facility was large enough to train brigade-sized units. While the record is not clear on whether this specific event was a field exercise (a one-sided simulation) or a field maneuver (a live wargame), or both, it likely was at least in part a wargame. There is abundant evidence that throughout his entire career General Monash used wargaming to train his subordinates and develop his own insights on war.[22]

The Great War also produced the beginnings of what would later be called operations research. It began with Thomas Edison, who donated his time and that of his laboratory to the war effort. What the military expected, and he delivered, was technical improvement. However, he also used his inventive mind to devise many ways to employ more effectively both existing technology and his emerging improvements—what would be a hallmark of operations research.[23] Frederick William Lanchester may have had an even greater long-term impact. Lanchester was a British engineer who wrote several articles and a book on the impact of airpower on warfare.[24] As part of his analysis he developed the "Lanchester equations," which have been widely cited as predictors of the relative

rate of attrition of two forces.[25] Almost a century later these equations are still at the heart of many of the attrition models used in military second-generation wargames.

Civilian Wargaming, 1914–1918

The carnage, the miserable conditions, and the years of stalemate made World War I deeply unpopular *after* the war; we often forget that its outbreak was greeted with widespread enthusiasm on all sides. Until that enthusiasm withered with growing casualty counts, games on military subjects sold well in several Western countries. Some of these were simple games decorated with military images or depicting military subjects. For example, in one game a player would advance in rank over the course of a military career using a mechanism similar to that of Chutes and Ladders.[26] Others were first-generation abstract wargames in some ways similar to War Chess games created for the military prior to 1811—that is, they used the basic constructs of chess but called their pieces by more-contemporary names or superimposed square grids on maps of actual battle areas. Of course, exceptions were the second-generation simulation wargames of Wells and Jane, which continued to be played throughout the war years and beyond.

Interwar Gaming: Innovation Catalyst and Inhibitor, 1919–1939

After the Great War, each power continued to wargame. How each wargamed had a profound influence on its readiness for World War II. These differences largely explain the easy victories Germany enjoyed early in the war.

Germany

Wargaming was even more prominent in the German military after the Great War than it had been before. There were many reasons for this, and most can be traced back to Gen. Hans von Seeckt, who was (clandestinely) Germany's first postwar chief of staff.[27] Because the Treaty of Versailles limited the size of Germany's military, Seeckt could keep only a small percentage of the officers available at the end of hostilities.

Of these he chose first of all to keep officers of the General Staff, the part of the officer corps that had been trained how to conduct wargames while attending war college.[28] In the much smaller treaty army, many of these officers dropped several ranks. Now commanding or assigned to much lower-level military units than in wartime, even to companies, they adapted their wargame techniques to the echelons where they were respectively assigned. The result was a proliferation in types of wargames Germany used. Second, Seeckt dedicated roughly 10 percent of the entirety of his small officer corps to undertaking a process of doctrinal development, with wargaming at its core.

Seeckt's officers took an extremely pragmatic and detailed look at the history of the recent war. From their findings they were encouraged to derive a wide spectrum of

theories about what would and would not work in future wars. These theories were then rigorously compared back with the historical facts. Theories that appeared consistent with the facts were then explored further, through traditional map-based wargames. The most promising ideas were further refined through adjudicated field maneuvers (live wargames). Even foreign maneuvers were studied for lessons that could be drawn from them.[29] Seeckt also used wargames to develop commanders and staffs and to test the aptitude of individuals for command and staff duty. Under him, wargaming was a big part of the life of the German officer, as a cadet, during service with units, and at the war college.[30]

In fact, one thing Seeckt did *not* change was the central role of wargaming in the curriculum of the German War College. Though it was not called the Kriegsakademie for several years—to obey the letter (while flouting the intent) of the Treaty of Versailles—little actually changed. Students still participated in roughly one wargame a week. Each of the course's three years ended with a staff ride / wargame that Moltke would have found familiar. The graduation exercise of each class remained the *Abschlussreise,* the final journey—an eight-to-fourteen-day wargame that included live wargame elements, frequent command-post changes, and the simulated deaths of key leaders (to generate friction and allow more students a crack at command).

Hans Delbrück may have had a hand in bringing about the most sophisticated wargaming of the interwar period. Delbrück testified before a government panel that poor grand strategy had been the root cause of Germany's defeat and that the General Staff's purely military analysis of war plans was a cause of the strategy's failings. The General Staff's wargames could only show the attrition effects of the invasion of neutral Belgium or declaration of unrestricted submarine warfare. They could not suggest the political effects of these actions or the subsequent military consequences of those effects. In 1927 the German government established strategic-level wargames—not at the "shadow" general staff but at the Ministry of Defense.[31] These wargames were truly comprehensive: industrialists were brought in to advise on the speed of industrial mobilization; attachés were brought back from their assigned countries to play those countries' militaries realistically (in what may be the earliest conscious effort to play Red as the real adversary would); and diplomats integrated actions with the military's. Even journalists participated, commenting on likely world public opinion.[32]

In addition to limiting the size of the German military, the Treaty of Versailles prohibited entire classes of weapons: combat aircraft, tanks, and submarines. How could Germany develop doctrine for forces it did not possess? First, it gained some understanding of their capabilities by studying World War I, conducting exchanges with foreign militaries, and observing foreign maneuvers. German officers then conducted map-based wargames that involved units with equipment Germany did not possess.[33] Finally,

they examined the most promising concepts they had derived in field maneuvers (live wargames) in which substitutes were used for forbidden equipment and forces that did not physically exist.[34] The Germans called one concept they so developed "Mobile Operations"; the rest of the world would soon call it *"Blitzkrieg."*[35]

As important and impressive as was the German army's use of wargaming to develop doctrine for weapons and identify their important capabilities, more-humble games may have had even more significant impact in World War II. Only a fraction of the German army in that war was to comprise panzer (armor) formations; the bulk of the German army used the same transport (horses) as its soldiers' fathers had. Yet history after history of World War II affirms the fighting effectiveness of the entire German army.[36] This effectiveness is often explained as the outcome of veteran German forces fighting inexperienced ("green") adversaries. Yet this high effectiveness was observable from the beginning of World War II; were not German troops then as green as their opponents? Part of the true explanation may be the breadth and depth of German army wargaming. In an excellent 2012 article, Dr. Milan Vego describes a host of interwar German wargame types optimized for each level of command and for a host of applications—including developing the tactical abilities of noncommissioned officers.[37] Using 1930 technology the German army had found a way to create "virtual veterans" before the first real battle was fought.

Germany's wolf-pack doctrine for U-boats is an even clearer example of the power of its interwar application of live and map-based wargames.[38] Britain ended World War I with the submarine threat substantially under control, and it correctly estimated technological advances during the interwar period would favor antisubmarine warfare. Britain was accordingly almost unconcerned about the German submarine threat when World War II began. Unfortunately for Britain, Germany's submarine doctrine, which was largely developed even before Germany acquired U-boats, allowed it to win the first several rounds of the Battle of the Atlantic, sinking shipping far faster than the Allies could build replacements.[39]

Unfortunately for Germany, however, in its navy's wargames the "British" continued to follow then-current British doctrine and strategy even after Germany's new tactics would have compelled adaptations. As a result, in the real world the Germans did not anticipate, and so were not prepared for, British countermoves.[40] The surface German navy also used wargames to develop doctrine and plans and it too reaped early benefits.[41] Gaming may have contributed to the surface fleet's showing—surprisingly professional for so new a force—during the Norwegian campaign.

When German rearmament "went public," so did German wargaming: the first large-scale Luftwaffe game was played in November 1934 and large Wehrmacht games took

place in 1935 and 1936.[42] These live wargames continued to grow in size and sophistication up to the beginning of the war. While these field wargames did not play Red as accurately as did political-military games (both sides typically followed the evolving German doctrine), they were vital in both developing that doctrine and socializing it throughout the German army.[43]

Still, it can be argued that what might have been the most decisive wargames of the interwar period were never played. When Hitler came to power in 1933 he quickly put a stop to the strategic-level wargames: *he* would make the future strategic decisions for Germany. However, the German military was allowed to continue gaming at the operational and tactical levels. During the war, Germany fought brilliantly at those levels yet made poor decisions at the strategic level. Would continued political-military wargames have influenced Hitler's decisions?

Perhaps not. In 1938, Gen. Ludwig Beck, then chief of the German General Staff, conducted a wargame of a German campaign against Czechoslovakia. While the game indicated a German victory, it also suggested that the fight would critically weaken Germany.[44] Hitler ignored these findings, convinced that there would be no fight.

The United Kingdom

Germany's World War II preeminence in armor is all the more remarkable because at the end of World War I the United Kingdom had the world's most potent armored force. Britain also produced the interwar period's most prominent armor theorists, J. F. C. Fuller and B. H. Liddell Hart. How did Britain then fall so far behind? Many factors worked against the development of British armor, and wargaming was one of them. England had abandoned map-based (constructive) wargames, and its field-type (live) wargames did not reflect the tank's true value.[45] As for the Royal Navy, it continued to wargame, but its exercises focused on fighting the battle of Jutland better the next time, not developing the most effective doctrine to exploit emerging technologies or to counter emerging threats.[46] As for civilian wargaming, for over a decade all things war were so unpopular that even makers of toy soldiers struggled to stay in business.[47] However, by the mid-1930s interest had recovered to the point that the small British Model Soldier Society was founded. The society included an even smaller model soldier–based simulation wargame wing.[48] By the late 1930s several British board games on war topics were approaching the nature of true second-generation simulation wargames.

France and Poland

As was true of many of its aircraft designs of the period, France's interwar games were compromises between the demands of too many missions at once. Its field-maneuver wargames were expected both to train its largely reserve army and to explore doctrinal

innovation. However, the need to familiarize inexperienced troops with current doctrine with current equipment inhibited these games' usefulness for transformation. As a result, the games helped France prepare to fight World War I even better than it had done before. Given how inappropriate French doctrine was to prove in 1940, it is difficult to imagine wargames dedicated to doctrinal development *not* helping.[49]

Even French wargames that, in retrospect, got the outcome largely right got enough things wrong to make them misleading. In 1938 a French army wargame postulated a German mechanized offensive through the Ardennes. The White (control) team used established norms to estimate the time Germany would need to reinforce the critical Meuse River crossings around Sedan. In the game, this delay gave Blue (the French) time to take some countermeasures. Though not a win for the French, the wargame's outcome was not sufficiently bad to get much attention from the French high command, and only minor (and ultimately ineffective) actual additional defensive measures were taken.[50] It might have been bad enough had the game's norms been right: in May 1940 the Wehrmacht delivered exactly the attack France had wargamed, but it had found ways to speed up its advance.[51] More importantly, Germany used airpower to suppress the French defenders during the critical crossing of the Meuse River, instead (as the game had assumed) of waiting until the bulk of German artillery arrived. With almost none of the expected time to react, France suffered not the minor defeat it anticipated but a disaster.

As for Poland, a French military mission had brought wargaming there in the early 1920s to become part of the Polish army's course in military studies. The Poles soon began using both map and field wargames to test and refine operations plans (i.e., the map-based games) as well as assess the development of their military (field games). Major wargames in 1928 and 1931—in fact most Polish wargames during the interwar period—assumed that hostilities would occur against the Soviet Union, that Poland would keep Germany neutral diplomatically.[52]

The United States

The early-to-middle interwar period was the low point of U.S. Army wargaming. Though little written record exists, all that is known is bad.[53] For Army ground forces, all too often wargames became scripted exercises or became smaller and less frequent. The Army's air forces conducted no wargames during most of this period. Still, by the end of the interwar period, especially in the Army ground forces, wargames had largely rebounded.

U.S. Army Ground Forces Wargaming. According to two U.S. Navy histories, wargaming in the Army largely atrophied during the interwar period. While I'm generally

skeptical of one service's criticism of another, this seems plausible, given the slow promotions, meager budgets, and dispersed nature of the Army in those years. Still, the reality was more complex and varied. To understand interwar Army wargaming you need to understand the service's goals and difficulties at the time.[54]

As young officers would return from Vietnam a half-century later swearing "never again," so many junior officers, and some senior ones, returned from "the Great War" promising the United States would never again send a half-trained force into the meat grinder that the battlefield had become.[55] The Army's first choice of a way to avoid another bloodbath was to keep itself large. But with no major war on the horizon the American people were not willing to pay for a large standing Army. The politically viable alternative, one that was to evolve fairly quickly and remain in place until the buildup for World War II began—was an expandable Army. Elements that required a long time to create, such as a body of educated strategists, were adequately funded even in the depths of the Great Depression. Elements of the Army with a shorter "lead time," such as trained marksmen and units, were starved for funds.

Given the above, it would seem a safe guess that the two places where wargaming did not decline were at the Army's staff and war colleges. You'd be half-right. With the return of peace, the U.S. Army's Command and General Staff College resumed teaching a decision-making technique that began with an assessment of the situation, progressed to the formulation of potential courses of action, and concluded with a wargame.[56] The name of these games changed from "free *Kriegsspiel*s" to "map maneuvers." Also in these years the faculty played Red more often;[57] however, for their big wargame at the end of their second and final year of instruction, the students continued to split into Red and Blue teams. Blue would defend New England from invasion, while Red was free to attack anywhere in the region.[58] Finally, CGSC taught its students that after graduation they should wargame all plans before they were finalized.[59]

Nevertheless, some have argued that CGSC wargaming was not quite as effective as that conducted at the same time in Germany. The reason given is that CGSC games typically only covered the opening moves of a battle or campaign, while the Germans played until one side was decisively defeated.[60] Even this deficiency, however, became less pronounced when in 1939 CGSC began a series of linked wargames, challenging students to cope with operations of long duration.[61] In any case, it would be difficult to overstate the importance of CGSC's interwar games. At a time when most Army officers were stationed with regiment-sized units where command-post exercises (CPXs) were scripted and field maneuvers were increasingly rare, at CGSC they had opportunities to plan and wargame the operations of divisions, corps, and armies. Most of the senior

U.S. Army commanders of World War II did not learn their craft solely under the fearful tuition of the Axis; they were virtual veterans, thanks to CGSC.[62]

Curiously, the Army's war college did not exceed or even match the staff college in wargaming. As a result of its proximity (at Fort McNair, inside the District of Columbia) to the undersized Army General Staff, more and more of the curriculum was taken up with large student working groups tasked to solve current problems. At the time this was seen as a win/win/win innovation: the overworked Army Staff received some very talented free labor, the students got to work on real issues, and their work produced real benefits.[63] But there were also opportunity costs. The Army War College was the only institution for the study of operations at the army and theater levels. A few more hours on planning and execution at such levels may have better prepared the Army for leadership at the highest level in World War II.[64]

Greater wargaming decline took place in the underfunded field forces. CPXs appear to have suffered most. Prior to World War I, CPXs had been conducted as map maneuvers in which the members of a command post performed their normally assigned roles. During the interwar period many CPXs devolved into timed scripts of inputs (i.e., scheduling when preplanned developments or intelligence would be made known to the players). The same script would be used year after year.[65] While command-post members got to practice their present functions, they did not learn how to make decisions in the face of uncertainty (many memorized the scripts), nor did they learn how to outthink a thinking adversary.

For the type of live wargame the Army called "field maneuvers," the glass was a little over half-full. Prior to World War I units had typically ended their annual training cycles with a field maneuver. Local units would be split into Blue and Red forces, and umpires would assess the outcomes of their simulated battles. Even under the tight budgets of the 1920s, units typically cut corners elsewhere to preserve the funds needed for credible field maneuvers. However, as money became even scarcer during the Great Depression, maneuvers tended to become less frequent, shorter, and smaller. Still, there were exceptions: in 1935, at the height of the Great Depression, First Army conducted a fourteen-day field maneuver involving two corps and elements of five divisions.[66]

Late in the interwar period, the number and sophistication of Army map and field maneuvers, including coordinated wargames conducted by the Army and Navy together, increased markedly. Even where it had never stopped, wargaming increased in sophistication. The 1939 linked wargames mentioned above are examples. The evidence of this increase is plentiful, but I have found no record indicating why it took place.[67] A plausible explanation is that the Army Chief of Staff, Gen. George Marshall, directed it. Like

Moltke, Marshall had valued map wargaming since he was a junior officer. Marshall did in fact direct the Army to undertake extremely ambitious field wargames.

Of these, the Louisiana Maneuvers are best remembered, because so many historians have credited them with helping the Army "get its act together" for World War II, helping not only to assess the effectiveness of weapons and doctrines but also to identify key leaders.[68] While live play increased realism, especially in movement rates, it was their umpires who determined combat outcomes. This was a problem. Such determinations were traditionally based on matching the game's range of outcomes with that of historical outcomes. Since, by then, most American equipment had been developed after World War I, there were no historical data available. Hence, the wargame could be only as accurate as the umpires' guesses about their effectiveness.

There were some honest mistakes. The head of the tank-destroyer program approved the adjudication guide for the effectiveness of tank destroyers.[69] Later combat would show that these guides overstated their lethality, but until then, many believed their effectiveness had been "proved." As a result, in the early North African battles tank-destroyer units were employed far too aggressively—with tragic results for their crews.[70]

Other flaws in adjudication may have been deliberate.[71] Efforts were made before play ever began to guarantee an outcome that would "prove" the ground officers' position on the employment of airpower. As a result, ground officers' air concepts prevailed.[72] Procedures were not changed until tragedies like the battle of Kasserine Pass demonstrated the need.[73]

Still, the Army continually worked to make the adjudication of field maneuvers as accurate as it could be. The Army published a new *Umpire Manual* on 17 February 1941; it included updates on the adjudication of tank destroyers. The Army also published, on 21 August 1941, a supplement for umpires assigned to adjudicate aviation forces. In late 1941 the Army conducted field maneuvers in the Philippines. These wargames provided valuable insights and training opportunities. In the beginning of December 1941 it was planning expanded field maneuvers when the Army, and the United States, ran out of time.[74]

U.S. Army Aviation Wargaming. In many ways the Army's air forces had less success than the service as a whole with wargaming, either in convincing the larger Army to wargame airpower more accurately or in wargaming internally.

In 1934 six Air Corps Tactical School (ACTS) faculty members, including Maj. Claire Chennault, were called to testify before a commission on the Army's use of airpower.[75] They were originally told they would have to pay their own way, that the Army's budget had insufficient funds for their travel. Testifying on Army field maneuvers (live

wargames) at the hearings, Major Chennault stated that airpower had not been allowed to attack enemy forces before, during, or after amphibious landings but only in close support after trench lines had formed. The Army's response to this criticism was that the learning objective had been to practice trench warfare and if airpower were used too soon, trench lines might not form. Chennault insisted that these wargames needed to depict airpower more accurately precisely *because* airpower would prevent the World War I trench systems from forming. If the Army did not learn through wargaming how to fight a mobile style of future war it would have to learn at a far higher cost on actual battlefields. When Major Chennault returned from testifying he was informed that his orders to attend the Army's Command and General Staff College had been canceled.[76] Not seeing a chance for advancement without attending CGSC, Chennault left the service.

This was not an isolated incident. The faculty of ACTS participated in Army War College annual wargames starting in 1923, hoping to educate senior Army officers on the best use of airpower.[77] The results were uniformly disappointing. Despite the gradual inclusion of air officers in the planning process, the Army War College restricted air participation to the combat zone, prohibiting attacks against vulnerable enemy rear-area targets. If the distorted depiction of airpower disgusted the ACTS participants, it may have provided "negative training" for the Army's future leaders.

Things were not perfect inside the Army's air arm either. At Maxwell Field, Alabama, ACTS was developing doctrine and educating the airpower leaders who would fight World War II. On the surface, their teaching methods appear outstanding. Periodically the students would apply what they learned by writing plans to attack real targets. The faculty would then pick one of the plans, and the entire student body would climb into aircraft and execute that plan. Not since Moltke's staff rides had planning received such fast real-world confirmation. There was just one problem: ACTS was simulating actual missions, not wargaming them. The bombers always got through to Selma, Alabama; there was no enemy resistance. How this caused doctrine to evolve, or more likely not to evolve, can only be guessed.[78]

There was one bright spot. In 1927 a young captain recognized the need for airmen to understand how airpower fit into overall joint theater campaigns. On his own initiative he developed an air/sea/land wargame that took maintenance, supply, and even airfield construction into account. Student reaction to his wargame was mixed. The game was rated relatively highly in graduation surveys, but immediately after execution it received a lot of criticism for being slow and difficult to play.[79] Unfortunately the wargame really was complex and cumbersome; after the captain's departure in 1931 no faculty member was willing to continue the program. How much impact could such a short-lived

wargame have had? The captain's name was George Kenney. Many historians believe that General Kenney was the principal architect of Gen. Douglas MacArthur's air, sea, and land campaign in the Southwest Pacific Theater. How much impact, indeed?

Wargaming returned to ACTS in the mid-1930s, in the form of a naval air tactical wargame.[80] Though its origin is not indicated in the ACTS history of the period, a surviving photograph suggests that the game was acquired from the Naval War College.

U.S. Navy Wargaming. Clearly the wargaming success story of the interwar period is that of the Navy. Both the fleet and the Marine Corps made impressive use of wargaming, with a positive impact that has seldom, if ever, been equaled. I cannot hope to capture the spirit of the Navy's interwar wargaming half as well as did Adm. Isaac C. "Ike" Kidd Jr. in a 1984 letter:[81]

> Study was directed to the preparation for war at sea and of the consummation of any such war in swift and decisive fashion should war become necessary. The most penetrating examination of the personalities most likely to be involved was taken very, very seriously. In other words, know your enemy, the adage of today. Their analyses were entitled, "estimates of the situation." Computer modelling to predict outcomes was handled on one's hands and knees moving miniature models about on a large game room floor in reaction to rolls of recalcitrant dice. . . . Competition was at its keenest. Poor judgements, bum guesses, inadequate preparation and incompetence were rewarded appropriately. It was not an uncommon thing for some careers to change direction radically and even for some to end, following the rigors of the gaming floor which quickly separated the sheep from the goats and left no room for doubt as to which was which.

With the active support of Adm. William S. Sims, President of the Naval War College, the U.S. Navy built upon the work of McCarty Little, continually refining his techniques. Even before World War I, College wargames looked at a possible war with Japan.[82] Initially, all the games assumed the American fleet would dash across the Pacific, fight and win a big, climactic battle near Japan, and relieve the Philippines. However, as the Naval War College refined its methods, the logistical constraints on such a rapid advance became obvious. Soon the wargames also made clear the need for forward bases and underway-resupply ships in such a campaign. As understanding increased, the time thought needed for the advance grew from days to months to years.[83]

However, not all was smooth sailing, and the Navy had to come up with innovative ways to cope with gaps in its knowledge of the Japanese. All through this period, American intelligence on the specific characteristics of Japanese weapons and training was atrocious. But instead of arguing over what it did not know, the Navy turned this handicap into an advantage. How it did that shows keen insight into the natures of education and of people.

Naval War College students always wanted to win the big "capstone" wargames at the end of their school years.[84] As students have always done, they asked those who had graduated before them for advice—or, in the vernacular of the U.S. military, they looked

for "gouge." Graduates were happy to provide advice: "Try to engage the Japanese at night, they are blind. Watch out for their torpedoes, though—they're killers. Fortunately, though, their ships sink like rocks after the lightest battering." However, when they talked to someone who had graduated in a different year they might learn: "Avoid night engagements—the Japanese are incredible, and their ships are so rugged they can really close in and slug it out. At least you don't have to worry about their tinker-toy torpedoes." Slowly it dawned on the students—the faculty was giving the Japanese different strengths and weaknesses in each wargame!

What were the students to do? Unable simply to learn Japanese strengths and weaknesses before the game, they had to play in such a way that they could learn them through experience before any decisive game engagements took place. Once they felt they had learned what those strengths and weaknesses were, they would develop a strategy to pit American strengths against Japanese weaknesses, while protecting their weaknesses from Japanese strengths. They would then *force* decisive engagements. In other words, they were "learning how to learn." The positive impact this had on the Navy's performance during World War II would be difficult to exaggerate. Virtually every line officer in the Navy had attended the Naval War College between the wars. Each during his year in Newport would have played easily a dozen wargames.[85]

All this was a breakthrough in itself, but the Navy's wargamers did more. Sims, a proponent of naval airpower, ensured that the College's wargames included an accurate depiction of the impact of airpower on naval tactics and operations. Through these games the faculty and students worked out initial concepts for the naval employment of airpower.[86]

Like Germany, the U.S. Navy also used live wargames—"Fleet Problems," adjudicated fleet maneuvers to test and refine concepts and ideas first developed through map wargames.[87] Battleship admirals commanded the Navy of this period, but the aviation community was able to develop operational concepts and procedures that were ready when, at Pearl Harbor, the Japanese took away the battleship option. The Navy was able to use wargames to try out—cheaply, quickly, and insightfully—ideas in aviation and even ship design. For example, the circular formation used during World War II by carrier task forces was first developed during an interwar game. Some of what was learned in these wargames later drove the basic design philosophy of American carriers—maximizing the number of aircraft each carrier could carry and maximizing the sorties each aircraft could fly.[88] In at least one case what gamers learned resulted in changes in the design of ships already under construction, when in an early wargame a carrier's single aircraft elevator became jammed. The wargame made clear the operational costs of such an event. A carrier then under construction was modified to add a second elevator, eliminating the potential for such a "single-point failure." Wargames could also have

more-systematic effects on design. For example, the design of the *Brooklyn* class of light cruisers was validated through wargaming.[89]

Largely through the efforts of Adm. Harris Laning, the Navy's live wargames (Fleet Problems) and constructive wargames (at the Naval War College) acted synergistically.[90] Naval War College game rules were used to help improve the umpiring of the live wargames, and live tests of air-attack accuracy and, probably, Fleet Problem logistical usage improved the Naval War College's wargame rules. Also, both the College's wargames and the Fleet Problems seem to have helped not only develop the Navy's evolving doctrine but socialize the changes throughout the force.[91]

As influential as the Fleet Problems were, it is something of a mystery why they did not have a still greater impact. Fleet Problems twice adjudicated successful, surprise carrier air raids on Oahu. The first, in 1932, occurred during a joint element of Fleet Problem XIII. The air raid was conducted on a Sunday morning and achieved complete surprise. The second air raid took place in 1938 and was part of Fleet Problem XIX, commanded by Adm. Ernest J. King, then Commander, Aircraft, Battle Force. Yet on 7 December 1941 our defenses on Oahu required hours to become fully effective. Then there was the finding of Fleet Problem XXI in 1940 that the Navy was inadequately trained to fight a night surface engagement. During the "hot wash" (immediate) debriefing, Japanese proficiency in this area was mentioned. That proficiency was to be demonstrated just years later during the Navy's lopsided defeats off Guadalcanal. (At least in this case we have a clue about why action was not taken. During the previous year's Fleet Problem XX an experimental radar demonstrated great effectiveness in night actions. The Navy assumed that this technological solution would reach the fleet before war came with Japan.)

Finally, the 1924 Fleet Problem III / Grand Joint Exercise 2 indicated that suicide attacks could be very effective. When some participants expressed skepticism that suicide attacks would really be launched, the commander of the Black (U.K.) Fleet, Vice Adm. Newton A. McCully, expressed his strong conviction that they would be.[92] Yet this tactic did not become a standard part of Red play. In fact, after the war Fleet Adm. Chester Nimitz would say that the interwar games had missed this (and only this) element of the Pacific War.

U.S. Marine Corps Wargaming. While relatively little is known about Marine Corps wargaming during the interwar years, a case can be made for its being the most important wargaming work done during this period. The Naval War College's games had shown the importance of seizing forward bases during any war with Japan. Yet World War I had seemed to show that, against modern weapons, amphibious assaults were problematic. So the Marines had to solve an enduring problem, and they had to do so

despite one of their traditional handicaps—a very sparse budget. Wargaming was a vital method.[93] Through study, debate, constructive wargames, and live-wargame exercises the Marines developed their doctrine of amphibious operations.[94]

Why was this so important? The Marines set out to make an offensive against Japan sustainable; that was important in and of itself, but what they actually did was develop the key to Allied success in all theaters. D-day and victory in Europe would have been impossible without the work done by the Marine Corps during the thirties on amphibious techniques—with almost no budget and all too little recognition (then or now).[95]

Civilian Wargaming. The interwar period was a low point for civilian second-generation wargaming in the United States. While the general antiwar mood was not as strong as in Britain, during the 1930s economic hardships, uncertainty, and fear of joining the unemployed discouraged investing in expensive miniatures.

However, there were three bright spots. First, as early as 1915, Norman Bel Geddes, today best remembered as the designer of the Futurama for the 1939 New York World's Fair, conducted ground-combat miniatures wargames at, and later near, his Manhattan apartment.[96] Second, as early as 1929, the writer Fletcher Pratt began holding naval-combat miniatures wargames at *his* Manhattan apartment. In 1940, Pratt published a set of rules for miniature naval wargames. The recovering economy, increased concern with national defense, and the alleged accuracy of his system may have contributed to Pratt's success;[97] this book outsold all previous civilian wargame rules by a wide margin.

Finally, in the late 1930s a handful of Americans joined the British Model Soldier Society and began receiving its newsletter, the *Bulletin*.[98] Though few in numbers, they would provide most of the leadership for the post–World War II growth in American miniatures wargaming.

The Soviet Union

Apparently the former tsarist officers who came over to the Red Army during Russia's civil war brought imperial Russia's wargaming techniques with them. Soviet games, however, seemed closer to Baron von Reisswitz's methods than to those of Lieutenant von Reisswitz. Terrain models were common for even very large operations, and a wargame typically comprised a single turn.[99] The slow, detailed adjudication of these wargames that was optimal for decision support was poorly suited to developing the thinking skills of Soviet officers. Perhaps to fill this void, in 1924 the Red Army developed and distributed a variant on chess.

From 8 to 11 January 1941, senior leaders of the Red Army wargamed a German invasion, testing a defensive campaign plan developed the previous summer.[100] Gen. Georgy

Zhukov later said the situation depicted in the wargame was very similar to the actual invasion just a few months later. The results of the wargame were briefed to Stalin. His "displeasure" at the depth of German advance in the game may help explain the premature counterattacks made during the actual invasion. Stalin did concede that one of the reasons the Red Army did so poorly in the game was that the young general playing the Germans had performed brilliantly. What was this general's name? Georgy Zhukov. Over and over during the "Great Patriotic War" Stalin would assign General Zhukov to the most-endangered sectors, the most-difficult missions. Was this performance in this wargame one of the origins of Stalin's faith in him?[101]

Japan

Wargaming was an integral part of the curricula of Japan's army and naval academies and war colleges during this entire period, and insights from these wargames were applied throughout Japan's armed forces.[102] In August 1941 Japan's Total War Research Institute conducted a global political-military wargame.[103] Paying close attention to the politics of target, neutral, and friendly countries, this wargame (which did not include an attack on Pearl Harbor) pointed to an Axis victory and may have encouraged Japanese entry into the war. After the decision for war, each service wargamed its planned operations. These wargames projected relative attrition with greater precision but they did not include political considerations.

Some historians have maintained that Japan's wargaming of the attack on Pearl Harbor demonstrates how wargaming should be done.[104] Japan originally planned to sail its carrier force from its normal base on Japan's Inland Sea straight toward Pearl Harbor. During the wargame, however, the Japanese officers playing the Americans used their limited sea surveillance assets to search for a fleet coming from that direction and spotted the Japanese force well out to sea from Hawaii. The wargame's umpires adjudicated that this warning would allow the American side to ready its defenses almost fully. The Japanese side still "won" (i.e., it sank slightly more ships than it lost), but it was a Pyrrhic victory, of a kind that Japan could ill afford at the beginning of a long war against an industrially stronger nation. So the Japanese strategists went back to their planning cell and came up with something new. This plan was wargamed too, with much better results. Japan's subsequent victory at Pearl Harbor seemed to validate its planning methods—including its wargaming.

Yet was Pearl Harbor a Japanese victory? Certainly it was a tactical victory, by the standard of attrition ratios. It was also clearly an operational victory; it put the U.S. Pacific Fleet's battleships out of action for months. Still, what were the strategic consequences for Japan? Shortly after his great "victory" Adm. Isoroku Yamamoto, who had conceived and championed the attack, has been quoted as saying, "I fear all we have done is waken

a sleeping giant and fill him with a terrible resolve."[105] The sense of purpose Pearl Harbor gave the American people far outweighed any temporary advantage it gave Japan. How could Japan have missed this beforehand? Japanese naval wargaming did not take political impact into account. Of course, we will never know whether, had the Japanese rerun their political-military (pol-mil) wargame with the Pearl Harbor attack included, the outcome would have been close to what actually happened. (Remember, the United States mobilized for this war far faster than it had for the Great War.) Still, *not* wargaming the strategic pol-mil consequences of their attack meant the Japanese had no chance of learning what such a game might have shown them.

Wargaming in World War II, 1939–1945

As in the years before World War II wargaming influenced, for good and ill, the development of each future combatant's capabilities, so once the conflict began, wargames influenced its course.

The Axis

Germany continued to wargame throughout World War II, using its games to cultivate and help select commanders and staff members and (when time permitted) to develop and test actual operational plans.[106] Hitler gave his generals too little notice of his decision to invade Poland for them to conduct most of the wargames called for by their doctrine;[107] the invasions of the West and the Soviet Union, however, were both extensively wargamed.[108] Sometimes those games strongly influenced German decisions on the conduct of the war.

For example, in 1940, wargames conducted by Gen. Erich von Manstein, then a relatively obscure chief of staff of an army group, indicated that an attack into the Low Countries through the Ardennes would be more effective than the current scheme, which was to repeat the Schlieffen Plan—only better. Skepticism from headquarters was partially overcome by a successful field wargame over similar terrain in Germany. Admittedly, though, the real clincher was Hitler's support.[109] The result was a French defeat that was far faster and more complete than would have otherwise been possible.

Wargames that indicated a plan could fail were taken seriously. One wargame of an air campaign against Britain and a second of a cross-Channel invasion both indicated there would be serious difficulties. When the actual Battle of Britain ran into problems similar to those forecast by the Luftwaffe's game, the worrisome outcome of the cross-Channel invasion wargame was given even more weight.[110]

Hence, a wargame indicating disaster ensuing from an attack on the Soviet Union may have had some effect. Games of that invasion were conducted at several levels of

command.[111] Operation Otto, the highest-level wargame, was conducted over three sessions during November and December 1940.[112] At the end of the unprecedented third session, the players had proceeded only through early November 1941. Yet no fourth session was scheduled. One reason was that the wargame had already predicted the destruction of 240 of the three hundred Soviet divisions and a front line deep in the Soviet Union. Surely the Soviets would not be able to recover. Ironically, in the actual campaign, by the "game date" on which Operation Otto ended, the Germans had advanced about as far as the wargame had indicated and had actually destroyed more Soviet divisions (248). However, the Soviets were not down to sixty divisions: they still had 220. How could the wargame have been so wrong? The Soviets had mobilized entire new divisions after the beginning of hostilities. To make matters worse for Germany, just after the period covered by the wargame the Soviets acquired an old ally—winter. German forces were woefully unprepared for winter fighting. Would a fourth session of Operation Otto have prompted abandonment of the invasion, or at least better preparation?[113]

The German general staff continued to conduct wargames as an integral part of the operational planning throughout the war.[114] To describe all of the efforts would require a very lengthy work. The following is just a sample. Ironically, wargaming both improved the Germans' preparations to meet the D-day invasion and hindered their actual response. Early in 1944 the Germans conducted a wargame on an Allied invasion of France, focusing on German logistical preparations. The exercise prompted logistical improvements that increased the effectiveness of German resistance when the invasion came.[115] Later, German reconnaissance spotted some of the preparations being made across the Channel from Normandy. The Germans concluded that the Allies were preparing a feint, a secondary invasion intended to trick them into thinking Normandy was the main attack and not Calais, as they believed. Still, they conducted a wargame of an Allied landing at Normandy and concluded that a lodgment was probable. If the feint were successful, the Germans considered, the Allies might decide to make the feint their main effort, especially if Germany pushed the expected main effort, at the Pas de Calais, into the sea. Germany therefore decided to reinforce Normandy, but could not weaken the defense against the main attack expected in the Pas de Calais. The Wehrmacht found three units from other sectors to reinforce Normandy. The regiment that made Omaha Beach so bloody was one of those reinforcements.

Ironically, while that German wargame made D-day far more costly for the Allies, another actually helped them. The Germans planned to conduct a second wargame once all three of the units selected as reinforcements for Normandy were in place, to test whether they now could defeat an invasion there. However, the local commanders were concerned an invasion could be imminent. They did not want their units' chiefs of staff away at a wargame when it came. So when several days of bad weather were forecast,

they decided to move the date of their wargame up, although only two-thirds of the reinforcements were in place. They moved the date of the wargame up to 6 June 1944, and as feared, many key staff officers were away from their posts when the invasion came.[116]

World War II's first battle of the Ardennes (Germany's 1940 breakthrough) and its third battle of the Ardennes (the "Battle of the Bulge") are far better known, but Germany's wargame of the "middle" battle of the Ardennes (i.e., the battle of the Hürtgen Forest) may have been its most unusual.[117] Early in the fall of 1944, the Fifth Panzer Army conducted a wargame of an American attack on its assigned sector, the Ardennes. While the game was going on, the Americans actually attacked. Instead of dismissing the game, Field Marshal Model sent only the commanders of units that were in contact back to their commands. He then directed that actual American movements be fed into the game. When it was time to commit the reserve, Model called its commander over to the wargame map, personally briefed him, and sent him on his way. The Allied offensive was quickly stalled.

Wargaming was an integral part of Japanese planning procedures as well. It played a vital role in the planning of Japan's initial rapid conquests.[118] In contrast, the Japanese game prior to the battle of Midway (in which, for example, the opposing player actively cooperated with Japanese plans—a worse fault even than "mirroring," playing Red as Blue would act) is usually cited as the epitome of how *not* to wargame. That impression has endured, but two developments in historical research significantly change the narrative and the main lesson that incident should teach.

For decades we read in books, chapters, and articles the same story. During the game American airpower sank two Japanese carriers. Rear Adm. Matome Ugaki, who was to command the carrier force for the actual operation, unilaterally reversed the umpires. With the carriers restored to the game, the Japanese side went on to capture Midway. Just weeks later, the Americans sank the same two carriers, plus two more. This time Admiral Ugaki could not reach into the "dead pile" and replace his ships.

First, new details seemed largely to exonerate Admiral Ugaki.[119] Then in 2005, a book was published that for the first time accurately examined the planning and execution of the battle from the Japanese perspective.[120] Jonathan Parshall and Anthony Tully's *Shattered Sword* clearly shows that the fundamental flaw in the Japanese navy's wargaming was a failure to play Red (U.S. Navy forces) realistically. At the strategic/operational level, an even greater flaw may have been the conduct of the game as a "rubber stamp" for a decision already made.[121] Even so, more-realistic (i.e., aggressive) Red play may have helped. However, the clearest example of poor use of Red came in an operational/tactical wargame conducted just prior to the operation.[122] The Japanese officer assigned to play the Americans put his naval forces northeast of the atoll, right where Adm.

Raymond A. Spruance would put his carriers during the actual battle.[123] Red inflicted heavy casualties on Blue (Japan). But Red play was dismissed as uncharacteristic of the timid Americans, and so this foresight did not affect Japanese plans.[124]

Understanding the role of wargaming in the Japanese armed forces also helps us to answer one of the biggest questions of the war: After the Japanese were hopelessly outnumbered in 1944 and 1945, why did they keep fighting?[125] When the Japanese ambassador to the United States and his staff returned to Japan after the outbreak of war, they were taken to a secret location outside Tokyo. There they played the American side in a rare Army/Navy wargame. In that game Japan lost the war. Now what? A new strategy was produced: Japan could not win, but it could kill Americans. These Japanese leaders believed that if they killed enough Americans, the United States would grow war-weary and give Japan better terms. Hence, by this view, the Japanese strategy for the remainder of the war: inflict the maximum cost on the Americans in time and blood. It was not until after the dropping of the atomic bombs that Japan abandoned this strategy.

The Allies

It is beyond dispute that the Axis began World War II with superior wargame technique and broader application. However, as they did in so many areas, the Allies first narrowed the gap and then in some aspects pulled ahead.

The United Kingdom. British wargaming ran the gamut from the birth of modern operations-research wargaming to the rediscovery of very free *Kriegsspiel*. The British coined the term "operations research" and institutionalized the practice of OR.[126] Like Edison's during World War I, the work of the British operations researchers started with requests for technical innovation and grew to strategic importance.

As the prospects for war and the threat of bombardment of its cities grew, Britain turned to its scientific community. Sir Henry T. Tizard formed a committee to identify technologies that could help. Radar was the committee's first and in some ways most important contribution; it then worked to identify how radar could be of maximum benefit to the war effort. From there the scientists branched out to identify models to help optimize a host of military decisions. For example, if your objective is to get the most supplies through to England but you have only so much industrial capacity, should you build merchant ships to replace those sunk or build destroyers to sink the submarines that attack your merchant ships? Patrick M. S. Blackett was particularly prominent in establishing OR sections at the headquarters of Fighter, Antiaircraft, and Coastal Commands, as well being one of the first to define the methodology of OR. When the United States entered the war, it established similar OR sections throughout the armed forces.

As the war progressed and Germany implemented counters to OR-recommended actions, OR teams began exploring what a decade later would be called "game theory" in an attempt to anticipate how their thinking adversary might react in given cases. Apparently ignorant of previous military wargaming, they independently reinvented a similar field, but with an even more analytical, mathematical inclination.[127]

The other extreme of British wargaming was occupied by Field Marshal Sir Bernard Law Montgomery. From at least the time of the second battle of El Alamein, Montgomery would "walk through" all his operations ahead of time, with his chief of intelligence providing the German moves, his chief of operations the Allied moves, and his chief of logistics keeping a running tally of the projected supply condition. "Monty" was the umpire. This practice was even freer than Germany's Free *Kriegsspiel* but seems to have been effective.[128]

Between these two extremes were wargames the British conducted to explore options in the Battle of the Atlantic. A British wargame indicated, for instance, that if a hunter-killer group of antisubmarine warships could be formed, many more U-boats would be sunk. At that time in the war, appropriate ships would have to be taken from the escorts of convoys to the Soviet Union. The game indicated that by delaying the next convoy to the USSR long enough to cut down the size of the U-boat fleet, more cargo would get through to the Soviets overall. The findings of the wargame convinced Winston Churchill, who authorized the temporary diversion. Actual outcomes were close to those indicated by the wargame.[129]

At its apex late in the war, British wargaming was successfully used to prioritize possible future German threats and develop counters to them. In 1942 the Royal Navy's Western Approaches Tactical Unit began using wargames to train ships' captains in how to fight German U-boats and survive. Soon, between classes the faculty began using the wargame to anticipate enemy tactics and develop more-effective friendly ones. These wargames developed and tested tactics that were then taught to the next class. Later in the war the unit started working to anticipate feasible enemy technology and methods. These possible future capabilities were then used by Red in wargames. Those determined to be both feasible (through analysis) and highly effective (in the wargame) became priorities for the development of countermeasures. This allowed Britain to have responses ready to construct or teach as soon as the forecast capabilities actually appeared. Hence, any new advantage the enemy achieved by some innovation would be far briefer than had Britain waited until it appeared.[130]

The Soviet Union. The Soviets continued to evolve a unique style of wargaming.[131] Soviet games typically centered on terrain models. Using each side's plans for the entire mission, the umpires, using incredibly detailed and cumbersome procedures, would

adjudicate the operation all at once, all the way to its conclusion. Only then would the two teams be called back and walked through the operation, step by step. Essentially, these were one-move wargames.

There is no mention of Soviet wargaming during the early war period. This may be due to the haste with which the Soviets had to respond to German offensives, which probably precluded their laborious wargames. The first reference to gaming comes from the Soviet after-action report following the Stalingrad campaign.[132] The report, which listed wargaming as having been the seventh of the nine most important factors in their success, undoubtedly secured the place of wargaming in the planning of subsequent campaigns. In fact, the pattern of those offensives—many simultaneous initial actions, culminating over time, and followed by long pauses—seems consistent with their wargaming methods.

The United States. While I've found no indications of Army Air Forces wargaming during the conflict, the Army continued to use wargames to prepare its officers for combat, and the Navy and Marine Corps continued their broad-application wargaming throughout the war.

With the coming of mobilization and then war, the Army's CGSC greatly increased class sizes, cut the length of classes to nine weeks, and actually increased the proportion of student time devoted to wargaming. (From the beginning of mobilization in 1940 to the termination of these short courses in 1946, CGSC graduated three times as many students as it had from its founding in the 1880s to 1940.)[133] CGSC also initiated a New Division course for the commanders of divisions being activated and their dozen most senior staff members. This high-level course dedicated an even higher proportion of its length to wargaming than did the staff course.[134]

This makes it all the more surprising that I can find no reference to Army use of wargames to plan and prepare for specific operations during World War II.[135] After over half a century of wargaming at CGSC, the Army War College, and to a lesser extent throughout the Army, even during the lean interwar years and particularly in the final prewar years, it would seem, as far as the record goes, that Army ground and air forces did not wargame during World War II. It is possible that wargaming was such an ingrained part of planning for combat it was simply not mentioned. It may also be that wargaming was seen as an education and training tool, not suited to actual combat operations. Or it may simply be that records do exist and I have yet to find them. In contrast, there are many clear references to heavy use of wargaming by the Navy and Marines throughout the war.

The U.S. Navy was reaping a rich harvest from its years of interwar gaming. A few months into the war, Admiral Nimitz sent two lieutenant commanders back to the Naval War College. Their mission was to see whether the College had ever, by chance, used Japan's actual strengths and weaknesses in its wargames. They found two years when the gamed Japanese characteristics had closely matched the evaluations of current intelligence. The officers returned with the Blue doctrine and plans from those years.

The Marines also got to see how accurate their interwar games had been. Frankly, their early landings such as Tarawa did not unfold as the prewar games had forecast. Their inaccurate "lessons" had contributed to flawed doctrine and the development and purchase of not quite the right equipment.[136] But the wargames had been close. The Marines learned that in war it is easier to fix something almost good enough than to come up with a capability from scratch.

The Marines refined their wargame techniques quickly. After a few assaults they were getting results so close to actual casualty counts and "island secure times" that one Marine called it "eerie." Then suddenly a preassault game was way off on both counts. The Marines had adjudicated as before and used the same methods to estimate Japanese strength. Why then was the wargame's outcome so far from reality? What had gone wrong with the Marines' wargame was that the Japanese were gaming too. A joint game (described above) had just prompted a new Japanese doctrine, and the Marine Red team, unaware of that, had continued to follow the old one.[137] Later Japan would produce a still larger variance from the War Plan Orange wargames, using an innovation called "Divine Wind," or "Kamikaze."

In addition to classical wargaming, new operations-research techniques, in part inspired by the British and in part homegrown, supported each American service. Applying these techniques, civilian scientists and engineers added a range of quantitative applications as diverse as antisubmarine warfare and strategic bombing.[138] The war also spurred the development of flight simulators and computational devices for purposes as diverse as breaking codes and aiming artillery. The continuing requirement for computational machines during the beginning of the Cold War provided the seed money for what would soon take off as the computer industry.[139]

The defeat of the Axis powers ushered in an eclipse of wargaming. Obviously, the former Axis nations ceased wargaming. Within the United States, gaming dropped almost as steeply. Only inside the Soviet Union did wargaming expand and become more rigorous. Few knew this at the time, and few would have cared. If the atomic bomb had made war obsolete, was not wargaming also obsolete?

Notes

1. Vego, "German War Gaming," p. 113.
2. Hill, "Influence of War Gaming on the Schlieffen Plan."
3. Why did the German General Staff stop rotating the staff rides between the east and the west after over a decade? The most likely explanation is that it believed it had found its basic strategy and was focused on perfecting it. There is a more interesting possibility. General Staff officers who spot-checked Russian and French maps of the period commented favorably on the French maps but found gross inaccuracies on Russian maps. Could the General Staff have decided to wargame defending in the east (hence fight in Germany) and taking the offensive in the west so that maps of the invaded territory would be more reliable?
4. For more detail on this key British wargame see Wilson, *Bomb and the Computer,* pp. 28–32.
5. *Wikipedia,* s.v. "Field Marshal Sir Henry Hughes Wilson," en.wikipedia.org/.
6. Patrick Bishop, *Wings: One Hundred Years of British Aerial Warfare* (London: Atlantic Books, 2012), pp. 25–26.
7. Hill, "Influence of War Gaming on the Schlieffen Plan."
8. I can almost hear Moltke asking his staff officers, "Are Italians smarter than we Germans?"
9. Hill, "Influence of War Gaming on the Schlieffen Plan."
10. Barbara W. Tuchman, *The Guns of August* (New York: Macmillan, 1962), pp. 90–91.
11. The French thought they knew Germany's broad plan in the event of war: an immediate offensive to defeat France before Russia could fully mobilize. To defeat this strategy France urged its Russian ally to focus on mobilizing its two most modern armies and with them invade East Prussia. This would help Russia, as the Germans would be unready for such an early offensive. Even more importantly, it might help to keep France in the war, by causing the Germans to divert forces from the west. Russia agreed to the French strategy and developed it into a detailed plan. The wargame would test this new plan.
12. See Wilson, *Bomb and the Computer,* p. 33.
13. Vasily Zatsepin of Romania doubts this incident took place, having found documentary evidence that one of the Russian generals was still in command of a distant district after the wargame was supposed to have taken place. But it is possible that knowing he would soon command the army, the general made a special trip for the game.
14. The U.S. Naval War College's website includes a section on the College's wargaming activities at various moments in history. There is a picture of a United States–versus–United Kingdom game in the 1905–1906 academic year.
15. *Scientific American,* 5 December 1914, as quoted on Eaglehorse.org, the website of the 2nd Squadron / 11th Armored Cavalry Regiment, Baley Barracks–Bad Kissingen, Germany.
16. Here is how Wikipedia describes the incident: "During the presidency of Montgomery M. Macomb in 1916, President Woodrow Wilson accused students and staff of planning for taking part in an offensive war, even though the United States had not entered World War I. Wilson was unconvinced by Macomb's explanation that the college was concerned only with the intellectual growth and professional development of its students, and insisted that the school curtail its activities in order to ensure that the U.S. maintained its neutrality."
17. Albert Nofi, e-mail, 21 November 2013. Dr. Nofi is a respected author, researcher, and wargame designer. Also see Keith Jeffery, *Field Marshal Sir Henry Wilson: A Political Soldier* (Oxford, U.K.: Oxford Univ. Press, 2008), p. 213, for the game's structure.
18. Paret, *Makers of Modern Strategy,* pp. 349–50.
19. See Vego, "German War Gaming," p. 114.
20. Muth, *Command Culture,* p. 11.
21. Dunn, e-mail.
22. Peter A. Pedersen, *Monash as Military Commander* (Carlton, VIC, Austral.: Melbourne Univ. Press, 1985), pp. 166–67.
23. William F. Whitmore, "Edison and Operations Research," *Journal of the Operations Research Society of America* (1953), p. 83.
24. Frederick William Lanchester, *Aircraft in Warfare: The Dawn of the Fourth Arm* (London: Constable, 1916).
25. According to Dave Ross of AFRL, Lanchester initially used the equations to estimate the attrition rates of aircraft engines to predict how

many spares a squadron needed. Also, see a briefing by Lt. Col. Lance A. Forbes, "Combat Modeling: Lanchester's Equation" (Air Command and Staff College, Montgomery, AL, 14 March 2002).

26. Lewin, *War Games and Their History,* p. 108.
27. For Seeckt's role in the rebirth of the German army see James S. Corum, *The Roots of Blitzkrieg: Hans von Seeckt and German Military Reform* (Lawrence: Univ. Press of Kansas, 1992).
28. Williamson Murray and Allan R. Millett, *Military Innovation in the Interwar Period* (Cambridge, U.K.: Cambridge Univ. Press, 1996), pp. 36, 313.
29. Murray and Millett suggest Germany may have learned more from British armored maneuvers than the British did. Ibid., p. 41.
30. See Hofmann, *War Games*.
31. After World War II General Manstein claimed that these exercises had been initiated at his suggestion. See F. J. McHugh, *Fundamentals of War Gaming* (Newport, RI: Naval War College, 1966).
32. Robert Michael Citino, *The Evolution of Blitzkrieg Tactics: Germany Defends Itself against Poland* (New York: Greenwood, 1987), pp. 147–49.
33. For the most comprehensive and authoritative description of German wargaming uses and methods during the interwar period see Hofmann, *War Games.*
34. For example, motorcycles would be allowed to drive through the lines of opposing forces to carry the information that could have been provided by observation aircraft.
35. For the best description of the overall process and wargaming's place in it see Robert M. Citino, *The Path to Blitzkrieg: Doctrine and Training in the German Army, 1920–39* (Mechanicsburg, PA: Stackpole Books, 1999).
36. Perhaps the most convincing case was made by Col. Trevor Dupuy in his invaluable *Numbers, Predictions and War: Using History to Evaluate Combat Factors and Predict the Outcome of Battles,* rev. ed. (n.p.: Hero Books, 1985).
37. Vego, "German War Gaming," pp. 106–47.
38. For more information on this and other interwar examples of map and live wargames as catalysts for transformation during the interwar period see Brian McCue, *Wotan's Workshop: Military Experiments before the Second World War* (Alexandria, VA: Center for Naval Analyses, 2002). For the development of wolf-pack doctrine, pp. 29–31.
39. The first interwar naval wargame to incorporate submarines took place in 1927; the first submarine-doctrine manual appeared in 1935—the year Germany launched its first submarine after the Treaty of Versailles. Murray and Millett, *Military Innovation in the Interwar Period,* p. 237.
40. Ibid., p. 239.
41. The earliest reference I have found was 1927, but the German navy appears to have used wargaming during the entire interwar period. See ibid., p. 238; and Citino, *Evolution of Blitzkrieg Tactics,* p. 156.
42. Gebhard Aders, *History of the German Night Fighter Force 1917–1945* (London: Jane's, 1979), p. 9.
43. See Citino, *Path to Blitzkrieg.*
44. Many sources allude to this incident. The earliest I've found is Wilson, *Bomb and the Computer,* p. 21.
45. Basil Henry Liddell Hart, *The Liddell Hart Memoirs* (New York: G. P. Putnam, 1965), vol. 1, pp. 252–54. Some historians claim the British army's Chief of Staff "asked" umpires in a wargame to rule that the experimental armored force had failed, providing the pretext to disband the force. Other historians argue that the results of a challenging exercise were honestly misinterpreted.
46. Murray and Millett, *Military Innovation in the Interwar Period,* p. 249.
47. One company literally turned swords into plowshares, replacing dioramas of soldiers with dioramas of farms. Peterson, *Playing at the World.*
48. The society's newsletter reported regularly on civilian wargaming. See ibid., p. 272.
49. France actually outspent Germany on military forces during the interwar period—proof, if any is needed, that money cannot overcome faulty doctrine. Murray and Millett, *Military Innovation in the Interwar Period,* p. 333.
50. Nofi, e-mail, 21 November 2013.
51. The lead headquarters saved some time by editing orders used in a German wargame of the advance instead of drafting them from scratch.

52. Citino, *Evolution of Blitzkrieg Tactics,* p. 135.
53. All I initially found on interwar Army wargaming was brief references in two articles about interwar naval gaming.
54. Much of the information in this section comes from Schifferle's excellent *America's School for War.*
55. Or as Schifferle writes, they vowed never again to pay "the bloody cost of amateurism in combat" (ibid., p. 86).
56. Ibid., pp. 66, 98.
57. Ibid., pp. 108–109.
58. Ibid., p. 72.
59. Ibid., p. 63.
60. Muth, *Command Culture,* p. 117.
61. Ibid.
62. Schifferle, *America's School for War,* p. 63.
63. Ibid., p. 24.
64. Muth, *Command Culture,* p. 121.
65. I remember an article years ago in which a major described returning to a unit in which he had served twelve years before as a captain to find it using the same CPX script.
66. Schifferle, *America's School for War,* p. 26.
67. On 3 July 2007 I spent half a day in the archives at the Army War College Library and barely scratched the surface of the post-wargame reports available from this period.
68. Christopher R. Gabel, *The U.S. Army GHQ Maneuvers of 1941* (Washington, DC: U.S. Army, Center of Military History, 1991).
69. U.S. War Dept., *Umpire Manual* (Washington, DC: General Headquarters, 17 February 1942).
70. Martin Blumenson's chapter on Kasserine (pp. 226–65) in Charles E. Heller and William A. Stofft, eds., *America's First Battles, 1776–1965* (Lawrence: Univ. Press of Kansas, 1986), provides a good and concise, if somewhat Army-centric, view of the battle. The lessons the battle taught about tank destroyers are summarized on page 263. Not everyone believes their overestimation was an honest mistake; see David E. Johnson, *Fast Tanks and Heavy Bombers: Innovation in the U.S. Army, 1917–1945,* Cornell Studies in Security Affairs (Ithaca, NY: Cornell Univ. Press, 2003), pp. 148–50. One of the major objectives of Gen. Lesley J. McNair—Army General Headquarters (GHQ) chief of staff and an ordnance officer by career and training—in the 1941 "Carolina Maneuvers" was "to see . . . how we can crush a modern tank offensive." Indications are that he strongly influenced the umpires' combat tables. McNair ensured that these GHQ-controlled maneuvers never tested tank-versus-tank combat, instead usually setting antitank units, with support, in defense against unsupported tanks. The woeful performance of the 37 mm antitank gun in actual combat was somehow translated to "Works great!" by the time GHQ released its report on North Africa. It is fairly clear that McNair stood in the way of antitank main guns for U.S. tanks until his death in 1944. See Rick Atkinson, *An Army at Dawn: The War in North Africa, 1942–1943,* rev. ed. (New York: Henry Holt, 2007).
71. Comments on the depiction of airpower during the Louisiana Maneuvers are based on research done by Mark Clodfelter while he was on faculty, as a major, at the School of Advanced Airpower Studies.
72. Warren A. Trest, *Air Force Roles and Missions: A History* (Washington, DC: Air Force History and Museums Program, 1998), p. 77.
73. In fairness, the air battle over Kasserine also demonstrated the need for sufficient air-base construction engineers to allow forward fields to keep up with advancing ground forces.
74. Dr. James G. Roche (of the Naval Surface Warfare Center Carderock, Maryland), e-mail, 13 December 2004: "Beginning in June 1941, the U.S. Army in the Philippines began exercises with the objective of reaching the level of the Louisiana maneuvers. In September 1941, the Philippines Division held exercises which demonstrated its lack of mobility. In October, the 26th Cavalry held an exercise to deploy and defend the beaches of Lingayen Gulf—horses had a tough time after the approach march providing the necessary mobility. In November, the 1st Provisional Tank Group repeated the exercise successfully. To begin in December, plans were made for advanced exercises combining the different arms (armor, infantry, and cavalry) and adding the new Philippine Army units. Facilities were being constructed when the war began."
75. H. Dwight Griffin [Maj.] et al., *Air Corps Tactical School: The Untold Story* (Maxwell Air Force Base, AL: Air Command and Staff College, 1995), p. 7.

76. Claire Lee Chennault, *Way of a Fighter: Memoirs of Claire Lee Chennault* (New York: G. P. Putnam, 1949), pp. 18–19.

77. Robert T. Finney, *History of the Air Corps Tactical School, 1920–1940* (Manhattan, KS: MA/AH for Air Univ., Center for Air Force History, 1992), pp. 22–23.

78. Various lectures at Air University have gone into greater depth than any published source I have found, but the bare bones of this method are laid out in Griffin et al., *Air Corps Tactical School,* p. 5.

79. During work on my master's thesis on the history of wargaming, I was unable to find any information on gaming at the Air Corps Tactical School. The above is based on conversations I had in the early 1990s with Peter Faber (then a major) while we both worked at the School of Advanced Airpower Studies. Colonel Faber's PhD thesis is on the Air Corps Tactical School.

80. Jerome A. Ennels and Wesley Phillips Newton, *Wisdom of Eagles: A History of Maxwell Air Force Base* (Montgomery, AL: River City, 2002), p. 59.

81. "War Gaming, 1930s Style," *Naval War College Review* 42, no. 3 (Summer 1989), p. 51.

82. One hundred twenty-seven of the 136 strategic-level wargames played at the Naval War College during this period addressed war with Japan. Murray and Millett, *Military Innovation in the Interwar Period,* p. 355.

83. Michael Vlahos, "Wargaming, an Enforcer of Strategic Realism: 1919–1942," *Naval War College Review* 39, no. 2 (March–April 1986), pp. 7–22.

84. These games were taken very seriously during a period when promotions were slow and opportunities to stand out in combat nonexistent. See Admiral Kidd's brief but vivid description of Naval War College gaming at this time above.

85. Nofi, e-mail, 13 December 2004.

86. See Perla, *Art of Wargaming,* p. 71, and Murray and Millett, *Military Innovation in the Interwar Period,* pp. 192–93.

87. The best sources on the Navy's interwar live wargames are McCue, *Wotan's Workshop,* and Murray and Millett, *Military Innovation in the Interwar Period,* p. 355.

88. Murray and Millett, *Military Innovation in the Interwar Period,* pp. 400–403.

89. John Prados, *Pentagon Games: Wargames and the American Military* (New York: Harper & Row, 1987), p. 4.

90. As mentioned above, between 1923 and 1940 the U.S. Navy conducted a remarkable series of live wargames, Fleet Problems I through XXI. Albert A. Nofi, *To Train the Fleet for War: The U.S. Navy Fleet Problems, 1923–1940* (Newport, RI: Naval War College Press, 2010), pp. 28, 341.

91. See Albert Nofi's truly outstanding work on the interwar naval fleet problems and their impact, ibid.

92. Based in part on Nofi, e-mail, 21 November 2013, and in part on his *To Train the Fleet for War.*

93. The Marines wargamed at least as early as 1924; Victor H. Krulak, *First to Fight: An Inside View of the U.S. Marine Corps* (Annapolis, MD: Naval Institute Press, 1984), p. 89. However, work on developing an amphibious doctrine shifted into high gear in 1933, when the Commandant of Marine Corps Schools discontinued all classes so faculty and students could work on defining what was needed for the capability; John H. Cushman, "Maneuver from the Sea," U.S. Naval Institute *Proceedings* (April 1993), p. 47.

94. Col. Eric Walters, USMC (Ret.), a longtime wargame advocate and innovator, has found a single contemporaneous reference stating that during the development (1934–40) of the *Tentative Landing Operations Manual,* the floor of the old seminar building at Marine Corps University (the same room he would use for wargames in 1994) was laid out with model fleets and islands. While his discovery seems to confirm that Naval War College–style wargaming was part of the development process, it is also plausible, as Colonel Walters points out in a 6 April 2014 e-mail, that the layout was constructed purely for problem visualization. For live wargame exercises, Murray and Millett, *Military Innovation in the Interwar Period,* pp. 74–76.

95. Cushman, "Maneuver from the Sea," p. 47.

96. Peterson, *Playing at the World,* p. 276.

97. Pratt claimed his rules system correctly predicted the outcome of the naval battle with *Graf Spee.* See Perla, *Art of Wargaming,* pp. 38–39.

98. Peterson, *Playing at the World,* p. 271.

99. See John F. Sloan et al., *Soviet Style Wargames* (Washington, DC: Science Applications, June 1986), for the nuts and bolts of Soviet wargaming.

100. Earl F. Ziemke and Magna E. Bauer, *Moscow to Stalingrad: Decision in the East* (Washington, DC: U.S. Army, Center of Military History, 1987), pp. 16–18. See Richard W. Harrison, *The Russian Way of War: Operational Art, 1904–1940* (Lawrence: Univ. Press of Kansas, 2001), pp. 264–68.

101. The general had previously decisively defeated the Japanese in a rather large border skirmish, which may have helped even more in gaining Stalin's confidence.

102. Murray and Millett, *Military Innovation in the Interwar Period,* p. 197.

103. Perla, *Art of Wargaming,* p. 45.

104. Prados, *Pentagon Games,* pp. 1–2.

105. While this quote is now often attributed to Admiral Yamamoto, the earliest reference to it I could find was its appearance on-screen at the conclusion of the 1970 feature movie *Tora! Tora! Tora!*

106. For selecting personnel, Hofmann, *War Games,* pp. 74–75.

107. Still, according to Vego, "German War Gaming," pp. 132–33, they did conduct two staff rides, which proved very useful.

108. Hofmann, *War Games,* p. 15.

109. Dupuy, *Genius for War,* p. 266.

110. For the Sealion wargame see Wilson, *Bomb and the Computer,* p. 38, and Hausrath, *Venture Simulation,* p. 27. For the Luftwaffe's game see James S. Corum, *The Luftwaffe: Creating the Operational Air War, 1918–1940* (Lawrence: Univ. Press of Kansas, 1997), p. 356; also Edward L. Homze, *Arming the Luftwaffe: The Reich Air Ministry and the German Aircraft Industry, 1919–39* (Lincoln: Univ. of Nebraska Press, 1972), p. 243.

111. Again there are several accounts. The most authoritative (if somewhat verbose) of them comes from the U.S. Army program to learn from the German army's experiences during World War II by commissioning a number of papers from the German generals themselves: One of them, Gen. Rudolf Hofmann's 1952 *War Games,* cited above, was later developed into his *German Army War Games* (Carlisle Barracks, PA: U.S. Army War College, 1983). See pp. 38–44.

112. Barry A. Leach, *German Strategy against Russia, 1939–41* (Oxford, U.K.: Oxford Univ. Press, 1973), pp. 82, 105–107. Actually, Operation Otto encompassed all planning for an attack on the Soviet Union. One or more wargames were conducted at each echelon—Supreme High Command of the Army (OKH), army group, army, corps, division, etc.—so there was no one Operation Otto game. The one referred to was that conducted by OKH. See Hofmann, *War Games*.

113. A second irony: the wargame was conducted by Gen. Friedrich Paulus. Little more than two years later, Field Marshal Paulus would surrender the Sixth Army at Stalingrad—an outcome far different from what his wargame predicted. Leach, *German Strategy against Russia,* p. 105.

114. For example, in *Messerschmitts over Sicily: Diary of a Luftwaffe Fighter Commander* (Mechanicsburg, PA: Stackpole Books, 2007), Johannes Steinhoff tells of observing the defense of Sicily being gamed by the front commander. His implication is that the Germans were continuing to plan as usual despite the increasing hopelessness of the situation.

115. See *World War II German Military Studies* (Washington, DC: U.S. Army Europe, Historical Division, 1979), vol. 12, p. 50.

116. Many sources on D-day mention the Germans' anticipation of a feint in Normandy and their second wargame. The best known is Cornelius Ryan, *The Longest Day, June 6, 1944* (New York: Simon & Schuster, 1959), pp. 80–81; in 1962 a movie appeared, with the same title. My most detailed source on the second German game is Paul Carell, *Invasion—They're Coming: German Account of the Allied Landings & the Eighty Days' Battle for France* (Boston: Dutton, 1963), p. 13. However, I have been unable to recover my source for the Germans' first Normandy game and would appreciate any leads.

117. Hausrath, *Venture Simulation,* p. 27.

118. J. K. Hjalmarson, "The Development of War Games," *Canadian Army Journal* (Winter 1961), p. 9.

119. This morality play is arguably the most-often-told incident in the history of wargaming. While the above is true, it makes the argument against the admiral more "open and shut" than was actually the case. Most authors fail to mention that the American aircraft that sank the carriers during the game were B-17s. In

the actual battle the B-17 proved completely ineffective (during the entire war in the Pacific B-17s sank only one enemy ship that was under way), so in a narrow sense, Admiral Ugaki was right. Still, Ugaki failed to address the issue that the loss of his carriers in the wargame should have brought up: What if the Americans get in the first hit? Would we have enough strength to win anyway?

120. Jonathan Parshall and Anthony Tully, *Shattered Sword: The Untold Story of the Battle of Midway* (Lincoln, NE: Potomac Books, 2005).

121. Ibid., pp. 61, 67, 410.

122. Ibid., pp. 61, 67.

123. By one account this U.S. force consisted of only cruisers; by another *(Shattered Sword)* it included carriers.

124. Nofi, e-mail, 21 November 2013.

125. During a master's course he taught for the University of Alabama at Air University, Dr. Ronald H. Spector went into detail on his long quest to understand why the Japanese kept fighting. It was this joint wargame (of which he learned just after his *Eagle against the Sun,* cited below, went to press) that enabled him finally to understand. Several published sources touch on it, such as Hausrath, *Venture Simulation,* p. 32.

126. For the birth of OR see any of the "Historical Perspectives" papers presented by Gene Visco and Michael W. Garrambone at the annual Military Operations Research Society (MORS) Symposia over the last several years. Of particular interest are papers to be found at www.mors.org/meetings/combat_analyst/ca_pres/Garrambone.pdf and at www.mors.org/education_colloquium/EC2003/presentations/Garrambone.pdf.

127. For example, a 1957 article by two prominent OR practitioners seems to indicate unawareness of prior games used for war-plan development. Clayton J. Thomas and Walter L. Deemer Jr., "The Role of Operational Gaming in Operations Research," *Operational Research* (February 1957), pp. 1–27.

128. My source is a briefing given by Mr. Michael Garrambone to the MORS Symposium at Quantico Marine Corps Base, Quantico, Virginia, in 2003. Mike is a senior operations research analyst and a senior officer in MORS. He is currently researching the history of operations research.

129. Based on discussion during the first Connections UK conference, King's College London, 2–3 September 2013. For the Connections conferences generally, see *Connections Wargaming Conference,* connections-wargaming.com.

130. This account is based principally on a lecture given at Connections UK 2017 but also on Ministry of Defence, *Wargaming Handbook* (London: 2017), pp. 19–20.

131. The most detailed description of Soviet wargaming I have found was based on the debriefing of two Afghan army colonels. See Sloan et al., *Soviet Style Wargames*.

132. "Did You Know?," fifth item, *Strategy & Tactics* (March 2004), p. 25.

133. Schifferle, *America's School for War,* p. 155.

134. Ibid., p. 158.

135. A colleague at the Army War College has seen a reference to the Ninth Army gaming its prospective operations after the breakout from Normandy, but as of this writing I have not found a citation.

136. For the best brief account of Tarawa and its lessons see Ronald H. Spector, *The Eagle against the Sun* (New York: Vintage Books, 1985), pp. 259–66.

137. From a briefing I acquired years ago but cannot now find.

138. U.K. Air Ministry, *Operational Research in the RAF* ([London]: 1963), provides a comprehensive look at the application of OR techniques within the Royal Air Force (RAF), but I have found no analogous description for the U.S. Army Air Forces (USAAF). Still, given the close relations between the RAF and the USAAF, the British book likely provides some insight into the latter's employment of OR. Several books and chapters by MORS in the United States cover this period. For example, Wayne P. Hughes Jr., ed., *Military Modeling for Decision Making* (Alexandria, VA: MORS, 1983, 1989, 1997), although focused on OR, includes some material on historical wargames.

139. This is commented on in a number of histories of technology in general and of the computer specifically. For perhaps the clearest and most succinct see Ernest Volkman, *Science Goes to War: The Search for the Ultimate Weapon—from Greek Fire to Star Wars* (Hoboken, NJ: Wiley, 2002), pp. 216–17.

CHAPTER THREE

Wargaming in the Cold War
1946–1989/1991

The impetus and initiative for the rebirth of war gaming in the 1950s as a research instrument rather than a training or planning aid, came from the scientists and not the soldiers; with, it is fair to say, Britain in the lead, followed closely by U.S.A. and Canada, and now certain other NATO countries.

BRIGADIER M. R. J. HOPE THOMSON, DSO, OBE, MC

Wargaming in the years immediately following World War II has been described as an "eclipse," a "breakthrough," and a "transition."[1] Like the proverbial blind men's descriptions of the elephant, each characterization provides a correct but incomplete idea of wargaming at the time. Together, though, they paint a fairly complete picture.

Eclipse, Breakthrough, Transition: The Late 1940s and the 1950s

It is indisputable that wargaming in the former Axis countries went into eclipse. Unlike after World War I, when the small German army allowed under the Treaty of Versailles had a higher percentage of officers trained in wargaming than it had had before, Germany had no post–World War II army. The victorious Allies blamed the German General Staff, if not for contributing to the start of the war (though some of the Allies did), at least for prolonging it (which it almost certainly did). When the German army was reestablished in 1955 as an integral part of the North Atlantic Treaty Organization (NATO) it included few World War II–era officers with knowledge of wargaming. So few were they that when the U.S. Air Force agreed to provide a faculty member for the German War College, the school requested an officer with knowledge of wargaming, to help restart that element of its curriculum.[2] Japan too stopped wargaming for a time after World War II. Its new constitution actually outlawed armed forces, though Cold War tensions led to the creation of the Japan Self-Defense Force in 1954. Even in the United States wargaming virtually stopped in war colleges.[3] With the U.S. Army's budget and

manpower dropping rapidly, it appears that wargaming was neglected, like many other things.

Shortly after World War II, two wartime advances came together to shape the nature of American and Western wargaming throughout the Cold War. Wartime work in code breaking, radar, avionics, communications, electronic warfare, and flight simulation had produced advances that would underlie the electronic computer. Also, unlike the pioneering work of Edison and Lanchester during World War I, which was soon forgotten, the field of operations research, which had started in England on the eve of World War II and spread to the United States and Canada during the war, soon developed into an enduring discipline.

The latter was probably largely due to the fact that global tensions resulted in a continued need for the talents of OR professionals. Searching for ways into problems with many variables, several OR folks working at different locations hit on wargaming as a tool. With the emergence of computers, the OR specialists could conduct their wargames without the many military or naval officers previously required. To many OR professionals and some policy makers, these automated games, played without humans, were a breakthrough.

In fact, calling the immediate post–World War II period a time of transition is an enormous understatement. In what seemed the blink of an eye the United States went from bombing Berlin and shipping Lend-Lease arms and supplies to our "great Russian ally" to flying supplies to Berlin in the face of a blockade orchestrated by the Soviets. Naval War College gaming in the 1945/46 school year illustrated the speed of this change. The curriculum included wargames against the now nonexistent Imperial Japanese Navy (too little time to change it), yet by the 1946/47 school year the Soviet Union had already become the hypothetical enemy.[4] Yet more changes were coming to American and Western wargaming, changes that would fundamentally reshape the field.

A lasting legacy of the war was the mobilization of the scientific community of the English-speaking world. The Manhattan Project is the most famous example, but the radar work at the Massachusetts Institute of Technology and elsewhere, as well as countless other projects on both sides of the Atlantic, had contributed greatly to Allied success. Western militaries now found ways to hold on to a particularly helpful element of that scientific mobilization—the new community of operations-research experts. The OR community's survival would in a surprisingly short time lead to the reinvention and reemergence of wargaming. Initially, however, it would be a very different type.

A distinguished scholar has called the change in wargaming during the early postwar period a transition from amateurs (i.e., military officers) to professionals (OR experts). That is, instead of an Army combat engineer or a committee of Navy line officers on a

war college faculty designing and conducting wargames, they would now be developed and largely executed by OR specialists. But this amateur-versus-professional statement is at best misleading. A more accurate description would be wargaming transitioning from military strategy professionals / mathematics amateurs to military strategy amateurs / mathematics professionals. As the following pages will show, the net benefit of this transition to the defense of the United States and its allied and associated nations is not intuitively obvious. That the Soviet Union, its satellites, and its associated nations continued to wargame much as they had prior to World War II is interesting in terms of what might have been. Still, great advances were achieved, and the greatest came at the end of this period when military and OR professionals worked together closely.

Our expectations of the future shape that future. The United States expected peace, guaranteed by atomic weapons; the Soviets expected continued conflict, and they (at least publicly) asserted that the effectiveness of atomic weapons was overstated. Because of those divergent expectations, wargaming initially atrophied within the United States and grew in the USSR. As with the space programs, the Soviets widened their lead in wargaming because the United States was comparatively standing still. Unlike space programs, Red play was virtually unknown outside the Soviet sphere, so the Soviet lead did not spur the United States to action. Still, this unipolar wargaming world quickly began to change.

The seeds of wargaming's eventual recovery in the West were planted even before its post–World War II eclipse. Techniques and technologies developed during the war years would eventually support its recovery. Though it was not apparent at the time, the early computers (developed to help break codes and target artillery) and early flight simulators (designed to teach pilots the use of instruments and instrument flying) would eventually fundamentally change the world. The development of computers would also aid in the recovery of wargaming. As early as 1955, a conference in Michigan concluded that the computer could speed wargame adjudication—though only when psychosocial, political, and economic factors could safely be ignored.[5]

The Korean War

Very little is known about wargaming in preparation for, or during, the Korean War. It appears likely the United States did no wargaming before the outbreak to explore a North Korean invasion.[6] Although operations research was resurrected for this new war, the only history that mentions its efforts during Korea does not mention or imply wargaming.[7]

In the histories covering the communist side, however, there are several references, direct or indirect, to wargaming. One report suggests that wargaming may in fact have

been used extensively.[8] Officers who had graduated from Soviet staff and war colleges planned the initial invasion with Soviet assistance. The facts that, first, the Korean War was planned during the heyday of post–World War II Soviet wargame development and that, second, the initial assault had the signature, the "look and feel," of Soviet-wargame-designed attacks make a strong if circumstantial case for North Korean use of Soviet-supported wargaming.

There are indications that wargames were used throughout the Chinese-dominated phase of the Korean conflict. Many of China's top generals, including Gen. Lin Biao, commander of the Chinese "volunteers" who crossed the Yalu River, had attended Soviet staff and war colleges.[9] A standard account of the Chinese intervention seems to describe in a brief passage Soviet-style wargames being used to plan the initial offensive.[10] Because the wargame indicated that the superior firepower of U.S. / United Nations (UN) forces would defeat Chinese troops dug in across the narrowest part of the Korean Peninsula, China developed (and used) a second plan, one that would lure the enemy into a trap.[11]

There is an even briefer reference to what appears to be a Soviet-style wargame used to plan the final defeat of U.S./UN forces south of Seoul.[12] This and the signature of many of China's offensives—complex and intensely effective initially but less coordinated with time—also suggest Chinese use of Soviet-style wargames.

The U.S. Military

One legacy of World War II for the American armed forces was an increased emphasis on joint planning and "warfighting." While the individual services would continue to dominate the Department of Defense until at least the passage of the Goldwater-Nichols Act (see below), the trend toward greater "jointness" began immediately after the war. One indication, and catalyst, of that trend was the initiation of wargaming at the Joint Staff level. The formal use of wargaming by the Joint Staff began in 1949 when the Army Advanced Studies Group was transferred there.[13] First called the Joint Advanced Studies Group, it became the Joint War Games Agency in the late 1950s.

As for the actual recovery of wargaming, the Navy again led the way. As we have seen, immediately after World War II, wargaming at the Naval War College dropped to about 10 percent of its prewar levels. However, as early as 1947 the College increased its use of wargaming with the addition of a game-intensive logistics course.[14] Then, in 1958, the Naval War College's computerized Navy Electronic Warfare Simulator (NEWS) became operational.[15] While this early analog computer system was hailed as a breakthrough at the time, later articles would admit that this first computerized wargame never quite worked (aside from its big status screen). But the mere fact that the wargame was

computerized lent an air of modernity to what was by then supposed to be an antiquated procedure.[16]

In 1958 an Assistant for Wargaming was established on the Navy Staff and given responsibility for computer simulations and studies conducted in Washington, primarily in support of budget decisions concerning force sizing and technology.[17] Also in 1958, the Navy formalized the longtime organization of the work of the Naval War College's War Gaming Department: half the year the College provided wargames for its students, the other half wargames for various elements of the fleet.[18]

As for the U.S. Army, in 1947, Gen. Dwight D. "Ike" Eisenhower, then Chief of Staff of the Army, established a wargaming capability at the headquarters level, the Army Advanced Studies Group.[19] When the group was transferred to the Joint Staff in 1949 the Army created the Strategy and Tactics Analysis Group (STAG) to support its own Pentagon budget-development and other needs. Located nearby in Bethesda, Maryland, the STAG possessed an unheard-of set of *three* computers, a staff of 150, and a budget of $1,750,000 ($18,150,000 in 2017 dollars).[20] Similar wargaming was conducted at Johns Hopkins University by the Operations Research Office, an organization created by the Army to perform functions similar to those of the U.S. Air Force's RAND Corporation. This operations-research-PhD-heavy body performed a host of studies for the Army, including big OR-intensive wargames.

Unfortunately, if OR-heavy wargaming flourished in support of the Army's Pentagon headquarters, it appears few field units of any size wargamed during this period. One possible reason was a lack of training in wargaming. The Army had closed its war college during World War II to make more officers available to command all the incoming draftees. The school did not reopen immediately after the war: the Army was trying to get all the services to agree to one joint war college. Facing strong opposition, especially from the Navy, it gave up and reestablished the Army War College in 1954. But even then its curriculum did not contain the amount of wargaming of the final prewar years.[21]

Still, need drove the continuation of some wargaming. The post–World War II U.S. Army conducted wargames for some of the same reasons as the post–World War I German army had—with only a fraction of its former budget and manpower, wargaming was one of the few modes of training it could afford. A series of articles in a service quarterly, *Military Review,* offered advice on conducting effective map-based wargames.[22] Stung by its lack of preparedness in Korea (and enabled by higher budgets), the Army expanded its field wargame maneuvers. Its cartoon adversaries, the "Aggressors," did not duplicate Soviet tactics, but this was a start.

The Army did realize it might have to fight the Soviets. To prepare, it started debriefing general officers of the last army to have done so—the World War II German army. One of the things the Army learned from these generals was the value the Germans had derived from wargaming.[23] In 1954, just two years after the Army published its report on German wargaming, the Army established a wargaming function within the Continental Army Command (CONARC). The Deputy Commanding General for Development of CONARC strongly believed in the value of wargaming for both training and evaluating proposed changes.[24] In fact, he recommended that all units conduct wargames, using maps of the deployment area, before conducting any field exercise.

The Marines, for their part, continued after the war to conduct field maneuvers, landing exercises, and command-post exercises. When these exercises included reacting Red opponents and adjudication of the interactions of Red and Blue, they were wargames; those that followed scripts or fixed schedules were simulations. However, for over ten years after the war, it appears, the Marines did not use map- or computer-based wargames. In fact, a survey conducted in the mid-1950s indicated that few Marines knew these types of wargame even existed. The Corps's response to this finding included a *Marine Corps Gazette* article outlining the current state of wargaming.[25] In 1958 the Marines established a Landing Force Wargame series at Quantico, Virginia. The games were conducted by a small War Games Group of ten officers and four senior noncommissioned officers (NCOs) and used physical terrain models and rigid, manual adjudication procedures; their purpose was to examine the impact of proposed weapons and tactics. The group planned to expand its activities soon to include examining various Marine operations plans.[26] As it turned out, "soon" took a while.

Meanwhile, an office of Operations Analysis had been established at Headquarters, U.S. Air Force. Nevertheless, the new service initially depended on the OR community for all its wargame needs.[27] After the war the Air Force facilitated the creation of RAND as a way to retain its access to OR specialists. In 1948 RAND began experimenting with "crisis" gaming. By 1954 it had launched a number of innovative wargaming projects. That year, RAND began a computer model of the Cold War competition between the United States and the USSR. Input from the Air War College and the State Department prompted RAND to add political and economic factors. Accordingly, building on the foundation of earlier German and Japanese work, in the 1950s American academics and defense analysts developed what is today called "political-military" (or more succinctly, "pol-mil") wargaming. Though the depiction of these factors in a December 1954 wargame was viewed even at the time as crude, the potential value of including such factors was recognized. To increase flexibility, RAND later turned to a Free *Kriegsspiel* style of play and in so doing reinvented the German political-military (pol-mil) wargame. Also, in 1954, RAND attempted to wargame an entire nuclear war; the next

year it used an Air Warfare Model to accomplish a "net assessment" at the Air War College.[28] The prestige of OR at the time rubbed off on Air Force wargaming.

In the civilian arena, the wargaming picture during the 1950s was one of expansion in academia, recreation, and even business. Dr. Lincoln Bloomfield at the Massachusetts Institute of Technology (MIT) and several individuals at RAND developed techniques and explored applications for a class of wargame that if played well might not involve war. Dr. Bloomfield was a particularly articulate advocate of these games' educational and even policy insight applications.[29]

RAND was also a large part of the OR community's other big wargame-related breakthrough of the 1950s, game theory.[30] Like those of pol-mil wargaming, the roots of game theory extend decades earlier, but also like pol-mil wargaming, even more so, it was not widely applied until the 1950s. Basically, game theory holds that if the payoffs of various choices open to each of two individuals can be established, then the "rational" choice of both sides can be established. The most famous example of game theory is the "prisoner's dilemma." Game theory has been applied to economics, politics, and several other fields. When game theory was applied to armed conflict, the result was called a "war game." This has led some in the OR community and the wider defense arena to call wargames "war games" as well.

By the early 1950s, "miniatures"—tiny models of warships, planes, and vehicles and figures of soldiers—had been used to play second-generation simulation wargames by a small but slowly growing number of rich and upper-middle-class men for forty years. By the late 1950s, the players were much more numerous and were from a much wider socioeconomic range. Several trends contributed to this change. First, the postwar era's improving standard of living made collecting miniatures economically feasible for a larger segment of the middle class. Second, the price of miniatures fell, and by an amount that is even larger when adjusted for inflation. Third, a number of wargame rule books were published, mostly in Britain. Finally, during 1957 Jack Scruby in California started publishing *War Game Digest*. Scruby's circulation was initially tiny—forty gamers in the United States, Canada, and England—but by creating an informal network the *Digest* acted as a catalyst for further innovation and growth.

However, even more revolutionary changes were beginning. Even the *Harvard Business Review* published an article on adapting wargaming techniques to developing business strategy.[31] In 1953 a young man named Charles Roberts started selling Tactics, a map wargame he had designed, to civilians. Though similar to the wargames published in England and elsewhere over the previous half-century, Tactics was enough of an improvement to be considered by many to be the first second-generation print wargame produced for the civilian market. By 1958 Roberts had sold two thousand copies and

had come within thirty dollars of breaking even.[32] Encouraged, in 1958 Roberts founded Avalon Hill to sell war, economic, and sports simulation games to the general public.[33] In 1959 he saw a picture of a RAND wargame in *Life* magazine.[34] The game's map, he saw, had a hexagonal grid; he immediately realized that the "hex" grid allowed more realistic movement than a chess-like square grid, while keeping movement simple. In the coming decade he would design and publish wargames that were indisputably second-generation.

International

Military wargaming took different paths for each of the former belligerents. Germany's general staff and military were disbanded, so all military wargaming ceased. The same was true for Japan. In the case of the United Kingdom and Canada, developments followed a similar course to those in the United States, with wartime OR experts leading the move toward Cold War gaming. Initially, this gaming was for "research" only—that is, exploration of doctrinal and technology choices, not the traditional uses of education and operational-plan development.

The United Kingdom, most notably, conducted comprehensive lessons-learned exercises that resulted in the creation of a set of analytical models that would prove invaluable in assessing options at various levels of combat.[35] The first postwar wargaming in the United Kingdom for which there is hard evidence took place in 1956, the evidence being the game's publication that year as *The British Army Tactical Wargames*. This was a map-based game, based on OR from 1944/45, meant to model a fighting NATO withdrawal in the face of a Warsaw Pact advance. It contained the first wargaming rules for the use of tactical nuclear weapons.[36] In 1958 the United Kingdom produced a tactical ground-combat wargame; it used a 3-D map (i.e., a terrain table) with analog line-of-sight determination (what was visible from where) using a graduated pole.[37] Most British wargames during this period were developed and executed at Fort Halstead, in Kent. Fort Halstead is still home for much of the wargaming of the Defence Science and Technology Laboratory (Dstl), but few documents survive from this period. There is only a photo of eleven men and two women, captioned simply, "Founding Team June 1959," and a summary of a report on a corps-level wargame in which individual companies were depicted on the 3-D map.[38]

If the British were less than thorough in their data collection, the Soviets were obsessive. Even before the cessation of hostilities, they launched a massive effort to collect and compile operational data from their part of World War II, the "Great Patriotic War," to increase the validity of their wargaming. Owing to Cold War secrecy, this effort was not known in the West until the 1980s.[39]

On the civilian side, the growth of miniatures wargaming in the United Kingdom and the Commonwealth paralleled, if not exceeded, that in the United States. The slow but accelerating postwar recovery and the publication of several rule books fueled this growth. *War Game Digest* had contributors and subscribers throughout the English-speaking world.[40]

The High Point and the Low Point: The 1960s

By the end of the decade of the fifties, then, wargaming was clearly on the rebound. In the United States, the 1960s got off to a promising start; and wargaming was also becoming even more international.[41]

The United States

At home, the main source for hope was the new secretary of defense, Robert McNamara, whose strategy was to merge successful management techniques he had brought from General Motors with proven OR techniques.[42] His goal: effective defense at a cost the United States could sustain over the long haul. Problems would emerge during execution, but at its core, McNamara's concept for approving and continuing defense initiatives was sound and elegantly simple: accomplish a life-cycle cost analysis to learn what a proposal would really cost, and then use OR techniques and wargaming to estimate military utility. Meanwhile, if noticed by few, civilian second-generation wargaming growth accelerated.

In the joint realm, President John F. Kennedy was angered by what he perceived as a lack of political sensitivity demonstrated by the military in planning for what became known as the Bay of Pigs debacle. To address this concern, in 1961 Secretary McNamara ordered the Joint Chiefs of Staff (JCS) to wargame all impacts of contemplated operations: military, political, and economic. Political-military gaming had originated in Germany during 1927 and (as we saw above) was reinvented by American academia during the 1950s. The Joint Staff, in turn, expanded the capabilities of its existing wargaming activity, the Joint War Games Agency, to encompass this type of wargaming. With the increased scope came a new name, the Studies, Analysis and Gaming Agency (SAGA). McNamara would use SAGA for the unbiased evaluation of options throughout his tenure.[43]

That same year the computerized adjudication engine CARMONETTE was first used, to assist with comparing the military effectiveness of weapon systems.[44] In 1962, wargames and cost studies helped convince McNamara to support the creation of an "airmobile division," whereas indications of relatively low cost-effectiveness influenced him to cancel the Skybolt air-to-surface missile system. The latter caused a storm of protest from Britain, which had spent a substantial amount on the codevelopment of

Skybolt. The United States was blindsided by this criticism; McNamara's attrition-per-dollar calculations had not even considered diplomatic repercussions.

The biggest wargame of the period was completed six months after the Cuban Missile Crisis. Called the "Simulation of Total Atomic Global Exchange," this early computerized wargame took three years to prepare and six months to play. According to reports, the outcome confirmed that the United States could survive an atomic war.[45] (But why were there reports at all on what would normally be a highly secret wargame? This is speculation, but we may have wanted the Soviets to know we believed we could endure such a war.)

During the 1960s, the military began efforts to broaden wargaming beyond attrition. President Kennedy's criticism resulted in political-military wargaming not only by the Joint Staff but at "professional military education" (PME) schools as well. In 1964 the Advanced Research Projects Agency (ARPA, renamed in 1972 the Defense Advanced Research Projects Agency, or DARPA) funded a game that would depict all the political, psychological, and economic ramifications of an insurgency.[46] (Such an effort might have produced an entirely new generation of wargames, one capable of examining all wars in a much more comprehensive way. But regrettably, and despite some interesting work in this area, the defense planning community continued to use primarily attrition-based wargames.) That same year, the Joint Chiefs of Staff conducted a political-military game, Sigma I-64, that examined U.S. strategy options for Vietnam. The exercise was repeated as Sigma II-64, with even higher-level participation. The author Thomas Allen implies that these games predicted an American defeat.[47] However, review of the actual declassified reports makes interpreting the outcomes not so simple.[48] First, the strategy they executed did not match what followed in the actual event. During Sigma II-64, for example, the Blue side immediately attacked an expanded version of the Joint Staff's list of ninety-four targets and promptly mined North Vietnam's ports. Second, each exercise depicted only the first several months of U.S. involvement. Even if they had been able to adjudicate the political consequences of American casualties, the wargames did not cover sufficient time for those consequences to arise. As more and more information is declassified, accounts of the Sigma games become more and more complete.[49]

In the mid-1960s wargaming spread to what would become the National Defense University's Industrial College of the Armed Forces, for which the Raytheon Corporation developed a fully automated wargame. TEMPER (for Technological, Economic, Military, and Political Evaluation Routine) was judged a useful tool for applying the school's course material.

The innovation that undoubtedly would in time have the greatest impact on wargaming, and indeed on the progress of the human race, started in 1969 as a relatively small

Advanced Research Projects Agency project. ARPANET linked a handful of universities doing defense-related research. It would grow, a little, during the succeeding decades and become better known as the Internet.[50]

The 1960s also started well for naval wargaming, with a ringing endorsement from Admiral Nimitz.[51] "The war with Japan had been [enacted] in the game rooms here by so many people and in so many different ways that nothing that happened during the war was a surprise," he said, "absolutely nothing except the kamikaze tactics." Also, the Naval War College soon began offering a course in wargaming. In 1964 the Navy conducted the first "remote" wargame, with the players on board ship and adjudicators in Newport, at the College.[52] Also in 1964 the Navy upgraded its wargaming system, NEWS, to the Warfare Analysis and Research System (WARS).[53]

However, there were serious problems. WARS was so cumbersome that even many members of the War Gaming Department had trouble using it. Even so, the Navy believed that maritime warfare was increasing in scope and complexity faster than it could improve the capabilities of its wargames. Perhaps the problem was, in part, the growing complexity of computers and the corresponding difficulty of using them. There was also a trend in both Washington and Newport to keep the Red moves constant. Analysts and students would see how their plans fared against Red, but Red would have no opportunity to react; that reduced the value of all such wargames, for as any student of war will tell you, "The enemy gets a vote." That is, the opponent always preempts or reacts to your plans. Further, even this less-than-completely-effective wargaming occupied by the end of the decade only twenty-nine days of the Naval War College's yearly curriculum, a fraction of the prewar level.[54]

As for the Marines, as of 1964, they still had only one small wargame unit (now called the War Game Division), and it had not expanded beyond its original mission of examining the probable impacts of alternative weapons and tactics. It had not begun to address operations plans, education, or training. The War Game Division's games were still adjudicated manually; twelve hours of combat could take six months to play. Still, two articles published in the early sixties indicate that the Marines recognized the increasing importance of games for Department of Defense budget decisions.[55]

For its part, the Air Force during the 1960s made major advances in wargaming. Working with the Joint Staff and RAND, the Air Force started to wargame the Strategic Air Command's Single Integrated Operational Plan (SIOP) against a Red SIOP.[56] The "RSIOP" was prepared by intelligence officers, who studied not only the Soviet Union's weapons but its strategies and tactics as well. The Air Force also wargamed the defense of North America. The game it used, Big Stick, was demonstrated in 1961 at the Air Command and Staff College, where in 1964 it became part of the school's core

curriculum. During the 1960s, Abt Associates delivered three wargames to the new Air Force Academy. The first, Strategy and Force Evaluation, enabled the students to explore various strategic-weapons force structures. The second was a pol-mil game, and its final "deliverable" dealt with insurgency and counterinsurgency.[57] Finally, in 1967, the Air Force introduced the world's first instrumented air weapons range, established at Eglin Air Force Base (AFB) and used in weapon effectiveness testing. The full impact of this innovation would become apparent in the next decade.

The Army's wargaming too became more effective during the 1960s. In 1961, the Research Analysis Corporation (RAC) replaced the Operations Research Office as the Army's RAND-like think tank. As the Army focused more on counterinsurgency, it hired RAC to develop a squad-to-division-level wargame simulating the situation in Vietnam. The result, TACSPIEL, used the classic design of Red and Blue in separate rooms and White updating a "game truth" map in a third room. As reports reached Washington of real-world developments in Vietnam, the game was updated.[58] Early in the 1960s the Army's Operations Research Office at Johns Hopkins University began work on HUTSPIEL, a manual game that explored a ground battle between NATO and the Warsaw Pact, including both the use of nuclear weapons and battlefield logistics. When RAC took the project over in 1965 it computerized the adjudication.[59] Though RAC's emphasis remained the conduct of big wargames in the Washington, DC, area, we'll see below that it had some success reaching down to the field-army level.[60]

Wargaming was used by Army helicopter enthusiasts to develop the concept of an airmobile division. In 1962, as mentioned above, wargaming was used to sell the idea to McNamara, who in turn directed the Army to follow through with it quickly.[61] When the Army deployed its first airmobile division to Vietnam, it found, as the Marines had earlier, that real combat was different from wargames.[62] Also like the Marines, though, the Army found that its initial concepts were close enough for field adaptation.

Throughout the sixties the operations-research community's wargame support to the Army's Pentagon staffs remained strong.[63] However, wargaming in the field atrophied. One reason appears to have been a decline in the study of warfighting, and hence wargaming, at the Army's highest school, the Army War College. During the fifties and sixties, revision after revision of the curriculum increased the hours spent on international studies and other academic subjects at the expense of material more directly relevant to warfighting—such as wargaming. Ironically, a history of the school praises the subjects added in this period but is mute on where the time was coming from.[64] Meanwhile, the Army Command and General Staff College was shifting time away from warfighting and wargaming toward leadership, management, and communication, although it never completely abandoned wargaming.

The U.S. Army did continue to execute the type of live wargames it still referred to as "field maneuvers," or more often simply "maneuvers." Techniques for such games continued to evolve during this decade, as evidenced by the publication of two new editions of the Army's field manual on conducting them—*Maneuver Control,* FM 105-5.[65]

Wargaming was also used in direct support of our forces in Vietnam. Three wargames were conducted between May and October 1966. In-country commanders were quoted as calling the insights gained extremely useful. For example, one of the wargames followed an actual, and very effective, communist attack on an air base. The Americans gamed a hypothetical future attack and implemented the insights gained, and then the communists struck again—this time with much less success. The dramatic impact of all three wargames on real-world "friendly casualties" indicated that wargaming could be of great value in an "active theater." Nevertheless, an article advocating wargaming for planning down to the battalion level admitted that the Army would be hard-pressed to find enough personnel in the entire service qualified to man wargame cells at even the division level in Vietnam.[66]

Apparently unbeknownst to commanders in Vietnam, however, some in the Army had been working to make wargaming more "deployable." In the late 1950s, Dick Zimmerman of the J Operations Research Office and others worked to develop "quick games" that could be executed by small staffs as far down the chain of command as field armies. In October 1963, Gene Visco, of RAC's European field office, observed Operation Big Lift, in which for the first time the United States flew forces to Europe to "marry up with" prepositioned equipment and then engage in a live wargame. Using what he observed and his experience with complex wargames he developed Schnellspiel, a wargame that could be used at the brigade level, with the help of a single analyst. It was Mr. Visco's hope that Schnellspiel would replace the judgment of G-3s (staff operations officers) as the source of adjudication in unit command-post exercises.[67] Such "eyeball adjudication" had worked well immediately after World War II, when most unit G-3s were World War II combat veterans, but by even the early 1960s such men were becoming scarce.

On the civilian side, the 1960s saw continued growth of miniatures wargaming, and an increasing number of wargame rule sets, for different historical periods and even air warfare, were published in the United Kingdom and United States. These rules, and ever more numerous newsletters, were immediately available on both sides of the Atlantic.[68]

However, in the United States board or print wargames soon overtook miniatures in numbers of participants. It is easy to see why. To start a miniatures-based wargame, an individual needs to purchase miniatures and paint them; buy and read a rule book appropriate to the era of the miniatures purchased; build a playing surface like a model

railroad layout; often, buy and read a second book with descriptions of the battles of the era; and then, finally, play.[69] With a print/board wargame, an individual needs to purchase the game, open the box, unfold the map or board, read the rules, and start playing.[70]

Charles Roberts's Avalon Hill firm published roughly two new wargame titles per year. Most broke new ground by depicting different eras (ancient to modern), levels (tactical to strategic), or regimes (air, sea, or land). Through the 1960s the only publisher of print (board) wargames worldwide was Avalon Hill, even though in 1963 it almost went bankrupt. It was taken over by its largest creditor, Monarch Printing, and under the leadership of Monarch's president, Eric Dot, Avalon Hill grew in sales from a few thousand annually at the beginning of the decade to over a hundred thousand by the decade's end. Young American males purchased most of these wargames. They were, on average, above the national norms in education and income.[71]

In May 1964, Avalon Hill planted the seed of what would enable, or at least accelerate, the breaking of its own monopoly on print wargames. In that month Avalon Hill published the first issue of its house magazine, *The General*.[72] Intended principally to boost sales, by helping individuals find opponents, *The General* also ran users' complaints about current wargames (all by definition from "AH") and suggestions for designing better ones. Soon the magazine's readers began feeling like a community with common interests, and the black art of wargame design became less opaque. During the summer of 1969 a shoestring wargame publisher began operations, in New York City: Simulations Publications Incorporated (later better known as SPI). The two young founders, Jim Dunnigan and Redmond Simonsen, would have a huge impact during the 1970s and beyond.[73]

Seeds of even bigger changes, even less noticed at the time, were being planted near Boston. In 1961 three friends at MIT's Project Warrior (about which more below), Steve "Slug" Russell, Martin "Shag" Graetz, and Wayne Wiitanen, began working on what is widely considered the first computer-based second-generation simulation wargame for civilian use. By February 1962 Spacewar was running on an MIT PDP-1 computer. A two-player, real-time, tactical computer wargame depicting combat between two spaceships orbiting a common sun, Spacewar was never published, but it was given to other universities and individuals.[74]

Despite this significant growth of commercial wargaming, for a long time many in the military wargaming community appear to have been unaware of its existence. As late as the late 1980s, in the author's experience, the few practitioners of military wargaming who were aware of commercial gaming were hostile to it. Several felt that the very existence of commercial wargames hurt their own games' credibility. For their part,

the commercial wargame designers believed (usually correctly) they did not have the clearances to learn from military wargamers. The wall between these two communities would take a long time to fall.

But the wall began to develop cracks almost immediately. In the mid-1960s the first attempt at technology transfer from the fledgling civilian sector to the military was made. Charles Roberts developed a wargame, Gametrain, specifically to teach infantry tactics, a weakness for many of our troops starting their deployments to Vietnam. The military faculty at the Army's Infantry School accepted the product, but the civilians who controlled the funds rejected it.[75]

International

Wargames were used by militaries on both sides of the Iron Curtain. In the West, the United Kingdom and Canada continued to use OR-based wargaming for research purposes.[76] However, some in those nations were advocating the return of wargaming to its traditional uses of education and the development of operations plans.[77] Throughout this period the United Kingdom continued to use manually adjudicated wargames with 3-D maps. How slow the adjudication was can be guessed—the surviving rule book is a hundred pages long. It is therefore not surprising that as early as 1962 a report was published in the United Kingdom advocating the use of computers, at least to accomplish the especially cumbersome line-of-sight calculations.[78]

Elsewhere, there is some evidence of Australian wargaming during the 1960s. Wargaming was defined in the 1965 edition of the Australians' *Armed Forces Dictionary*.[79] Years later it was noted that what was then the Scientific Services Office had been "actively engaged in wargames since 1969."[80]

But the largest impact was achieved in the East, by Soviet-style wargames. The Soviets opened their service schools to the officers of satellite and other communist countries. Wargaming constituted a very significant part of their curriculum.[81] The North Vietnamese applied the methods they learned in the USSR with effective results. Using Soviet methods, they wargamed each of their attacks against the South Vietnamese and their allies, from firefights to major battles. Familiarity with the plans the Soviet method produced allowed the communists to coordinate fairly complicated attacks without radios: subordinate commanders remembered a plan's timetable and executed it by their wristwatches.

In the 1960s China was the one communist country not invited to send students to Soviet war and staff schools. It had once been, but relations between the two communist great powers had begun to fray in the late 1950s; by the early 1960s diplomatic relations had been broken off. China's domestic war and staff schools were initially able to fill

some of the gap, but China's leader, Mao Zedong, was wary of his army growing too professional to control politically. Having underfunded China's professional military education institutions since taking power, Mao in 1966, the beginning of his Cultural Revolution, shut down military education entirely.[82] It is probable that China did not return to its Korean War level of wargaming competence until the early 1990s.

Among civilians overseas, the 1960s witnessed a breakthrough in wargaming in the United Kingdom and the beginnings of a global civilian wargaming market.[83] In 1962, Donald Featherstone, a World War II British army veteran and prolific author, released *War Games*.[84] It was a half-century after Wells's *Little Wars* but just four years since Charles Roberts published the first unambiguously second-generation board wargame, Tactics II. Featherstone had now created the first clearly second-generation set of wargame rules for miniatures. Gone were the spring-powered cannon, replaced with probability tables and dice. His rules took the "figures" wargaming hobby in the United Kingdom by storm, thanks in part to endorsements by respected military figures but even more to the book's clarity. Featherstone went on to write rule books for all regimes of war (air, sea, land) and most periods of history.

It was also in 1962 that Featherstone began editing *Wargamer's Newsletter,* one of the first and most influential publications on "miniatures" (the American term) / "figures" (British) wargaming.[85] In its pages, through articles on wargame design and insightful critiques, he helped develop a generation of miniatures wargame designers. As importantly, in a manner similar to what *The General* did for print wargaming, he helped (primarily English-speaking) wargamers in the United Kingdom and throughout the world realize they were part of a community.

Largely through the efforts of Don Featherstone, the United Kingdom pulled farther ahead of the United States in miniatures wargaming. Print gaming never really caught on in the United Kingdom. Both nations began exporting a substantial percentage of their games, predominantly to other English-speaking countries, but a few brave souls from a spectrum of non-English-speaking nations were starting to buy both types of wargames by mail order.

Wargaming had made a comeback. By late in the decade, one author has estimated, fifteen to thirty thousand officers and scientists worked in wargaming in the United States alone.[86] However, at the decade's end there was a modest backlash against wargaming and against operations research. McNamara, the Pentagon's leading exponent of wargaming, was gone. Many blamed, at least in part, the fact that the war in Vietnam was not going well on his policies and the OR tools he had used to devise them.[87]

However, like Prussia's loss to Napoleon, that poor performance would itself soon motivate advances in wargaming, the greatest since Prussia's breakthroughs.

Learning from Vietnam: The 1970s

The seventies were very good for wargaming. Unbeknownst to the West, wargaming continued strong in the Soviet bloc, as it declined in China. In the United States, wargaming started the decade weak. Very little was published on military wargaming in the early 1970s, perhaps reflecting the antimilitary attitude of the times. Yet by decade's end the U.S. military would produce significant advances in wargaming. On the civilian side, many consider the 1970s to be the golden age of innovation in U.S. print wargaming, while predominantly British miniatures wargaming continued to grow in popularity and more civilians who did not speak English as a first language began to wargame.

The United States

In the early 1970s, it appears, there was something of a downturn in the use of wargaming by the U.S. military. If so, the decline was short-lived. As before, the Navy led the way, but this time it was soon overtaken by the Air Force.

Vietnam was not going well for the United States. Aside from all the other problems, the American air-to-air kill ratio had dropped from spectacular in Korea to dismal (occasionally worse than one-to-one, seldom even as good as two-to-one). A study called "Red Baron" concluded that we were teaching our pilots how to fly, but not how to fight. If a pilot survived his first eight missions, "on-the-job training" would have taught him to fight, and he would very likely survive his tour.[88]

The Navy acted first, establishing its Top Gun school in 1969, formally (until 1996) the Fighter Weapons School.[89] The aggressor/instructor pilots flew small, nimble jets similar to those flown by the Soviets. The aggressors also attempted to duplicate Soviet tactics. It worked—the Navy saw a significant improvement in its kill ratios over Vietnam, while the Air Forces's ratio stayed virtually unchanged. Despite this proof of the success of live wargames in enhancing the tactical effectiveness of Navy aviators, there was no immediate increase in wargaming by the Navy's other communities or for higher levels of warfare. On the surface warfare side of the Navy, one officer, Joseph Saur, saw at the time little evidence of real interest in wargaming.[90]

However, in time the Navy's use of wargaming did expand. In 1972, Vice Adm. Stansfield Turner became President of the Naval War College. Among his many initiatives was to recast wargaming at the College from a few big exercises focusing on staff work to many small exercises that enabled (i.e., required) each student to devise a strategy. To facilitate this shift he supported the development of "tabletop" wargames, the first

being the Sea Control Tactical Analysis Game (SEATAG). Soon the exercises shifted from the wargaming center in Sims Hall to classrooms.[91] In 1978, SEATAG was replaced by NAVTAG, a hardware/software system with a hardware "footprint" so small (for the time) and inexpensive (for the time) that the Navy could afford to put sets on board individual combatants. NAVTAG was so user-friendly (again, for the time) that some sailors started using it during their free time.[92]

However, big, complex wargames were still being conducted in support of the fleet. In 1975, the Navy established its Tactical Command Readiness Program (TCRP), an ongoing series of wargames played on board the actual surface combatants involved.[93] By then the difficult-to-use, insufficiently capable WARS adjudication software was being replaced by the far more powerful Naval Warfare Gaming System (NWGS) software. While not as user-friendly as hoped, it was clearly an improvement. These enhancements and the strong advocacy of wargaming by Adm. Ike Kidd, first as Chief of Naval Material and then as Supreme Allied Commander Atlantic (SACLANT), increased the fleet use of wargaming to sixty days a year by late in the decade. More important in the long term, as SACLANT Admiral Kidd pushed to make his wargames more strategic and more joint.[94]

At decade's end the Naval War College made two additional wargame initiatives. One was an elective that used gaming to help develop and test new fleet tactics. The other—the Global War Game—was an attempt to recapture the kind of invaluable insights gained from the College's gaming of War Plan Orange during the interwar years. Planning began in 1978, and the first exercise, three weeks long, was held in the summer of 1979. The fifty participants, mostly students who had yet to leave the College for their next assignments, executed the opening days of a global war against the Soviet Union. The adjudication methods were simple, Red play was rather amateurish, and Army and Air Force actions had been scripted before the exercise began. Nevertheless, "Global" offered a new and important perspective: other contemporary wargames had much narrower foci in geography and duration. The perceived value of this broader approach would lead first to Global's growth in size and sophistication and then to insights that may well have helped win the Cold War. But that is a story for the 1980s section.[95]

As for the Air Force, its main wargame initiative of the 1970s was Red Flag. If the Air Force took longer than the Navy to respond to adverse loss ratios over Vietnam, its response was more comprehensive. In 1974 the Air Force established its own Fighter Weapons School. The school was similar to the Navy's Top Gun; air-to-ground tactics were also taught. Then in 1975, owing largely to the vigorous efforts of Richard "Moody" Suter, then a major, the Air Force initiated the Red Flag series to improve the fighting skills of all its combat pilots. Both the school and Red Flag used an electronic

range like that at Eglin AFB to allow accurate adjudication and debriefing of engagements. Over time, the Air Force created in the Nevada desert an entire enemy "nation," complete with strategic targets guarded by simulated integrated air defenses. This system included both aggressor squadrons that flew Soviet-like aircraft and employed Soviet tactics (another initiative Moody Suter helped to make a reality) and a network of Soviet-like radars and simulated surface-to-air missiles.[96] All this also provided a realistic environment for trying out new equipment and tactics.

Actually, the environment was even more realistic than the general public would know until November 2006. In July 1979, under a program code-named Constant Peg but known to its pilots as the Red Eagles Squadron, the United States began flying "acquired" Soviet aircraft. The Pentagon architect of the program and its first commander, Col. Gaillard R. Pack Jr., USAF, would over thirty years later write a book on it.[97] Pilots flying Red aircraft and using Red tactics and a simulated Red ground-control intercept system—it would be difficult to imagine a more realistic wargame or a more valid means of testing tactics and equipment.

The seventies also saw the beginning of efforts to improve Air Force educational wargaming. For years people inside the service (notably then–lieutenant colonel Dennis Drew) and outside (most notably Congressman Ike Skelton) pushed for "more war in the War College" and more rigor in PME generally. Indeed, some progress was made, as individuals in each school's wargaming department adapted games received from the operational Air Force or elsewhere or built their own.[98] The Clements commission (see below) provided additional support. But someone with a comprehensive vision was needed to lead the effort to implement these recommendations fully.

That vision became available in September 1979, when Col. Constantine "Dean" Pappas returned to Maxwell AFB. His career up to that point had been a perhaps unique mix of operational, technical, and educational assignments, including a tour during which he enhanced wargaming at Maxwell's Air Command and Staff College. He now joined the faculty of the Air War College as chief of wargaming.[99] He was originally tasked simply to improve the school's existing Theater Warfare Exercise. But by 15 October he not only had developed a comprehensive plan (including the facilities, hardware, software, and personnel needed to catch up with the other war colleges and services) but had secured the permission of Air Training Command to seek funding for it.[100] What he did next is more properly a story for the eighties.

Finally, 1979 also saw the first effort by the Air Force to reach out to friendly air forces by running wargames for their war and staff colleges. Individuals from Maxwell AFB traveled to allied and friendly nations' war and staff colleges and conducted games identical or similar to one used at Air University. Although in 1979 only the Canadian

Forces Staff College hosted such a wargame, the list would grow in the 1980s and beyond.[101]

The U.S. Army, largely to correct tactical deficiencies observed in Vietnam and to prepare better for an anticipated Soviet-led Warsaw Pact attack on NATO, worked to increase wargaming in combat units. More user-friendly manual adjudication manuals were published, and several procedures were computerized;[102] however, owing to time demands on unit staffs, games' actual use remained below the levels Army leadership preferred.

There were, however, some notable successes. In 1974, the Command and General Staff College introduced its first two-sided, computer-aided wargame.[103] Some successes were local; in Hawaii, for instance, the 25th Division made extensive use of wargaming.[104] Others had broader impact. In 1975, two students at the Command and General Staff College, Capts. Hilton "Stretch" Dunn and Steven Kempf, began developing ground tactical wargame rules for miniatures. The resulting Dunn/Kempf game was adopted first by the Army's Staff College, in 1977. Years later Kempf, by then a colonel, recalled that the initial objectives of the wargame had been to allow students to test the plans they had been developing in the curriculum and also to serve as a visual aid. The Dunn/Kempf wargame was used in a series of conferences exploring various tactical options for countering a Soviet ground thrust in Europe. Following positive feedback from the conferences, the Combined Arms Center assembled five hundred Dunn/Kempf kits (rules, miniatures, terrain) and shipped them throughout the Army. While extent of use varied with unit and over time, the game was widely played into the 1990s—in part because, to play it, units built terrain tables of the locations to which they expected to deploy in wartime.[105]

In the late 1970s, the Army acted to strengthen wargaming for command-post exercises and other unit training. To do so it developed the Computer Assisted Map Maneuver System (CAMMS) and established mobile teams to set up wargames for field units. For example, during the summer of 1977 a training team of the 75th Maneuver Area Command visited the garrison of the 14th Armored Cavalry Regiment. Using molded foam terrain boards to display the current battle situation and portable computers to automate (hence speed up) adjudication, CAMMS allowed the regimental commander and his staff, as well as his squadron commanders and their staffs, to practice making the decisions they would make to defend the Fulda Gap from the invading forces of the Warsaw Pact. Though the original version was almost as slow as manual adjudication and contained some adjudication elements that defied logic ("popping" smoke camouflage did not decrease your odds of being hit), CAMMS was a start at bringing

computer-assisted wargaming to the "pointy end of the spear." With incremental improvements and faster processors, CAMMS continued in use well into the 1980s.[106]

The "hollow force" of the mid-1970s may well have been the low point for Army field maneuvers. With most units starved for training funds and less-qualified recruits needing more time on fundamentals, such wargames were conducted less and less frequently. However, in the late 1970s, as budgets began to recover, the Army significantly enhanced the number, speed, and accuracy of its live wargames.[107] Electronic systems such as SCOPES and REALTRAIN, and finally the Multiple Integrated Laser Engagement System (to oversimplify, a military version of laser tag), progressively improved the adjudication of Army live wargames.[108] However, the real breakthrough would not come until the 1980s.

Finally, in the late 1970s Col. Ray Macedonia began his long tenure as head of wargaming at the Army War College. In the coming decade he would do much to advance wargaming throughout the college, the Army, and the American military.

The U.S. Marines continued during the 1970s their long practice of conducting live "field exercise" wargames and constructive "analytical" wargames. Wargames were also part of the curriculum of their staff college. As the 1970s progressed, Marines in the field demonstrated initiative in bringing wargaming first to their units and then to the Marine Corps as a service.

The War Games Branch, Studies and Requirements Division, Development Center, of the Marine Corps Development and Education Command, in Quantico, Virginia, conducted several analytical wargames in the decade. For example, beginning in November 1972 it conducted a set of wargames called Atlas I and II, using the Landing Force War Game method of manual adjudication. The scenario depicted a Marine amphibious unit fighting a delaying action on the south shore of the Strait of Gibraltar, in Atlas I, until it could be reinforced by a Marine amphibious brigade, in Atlas II. The objective was to assess the Marines' ability to assist in sea control by keeping key straits under friendly control.[109] The objectives of their live wargames in the 1970s seem to have been both to train commanders, staffs, and troops and also to "prove again" that the Marines had not become obsolete.[110] Such exercises were conducted in both the European and Pacific theaters.[111] Several seem also to have had a secondary objective of building alliance cohesion, the clearest example being Pegasus II, during which exercise forces conducted a vigorous civil-action program.[112] During the 1970s the Marines also conducted the constructive manual wargame APRX as part of their staff college curriculum.[113]

However, several individual Marines were working to extend wargaming even further. Perhaps the Marines' most successful champion of wargaming was Col. John C. Studt, then commanding officer of the 3rd Marine Regiment, 1st Marine Brigade, Marine

Corps Base Kaneohe Bay, Hawaii. An enthusiast of civilian board wargames, Studt was interested when the Army fielded a new family of manual games. During May and June 1977 Studt loaned several of his officers to the Army to help run one of them. These officers were to learn how to use and run the games and to "borrow" as many game components as possible.

The 3rd Marines subsequently adapted and modified various Army games and used them frequently to control battalion, regimental, and brigade command-post exercises through at least 1979. They built a regimental simulation center (roughly five years before this became a standard Army practice) in an unused troop theater and assigned Marines to run it as an "additional duty." The "sim" center was one of the standard stops for VIPs and was visited at least once by the Commandant of the Marine Corps. The most successful of the wargames adapted from an Army predecessor (the Army's Pegasus, the Marines' Pegasus II) was described—with its costs ($250) and benefits (enormous)—in a 1980 *Marine Corps Gazette* article.[114]

Colonel Studt's next assignment was to Quantico, where he continued to champion wargaming. In 1979 a similar facility was established (in a similar way) by the 3rd Marine Division on Okinawa, and a project was initiated to create the Marines' own family of manual wargames.[115]

The '70s also saw increased joint wargaming within the PME schools. After the defeat in Vietnam, the Clements Commission on Excellence in Education (led by William Clements, deputy defense secretary) reviewed the curricula of all the service war colleges and concluded that they all needed to "put more war in the War Colleges." Its finding would help advocates of more wargaming in all the services.[116] Also, the growing numerical advantage of the Warsaw Pact in Europe was starting to generate real concern.[117] That concern grew when the 1973 Arab-Israeli War demonstrated how fast and deadly war had become. Before and during World War II, wargaming had helped the Germans develop and execute the increased tempo of blitzkrieg. Some thought wargames could help the American armed forces cope with still faster warfare.

The 1970s also saw the beginnings of cooperation between the wargaming efforts of the services. Specifically, Col. Dean Pappas, USAF, and Col. Ray Macedonia, USA, developed the concept of joint, distributed wargaming. Originally called "Car-Max" (for the bases where the Army and Air Force War Colleges are located, Carlisle Barracks, Pennsylvania, and Maxwell Air Force Base, Alabama, respectively) the idea quickly evolved into the Joint Land Air Sea Simulation (JLASS)[118] Exercise, which involves all the senior war colleges, and about which see below.[119]

If during the seventies one couldn't yet speak of the "interagency" arenas as we can now, the State Department was already moving toward political-military wargames and

related computerized aids. Under Secretary of State Elliot Richardson was particularly enthusiastic about a system called CASCON, developed by Professor Bloomfield. (By the end of the decade, interest had faded.)[120]

In the civilian world, the 1970s were the commercial high point for print (board) wargames. While predictions that print wargames would make miniatures gaming obsolete turned out to be incorrect (the popularity of miniatures actually grew gradually throughout the decade), print wargame sales grew phenomenally.[121] About a hundred titles were published each year; most titles sold between ten and twenty thousand copies, twice the average sales of books on the same subjects.[122] This increase in sales was due to several factors, but one remarkable individual and his organization had a disproportionate impact.

During the late 1960s, James Dunnigan found he could design and develop print wargames faster than Avalon Hill was willing to publish them. Largely to get his wargames into print sooner, he and Redmond Simonsen founded Simulations Publications Incorporated (better known as SPI, mentioned briefly above). They purchased a low-circulation history magazine, *Strategy & Tactics (S&T),* and started including a wargame in each issue. By this key strategy, bringing together amateur and professional historians (who both wrote and read the articles) with amateur and professional wargamers (who designed and played the wargames), the magazine generally increased the range and historical spectrum of subjects wargamed.[123] Mr. Dunnigan served as president, editor, and lead designer; Mr. Simonsen was vice president and art director.

A significant percentage of SPI's innovative designs came from Dunnigan himself—easily the most prolific wargame designer to date in any medium, with well over 140 titles to his credit. In part to cope with such volume (SPI would produce over four hundred titles during the 1970s), Dunnigan and the *S&T* staff developed techniques and procedures for designing and developing wargames, even publishing a guide to them.[124] Similarly, Simonsen developed conventions for print wargame graphics; many are still followed today, and some continue to influence computer game interfaces. Perhaps even more importantly, SPI's success demonstrated that the market could support more than one publisher and so encouraged a number of others to enter the field.[125] Still, during the 1970s SPI would publish more than half of all print wargames produced worldwide.[126]

In 1975, the first national civilian wargaming convention, Origins, was held, and this too stimulated the growth of the field.[127] The presence of an increasing number of publishers encouraged such innovations as wargaming the effects of morale, training, surprise, and many other supposedly "intangible" factors. For its part, the military wargaming community, largely uncompetitive, did not even attempt to depict such factors during the 1970s, the 1980s, or for the most part the 1990s either.

Sales of print wargames rose steadily during the decade, exceeding two million units in 1979.[128] However, by then two developments had already taken place that would cause those sales to decline in the 1980s. First, in 1971 a tiny company published miniatures rules (as the book *Chainmail*) for battles set in the medieval period. In 1974, a supplement to those rules, by Dave Arneson and one of the coauthors of *Chainmail,* Gary Gygax, appeared; the supplement initially sold very slowly. In 1977 a young man named Chris Crawford published the first computer wargame for the civilian market.[129] However, few private individuals owned computers at that time, and his sales were modest. Sales of both computers and computer-based wargames would increase significantly during the coming decade, as would sales of a variant of that miniatures wargame supplement—Dungeons & Dragons.[130]

The wall between civilian and military wargaming, which showed cracks in the sixties, developed more in the 1970s. In 1974 the U.S. Army became the first service to buy a commercial-style wargame, the tactical ground combat simulation Firefight, by SPI. Many at fairly high levels in the Army believed that soldiers needed to do more wargaming and hoped that a wargame as easy to learn and to play as civilian wargames would get used more than the Army's current ones. Though Firefight has been described as only a modest success, the crack had been made.

In 1976 it got much larger when Colonel Macedonia invited James Dunnigan to help him reintroduce wargaming at the Army War College.[131] Dunnigan's contributions, including helping to design the McClintock Theater Model (discussed below), brought him to the attention of the legendary head of the Net Assessment Office of the Office of the Secretary of Defense (OSD/NA), Andrew "Andy" Marshall. In 1977 Marshall invited Dunnigan to address the first-ever conference of military wargamers from across the Department of Defense. Dunnigan used the conference, held at Leesburg, Virginia, to demonstrate the effectiveness of historical wargames (pointing out, for instance, that they are self-verifying—that is, if you can't reproduce history, you've missed something).

Leesburg kicked off a decade of reform and expansion in military wargaming; Marshall often asked, "Why can't *your* models do what Dunnigan's can?"[132] When Dunnigan's huge commercial wargame The Next War came out in July 1978, the defense contractor BDM took notice and hired the game's developer, Mark Herman. So began a chain of events that would lead commercial wargaming techniques into the heart of the U.S. defense establishment.[133]

International

Influences from American and to a lesser extent British and Canadian wargaming spread to Australia in the 1970s. In 1972, Lt. Col. (later Maj. Gen.) J. C. Gray visited the

United States and was impressed by our army's growing use of wargames. His recommendation that the Australian army begin wargaming was adopted. A review of progress in 1977 confirmed its value, recognized that significant progress had been made, and recommended additional wargames be secured from the United States and United Kingdom.

Early in the eighties the Australian army published *Training Information Bulletin 52* (TIB 52). The bulletin (to be discussed more broadly in the next section) noted, "Units and formations . . . have been developing and employing wargames to achieve collective and individual training objectives for a number of years"; an appendix listed wargames used by Australian forces. The appendix contained eleven titles, ranging from individual-training games (one employing an armored corps) to team-played, logistics-heavy games. The list suggests that during the seventies Australia might have done more wargaming, covering a wider spectrum of applications, than did the U.S. military. Finally, in 1979, a small section was set up in the Central Studies Establishment (CSE) as a center for expertise in wargaming. This section soon developed and conducted several training games for the Australian army.[134]

The early 1970s also saw the British beginning to use computers for some adjudication tasks in procurement-support wargaming.[135] Late in the decade the British upgraded from their 1950s-vintage manual ground tactical game to an internally developed hybrid game.[136] Units were still represented by markers on a now 2-D (i.e., flat) map, but a computer made line-of-sight and other calculations.[137] It appears this both made adjudication significantly faster and permitted a modest reduction in staff.[138]

Also in Britain, in 1973 a young scholar, aged twenty-six, joined the faculty of the Royal Military College at Sandhurst as a lecturer in war studies. He quickly brought wargaming into the Sandhurst curriculum. In 1974 this scholar, Dr. Patrick "Paddy" Griffith, raised awareness of wargaming within Britain by running for the *Daily Telegraph* a large game that explored the chances of a German invasion in 1940. Several generals and admirals who had actually commanded forces in 1940, British and German, participated. The game appeared in a novel by Richard Cox in 1974, and Griffith himself published further details in 2009.[139] By the end of the seventies he had founded Sandhurst's wargame. Well before the end of the century he would become Britain's best-known professional wargamer.[140]

In 1975, the United Kingdom's Divisional Wargame (DWG) first became operational. The DWG supported analytical wargaming from the corps through division levels. Something of a technological marvel at the time, the DWG's run speed of ten to fifteen minutes of real time for each minute of game combat seems glacial by today's standards.[141]

In 1970, as mentioned at the beginning of the chapter, the German War College requested that its next U.S. Air Force exchange instructor be knowledgeable about wargaming. It appears that the end of World War II and the disbandment of the military had produced such a break from the Germans' traditions of military education that they needed the Americans (who had originally learned wargaming from them) to teach them how to use wargaming again.[142] By the mid-1970s the Luftwaffe department of the school was using an aggregated one-aircraft-on-one-aircraft analytical model called AGATHA. While this software was very cumbersome to use, it would wargame complex air operations. In 1979, the college's army department adopted a modern graphical-interface wargame called KORA/OA (Simulation Model for Officer Training at Corps Level, and below). KORA/OA replaced an earlier text-only ground wargame used at the college. KORA/OA was subsequently used throughout Germany for the training and education of officers in fighting units at corps level and lower.[143]

The 1970s saw China begin to rebuild its wargaming capabilities. The end of the Cultural Revolution in 1976 allowed military schools to reopen. However, basic education had been so neglected that at first much of its military schools' efforts went to rudiments.[144] When the Chinese military resumed teaching wargaming, it must have had trouble finding instructors after a pause of roughly two decades. Finally, in a precursor to a trend that would grow during the next decade, it appears American computerized wargames were first used by China in 1975.[145]

In the international civilian gaming arena, throughout the 1970s Don Featherstone continued to publish wargame rules and to edit the *Wargamer's Newsletter*. However, by now there were several other Britons writing game rules, owing in part to his efforts in the *Wargamer's Newsletter* to develop new designers and in part to rising incomes and falling costs of miniatures, which put wargaming within the reach of more of the British population.[146] The most prolific and enduring of these new voices was Phil Barker. Since the 1970s his Wargames Research Group has played a key role in developing more realistic hobby miniatures rules for all time periods. Mr. Barker has also worked as a consultant for the United Kingdom's, and other nations', defense establishments.[147]

While the 1970s saw an increase in the number of both print and miniatures wargames sold outside the United States and the United Kingdom, most were still published in those two nations, the United States continuing to dominate print and the United Kingdom miniatures.[148] The few small publishers who emerged in other countries captured only a tiny share of the increasingly global market.[149] With the coming of the 1980s, this would change.

Although the seventies were good for wargaming, the trend that would ultimately have the biggest impact on military gaming was not initially about gaming at all.

Vietnam-era company-grade officers began to enter positions of greater authority. Many felt our fighting forces had been hamstrung by a failure of strategic vision and a lack of basic campaign planning. As individuals and groups, many worked to ensure that the services would be better prepared intellectually the next time. In the Air Force, Maj. Moody Suter had already initiated the live wargame Red Flag, and others, like Lieutenant Colonel Drew, pushed to put more "war" in the war colleges.[150] In each service folks like the Air Force's Lieutenant Colonel Pappas and the Army's Lieutenant Colonel Macedonia thought they knew how to do that—more wargaming.

Promise and Performance: The 1980s

Things seemed to come together for wargaming in the eighties. All U.S. services, NATO, and commercial wargamers made great progress. Though little known at a time, one wargame may have brought the world to the edge of nuclear war, while another did much to preserve the peace during the difficult period of transition at the end of the Cold War.

U.S. Defense

In joint wargaming, the eighties also saw continuity and innovation. It appears that this acceleration was due at least in part to the greater emphasis on all things joint resulting from the Goldwater-Nichols Act of 1986. In that year the Joint Staff's Joint Analysis Directorate was redesignated J8.[151] It continued its low-profile but highly influential wargames. However, joint gaming also spread into education, training, and theater strategy development. In 1982 the National Defense University (NDU) had finally initiated a wargaming center.[152] The Warrior Preparation Center became operational in Germany.[153] Wargaming at the National Defense University rapidly expanded during the 1980s, thanks in no small degree to the support of the university's president, Lt. Gen. Richard D. Lawrence, USA.[154] By mid-decade wargames supported the curricula of each of the university's colleges, including its Armed Forces Staff College.[155]

In the 1980s the late-seventies vision of two wargame pioneers, the Air Force's Colonel Pappas and the Army's Colonel Macedonia, of a joint wargame between service colleges was finally realized by all services. JLASS had become an annual elective exercise for students of the Air, Army, Naval, and National War Colleges. The 1987 iteration was held at the Naval War College; sixty controllers were needed to adjudicate the moves of just fifteen students, in part because the only way to depict the joint campaign was to run each move simultaneously through three service wargame adjudication programs and then manually integrate the outcomes into a theater picture. Even so, the controllers managed to adjudicate two game days per calendar day, allowing participants to go from

just the first four days of a campaign to the first eight. The scenario was also moved to the Korean Peninsula, allowing better Navy and Marine play.[156]

The 1980s also saw now-colonel Moody Suter's last great innovation. As Red Flag had allowed the United States to create virtual air-combat veterans, so he now crafted an environment that would create virtual joint-campaign veterans. He designed the Warrior Preparation Center specifically to allow senior U.S. and NATO headquarters to practice the execution of war plans without having to maneuver troops. Colonel Suter retired, in July 1984, before his vision could become operational, but the momentum was irresistible. Live exercises, the traditional method of training battle staffs, were coming under increasing scrutiny. Bills for exercise damage, environmental concerns, and vulnerability to Soviet monitoring all increased support for the center. While the U.S. Air Force provided the real estate (in Einsiedlerhof, Germany) and the center's first commander, Col. John Vickery, the fourteen to fifteen million dollars needed to build the center and the three million required each year to operate it came from both the Army and the Air Force.[157] The center conducted its first major exercise in 1984, and by 1989 it was hosting mammoth exercises involving every major command element in NATO.[158]

In April 1986, the Joint Warfare Center was activated at MacDill AFB, Florida, to provide similar wargame support to the chairman of the Joint Chiefs of Staff and to U.S.-based joint headquarters, especially the warfighting area commanders.[159] By the late 1980s, all area commanders in chief were using wargames. A 1989 study concluded that U.S. Central Command was clearly ahead of the pack—a circumstance that would turn out to be fortunate. In particular, the Gallant Knight series, designed to test American plans to protect the Strait of Hormuz from a Soviet drive southward from Afghanistan, revealed that there was not enough ramp space in the Arabian Peninsula for all the aircraft the United States intended to deploy there. In addition, given how little warning could be expected, it was vital that munitions be prepositioned in-theater. Finally, to move fast our forces would have to be light, whereas the Soviets would be attacking with tanks; to have a chance, our forces would need to defend in the rough terrain north of the strait. To supply them with fuel effectively, we would need miles of pipe. The wargame having indicated these needs long before the actual fighting that was to come, the United States had the time to convince governments in the region to build more ramp space, persuade Oman to accept U.S. prepositioned munitions, and buy and preposition an enormous amount of pipe.[160] As it would later turn out, we had the invading power wrong, but we were right about the enablers of military success. The additional ramp space would soon prove crucial, as would the prepositioned munitions and pipe.[161]

The bigger budgets of the 1980s also led to an increase in the number and size of live wargames, now usually referred to by the military as "exercises."[162] Indeed, though all these exercises involved live troops, many did not include opposing forces and were actually simulations of wartime tasks. The most commonly exercised task was deployment. In any case, these exercises provided excellent practice for what may well remain the fastest and farthest large deployment in our history—Desert Shield.[163]

In the mid-1980s the State Department showed some interest in computerized wargaming as well as related analytical aids, though it appears this resurgence was not sustained.[164] There was also at least one interagency wargame. In March 1982, a five-day game was played to determine the government's ability to survive and strike back after a nuclear "decapitating strike." The exercise was executed at several locations around the nation, including the White House Situation Room. Though one of an annual series, it was described as the largest such exercise in over two decades (which implies that there was an even larger similar exercise sometime during the 1950s).[165] While unusually high-level folks participated (including a former secretary of state, a former Central Intelligence Agency [CIA] director, and two serving cabinet secretaries), what was unique was the publicity given the exercise. Since the 1950s, J8, like its predecessor organizations, had closely guarded the names of all wargame participants; now it was announced that President Ronald Reagan, Vice President George H. W. Bush, and the secretaries of both state and defense observed the wargame and received the outbrief. Why was this wargame not kept secret like all the rest? Apparently the reason was President Reagan's view that demonstrating "the ability to maintain the continuity of government is as much a deterrent to attack as sophisticated weapons."[166]

Though few would have thought so at the time, the most important joint wargame development—perhaps the most important wargame development, *period*—may have been a 1983 DARPA initiative, Simnet (for Simulation Network). The idea of an Air Force captain, Jack Thorpe, Simnet allowed flight and other simulators to be networked so that they all appear to be in the same synthetic battle space.[167] Like that other DARPA innovation, what would become the Internet, Simnet got off to a slow start. Not many simulators were capable of being networked, and not many people saw any point in doing that. By the decade's end only the U.S. Army had a small pilot project, at Fort Knox, Kentucky. Like the Internet, though, Simnet's use would later explode, and its military use would be dwarfed by commercial applications.

Finally, wargaming was used in the planning for Operation Just Cause, the invasion of Panama in December 1989.[168] Less than a year later, a lot more gaming would be applied to support a much larger war.

It was the Army, however, that made the most important advances of the early 1980s. In 1980 it opened the National Training Center (NTC).[169] This "Red Flag for ground forces" employed an instrumented range, technology similar to laser tag, and a credible aggressor force to produce the most realistic ground-combat environment up to that time.[170] More wargaming was also being done at home stations, thanks to an innovation by III Corps.[171] A decade before, the Army had sought to make wargames independent of scarce computer hardware and (relatively) more user-friendly. In 1981, III Corps simply established a wargaming center at the garrison of each maneuver unit. Wargaming skyrocketed when overworked commanders found that using the centers, setting up wargames took less of their own time than other types of training.

Also in 1981, the Army established a War Gaming Department and built a Center for Wargaming at the Army War College and named wargame pioneer and advocate Colonel Macedonia as the new organization's first chief.[172] The concept was for it to function like the Naval War College's War Gaming Department, splitting its support roughly evenly between the educational needs of the Army War College and the wargaming needs of the operational Army.[173] One of the first accomplishments of Colonel Macedonia's organization was the creation of the McClintock Theater Model (MTM). After years of improvements and periodic name changes, MTM remains as the core of many of the theater-level models the Army uses today.[174]

The Army was also working to modernize its decision-support wargames. Tests conducted from 1980 through 1982 determined that MTM was insufficiently joint (i.e., did not adjudicate air and naval forces well enough) to be fully capable of teaching and planning joint theater campaigns. In 1983, the U.S. Readiness Command of the Army War College and the Army Concepts Analysis Agency funded the Joint Theater Level Simulation (JTLS) project. The intent was to create a computerized "engine" for theater-level games, to support the development of strategists, strategies, and doctrine. This work was both less and more significant than it may immediately appear. On one hand, as described above, the Army had been using computer adjudication of wargames for analytical support to the Army Staff since the 1950s. On the other hand, JTLS brought the perceived credibility of computerized adjudication to applications worldwide. In 1985, the further development of JTLS saw it transferred from an Army to a joint program.[175]

As the decade progressed the Army continued to make important advances. In 1987 it moved the gaming support of the service's operational mission from the Army War College to the Command and General Staff College.[176] Now designated the Battle Command Training Program (BCTP), it was to run computer-driven command-post wargames for all U.S.-based divisions. This program was part of a more general emphasis on gaming to train higher-level battle staffs in the art of war. Wargaming was seen as a way to

conduct such training, which, traditionally, had been neglected in peacetime as being too hard to do.[177] BCTP would just have time to exercise all the divisions that deployed to Desert Shield/Storm.[178]

Also in 1987, the Army extended the techniques and technology of the NTC to enhance the combat effectiveness of more forces. The high deserts of NTC's home in Fort Irwin, California, were most suitable for training heavy divisions—armor (tank and mechanized) and infantry in fighting vehicles. Now the Army built the same type of instrumented training environments in forests, swamps, and mock urban areas at Fort Chaffee, Arkansas, creating the Joint Readiness Training Center (JRTC). At JRTC the Army's light forces (airborne, airmobile, air assault, light infantry, and special forces) began to receive training of the same quality as its heavy forces.

But even then, the Army was having increasing difficulty preserving the use of its exercise areas. In some cases, restrictions were imposed to address environmental concerns; in others, exercise areas were lost outright. As a possible solution, the Army built a "technology demonstrator" called SIMNET-T at Fort Knox, tying a handful of tank simulators into a virtual network like Simnet. These simulators had been used mainly to teach procedures; now they showed users a virtual battlefield. Crews of all the networked tanks could "see" each other and a virtual enemy.[179] This small project was very impressive.

Finally, in 1989 the Army used wargames to explore various courses of action during the planning for Operation Just Cause. It used Janus adjudication software, at the Los Alamos National Laboratory, in New Mexico, to help train battalion and brigade commanders.[180] This innovative "repurposing" of an existing wargame would be followed on a much larger scale just a year later.

The U.S. Navy in 1981 enhanced its wargame process and technology. In that year the Chief of Naval Operations (CNO) established the Strategic Studies Group (SSG) to tackle the really hard problems facing the Navy. Resident at the Naval War College but reporting directly to "the Chief," the SSG typically executed three wargames each year as an integral part of its work.[181] It was in that year that the Navy completed the replacement of its wargaming system WARS by NWGS, which we mentioned above as in progress.[182] Seven years later it upgraded its system again, to the Enhanced Naval Wargame System, or ENWGS. Each upgrade roughly doubled computing power, yet as before, the scope of naval gaming always seemed beyond the latest system. As in the fifties, faculty filled the gap with innovation, common sense, and long hours. The strain stemmed from increased gaming by the College and fleet use, but also from the Global War Game series.[183]

We saw earlier that Global was an attempt to recapture the fruitfulness of wargaming during the interwar years and that it began on a modest scale in 1979. But each succeeding year saw an increase in the game's sophistication and size. Global 1982 saw important "firsts": attendance topped two hundred, play began long after the beginning of hostilities (it used the end state of an NDU exercise, Globex 82, as the starting point), and the Army and Air Force were full participants. Because Global started in the midst of hostilities, participants were able to see deeper into the campaign than ever before, and what they saw was that the West might win before "nukes" were used by either side.

In 1983, Global began before the conflict did but worked hard to move well into the campaign. A panel to adjudicate economic/mobilization issues was formed, for the first time. Again, it began to look as if NATO could prevent a quick Soviet victory; further, the West's greater economic strength could make a long-term victory likely. Still, it could go only so deep into the campaign in the three weeks of play, not enough to explore cross-effects between theaters or economic mobilization fully.

Globals 1984 through 1988 featured a single scenario that continued from one summer (when each year's game was played) to the next, allowing a total of nine weeks of wargame execution. That much real time allowed the scenario to be adjudicated all the way to war termination. (Global 1988 dealt with both war-termination and postwar issues.)[184]

By mid-decade, participation had increased to six hundred individuals from over a hundred government departments, agencies, military commands, educational and research faculties, businesses, and industries, as well as civilian and military representatives of the United Kingdom and Canada.[185] It was becoming increasingly evident that a war with the Soviets would likely be protracted and that in a protracted war the Soviets were doomed.[186] As Global attracted more of Washington's power hitters, that perception became widespread, coloring not only Navy strategy but national strategy as well. Global also increased the credibility of wargaming with Congress, and the Navy turned to it to support budgets.[187] In 1988 the Marines began gaming their budget initiatives as well.[188]

From the start, Orville E. "Bud" Hay was Global's guiding light. He personally developed the unprecedented multiyear series and recruited the high-profile participants. Bud took over as the chief of the Naval War College's War Gaming Department in 1985 and ran Global until his departure (for a Senior Executive Service position at U.S. Joint Forces Command) in 1999.

Another key to Global's success was its Red team. Red teams for many wargames are pickup affairs organized a few days before and disbanded at the end. Global greatly benefited from the personnel of the Navy Operations Intelligence Center (now Office of Naval Intelligence) Detachment at the Naval War College as specialist Red players

and "intel" controllers in all Globals and all department wargames. Its senior civilian, Dennis Callan, was critically involved in all phases of Global, and in fact of most department games. Dennis trained "generations" of Red gamers.[189]

Still, not all was well with U.S. naval wargaming. The final reports on successive Globals were of uneven scope, seldom including a candid evaluation of a given year's problems with design, preparation, or execution.[190] ENWGS frequently crashed, delaying adjudication by from a few minutes to several hours. When ENWGS did produce estimates of the net effects of Red and Blue moves they sometimes included outcomes that defied common sense and even physics. Hence, most Navy wargames used umpires to, at a minimum, reality-check ENWGS, typically to conduct manual adjudication in parallel. Tactical outcomes were often negotiated by opposing controllers (officers and civilians who supervised enlisted console operators) in the large ENWGS room of Sims Hall, higher matters by seniors in a booth overlooking it—much like a stock exchange. These negotiations were sometimes heated. Wargames in which the umpires (adjudicators) outnumbered the Blue and Red teams were not uncommon.[191]

For the Marines, the 1980s began with wargaming mostly limited to live field exercises and a small number of manual constructive games at Quantico for analytical or educational purposes. However, the decade saw a significant increase in the Marine Corps's use of wargaming, culminating with the creation of a dedicated wargame organization with Corps-wide responsibilities.

In 1980, most Marine wargames were training-oriented, tactical-level undertakings, though one series was built around an early "man in the loop" automated system—the Tactical Warfare Simulation and Evaluation Analysis System, TWSEAS, which focused on operational units. All wargaming done in and by the operating forces was by local option, internal to those organizations, and not coordinated or integrated at the service level. Another "thread" during this time was the work of the Concepts, Doctrine, and Studies Activity, long since reorganized out of existence, that did "wargaming-like" things but that properly belonged more in the "analysis" world. Finally, schools did some internal, curriculum-related wargaming—or so they called it.[192]

Early in the decade the Marines began awarding contracts for a set of manual constructive wargames that would provide artificial experience to commanders and staffs at each echelon. Four games resulted, developed by the University of Central Florida under the management of the Naval Training and Equipment Center in Orlando, Florida.[193] They were these:

- TacWar (platoon/company level). TacWar used miniatures with 3-D terrain boards. Neither side knew the location of enemy forces until contact was made.

- Steelthrust (battalion / Marine expeditionary unit level). Steelthrust was played on enlarged topographic maps, with cardboard units.
- Landing Force (regimental / Marine expeditionary brigade [MEB] level).
- TWSEAS (MEB or Marine expeditionary force level).

TWSEAS was computer based and was run from vans that could be transported to where the wargame was to be played. In time, TWSEAS would evolve into the Marine Air/Ground Task Force Tactical Warfare System, which was still in use around 2015.[194] By late 1982 a prototype of TacWar was far enough along to use in the Marines' Staff NCO Academy and Basic School. Steelthrust began testing in December 1982. A fifth wargame for the Marine Corps's tool chest, Warfare, was developed by Ketron Inc. to depict warfare at the Marine amphibious force level.[195]

Not all Marines believed these new wargames represented a step forward. One, T. X. Hammes, knew the earlier games well, having served as a secondary-duty wargaming officer with the 3rd Marine Regiment in 1978 and the 3rd Marine Division in 1979. He gained considerable experience with the new wargames, later using them as commanding officer of several units. Nevertheless, in 2014 he asserted that the new wargames "cost roughly 1000 times more to purchase and a hundred times more to run" than the earlier Marine Corps wargames.[196] Overall, he believed despite all the money spent the 1980s initiative moved wargaming in the wrong direction.

Still, as the decade progressed the Marines deployed their new family of wargames, with their different media to fit their different target audiences.[197] Initially these wargames were not used often, but by the late 1980s their use had increased significantly.[198] Since the games themselves changed little, if at all, it appears that this increase was due to the establishment of wargaming centers that provided administrative support. With less work needed on their part, more (already task-saturated) commanders were able to find enough time to game.

In the late 1980s, wargaming would have a profound, if indirect, impact on the Marine Corps and beyond. In 1989 John Schmitt wrote the Fleet Marine Force manual *Warfighting,* FMFM-1. It was the first of his highly influential "white books" on strategy, campaigning, and operations—a series that covered all major elements of military victory. Schmitt was an avid commercial wargamer, a player who took all wargaming very seriously. In fact, in mid-decade he began a series of one-move "tactical problem" wargames that ran in the *Marine Corps Gazette* well into the next decade.[199]

In 1988, at the direction of Gen. Alfred M. "Al" Gray Jr., the Commandant of the Marine Corps, the War Gaming Division was expanded into the Marine Corps Wargaming and Assessment Center. In addition to being larger, it now reported to the commanding

general of the Marine Corps Combat Development Command, through its Deputy Commander for Warfighting. Designated to support wargaming throughout the Marine Corps, during its first two years the center prepared and sent Marines to participate in joint and other-service wargames, planned and successfully budgeted for a program to upgrade TWSEAS, built a course to train controllers for TacWar and Steelthrust, and worked with the Marine Corps University to introduce wargaming into the formal professional military education curriculum. Perhaps most importantly, it developed the Commandant's Wargame, an exercise specifically designed to prepare Marine general officers for participation in joint and other-service wargames—and, incidentally, for a war that was much closer than any suspected.[200]

Finally, during the 1980s the Marines made good use of commercially available wargames. Two articles in the *Marine Corps Gazette* recommended them as a means to professional development.[201] The Marine Corps Wargaming and Assessment Center's plan to create a library of commercial wargames seems to have endorsed that assertion.[202] Wargame clubs were established at several Marine Corps installations, including Camp Pendleton, California, and Camp Hansen, on Okinawa. Throughout the decade individual Marine leaders used commercial wargames, sometimes right off the shelf, sometimes extensively modifying them. For example, Steve Dethlefsen modified the commercial wargame Advanced Squad Leader to teach and rehearse infantry tactics with his Marines shortly before Desert Storm.[203]

The Air Force, for its part, advanced its wargaming capabilities on several fronts. Its big story of the 1980s was the nearly decadelong struggle to plan, fund, build, and run a world-class wargaming facility at Maxwell AFB, Alabama. But as the 1980s began, the Air Force's emphasis was on more general encouragement of all airmen to think more about warfighting. Called Project Warrior, the program included emphasis on wargaming from the start.[204] As Project Warrior focused on individual, voluntary professional development, commercial wargames, being relatively accessible, were emphasized from the beginning.[205] The Air Force even purchased about a dozen commercial game titles and sent them to base libraries, aircraft crew alert buildings, and other facilities Air Force–wide.[206] Project Warrior also funded the publication of print wargames designed by Air Force officers and distributed throughout the service.[207]

The year 1984 was a banner one for Air Force wargaming. In 1984 the Air Staff Director of Operations was given oversight of all the service's gaming.[208] Also in 1984 the Air Force established the Blue Flag series of exercises. As Red Flag gave individual fighter pilots virtual combat experience, Blue Flag was meant to give air operation center staffs that same head start toward becoming veteran campaigners. Finally, 1984 saw the first exercises at the above-mentioned Warrior Preparation Center, an Air Force initiative

to support its theater-level commanders and planners in Europe. It would soon be conducting joint (that is, with members of other services) and then combined (with members of friendly or allied, especially NATO, nations) exercises.

Still, the epic drama was at Maxwell AFB. Maxwell is home of Air University and all the colleges (war, staff, and company grade) that provide professional military education throughout an officer's career. Since the 1960s (as discussed above), individuals had developed or adapted wargames for these schools' curricula:

- Air War College: Theater War Exercise (TWX) and, in cooperation with other war colleges, JLASS
- Air Command and Staff College: TWX, Fastick, Big Stick, and JPLAN
- Squadron Officer School: TEMPO III and Balboa[209]

Now work was under way to create one center for wargaming that would support all of Air University and in time the whole service. After an incredibly quick start (see above), Colonel Pappas's team needed almost a decade to achieve even most of its vision. First, it refined its definitions of the requirements. Though at first officially an Air War College faculty member, right from the start Colonel Pappas looked beyond his college's requirements, even beyond those of his parent command, Air University, to the wargaming needs of the entire service. Indeed his team envisioned providing Air Force wargaming support to the sister services and the joint community.

Having defined the needs, it developed a phased plan for meeting them.[210] Phase I would meet those of all of Air University's schools. As each school focused on a different level of warfare, the center would have to offer a different learning experience for each.[211] Given that jointness had not really caught on in the early 1980s, Phase II was prescient—its objective was to allow Air University students to wargame jointly with students attending other service schools. Finally, taking (like Red Flag) a Navy initiative and building on it, Phase III was to support decision makers throughout the Air Force—not just in the air equivalent of fleet exercises, as the Naval War College had been doing for decades, but in everything from crisis action planning and doctrinal development to building and defending the Air Force budget.[212]

Colonel Pappas's team now turned to what it would take to do all that. Going well beyond software, it determined how large a facility would be needed to plan, build, and execute the wargames; how much of what kind of hardware would be needed; and how many of what types of people would be needed to make it all work. Because realistic wargames need realistic opposing-force play, the team planned an embedded intelligence operation. The intelligence operation would have two elements: an embedded detachment in an arrangement similar to that used by the Navy in Newport (see above)

and a permanent Red team made up of a few active-duty members but mostly of specially trained reservists, who would be called up shortly before each wargame execution.[213] So the center could continually improve the software, the team planned for programmers. To promote realism and relevance as well as increase credibility, it planned to have folks with operational backgrounds run the operation. All told, the team calculated it would need a 42,600-square-foot facility that would cost $3.5 million to build and $6.1 million to equip.[214]

Envisioned as a mutually synergistic set of capabilities, all this was called the Command Readiness Exercise System (CRES). Now came a four-year fight for funding. While Pappas originally hoped for funding in fiscal year 1982, the building and manpower were not funded until 1983, and it would be 1984 before CRES itself would be.

Then came the campaign to build the promised capability. In 1983, the building contractor defaulted. A conference was held for potential second-round bidders that December, but the actual request for proposal for Phase I was not completed until March 1984.[215] A new firm was selected and awarded the contract the following December. Meanwhile, the CRES team learned it would have to take many of the manpower-accounting "slots," or billets, that the center would need to become operational from existing Air University positions. As it turned out, most came from the wargaming departments of Air University's largest schools: the Air War College, the Air Command and Staff College, and the Squadron Officer School. The transfer of these billets meant a temporary *reduction* in Air University's wargaming capabilities, as individuals would be leaving functioning departments for an organization that was not yet operational. Not surprisingly, filling those slots took longer than anticipated.

Now work on the building began, with a new interim contractor, and continued throughout 1984. Construction was originally scheduled to be completed in July 1985, but delay followed delay. As a result, no one moved in until 28 October 1985, and full occupancy was not possible until 1986.[216] But also in 1986, CRES secured not only all the computer hardware needed for the facility but enough desktop units to put one in each classroom of all of Air University's major schools—unheard of in 1986. However, problems were developing with the core software those computers were to use. The contract called for it to be complete in March 1987. The contractor failed to meet that date, and the software, when finally turned over to the Air Force, did not meet requirements. Nevertheless, by using other software, the CRES office was able to announce it had achieved Phase I capabilities on schedule, on 8 September 1986, and Phase II ahead of schedule, also in 1986.[217] Despite all the above, as well as budget cuts (of course)—or perhaps *because* of the skill and effort applied to cope—CRES won the Air Force Organizational Excellence Award in 1985.

Mr. Andrew E. Bilinski, the Deputy Assistant Secretary of the Air Force for Information Systems Management, joined Lt. Gen. Thomas C. Richards, commander of Air University, to dedicate the Air Force Wargaming Center (AFWC).[218] Addressing the gathered dignitaries, Mr. Bilinski declared the twenty-one-million-dollar facility and computer system operational.[219] He declared, "[The Air Force Wargaming Center's] mission is simple yet profound, to prepare the current and future leaders of our nation['']s aerospace forces to make the strategic and tactical decisions on the complex battlefields of tomorrow which will lead to victory. . . . Wargaming adds a vital, extra dimension to the student's learning."[220]

Now, with a staff of roughly a hundred on board, it was time to deliver.[221] As with the Naval War College thirty years earlier, there were initial problems with software.[222] In fact, the 1988 official declaration that AFWC was fully operational appears to have been premature. AFWC was soon "firing" its prime development contractor. According to its technical director at the time, AFWC was clearly not satisfying its Phase II or III objectives.[223]

Despite the failure of the original software system, major successes came early. For example, in 1987 the Joint Flag Officers Course was inaugurated at AFWC. To meet the course's objective, to "foster among flag officers a better understanding of the relationships of national goals and objectives, strategies, campaign planning, and force employment and how these relate to war at the operational level," it was built around a major wargame. By 1989, AFWC's efforts to improve wargaming at the Air Force's service schools had begun to produce results. The first success was the GLOBEX (not to be confused with NDU's Globex) wargame, in support of the Air War College.[224] AFWC also expanded on earlier efforts to conduct U.S. Air Force wargames at the staff and war colleges of friendly nations. Over time, a single game at the Canadian Forces Staff College expanded to, first, the United Kingdom's staff college and then Australian and Dutch staff colleges.[225]

Finally, in 1989, exactly ten years after the Navy's first Global War Game, AFWC kicked off a series of wargames that are considered collectively the father of "Title 10" wargaming (see chapter 4) within the Air Force, as Global would be in the Navy. The Air and Space Power Symposium (APS) attracted senior leaders from beyond the Air Force: the Defense Department, other government agencies, defense contractors, and educational institutions such as Harvard and MIT. The APS was designed, developed, and executed by AFWC.[226]

The decade of the eighties was also successful for commercial wargames, but transitional as well.[227] Print game publishers saw their sales plummet. Peaking at 2.2 million units in 1980, they had dropped to less than a million at mid-decade and half a million

by the decade's end. Print wargaming was losing two key elements of its customer base. Increasing numbers of the younger consumers, who a decade earlier would have started playing wargames in their preteens or teens, now were playing Dungeons & Dragons. Many of their older customers, now with more money but less time, purchased the still-expensive personal computers and played computer-based games.

As for Dungeons & Dragons, after a slow start in the mid-1970s the growth in its popularity in the late seventies and throughout the 1980s had been phenomenal. "D&D" had founded a new type of gaming, "fantasy role playing." Actually, the original cover of *Chainmail* had been correct. D&D is actually a close tactical (i.e., depicting individuals, not units) miniatures wargame, albeit one set in a fantasy world. With D&D's success, other close tactical wargames followed, at first also set in fantasy worlds but soon with science fiction and even contemporary military themes. None achieved anything close to the popularity of D&D.[228]

After an even slower start (Spacewar had been programmed in the early 1960s), computer-based consumer wargames began to grow during the 1980s in both titles available and sales per title. Increasingly affordable personal computers allowed the recreational software industry to take off, and with it computer-based games for home use. These early home computers were still too expensive for many homes and too limited in capacity to depict warfare with the sophistication of contemporary print or miniatures wargames, but they were easier to learn (the computer did the adjudication, not the user), were quicker to play, usually featured "limited intelligence" (you saw only what your units could see), and perhaps most importantly, provided an opponent, the computer. Pioneers such as Gary Grigsby (designer of USAAF) and Chris Crawford (Balance of Power) were demonstrating through their work that impressive work was possible even with the modest computers of the day.

In 1980, BDM, with Mark Herman as lead designer, created a computerized, classified version of Herman's 1978 commercial print wargame The Next War. Called Tac Eur, the design benefited from the participation in the design team by Gen. William E. DePuy, who had recently retired as the commander of the Army's Training and Doctrine Command (TRADOC). The work was done for Andy Marshall of OSD/NA fame and was used for various Cold War analyses on the NATO / Warsaw Pact balance.

In 1982 Marshall decided to go directly to The Next War's publisher, SPI, for a new wargame, the Strategic Analysis Simulation (SAS). Despite a contract with a new company, the lead designer was again Mark Herman. SAS was used principally by SAGA, by then J8 Political-Military Analysis Division (PMAD), and OSD/NA to look at strategic nuclear issues, national missile defense, and competitive strategies against the Soviets. SAS gained quick acceptance in the educational community and was used by NDU for

its end-of-year Prudent Stride exercises in 1982 and 1983. The key innovation of this manual simulation was the flexibility to explore the wide range of defense technology issues. It was the first simulation to look at the impacts of stealth, space-based missile defense, and antisatellite weapons on the global strategic balance.

In 1983 the success of SAS led OSD/NA to contract with a publisher that had hired most of the staff of the now-defunct SPI, Victory Games, to develop the Theater Analysis Model (TAM). Marshall was now dealing with a third company, but the lead designer was again Mark Herman, who was now chief executive officer of Victory Games.[229] Interestingly TAM was designed in parallel with a commercial title, Gulf Strike. TAM was used through the 1980s on a variety of military planning exercises for J8 on such topics as the Chiefs of Defense wargame series, where it was used to support NATO games; by Adm. William Crowe (chairman of the Joint Chiefs of Staff) for senior decision-making exercises; and on a variety of war plans in exotic places. TAM was the first JCS model to use cohesion as a measure of combat effectiveness.[230]

The 1980s also saw the first examples of military wargames being adapted to the commercial market. The Air Force's Capt. Gary "Mo" Morgan adapted his games, which had been published by Project Warrior, for commercial publication by Avalon Hill as Flight Leader and TAC AIR. The Army's Capt. Bill Gibbs designed a wargame to train his Ranger platoon in patrol planning and execution. He later cofounded a wargame publishing house and published his design commercially as Ranger.[231] The Navy's Lt. Larry Bond developed a wargame to help his subordinates and peers hone their skills in fighting naval engagements. Later, when he was a civilian analyst at the Center for Naval Analyses, he published his game as Harpoon.[232]

Another development in American wargaming during this time, one that does not fit neatly into any category, was the work of Col. Trevor Dupuy, USA (Ret.). He challenged the use of Lanchester equations in military wargame adjudication, in favor of his own Quantified Judgment Method of Analysis (QJMA). At the risk of oversimplification, QJMA proposed to adjudicate future combat by comparing a tentative equation against historical data (a *lot* of historical data) and adjusting until the equation produced historical outcomes. While he pitched his process to the defense OR community and to military wargamers, he also published it in the popular press.[233] While his work received a lot of interest (including internationally, see below), it was never incorporated into U.S. military wargaming.[234]

International

The 1980s saw the first unclassified reports on how the Soviets wargamed. This glimpse was due in part to greater openness in the USSR. Articles that wanted to appear frank

but actually revealed very little began to appear in the open Soviet press. The real meat came from defectors from the Afghan army. Trained in Soviet wargaming methods, these officers were only too happy to provide details.[235]

Another source of insight into Soviet wargaming was Iraqi wargaming during the Iran/Iraq War. The Iraqis used Soviet methods in their successful offensives late in the conflict.[236] However, Soviet wargaming could not then adjudicate the strategic impacts of airpower. So, in 1986 Iraq hired an American defense contractor to produce a computer wargame.[237]

In the long term, the most significant international wargaming development of the late 1980s was the Chinese acquisition of U.S. wargaming procedures. China apparently possessed some American wargames as early as the mid-1970s, but it took advantage of the good relations before the Tiananmen Square massacre to gain a rather comprehensive understanding of U.S. military gaming procedures. First, fairly high-level delegations visited numerous American wargaming facilities. Then, in 1987, China hosted in Beijing the first Sino-American Seminar on Methodologies in Defense System Analysis. Particularly interested in the work of Trevor Dupuy, the Chinese did more than borrow American techniques: they quickly began to evolve a longer-term, more holistic approach to wargaming.[238]

For many in the British defense wargaming community, the 1980s were the "Golden Age"—both for the volume of wargaming and the number of innovations. For example, Britain's internally developed Divisional Wargame was played typically six times a year, each game lasting a month.[239] The U.S. adjudication software Janus was used in wargames at the battle-group level.

Many of the most analytical wargames were conducted by the Royal Armament Research and Development Establishment, at Fort Halstead. It was not uncommon for a single analytical game to take a year: months of preparation, three months for game play, and months more for analysis and report writing. It was a slow process, but since Red was the Soviet Union, it was fast enough—the threat seemingly evolved at glacial speeds. There was also a trend to use artificial intelligence (AI) software to play Red or both sides. This saved manpower (hence money), increased the speed of execution, and best of all, ensured that the same decisions would be made over and over again, eliminating that inconvenient human variability from the data. Again, against the Soviets, who slavishly adhered to their doctrine, AI routines worked well enough.[240]

Also during the 1980s, the British, long leaders in OR-heavy gaming for national analytical uses, began using games in innovative ways. In part through the efforts of Dr. Griffith, gaming was incorporated into the curriculum of Britain's Army Staff College at Camberley.[241] In 1988, the British replaced their hybrid map/computer tactical

ground-combat wargame with the American Janus. As more British wargames came to be completely adjudicated by software and their outcomes displayed on screens (one large map was retained for situational awareness and team coordination), Dstl analysts realized a lot of data were being generated. Dstl found it could run increasingly sophisticated mathematical analyses with rather little additional effort.[242] Most importantly, Dstl began stationing operations-research and wargame personnel at British joint standing headquarters, signaling its commitment to gaming to support specific operational plans.[243]

Some fraction of the credit for this expanded gaming should likely go to Paddy Griffith, the Sandhurst lecturer, historian, and wargame designer and advocate. In 1980 he organized an international society, Wargame Developments, for the reform of wargaming. Members included military personnel, civil servants, educators, and both professional and amateur wargame designers. In 1981 (fully a dozen years before the founding of Connections in the United States), Dr. Griffith helped inaugurate the Conference of Wargamers, dedicated to the advancement of wargaming. It has been held in Northamptonshire each year since.[244] Also in 1981, Griffith's *Forward into Battle* was published.[245] This history of tactical land warfare introduced the concept of the "empty battlefield" (greater troop dispersion in response to higher weapon lethality, producing lower casualty rates per unit area). The book became very influential on both sides of the Atlantic, increasing Griffith's stature and the credibility of his advocacy of wargaming. In 1989 he left Sandhurst to become a full-time writer and wargame designer.

In Australia, the 1980s were particularly active for wargaming. The record is abundantly clear on that fact; I have yet, however, to discover documents establishing a cause. It was a time of shrinking budgets: Were wargames seen as objective (or effective) ways of resolving what could be cut from defense with least harm? There may also have been a nobler reason. Australia had fought alongside the United States during the Vietnam conflict. Could its increase in wargaming, concurrent with that in the U.S. Army, have been motivated by the same thing, the determination of Vietnam veterans to prepare better for the next conflict?

Major progress occurred in 1980, when, as mentioned in the last section, the Australian army published TIB 52. This publication encouraged wargaming by defining it, describing types of applications, and offering guidance on how to conduct effective games. In 1981, another major step was taken, with the publication of the Australian army's first policy document on wargaming, Army Office Staff Instruction (AOSI) 33/81. It directed the Australian army to take over from CSE the task of developing and conducting wargames. In response, that same year the Australian army's Logistics Plans Group

began to develop and conduct games. Its wargame cell was staffed by army reserve officers; initially, assistance was still needed from CSE.

AOSI 33/81 also directed a high level of standardization. Army wargames were to use specific, externally provided scenarios and "be based on common organizational data, planning data and adjudication rules." AOSI 33/81 also announced that "training and evaluation wargames are to be essentially manual so as to enhance their flexibility." Computer assistance was to be limited to facilitating adjudication, storing data, and recording play for later analysis.

In accordance with AOSI 33/81, Headquarters Training Command issued "The Conduct of War Games in Training Command" in December 1982. It reiterated the policies of AOSI 33/81 and laid out how they would be applied to the various army schools and training establishments. It updated the list of wargames in TIB 52 and added U.S. Army and commercial wargames that could be requested from headquarters for introducing wargaming to units.[246]

By 1982 the Australian army's wargame cell was reaching out to gaming organizations in allied nations. For example, one of its wargames was based on a U.S. Marine Corps wargame called JIFFY; several others had been originally developed by the Directorate of Land Operations Research in Canada. In late 1982, the War Gaming Cell moved to Victoria Barracks in Sydney. There in late 1983 it came under command of the Development Branch Field Forces Command, with an expanded staff that included a small number of regular army officers.

In late 1983 the War Gaming Cell began work on a new game, based on one of its current games (Water Buffalo) but with a bigger map and computer-assisted adjudication. Eventually called Cannon Row, this wargame, continually developed, would be kept in use by the Australian army until well into the 1990s. It would in time be used also by New Zealand, Malaysia, Singapore, and the Philippines.

The year 1984 was truly a watershed for Australian wargaming: it saw both the establishment of its first wargaming center and the issuance of new, expanded guidance. Australia's Army War Gaming Center (AWGC) was established to "concentrate [Australia's] limited war-gaming resources" to provide "maximum benefit to all wargaming activities in the Army."[247] AWGC was first commanded by Lt. Col. Harry Clarson, who reported to the Australian army's Training Command. AWGC was located in Sydney, and it absorbed the War Gaming Cell.

AWGC immediately got to work, clarifying its role and conducting wargames. In a working paper (known as WP84-21), AWGC clarified requirements for future Australian army wargames. These included practicing decision making at all levels; practicing

staff procedures from company through corps headquarters; helping to develop, refine, and test contingency plans; and examining force-structure alternatives. During its first year AWGC supplied the Australian control element in the last ANZUS (Australia–New Zealand–United States) wargame, Triad, which was held in New Zealand. This game used a New Zealand–created variant, First Foray, of the U.S. Army game First Battle.

The new guidance came from AOSI 17/84, "War Gaming in the Australian Army," which replaced AOSI 33/81. The Australian army was to "make increased use of war gaming" for appropriate applications. Those applications were training, both in individual decision making and team procedures, and analysis, both for procurement decisions and contingency planning. AOSI 17/84 also defined the responsibilities of the Australian army organizations involved with wargaming. Both the Army Office and the Field Forces Command were to provide guidance and arrange scientific support. Logistics Command was to identify applications for wargaming and oversee execution. Finally, Training Command was to develop improved games.[248]

In 1985 AWGC began two wargames that would be its workhorses through the end of the decade. The first, the Computerized Battle Simulator, or ComBatSim, was fully computerized, was purchased from a U.S. company (Perceptonics), and was used to train staffs throughout the Australian and New Zealand armies in wartime procedures. The second, the above-mentioned Cannon Row, which used a computer for most adjudication and for data storage, was developed by AWGC. At decade's end, Cannon Row was transitioning from developing and testing software by using plans to developing, refining, and testing the contingency plans themselves.

Finally, for individual nations, in 1980 the Canadian army (then the Canadian Forces Mobile Command) adopted the U.S. Army Dunn/Kempf tactical miniatures-based wargame. At the alliance level, the burning question for the eighties was: Did a NATO wargame almost trigger the end of the world as we know it? Even after thirty years, the answer is less than obvious. What is known is that on 2 November 1983 NATO began a constructive wargame/command-post exercise. Among its objectives was to practice procedures to be followed if a NATO / Warsaw Pact conflict ever escalated to nuclear war. The wargame involved heads of government and a new, unique format of coded communication. Before the end of the game, the real-world Soviets had readied their nuclear forces and placed air units in East Germany and Poland on alert. When the wargame ended, on 11 November, Soviet forces stood down. Western governments tried to determine whether the Soviets had believed the wargame was a cover for preparations for a real attack; and if they had, whether they had been alarmed enough to strike first; or if not, whether their actions had been a ploy. Few outside the higher levels of government and the military even knew of the incident at the time. It has since become known

as the "war scare of 1983" and as one of the three times the Cold War came closest to becoming hot.[249]

Perhaps it was a coincidence, but future big constructive NATO wargames were played not at NATO headquarters but at the newly opened (1982) Warrior Preparation Center.[250] By the end of the decade, NATO was dramatically increasing its constructive wargaming in an effort to reduce criticism arising from damage caused by its live wargames.[251] Other NATO exercises were conducted at the U.S. Naval War College.[252]

In April 1988, DARPA began work on a Distributed Wargaming System for NATO. By December it had successfully linked four corps headquarters and conducted a test wargame with five hundred participants. By November 1989 it had scaled up enough to make possible Allied Command Europe 89, a 1,500-participant exercise linking all the major Central Region ground and land headquarters.[253] At decade's end, several NATO nations were also showing an interest in DARPA's Simnet initiative.[254]

On the international civilian side, in the 1980s the United States continued to dominate print wargaming and the United Kingdom the publication of miniatures rules, but the "globalization" of commercial game publishing was beginning, in Australia. Thanks to the (more or less) common language, Australia had always been a strong export market for American print wargames. Now not only print wargame publishers, like Australian Design Group and Panther Games, but also such computer-game developers as Strategic Studies Group (SSG) began operations. Some SSG games, such as Carrier Wars (1986), utilized multilevel (hierarchical) AI to game command and control, long before any military computerized games could. Also in the 1980s, a small (but good) Canadian design, development, and publishing company was founded—Simulations Canada, which quickly expanded from print to computer games. Also, a few print wargames were published in Britain. Finally, Japanese-published print wargames enjoyed in mid-decade relatively great, if brief, success.[255]

The 1980s saw tremendous developments in the military and civilian spheres of wargaming. How did each sphere influence and react to the momentous changes that were about to occur? The next chapter answers this question. From the above, though, it is clear the Cold War period had a great impact on wargaming and vice versa. Still, wargaming had its greatest impact at the period's end, not by better planning and preparing for the Cold War "going hot" but in promoting international understanding to increase the odds that the Cold War would end peacefully. Elements of the U.S. Joint Staff and Soviet General Staff met together on five occasions, ultimately gaming the collapse of the Soviet Union.[256] Did these efforts make a peaceful outcome more likely?

As the 1980s came to a close, both the United States and the USSR made highly publicized strides toward greater openness, including increased contact between the U.S. and Soviet militaries. While the meetings between Marshal Sergey Akhromeyev, chief of the Soviet General Staff, and his counterpart Admiral Crowe were getting headlines, quieter meetings were being arranged between their senior staffs. The goal was to increase mutual confidence through familiarity with each other's analytical methodologies, including wargaming.

The first U.S./USSR staff meetings were held in the Pentagon, 10–13 December 1990. The goal was to enhance strategic stability through better understandings of how the other side analyzed (i.e., understood) strategic (nuclear) deterrence and regional stability (largely a function of conventional forces). The U.S. side was led by Maj. Gen. David Robinson, director of J8, and Vincent "Vince" Roske Jr., his deputy for wargaming, simulation, and analysis.[257] The Soviet team was led by Lt. Gen. Sergey Bogdanov, chief of the Center for Operational and Strategic Studies (COSS) of the General Staff. The sides actually exchanged the equations they used to analyze strategic stability and deterrence.

Their next meetings, on how each side analyzed the conventional balance in Europe, were held in Feldafing, West Germany, from 24 February to 1 March 1991. This was during the air/ground phase of Desert Storm.[258] The U.S. side was led by Mr. Roske and Col. George Brock, USA, director of PMAD in J8. The Soviet side was led by Maj. Gen. Professor Dr. Vsevolod Medvedev, the deputy chief of COSS. Representatives from NATO's Supreme Headquarters Allied Powers Europe Technical Center (Dr. Ron Speight) and the United Kingdom's office of net assessments also played important roles.[259]

Moscow was the venue of their third meeting, 2–8 June 1991. Teams were led by, for the United States, Major General Robinson and Mr. Roske, and for the USSR by Generals Bogdanov and Medvedev. It was very much a working meeting, with serious exchanges of analyses of deterrence and strategic stability and their results. As analysts, the teams together crunched the numbers on reducing nuclear warheads of both sides to roughly 1,500 while maintaining strategic stability.

Their final meeting prior to the culminating wargame was held 16–21 June 1991 in the Schloss Elmau, a historic five-star hotel in the western part of a reunified Germany. The senior American and Soviet leaders remained the same, but the focus shifted to the nuts and bolts of wargame adjudication and preparation for the game.

In October 1991, at Monte Argentario, Italy, officers of the senior staffs of the armed forces of the United States and the Soviet Union sat down to play a pol-mil game, Elegant Voyager. To say the times were turbulent would be an enormous understatement: two months previously there had been an unsuccessful coup in the Soviet Union; two months hence the Soviet Union would cease to exist. Rear Adm. Dennis Blair, Mr.

Roske, and Colonel Brock led the American delegation; the Soviet team was again led by Generals Bogdanov and Medvedev. Elegant Voyager was above all intended as a loosely structured forum in which measures tending to create and maintain stability between states (i.e., the players representing them) in a complex international environment could be demonstrated and identified.[260] The outcome of the wargame closely tracked with later events.

While the decision to move forward with this sustained effort was made at the highest levels, success in building the respect and trust needed actually to succeed depended on a small team of individuals, and one in particular—Maj. Roy "R2" Rice.[261] Writing almost a quarter of a century later, Mr. Roske would recall,

> Roy was singularly instrumental in making the US/USSR analysis meetings and game a success. The Soviets immediately respected his analytic skill and enjoyed his energy and personality. To say there was a challenge in "breaking the ice" and achieving the levels of trust needed to conduct the game would be an understatement; more than anyone else on the American team, Roy was the one person who delivered the needed personal connections that provided the basis for that trust to develop. Something that important came down to the skills of one analyst to carry the day. . . . [S]ometimes the success of even the best ideas under the most important circumstances come down to the efforts of a few key people and one person can determine the outcome[;] . . . in this case, that one person was Roy Rice, Lt. Col. USAF (Ret.), Ph.D.[262]

In the history of the world, empires have rarely broken up without a fight. Certainly, the Soviet (and then ex-Soviet) leaders must have found the shocking events of the next several years a little less shocking for having seen them before in a wargame. As Mr. Roske would write, "Through the preparation and playing of the game, the Western and Soviet staffs developed a trust in each other, a common understanding of the challenges and were prepared to support the planning that would be needed to keep things under control." Wargaming and other analytical methods were developed to help nations fight wars more effectively. In the early nineties it appears that by increasing transparency and reducing uncertainty, perhaps they played a role in avoiding war altogether.

Notes

1. The epigraph is from Thomson, "Military War Game," p. 50.
2. The author was given a copy of the letter when guest lecturing in 1999.
3. Air University catalogs have nothing like wargames in either the war or staff college curriculum. A colleague, Lt. Cdr. Dan McDonagh, who in about 1989 checked reservations of the Naval War College's wargaming facility, found that they fell to a small fraction of prewar bookings. Finally, the Army had no war college to conduct wargames until 1950, having in 1946 lost its facilities to the new National War College (renamed the National Defense University in 1976).
4. Hal M. Friedman, *Blue versus Orange: The U.S. Naval War College, Japan, and the Old Enemy in the Pacific, 1945–1946* (Newport, RI: Naval War College Press, 2013), does an excellent job of describing wargaming during the transitional class of 1945/46. In doing so it also provides a snapshot of the craft/art/

science of naval wargaming on the eve of the impacts of computers and operations research. The gaming focus at the College quickly turned to the Soviet Union, as addressed in his *Blue versus Purple: The U.S. Naval War College, the Soviet Union, and the New Enemy in the Pacific, 1946* (Newport, RI: Naval War College Press, 2017). That completes a trilogy, begun with *Digesting History: The U.S. Naval War College, the Lessons of World War Two, and Future Naval Warfare, 1945–1947* (Newport, RI: Naval War College Press, 2010).

5. Paul Deems, "War Games and Exercises," *Air University Quarterly Review* (Winter 1956), p. 118.
6. Histories of the Korean War categorically state that the United States had no war plans. Normally, the United States only conducts wargames in conjunction with developing a war plan, so no war plan strongly suggests no wargaming. E-mails from both James Dunnigan and Dr. Al Nofi confirm no wargaming.
7. See Clayton J. Thomas, "Models and Wartime Combat Operations Research," in *Military Modeling for Decision Making,* ed. Hughes.
8. Sloan et al., *Soviet Style Wargames*.
9. Conversation with Dr. Paul Kan, professor at the Air Command and Staff College and expert on China.
10. Russell Spurr, *Enter the Dragon: China's Undeclared War against the U.S. in Korea, 1950–1951* (New York: Newmarket, 1988), pp. 80–82. An audience member at one of my talks on wargaming told me of a book that described a Chinese preintervention wargame and later mailed me pages from it. Unfortunately, he included in his letter neither the title of the book nor his return address. Years later I ran across a book on the Chinese intervention, and since it was on sale for a dollar I bought it, even though the index did not include "wargaming." Years after, I finally read it—*Enter the Dragon*—and discovered it was the book that had been recommended so long ago.
11. Ibid.
12. Ibid., pp. 283–85.
13. See Command Briefing, J8 Studies, Analysis and Gaming Division, Pentagon, slide 22: "Joint Staff Gaming History: 50 Years of Gaming, Seminars, Analysis, and Futurology," 1997 [hereafter J8 Command Briefing].
14. Perla, *Art of Wargaming,* p. 77.
15. Ibid., p. 78.
16. Abe Greenberg, "War Gaming: Third Generation," *Naval War College Review* 27, no. 5 (March/April 1975), pp. 71–75. While not the most critical article, it provides the clearest picture of why the Naval War College eventually replaced NEWS.
17. Wilson, *Bomb and the Computer,* p. xiv.
18. Hurlburt, "War Gaming at the Naval War College," p. 46.
19. J8 Command Briefing.
20. Wilson, *Bomb and the Computer,* p. xiv.
21. My estimate of prewar gaming is based on archival material at the Army War College, checked against descriptions of the postwar curriculum in two histories of that institution.
22. See R. H. Holt, "Preparation of Map Exercises," *Military Review* (January 1948); Dean Benson and Glenn Muggelbey, "Preparation of a Map Exercise," *Military Review* (December 1950); and Raymond Ashby, "Realistic Umpiring: Map Maneuver Mainspring," *Military Review* (November 1952).
23. Hofmann, *War Games*.
24. Gordon Rogers, "Battles without Bloodshed," *Army Information Digest,* December 1960.
25. E. S. Maloney, "Modern War Gaming: State of the Art," *Marine Corps Gazette* (November 1960), p. mca-10.
26. "War Games: Key to Doctrine?," *Marine Corps Gazette* (November 1960), p. mca-9.
27. The best work on specific early RAND / Air Force wargaming initiatives is Sharon Ghamari-Tabrizi, "Simulating the Unthinkable: Gaming Nuclear War in the 1950s and 1960s," *Social Studies of Science* 30, no. 2 (April 2000), pp. 163–223. For a more general history of the RAND / Air Force relationship see *50th: Project Air Force, 1946–1996* ([Santa Monica, CA]: RAND, 1996), available at www.rand.org/content/dam/rand/www/external/publications/PAFbook.pdf.
28. A net assessment is an estimation of the overall balance of power between two sides. Whereas intelligence estimates may estimate the strength of various adversaries, net assessments compare the strengths of both sides in a conflict and estimate which, if either, has a net advantage.

29. Lincoln Bloomfield, "Political Gaming," U.S. Naval Institute *Proceedings* (September 1960), pp. 58–64.
30. While the literature on game theory could fill a large bookcase, the Wikipedia article is the best overview I have found.
31. G. R. Andlinger and J. R. Greene, "Looking Around: Evolution in Which Business Gaming Finds Itself Today," *Harvard Business Review* 36 (July–August 1958), pp. 147–52.
32. Staff of *Strategy & Tactics* Magazine, *Wargame Design,* p. 11.
33. Martin Campion and Steven Patrick, "The History of Wargaming," *Strategy & Tactics* (July 1972), p. 12. The firm later became the Avalon Hill Game Company. For more on the company's history go to www.costik.com/arequiemfo-ed-1.html.
34. In his exceptionally well documented 2012 book *Playing at the World,* Jon Peterson republishes the picture from *Life* (p. 286).
35. Paul Glover and Keith Higgins, *The UK Approach to Wargaming: Past and Present* (Porton Down, Wiltshire, U.K.: Defence Science and Technology Laboratory [Dstl], 2004), p. 3.
36. See John Curry, "British Army 1956 Wargame Rules," wargaming.co, 10 April 2011, www.wargaming.co/professional/details/britisharmy1956.htm. The site is Curry's.
37. Keith Higgins, Dstl, e-mail, 1 October 2004.
38. Based on Paul Pearce, briefing to Connections UK 2014, 3 September 2014, King's College London, U.K. The brief was prepared by Pearce and Mark Taylor, principal analysts, Land Battle Space, Systems Department, Dstl.
39. See Sloan et al., *Soviet Style Wargames*.
40. Discussion with Col. Bill Gray (Ret.), president of the Historical Miniatures Gaming Society East.
41. See Hausrath, *Venture Simulation,* pp. 143–44, for an overview of British and Canadian wargaming at that time. There were also some open-source hints about Soviet gaming; see Ivan Boikov, "At the General Staff Academy," *Soviet Military Review* (1967).
42. Ghamari-Tabrizi, "Simulating the Unthinkable," offers a convincing picture of the level of credibility OR enjoyed at the time.
43. Thomas B. Allen, *War Games: The Secret World of the Creators, Players, and Policy Makers Rehearsing World War III Today* (New York: McGraw-Hill, 1987), p. 28.
44. Defense Modeling and Simulation Office (DMSO), "History of Modeling and Simulation," M&S Staff Officers Course 98-2, slide 17, Alexandria, VA, 1998. DMSO is now the Modeling and Simulation Coordination Office.
45. Wilson, *Bomb and the Computer,* p. ix.
46. Ibid., p. 188.
47. Allen, *War Games,* pp. 193, 195–207.
48. See U.S. Joint Staff, *The Final Report on Sigma I-64* (15 April 1964), and *The Final Report on Sigma II-64* (5 October 1964) (Washington, DC: Joint War Games Agency).
49. As of this writing the most recent account and most complete account is Robert Mason and Gretchen Green, "Sigma 64: Ignored Vietnam Wargames," *Modern War* (March–April 2015), pp. 32–41. The article also describes other Vietnam-era U.S. games.
50. DMSO, "History of Modeling and Simulation," slide 19.
51. E. B. Potter, *Nimitz* (Annapolis, MD: Naval Institute Press, 1976), p. 136.
52. Perla, *Art of Wargaming,* p. 83.
53. Ibid., p. 85.
54. Hurlburt, "War Gaming at the Naval War College," p. 46.
55. See Frederic Green, "The Best Kind of War," *Marine Corps Gazette* (November 1964), pp. 32–35, and Edgar F. Musgrove, "No Game," *Marine Corps Gazette* (August 1965), pp. 53–56.
56. The term used in practice was "Red Integrated Strategic Operation Plan," so the acronym could be pronounced.
57. See Mason and Green, "Sigma 64," p. 36.
58. Ibid.
59. Ibid.
60. Based on comments by Mr. Gene Visco during a MORS "brown bag" talk on 17 December 2014.
61. Raymond Macedonia [Col., USA (Ret.)], telephone interview, late 1990s.
62. Hausrath, *Venture Simulation,* p. 47.
63. See Edwin Tankins, "War Gaming," *Military Review* (December 1967), pp. 88–96, and Robert Walker, "The Military Analyst in Research

War Games," *Military Review* (January 1969), pp. 22–30.

64. George Pappas, *Prudens Futuri: The U.S. Army War College, 1901–1967* (Carlisle Barracks, PA: U.S. Army War College Alumni Association, 1967).
65. The first was published April 1964, the second in December 1967.
66. George Webb, "War Gaming and Combat," *Military Review* (April 1969), pp. 18–23.
67. Visco, comments.
68. See Robert Beattie, "A Timeline of the Historical Miniatures Wargaming Hobby," *Courier,* special issue, available at www-personal .umich.edu/~beattie/timeline2.html.
69. Of course, membership in a club can spread out and minimize the entry costs. This may explain the relatively large number of clubs associated with this mode of wargaming.
70. However, both types also required an opponent who had also read the rules. This was not always easy: mutually convenient times were often hard to establish. Later, civilian computer-based wargaming against artificial-intelligence opponents eliminated this difficulty.
71. This assessment is based on later surveys conducted by James Dunnigan through the magazine *Strategy & Tactics*. For more detail see below in this chapter.
72. You can view that first issue—in fact, every issue—of *The General* on the British website *View from the Trenches,* at vftt.co.uk/ah_mags .asp.
73. Mr. Dunnigan had started his wargame career designing Jutland, 1914, and several other titles for Avalon Hill. For Simonsen, see Margalit Fox, "Redmond A. Simonsen, 62, Maker of Strategic Board Games, Dies," *New York Times,* 16 March 2005.
74. While Spacewar was described during the mid-sixties in the science-fiction magazine *Analog* and has since been mentioned in numerous histories of computers, consumer electronics, wargaming, and other fields I think the best overall account is Spacewar's Wikipedia entry. Somehow that seems fitting . . .
75. Campion and Patrick, "History of Wargaming," p. 13.
76. The *Canadian Army Journal* published a series of articles on wargaming at this time—for example, E. A. Keenan, "CAORE War Game: Background and Operation" (Spring 1961), pp. 12–18.
77. Thomson, "Military War Game," pp. 50–55.
78. Pearce, briefing to Connections UK 2014.
79. The definition used was that then current in the U.S. Army. Todd Mason, e-mail, 27 January 2015.
80. "Training Simulation Techniques: War Games," *Training Information Bulletin 52,* Australian Army, 1980.
81. See Boikov, "At the General Staff Academy," pp. 12–13.
82. Dean Cheng, "The People's Liberation Army on Wargaming," *Commentary,* 17 February 2015.
83. Campion and Patrick, "History of Wargaming," p. 17.
84. An excellent published obituary notes that Featherstone's military service as a clerk in an armored battalion gave him "the opportunity to observe war, while having a reasonable chance of survival." John Curry, "First in the Field: Don Featherstone's Place in War-Gaming History," *Miniature Wargames,* no. 367 (October 2013).
85. See Peterson, *Playing at the World,* p. 17. The publication's full name was *Wargamer's Newsletter: A Monthly Magazine for Those Who Fight Battles with Model Soldiers;* John Curry, Wargame History Project UK, e-mail, 30 October 2017.
86. Wilson, *Bomb and the Computer,* p. xii.
87. However, Thomas C. Thayer argues convincingly in *War without Fronts: The American Experience in Vietnam* (Boulder, CO: Westview, 1985) that McNamara would ignore input from the OR community when it disagreed with his preconceived notions.
88. Through pure dumb luck I had the privilege of reading and declassifying the "Red Baron" studies, while on temporary duty with the Southeast Asia Review and Declassification team: Red Baron I (1966), Red Baron II (1973), Red Baron III (1974), all prepared by the U.S. Air Force.
89. DMSO, "History of Modeling and Simulation."
90. While on active duty Joseph Saur wrote two pieces for U.S. Naval Institute *Proceedings*. One (March 1976) was an untitled letter in the Nobody Asked Me, But . . . column in which he advocated wargaming for both training and the evaluation of officers' readiness

for promotion. His classmates at the Navy's Destroyer Department Head School, Class 51, were generally supportive, but he saw no evidence of high-level interest. A follow-on in October 1983, an article entitled "Tactical Thought; Tactical Testing," also seemed to generate no interest. Joseph Saur, comments on the manuscript of this book, 6 January 2005.

91. Hurlburt, "War Gaming at the Naval War College," pp. 47–48.

92. DMSO, "History of Modeling and Simulation," slide 21. NAVTAG, originally written by a Lt. Neil Byrne, was a secret-level adaptation of a game set in World War II that Neil and his brother had written in high school. Before the computer-based version referred to was developed, NAVTAG was played as a tabletop game during the late 1970s by ships of Cruiser-Destroyer Group 3, under Rear Adm. Thomas S. Rowden. Cdr. T. C. Davis Jr., "Play for Fun, Fight for Keeps," *All Hands,* June 1978.

93. The Tactical Command Readiness Program operated on at least two levels, both classified as secret. At the fleet level, a TCRP evolution brought a battle-group commander (two stars—i.e., rear admiral, upper half) and staff to the Naval War College (NWC) in Newport, Rhode Island, to exercise one or more of the numbered general war plans. NWC students, faculty members, and other "volunteers" acted as Orange or Green (umpires). At the local (shipboard) level, TCRPs were text-based simulations intended for junior-officer training. Players did not actually "make" tactical decisions but answered questions to show they understood the situations presented. It was because Joseph Saur believed this local version to be very unpopular in wardrooms that he devised a series of NAVTAG games. These were run on the ship to which he was then assigned, the combat stores ship USS *Sylvania* (AFS 2). He asserts that his shipmates enjoyed the games and were amazed by what they learned playing them. Saur, comments.

94. Hurlburt, "War Gaming at the Naval War College," p. 48.

95. Bud Hay and Bob Gile, *Global War Game: The First Five Years,* Newport Paper 4 (Newport, RI: Naval War College Press, 1993), does a great job of describing the origins and early growth of the series.

96. Amazingly, no formal history of Red Flag has yet been written. However, Michael Skinner, *Red Flag: Air Combat for the '80s* (Novato, CA: Presidio, 1984), provides a great snapshot of what it was like going through Red Flag in the mid-eighties.

97. See Gaillard R. Pack Jr. [Col., USAF (Ret.)], *Red Eagles: America's Secret MiG Squadron* (Oxford, U.K.: Osprey, 2012).

98. This assessment is based primarily on informal discussions with "old-timers" in the late 1980s. The only (and brief) published description I've found on this time period is Stephen Ellertson, "Air Force Wargaming: Warfare without Bullets," *Dispatch,* 3 May 1991, p. 10.

99. Colonel Pappas's official Air Force biography, 1 August 1980, available from the Air University History Office, Maxwell AFB, Alabama.

100. Air University Official History, 1980, Air Univ. History Office, Maxwell AFB, AL, p. 47.

101. Colonel Daniels, "History of the Air Force Wargaming Institute" (bullet background paper, Maxwell AFB, AL, 12 July 2006) [hereafter Daniels, BBP].

102. DMSO, "History of Modeling and Simulation," slide 20.

103. *History of Wargaming Project,* wargaming.co.

104. "The U.S. Army 25th Infantry Division Schofield Barracks Hawaii used the 'First Battle' game set to control a Division level CPX in mid-June 1977. The exercise name was 'Tropic Lightning Exercise First Battle' (TLX 3-77). From setup to tear down, the exercise lasted at least a week. A very large control group and the First Battle game set were located in a single large building. The major command headquarters were located around the building and around the base in tents and were connected to the control facility via wire and possibly radio. The exercise director was LTC [Lt. Col.] Delbert F. Shouse (Infantry). I have a document that makes the following claim: . . . '[T]his marks the first time in Army history that any division has implemented the Training and Doctrine Command's Wargame Simulation Package with all major command headquarters represented in the field.' I visited several similar exercises over the next six months. Around the same time period, units of the 25th Infantry Division also used 'Pegasus,' 'Steel Thrust,' and 'Long Thrust' in unit exercises. The base training aids facility had at least two copies of each game set." I. L. Holdridge [Maj., USMC (Ret.)], e-mail, 13 December 2004.

105. The most detailed account of the Dunn/Kempf wargame I have found is on the website of John Curry's History of Wargaming Project, wargaming.co.

106. "CAMMS Event, Daley Barracks, 1978," *2nd Squadron, 11th Armored Cavalry Regiment, "Eaglehorse," Daley Barracks, Bad Kissingen, Germany, 1972/1992,* eaglehorse.org; Robert Stefanowicz, "Where's My Beer, Where's My Battalion?," *Strategy & Tactics* (1980).

107. Called "maneuvers" prior to World War II, live wargames are typically called "exercises" today.

108. Based on feedback on this manuscript by U.S. Army colleagues named in the acknowledgments, October 2014.

109. P. B. Watson, "Interim Draft Report on War Game Atlas (Phase 1)," War Games Branch, Studies and Requirements Division, Development Center, Marine Corps Development and Education Command, Quantico, VA, 30 October 1972.

110. 2nd Marine Regiment, 2nd Marine Division (Reinforced), "Exercise Northern Wedding / Bold Guard 78: Post Deployment Report," 1978, p. 1-1.

111. Northern Wedding / Bold Guard took place in the Shetland Islands, Denmark, and Germany; Exercise Team Spirit was conducted in Korea. See 9th Marine Amphibious Brigade, CDRMARTF OPLAN I-77, Exercise Team Spirit 77, 28 February 1977.

112. Commander Amphibious Group 1, CTF 191 Operations Order 342, 1 September 1973, p. 2.

113. "Amphibious Planning Exercise APEX," Marine Corps Command and Staff College, Quantico, VA, May 1972.

114. T. X. Hammes, "Combat Simulation for Next to Nothing," *Marine Corps Gazette* (March 1980).

115. Holdridge, e-mail, 13 December 2004. "While cleaning out some file folders I came across a scrap of a 'call back' phone note from 19 August 1979. It identified a Lt. Col. L. Sherretz (USMC) as 'Project leader of Fleet Project Team for USMC family of manual war games, Naval Training Equipment Center, Orlando, Florida, 32813.' It also mentioned a Colonel Lewis (USMC) as being Lt. Col. Sherretz's boss"; Holdridge, e-mail, 26 February 2005. Major Holdridge was one of the officers loaned to the Army in 1977.

116. Kenneth E. Lavoie, Deputy Director, Air Force Wargaming Institute, e-mail, 12 October 2000.

117. James F. Dunnigan and Raymond M. Macedonia, *Getting It Right: American Military Reforms after Vietnam to the Gulf War and Beyond* (New York: William Morrow, 1993), p. 159.

118. This wargame has been given slightly different names by the services at various times. One is the "Joint Land, Air, Sea Strategy" exercise; the Naval War College website has "Joint Land Aerospace Sea Simulation"; Maxwell AFB's website gives "Joint Land, Aerospace and Sea Simulation." Under whatever name, sometimes the original one, the event itself has continued to the time of this writing, 2017.

119. Lavoie, e-mail.

120. Lincoln P. Bloomfield, "Computerizing Conflicts," *Foreign Service Journal* (June 1988), pp. 46–49.

121. Beattie, "Timeline."

122. James Dunnigan, *The Complete Wargames Handbook,* 3rd ed. (New York: William Morrow, 1992), p. 9.

123. For example, in 1972 the wargame catalog of *Strategy & Tactics'* parent company, SPI, listed only thirty wargames. By 1980 that number had grown to 196. Seth Owen, "The History of Wargaming 1975–1990," *Strategy & Tactics* (July 1990), p. 52.

124. Though long out of print, their *Wargame Design* is still sought after by all who are interested in creating wargames.

125. For both a history of print wargaming up to the 1970s and a snapshot of the optimism of those in the field see Nicholas Palmer, *The Comprehensive Guide to Board Wargaming* (New York: Hippocrene Books, 1977).

126. Fox, "Redmond A. Simonsen."

127. However, Origins was not the first civilian wargame convention. According to Bill Speer, e-mail, 13 December 2004, "The first civilian war-gaming convention was held July 15, 1967 in Malvern, Pa. It was hosted by the International Federation of Wargaming and became a cover story in *The General*. The convention was organized by myself, Scott Duncan, Gary Gygax, George Petronis, Clark Wilson, and myself [*sic*]. Also, Gencon was around long before Origins." See Gary Gygax, "What Is the National Wargame Convention?," *Strategic Review* (December 1975), p. 14.

128. See Stephen B. Patrick, "The History of Wargaming Update," *Strategy & Tactics* (1975), p. 11, and Owen, "History of Wargaming 1975–1990."

129. Dunnigan, *Complete Wargames Handbook,* p. 179.

130. Far and away the best researched and best documented book on the history and impact of Dungeons & Dragons is Peterson, *Playing at the World*.

131. As stated elsewhere, Colonel Macedonia was the individual most responsible for bringing wargaming back to the Army War College. He and Col. Constantine Pappas, USAF, were the fathers of the JLASS wargame, which involves students of all U.S. war colleges, and he was one of those responsible for the Army-wide renaissance in wargaming.

132. James Dunnigan, e-mail, 23 November 2004.

133. Mark Herman, e-mail, 29 October 2004.

134. Australian Army, Army Office Staff Instruction (AOSI) 33/81.

135. Glover and Higgins, *UK Approach to Wargaming,* p. 3.

136. A hybrid wargame combines presentation or adjudication methods. This hybrid game was adjudicated in part manually, in part with software.

137. Higgins, e-mail.

138. Pearce, briefing to Connections UK 2014.

139. Paddy Griffith, *Sprawling Wargames: Multiplayer Wargaming* (n.p.: lulu.com, 17 December 2009).

140. See *Welcome to Paddy Griffith's Website,* myweb.tiscali.co.uk/paddygriffith.

141. Untitled document on U.K. wargaming, para. 1.3.1. Given to author at first Connections UK, in 2013.

142. Military Academy of the German Armed Forces, Luftwaffe department (Führungsakademie der Bundeswehr, Bereich Luftwaffe), letter, 13 November 1970.

143. These comments are based on interviews conducted and briefings received during two visits to the academy during early and late 1999, respectively.

144. Cheng, "People's Liberation Army on Wargaming."

145. Charles Hawkins, "Chinese War Termination Calculus and Its Impact on PLA Operational Plans and Decisions" (unpublished paper, 18 May 2003), p. 22.

146. While the British wargaming community had (and has) a "deep bench," Don Featherstone stood out for the volume and impact of his writing. See Beattie, "Timeline."

147. For Phil Barker see *Connections UK,* www.professionalwargaming.co.uk/index.html.

148. See Beattie, "Timeline."

149. According to a conversation with Dr. Peter P. Perla in the early 2000s, during the 1970s the Australian publisher Jedko published Russian Campaign (republished in the United States by Avalon Hill) and a North Africa game. SPI UK had been in existence in the 1970s as well and may have done uniquely British/European games; SimCan existed by the late seventies.

150. At Drew's retirement dinner (as a colonel), general officer after general officer praised his many articles and their impact.

151. J8 Command Briefing.

152. Cited in DMSO, "History of Modeling and Simulation."

153. David B. Lee, "War Gaming: Thinking for the Future," *Airpower Journal* (Summer 1990), p. 44.

154. He personally wrote a very informative article on NDU's use of wargaming: Richard Lawrence, "Playing the Game," *Defense,* January/February 1986, pp. 22–29.

155. "Playing Red" for an NDU capstone exercise during the summer of 1992, I was told that its scenario had been used for many years, though with continual updates to the forces and to the locally developed adjudication software.

156. Dan Burns, "Joint Land, Aerospace and Sea Simulation Exercise 1987," *Wargaming Clearinghouse Bulletin,* 2 May 1988, pp. 9–10.

157. See "U.S. Simulated War Game Center Begins Operation," *Aviation Week & Space Technology,* 3 September 1984.

158. David Vesely, "Warrior Preparation Center: Training Battle Commanders," *Defense,* July/August 1991, pp. 13–16.

159. As of this writing there is no longer an organization called the Joint Warfare Center in support of U.S. Central Command. Neither the official Central Command website nor Wikipedia mentions it. The name is now used by a NATO wargaming facility in Stavanger,

Norway, for which see the official website and Wikipedia.

160. These comments are based on personal recollections from serving as an umpire in Gallant Knight 87.

161. What became of all that prepositioned pipe? Dave Ross, Air Force Research Laboratory's wargaming lead, tells me of a C-130 pilot who hauled a lot of that pipe into northern Saudi Arabia to help fuel the "Left Hook" into Kuwait in 1991.

162. From the 1880s until at least the 1960s the military distinguished between two-sided "maneuvers" and one-sided "exercises"; either could be map based or live. In the 1980s all live events, whether one- or two-sided, were referred to as "exercises." I have no idea why or exactly when the change occurred.

163. For an impression of the scale of exercises during a year in the 1980s see "War Games," *Defense Monitor,* 1964.

164. Bloomfield, "Computerizing Conflicts," p. 49.

165. Peter McGrath, with David C. Martin and Eleanor Clift, "The Doomsday Exercise," *Newsweek,* 5 April 1982, p. 31.

166. Ibid.

167. Doug Richardson, "War Games in Cyberspace," *Armada International,* May 1995, p. 65. For Captain Thorpe's role in the creation of Simnet, see the Simnet sidebar in Rob Riddell, "Doom Goes to War," *Wired,* April 1997, pp. 114–18.

168. Richardson, "War Games in Cyberspace," p. 62.

169. Anne W. Chapman, *The Origins and Development of the National Training Center, 1976–1984* (Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1992).

170. For the rationale and creation of the National Training Center see Dunnigan and Macedonia, *Getting It Right,* pp. 175–83. For a participant's view see Daniel P. Bolger, *Dragons at War: Infantry in the Mojave* (Novato, CA: Presidio, 1986), pp. 2–34.

171. John D. Borgman [Col.] and Richard L. Hooverson [Maj.], "The Rebirth of Wargaming," *Armor,* September–October 1981, p. 44.

172. Dunnigan and Macedonia, *Getting It Right,* p. 265.

173. Macedonia, telephone interview.

174. For the "genealogy" of the MTM see Roddy MacDonald, "W.W. III," *Journal of Defense and Diplomacy* (May 1988), p. 26.

175. T. D. Sloan, "Repetitive Use of the Joint Theater Level Simulation (JTLS) for Investigation of Headquarters Effectiveness" (master's thesis, Naval Postgraduate School, Monterey, CA, 1988), available at archive.org/stream/repetitiveuseofj00sloa.

176. According to Colonel Macedonia (telephone interview), the Army War College, required to cut personnel, had done so not from the college as a whole but from his dual-use wargaming organization. In retaliation, the Army Chief of Staff moved the mission to the Staff College, taking the needed manpower billets from the Army War College faculty.

177. Gordon Sullivan, "Learning to Decide at the Operational Level of War," *Military Review* (October 1987), pp. 16–23.

178. Dunnigan and Macedonia, *Getting It Right,* p. 268.

179. Roger Lesser, "Military Training Systems Keying on State of the Art Technology," *Training and Simulation,* November 1994, p. 2A.

180. Richardson, "War Games in Cyberspace," p. 62.

181. William "Bill" Glenney IV, former deputy director of the CNO Strategic Studies Group, e-mail, 26 March 2015. Glenney was later director of the Institute for Future Warfare Studies at the Naval War College, Newport, Rhode Island.

182. Perla, *Art of Wargaming,* p. 85.

183. While the influence of Global is widely recognized, during the 1980s the Navy's fleet wargames in Newport could also be very influential. Joseph Saur, longtime naval wargamer, recalls: "In about mid-1985, I was the 'Red EW [electronic warfare] Officer' for a war game at NWC where ADM Hank Mustin, at the time, COMSECONDFLT [Commander, Second Fleet], wanted to 'prove' the concept of 'rock chaff.' Unfortunately, his tactical answer to the problem of dealing with waves of Soviet air-to-surface missiles put him in a strategic hole, and he ended up getting badly hammered. Never heard about rock chaff again."

184. For an excellent history of Global in the 1980s and its impact on Navy and national thinking see Robert H. Gile, *Global War Game: Second Series, 1984–1988,* Newport Paper 20 (Newport, RI: Naval War College Press, 2004).

Its executive summary and review of the first series are particularly good.

185. Ibid., p. xiii.

186. Hay and Gile, *Global War Game,* p. 52.

187. Raymond A. Hord [Col.], "The Marine Corps Wargaming and Assessment Center," *Marine Corps Gazette* (December 1989), pp. 38–40.

188. Ibid.

189. Including this book's contracted copyeditor, who was a member of the "NOIC Det" from 1988 to 1991.

190. See John Hanley, "On Wargaming" (doctoral dissertation, Yale Univ., 1991).

191. Robert C. Rubel, telephone interview, 9 May 2014. At the time, Captain "Barney" Rubel was the Dean of Naval Warfare Studies at the Naval War College. My notes on the interview were later reviewed and corrected by Dean Rubel.

192. Frank Jordan, Director, USMC Wargaming Division.

193. C. A. Leader, "The Tacwar Wargame," *Marine Corps Gazette* (December 1981).

194. My description of 1980s Marine wargaming is based principally on Eric Walters [Col., USMC (Ret.)], e-mail, 31 March 2014.

195. "More Wargaming at Ed Center," *Marine Corps Gazette* (December 1982), p. 6.

196. T. X. Hammes, e-mail, 6 April 2014.

197. In July 1990, after an excellent briefing on Marine wargaming, I asked what tool the Marines would use to wargame multiple divisions fighting side by side. I was told I was living in the past—never again would two Marine divisions be committed to the same theater. Days later Saddam Hussein attacked Kuwait, and seven months after that two Marine divisions were attacking side by side.

198. For example, in 1987 TWSEAS was being used heavily at Camp Lejeune, in North Carolina. Walters, e-mail, 22 April 2014.

199. Walters, e-mail, 6 April 2014.

200. Hord, "Marine Corps Wargaming and Assessment Center," pp. 38–40.

201. See P. D. Reissner, "It's More Than a Game," pp. 67–72, and Eric Walters, "Board Wargames in Review," p. 49, both *Marine Corps Gazette* (December 1989).

202. Hord, "Marine Corps Wargaming and Assessment Center," p. 40.

203. Example from Walters, e-mail, 31 March 2014.

204. As a captain the author was invited to the first Air Force–wide meeting on Project Warrior, months before the official kickoff.

205. The chapter on wargaming (written by the present author) of the Project Warrior manual, in all three editions, included advice on wargaming for professional development and lists of titles. See *Professional Studies Support Booklet* (Washington, DC: Headquarters, U.S. Air Force, 1983, 1985, 1987).

206. For Project Warrior and its use of wargaming, see Matt Caffrey, "Project Warrior," *General* (Avalon Hill), 1986, p. 11.

207. The present author, then a captain, sold the Project Warrior team on publishing a set of six print wargames: three tactical games (air, sea, and land); two low-level operational games (air/land, air/sea); and one theater-level air/sea/land wargame. Unfortunately, only the tactical air (Check Six!) and low operational air/land (TACAIR) games were ready for publication before the design team—led by then-captain Gary "Mo" Morgan, assisted by Captains Mark Thibodeau and Caffrey—was broken up by transfer orders.

208. Lee, "War Gaming," p. 44.

209. Daniels, BBP.

210. Air Univ. Public Affairs, "Command Readiness Exercise System," U.S. Air Force Fact Sheet, January 1985, Maxwell AFB, AL.

211. Each school is charged with helping its students prepare for their responsibilities one or more promotions after they graduate: the lieutenant colonels attending the Air War College would need wargames fitting them to make decisions at the national level; the majors at the Air Command and Staff College need to experience virtually the command of theater air forces; and the captains at Squadron Officer School would need a wargame that would prepare them to lead a wing in combat.

212. Games in each phase were expected to support the formulation of doctrine: first by Air University students, then joint doctrine by all service-school students, and finally Air Force–wide.

213. From the late 1980s to the middle 1990s your author was one of those reservists.

214. Air University Annual History for 1980, Air Univ. History Office, Maxwell AFB, AL, pp. 46–47.

215. CADRE Annual Unit History for 1984, Air Univ. History Office, Maxwell AFB, AL, p. 17. Owing to a blizzard in Boston, the request for proposals was not actually mailed until 2 April.
216. CADRE Annual Unit History for 1985, Air Univ. History Office, Maxwell AFB, AL, p. 21.
217. For Phase I, CADRE Annual Unit History for 1986, Air Univ. History Office, Maxwell AFB, AL, p. 43.
218. Air Univ. Public Affairs, News Media Advisory, U.S. Air Force News Release, 1 April 1984, Maxwell AFB, AL.
219. Nick Lackeos, "Military Presence Reinforces Area Economy," *Montgomery Advertiser,* 12 May 1989, p. 5H.
220. Air Univ. Public Affairs, For Immediate Release, U.S. Air Force News Release, 14 April 1984, Maxwell AFB, AL.
221. Daniels, BBP.
222. Schools that had lost the personnel in their dedicated wargaming departments to the Air Force Wargaming Center naturally wanted better wargames in return. Unfortunately, the CRES software was behind schedule, and the folks at the wargaming center, just as naturally, were initially reluctant to improve "legacy" games that would soon be replaced. This caused some friction. When it became obvious CRES would never work, the AFWC began making significant improvements to a host of existing wargames, and relations with the schools improved markedly.
223. Lavoie, e-mail.
224. Daniels, BBP.
225. Ibid.
226. Ibid.
227. Owen, "History of Wargaming 1975–1990," pp. 51–56; James F. Dunnigan and Gene Billingsley, e-mails during the middle to late 1990s. Gene Billingsley is president of GMT Games (a leading publisher of print wargames) and a computer wargame developer.
228. For the most comprehensive history of not only the birth of Dungeons & Dragons but the role-playing industry itself see Shannon Appelcline's four-title Designers & Dragons series on Kindle from Evil Hat Productions (expanding and updating a single-volume issuance from Mongoose Publishing). It is also a good history of print and miniatures wargame publishers.
229. At the same time, Herman was working as a subcontractor for Booz Allen Hamilton.
230. Herman, e-mail.
231. Omega Games ceased operations, in early 2017, shortly after the death of its cofounder Bill Gibbs. Just a few years before, he had published a computer-based (PC and Mac) version of Ranger.
232. Dunnigan, *Complete Wargames Handbook,* p. 243.
233. Dupuy, *Numbers, Predictions and War.* Be sure to consult the 1985 edition specifically.
234. While it is impossible to say with certainty why it is so, a senior military wargamer told me the OR community was suspicious of his background as a historian and that historians were wary of his use of OR.
235. Sloan et al., *Soviet Style Wargames*.
236. After one of its successful offensives late in the war, the Iraqi government offered a tour of the battle area to all attachés. Col. Charles "Westie" Westenhoff, USAF, now retired, was then the U.S. air attaché in Baghdad. During the tour he observed an Iraqi wargaming facility; it matched the setup of a Soviet wargame perfectly.
237. Allen, *War Games,* p. 4.
238. Hawkins, "Chinese War Termination Calculus," passim, esp. pp. 22–23.
239. Pearce, briefing to Connections UK 2014.
240. A. W. Timberlake, e-mail, 16 February 2015. Timberlake is a former defense wargaming analyst and programmer in the United Kingdom.
241. MacDonald, "W.W. III," p. 28.
242. Pearce, briefing to Connections UK 2014.
243. Higgins, e-mail.
244. John Curry, obituary of Dr. Griffith, published several times.
245. Paddy Griffith, *Forward into Battle: Fighting Tactics from Waterloo to the Near Future* (London: Anthony Bird, 1981).
246. Listed wargames appear in the table below.
247. Australian Army, AOSI 17/84.
248. Training Command was, aside from improving code, to foster wargaming throughout the army; conduct wargames as directed by the Army Office; promulgate and maintain a catalog of games; collect, consolidate, and disseminate wargame information; advise

TITLE	REMARKS	MANUFACTURER
First Battle	Divisional-level game, not terrain dependent; U.S. / opposing force orders of battle	U.S. Army
Dunn/Kempf	Battalion-level game, not terrain dependent; U.S. / opposing force orders of battle	U.S. Army
Tobruk	Tank battle in northern Africa 1942	Avalon Hill
Blitzkrieg	Lightning warfare in North Africa 1942	Avalon Hill
Anzio	The Allied offensive against the Germans, Italy 1944	Avalon Hill
Spartan	Tactical warfare in the Hellenistic age, 500–100 BC	Simulations Publications Inc.
Legion	Tactical warfare in the Roman era, 100 BC–AD 700	Simulations Publications Inc.

commands on the best use of games; assist commands in their development and conduct; conduct wargame training; act as training advisor for wargaming; and act as the army point of contact for technical aspects of wargaming.

249. Wikipedia has a concise description of this incident, but far and away the most informative source is "The ABLE ARCHER 83 Sourcebook" on George Washington University's *National Security Archives,* nsarchive.gwu.edu/nukevault/ablearcher/. There see, among other articles on the incident, a link to Nate Jones, "Countdown to Declassification: Finding Answers to the Able Archer 83 Nuclear War Scare," *Bulletin of the Atomic Scientists* (November 2013), and three associated videos.

250. Vasely, "Warrior Preparation Center," pp. 13–16.

251. For example, damage attributed to the 1988 REFORGER exercise was estimated at between forty and sixty million dollars. See Glenn W. Goodman Jr. and Robert R. Ropelewski, "NATO Plans Simulation War Game for Its Central Region Commanders," *Armed Forces Journal International,* April 1989, p. 16.

252. According to Joseph Saur, in 1983 Admiral Crowe, at the time commander of NATO's Southern Command (in Naples), took his planning staff to the Naval War College to exercise their various national war plans in a coordinated exercise. Red, played by Army officers who were students there, attacked southward, then turned abruptly to strike the Dardanelles; they ignored Greece. The Greeks were first surprised, then outraged, that they had been deliberately bypassed, and there was a frantic effort to come up with a Soviet motorized rifle division to attack them. It was also interesting that the various national plans had never been "passed around" to the planning staff; at least one British officer, listening to the Greeks describe their "standard deployments," commented, "They've never told us that!"

253. Goodman and Ropelewski, "NATO Plans Simulation War Game," p. 16.

254. Ibid.

255. Some were original Japanese designs, but the majority were reprints of American print wargames. For the early globalization of wargame design and publishing, Owen, "History of Wargaming 1975–1990," p. 52.

256. The following is based on Mr. Vincent "Vince" Roske Jr. and Dr. Roy Rice, e-mails, February 2014.

257. The Joint Staff's J8 division was (and is) responsible for force structure, resources, and analysis.

258. Almost twenty-five years later Dr. Rice recalled, "The head of the British delegation remarked on the last day of the meeting that we analysts must return home and perform vital analyses of the recent operations 'before the military and political leaders rationalize it away.'"

259. Mr. Steve McCarthy and Mr. Geoff Hawkins from the United Kingdom played particularly significant analytical roles, enabling the mutual trust to grow. Rice, e-mail, 25 February 2014.

260. As stated in the wargame's terms-of-reference document: "ELEGANT VOYAGER will be a multi-move, two team politico-military game. As a pure pol-mil game it will not involve the quantitative assessment of military strength or feature force-on-force engagements requiring statistical gaming techniques. Instead, it will be a scenario-driven path game, monitored and structured by an independent management team."

261. After reviewing a draft of this epilogue Dr. Rice modestly insisted that I had given him too much of the credit: "LTC John Shull and CDR Don Jagoe were two exceptional Pol-Mil officers working in COL Brock's division who played much more significant roles than I." Rice, e-mail, 25 February 2014.

262. The Soviet participants shared Roske's high regard for "R2." When Major Rice's selection for promotion to lieutenant colonel was announced during the game, the Russian generals presented him with his new rank insignia, silver leaves.

CHAPTER FOUR

Wargaming after the Cold War
1990s–10 September 2001

The 1990s saw an explosion in wargaming by the U.S. military and by other militaries throughout the world. It was paralleled by an explosion in commercial computer games (though only a fraction of them wargames), again both in the United States and around the world.[1] It is probably too soon to grasp all the impacts, for good and ill, of that expansion.

War on Sand Table and Sand: The First Gulf War, 1990–1991

To a small degree, the Gulf War was a fight between Soviet and American wargaming methods. Wargames conducted by both sides, both before and during the conflict, influenced the course of the war, and perhaps the following peace. Given the success Iraq had had with Soviet-style wargaming, it would be reasonable to assume it used such methods in planning its invasion of Kuwait. Indeed, the Iraqi invasion followed the pattern of Soviet-gamed operations—a fast start that petered out, at the Saudi border. It would take time for the cumbersome Soviet technique to game and plan the next phase, an attack into Saudi Arabia (if one was intended), time the still-forming coalition desperately needed. It is also likely that the Iraqis had continued to use the airpower wargame that they had purchased from an American defense contractor during the Iran-Iraq War. Could this explain why the Iraqi air force launched no big raids into Saudi Arabia? That is, if they used that wargame at all, it likely would have told them such attacks would be costly and futile.

The wargames that the U.S. Central Command (CENTCOM) had played over the previous decade had given the United States a priceless head start in preparing for the war. The superb training received during live games such as Red Flag and those at the NTC also contributed much to our success. In fact, planning for and wargaming an American response to an Iraqi invasion of Kuwait began less than a year before Iraqi tanks rolled across the border. The CENTCOM commander, Gen. Norman Schwarzkopf, had become concerned by the possibility of such an invasion and on his own authority had

initiated the deliberate planning process.[2] Following the course-of-action wargames and the drafting of a plan, CENTCOM initiated the equivalent of its 1980s wargame Gallant Knight (chapter 3), a large game called Internal Look, postulating an Iraqi invasion of first Kuwait, then Saudi Arabia. The participants noticed that some of their wargame "injects" (scripted information released by controllers) were disconcertingly similar to actual CNN reports they heard during breaks.[3] During Internal Look, those playing the roles of CENTCOM's leaders initially decided to deploy only a token force, "to show resolve." The Red team, controlling Iraq's forces, decided to drive south immediately into Saudi Arabia. The Blue, or U.S., team had trouble getting sufficient forces in-theater to slow the Iraqi advance.[4] When the actual invasion occurred, the CENTCOM staff, with Internal Look still fresh in their minds, pushed hard for the fastest possible deployment of U.S. forces.

Not long after General Schwarzkopf began planning for an Iraqi invasion and months before Internal Look, the Chief of Naval Operations' Strategic Studies Group conducted a wargame that proved remarkably prescient.[5] It was conducted at the War Gaming Department at the Naval War College (NWC), from 5 to 9 February 1990.[6] Held just three months after the fall of the Berlin Wall, this game examined how a weakened Soviet Union might affect regional conflicts, specifically a conflict set in the Persian Gulf. John Hanley, then the SSG deputy director, was the "brains" and principal driver of the game. Jim FitzSimonds, SSG intelligence officer, was central in developing the scenario. The fifty-three participants included members of the CNO SSG and representatives from NWC, the Central Intelligence Agency, Defense Intelligence Agency, CENTCOM, NATO, the Office of the Secretary of Defense, the CNO's staff, and the Joint Chiefs of Staff.

The objectives of this game were to examine the likely American and Soviet strategies in the region; identify factors that would likely limit U.S. military capabilities in the theater; assess the ability of U.S. and allied military forces to deter, to contain, and finally to terminate hostilities on favorable terms; explore the need to influence positively the USSR as it developed its own response to crisis and the ability of the United States to do so; and study the joint and combined task force organizations and operations involved.

In this scenario, Iraq acted as an aggressor, with national objectives to improve its political, economic, and military position. Given the number of real-world stakeholders in such a conflict, the wargame used seven cells: Control, United States, Soviet Union, Iraq, European Community / Japan / Turkey, Gulf Cooperation Council / Egypt / Iran, and Assessment. The players' moves were not scripted; Control used a prepared general framework, to ensure that the game objectives were properly explored. Two models were used for analysis of engagements, but overall adjudications of move outcomes were

subjectively determined, relying on the professional experience and judgment of the members of Control.

Over the course of seven moves this multisided wargame depicted a conflict that extended from October 1994 through January 1995. Events started when Iraq demanded both a higher oil production quota from OPEC (the Organization of the Petroleum Exporting Countries) and recognition of its claims of sovereignty over Bubiyan and Warbah Islands. As global oil prices continued to decline, Iraq issued a series of ever-stronger demands and conducted military maneuvers. Then, on 1 January 1995, Iraq invaded Kuwait and struck three Saudi airfields. The Iraqis used chemical weapons in the assault. On the 4th, Iraq invaded Saudi Arabia and quickly established control of its oil fields, but not before the Saudis had destroyed key infrastructure and withdrawn their forces to Riyadh. During the seventh move, U.S. and allied forces responded to the invasions.

Many of the major insights drawn from this wargame would soon be confirmed:

- Soviet crisis behavior in the foreseeable future would probably not be as it had been in the Cold War, but driven more by domestic concerns, including rebuilding the economy.
- The shift to a multipolar world would reduce the ability of the United States and the Soviet Union to moderate the behavior of regional belligerents.
- Maintaining the U.S. technological edge would be as important as ever.
- The future alliance structures used by the United States deserved further review; ad hoc alliances might be paramount yet more difficult to establish and maintain.
- Deterrence remained a principal goal of the United States and its allies, and the presence of military forces was vital when diplomatic efforts failed.
- While the United States sought termination of hostilities on terms favorable to its interests, the reality of regional power structures and military capabilities might force a reevaluation of what is "favorable," in order to avoid long-drawn-out hostilities.

This wargame also produced a number of tactical insights that were forewarnings of some of the challenges that would soon be faced in the Gulf War.

In Washington on the morning of the actual Iraqi attack, Mark Herman, the designer of the commercial wargame Gulf Strike and now an employee of the defense contractor Booz Allen Hamilton, was approached by the Joint Staff and asked to produce a game of the developing situation. He was under contract by lunch. He modified Gulf Strike to produce a classified wargame—and play began by midafternoon![7] Before the end of the month the Joint Staff was running a more traditional wargame, TacWar, which it

continued to run as the situation evolved until March 1991.[8] Early U.S. Department of the Army wargaming of the evolving crisis was conducted by the Contingency Force Analysis Center of the Center for Army Analysis.[9]

On 10 August 1990, the private British organization CORDA independently decided to use Gulf Strike as a rapid-analysis tool.[10] As its information was completely unclassified, CORDA was able to publish its findings in a paper just one year later.[11] It used the game to explore the likely outcome of an immediate drive into Saudi Arabia by Iraqi forces. During its first wargame it assumed that the supplies Iraqi forces would need to sustain an offensive were stockpiled in the Baghdad area only; coalition airpower easily starved any offensive before it could get under way. For the second game it was assumed that supplies were also stockpiled around Basra. This time the Iraqis could supply more of their forces—enough to give them a thin advantage over the few coalition ground forces then in place. This presented the Iraqi side with a dilemma: the more time it took to supply more of its units, the more coalition ground units moved to the border. After six days of combat the outcome remained in doubt. Later, CORDA would create the scenarios used to train British forces prior to deploying to the Persian Gulf.

During August, a joint planning cell led by Col. John Warden and built on the Air Staff's Checkmate office produced the Instant Thunder theater joint campaign plan and then wargamed it. The game, which used software that did not adjudicate the impact of hitting strategic targets—having been designed to model Cold War force-on-force attrition campaigns—indicated that the plan would have virtually no effect.[12] This misleading outcome may help to explain some of the opposition to the Instant Thunder plan.

After offensive air planning activity shifted to the theater, the Air Force Studies and Analysis Agency (AFSAA) deployed forward a small cadre of analysts armed with a brand-new wargame adjudication program, EADSIM (Extended Air Defense Simulation).[13] While EADSIM had zero ability to anticipate the theater effects of hitting any particular enemy target, it did a great job of determining a pilot's chance of reaching that target alive. By modeling the enemy's air-defense system, EADSIM was able to indicate the impact of attacking any part of it. On 21 October, Lt. Col. Mike Carpenter and a four-man team arrived in Riyadh. While they called on both AFSAA and Checkmate for what would soon be called "reachback support," the principal lesson they would learn from Desert Shield / Desert Storm was the importance of having analysts in-theater with the warfighters to build trust and open communications.[14]

In the theater, U.S. joint wargaming had already begun. General Schwarzkopf deployed Col. Gary Ware, USAF, his chief of modeling, simulation, and wargaming, from CENTCOM's Tampa, Florida, headquarters to Riyadh, Saudi Arabia, with a small cadre of analysts. Colonel Ware's detachment would accomplish small studies

on the spot and "reach back" to the balance of his team, still in Tampa, for larger jobs. By early September, Ware's work was indicating that Saudi Arabia would soon be safe but that substantially more force would be needed to go over to the offensive.[15] His team continued to be used extensively in the lead-up to Desert Storm.

For example, as the time for the coalition counterattack approached, an element of the U.S. government pushed CENTCOM to occupy western Iraq with the 101st Air Assault Division, to prevent mobile Scuds from getting close enough to launch against Israel. CENTCOM quietly wargamed such an operation and passed back the forecast high casualty figures; the suggestion did not come up again.[16] Given the subsequently revealed "wrongness" of the attrition-based casualty projections for this conflict (and the success of a somewhat similar operation in 2003, in the Second Gulf War), it is possible that this may have been an opportunity lost.[17]

Reachback was used to wargame the initial days of the air phase of Desert Storm as well. Planners in the Joint/Combined Air Operations Center's Strategy Cell, known locally as the "Black Hole," called back to Checkmate to wargame each new version of its plan.[18]

Deployed British forces also used wargaming, both before and during the Gulf War. Most of their gaming during the run-up to the counteroffensive centered on, first, the breakthrough of the "Saddam Line," and second, the mobile battle that was expected to follow.[19] The Saddam Line was a sophisticated obstacle belt along Iraq's Saudi Arabian / Kuwaiti border, constructed between August 1990 and January 1991. To help devise the best way to breach that line, the United Kingdom's Ministry of Defence (MoD) asked the Royal Armament Research and Development Establishment (RARDE) at Fort Halstead, in collaboration with Rex, Thompson & Partners Limited, for advice on how this might best be achieved. RARDE developed and used a simple manual wargame depicting both the obstacle belt and the covering Iraqi forces. Officially the Obstacle Modelling Project, it was soon better known as "the Lego Game." One of the developers raided his child's Lego set and used some of the blocks to represent the vehicles and engineering materials.[20] The name stuck. This manual wargame was designed, developed, and conducted by a small team that included Paul Donovan (section head in CA3 Division, RARDE), Paul Glover, Keith Jennings, Rick Atkinson, and David Gascoyne. Armored engineer officers and senior NCOs examined the use of engineer resources to breach this obstacle. The aim was to develop and refine the concepts of operations and, in particular, to identify how the new techniques and equipment might best be integrated. The results were passed immediately to British engineers in the Gulf. Later, the game itself, which had been further developed to serve as training and planning aid, was sent to the Gulf as well. (Tragically, Lt. Col. Alec Wright of the Royal Engineers, the principal champion of the wargame at the MoD, was killed while taking the game to the Gulf.)[21] The soldiers

who were to plan and execute the breaching of the Saddam Line wargamed their plan over and over again to minimize the time needed for this operation.[22]

While the "Lego Games" were in progress, the Battle Group Wargame (BGWG) team—the CA4 Division of RARDE—looked at the main armored battle expected after the break-in.[23] It chose Janus as its principal adjudication tool, though it had received Janus from the U.S. Army's TRADOC Analysis Center just two years earlier and had limited experience with it. Its choice resulted in a frantic data-input effort in the weeks leading up to the gaming. Why? The United Kingdom had been using Janus to explore procurement alternatives and so had focused on ten to fifteen years in the future, with planned or contemplated British systems facing systems the Soviets were expected to field by the late 1990s. At first CA4 Division had no data for present-day Blue systems, let alone the obsolete Red ones the Iraqis were using.[24]

The Janus series was conducted in three distinct phases. The first phase began during August 1990, self-started by the battle group's wargame team; it looked at the composition of reaction forces to assist Jordan should the Iraqis seek to widen the conflict. The second, tasked by MoD, examined the capability of a British armored brigade as part of a U.S. Marine division. The third examined the tactical options available to the British commander, Lt. Gen. Rupert Smith, and originated with his embedded scientific advisor, Hugh Richardson. By this time the turnaround time between tactical problem and one-page report was down to twenty-four hours.

The main people using Janus were Gavin Jakins (acting section head), Dr. Diane Harmer, Alasdair "Fred" Hood, Ian Gardner, and Russ McWilliam. The key military players of the wargame were Lt. Col. A. D. R. "Tony" Critien (battle-group wargame controller), Maj. Steve Bowkett, Maj. Paddy Clarke, WO2 (Warrant Officer Class 2) Paul Leonard, and Maj. Edward Trousdell (Ret.).[25] The Janus gaming stopped twelve hours before the start of the ground war. The insights the series generated influenced the formation and tactics used during the British army's drive into Kuwait. On a postwar visit to RARDE, General Smith thanked the BGWG team for its assistance in developing his tactical thinking.[26]

U.S. Marine wargaming in support of Desert Storm comprised wargames held both at Quantico and (presumably on the basis of Marine doctrine) in-theater. The Wargaming Division conducted three games in direct support of Operation Desert Storm.[27] The first was the Policy and Strategy Wargame (PSWG) played in September 1990. The Commandant, General Gray, convened a PSWG every six months for flag and general officers, Marine and others. This PSWG examined the real-world crisis and explored the military options for resolving it. The participants developed operational plans and concepts of operations (CONOPS) and briefed them to General Gray. The CONOPS

developed by the flag participants looked strikingly similar to those actually executed during Desert Storm.

The second gamed and assessed a breaching CONOPS in support of Lt. Gen. Walter E. Boomer, Commanding General, I Marine Expeditionary Force (MEF), who was preparing to penetrate the Iraqi lines defending Kuwait. Through the leadership and direction of Maj. Gen. Matthew Caulfield, the Marine Corps Wargaming and Analysis Center (MCWAC) gamed around the clock for about ten days in October. The game used the Janus model with real-world Red and Blue "laydowns" (force positions) and Red defensive structures. Lieutenant General Boomer's original plan called for twenty-four breaching lanes across a two-division front. He was very concerned about heavy casualties due to indirect fire (i.e., from distant artillery, called in and corrected by observers in sight of the target).

The game ran through multiple iterations and interactions. No iteration of the original plan produced a breach in the Iraqi defenses. When the lanes were reduced from twenty-four to twelve across the two-division front, there were several successful breaches. MCWAC reported its results and recommended that Lieutenant General Boomer consider reducing the number of lanes. Further, MCWAC, which had found that the indirect-fire threat was greatly affected by Marine tactical air (TACAIR) support, recommended that Marine TACAIR be concentrated to neutralize it. General Boomer did reduce the number of breaching lanes, and he did employ Marine TACAIR to reduce the indirect-fire threat.

A third wargame facilitated development of the amphibious plan for Desert Storm. Another initiative of Major General Caulfield, this plan envisioned a deep thrust to Basra to create a double envelopment of the Iraqi army. Col. Marty Steele was the "action officer"; MCWAC designed and executed the game. The resultant plan was briefed to General Gray and then taken to CENTCOM for presentation to General Boomer and Adm. Henry H. Mauz, commander of naval forces in the Gulf. The plan was considered but not executed by General Schwarzkopf—who did, however, use the amphibious forces to deceive the Iraqis about his actual plans. As coalition forces moved forward, they uncovered evidence of Iraqi wargaming; from the terrain modeled, it was clear the Iraqis had been rehearsing to repel an amphibious invasion.[28]

Back in Washington too, many were gaming the Gulf War. A few estimates of casualties were extremely high;[29] others were fairly accurate.[30] Most wargames projected coalition casualties (killed and wounded) totaling about thirty thousand, of which six thousand would be American fatalities. Senator Sam Nunn of Georgia, chairman of the Senate Armed Services Committee, decided to oppose the counteroffensive: in his political judgment, the American people would not accept such high casualties.

As the time to attack grew closer, individual Army units started to wargame their own parts of the plan.[31] Most U.S. Army and many coalition formations used the Joint Theater Level Simulation to adjudicate their games.[32] But at least one Army unit used a commercial game. A soldier wrote to Frank Chadwick, president of Game Designers Workshop, a print wargame design and publishing company, that his unit had been using one of Chadwick's games to practice its part of the operation until a sandstorm had literally blown the game away. The writer naturally could not tell him how soon the operation would be launched—but could he send a replacement game, *very quickly*?[33] He did.

Also in this period, the British assembled a small Scientific Support in Crisis and War (SSCW) team of civilian operations research experts and deployed it to Saudi Arabia with the British 1st Armoured Division.[34] During the air/ground-maneuver phase of the war it reached back to RARDE and other establishments in England. British commanders in the field would discuss their contemplated actions with the SSCW analysts, who would explore them either directly in wargames or through consultation with the United Kingdom and report the results back to the field.[35] However, as the Iraqi army collapsed the speed of the advance accelerated so greatly that SSCW's process proved unable to keep up.[36]

Wargaming also helped American forces during execution, if indirectly. During the war, pilots based in Turkey referred to northern Iraq as "The Range";[37] a number of soldiers were caught on camera saying, "The NTC was much harder than this."

However, computer wargames can mislead. Computerized games did not then include code that would have units "involuntarily change their posture"—that is, stop attacking, retreat, or melt away, as a result of casualties suffered and other factors.[38] Therefore, a number of wargames depicted Iraqi units fighting, and inflicting coalition casualties, to the last man. The resulting expectation of high casualties resulted in C-130 transport aircraft being configured for medical airlift, not for flying in the fuel that was actually needed. Because the U.S. military's games had indicated the Iraqis would fight to the last man, there was too little preparation for prisoners of war.[39] These high casualty estimates may have also influenced the American decision to suspend offensive operations after the liberation of Kuwait. While polling data showed that the American people wanted Saddam Hussein removed, they also showed support for the war beginning to decline at thirty thousand casualties, a few thousand fewer than most wargames projected just to liberate Kuwait.[40]

Though we achieved in this war one of the most overwhelming military victories in history, we did not achieve a proportionately positive state of peace. Why? It appears the United States never wargamed all the way through to peace. The Marines had planned

to conduct such a wargame, but military victory came too quickly. Even if it had been conducted, it is doubtful that our attrition models would have anticipated the revolts against Saddam. The impact of wargaming on the Gulf War was enormous, and mostly positive. Yet coalition casualty indications were over twenty times too high. These indications had real political and military consequences. How would experience shape the evolution of wargaming in the United States and around the world?

Continuity and Progress, 1991–2001

During the 1990s the U.S. military spent more money on wargaming than in all previous decades combined.[41] Much of this increased investment produced excellent value.[42] Yet the central problems that had caused the high casualty predictions for the Gulf War were often pronounced impossible to fix or were ignored. A RAND paper, *The Base of Sand Problem,* captured the problem well: What was needed was a more comprehensive adjudication of armed conflicts. More computing power without a more comprehensive understanding of war would simply produce the wrong answer faster and with more-persuasive graphics.[43] Relatedly, an article in the Army quarterly *Parameters,* drawing on strong historical precedents, argued that while the then-current interwar nature of the international environment made wargaming more difficult, it also made gaming far more important.[44]

Undeniably, increased competition for limited defense dollars and the success of the Navy's Global War Game as an analytical and lobbying tool have led all the services to conduct Global-like games—collectively called "Title 10" wargames, in reference to Title 10 of the U.S. Code, the legislative foundation of the armed forces. As we'll see later, Title 10 games such as the Air Force's Global Engagement and the Army's Army After Next grew in influence.[45]

At the opposite end of the strategic-to-tactical spectrum, the 1990s also saw DARPA's modest efforts to encourage wargaming by networking simulators into a virtual battle space increase in size and sophistication.[46] In case after case, traditional simulators, individually effective for little more than learning emergency procedures and "switchology," were integrated into networks and collectively transformed into devices allowing the learning, testing, and rehearsal of tactics against thinking adversaries.

Joint

During the 1990s most money spent on improving wargaming was devoted to facilitating the computer adjudication of joint operations. Perhaps, in turn, the most important post–Desert Storm / post–Cold War development in joint wargaming was not a new game or process but the increased rigor given to existing ones. For instance, for decades the U.S. combatant commands had received, every two years or so, a classified

document called the Joint Strategic Capabilities Plan (JSCP). The JSCP would (and does) require specific commanders to build or, more usually, update plans to deal with specific contingencies.[47] However, many of these plans had long been little more than transportation feasibility studies and their updates little more than "pencil whipped."[48] Gaming was an integral part of the effort to lend rigor to that planning, especially in CENTCOM. Seeing the impact that CENTCOM's wargaming-assisted planning had on the success of Desert Shield and Desert Storm, all other combatant commands picked up their own games.

Nevertheless, CENTCOM still seemed to lead the pack in quality and timeliness of wargaming. With prescience equal to that of his predecessor Norman Schwarzkopf, in the late 1990s the new CENTCOM commander, Gen. Anthony Zinni, USMC, became concerned about conditions in Iraq should Saddam Hussein fall from power for any reason. On his own authority he directed the drafting of a "branch" plan to his JSCP-required operations plan (OPLAN) 1003-98.[49] This plan's equivalent to Internal Look was called Desert Crossing. Held in late April 1999, the wargame assumed a four-hundred-thousand-strong U.S. force and indicated many events that actually occurred after Saddam's overthrow. An after-action report provided clear insights that would have been valuable in such a situation. Of course, to have had that value the report would need to have been read.[50] In the next chapter we will continue this story arc.

In 1990, the deputy secretary of defense created the Executive Council on Modeling and Simulation to take a comprehensive look at wargaming.[51] It saw a maze of adjudication software—most of it for a single warfare domain (i.e., air, sea, or land), using different data, and producing different answers to the same questions.[52] Ground and naval surface forces had clearly played important roles during the final days of the Desert Storm campaign, yet no game could fully depict such a joint operation.

As a first step to bring order to this perceived chaos, a permanent Defense Department–level office was established: the Defense Modeling and Simulation Office (DMSO), in 1991.[53] A small office with four military and three civilian positions, in 1993 DMSO established an information clearinghouse so that work would not be duplicated out of ignorance.[54] In 1999, this clearinghouse became the Modeling and Simulation Information Analysis Center.[55] Toward the decade's end, and following successes with them by several services, DMSO became interested in commercial wargames and simulations.[56]

As an interim measure in that connection, the wargames each service was already using for command-post exercises were collectively dubbed the Joint Training Confederation.[57] DMSO then funded development of software that would allow these service games to "talk to each other." When an aircraft in the Air Force wargame dropped a bomb, it would hit (or miss) its target in the Army's wargame as well.[58] The Joint

Warfare System (JWARS) was to replace most service analytical models. A purely constructive model (that is, no element of the wargame could be either live or virtual), it would be capable of running much faster than real time. Its primary usefulness would be in helping develop, compare, and select between operational courses of action, and examining alternative force structures or weapon systems. At mid-decade JWARS was scheduled to be completed in a few years: Block 1 in 1998, Block 2 in 1999, and Block 3 in 2000.[59]

Each service was to fund programs to replace many one-service adjudication "engines" with a smaller number of joint ones. The Joint Simulation System (JSIMS) would be the largest, most capable, and most expensive of the new wargame engines. Designed primarily to support command-post-type games, it would run in real time and allow constructive, virtual, and live elements to be incorporated into one battle space. Technically, JSIMS would be a set of intercompatible models. Each service was to develop its own "module," in compliance with a "high-level architecture" (HLA). Essentially a set of standards, HLA was supposed to help ensure that all the service modules would be able to talk to each other when completed. JSIMS was to replace all service wargames adjudication software used for command-post exercises and would be used to help refine selected courses of action and support the rehearsal of plans by joint and component staffs. At mid-decade, it was expected that JSIMS would reach initial operating capacity by 1999 and be at full operational capacity by 2003.[60]

JSIMS was controversial almost from its inception.[61] Part of the reason was a manyfold increase in the price tag. It was originally funded at sixty-nine million dollars;[62] by decade's end the total development price tag was approaching a billion dollars. This was due both to additional organizations joining the program (and simply adding their budget requirements to the total) and to growth in the original costs. Similarly, there were slippages in the schedule—again, some resulting from new work and some outright delay. There was also some pushback, because the Department of Defense (DoD) planned to force the services to use JSIMS, by establishing a "no pay" date (i.e., no additional funding allowed for "legacy" models) and a "no play" date (after which legacy models could not be used). But the greatest source of dispute was the total price: a billion dollars is enough money to attract attention even in Washington.

Despite the controversy and the "innovative" organizational structure (in which the project office controlled almost no money), it looked for a time as if JSIMS might actually work. By mid-1999, JSIMS target dates had slipped to initial capability in April 2001 and full in December 2003, but a major test of JSIMS by the U.S. Atlantic Command suggested that this potentially important system was approaching operational usefulness.[63] However, later in 1999 the director of the Joint Staff's J8 division, which

had repeatedly heard statements of concern regarding both JSIMS's management and technical approach, called for an assessment of the project. Subsequently, in early 2000, the deputy secretary of defense directed the restructuring of the program and a fundamental change in its technical approach.[64]

Meanwhile, the joint community continued to use legacy wargames for a spectrum of applications. For example, in 1997 the Joint National Testing Facility used the Advanced Real-Time Gaming Universe Simulation (ARGUS) to examine the operational impact of projected antimissile systems, even though ARGUS was supposed to be replaced by a JSIMS member simulation, Wargame 2000.[65]

Also during the 1990s, the Warrior Preparation Center continued to grow in importance, capability, and popularity. As the Soviet threat disappeared, with the dissolution of the Soviet Union, and Europe became more ecologically conscious, it became first more difficult, and then nearly impossible, to conduct large-scale field exercises. The Warrior Preparation Center allowed generals to mass their forces wherever they wanted across their synthetic battlefields at perhaps 1 percent of the cost of a live exercise.[66] Small wonder that, being able to host a maximum of ten exercises a year, it spent most of the 1990s booked up eighteen months in advance.

Partly in response to the recognized importance of wargaming during the Gulf War, the Joint Warfare Center was moved, reorganized, and expanded to become the Joint Warfighting Center (JWFC). It also moved to historic Fort Monroe, Virginia. JWFC was responsible for joint doctrine and lessons learned as well as wargaming. After the move, the element specifically dedicated to wargaming was designated the Joint Training, Analysis, and Simulation Center (JTASC) and moved out of Fort Monroe to Suffolk, Virginia. The first major joint wargame conducted by JTASC, Unified Endeavor 95 (UE95), demonstrated the cost advantage of constructive wargames over live iterations. A traditional live wargame with the same scenario and order of battle would have cost roughly thirty-seven million dollars to conduct; JTASC executed UE95 for $3.4 million.[67] Other advantages included security from overhead observation and the virtual elimination of environmental impacts, wear on military vehicles, and claims for property damage. Still, there were significant disadvantages.[68]

In addition, wargaming continued to play a role in joint professional military education. Each wargame was optimized for the educational objectives of the school using it. The curriculum of the Armed Forces Staff College was designed to prepare midcareer officers—lieutenant commanders (Navy and Coast Guard) and majors (all others)—for assignments to joint staffs at the theater level. Its curriculum emphasized theater operations, and its capstone game placed the students in leadership positions in a theater campaign. To increase wargaming's contribution to the effectiveness of this curriculum,

the Joint Staff funded a new wing for wargaming (and a library) at the Armed Forces Staff College. The chairman of the Joint Chiefs of Staff, Gen. John Shalikashvili, dedicated the new wing.[69] The curricula of the National Defense University's National War College and Industrial College of the Armed Forces, in contrast, are designed to prepare more-senior officers—lieutenant colonels and colonels, commanders and captains—for positions at the national strategic level. Therefore, their capstone wargame, the Crisis Decision Exercise, requires the student to cope with a crisis from the national perspective.[70]

Individual service war colleges continued to participate in JLASS (see chapter 3). Throughout the nineties the exercise continued to evolve. Two examples:

- In JLASS 96, eighty-seven students were called on to cope with three major contingencies, during an era when the American armed forces were focused on coping with two nearly concurrent ones. This year also included expanded media play.[71]
- During JLASS 98, ninety-three students and almost as many controllers participated. A key innovation was the inclusion of Red media, allowing participants to assess and devise counters to Red information operations against the United States.[72]

Some valuable joint innovations were not exactly wargames. As early as 1989, the Joint Staff began conducting experiments to evaluate the operational utility of fast-evolving commercial information technology. During the 1990s, these experiments were formalized into the Joint Warrior Interoperability Demonstration (JWID). Each year the Joint Staff would create a wargame-like exercise and invite commercial vendors to demonstrate in it how their technologies could enhance joint command and control. As many of the projects were in the prototype or beta stage, they were not fully games, with Red trying to negate the new technologies. Still, JWID identified so many low-cost, high-benefit, commercial-off-the-shelf (COTS) technologies that by 1995 Australia, Canada, New Zealand, and the United Kingdom were participating, and by the late 1990s so were France, Germany, the Netherlands, Spain, and Turkey. *Signal* magazine would even call JWID "the ultimate war game."[73] But it was not technically a wargame at all, and such imprecision would lead to confusion and controversy in a few years.

Late in the 1990s, the joint community and the services became convinced that wargaming could be valuable for assessing doctrines and technology choices. Essentially, the conviction began to grow that before money was spent developing a new technology, games could provide insight into its probable operational benefits.[74]

The late 1990s also saw the first unclassified paper about what had been a largely uncommented-on wargame operation, the Joint Staff's Studies, Analysis and Gaming Division (SAGD, formerly SAGA). The paper, published by the National Defense

University's Institute for National and Strategic Studies, described SAGD's work in support of the Quadrennial Defense Review (QDR).[75] A greater-than-normal need for transparency was the likely cause of this publicity. Some in the administration, Congress, and the public at large felt the "peace dividend"—that is, money that could be cut from defense spending now that the Cold War had ended—should and could safely be larger. However, many (including some of the same organizations and individuals) were concerned that too-large cuts could lead to a return to the post–Vietnam War hollow force, leaving the United States vulnerable, especially if multiple conflicts or other contingencies (disaster relief, peacekeeping) occurred simultaneously. To address the tension between these concerns the fiscal year 1997 National Defense Authorization Act initiated the Quadrennial (i.e., every four years) Defense Reviews. They would examine every defense program, from force structure and infrastructure to modernization plans, to ensure no more was being spent on defense than necessary. SAGD's wargame was intended to project the risk at various funding levels.

It was the high stakes inherent in such a wargame that called for such unprecedented transparency, at least among the stakeholders within the Department of Defense. The wargame process that SAGD developed was named Dynamic Commitment. Instead of SAGD's normal sequence of designing, developing (getting the needed data and materials), and conducting a game, Dynamic Commitment comprised four events. First, Dynamic Commitment was designed in a very open manner. On 5–6 December 1996 a game-design conference was held with eighty-five participants, mostly O-5 and O-6s (lieutenant colonels and colonels, Navy commanders and captains) from across DoD. On the basis of this exceptionally broad range of inputs, SAGD developed the wargame. Two Blue teams would meet the same series of threats and contingencies, all consistent with American historical experience since World War II. Actual execution would include a host of other teams, each working to ensure an accurate outcome. On 14–17 January, SAGD hosted what it called a Scoping Game. In what was essentially a "playtest" of the game's design, two hundred people, mostly O-6s (colonels and Navy captains), from across the defense establishment participated.

The third event, 19–20 February 1997, brought in over a hundred flag officers (generals and admirals), including several deputy commanders of geographic commands. The event was part outbrief on the playtest, part seminar wargame, and part opportunity to collect very senior input on game design and execution. The final Dynamic Commitment event was held 20–22 March; over two hundred participants put together everything that had been learned to date. The authors of the published paper were able to report that Dynamic Commitment's findings made a substantial contribution to the QDR.

In 1998, DMSO initiated a program of annual awards to enhance awareness of modeling and simulation (M&S) throughout DoD and to recognize excellence, innovation, and achievement in advancing the state of the art of M&S or in contributing to interoperability (ability of software to exchange data with other software) and reuse (ability to run the same code or data in multiple efforts) in support of DoD M&S objectives.[76]

As the decade came to a close, the recognition grew that the world was indeed being transformed at an increasing rate and that just as the services were working to transform themselves over the long term, so the joint community had to find a way to look and act far enough out to recognize the need for, and make, the necessary changes. This was a bit of a problem, because, by design, joint combatant commanders (see chapter 6) are supposed to focus on accomplishing today's and tomorrow's missions; it is the services that are to look, plan, and budget for the long term. The solution was the creation of a joint command that would act a little like a service—that is, look far enough into the future to organize, train, and equip the joint headquarters that would be needed to command the forces provided by the services. In October 1999, the U.S. Joint Forces Command (USJFCOM) was established. By then it had already been assigned JWFC, in part so the new command could conduct the "Title 10–like" games it would need to anticipate joint needs.[77]

U.S. Army

The demonstrated utility of wargaming during Desert Storm strengthened still further the acceptance of wargaming within the Army, though some criticism continued. As we've seen, even before the Gulf War the Army had been working to improve its wargames. After the conflict, on 15 February 1996, the Army Models and Simulation Office (AMSO) was established. Reporting to the Army Chief of Staff through the Deputy Chief of Staff for Operations, AMSO was to monitor and coordinate wargaming activity across all Army uses, validating requirements and setting policy and standards.[78]

Since 1990 the Conflict Analysis Division (CAD) of the Center for Army Analysis (CAA) had provided a political-military gaming capability to the Department of the Army. Over nearly twenty years CAA would conduct over a hundred political-military games, issues workshops, and seminars in support of headquarters, the combatant commands, Army service component commands, and other sponsors. Gamers represented more than a hundred agencies and twenty countries. CAA's political-military capability was flexible and diverse with respect to the depth and range of issues it could address, from strategy to planning to operations. A major strength of CAA's events was that they offered immediate insights to sponsors. Another was that CAA's methodology

represented for senior leaders a structured analytical tool for challenging and complex problems that were not readily quantifiable.[79]

On 1 January 1990 the Army Model Improvement and Study Management Agency was established, at Fort Leavenworth, Kansas. This body was chartered not only to identify and implement improvements to Army wargaming but also to coordinate policy regarding the service's three broad purposes that in the 1990s most Army wargames served.[80]

Education and Training. Wargaming made up a pivotal part of the curricula of the Army's war and staff colleges.[81] The opening in July 1994 of a new multimillion-dollar wargame facility at the Army War College was proof of the importance the Army placed on this aspect of officer development.[82] The Army also used wargames at all levels of command to generate input to command-post exercises. Games used included Corps Battle Simulation, for use by corps and division headquarters, and Janus or Brigade/Battalion Battle Simulation (BBS) for use by brigade and battalion staffs.[83] The overall program for training division commanders and their staffs was Warfighter. While the program, of which the wargame was just one (but vital) element, did not claim to be as effective as actual combat in creating veteran commanders and staffs, it has been estimated that sixteen thousand battlefield casualties would be needed to achieve the same level of proficiency the old-fashioned way.[84] So maybe Warfighter's not quite as effective as actual combat, but its "tuition" is certainly much lower!

Crews of Army vehicles, from tanks to attack helicopters, were increasingly trained on a network of simulators called the Close Combat Tactical Trainer (CCTT). The impacts of fire support, combat engineering, and logistics were included. In 1994 it was predicted all Army combat simulators would be networked into CCTT by 2000. The results proved mixed at best.[85] By decade's end, the Army was able to document undeniable, if modest, performance improvements owing to its new virtual environment.[86]

Anticipating, Testing, Evaluating, and Researching. The point here was to anticipate the overall nature of land warfare in a specific theater at a specific time in the future.[87] Particular uses ranged from virtual prototyping (e.g., building a cockpit in a simulator before you build it in a real aircraft) to discerning which technically feasible technology options would have the greatest positive impact on the battlefield. The largest, most expensive, and most influential Army wargames in this category were the service's Title 10 games, the Army After Next (AAN) series. These annual exercises were designed to help the Army foresee how it would organize, train, and equip its forces in the future. For example, wargamers would play several different plausible force structures in parallel wargames against the same threats and see which did best.[88]

Each year's AAN exercise was a little different. The first was conducted in 1997. Actually, the Army conducted two AAN wargames that year. A winter game, with a more global, conventional view, began with Red taking out a number of U.S. satellites on which the Army depends.[89] The summer game focused more on unconventional operations and was set in and around Indonesia. Over three hundred Army officers participated in the summer game alone, alongside representatives of Great Britain, Canada, Australia, and several U.S. non-DoD government agencies.[90] After the events of 11 September 2001, this wargame would seem more than a little prescient.[91]

Throughout the remainder of the decade AAN wargames reflected themes selected for that year and were designed to provide insights relevant to stated objectives. In 1998, the theme emphasized the operational level of future warfare. AAN 98's objectives were to look deeply into "asymmetric" threats, experimental force structures, domestic counterterrorism, logistical implications, and technology "enablers."[92] Within AAN 98 there was a separate, 120-participant wargame dedicated to conflict in space and how it could affect surface operations.[93] In 1999, AAN focused on the fusion of airpower and land power.[94] AAN 99 themes included strategic settings, force projection and sustainment, urban and other complex terrains, hybrid forces, employment, homeland defense, coalition and joint issues, interdependence, and science and technology. Its objective was simply to examine and expand understanding of each theme.[95]

In 2000, the Army changed the name and the focus of its Title 10 wargame. It was now called the Army Transformation Wargame, and its focus was to see how much difference the Army's transformation initiatives might make in a campaign fifteen years in the future. This change could be seen in the wargame's themes and objectives. The former were fewer and more specific:

- Why an army?
- Why this army (Objective Force)?
- Insights for the Army in 2015.

The objectives were much more specific:

- Visualize and define the strategic and operational environment.
- Highlight the Army's role in strategic responsiveness and "full-spectrum dominance."
- Demonstrate importance of achieving "overmatch."[96]

The Army Transformation Wargame projected a plausible regional adversary's technology and an economically supportable force size forward fifteen years. Two significantly different future forces were postulated and played in separate games. The exercise's Red team developed a strategy it believed would be both effective and true to the adversary's

culture and doctrine. In brief, in 2000 Red sought to kill enough Americans to turn the American people against the war. Each of the two Blue teams tried to employ its forces to achieve their political leadership's desired end state with the minimum cost in time, lives, and treasure. After the exercise the Army analyzed the results to determine which force attributes were the most helpful, so that research and development could be prioritized accordingly.[97]

Deliberate and Crisis Planning. All branches of the U.S. military used one of two methods, similar but distinct, for creating war plans: "deliberate planning," a two-year process used to update and occasionally create new standing (on-the-shelf) war plans; and "crisis action planning," which adapts standing plans or creates new plans to address a breaking crisis. War plans probably constituted the most controversial area within Army wargaming. Some emphasized granularity and rigor over speed of analysis, while others traded precision for greater speed. Generally, common sense prevailed, and fast adjudication techniques dominated crisis action planning, while more-time-intensive and -granular efforts were the norm for deliberate planning. Wargaming became so integral to the Army decision-making process that several articles appeared on wargaming techniques specific both to different phases of planning and to different branches.[98]

The U.S. Army also explored contingencies that did not fit neatly into either category. For example, more than two years prior to the 11 September 2001 terrorist attacks, CAD pointed to a need to be better prepared in the area of homeland defense / homeland security. CAD engaged in a series of innovative workshops and political-military games, sponsored by the Army Deputy Chief of Staff for Operations and Plans, under the rubric of the "Homeland Security Initiative." Over the next eighteen months these games helped define the Army's roles and responsibilities in homeland security, promoted communication on this critical issue within the Department of Defense and with the interagency community, and led to the development of a series of "Defense Planning Guidance Illustrative Planning Scenarios" dealing with homeland security. CAA itself conducted a series of wargames and workshops in related critical missions for the Army, from terrorism response to antiterrorism / force protection and critical-infrastructure protection.[99]

Still, Army improvements amounted mainly to supporting the development of the new JSIMS family of joint games and also (see below) to working with civilian industry. The Army's element of the JSIMS toolbox was WARSIM 2000, a constructive model that could interface with virtual and live exercises. It would communicate with JSIMS and the other service/agency elements.[100] WARSIM 2000 was to replace most if not all of the Army's models depicting warfare above the battalion level, such as Corps Battle Simulation and Brigade/Battalion Battle Simulation. Like the other elements of JSIMS,

WARSIM 2000 was designed primarily for command-post exercises, as well as for exploring and rehearsing plans.[101]

There were also some in the Army who advocated a far less costly way of improving Army wargaming—using commercial games, either "as is" or modified. For example, Lt. Col. Michael Robel demonstrated how a commercial game could be used to explore the combat advantages and disadvantages of various battalion organizational configurations.[102] Others argued for such games in education and training.[103]

U.S. Navy

During the 1990s the Navy continued to use a spectrum of wargames. It worked to complete its element of the JSIMS tool kit; JSIMS Maritime was designed to communicate with JSIMS and other service/agency elements. It worked also on several other wargame engines. For example, the Navy was also developing the Battle Force Tactical Trainer as its element of the virtual battle space.[104]

In 1995, the Navy Modeling and Simulation Management Office (NAVMSMO) was established as the senior Navy wargaming activity. Located in Washington, DC, NAVMSMO was to provide leadership and guidance for Navy modeling, simulation, and wargaming, particularly in policy, strategy, investment, and procedures.[105]

Also in 1995 the Chief of Naval Operations changed the emphasis of his Strategic Studies Group from immediate problems toward the future operational and warfighting concepts generated by a given SSG in response to the CNO's annual theme. In 1998 the SSG decided it could do so more effectively if it switched from its previous three wargames a year to two.[106]

On the strategic level, the service used a series of program objective memorandum wargames to explore program/budget issues and the Navy RMA (revolution in military affairs) War Game Series to look further into the future.[107] The Navy's RMA series was interesting on many grounds: its unusual length, April 1995 through November 1996; the participation of DoD's Office of Net Assessment; and its structure with multiple panels that fed findings into the main game.[108]

The Navy continued its Global series, which did so much to help win the Cold War and prompted the adoption of Title 10 gaming by the other services. However, with our global conflict with the Soviet Union winding down, then ending (the Soviet Union ceased to exist in December 1991), Global's sponsors began looking for a new focus. What was effectively the first post–Cold War Global exercise occurred in 1990, days before the beginning of the Gulf War. The game reflected the strategic uncertainty of the time, postulating three different directions in which the world might evolve after the fall of communism. At the time there appeared to be some doubt about the utility

of wargaming in so uncertain an environment, but looking back well over twenty years later, its "guesses" appear amazingly prescient.[109] During the early-to-middle 1990s, Global typically explored the feasibility and effectiveness of U.S. power projection predominantly "from the sea," in scenarios similar to those the United States had experienced during those years, in places like the former Yugoslavia and Somalia.

Nevertheless, some believed Global had lost its way, that it was being "kept going to keep going." Many players (see chapter 3) were "FOBs"—friends of Bud (Hay)—while an increasing number were contractors, working to ensure that Global acknowledged the utility to national defense of their proposed products. But on 24 July 1998, Vice Adm. Arthur K. Cebrowski became President of the Naval War College, and for better and for worse, Global found a niche.[110]

Admiral Cebrowski had long been a proponent of "network-centric warfare."[111] Now, as President, he directed that Global explore the potential of this type of warfare and the practical requirements for implementing it. Admiral Cebrowski's influence was first felt in Global 1998, though there was only enough time to make modest adjustments to that game. Global 1999, however, marked a fundamental shift, from *hitting targets* to *achieving effects*.[112] Adjudicating such warfare is difficult for human umpires. Fortunately, after a decade of investment, the software and hardware were now in place to support this first truly network-centric Global.[113] Still, Global 99's designers also increased their emphasis on depicting human factors.[114]

Global 2000 explored ways to implement network-centric warfare. Held from 14 to 25 August at the Naval War College's then brand-new McCarty Little Hall (see below), Global 2000 attracted over six hundred participants, not counting War Gaming Department support staff. Set in 2010, it examined how increased data collection and sharing of information might affect the actual conduct of naval operations. Global 2000 also featured the first use of several new gaming devices, including the "Knowledge Wall," a large flat-panel display designed to summarize in one place all operational and logistical information a commander needed.[115]

Global 2001—which concluded just a month and a half before the 9/11 attacks—emphasized network-centric operations.[116] Played from 16 to 27 July 2001, primarily at the Naval War College, its 850 participants (not counting support staff) developed strategies that were assessed with the help of ten computerized adjudication engines. Appropriate to the network theme, some players participated from one of four "distributed" locations: the Pentagon, U.S. Space Command (in Colorado), and two Navy command ships (one in the Atlantic, one in the Pacific). Even more than in 2000, a variety of innovative information displays were evaluated.[117]

Perhaps the greatest benefit of this series of Global games was the opportunity to apply the newest information technologies in a simulated wartime environment. Supporters saw a "cultural shift" over the course of these wargames, as repeat players became more adept at using emerging technology. Some applied these new technologies and techniques when they returned to the fleet. The most extreme and famous such case was that after Global 2000 Rear Adm. Thomas E. Zelibor, commander of Carrier Group 3, directed that the Knowledge Wall be delivered to his flagship. The War Gaming Department was very proud when the Knowledge Wall was used by the naval command element of Operation Enduring Freedom—the liberation of Afghanistan.[118]

Still, Global continued to have critics. Some felt it had become too large; total participation in Global 2001 substantially exceeded a thousand. Others felt Global was being designed to demonstrate the correctness of a network-centric "ideology," not to seek answers. Finally, with more contractors participating than ever, there were those who felt it had become too focused on technology, that it was coming too close to being a sales opportunity that included a wargame.

In 1999, a new elective was offered at the Naval War College, the Mahan Group. It was based on the innovative premise that wargames and other techniques useful to real-world decision makers could also be effective for teaching. Largely owing to the top-secret classification of its work and reports, few would learn of the existence of the Mahan Group. In later years, however, other, less highly classified applications of its technique would become fairly well-known, especially within the U.S. Navy.[119]

Better known, though far less publicized than the Global, was the Navy's continued distributed gaming—perhaps the most valuable wargaming the Navy did during the 1990s. Now collectively called Battle Force In-Port Training, these games continued to let leaders—from those of task forces to those of individual ships' bridge teams—hone their operational skills while their ships were in port, alongside a pier.[120]

Also continued during the 1990s were the Navy's live wargames, made famous by the movie *Top Gun*. In 1996 the Navy's real Top Gun course, the Fighter Weapons School, was renamed the Navy Strike Fighter Tactics Instructor program, merging the original program with the Naval Strike course. The new course reported to the Navy's Air Warfare Center and was taught at (and above) Naval Air Station Fallon, Nevada. The new school retained live wargaming and expanded its curriculum to cover all aspects of air warfare (air-to-ground as well as air-to-air). It also began training controllers (the folks who sit in the back of E-2 Hawkeyes, for instance) and aviators from friendly nations.[121]

The Navy was also making increased use of COTS software for uses as diverse as education and sophisticated analysis. In the late 1990s, the Naval Academy issued the commercial wargame Fleet Command to its midshipmen.[122] An article in the prestigious U.S.

Naval Institute *Proceedings* encouraged still greater use, listing advantages and drawbacks and citing several examples of successful use.[123] These included the exceptional performance of a naval pilot candidate who had used a commercial flight simulator, the demonstrated training value of a commercial submarine simulation for the Naval Submarine School and operational submarines, and the use of a modified version of Fleet Command by the CNO SSG.[124]

Finally, as a fitting conclusion to a century of achievement, on 28 September 1999 the Naval War College dedicated its new nineteen-million-dollar wargaming facility.[125] Most appropriately, this latest attempt by the Navy to "push the envelope" is named for the selfless individual who started it all—William McCarty Little.[126]

U.S. Marine Corps

During the 1990s most of the original Marine Corps wargames were gradually overtaken by later innovations. For example, while as late as 1998–99 TacWar was still being used extensively at the II MEF Wargaming Center in Camp Lejeune, North Carolina, in 2000 not a copy of it could be found in the extensive Marine installations on Okinawa.[127] The 1990s also saw an increase in the organizational sophistication and mission impact of the Marines' wargaming and a continuation of their long tradition of innovation.

In 1990, the Marine Corps Institute initiated a course, Tactical Fundamentals. Mandatory for lieutenants, the course used wargaming to develop their ability to make tactical decisions quickly.[128] In the early 1990s, Lt. Gen. Charles Krulak (later general), then Commanding General, Marine Corps Combat Development Command, in Quantico, Virginia, initiated a series of initiatives and reorganizations to increase the effectiveness of Marine Corps wargaming and bring it more in line with that of the other services.[129] These initiatives included the following:

- Combining the Wargaming and Assessment Center's Modeling and Simulation with Marine Air-Ground Task Force Instruction Team. This gave the Marines the same level of computer wargame–based training that the other services already had.
- Activating the Marine Corps Modeling and Simulation Management Office (MCMSMO). This office would both develop the Corps's modeling-and-simulation policy and represent it in the Defense Department M&S arena. (As you will recall, DoD was spending a considerable amount of money on M&S during this period.)
- Finally, renaming the Marine Corps Wargaming and Assessment Center the Wargaming Division, with a new charter to support Headquarters Marine Corps (located primarily in the Pentagon), the Marine Corps Combat Development Center (at Quantico Marine Corps Base, Virginia), and all Marine expeditionary forces.

The move of responsibility for computer-wargame adjudication to other organizations accelerated an existing trend in the Wargaming Division toward human-adjudicated games that emphasized decision making. One of the first products of this new focus was a series of strategic-level, seminar-type games the Marine Corps Wargaming Division hosted in mid-1993 to explore U.S. options in the Bosnian crisis.[130]

One of the most successful results of this new approach was the Cultural Intelligence Seminar Series, which started in 1994. Responding to a field commander's questions about how the cultures of various peoples affect their warfare and decision making, the series focused on various hot spots, areas of potential employment, and sought to supplement planning for them by exploiting the insights of nonmilitary experts relative to social, economic, religious, and political realities "on the ground." Cultural Intelligence Seminars on Somalia and Haiti provided commanders valuable information. Years later, General Zinni said that the takeaways from the Somalia seminar allowed him to evacuate the United Nations contingent from Somalia with a minimum of casualties on all sides.

In 1992 the Marines initiated an annual wargame designed both to give defense contractors a firsthand, though virtual, experience of Marine combat operations and to expose the Marine Corps to emerging technologies that might be beneficial in combat.[131] In October 1995 General Krulak established the Commandant's Warfighting Laboratory (now the Marine Corps Warfighting Laboratory). The Wargaming Division was placed under the laboratory, first temporarily, then permanently, but it not only retained its original mission but assumed that of wargaming support for the "Lab's" innovation and experimentation program. General Krulak also encouraged wargaming by individual Marines. He published a letter basically mandating that all Marines were to read military history and theory as well as play wargames.[132]

Also mid-decade, the Marines initiated two short-lived Title 10 wargames, Urban Warrior and Joint Irregular Warrior.[133] Urban Warrior grew out of a Marine-centered series of games from the operational to tactical levels. After several years Urban Warrior stopped; it had run out of new territory to explore, and real-world urban combat experience was making it redundant. Joint Irregular Warrior was held on an off-and-on basis. The demand was not high, given, again, the real-world data coming in.

There were a number of important Wargaming Division initiatives in the late 1990s.[134] The Emerald Express program of small-wars conferences was inaugurated in 1999 to examine lessons learned and critical issues arising from Marine participation in such conflicts. These conferences focus on military, joint, interagency, nongovernmental-agency, and private-voluntary-organization operations and relationships in humanitarian

efforts, disaster relief, insurgencies, and peacekeeping operations. The Small Wars Center of Excellence at the Warfighting Laboratory was a direct result of Emerald Express.

The Wargaming Division continued its historical mission of innovative wargaming support to the Joint Non-Lethal Weapons Directorate with a variety of games and seminars, including the American/British Non-Lethal Weapons Urban Wargaming Program, in cooperation with the Ministry of Defence. Also, well before 9/11 the Biological Warfare Wargaming Program examined the problems associated with the nation's incident-response command structure and processes. It played an important role in the establishment of the Marine Corps's Chemical and Biological Incident Response Force.

During the late 1990s the Marines continued their strong interest in exploiting the force-development potential of commercial games. This commitment started at the highest level, with the Commandant of the Marine Corps, then General Krulak, who endorsed simulation technology in training as "innovative, challenging and fun" and specifically approved several commercial titles for use on Marine Corps computers.[135] The officer in charge of MCMSMO argued for commercial wargames in training in *Navy Times:* "Our junior Marines are computer literate—we are foolish if we don't capitalize on that skill and turn it into good training" by capitalizing on the fun factor.[136] The *Marine Corps Gazette* ran several favorable articles, including one that proposed specific games to parallel the Commandant's official reading list.[137] Outlets such as the Marine Corps Association bookstore began selling these and other titles.[138]

The Marines' most successful adaptation of a commercial wargame involved Doom, a popular "first-person shooter" game. For less than two hundred dollars the Marines produced a game that would have cost millions to develop from scratch. Exemplifying the proud Marine tradition of improvisation on a shoestring, Marine sergeant Dan Snyder simply wrote a small program, a "patch" so that players, instead of fighting monsters with science-fiction weapons, fought enemy combatants with weapons in the Marine inventory. Lt. Scott Barnett secured the copyright permissions necessary to allow any Marine (actually, anyone) anywhere to go to the Marine Corps website and download the patch. Within less than a year, more patches were downloaded than there were Marines.

It is easy to understand Marine Corps Doom's popularity. Easy to learn and fun to play, Marine Corps Doom provided valuable virtual training experience, some of which could be gained in no other way. Networked so a four-man fire team could train together, the game allowed Marines stuck on cramped amphibious assault vessels for months at a time to maintain some level of tactical proficiency. Better still, the Marines created virtual re-creations of the grounds and interiors of embassies considered highly likely sites for hostage-rescue operations. They could even practice shoot/no-shoot

decision making, by including synthetic embassy personnel in the game environment.[139] The Marines purchased the rights to distribute internally at least one other commercial computer wargame, TacOps, as well.[140]

Meanwhile, the Wargaming Division at Quantico, Virginia, continued to host a spectrum of games needed to develop decision makers and evaluate planning decisions, from the tactical level to the strategic. In 2000 the division assumed the responsibility for Marine Title 10 gaming.[141] This task included coordination of all Marine participation in joint and other-service Title 10 games, in addition to the resurrection of the Marines' own Title 10 gaming. The former began immediately, but the latter would be delayed by the events of 9/11.

U.S. Air Force

Despite a rough start, in the 1990s the Air Force Wargaming Center hit its stride. In February 1990 the Air Force terminated the AFWC's software contractor for failure to provide a fully functional product. Fallout was swift: substantial budget cuts to Phase II, cancellation of Phase III, and closure of the Program Management Office.[142] Yet in 1991 alone, AFWC developed or improved ten major adjudication programs and hosted forty-four computer-adjudicated games.[143] AFWC was also playing an increasingly important role in the curricula of all the schools of Air University. The next year was another important one for AFWC and Air Force wargaming. First, the Air Force Command Exercise System (ACES) series of computer-assisted games came on line. Set in a variety of theaters, the ACES series would be the mainstay of the service's wargaming for over a decade. Also, the Air Force Wargaming Institute (AFWI, and see below) hosted the second Air and Space Power Symposium.

After participating in the third Air and Space Power Symposium in 1994, the Air Force Chief of Staff, Gen. Ronald R. Fogleman, decided to bring the event more in line with the Title 10 wargames conducted by other services. When the Air Force held its first official Title 10 game two years later, the event would have a new name. Also, General Fogleman decided to rename AFWC the AFWI, in keeping with his policy of reserving "Center" for very large organizations.[144]

The 1990s also saw the activation of a second Air Force wargaming organization, the Air Force Agency for Modeling and Simulation (AFAMS), in June 1996, in Orlando, Florida. The location had been selected in the hope of achieving synergy with Army and Navy facilities that had been in the Orlando area for years, and also with the modeling and simulation department at the University of Central Florida. AFAMS was charged with both improving Air Force models, simulations, and wargames and providing support to warfighters as excellent as what AFWI was providing to educators. Aside from

fixing several long-standing deficiencies in existing wargame engines, AFAMS managed the Air Force's work in the Joint Simulation System programs and established an online Modeling and Simulation Resource Repository, to reduce the chance of duplication of effort.[145]

In the early 1990s the Air Force finally caught up with the Navy in that it began conducting distributed wargames. In 1990, an investment of $2.5 million allowed Blue Flag at Hurlburt Field, Florida, to conduct command-post-type wargames/exercises for Air Force units worldwide. Simply by not having to bring commanders and their staffs to Florida to participate in Blue Flags, the Air Force was able to save two million dollars a year. Perhaps even more importantly, cutting out the time needed to travel left more time to train.[146]

By the late 1990s, the Air Force was catching up with the Army as well, in the use of virtual battle space. Though Simnet, as we've seen, was the brainchild of an Air Force officer, most of the initial investments were made by the Army. By decade's end, however, the Air Force had completed the Theater Aerospace Command and Control Simulation Facility, a $27.5 million, 120-person structure that allowed more of the Air Force to join the fight in the virtual world. Now an F-15 pilot at Nellis AFB, Nevada, could fly "top cover" for an air-rescue helicopter piloted at Kirtland AFB, New Mexico, while a command-and-control (C2) node in Tampa, Florida, notified a friendly air-defense battery at Fort Hood, Texas. For the participants, in their individual simulators, all this would seem to be happening in the same space. The facility could also insert not-yet-fielded weapon systems, helping the military develop in advance the most effective tactics for their employment and helping Congress assess whether their potential positive impacts would be at least proportional to projected costs.[147]

During the 1990s the Air Force also worked to complete its element of the JSIMS tool kit. Called the National Air and Space (Warfare) Model (NASM), it was designed to communicate with the other JSIMS service/agency elements. NASM was meant to replace the Air Force's 1970s-era interim wargame engine Air Warfare Simulator. In addition to performing the missions expected of all models in the JSIMS family, NASM was to be able to execute a hundred times faster than real time, thereby opening up the possibility that it could be used to plan the entire air slice of joint theater campaigns as well.[148]

During the 1990s, of all the services, the Air Force seemed to be the most concerned about what it perceived as a growing divergence between how future wars would be fought and how they would be gamed. In 1993, the commandant of the Air Command and Staff College, Colonel Warden (who had been the first architect of the Desert Storm

joint campaign), had a great deal to say about shortcomings in wargames—essentially, that they did not depict enemies as systems.

As one response to these concerns, in July 1993, the entire Air Force senior leadership gathered for the first four-star Modeling and Simulation summit.[149] As a result of the summit, the Air Staff created a new directorate, HQ USAF/XOM, led by Brig. Gen. Thomas R. Case. In January 1995, the directorate produced a pamphlet, *New Vector for Air Force Simulation,* which was endorsed by a second four-star summit in June of that year.[150] But concerns about wargaming continued. For instance, in the mid-1990s, as a reservist assigned to the Air Staff's Checkmate division, I listened to a briefing by the Air Force Director of Operations in which he outlined problems he saw in wargaming. Even the Chief of Staff of the Air Force succinctly declared, in a 1996 speech, "Legacy models are woefully inadequate."[151] In 1997, General Fogleman wrote to the chairman of the Joint Chiefs,

> These legacy models are most reliable when considering linear battle space, the forward edge of the battle area (FEBA) and an employment strategy of attrition and annihilation.[152] Models assessing force on force engagements based upon force ratios and territory lost or gained lack the capability to fully and accurately portray the significant effects of operations involving nonlinear battle spaces or an asymmetric strategy directly attacking the enemy's strategic and tactical centers of gravity.[153]

Also in 1997, Lt. Col. Steve McNamara, an Air Staff member and School of Advanced Airpower Studies graduate, described in an article fallacies in how the then-dominant Army and joint theater wargame software, TACWAR, depicted airpower. His conclusion: Quadrennial Defense Reviews and the operations (war) plans of what are now "combatant commanders" were being distorted by TACWAR's undervaluing of airpower.[154] Maj. Gen. (as he was then) David Deptula believed he knew the way to improve Air Force wargaming—adjudicate not only attrition but also the full spectrum of physical human-network effects.[155]

Air University too worked to improve wargaming. In 1993 it began hosting an annual series of conferences, called Connections.[156] Originally the initiative of Colonel Warden, the conference was later championed by the commander of Air University, Lt. Gen. Joseph Redden. The goal of the conference was to "push the envelope" of wargaming. The strategy was to "connect" developers from different disciplines, services, and countries so they could learn from each other.[157] The conference immediately attracted leaders from the military and commercial wings of the wargaming field.[158] Over the decade, the conference evolved, but the emphasis on advancing the art and science of designing and developing games stayed constant.[159] In 1994 Air University also expanded its participation in multiservice wargaming. In that year its School of Advanced Airpower Studies began conducting the Theater Campaign Warfare game, in collaboration with other services' "advanced" schools.[160]

The mid-1990s were also when the Air Force began conducting Title 10 games, which, as we've seen, General Fogleman decided late in 1994 to revive. In 1995 he said, "We must put together our own Title 10 game to highlight modern air and space power to the joint warfighting community." While these games were to showcase airpower, General Fogleman wanted them conducted on a "level playing field." That is, he did not want the wargames' designers to fix outcomes in favor of airpower. Similarly, he recruited participants from the combatant commands, "to ensure Air Force Title 10 wargames were truly purple [i.e., joint]." General Fogleman envisioned games in both the middle (ten to twelve years in the future) and far (twenty to twenty-four years) terms. General Fogleman required a midrange game as he believed the Air Force had a relatively good idea of the threats at that distance into the future. However, as ten to twelve years is actually too short a time to create entirely new weapon systems, the midterm wargame would be limited to exploring options for the employment of what was "in the pipeline." To explore new weapon-system concepts he initiated a far-term game. Twenty to twenty-four years, he believed, was far enough in the future to field new systems yet close enough to the present to project fairly reasonable threats.

The midterm wargames were initiated first. Strategic Force 96, conducted at AFWI, demonstrated that even with the weapons and systems projected to be available to the Air Force in 2010, a resourceful enemy could minimize the impact of air attack and prolong a war.[161] Global Engagement 97, also played at AFWI, started with a pregame event to establish the strategic guidance that would shape the theater campaigns depicted in the main exercise. Nearly three hundred individuals participated in the core exercise, including three retired four-stars, one each from the Army, Air Force, and Navy. Each played a theater commander in one of the three parallel exercises. Space played the biggest part to date in any Air Force wargame, and the role of information operations was also increased.[162]

In 1997 General Fogleman directed the establishment of a second Title 10 game—the Aerospace Future Capabilities Wargame (usually referred to as the Futures Game, or simply FG)—to understand better what force structure the Air Force as a whole should possess twenty to twenty-four years into the future. It has also become a vehicle to thrust uncomfortable issues onto the agendas of senior Air Force leaders, who have designed and used the FG series in various ways. The games generate final reports, usually along with a Chief of Staff tasking memo for follow-on work to explore initial insights of the game in a more focused, rigorous manner or to take specific actions.

The goal of the first FG, held in June 1998 with 250 participants, was to examine future options for either penetrating an enemy's defenses or standing off. It did so by exploring the relative effectiveness of three force structures, the one the Air Force was planning to

acquire and two different technology-enabled forces.[163] Set in the Far East in 2018, this first FG now appears remarkably prescient, in that it was the first wargame to alert the Air Force to the possible future effectiveness of an adversary antiaccess strategy.[164] The Air Force would go on to conduct FGs in 1998, 1999, 2001, 2004, 2005, 2007, 2009, 2011, 2013, and 2015—almost two decades. The FGs have typically featured participation by the air forces of the United Kingdom, Canada, and Australia, as well as other U.S. services.

All FGs except those held in 2004, 2005, and 2007 followed the basic format of comparing the service's actual planned future force structure (usually dubbed "Blue 1," or the "baseline" force) against an alternative structure ("Blue 2," or the "alternative force"). The structures were designed under the same fiscal constraints and addressed specific challenges against the same adversaries in the same scenarios (closely based on actual DoD planning scenarios, after the first few FGs). In other words, most FGs were really two games in one: the baseline force versus Red and the alternative force versus an identical Red. The Air Force observed particularly whether the alternative force performed more effectively than the baseline force and whether the "trade space" given up to "pay" for additional or enhanced capabilities created any noteworthy risks. In most cases, the FG effort involved about eighteen months of preparation for the "Capstone," or the game itself, comprising workshops and planning conferences to flesh out each game objective, force structures, concept of operation, etc., in advance. In addition, for six months following a Capstone the Air Force usually conducted postgame analysis workshops to scrutinize the results further and refine insights and observations.[165]

Global Engagement 98, again held at Maxwell, had several objectives: to explore the effectiveness of the Expeditionary Aerospace Force during the "halt" and "win" phases of a no-plan scenario (that is, a conflict we were not expecting) and to look at "focused logistics," "agile combat support," and airlift in a stressful scenario. Finally, the exercise was to facilitate examining concepts from *Joint Vision 2010* and from the information operations and space communities. Again, three panels were formed, each headed by a retired four-star from a different service, all contending in and against a common scenario and Red strategy.[166]

Global Engagement IV, in 1999, brought together 360 participants from all services and the eleven unified commands.[167] The scenarios, two major theater conflicts and four humanitarian operations (all simultaneous), severely stressed the Air Force's lift and logistics capabilities. The first-time participation of British, Canadian, and Australian coalition partners added an additional dimension to the decision making and also brought some excellent capabilities to the force mix.[168]

Futures Game 99 was held at the Bolger Executive Leadership Center in Potomac, Maryland, in June 1999 and was set in the Far East. This time the goal was to explore various command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) alternatives to enable "stand-off" (i.e., from a defended coast). To achieve this, FG99 fought two cost-neutral (equally expensive) force structures—the one the Air Force was planning to buy by 2020, and a force with C4ISR systems that enabled stand-off warfare—against a common Red. FG99 appears to have influenced a later Air Force decision to increase funding for C4ISR and add "Global Vigilance" to the Air Force vision—thus, "Global Vigilance, Global Reach, Global Power."[169]

Global Engagement V was conducted in June 2000 in the Washington, DC, area and explored ways in which changes in force structure and employment concept could defeat a "near-peer" competitor's antiaccess strategy.[170] The scenario, set in 2015, envisioned an enemy using stand-off weapons, ballistic missiles, and cruise missiles to contest U.S. basing in the theater. Global Engagement V looked at concepts that could help defeat such a strategy quickly, such as time-critical targeting, theater air and missile defense, aerospace operations dislocation, forward support, and dispersal basing.[171]

In addition to its "global" wargames, which embraced the Air Force's overall capabilities, the service conducted a number of games for specific areas of interest. The Air Force Research Laboratory (AFRL) conducted games that (not surprisingly) focused specifically on technology choices, far enough in the future to guide basic-research investment. The first Technology Seminar Game (TSG) was a spin-off from Futures Game 99. The general officer in charge of FG99, Maj. Gen. Norton Schwartz (later a full general and Air Force Chief of Staff), briefed the game results to the AFRL Corporate Board and asked that the research laboratory run a TSG. One reason for the request was that some had questioned the ability of the Air Force actually to field some of the future systems played in FG99 by the year of its scenario (the game's "epoch year"), while some asserted that other future systems were overly conservative—that is, postulating less capability than could be fielded by then. General Schwartz asked AFRL to come up with more-ambitious ideas but also to ensure all could be achieved by the epoch year of the next Futures Game. The first TSG was held in 2000 and was called, oddly enough, TSG 2000.[172]

Also in 2000, on 6 October at the Joint National Test Facility, at Schriever AFB, Colorado, the Air Force conducted Phase II of the Joint Theater Air and Missile Defense Organization's Joint Theater Ballistic Missile Defense Wargame. One of its interesting objectives was to test improved command-and-control interfaces, the need for which was identified in the first phase of the game.[173]

On 22 January 2001, the Space Warfare Center, also at Schriever, began the first "Title X–like" wargame designed specifically to examine the military utility of emerging space systems and how projected Red forces could degrade them. Called Schriever 2001, this four-day exercise, set in 2017, brought together 250 experts from around the nation. The full report remains classified, but our dependence on commercial space systems and the vulnerability of even military space systems to often "asymmetric" Red attacks were acknowledged publicly.[174]

Later that year, Futures Game 2001 was held, near Washington, DC. The goal was to explore the effectiveness of two force structures (again programmed and alternative) in relationship to the (then) recently published *Joint Vision 2020*. This time the scenario depicted conflict in Southeast Asia. This FG triggered a dozen studies and several workshops and recommended changes to doctrine.

Nevertheless, and despite a decade of heavy investment and significant innovation, all was not perfect in air wargaming. For example, in the spring of 1999 America again sent its people into harm's way, this time in the skies over Kosovo. Tactical games and simulations—from virtual experience at Red Flag to analytical games that examined individual missions—again gave the United States an important edge. However, the American weakness in campaign-level/campaign-duration wargaming was made evident by the difficulty of adjudicating the types of human effects and system impacts that were the main focus of NATO's air campaign. In 2001 the commander of the College of Aerospace Doctrine, Research and Education (CADRE) at Air University, Col. Bobby J. Wilkes (later a brigadier general), advocated the creation of a Red Flag–like exercise at the operational level of war.[175] Among his arguments was that periodic wargaming would allow air strategists to develop more-effective plans faster. The need for such quick thinking would be demonstrated sooner than most expected.

U.S. Civilian

The nineties were full of surprises for commercial gaming.[176] Sales of print wargames continued to decline, falling to two hundred thousand units a year by mid-decade. The industry then stabilized, as desktop publishing allowed lower sales per title to be still profitable.[177] At the same time, the recreational software industry had exploded ($25 billion in global sales in 1997).[178] However, wargaming's share of those sales fell from 25 percent (when PCs were new) to about 10 percent in 2000.[179] (Still, 10 percent of $25 billion . . .) This loss of market share prompted changes in the way commercial wargames were developed and marketed.

In the early 1990s, most big recreational software publishers included a few serious wargames in their product lines, and several midsize companies (such as SSI, Talon Soft,

and Australia's Strategic Studies Group) focused entirely or primarily on wargames. As higher production standards, principally graphics, drove up the cost of mainstream titles, the big companies dropped all or most of their more modestly selling wargames, and medium-sized game publishers found it harder and harder to get on store shelves. By decade's end new publishers had emerged, such as Matrix and HPS, who had found they could thrive in the now "niche" wargame market by keeping overhead low and selling via the Internet and catalogs. Like the print wargame designers of the same period, computer-game designers like Koger, Grigsby, and Tiller found that producing more titles was the key to success.[180]

Also in the 1990s, increasingly powerful computers enabled the early flight-simulation programs to evolve into acceptable combat flight simulators. Some of these could be networked to create a virtual battle space for civilians at roughly the same time that the military was creating its own.[181] (Guess which cost less per user!) The rapid expansion of the recreational software industry led some to predict that future advances in simulation technology would come from the commercial side—not the military.[182] Most surprisingly, miniatures wargaming actually grew during this period, its proponents calling its painted figures the ultimate "high-resolution graphics."[183] Commercial wargaming also became global, many American titles selling well overseas and several foreign titles selling well in the United States.[184]

U.S. Civil/Military

Not surprisingly, in the 1990s, the U.S. defense establishment began to take an increasing interest in, and notice of, the commercial wargame industry. As early as 1992, a Defense Science Board study stated, "The development of simulation technology is far ahead of the military application of this technology"; it recommended, "DOD investment should leverage off commercial and entertainment developments of technology."[185] That recommendation was acted on in 1999, when the Defense Modeling and Simulation Office initiated collaboration with Paramount and the Army provided forty-five million dollars to the University of Southern California to establish an Institute for Creative Technologies.[186]

In the 1990s, Mark Herman continued to bridge the gap between defense and commercial wargaming. The lead designer of Booz Allen Hamilton's next-generation wargame Entropy Based Warfare (EBW), Mark picked the commercial computer-wargame-development house Breakaway Games to do the programming, saving millions of dollars and months of time and winding up with a more user-friendly user interface to boot. A campaign model, EBW has been used in several hundred defense wargames covering a wide range of war plans, future doctrine, advanced weapon systems, and the like. The best known was the Army's Title 10 futures game series (whose name, Army

After Next, has morphed over time). According to the Joint Staff, EBW is the only model that accurately represents information systems, information operations, C4ISR, and situation awareness, along with their respective impacts on conflict. During the late 1990s EBW was used in a variety of classified war plans and planning exercises.[187]

In the middle 1990s, Jim Dunnigan set up a website (strategypage.com) and LISTSERV (milgames@yahoogroups.com) dedicated to military wargame professionals and everyone who is serious about wargaming.[188] The site has helped create a sense of community and cross-service assistance among individuals of different services who often had not even known that their counterparts existed. One of the first topics to come up there was the "politics of wargaming" (senior leaders "deciding" the outcome first, then having a wargame prove it). Previously, it seemed, most who had encountered this problem assumed that it never happened elsewhere. Some, irrationally, had blamed themselves. The politics of wargaming is still with us, but at least now it is openly acknowledged as an obstacle and so can be more readily confronted.[189]

In the late 1990s each service academy began using commercial wargames too.[190] The Military Sciences Department at West Point used Steel Beasts by Shrapnel Games to teach the principles of war. At Annapolis, third-year students were issued Fleet Command by Electronic Arts as part of the curriculum on naval tactics and strategy. The Air Force Academy used an internally developed game but was testing several commercial games, including a variant of StarCraft by Blizzard Entertainment.[191]

Wargaming around the World, 1991–2001

With the collapse of the Soviet Union came an eclipse of the study of Soviet methods of warfare by international students. However, as in the years after the German wars of unification, after the First Gulf War international militaries studied the military of the victor, and as in the 1880s one of the things they studied was the victor's use of wargaming.[192]

Military. The Gulf War's demonstration of the value of wargaming seems to have accelerated a trend among friends and potential foes. The growth of U.S.-sponsored international wargames may have contributed. For example, during the 1990s the U.S. Army's Center for Army Analysis explored coalition operations in numerous studies and games. The games examined diverse functional areas in binational and multinational environments. Among the partners were the Republic of Korea, the United Kingdom, Germany, NATO, and the American, British, Canadian, Australian and New Zealand Armies Program (ABCA). CAA supported political-military games and workshops with the Republic of Korea, the U.S. Eighth Army, U.S. Forces Korea, and the Combined Forces Command from 1991 through 2003 on the most pressing Korean Peninsula security issues, ranging from arms control to North Korean nuclear ambitions. From 1996 to 1999,

CAA conducted a series of workshops and games examining operational and medical issues arising in NATO operations in nuclear, biological, and chemical environments.[193]

U.S. Wargame Exports. By mid-decade Canada, France, Germany, and the United Kingdom were using the American ground-combat wargame Janus.[194] Within the United Kingdom, UK Janus was used primarily by its Defence Science and Technology Laboratory and education facilities. For applications for which other armies used Janus, the British army employed a heavily modified U.S. system, ARTBASS (Army Reserve Training BAttlefield Simulation System). Called by the British ABACUS (Advanced BAttlefield CompUter Simulation system), it was run by Hughes, and later Raytheon.[195]

The United States also exported wargaming through international participation in live American games. For example, in 1997, German, Canadian, and Dutch forces participated in a live wargame called Roving Sands. This twenty-five-million-dollar exercise, which took place around the Texas–New Mexico border, was designed to practice the C2 for and execution of integrated joint and combined air and missile defense. The allies provided 2,500 of the twenty thousand participants.[196]

In other cases U.S. wargames grew to become international. Even before the 1990s the U.S. Seventh Air Force in Korea was conducting wargames. By the early 1990s its wargames had grown so large that the local base community center had to be taken over before and during each of the several wargames each year. In 1993 the Seventh Air Force formally requested funds for a dedicated wargaming facility. That facility, the Korean Air Simulation Center, opened in 1998. With the additional capacity came increased joint (other U.S. services) and combined (other nations, specifically Korean) participation.[197]

NATO. Greater use of computer wargames by our NATO allies seems to have been initially triggered by the opening of the Warrior Preparation Center in Germany. As part of the NATO CAX (computer-assisted exercise) project that began in 1991, a multinational working group was established to create standards that would allow various national and service models to exchange information, thus enabling more-comprehensive adjudication of conflicts than possible using isolated models. The group's strategy was to develop a protocol for a common interface program, much as the Internet allows computers from different manufacturers to talk to each other.[198] The British, French, and Germans also developed wargaming capabilities independently.

The fall of 1999 witnessed several significant milestones in the internationalization of U.S.-style wargaming. In November 1996, NATO's Conference of National Armament Directors established a temporary steering group on alliance wargaming. Its goal was to improve NATO performance across the full spectrum of wargaming, cost-effectively. The steering group produced a Modelling and Simulation Master Plan, approved by the

North Atlantic Council in December 1998. In accordance with the plan, two permanent organizations were created. The first, the NATO Modelling and Simulation Group (NMSG), was established in 1999; it consists of a chairman, vice-chairman, secretary, and representatives from each NATO nation. The NMSG meets on an as-needed basis. The second, the full-time Modelling and Simulation Coordination Office, opened in the fall of 1999, in Paris.[199] Also in October of 1999, an "International Modeling and Simulation Week" was held in the Tidewater region of Virginia. Well attended by NATO members (as a distributed flyer asserted), the conference demonstrated that wargaming had indeed become increasingly international.

The United Kingdom. The United Kingdom was probably the fastest nation outside the United States to upgrade its wargaming capabilities. Recalling the utility of the Scientific Support in Crisis and War team deployed forward during the Gulf War, it began permanently assigning similar teams to all its "two-star" headquarters.[200] As computer advances provided ever more power for less money, Cold War–era software continued to be upgraded.[201] The United Kingdom also enhanced the wargames at its staff college, developing a set of diverse games and applying various types to the segments of the curriculum where they were most effective. British staff college games soon covered topics from leading peacekeeping forces to developing force structures under budgetary and other constraints.[202]

Still, as the decade progressed, many in the British defense wargaming community realized that the security situation was evolving away from its current modes of gaming. Its models were slow to prepare and execute—not a problem against the lumbering Soviets, but the emerging adversaries were much more nimble. For example, it took months to create a new weapon with its software. That had been fine when the Soviets took a decade to field, gradually, new systems. But in 1996 a Chechen commander captured six SS-21 missiles and overnight turned them into improvised explosive devices—IEDs, which were to be the main sources of casualties in Iraq. A real weapon had just been created far faster than its representation could be generated in the United Kingdom's software. The AI routines the United Kingdom used to play Red were programmed to follow Soviet doctrine, not the patterns of fighting demonstrated by new threats. Worst, its wargames assumed fights between Red and Blue, but now fights were increasingly among Red, Blue, Green, Lavender, and Plaid.[203]

These realizations contributed to the decision by the United Kingdom to cease operation of the Divisional Wargame in 1997. Though considered, with some justice, a technological marvel when it began operations in 1975, it no longer fit the defense environment. The end of the Cold War had allowed old regional grievances to reemerge, leading to conflicts that broke out with little warning. Inputting a new scenario in DWG

still took three or four months. At a time when the British people were looking for a peace dividend, DWG took over a million pounds a year to run, and that did not include the twenty to thirty military personnel and ten or twelve technical personnel needed to execute each wargame. Something much more flexible was needed.[204] That same year (1997), work began on the next generation of British analytical gaming—the Wargame Infrastructure and Simulation Environment.[205]

France. The French developed Carneade, an air- and land-combat game intended for plan development and training from the regimental level up.[206]

Germany. The most impressive advancements were made by the Germans. Germany upgraded every part of its war college's wargaming curriculum during the 1990s. In 1993, the college's army department added a second game to its tool kit. It had been using KORA/OA since the 1970s for units of corps size and smaller. Now it adopted a second graphical-interface wargame, SimoF (Simulation Model for Operational Command and Control Exercises). SimoF focuses on operations at the corps level and higher and depicts airpower more comprehensively than the earlier model. Both were produced by IABG, a German company. In addition, in 1993 the college's naval department converted from a manual wargame to the computerized game ITEM (Integrated Theater Engagement Model). ITEM, developed by the NATO Consultation, Command and Control Agency, simulated engagements up to task force size and very short campaigns by naval task forces. Finally, in 1997, the college's Luftwaffe department adopted a new model with vastly improved ability to simulate air campaigns: ALICE (Air Land Interaction Combat Evaluation), from IABG.[207]

The culmination of this decade of progress came in early 2000, when Germany dedicated a thirty-million-dollar (U.S.) Training and Exercise Center at its war college / command and staff college—the Bundeswehr's Führungsakademie. The largest military construction project in western Germany since reunification, the center is large enough to accommodate all five hundred of the college's German students and a hundred "international" students, including two Americans. It features over two hundred networked computers, newly developed adjudication software, and a multimedia-capable auditorium. The center can also accommodate exercises by international (NATO) and national (German) headquarters.[208] It runs upgraded versions of existing service software, linked together when needed, using JOANA (Joint Operations Army–Navy–Air Force) software, which also links with ADAMS, a strategic-mobility estimating routine. The center's sixteen-member staff conducts most exercises, though it is augmented by up to sixty war-college faculty members for the largest events.[209]

Australia. Throughout the 1990s, Australia improved and expanded its wargaming. In 1990 the Australian Defence Force Warfare Centre (ADFWC) was established by bringing together several joint schools, some dating from as long ago as 1946. Located on Royal Australian Air Force Base Williamtown in New South Wales, its mission was (and is) joint/combined education and training for Australian forces, as well as doctrinal development. While the ADFWC used constructive wargames from the start, over time it diversified into live games as well.[210]

In 1990 Australia acquired the U.S. Army's Janus wargame-support software through the ABCA relationship. Copies were installed at both the AWGC in Sydney and at the Defence Science and Technology Organisation facility in Adelaide. Within six months AWGC had used it to support an analytical wargame exploring the relative effectiveness of four different sets of surveillance equipment to defend air bases against unconventional attack.[211] For almost twenty years Australia would improve and adapt its version of Janus, called Janus(AS). During 1991 and through 1992, Australian wargamers focused on exploring the military utility of various mixes of wheeled and tracked vehicles given a range of threats and weather conditions.[212]

In 1993 AWGC was redesignated the Army Battle Simulation Group (ABSG).[213] The newly redesignated organization's first major effort was to explore, using both Janus(AS) and ComBatSim, options for Australian army employment of unmanned aerial vehicles. Janus(AS) continued to be used for analytical wargaming, helping to explore options for infantry-portable weapons in 1994 and for vehicle-mounted weapons in 1996. Janus(AS)'s functions also expanded to include education and training. It was installed at the Officers Advanced Course of each combat arm, starting with armor in 1993 and concluding with artillery in 1996. Also in 1993, a two-day all-combat-arms wargame was held at the armor school. In 1995 the game became the core of an all-arms course. Between 1994 and 1996 Janus(AS) was used at both the Army Command and Staff College and Land Warfare Center.

Meanwhile, the applications of ComBatSim were also expanding, to support unit CPXs. Starting as early as 1990 Australian and later New Zealand army battalions increasingly used ComBatSim to determine outcomes of their annual CPXs. Active-duty battalions would conduct their CPXs at home station; reserve units would travel to the ABSG.

The Australian military continued to look overseas for suitable wargames. The year 1993 saw the Australian military's first known, widespread trial of a commercial game. After very favorable reports from New Zealand's simulation center, the commercial computer wargame Operation Flashpoint was used by several elements of the Australian defense forces. Feedback varied by unit and application, but several licenses were purchased, and official use continued for several years. Also in 1993, Australia conducted a

trial of the U.S. military wargame software TACOPS, with a similar, though somewhat less positive, outcome.[214]

In 1995 Australia upgraded its ComBatSim software so that it could game a force of brigade-plus size. This made ComBatSim able to support multinational procedural training wargames. For example, it was used for Australian, Singaporean, and Malaysian participants in Kangaroo 95.

In 1997 Australia once again changed the name of its army's wargame organization, this time to the Army Simulation Wing (ASW). Also in 1997 the ADFWC expanded its use of wargaming to include live maneuvers.[215] In 1999 ASW moved from Sydney to Puckapunyal, in the state of Victoria.[216] At the same time, it was resubordinated to the Land Warfare Development Centre. As the decade closed, Australia began opening simulation centers at three of its army bases: Darwin, Brisbane, and Townsville. These new centers expected to use Janus(AS) for just a few years—but that is a story for the next decade.

China. Though information is fragmentary, it appears certain that China accelerated the improvement of its wargaming during the 1990s. Just as poor U.S. air-combat performance over Vietnam led to the Red Baron study, which prompted Top Gun, Red Flag, and the other improvements in live wargaming, so China's alarm at the effectiveness of U.S. forces in the Gulf War led it to study the American military and in turn create equivalent wargaming capabilities.[217] Chinese acquisition of U.S. methods and technology actually slowed with the cooling of relations after the Tiananmen Square massacre but was not reversed. The United States classified its military's games as "munitions," so that they could not be purchased by China, but China simply purchased wargames published for the consumer market. Ironically, the latter had user interfaces far superior to those of the military games China was not permitted to buy.[218] Also, in the mid-1990s Chinese defense researchers made a several-week-long visit to the United States, and among their stops was the new wargame center at the Institute for Defense Analyses (IDA). Very impressed, they vowed to build a similar center. By 1999 they had.[219]

It appears the first sector of the Chinese defense establishment to embrace computer-assisted wargaming was professional military education. By the 1990s China's PME system had largely recovered from the Mao era. New games were introduced within PME, such as Joint 99 and the Red Star System, but gaming does not appear to have extended beyond the classroom. It was reported that "leaders don't trust it, officers aren't familiar with it, and units don't wish to use it."[220] One reason seems to have been the fragmented nature of China's wargaming effort. Each major military school and each military region headquarters had its own gaming center.[221] Early attempts to develop computer

games domestically were disappointing: military people did not understand computers, and computer programmers did not understand the military.

In 1997 one man started to change all that. In that year the Central Military Committee ordered Hu Xiaofeng (later a major general) transferred from the National University of Defense Technology to the National Defense University, to take charge of China's computer-assisted wargaming. Hu was well qualified, having both impressive military and technical/scientific credentials.[222] By 1999 Hu had consolidated various game-development efforts into one organization, one system, with himself as lead designer.[223]

Sweden. Even neutral Sweden was initiating wargaming programs. In 1994, the Swedish Defense Wargaming Center became operational. Reporting directly to Sweden's Joint Forces Command, the center's fifteen military and civilian personnel support the Joint Forces Command's exercise program as well as development of improved wargaming and planning technology.[224]

International Trends in Wargaming

The 1990s saw Europe investing heavily in networked simulators, creating virtual battle spaces. The United Kingdom led the way, beginning a virtual-battle-space facility in 1991. It awarded the final $450 million phase of the project in 1996. In 1996 the German army took delivery of a similar facility. In 1997 the German navy opened a state-of-the-art simulator for training surface-warfare officers, submariners, and pilots. Located at Bremerhaven, this facility replaced an earlier training center at Wilhelmshaven that had used off-the-shelf U.S. simulators. This new facility can also conduct single-platform and small task-group wargames.[225] It was reported in 1996 that Belgium, France, the Netherlands, and Norway were planning to buy similar facilities in 1998.[226] This interest extended beyond NATO when Sweden purchased such a system for its Gripen multirole combat aircraft.[227]

The 1990s also saw the emergence of multinational live "peace games." For example, MARCOT 97 brought together maritime forces of the United States, the United Kingdom, Canada, Australia, and Chile to work out procedures for humanitarian operations.[228] In some ways even more remarkable, the RUKUS 94 "peace game" brought together the United States, the United Kingdom, and Russia just three years after the dissolution of the Soviet Union. Held at the U.S. Naval War College, the exercise helped develop an understanding of how the former adversaries could most effectively work together in peacekeeping and security operations.[229]

The 1990s saw a proliferation of non-American print and computer wargame publishers and development houses. First, the Japanese expanded from their strong base in arcade

and arcade-like console video games into more-sophisticated computer wargames. Then French publishers captured a significant slice of the global market share.[230] By the end of the decade what had been, with the exception of a few excellent but small Australian and Canadian publishers, an American industry had become truly global. Even American publishers were turning increasingly to development houses in places like Russia and the Czech Republic. With the increase in personal computers globally, more and more of the customers were overseas also.[231] In the United Kingdom, Paddy Griffith continued to advocate wargaming and demonstrate its value. In 1997 he helped develop and execute a TV series called *Game of War.* In each episode retired generals, historians, and defense experts refought a historical battle.[232]

Notes

1. It would be difficult if not impossible to establish exact numbers for total spending on commercial wargaming during the 1990s. Sales of print games plummeted; while the sales of recreational software exploded, wargaming's share of that market declined. Still, industry watchers such as Mr. Evan Brooks, recreational-software reviewer and columnist, estimate that total spending on commercial wargames rose throughout the 1990s. Mr. Brooks spoke at the Connections wargaming conferences held at Montgomery AFB, Alabama, from 1995 through 1999.
2. Combatant commanders must develop plans called for by the Joint Strategic Capabilities Plan, but they may generate additional plans at their discretion.
3. Internal Look 90 took place at Fort Bragg, North Carolina, and at Hurlburt and Duke Fields, Florida, from 9 July through 4 August. *Global Security,* 30 October 2017, www.globalsecurity.org.
4. Richard M. Swain, *"Lucky War": Third Army in Desert Storm* (Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 1994), pp. 7–8.
5. The final report was still classified at the time of writing, but William "Bill" Glenney IV, then deputy director of the CNO Strategic Studies Group, prepared an unclassified summary, from which the following account is slightly condensed.
6. The full title of the wargame was Strategic Studies Group IX Wargame III Regional War Game.
7. Dunnigan and Macedonia, *Getting It Right,* p. 67.
8. Richardson, "War Games in Cyberspace," p. 62, states that the JTLS was also used in planning for the First Gulf War.
9. Edgar Vandriver, Center for Army Analysis, e-mail, 11 May 2015. The e-mail chain included inputs from several colleagues at CAA.
10. CORDA is a part of BAE Systems.
11. See I. M. Mitchell, "The Development of Scenarios to Support Software for Operation Granby" (paper, Eighth Symposium of the International Symposium on Military Research, 15 August 1991), annex C.
12. This wargame most likely took place in Riyadh. On one hand, Col. Richard T. Reynolds, USAF (Ret.), *Heart of the Storm: The Genesis of the Air Campaign against Iraq* (Maxwell Air Force Base, AL: Air Univ. Press, 1995), p. 48, says it was held at the Air Force Wargaming Center. Colonel Reynolds later confirmed to me and elaborated on this assertion, and this is how I described the incident in my 2000 *Aerospace Power Journal* article. However, after my article's publication Mr. Ken Lavoie, then the technical director of AFWC, was kind enough to e-mail me that AFWC did not wargame the Instant Thunder plan, that in 1990 the center's theater-adjudication software did not depict most of the plan's target sets (or Southwest Asia either). However, he told me,

Col. Gary R. Ware, General Schwarzkopf's chief analyst, did extensively wargame the plan. Colonel Ware had previously been director of AFWC (the center's second); Colonel Reynolds, hearing Ware had tested the plan, may have assumed he had done so while still at AFWC. I regret my earlier apparent error.

13. According to *Air Force Modeling and Simulation Resource Repository,* afmsrr.afams.af.mil/, EADSIM models joint- and combined-force air and missile warfare. It supports analysis, operations, exercises, and training. In-theater air planning was initially, quite properly, absorbed by finding "bed-down" locations for arriving units and building a plan to counter an Iraqi attack that planners believed, not without reason, could come tomorrow. See Reynolds, *Heart of the Storm*.
14. Frederic Case, Christopher Hines, and Steven Satchwell, "Analysis of Air Operations during Desert Shield and Desert Storm," in *Warfare Modeling,* ed. Jerome Bracken, Moshe Kress, and Richard Rosenthal (Arlington, VA: Military Operations Research Society, 1995).
15. Richardson, "War Games in Cyberspace," p. 60. The primary software used was TACWAR, developed by the defense contractor IDA in the 1970s.
16. Col. Gary Ware, briefing to the College of Aerospace Doctrine, Research and Education, shortly after the war.
17. My thanks to Joseph Saur for this insight, in his comments on the second draft of this manuscript.
18. It was called the "Black Hole" because information, people, and coffee were seen to go in but not come out.
19. Based on several e-mails during March 2015 from Dr. Paul R. Syms, Defence Science and Technology Laboratory Land Battlespace Systems (Dstl LBSD), and several other individuals who participated in this wargame.
20. The developer was Keith Jennings. Alasdair "Fred" Hood, e-mail, 24 March 2015.
21. Paul Syms, several e-mails, March 2015.
22. Pearce, briefing to Connections UK 2014.
23. The British used a specially modified version of the American ground-combat wargame Janus. Richardson, "War Games in Cyberspace," p. 62.
24. Actually, the team updated the database three times. When its members thought they were done, they realized they needed to include Marine Corps supporting systems, such as the AH-1W and AV-8B, as well as the *Iowa*-class battleship. Hood, e-mail.
25. Syms, e-mails, March 2015.
26. Hood, e-mail.
27. Information originally provided to the author via e-mails from Col. Joe Mitchell, USMC (Ret.), and Mr. Frank Jordan, past directors of the Wargaming Division. Also see William L. Simpson, "USMC Wargaming History, 1970s to the Early 2000s" (unpublished paper, 2003). Bill Simpson, a retired lieutenant commander, had been a Wargaming Division wargaming specialist as a GS-13 since 1994.
28. For a picture of the Iraqis' terrain model, Norman Friedman, *Desert Victory: The War for Kuwait* (Annapolis, MD: Naval Institute Press, 1991).
29. One source—Claudio Cioffi-Revilla, "On the Likely Magnitude, Extent, and Duration of an Iraq-UN War," *Journal of Conflict Resolution* (September 1991), pp. 387–411—predicted casualties in the "100,000 to low millions" range.
30. A few analysts—such as Col. Trevor Dupuy, USA (Ret.), Dean Hartley (who, according to Joseph Saur, was working to computerize Colonel Dupuy's formulas), and James Dunnigan—would later brag about being "only" an order of magnitude off, but most estimates fell in the range given. "Crisis in the Gulf: Planning for the Worst," *Jane's Defence Weekly,* 19 January 1991, pp. 83–85; Mark Herman, e-mail, early 1990s.
31. The *Army Times* ran a series of division and independent-maneuver-regiment after-action reports. About half described some sort of unit wargaming. Most memorably, a battalion commander said he preferred death to gaming it one more time.
32. Dan Burkhart, comments on manuscript, 31 October 2014.
33. Frank Chadwick, address, Origins International Game Expo, Baltimore, MD, July 1991. (Origins, now the Origins Game Fair, is an international strategy-gaming conference.) Mr. Chadwick sent the soldier a replacement copy of the game. He tells me that he framed the letter and hung it on his office wall.
34. Higgins, e-mail.
35. I first learned of this effort from a Discovery Channel program on which I stumbled a few years after the war; I have yet to find its name.

36. Sources at the Defence Academy of the United Kingdom confirmed to John Curry that this near-real-time wargame was conducted but noted that "this process proved too slow for the rapid nature of that particular war."

37. This is a reference to the Nellis Air Force Base Range, where Red Flag missions are flown.

38. Alternatively, some blamed not the models but a lack of credible data. During a summer 1981 MORS conference Joseph Saur commented: "It became obvious that one of the issues that contributed to the errors of the attrition guys was a lack of intel on the Iraqis: since no one knew what to put in for leadership, morale, training, and equipment readiness, they ended up leaving those factors out, and running a straight hardware-on-hardware attrition run." Typically, when analysts speak of "leaving factors out," what they really do is set them to *1* for both sides. That would make Iraqi training levels equal to those of the Americans. In this way modelers confronted with inadequate data, trying to avoid bad guesses, effectively choose values far less accurate than any guesses they might have made.

39. Commercial wargame designers / military analysts such as Jim Dunnigan and Charles Kamps predicted far fewer coalition casualties than the "official" estimates—mainly because they were used to factoring in the intangibles that old hands in the government always said couldn't be calculated.

40. This is based on an Air War College seminar reading. I graduated in 2000.

41. Easily the best snapshot of U.S. defense wargaming in the late 1990s is William B. Scott, "Wargames Revival Breaks New Ground," *Aviation Week & Space Technology,* 2 December 1998, p. 57.

42. It is difficult to show a trend line for spending on wargaming. Estimates for the same year vary depending on what each considers a "wargame." Apparently using a working definition of "any multisided simulation of armed conflict," in 1987 John Prados estimated that a billion dollars was being spent annually throughout the defense establishment on wargames and gaming. During an early 1990s conference I could not get the director of the Joint Staff's J8 section even to guess, but he said my own guess of two billion was probably not far off. Recently an officer at the Air Force Doctrine Center estimated three billion dollars annually, given the above definition.

43. Paul K. Davis and Donald Blumenthal, *The Base of Sand Problem: A White Paper on the State of Military Combat Modeling* (Santa Monica, CA: RAND, 1991).

44. Robert P. Haffa Jr. and James H. Patton Jr., "Gaming the 'System of Systems,'" *Parameters* (Spring 1998), pp. 110–21.

45. William B. Scott, "'Title-10' Games Shape Policies," *Aviation Week & Space Technology,* 12 November 1998, pp. 61–62. "Title 10 war games can be defined as a series of major service-sponsored war games that address future concepts and capabilities in the context of Title 10 responsibilities to organize, train, and equip its forces to carry out its roles and functions as a component of the national instrument of power"; Douglas Ducharme, "Approaches to Title 10 Gaming" (paper, War Gaming Department, Naval War College, Newport, RI), www.usnwc.edu/getattachment/Research---Gaming/War-Gaming/Documents/Publications/Articles/Title_10_gaming_article---Ducharme.pdf.aspx.

46. Progress in this area was covered extensively in the press. For possibly the most comprehensive early coverage see "Training and Simulation Supplement," *Defense Electronics,* November 1994, pp. 1A–8A.

47. JSCPs also provide the information and planning assumptions necessary to create each plan.

48. I recall seeing as a young captain plans that included aircraft types long out of the inventory.

49. See "Post-Saddam Iraq: The War Game," National Security Archive Electronic Briefing Book 207, introduction by Roger Strother, *National Security Archive,* 4 November 2006, p. 2, nsarchive.gwu.edu/NSAEBB/NSAEBB207/index.htm.

50. The report has been declassified and posted online, ibid.

51. DMSO, "History of Modeling and Simulation."

52. At mid-decade a catalog published by the Joint Staff listed 529 wargames, models, and simulations. Richardson, "War Games in Cyberspace," p. 62.

53. "The Historical Background on the MSIAC," Modeling Simulation Information and Analysis Center handout dated 18 June 1999. MSIAC is the successor organization of DMSO.

54. For the initial structure and objectives of DMSO, Rick Adams, "Modeling and

Simulation Moves Front and Center," *Defense News,* Marketing Supplement, 1996, pp. 4, 6, 8.

55. Ibid.

56. J. R. Wilson,"Shall We Play a Game?," *Military Training Technology,* December 1999, pp. 20–25.

57. Kari Pugh and Collie Johnson, "Building a Simulation to Match the Real World," *Project Manager,* no. 2 (1999), p. 3.

58. For the nature and value of joint and service command-post wargaming at that time, Roger D. Smith, "Military Training via Wargaming Simulation," *Modelbenders LLC,* 19 August 1999, www.modelbenders.com/.

59. Rick Adams, "An M&S Primer," *Defense News,* Marketing Supplement, 1996, p. 9.

60. For the expectations for JSIMS near when the program was launched, ibid.; and Gregory Slabodkin, "DOD Integrates Best Sim Tools," *DOD Computing,* 15 September 1997.

61. Every source to whom I talked about JSIMS while working on my 2000 *Aerospace Power Journal* article had a substantially different view of the program.

62. Adams, "M&S Primer," p. 8.

63. Paul Holtzhausen, "On Target," *Military Training Technology,* 1999, p. 17.

64. Paraphrased from Lavoie, e-mail.

65. William B. Scott, "War Games to Include Cruise Missile Threats," *Aviation Week & Space Technology,* 14 July 1997, pp. 54–55.

66. David Vesely, "Warrior Preparation Center: Training Battle Commanders," *Defense 91,* July 1991, pp. 13–16.

67. The original source was *U.S. Joint Forces Command (USJFCOM),* at www.jfcom.mil/jwfc_history.htm, but the site was deactivated with the command. See Wikipedia, especially on history/organization and references.

68. Dr. Peter P. Perla points out in an 11 February 2005 e-mail, "In a real exercise, at least the operators are operating, getting some time under weigh, in the air, etc. and getting some minimal training value from that. In something like UE95, what fraction of the money spent actually went to the salaries of contractors and computer technicians and provided no useful training or education whatsoever to real operators?"

69. Joint Forces Staff College faculty, briefing, Norfolk, VA, August 2003.

70. Comments on the Armed Forces Staff College are based on my personal experience playing Red during one of its capstone exercises in early 1990. Those on the Industrial College of the Armed Forces and the National War College draw on Jerry Levesque (NDU wargaming department), e-mail, 2 August 2000.

71. Tonya Suttles, "JLASS '96 Rages Wargame in Week-Long Exercise," *Dispatch,* 1996, pp. 1, 5.

72. William B. Scott, "JLASS Wargame Challenges Players' Real-Time Battle Skills," *Aviation Week & Space Technology,* 2 November 1998.

73. "Joint Forces Play the Ultimate War Game," *Signal,* October 2000, p. 71.

74. William B. Scott, "Reality Checks Boost Wargame Credibility," *Aviation Week & Space Technology,* 2 November 1998, pp. 63–64.

75. Clarence E. Carter, Phillip D. Coker, and Stanley Gorene, *Dynamic Commitment: Wargaming Projected Forces against the QDR Defense Strategy,* paper 131 (Washington, DC: National Defense Univ., Institute for National Strategic Studies, November 1997), available at www.dtic.mil/docs/citations/ADA394532.

76. The former DMSO website was the source, but DMSO was replaced by the Defense Modeling and Simulation Coordination Office (DMSCO) in 2006. DMSCO's site, *Defense M&SCO,* www.msco.mil, is less informative but has the advantage (at this writing) of being active.

77. This is based on briefings I received in 2002 during a visit to USJFCOM.

78. "History," *Army Modeling and Simulation Office,* www.ms.army.mil/.

79. Gregory Andreozzi, e-mail, 11 May 2015. Where cited, this source has been taken up nearly verbatim. Greg Andreozzi at the time of this e-mail was Deputy Chief of Staff (G-8), U.S. Army Headquarters, Department of the Army.

80. This broad outline of Army wargaming in the 1990s is based on James Lunsford, e-mail, 17 August 1999. Lieutenant Colonel Lunsford was a member of the Command and General Staff College faculty and a wargame designer and expert.

81. John Auger, "Wargaming Logistics for Strategic Leaders," *Air Force Journal of Logistics* (Winter 1997), pp. 31–33, 41.

82. See "Department of Strategic Wargaming (DSW)," *United States Army War College,* csl.armywarcollege.edu/DSW.aspx.
83. Mike Dunn, Battle Simulations Specialist, Directorate of Simulations Education, Command and General Staff College, e-mail, 31 October 2017.
84. Mick Smith and Delores McCreary, "Warfighter: Realistic Combat Training," *National Guard,* February 1990, p. 37.
85. Lesser, "Military Training Systems Keying on State of the Art Technology," pp. 2A–3A. Asked whether capability had been achieved by 2000, Mike Dunn (e-mail, 31 October 2017) replied, the "short answer is *no*. The capability was/is there, but as a matter of course, the CCTTs did not / currently do not run network beyond the local installation level. The issue is not technical as much as it is administratively difficult to align training schedules and common agreement as to exercise priorities."
86. David Davidson, "Virtual Simulation Training," *Armor,* May–June 2000, p. 32.
87. George Conrad, comments on manuscript, 31 October 2014.
88. For the rationale for and origins of the Army After Next series of wargames, Robert B. Killebrew, "Learning from Wargames: A Status Report," *Parameters* (Spring 1998), pp. 122–35.
89. Haffa and Patton, "Gaming the 'System of Systems.'"
90. Heike Hasenauer, "Wargaming the Army After Next," *Soldiers,* December 1997, pp. 32–34.
91. Christian Lowe, "Future Wargame Presaged Terrorist Challenge," *Defense Week,* 17 September 2001, p. 12.
92. Burkhart, comments.
93. William Scott, "Wargame Raises New Space Policy Dilemmas," *Aviation Week & Space Technology,* 23 February 1998, pp. 100–101; "Space Wargame Grapples with Commercial Satellite Issues," *Aerospace Daily,* 4 February 1998, pp. 173–74.
94. Antulio Echevarria, "Fusing Airpower and Land Power in the Twenty-First Century," *Airpower Journal* (Fall 1999), pp. 66–74, is exceptionally insightful and historically well-grounded.
95. Burkhart, comments.
96. Ibid.
97. Dennis Steele, "The TRADOC Masters-Level War Game: Army Transformation's First Campaign," *Army,* July 2000, pp. 10–12.
98. The U.S. Army is made up of "branches"—e.g., the Armor Branch, Infantry Branch, or Quartermaster Corps. It appears that each takes a slightly different approach to wargaming; see Richard McEvoy, "Course of Action Analysis: How to Wargame," *Infantry,* July–August 1996, pp. 11–14. For gaming the logistical aspects of conventional and unconventional operations, Terry Beynon, Carl Gird, and Burt Moore, "Wargaming: The Key to Planning Success," *Army Logistician,* November 1999, pp. 4–8. For gaming field artillery, Patrick Sweeney, "FA Wargame Synchronization Matrix," *Field Artillery,* March–April 1999, pp. 36–39.
99. Andreozzi, e-mail.
100. While most civilians probably think wargaming is a technique solely of the uniformed services, several defense-support and intelligence organizations (such as the Defense Logistics Agency and Defense Intelligence Agency) also participate.
101. Adams, "M&S Primer," p. 10.
102. Michael Robel, "Three or Four Company Battalions," *Armor,* May–June 1999, pp. 40–42.
103. Various Connections speakers.
104. Adams, "M&S Primer," p. 10.
105. "Navy Modeling and Simulation Management Office," *America's Navy,* www.navy.mil/.
106. Glenney, e-mail.
107. Peter Perla, "Future Directions for Wargaming," *Joint Force Quarterly* (Summer 1994), p. 81. RMA refers to innovation that provides a significant, even decisive military advantage.
108. Edward A. Smith Jr., "The Navy RMA War Game Series: April 1995–November 1996," *Naval War College Review* 50, no. 4 (Autumn 1997), pp. 17–31.
109. Henry Bartlett and Paul Holman, "Global War Games & the Real World," U.S. Naval Institute *Proceedings* (February 1991), pp. 25–29.
110. Admiral Cebrowski would serve as President of the Naval War College until 22 August 2001, when he retired to become director of the Office of Force Transformation in the Department of Defense. He served there until January 2005 and passed away that November.

111. Network-centric warfare has been explained and justified in different ways, but at its simplest, proponents believe, improvements in connectivity, computing power, and interfaces would allow the United States to accelerate greatly the tempo of its military operations. With an ability to "turn well inside any potential adversaries' decision loop" the United States would gain such military superiority that other nations would be deterred from even attempting to become peer competitors.

112. This is the central principle behind "effects-based operations" (EBO). Strategists design war plans not simply to inflict casualties but to achieve desired political end states. All elements of national power are considered. The attraction of EBO is if it can be made to work, only actions that contribute to that end state would be necessary, and it should be possible to win wars faster, with fewer casualties on all sides, and at lower cost. See David A. Deptula, *Effects-Based Operations: Change in the Nature of Warfare* (Arlington, VA: Aerospace Education Foundation, 2001).

113. Rubel, telephone interview.

114. Lawrence Ash, "Fighting for Network Centric Warfare," U.S. Naval Institute *Proceedings* (August 2000), pp. 74–76.

115. Kenneth Watman, "Global 2000," *Naval War College Review* 54, no. 2 (Spring 2001), pp. 75–88. For the Knowledge Wall's first being used that year, Rubel, telephone interview.

116. "Network-centric operations" comprise a broad concept for enhancing military effectiveness through improved information. At its simplest it involves networking all sensors of a naval or joint force to improve "situational awareness." See Walt L. Perry, *Measures of Effectiveness for the Information-Age Navy: The Effects of Network-centric Operations on Combat Outcomes* (Santa Monica, CA: RAND, 2002).

117. William Scott, "Navy Probes Battle Concepts in 'Global 2001' Wargame," *Aviation Week & Space Technology,* 30 July 2001, pp. 56–57.

118. Conversations with War Gaming Department faculty members, 2005.

119. Primarily Dr. Stephen Downes-Martin, e-mail, 27 June 2014.

120. Perla, "Future Directions for Wargaming," p. 83.

121. *Wikipedia,* s.v. "United States Navy Strike Fighter Tactics Instructor Program," en.wikipedia .org/.

122. Naval Academy faculty brief, Connections 99 (?), Maxwell AFB, AL; Richard Folker, "Just Call Me Dr. Strangelove," *Personal Tech,* 31 August 1999, p. 2.

123. David Coleman, "PC Gaming and Simulation Supports Training," U.S. Naval Institute *Proceedings* (February 2001), p. 73.

124. Strategic Studies Group members briefed me on and demonstrated their version of Fleet Command during a visit to the Naval War College, 3–5 February 2016.

125. Jerry O'Brien, "Navy Dedicates Premier War-Gaming Center," *Providence (RI) Journal-Bulletin,* 28 September 1999.

126. Thankfully, the Navy has not demolished its original, historic wargaming facility. Pringle Hall—complete with the original black-and-white-tiled floor and viewing balconies used for the interwar games that proved so important for the Pacific War—is still there. Also, Sims Hall, originally a barracks but acquired by the College in 1946 and dedicated to wargaming from 1958 to 1999, is at this writing being remodeled for rededication to high-security gaming. The overall three-floor project is in the early stages, but spaces are already available for gaming on an interim basis.

127. Walters, e-mail, 6 April 2014.

128. Ibid. Colonel Walters notes that the course ended roughly ten years later. Was it stopped because lieutenants were then getting plenty of experience in tactical decision making in actual combat? If so, the tuition was much more dear.

129. Simpson, "USMC Wargaming History."

130. Perla, "Future Directions for Wargaming," p. 81.

131. Simpson, "USMC Wargaming History," and comments.

132. He is said to have used that letter for the rest of his career to justify his desire that the military pay to move his extensive collections of history books and wargames. Walters, e-mail, 22 April 2014.

133. Sandra I. Erwin, "'Expeditionary Warrior' Probes Marine-SOCOM Relationships," *National Defense,* February 2003.

134. Simpson, "USMC Wargaming History."

135. Quote from Michael Jernigan, "Marine Doom," *Marine Corps Gazette* (August 1997), p. 19.

136. Ibid., p. 20.

137. David Bartlett and Robert Curtis, "Why Not a Commandant's Wargame and Simulation List?," *Marine Corps Gazette* (July 1994), pp. 28–30.

138. Walters, e-mail, 22 April 2014.

139. The project officer and noncommissioned officer who actually wrote the patch spoke at several Connections conferences. This description is based on their comments and the many articles that later appeared on their achievement, including Riddell, "Doom Goes to War," pp. 114–18 (the cover story); and "Commercial War Game Sets Spell Doom for Adversaries," *Signal,* July 1996, pp. 35–37.

140. I. L. Holdridge (Maj., USMC [Ret.]), e-mail, 13 December 2012: "In August 1998 the Marine Corps University at Quantico purchased an unlimited duplication and distribution license for the USMC for a custom version of the 'TacOps' computer war-game system that was titled 'TacOpsMC v2.x.' [Marine Corps University] did not begin to distribute TacOpsMC v2.x until early 2000 and did very little to publicize the availability of the sim[ulation]." Major Holdridge was a designer of TacOps.

141. Dave Ross tells me that he participated in the last of the original series of Marine Title 10 wargames in 1999. According to Ross, it was held at Quantico, and the scenario depicted an Iranian invasion of Saudi Arabia.

142. Daniels, BBP.

143. Ellertson, "Air Force Wargaming."

144. Daniels, BBP.

145. Paul Holtzhausen, "A Model Agency for Simulation," *Military Training Technology,* November 1999, p. 32.

146. Edward Kolcum, "Warrior Flag Exercise Adds Efficiency in Air Combat Distributed War-Gaming," *Aviation Week & Space Technology,* 19 November 1990, p. 68.

147. John Lumpkin, "Logging On for Battle," *Albuquerque (NM) Journal,* 25 October 2000, pp. 1–2.

148. Adams, "M&S Primer," p. 10.

149. Since, especially at that time, many military members have been uncomfortable with the term "wargame," they tend to say "M&S," or "modeling and simulation," instead.

150. Thomas R. Case, "A New Vector: Air Force Modeling and Simulation," *Phalanx,* September 1995, pp. 1, 13–16.

151. Ronald Fogleman [Gen.], remarks, AMPS [Association of Modeling, Planning and Simulation] Symposium, New Orleans, LA, 22 March 1996.

152. "Forward edge of the battle area" is roughly equivalent to "front line," though contemporary wars seldom have nice, straight front lines.

153. Steve McNamara, "Assessing Airpower's Importance," *Armed Forces Journal,* March 1997, p. 37.

154. Ibid.

155. David Deptula [Maj. Gen.], keynote address, Connections 2002, Maxwell AFB, AL, and e-mail, 2003. General Deptula would later be promoted to lieutenant general and conclude his career as the Director of Air Force Intelligence.

156. Actually, the first year the conference was called "The Interdisciplinary Conference on Wargaming and Airpower Education." Small wonder that since 1994 it has been called simply "Connections."

157. As stressed by Colonel Warden in his opening or closing remarks at Connections events between 1993 and 1995.

158. Perla, "Future Directions for Wargaming," p. 81.

159. As evidence of the evolution of the conference, each year marked a milestone or a major innovation: 1992, ACSC "go" decision; 1993, Air University sponsors the first conference; 1996, "First Timers" program added; 1997, dual hosted by CADRE and ACSC, and "Demo Night" added; 1998, "Game Night" added; and 1999, "Friday Seminars" added. See Matt Caffrey [Col.], "Connections Wargaming Conference: Assessing the Past, Planning the Future" (PowerPoint presentation, Rome Research Site, Rome, NY, 9 September 2003), slide 5.

160. Daniels, BBP. Each U.S. service conducts an "advanced" course, typically selecting 1 percent of the students who complete its intermediate service school and educating them as strategists over an additional year of schooling. The other "advanced" courses are the Army's School of Advanced Military Studies,

the Navy's Maritime Advanced Warfighting School, and the Marines' School of Advanced Warfighting.

161. See Pat Cooper, "War Game Predicts Challenging, Lengthy Future Conflicts," *Defense News,* 2 December 1996, p. 31; Suzann Chapman, "Strategic Force," *Air Force Magazine,* February 1997, pp. 30–32; and Secretary of the Air Force, Public Affairs, "Strategic Force '96," *Maxwell Gunter Dispatch,* 15 November 1996, p. 15.

162. AF/XOCW [Air Staff, Wargaming Division], *Global Engagement 1997* (Washington, DC: n.d.), USAF Executive Summary.

163. This was the last FG played without cost-constrained alternative force structures until 2004 (also 2005 and 2007). During the outbrief, the Chief of Staff of the Air Force was told that both alternative forces played had been more effective than the force the service was actually planning. But when he was told that both alternative forces had been simply given advanced systems, the Chief of Staff asked, "Would not the programmed force also [have] been more effective if it had the same dollar value of additional systems we are planning to buy?"

164. Michael Barzelay and Colin Campbell, *Preparing for the Future* (Washington, DC: Brookings Institution Press, 2003), pp. 192–200.

165. Mort Rolleston, e-mail, 9 April 2015. Rolleston was a member of the Headquarters, U.S. Air Force Strategy Division; the two preceding paragraphs are almost verbatim.

166. See James Burlingame, AF/XOCW, *Global Engagement 1998* (Washington, DC: n.d.), and Scott, "'Title-10' Games Shape Policies."

167. Unified commands are major joint organizations normally commanded by four-star officers. They are either geographic in orientation (e.g., U.S. Pacific Command oversees our military interests and forces in the Pacific region) or functional (such as U.S. Transportation Command, which orchestrates the global deployment, sustainment, and redeployment of forces, through its Air Force, Navy, and Army components).

168. Andrew Reese, "Wargame Declared Success," *Maxwell Gunter Dispatch,* 5 November 1999, p. 1.

169. Barzelay and Campbell, *Preparing for the Future,* pp. 200–207.

170. Daniels, BBP.

171. "Introduction to GE-V 2015 Concepts," *Maxwell Air Force Base,* n.d., www.maxwell.af.mil/au/awc/ns/ge-v-2015.htm.

172. Robert Pollick, e-mail, 5 October 2004. Bob Pollick was head of AFRL wargaming.

173. Tom Mahr, "JNTF Hosts Missile Defense Wargame," *US Air Force On-Line News,* 6 October 2000.

174. "Air Force Gains Insights from First Space Wargame," *AFPN* [*Air Force Print News*], 29 January 2001.

175. Bobby Wilkes, "Silver Flag: A Concept for Operational Warfare," *Aerospace Power Journal* (Winter 2001), pp. 47–56.

176. Perhaps most surprising of all, there has been some movement toward cooperation between the military and commercial wargaming communities. See Wilson, "Shall We Play a Game?"

177. Comments based also on e-mails from James F. Dunnigan and Gene Billingsley.

178. Software Developers Association, press release, 1997 Computer Game Developers Conference, San Jose, CA.

179. Estimate by Evan Brooks, originator of an online index of computer wargames and former wargames editor for *Computer Gaming World.*

180. Personal experience and John Tiller (computer wargame designer), e-mail, 22 November 2004.

181. Mike Smoot, "Virtual Reality Comes to the Commercial World," *Training and Simulation,* November 1994, p. 4A.

182. Steven M. Bettner, "Simulation: Past, Present and Future," *Training and Simulation,* November 1994, p. 7A.

183. Based on comments made by Wilbur E. Gray, remarks, Connections 1998, Maxwell AFB, AL, 25–27 February 1998. Wilbur Gray was secretary of the Historical Miniatures Gaming Society East.

184. Caesar, which "bombed" in the United States, did so well in Europe that the publisher released Caesar II, which did well on both sides of the Atlantic. Several players of Paradox with whom I've talked do not know that the company is based in Sweden.

185. Bartlett and Curtis, "Why Not a Commandant's Wargame and Simulation List?"

186. Bob Brewin, "DOD Scripts War Games," *Federal Computer Week,* 30 August 1999.

187. Herman, in an e-mail of around 2008, acknowledged to the author that opinions on EBW differed but felt that the value, or lack of it, that users saw in EBW reflected how well or poorly it fit their individual needs.

188. LISTSERVs are (or, mostly, were) basically lists of e-mail addresses individuals can join or resign from. They help individuals with common interests communicate.

189. Dunnigan, e-mail.

190. Actually, the Air Force Academy may have been first by several years. According to a briefing given at an early Connections conference, it had been using Empire in Arms, a print strategic-level game of the Napoleonic Wars, for several years.

191. Jim Starling, "Military Academies Use Computer Games to Teach Art of War," *Defense News,* 22 January 2001.

192. For example, the first year in which students from former Warsaw Pact militaries attended the Air Command and Staff College, a Bulgarian student signed up for my wargame elective and a Czechoslovakian student purchased and took home every wargame on the market.

193. Andreozzi, e-mail.

194. Richardson, "War Games in Cyberspace," p. 62.

195. Tom Mouat [Maj.], e-mail, 5 January 2015.

196. "Multi-nation Wargame Tests Weapon Sharing Capabilities," *National Defense,* May 1997, pp. 40, 42.

197. Thanks for this to Lt. Col. Andrew "Drew" Hyatt, formerly of the Korean Air Simulation Center.

198. Richardson, "War Games in Cyberspace," p. 65.

199. *Defense M&SCO.*

200. Higgins, e-mail.

201. Timberlake, e-mail.

202. C. S. Grant, "Wargames at Camberley," *RUSI Journal* (October 1993), pp. 38–43.

203. Timberlake, e-mail.

204. Paragraph 1.3 in untitled document on British wargames attached to Timberlake, e-mail.

205. Ibid., para. 1.4.

206. Ibid.

207. Interviews conducted and briefings received during two visits to the German War College in early and late 1999, respectively.

208. *Führungsakademie der Bundeswehr: Training and Exercise Center* (Hamburg: Führungsakademie, n.d.); project officer, briefing, November 1999. While usually referred to as the "German War College," it is actually closer in structure to a U.S. staff college but with added elements similar to U.S. war colleges and "advanced" schools.

209. German War College briefings.

210. Mason, e-mail, 27 January 2015; *Department of Defence: Australian Defence Force Warfare Centre,* www.defence.gov.au/ADFWC/.

211. Mason, e-mail.

212. Ibid.

213. The "inside" explanation for the change in name was that some in the military did not like the word "game," while politicians did not like "war." Ibid.

214. Ibid.

215. *Australian Defence Force Warfare Centre.*

216. Puckapunyal is described as "alternatively a dust bowl or bog depending on the season." Mason, e-mail.

217. [James Dunnigan?], "Leadership: China Builds a Better Wargame," *StrategyPage: The News as History,* 6 March 2015, www.strategypage.com/.

218. Ibid.

219. Hawkins, "Chinese War Termination Calculus."

220. Cheng, "People's Liberation Army on Wargaming."

221. Clearly, some ability to conduct Soviet-style wargames had survived the two-decade break in training new gamers.

222. He was one of the first students of Dr. Qian Xuesen, father of China's nuclear and space programs.

223. Cheng, "People's Liberation Army on Wargaming."

224. Johan Elg, e-mail, 4 November 2017. Johan teaches at the Swedish Defense University (educating officers from cadets to lieutenant colonels) and is at this writing finishing a PhD at King's College London in contemporary military educational wargaming.

225. Giovanni de Briganti, "Virtual Battlefields Gain Europe's Nod," *Defense News,* 2 December 1996, pp. 10–18.

226. Ibid.

227. Lesser, "Military Training Systems Keying on State of the Art Technology," p. 3A.

228. "War Games That Keep the Peace," *Army Quarterly and Defence Journal* (January 1998), p. 74.

229. Barry Coombs, "The Russians Are Here," U.S. Naval Institute *Proceedings* (March 1995), pp. 58, 69.

230. While the below chart is as of 2003, the relative positions of the companies were roughly the same in 2000.

231. During the 1999 Computer Game Developers Conference the author attended a seminar on how U.S. publishers could "localize" their software to sell better in various international markets. Several of the American representatives said that typically half their income came from international sales. One title earned over 70 percent of its revenue outside the United States.

232. See *Welcome to Paddy Griffith's Website*.

RANK	COMPANY	COUNTRY HQ	FOUNDED	REVENUE (MILLIONS OF DOLLARS)
1	Electronic Arts	USA	1982	2,482.2
2	Sony Comp Ent	Japan	1993	2,180.5
3	Nintendo	Japan	1933	2,128.5
4	Activision	USA	1979	864.1
5	Vivendi Universal	USA/France	2000	832.5
6	Take-Two	USA	1993	793.9
7	Atari/Infogrames	France	1983	761.9
8	Konami	Japan	1969	740.2
9	Microsoft Games	USA	1984	614.4
10	Sega	Japan	1952	563.6

Note: This table was briefed to the 2004 Connections conference at the U.S. Air Force Academy. Necessary corrections and updates are that Sony is now Sony Interactive Entertainment, and that Nintendo was actually founded in 1889, as a publisher of playing cards. By 2015, leading publishers were much more international, and sales were much higher; see "Revenue of the Largest Video Game Publishers Worldwide 2015: Statistics," Statista.com, as cited in Wikipedia.

CHAPTER FIVE

Post-9/11 Wargaming
2001–2011

The smart man learns from his mistakes. The wise man learns from the mistakes of others.

PROVERB, VARIOUSLY ATTRIBUTED

"The world changed" on 11 September 2001, but not everything in the world changed. In the world of wargaming, some things changed and others did not. It is still a little risky to write so close to those events. Even today, over a decade and a half after the attacks, we may not have fully grasped all the implications or identified all the trends set in motion or deflected by the events of that awful day. We can, to the best of our ability, report how these events initially influenced wargaming and how gaming in turn initially shaped the nation's response.

Operations Enduring Freedom and Iraqi Freedom

The U.S. response to the attacks included the global war on terror, Operation Enduring Freedom–Afghanistan (OEF-A), and Operation Iraqi Freedom (OIF). It is too soon for much to have been declassified or published on the wargaming support for these operations. Because the global war on terror is as much a political as it is a military struggle, however, it is safe to bet that since 12 September 2001 the Joint Staff's J8 division has been diligently and discreetly wargaming U.S. strategy options. Given how quickly OEF-A kicked off, it is unlikely there was time to do any wargaming in support of that operation.[1] Notwithstanding, it is almost certain that transportation-feasibility simulators/estimators and other modeling and simulation tools were used. Also, some Air Force special forces units are known to have used networked simulators for rehearsing missions.[2]

The initial conventional phase of OIF, in contrast, was extensively wargamed, with substantial positive effect. In the first games, Blue (the United States with its coalition partners) advanced on Baghdad by the shortest, theoretically fastest route. Fortunately,

our intelligence had discerned the strengths, locations, and doctrine of the "Saddam Fedayeen." The Red team (Saddam's forces), as we saw in the introduction, deployed most of the Saddam Fedayeen into the cities along that route. They were to wait until leading Blue elements were leaving the city, then ambush the entire column at once with short-range weapons. The wargame adjudicators, as we saw, indicated that the outcome would not be pretty. However, in succeeding games Blue played the strategy of bypassing each city to the west, leaving the Fedayeen with no one to attack. The United States used this strategy in the actual invasion, and it worked very well for almost two weeks, until Saddam finally realized the United States was not going to play into his strength. At that point, the Fedayeen moved outward from the cities against our lines of supply and delivered attacks with which our logistics forces were neither trained nor equipped to deal effectively. It was these attacks, as we saw, that led to Lieutenant General Wallace's famous comment.

The senior commanders of OIF, speaking months after the operation, praised the wargames both for the improvements they pointed to and helped validate and for the growth in effectiveness of headquarters staffs they helped cultivate.[3] It appears that significant wargaming was also done by individual Army units. Jim Dunnigan tells of a conversation he had with a young company commander who had just driven through the Karbala Gap. "Boy, am I glad to get out of there," the captain exclaimed. "Why?" asked Jim. "Well," the captain replied, "I've wargamed that particular scenario seven times and got killed every time."[4]

So far, however, I have found no indication that wargaming was used either before or during OIF to help develop political plans to transition Iraq to democracy. Leadership seemed to have been unaware of the wargame conducted by the previous CENTCOM commander, General Zinni (see previous chapter), that warned of many of the problems actually encountered during the occupation. Still, however, it had become a standard operating procedure among both our Army and Marine forces to game each tactical operation before execution.[5]

The United States: Continuity, Progress, and Doubt

More than twin towers fell on the morning of 9/11. While some wargaming programs continued without apparent change, others were suspended. Some questioned whether the big force-versus-force games were still relevant in a "post-9/11 world." Still others worked to make wargames more relevant to the new environment. The U.S. military after all does not have a monopoly on wargaming within the U.S. government. For example, the National Intelligence Council, which comes under the Office of the Director of National Intelligence, has conducted a "program" of games since 2006.[6]

Joint

Within the joint community, the senior wargaming element remained the Joint Staff's Force Structure, Resources and Assessment Directorate, J8—the Deputy Director for Wargaming, Simulation and Analysis (DDWSA) in particular. J8 still conducted pol-mil games, but its mission expanded greatly. DDWSA, as the Joint Staff focal point, identified, budgeted for, acquired, and managed improvements to its gaming tools and those of the joint community generally. DDWSA had three divisions: the Studies and Analysis Management Division coordinates Joint Staff assessment; the Studies Analysis and Gaming Division conducts the pol-mil wargames and supports a host of joint and international games; and the Warfighting Analysis Division applies high-end models, simulations, and other operations-research tools to defense issues. The Joint Staff's Operational Plans and Joint Force Development Division, J7, was also involved in wargaming, through its support of exercises sponsored by either the chairman of the Joint Staff, or by one of the regional combatant commanders.

U.S. Joint Forces Command was a major actor in the area of joint wargaming during this period (it would not be deactivated until 4 August 2011).[7] USJFCOM was already the "transformation laboratory" of the U.S. military; much of its experimentation was done through wargaming. JFCOM's wargames were primarily supported by two subordinate organizations: the Joint Warfighting Center, which managed the games, and the Joint Warfare Analysis Center, which endeavors to improve their accuracy, particularly in the area of systems effects.[8] Most JFCOM wargames were conducted at the Joint Training, Analysis, and Simulation Center, in Suffolk, Virginia. JFCOM was formally dissolved in August 2011.[9]

Millennium Challenge 2002 (MC02) was the first big Title 10–like wargame run by JFCOM. MC02 was big in every way: cost ($250 million), personnel (13,500), and area (twenty-five locations across the United States). It was also very complex, consisting of twenty-three workshops and sixteen experiments over and above the main game, which itself was adjudicated by a new "federation" of forty-two wargame engines and simulations. MC02 was also ambitious, in that it attempted to explore eleven joint-service concepts, twenty-seven joint initiatives, forty-six service initiatives, and twenty-two issues from the regional combatant commands.[10]

Unofficial sources have called MC02 a big success, but most of the publicity went to a public exchange between JFCOM and one critic.[11] The incident seems a bit humorous in hindsight, but it illustrates an important point. Shortly after the exercise, a story broke claiming that Millennium Challenge had been fixed. An e-mail from the chief of the Red team, one Lt. Gen. Paul Van Riper, USMC (Ret.), to a friend was cited as proof. The e-mail complained that, at times, the Red team had been restrained inappropriately,

allowing a Blue technology or concept to perform better than it would against a real adversary. JFCOM's initial response was that the e-mail must be a fake or at least taken out of context. General Van Riper fired back with a second e-mail (this one got into the press!) reaffirming the original report. JFCOM then replied that the general must be confused about the difference between a wargame and an experiment, that Millennium Challenge involved both, and that he had not been constrained during the game phases, as such, but that "free play would have been inappropriate during carefully controlled experiments." General Van Riper insisted that he knew very well the difference between a wargame and an experiment but that while Red play was conducted appropriately during most of Millennium Challenge's games and experiments, some of the events had been conducted as experiments (including Red play) but had been called "wargames."[12] The general argued that this was more than semantics, as a wargame was a more rigorous test than an experiment. That is, calling an experiment a wargame gives the outcome more credibility than it deserves.[13]

Following MC02, JFCOM recognized the danger of the "politicizing" problem that the Air Force had spotted a few years earlier: slanting a game to get the (leaders') desired result. Games set in the relatively near term were needed to "prototype" concepts that could be implemented fairly soon, while wargames set in the more distant future were needed to identify technologies and concepts that would require significant enabling technology to be developed. Instead of establishing the alternating-game system adopted by the Air Force, JFCOM's director of joint experimentation, Maj. Gen. James Dubik, USA, began cosponsoring the services' near-term Title 10 games. These wargames changed accordingly:

- The Navy's Global War Game became Unified Course.
- The Marines' Urban Warrior became Joint Urban Warrior.
- The Army's Transformation Wargame became Unified Quest.
- The Air Force's Global Engagement became Unified Engagement (UE).

Under General Dubik's leadership, JFCOM's Joint Experimentation Directorate (J9) expanded the command's capability in distributed wargaming, allowing more groups to participate at a lower cost; acquired new software (Synthetic Environment for Analysis and Simulation) to facilitate the adjudication of social, political, religious, and diplomatic aspects of a conflict; and initiated work to conduct a wargame jointly with the State Department in 2005.[14]

The increasing importance of JFCOM had not diminished the DoD-wide importance of the Defense Modeling and Simulation Office. In fact, in April 2004 DMSO was designated the lead standardization activity for wargaming within the Department

of Defense. In 2006 DMSO was reorganized as the Defense Modeling and Simulation Coordination Office.[15] At the interservice level, however, success seems to have been mixed. There are many reasons for this, the fundamental one being that the services fight in different mediums and so emphasize different things in games. The Air Force tends to use a "cue-ball" Earth (that is, with a blank or minimally detailed surface) and to explore rapid, short engagements; the Navy needs underwater terrain (to constrain submarine play authentically); and the Army needs to distinguish between, say, swamp and marsh, and tends to play slower, longer engagements than the Air Force.

After years of schedule and budget difficulties, JSIMS appeared to be once again on the rebound. However, in late 2002 the Pentagon decided to end the program. Although the Joint Warfare System's budget and schedule difficulties were (relatively, at least) tiny, there was concern it too might soon be canceled. As it turned out, development and use of JWARS continued to the end of the decade.

In 2001 the senior organization for joint educational wargaming was the National Strategic Gaming Center (NSGC), under the Institute for National Strategic Studies at the National Defense University. Located next to the National War College at Fort McNair, in Washington, DC, NSGC designed, developed, and conducted strategic-level games, exercises, and simulations to offer experiential learning to students attending all National Defense University schools. In addition, NSGC

- Worked closely with the Institute for National Strategic Studies on issues of national security policy and strategy development and analysis
- Provided state-of-the-art political-military simulations for the Office of the Secretary of Defense, the Joint Staff, and the combatant commands
- Conducted, for congressional leadership, crisis-decision exercises designed to give these senior government officials insight into the nuances and complexities of policy making in the current global security environment, illuminate policy and organizational options, and improve dialogue between the executive and legislative branches on critical national security issues

On behalf of the National Security Council, NSGC conducted a program of interagency transformation, education, and after-action review for the strategic policy-making community, including executive-branch departments and agencies, "the interagency," regional combatant commands, and the staffs of various nongovernmental and international organizations. Finally, NSGC also conducted extensive outreach to colleges, universities, and other educational programs.[16] Even the service Title 10 wargames were becoming more integrated, pursuing common themes.[17]

U.S. Army

In the years between 9/11 and 2011, some elements of Army wargaming remained unchanged while others evolved to meet the new threats or exploit new opportunities. The Army Models and Simulation Office became the Battle Command, Simulation, and Experimentation Directorate, but its mission remains today largely what it was in the 1990s; monitoring, coordinating, validating, and synchronizing the budgeting of Army wargaming.[18] The Army is increasingly relying on gaming in education and training, the planning of operations at every level of war, and decision support for force development. However, there was high-level recognition of problems in wargaming. These included inadequate modeling of many of the Army's mission areas, incomplete gaming infrastructure, and too much on-the-job learning for practitioners.

The Army continued its Title 10 wargames, significantly influenced by the events of 9/11 and the following wars and campaigns. First, Army leaders decided that since projections of the far future (twenty to twenty-five years) do not change significantly in a single year, they could skip far-future Title 10 games for a few years and focus more on the near and middle terms. (It would be over a decade before such games were again set in the far future.) They also tended to focus on unconventional or mixed threats, increasing the chances of generating insights useful in the ongoing wars. Still, each year's Army Title 10 wargame was different.

The Army Transformation Wargame was renamed Vigilant Warrior in 2002. Held at Carlisle Barracks, Pennsylvania, home of the Army War College, Vigilant Warrior 2002 drew five hundred participants, including the Army Chief of Staff, the commander of TRADOC, and other senior Army leaders. The scenario was very different from before 9/11. The participants had to devise a strategy for a very complicated situation involving, possibly, enemy conventional forces, irregulars, and terrorists—in Army terminology, a hybrid threat. The security of our homeland was also threatened. The lessons drawn from the exercise, which gave much attention to how the Army contributed to homeland security, reflected the changed world.[19]

In 2003 the Army again changed the name of its Title 10 wargame. To mark the beginning of a JFCOM initiative to cosponsor service midterm games, the Army adopted "Unified Quest." Representatives of fourteen nations participated in this unclassified game. Unified Quest 2003 (UQ03) was the first wargame cosponsored by JFCOM with any service. It also produced a number of other firsts. It featured the first use of emerging joint concepts in a service wargame and the first joint exploration of future concepts. (As "equipping" forces is clearly a service function, alternative force structures and system concepts are usually the province of service games.) Depicting a spectrum of nearly simultaneous crises, Unified Quest 2003 was innovative also in that it explored

both present options to improve interoperability and future concepts. UQ03 was also the first of the Army's Title 10 games to be preceded by several seminars and workshops. The scope and number of these events before the "Capstone" would increase over the years.[20] Finally, UQ03 was distinctive for the breadth of high-ranking individuals attending the outbrief, the Senior Leader Seminar. In addition to the senior officer of the sponsoring service, the Chief of Staff of the Army, and the commander of the cohost, JFCOM, leaders at the briefing included the deputy secretary of defense, the Chief of Naval Operations, the Commandant of the Marine Corps, and the Vice Chief of Staff of the Air Force.

Unified Quest 2004. UQ04 postulated an adversary who had lost most of his conventional capabilities yet continued fighting a protracted struggle with both conventional and unconventional means. UQ04 was also unusually well documented; RAND prepared a 102-page report, with suggestions for increasing the effectiveness of Army Title 10 wargames.[21] After two years of planning, preparation, and study and with the participation of eleven international partners, all the American services, most joint combatant commands, and several government agencies, UQ04 produced nine insights, most with relevance far beyond the U.S. Army.[22]

Unified Quest 2005. UQ05 was set in 2015 and depicted a fictional Red using unconventional tactics. Blue players came from all U.S. services, joint commands, and agencies; the United Kingdom, France, and Germany; and seven other friendly nations. While again held primarily at the Army's wargaming center at Carlisle Barracks, Pennsylvania, members of the U.S. Joint Forces Command participated online from their wargaming center in Suffolk, Virginia. During UQ05, the Army explored the impact of conventional military operations on stability operations.[23] The game was planned as the first of what were to be two UQs looking farther into the future than most, seven to nineteen years. That is not exactly what happened.

Unified Quest 2006. UQ06 was a mix of continuity and innovation. As often happens, the game's sponsor, in this case the Army Chief of Staff, Gen. Peter Schoomaker, called for fresh, new ideas. The designers did not attempt to get these ideas from an established preparation process but from a radically changed one. Some things remained the same; the focus was still on unconventional warfare, the conflict was set ten years in the future, and, as in the previous year, the adversary was the fictional state of Redland in southeastern Europe. The spectrum of service, joint, and international participation also stayed about the same. What was very different was the scope and level of thinking before UQ06 started. In April 2006, the TRADOC commander (General Wallace)

initiated a study, "The Art and Science of Operational-Level Command." His guidance to the study team, dated 5 February 2006, included the following:

- Put together a forum for professional discussion on the art and science of operational-level command during UQ.
- Dialogue and argue over the points being raised regarding effects-based operations (EBO) and other approaches.
- Focus on the key ideas and figure out how we can harness the power of several tough concepts and make them one.
- Establish a framework within which to engage the participants regarding:

1. Understanding the nature and composition of systems that make up the adversary
2. Determination of the best way to influence those systems
3. Making early determination of the consequences of the success (or failure) of our influence to mitigate the result if bad or take advantage of it if good.

All the above had to be done in such a way that commanders could at least understand what was going on at multiple locations and echelons so as to be able to control the flow of resources, missions, and commander's intent in a way that led to a reasonably early and favorable end state.[24]

To comply with this guidance the UQ06 team conducted four seminars before the capstone game. These would generate, develop, and record new ideas that could be explored during game play. The first seminar was held with company commanders—a frequent source of new ideas. The second consisted of midcareer battalion commanders. A month later the third seminar brought together brigade commanders, soldiers considered prime candidates for a first star (i.e., likely future brigadier generals). The final seminar was made up of division and corps commanders, some of the busiest men (and women) in the Army.[25] Even the UQ06 game itself was somewhat innovative. It was again held at Carlisle Barracks, but its 250 participants included more representatives from more U.S. government agencies than previously.[26]

Unified Quest 2007. Relatively little was reported in the press on UQ07.[27] A *Washington Post* article hinted why not, quoting a participant as saying the scenario had been a Blue withdrawal from an "Iraq-like" nation and that it had not gone well for Blue.[28] The story's implication was that the Army did not want the outcome known. The Army did publish two unclassified documents on UQ07: a 104-page pamphlet and the standard brief (in this case, eleven-page) executive report. But even the long pamphlet, with a lot of information on process (UQ07 ran more pre- and postgame events than UQ06) and general observations, did not mention the scenario or how the game turned out for Blue. The far shorter executive report was actually more substantive. While it also covered process, it also described both the scenario and listed a spectrum of insights, many with

all-of-government, all-of-alliance relevance.[29] UQ07 focused on winning a long war by conducting a series of small games, set in the same conflict at different times over a twelve-year period. Finally, UQ07 was the first Army Title 10 wargame to be cosponsored by the U.S. Special Operations Command (USSOCOM) (along with JFCOM as before).

Unified Quest 2008. A great deal was published on UQ08. Even the names of the nations in which UQ08 had been set were made public by the Army: three scenarios, set in, respectively, Peru, the Philippines, and Nigeria, all in 2013. There had also been a 2025 scenario in Somalia. The theme was building partnership capacity—that is, working with partners to enable them to defeat their terrorist threats without direct American involvement. As one participant said, "If we have to have U.S. boots on the ground, something has failed."[30] The Army's executive report too provided much more information than the previous year, on the breadth of participation, structure, scenarios, and insights.

Unified Quest 2009. UQ09 was even less reported on than UQ07 had been. My single published source, an official information publication, describes a very methodical thirteen-event process to gain clarity of issues of near-term concern to the Army.[31] Fortunately, the Army once again produced a very substantive executive report, describing the continuing broad range of participation, the extensive series of precapstone workshops and wargames, and insights produced. What was new was a shift from counterinsurgency to a balanced force coping with a host of threats, a precapstone game exploring conflict nine-plus years in the future, and an exploration of special forces employment in a predominantly conventional campaign.

Unified Quest 2010. Given the topic of UQ10—restructuring the U.S. Army to balance risk across threats and time—it is hard to understand why coverage was only slightly greater than UQ09's. The best article, by a retired general officer, describes an innovative structure and lively debate and asserts that the resulting recommendations (not described) were valuable. Interestingly, the article mentions a "smattering" of allied participation and specific years of the Army's budget.[32] Again, the unclassified UQ10 executive report filled in the gaps, naming the "smattering" of allies involved (Australia, Brazil, Canada, France, Germany, Italy, Netherlands, Singapore, Spain, and the United Kingdom) and calling what appears to have been the capstone the "Army Future Game." In fact, the Army's Title 10 program seemed to have shifted from a series of preparatory events and a capstone game to a "campaign for learning" of which all Unified Quest events were seen as parts.[33]

Unified Quest 2011. This shift became even more pronounced the following year. Despite, or perhaps because of, the enormous amount of press coverage UQ11 received, it is the hardest of the post-9/11 Army Title 10 wargames to gain a clear picture of. One source of this difficulty is that so many events were involved. Since UQ03 introduced precapstone events, most years had seen their number grow; UQ11 was a yearlong series of such events, all of them called "Unified Quest." Commentary, including two articles written by the Army, tended to focus on one aspect and miss the overall effort. This, in turn, was partly due to UQ11's theme, homeland operations. An Army-produced video on this element of UQ11 showed discussions among American military entities and civilian agencies and Canadian military personnel of the constraints each faced when operating within their respective homelands.[34] All very businesslike, but some media went nuts anyway, reporting that the Army was planning to intervene in (or cause) bread riots. What seems to be the only article on the Capstone that describes its basic flow paints a picture very similar to all services' Title 10 games: participants working to devise an effective strategy for coping with a plausible future scenario given the resources they expect to have in the year of the scenario.[35]

During this period Army wargaming went much deeper into the organization than its Chief of Staff's Title 10 wargames did. The Army worked to make sure soldiers were using exactly the right games for the challenges they confronted in Afghanistan and Iraq. Lt. Gen. William Wallace, he of the famously misinterpreted quote about gaming, became one of the leaders of that effort. Now commander of the Army Combined Arms Center at Fort Leavenworth, Kansas, General Wallace strove to ensure that each rotation of active-duty troops had the opportunity to fight in a virtual battle zone before it deployed to the real thing.

He hoped to bring down the cost enough to make our deploying National Guard and reserve soldiers "virtual veterans" also.[36] In this connection the Army was (and is) pressing on with WARSIM, its part of the JSIMS set of wargames, even though JSIMS itself has been canceled. Col. Kevin Dietrick (Project Manager, Constructive Simulations, Program Executive Office for Simulation, Training and Instrumentation) estimated that after the expenditure of three hundred million dollars over the previous ten years, the software was between 70 and 75 percent complete. Recasting WARSIM as the centerpiece of a new Army Constructive Training Federation, designers hoped to achieve a ground-centric, but still joint, wargaming capability quicker and for far less money than the original JSIMS.[37]

In 2005, General Wallace received his fourth star and assumed command of TRADOC, where he continued to advance the effectiveness of Army wargaming.[38] Toward the end

of the decade, innovativeness in Army wargaming resided less in big defense-contractor adjudication programs like WARSIM than in adaptations of software originally created for the civilian market. Finally, in 2009 the Center for Army Analysis closed its Conflict Analysis Division. The division had provided a political-military gaming capability to the Department of the Army for almost twenty years.[39]

U.S. Navy

Over the years U.S. Navy wargaming had been blessed with a succession of individuals who advanced the state of the art for the Navy and the nation. From William McCarty Little to Orville "Bud" Hay, they had done great things. During the early twenty-first century, naval wargaming was advanced by a leader who also did great things, mostly through others—Robert C. "Barney" Rubel.

Much of Dean Rubel's career had prepared him for success in wargaming. His active-duty naval service after commissioning in 1971 had been a mix of operational (flying the A-7 Corsair II and F/A-18 Hornet), staff (in a combatant command, U.S. Southern Command), and academic (on the faculty at the Naval War College, where he expanded student wargaming) tours. As a student at the Spanish Naval War College he participated in its wargames.

When he returned to the Naval War College in 1998 as a captain, his personal mission was to "fix wargaming." Instead, in 1999 the Navy made him deputy dean of research. Upon his retirement from active duty in 2001, he stayed on at the College as a civilian and was named director of the Research and Analysis Division of the College's War Gaming Department. In 2004 he became chairman of the department and began "fixing" wargaming in earnest. One of his most fundamental changes was converting its almost entirely military staff (whose members knew operations but seldom deeply understood wargaming) to a mix of academic wargaming professionals and operators. Together these two kinds of professionals produced games of effectiveness and accuracy neither could have produced alone.

Also, faced with a new generation of adjudication software that was "not working," he more or less gave up on computer modeling and simulation, focusing on human-centric adjudication—that is, by umpires. Gradually he and his faculty began to realize that software, which was producing ever-more-fine-grained numeric outcomes, had been inhibiting human interactions. With increased use of umpires came increased human interaction—and the umpires were recording not only outcomes but those human interactions as well. Some started to suspect: Could these human dynamics be the richest vein in which to mine for insights?

Far too soon, in 2006, he was named the interim dean of the Center for Naval Warfare Studies. He did such a good job there leading the development of the Navy's new maritime strategy that he was made the dean officially in 2007. However, for wargaming he became, like Gen. George C. Marshall during World War II, the enabler of success, for over a decade.[40] During this time the War Gaming Department remained the Navy's premier wargaming organization. Many of the department's fifty wargames a year were in support of the larger Navy, examining issues from the military use of space to counterinsurgency warfare.

The year 2001 would see the last of the Navy's Title 10 wargame series, Global, for most of the decade. Though Global was the first, as we have seen, and once the most influential of the service Title 10 games, Global 2001 was a poor fit for the challenges the Navy, the United States, and much of the world faced on 12 September 2001. In any case, the resources the Naval War College needed to support naval and national efforts in the global war on terror left little to stage a thousand-participant (or more) forward-looking wargame each year. The War Gaming Department explored many alternatives. It looked at working with Joint Forces Command to share the costs and redesign Global 2002. But as talks dragged on there was less and less time available to prepare for and hold a Global in 2002. The War Gaming Department also proposed holding Global every other year or reducing the number of participants to fit available resources. Briefed on the alternatives, the Navy's Vice Chief of Naval Operations, Adm. William J. Fallon, decided to "just kill it."[41]

In the direct aftermath of the 9/11 attacks, representatives of the New York Fire and Police Departments contacted the Naval War College's War Gaming Department for assistance. Having lost effectively their senior echelons in the attacks, both departments wanted to educate new ones rapidly, via wargaming. The College ran a series of games for both departments, both in Newport and in New York City, to train new leaders and to help the departments improve their ability to plan for and respond to citywide emergencies. The success of this effort produced requests from other organizations, federal, state, and local, for gaming support. The War Gaming Department established a small cadre of civilian gamers who focused on homeland-security and -defense gaming. The program continued for several years, but eventually the College had to refocus on its primary responsibilities for the Navy.

Another line of wargaming established after the attacks concerned maritime homeland security. Initially, a series of games was commissioned to assist the Navy and Coast Guard in coordinating their homeland-security efforts. These games morphed into the annual Maritime Homeland Defense and Security Games, originally for research. Out of them emerged the Maritime Operational Threat Response conference-call procedure,

which became national doctrine. The games were also pivotal in establishing close working relationships with the Canadian and Mexican navies, as well as a number of other government agencies from all three countries.[42]

In 2003 the Navy tried Title 10 again, announcing that it would cohost the game with JFCOM. In recognition of the change, Global was officially renamed Unified Course. The first was held at the College during October 2003 but was called Unified Course 2004 (UC04). It focused on the campaign planning process. JFCOM created a website (since disestablished), but most development and execution work for UC04 was accomplished by the Naval War College's War Gaming Department and the game's director, Barney Rubel (then a professor). UC04 produced some very interesting "countercultural" insights, including the need for a global operational-level staff. But by now many of the folks who knew how to conduct a Title 10 wargame had retired or moved on. Still hoping to resurrect Global, in 2005 the War Gaming Department hired several additional faculty.[43]

In 2006, the Chief of Naval Operations, Adm. Michael G. "Mike" Mullen, called for a new maritime strategy and tasked the Naval War College with the supporting research. The College carried out a nine-month program of conferences, consultations (in the United States and around the world), and a six-week-long Strategic Foundations Game. Conducted in one-week increments, the game featured senior policy players and a progressive challenge/response process. In the end the game produced the insight that became the heart of the new strategy's logic: every nation, including the so-called rogues, had a stake in the proper operation of the global system of commerce and security.

In 2007 the U.S. Navy and Marine Corps held a series of "Warfighter Talks." These periodic discussions between senior operational leaders of both services focused primarily on force-employment issues of common interest. One of the upshots was the need to rejuvenate wargaming in both services. Quickly a consensus grew: the best way to do so was to bring back the Department of the Navy's premier wargame—Global. The War Gaming Department succeeded in resurrecting in principle the Global War Game that year. Originally it planned to alternate between two very different types of Global. In even-numbered years, Global would address how cooperation between the world's navies could most effectively enhance naval security and mitigate natural disasters. To facilitate international participation, such Globals would be unclassified. In odd years, the game would address emerging military threats. These Globals would be classified and open only to closest allies.

The author was lucky enough to participate in both types of Global. Fifty-one navies sent representatives to the international-cooperation Global, and very important issues were put into context by the military-threats Global. However, Global's rotation has

been repeatedly thrown off, first to support the Quadrennial Defense Review, then to help refine the AirSea Battle concept.

Perhaps because the Naval War College is home to both educational and decision-support gaming, some of its wargame electives have proved educationally effective while also generating insights of value to decision makers. The first such "dual use" wargaming was by the College's Advanced Research Program, an array of individual and collective directed-study courses that began with the Mahan Group, begun in 1999. There were to be (and still are) several other such efforts, of which the Halsey Group was the first to become relatively well known. Development work for "Halsey" started in 2001; the students really got under way in 2003, when fifteen Navy and Air Force officers signed up for a very unusual elective. Halsey students soon found themselves immersed in all the details of high-end warfare in the western Pacific.[44]

The educational objectives were to gain a better appreciation of the emerging realities that would influence any conflict in the assigned theater and to improve the students' ability to plan and execute military operations generally. However, unlike traditional electives, Halsey and the other Advanced Research groups had the objective of producing insights useful to real-world American commanders in a given theater. Of course, combatant commands (see chapter 6) focus on conflicts that may break out *today*. As a result, they seldom look beyond two years into the future. The Halsey Group did look into the future, far enough so combatant commanders would have time to act on their insights, yet soon enough so that projections could be made with fairly high confidence.

The heart of the elective was a free-play wargame. With the guidance of two faculty members, the students played all the roles of a traditional wargame: compiling and checking the data and adjudication aids prior to play, devising and executing the Blue strategy and that of Red, and conducting the adjudication. Halsey's first game emphasized detail and transparency, concentrated on twelve hours of combat. This rigor earned for Halsey the respect of actual operational planners; many of its sometimes counterintuitive insights found their way into actual operations plans.

The Naval War College quickly decided to expand the effort. In 2004 the original Halsey Group became Halsey Group Alfa, and a second elective was spun off, Halsey Group Bravo. Initially, Halsey Bravo looked at sea basing. In 2006 it shifted to gaming threats to American naval power in Southwest Asia. In 2005 yet another Halsey elective was offered, Charlie. Halsey Charlie was later renamed the Gravely Group, in honor of Vice Adm. Samuel L. Gravely Jr.[45] However, its foci—ballistic-missile defense and undersea warfare—remained constant.

In 2007 the focus of the Mahan Group, the oldest of the directed research programs (now known as the Mahan Scholars), shifted from general analysis of strategy in the Far

East to nuclear deterrence and escalation. Partnering with U.S. Strategic Command, the group has since cosponsored a yearly Deterrence and Escalation Game and Review.[46]

Even after 9/11 the Navy continued to invest in its live wargames already made famous by the 1986 movie *Top Gun*. In 2002, the Naval Strike and Air Warfare Center received the first of fourteen F-16A/B Fighting Falcons from the Aerospace Maintenance and Regeneration Center. These aircraft, originally intended for Pakistan, to which weapons sales had been embargoed, joined previous "aggressor" aircraft, F/A-18A/B/C/D/E/F Hornets and Super Hornets. Like their predecessors, they were painted in exotic schemes.[47]

Finally, the Navy Modeling and Simulation Management Office remained the senior Navy wargaming activity. Located in Washington, DC, NAVMSMO was responsible for the Navy's Modeling and Simulation Information Service.

U.S. Marine Corps

During the decade following 9/11, U.S. Marine Corps wargaming continued to be concentrated principally at Quantico Marine Corps Base, Virginia. While Quantico's many schools continued to make innovative use of gaming, the core was still the Marine Corps Wargaming Division. The best known of its initiatives was the return of the Marine Corps to Title 10 gaming.[48] As mentioned in the previous chapter, the decision to reinitiate a Marine Corps Title 10 wargame predated 9/11, and the Urban Warrior series was close to what would be needed for a Title 10 game. However, the first such wargame did not take place until Expeditionary Warrior 2003 (EW03). The Marine Corps and its Wargaming Division were occupied with both the global pursuit of terrorists and the fights, both conventional and irregular, in Afghanistan and Iraq.

Actually, several "mini-wargames" made up EW03, and the first occurred in November 2002. Unlike most other Title 10 wargames, which have planning and preparatory events but one big "capstone" game, the Marines, ever innovators, designed EW03 as a series of smaller games, each set in a different part of the world, extending over more than a year. All, however—not surprisingly, given the then-current situation—explored possible synergies between Marine and special operations forces.[49]

Each Expeditionary Warrior game was sponsored by the Commandant of the Marine Corps. All were designed to study enduring problems of pressing concern with long-term policy and strategy ramifications. All brought participants from the joint (sister-service or Joint Staff), combined (allied or coalition-partner), and interagency (other U.S. government) arenas, as well as individuals from nongovernmental (typically aid) organizations. However, they had slightly different emphases:

EW03: USMC-USSOCOM operations, relationship/interoperability

EW04: USMC-USSOCOM operations, relationship/interoperability

EW05: distributed operations in the global war on terror

EW06: counterinsurgency and irregular warfare

EW07: campaign design and campaign planning

Expeditionary Warriors 2008 through 2010 examined the impacts of sea basing over the course of a three-year campaign.[50] Specifically, EW08 considered sea basing as a broad concept, examined interoperability issues, and contributed to naval sea-basing CONOPS development. EW09 examined counterinsurgency and foreign-internal-defense operations from a sea base. It too informed both Marine and joint/interagency concept development in those areas. EW10 focused on how to operationalize the sea base. Over the decade, the structure of EW evolved toward that of other Title 10 wargames, but the series continued to attract a broad spectrum of participants.

Though less well-known, a myriad of other games were executed by the Wargaming Division in the first decade of the new millennium. We'll look here at perhaps a third of them.[51] Their main impact came early in the decade. In January 2001 the Marine Corps Wargaming Division conducted the Command and Control Wargame, in which the Marine Corps and Navy explored alternative command relationships for Marine and naval forces acting together. It demonstrated the value of a single commander so clearly that on 19 September 2001 joint doctrine was changed accordingly and on 1 November James Mattis, then a brigadier general (later, in the rank of general, Commander, U.S. Central Command and today secretary of defense), was appointed the sole commander of Task Force 58. This was the first time a Marine officer had been given command of Navy forces.[52]

Policy and Strategy Wargames. The PSWG series was the first of the research/exploration type conducted by the Marine Corps's Wargaming Division. It was sponsored directly by the Commandant of the Marine Corps. The objectives were:[53]

- To use wargaming to support general officers' assessment of use of military force to protect national interests.
- To generate increased awareness of national security issues and the strategic formulation process.
- To strengthen regional expertise through area studies.
- To plan and operate more effectively.
- To demonstrate Marine Corps capabilities to other DoD agencies and the other services.

Some of the PSWG wargames looked at Marine force deployment in the third world for military operations other than war, nuclear proliferation (India, Pakistan), implementation of national policy in the Balkans, and the First Gulf War. Other PSWGs prepared for and rehearsed Marine participation in the Global War Games.

Concept of Employment Wargames. The Wargaming Division has conducted a successful series that helps program managers refine or assess their concepts of employment. Programs supported included next-generation night vision devices, the MV-22 tilt-rotor aircraft, the Advanced Amphibious Assault Vehicle program, and the forward-deployed advanced surgical suite.

Even as the global war on terror, as well as the only slightly more conventional wars in Afghanistan and Iraq, kept the Corps exceptionally busy, individual Marines still made time to innovate with wargames so as to develop their ability to formulate effective strategies quickly. In 2002 Lt. Col. Eric Walters (later a colonel) and Gy. Sgt. Paul Nichols worked together to adapt the commercial computer wargame Close Combat into a tool for individual Marines. They asked the publisher to create a Marine Corps edition; with Maj. Brendan B. McBreen they developed a workbook with scenarios and guidance on deriving tactical lessons.[54] In September 2004 a compact disc with a version of Close Combat Marine and the first scenario from Major McBreen's workbook were mailed out in the *Marine Corps Gazette*. For a few months a scenario was included in each issue.

In 2006 the Marine Corps's use of computer wargames to train individual Marines became more technically advanced but also, in the opinion of several Marines, less effective.[55] In that year the Marines began to field the Deployable Virtual Training Environment, with three components: the hardware (thirty-two laptops per battalion), the hardware and software to link them together (the Combined Arms Network), and the actual game software, the Infantry Tool Kit. It was (and is) an impressive system, powerful, and initially very popular. Unfortunately, over time more contractors were added and the software was locked (being proprietary), so leaders could not create scenarios to fit their training objectives. Also, time on the system had to be scheduled beforehand. Use declined.

On 24–25 June 2008, the final in a series of annual Marine Corps / defense-contractor wargames took place at the Gray Research Center at Quantico. Both parties felt they had derived significant benefit from the series, but the Marines were unable to navigate the complicated legal paths they would have to in order to continue.[56]

The post-9/11 period also saw the Marines' first use of contemporary live wargaming techniques. To be clear, the Marines had never stopped using techniques similar to those used by the Army during the Louisiana Maneuvers. Also, their use of live-fire

exercise areas such as their huge training area at Twentynine Palms, California, equals or exceeds anything similar in the Army. But while the Navy implemented "dissimilar" air-combat training (i.e., between aircraft of different types) as part of Top Gun, as the Air Force did them one better with Red Flag, and as the Army pushed the live-wargaming envelope yet again at the National Training Center, the Marines continued to use umpired field maneuvers. That changed when they built "Combat Town," a replica Middle Eastern village, complete with a mosque and covering two acres, at Twentynine Palms. Combat Town had many immersive elements and a continually updated "IED Alley," but the greatest value of Combat Town resided in its role players, portraying innocent bystanders, potential allies, or hardened terrorists. Marines had to sort out this "human terrain" and prevail against a thinking, reacting adversary.

U.S. Air Force

In the first decade-plus of the twenty-first century, wargaming's role in how the Air Force prepares for and fights its part of a joint campaign increased in importance. The high level of Air Staff involvement indicated the criticality of wargaming to the service.

At the time of 9/11, the executive agents for wargaming were the Director of Operations (AF/XO) and the Director of Plans (AF/XP). Most of the detailed oversight and execution was handled by their subordinate divisions AF/XOXS (for Global Engagement, later Unified Engagement) and AF/XPXC (for Futures Games).[57] The Air Staff's Modeling and Simulation Division (AF/XIWM) was the Air Force "lead" in that area. Other elements of the Air Force's modeling, simulation, and wargaming community contributed via the New and Emerging Warfighter Capabilities Integrated Process Team, which oversaw wargaming, experimentation, and analysis.[58] In 2006, the Air Staff reorganized so as to be more in line with joint (and Army) staffs. The Director of Operations became AF/A5, while the Director of Plans became AF/A8. The executive agents for the Title 10 wargames became AF/X5XS for Unified Engagement and AF/X8XC for Futures Games. The Modeling and Simulation Division became the Modeling and Simulation Policy Division.

Even before 9/11, the Air Force had decided that conducting both its Title 10 wargames every year was overly demanding of human resources (many planners and intelligence specialists participated in both) and, given how often projections changed, probably not necessary. The increased operations tempo following the attacks of 9/11 confirmed the need to shift to alternating Title 10 wargames. From 2001 on, with few exceptions, Global/Unified Engagement would be held on even years and Futures Game would take place on odd years.

Global/Unified Engagement still focused on the midterm security environment, ten or twelve years into the future. The three FGs held from 2004 to 2007 retained the basic FG format, but with differences for various reasons. There were similarities between the two Air Force Title 10 game series (often many of the same players and sometimes the same scenario) and also between successive games in each series (some scenarios repeated several times), but each game was in many ways unique.

Global Engagement VI culminated with the November 2002 Capstone. Global Engagement VI set a 2015 Blue force against a robust asymmetric threat, to examine how Blue might rapidly dominate a battle space and to identify conditions for transition to sustained joint operations.[59]

Futures Game 2004. FG04 started life as "FG03," but owing in part to the high operations tempo within the Air Force at the time (the invasion of Iraq began on 20 March 2003), the game slipped into 2004. Using a Northeast Asia scenario, FG04 focused much more on specific future technologies than on broad future force structures; looked only at an alternative force, with no comparison with the planned baseline force; and was not fiscally constrained. FG04 explored the potential applications and contributions of several future technologies: joint network-centric capabilities, unmanned vehicles, "persistent area dominance" munitions, and directed energy. FG04 also examined the relative campaign impacts of airborne and space-based sensors. Products included master plans for network-centric warfare, directed-energy weapons, and unmanned aerial vehicles, as well as follow-on experiments in network-centric warfare.

Global Engagement VII / Unified Engagement 2004. The Air Force teamed with JFCOM in 2004 to conduct Global Engagement VII, changing its name officially to Unified Engagement 2004.[60] In addition to greater joint involvement, it featured substantial participation by the militaries of Australia, Britain, and Canada, whose national objectives, level of participation, and projected future capabilities were integrated into the exercise. The game pitted two Blue teams against two Red teams in a common scenario—a failing state with weapons of mass destruction.[61]

Futures Game 2005. FG05, conducted at the Dulles, Virginia, offices of Booz Allen Hamilton, departed the farthest from the norm for Futures Games. FG05 was heavily influenced by its unfortunate timing during deliberations on the Quadrennial Defense Review. Air Force leadership decided it was not comfortable sharing potential alternative force structures (especially the envisioned "trade space"—i.e., what might be forgone—to pay for them) while such trade space was being explored in the QDR discussions. Therefore, FG05 became a senior Air Force leadership conference, to talk through future challenges, as opposed to a true wargame.[62] FG05 was also by far the smallest FG,

with roughly a hundred participants, including senior general officers from the United States, Britain, and Australia as well as officials from the Department of Homeland Security.[63] FG05 had a very broad scope, embracing most future Air Force strategic planning issues in the context of eight simultaneous contingencies postulated across a spectrum of size, intensity, and type. Finally, FG05's adjudication was less formal than usual. Notwithstanding, FG05 identified various likely future capability shortfalls and initiated several analyses of potential "mitigations." These insights are representative of some of the strengths of wargaming. Intelligence may be able to tell whether a potential adversary will have a better aircraft in the future, but if a wargame indicates our future systems cancel out that improvement, then we probably don't have a problem. If the wargame suggests, however, that we may in fact have a problem, the wargame may also point to potential solutions. FG05 also provided insights into escalation management.

Unified Engagement 2006. The 2006 game's capstone was held in Hawaii, to facilitate participation by U.S. Pacific Command and its supporting Air Force component, Pacific Air Forces. This implemented a strategy directed in 2005 by Gen. John Jumper, then the Air Force Chief of Staff, to "take the wargame to the warfighter." General Jumper's goal was to get the theater air forces to think farther into the future and the Air Staff gamers to develop closer ties to the commands that would have to fight. To this end the Unified Engagement team started partnership-building seminars with regional friends and allies.[64]

Futures Game 2007. The FG07 capstone was held 14–19 October 2007 at the Air Force Wargaming Institute, Maxwell AFB. It was designed to explore the effectiveness of an alternative force that would be technologically and fiscally feasible by the era of the wargame, 2030. FG07 was unusual in depicting just one Blue force and in being described with remarkable clarity and completeness in a published article.[65] FG07 looked for vulnerabilities in the areas of mobility, base defense, and counterinsurgency, and as always, it explored potential future systems in the air, space, and cyber realms—C4ISR, global strike, global mobility, and force protection—to see which concepts were worth a closer look. The scenario, set in Southeast Asia, was very interesting, as it depicted challenges resulting from simultaneous conventional and unconventional threats.

Unified Engagement 2008. At the request of the then commander of United States Air Forces in Europe (USAFE), Gen. Thomas Hobbins, UE08 switched theaters from the Pacific, to focus on operational challenges central to the European theater. The UE08 series of planning conferences and workshops, as well as the October–November capstone game, took place at U.S. military facilities in Germany, and included significant representation from not only USAFE but other European Command components as

well. UE08 resulted in significant findings relative to missile defense and access/supply into forward operating areas.[66]

Futures Game 2009. FG07 had produced useful insights, but subsequent FGs, starting with FG09, returned to employing two Blue forces. The FG09 capstone, played at Maxwell, explored whether an alternative force could more effectively conduct a major, sustained, global irregular campaign *and* counter a peer competitor capable of disrupting the U.S. Air Force in the air, space, and cyberspace than could the actual planned force. Participants included thirty-five active and retired general officers.[67]

Unified Engagement 2010. UE10 returned to the Pacific theater. As UE08 had done with Futures Game 2007, UE10 developed and shared its basic scenario elements with FG09, continuing the tradition of synergy between the Air Force's two Title 10 wargames.[68]

Futures Game 2011. FG11 was held at Maxwell and explored whether an alternative force could more effectively counter a regional nuclear-armed adversary and better mitigate challenges to logistics in forward operating areas than could the actual planned force.[69]

During this period several Air Force major commands and centers conducted "Title 10–like" and other wargames. The Air Force Research Laboratory ran the Air Force Technology Seminar Game for a few years. Designed to look sufficiently deep into the future to guide research investment decisions, the first was held in 2000, as we've seen. The second TSG (TSG II) was held in 2003.[70] These games were designed to help sort out which feasible future technologies offered warfighters the greatest relative advantages.

AFRL's Headquarters Wargaming Branch (AFRL/XPPW) led the Technology Seminar Games. AFRL/XPPW also supported Title 10 games across the defense community, by projecting—as explained at the time by the branch's separate website—what technologies would be available at the times depicted in each game. The wargaming branch has subsequently been reorganized into the XPT Division.

Several of AFRL's directorates worked to improve Air Force wargame software. One of them, AFRL's Information Directorate (AFRL/RI), worked

- To make adjudication more comprehensive
- To create the capability to deal with the adjudication of effects-based strategies against asymmetric adversaries over long counterinsurgency campaigns through the

development of third-generation wargaming (about which more in the second half of this book)

- To integrate wargaming with information systems to shorten the Air Force's decision-cycle time[71]

Toward these ends, AFRL's Information Directorate hosted Connections 2003 and supported Connections 2004, which was held in Colorado Springs. The Information Directorate continued to research the impact of doctrine, C2, unmanned-aerial-vehicle "swarms," and counterinsurgency warfare through 2011, under the leadership of Dave Ross.

AFRL's Human Effectiveness Directorate and Directed Energy Directorate were also active in improving Air Force wargaming. Starting in 2004, the Directed Energy Directorate conducted the Advanced Concepts Event (ACE), perhaps the first virtual wargame anywhere set in the future. ACE leverages the hardware, software, and infrastructure of Virtual Flag. In addition to aircraft currently in the inventory, virtual prototypes are employed in a scaled-down virtual Red Flag. Insights on military utility, Red counters, and best Blue employment can be acquired before one penny is spent on manufacturing. While Virtual Flag does not produce the stress of *g* forces on the trainees' bodies, it is superior to Red Flag in at least one way: peacetime safety restrictions are suspended (you can't really die in a simulator) so pilots can "fly" as close to the edge of the envelope as they would in wartime. Virtual Flag also costs far less per pilot hour than Red Flag. An ACE has been conducted most years since.[72]

As it had before 9/11, the Air Force space community continued its Schriever series (see chapter 4). The focus remained projected space capabilities, gaps, and requirements. The Schriever capstone wargames were originally conducted at Nellis AFB's Combined Air and Space Operation Center North, more recently at the Space Warfare Center at Schriever Air Force Base, Colorado. Like the Futures Game and Unified Endeavor, Schriever games were major enterprises; they were objective driven, often used scenarios similar to those of Title 10 games, and had epoch years in the future (typically ten to fifteen years).[73]

The Air Force's final "Title 10–like" wargame serves both as preparation for Air Force Title 10 games and as a useful exercise in its own right. During the fall of 2001, Headquarters, Air Force, Wargaming and Experimentation Division; Headquarters, Air Mobility Command; and the Air Mobility Warfare Center recognized their mutual interest in bringing more realistic mobility and logistics assessment to Title 10 wargames. They created the Global Mobility Exercise (GLOMO) initially as a precursor event for Global Engagement VI. Held biennially since 2002 at McGuire Air Force Base (now part of Joint Base McGuire, Dix, Lakehurst) in New Jersey, in partnership with Global/Unified

Engagement, Global Mobility helps prepare both inputs for and participants of capstone wargames and provides insights directly to the Air Force's Air Mobility community.[74]

The Air Force also conducted the Joint Expeditionary Force Experiment, specifically to test innovations in command-and-control technology. More a simulation or experiment than a true wargame, the 2004 iteration consisted of a number of "spirals," mini-games designed to address problems from the field and test solutions as quickly as possible—even before the main exercise.[75]

The Air Force Agency for Modeling and Simulation (see chapter 4) continued a field operating agency of the Deputy Chief of Staff for Warfighting Integration, in the Pentagon.[76] Its mission remained coordinating the growing requirements for modeling and simulation across the Air Force and working to fulfill them. During this period the Air Force Wargaming Institute remained the principal source of educational wargaming in the Air Force, as a division of CADRE (see chapter 4).[77] While 9/11 did not fundamentally change AFWI or its mission, several technical and procedural innovations have proved impressively congruent with post-9/11 needs. For example, AFWI has added homeland defense to many exercises. Its manual wargames now have cells playing the U.S. Northern Command (with major homeland-defense responsibilities) and "injects" to stimulate thought about asymmetric threats and terrorism. This process continues to mature, stressing improved "Phase IV" (transition to peace) planning. The wargames are computer adjudicated, but homeland-defense discussions have been added. Behind the scenes, AFWI's greatest challenges have been updating models, databases, and game materials to reflect the intent of the "modular army" (an initiative of the U.S. Army to make its force structure more "tailorable" to the various challenges facing it in the early 2000s) or the "policy/decision environment" of the Homeland Security Department, with no precedent and minimal guidance on which to base them.[78]

Shortly after 9/11, AFWI worked with the Air Force Doctrine Center to explore homeland-defense issues through a vignette-focused wargame designed to highlight doctrinal issues. The structure for this game proved unique for AFWI, which traditionally designed wargames that carry a thread from planning through execution to war termination. In the homeland-defense vignettes, many more issues were addressed, by focusing on the response to and repercussions of an isolated event within a finite period of time.[79]

AFWI also improved its software. Accelerated Combat Timeline, an internally developed product, allows students (and, in time, operational planners) to examine their campaign plans through to the desired end state in a feasible amount of time. The Wargame Construction Kit, WARCON, is a program it developed with the Air Force Research Laboratory, for which Dave Ross was the principal investigator. WARCON was

designed to allow educational wargames to be modified and even created quickly—an important attribute in a rapidly changing world.

In 2007 the AFWI parent organization, CADRE, merged with the Air Force Doctrine Center to become the Doctrine Development and Education Center. In 2008 this center was renamed in honor of Gen. Curtis LeMay, becoming the LeMay Center. Shortly thereafter, AFWI was renamed the LeMay Center Wargaming Institute (LCWI).[80]

Not all wargame projects at Air University were undertaken by AFWI/LCWI. In 2001, Gary "Mo" Morgan of the Squadron Officer College attended Connections and observed the demonstration of Modern Air Power, a commercial theater-level air wargame by Dr. John Tiller. Mo immediately saw the potential for his school, but it took until 2003, working through Dave Ross at AFRL, to arrange contract support and obtain Air Education and Training Command funding. Finally a contract was let to adapt Modern Air Power for military use. In 2004 the military version, Theater Airpower Visualization, was delivered and immediately became a core part of the Air and Space Basic Course. In 2012 it became a core part of the Squadron Officer School curriculum.[81]

Civilian

From the oldest to the newest media, sales of civilian wargames in the United States are up. With the general rise in living standards, more Americans are finding miniatures wargames affordable. When asked why computers have not taken a bite out of their community, one miniatures wargame enthusiast replied, "Until we can really create a holodeck, miniatures will be the ultimate high res[olution] graphics." The ease of creating new scenarios, no programming required, has also been cited as a reason for the continued popularity of miniatures. Others point out that with miniatures, one gets to make something tangible: a company of knights, a Napoleonic battalion, or a P-51 Mustang. With computers, whatever you "build" can be deleted in a keystroke; with miniatures, after a game one still has a display case full of troops.

In 2003, print wargaming finally pulled out of its nearly two-decade decline and achieved higher sales, even allowing for inflation. One reason was that desktop-publishing software now allows professional-looking games to be published profitably even with very small print runs. The members of the largest cohort of print wargame players, baby boomers, were entering their peak earning years and could afford to buy more wargames. More titles were selling fewer copies each, but total sales were still up.

Ironically, the civilian computer wargame industry presents a mixed picture. "First-person shooters" have become phenomenally popular. Part of their success is the increasing numbers of virtual worlds where players can shoot it out with others from across the country and around the world. However, this very success has made it difficult for the

developers of operational and strategic wargames to find publishers. Developers have responded in one or more of three basic ways. Some have selected the somewhat bizarre course of creating operational and strategic games that look like and play (a little) like first-person shooters. Called "real-time strategy games," these titles run continually, like a flight simulator or a close tactical wargame, but hundreds or thousands of times faster than real time. Other developers of operational and strategic wargames are increasingly selling directly to consumers across the Internet. Still others are actively seeking to sell their operational or strategic wargames to governments.

Perhaps in the long term, even more important than the military's discovery of commercial wargaming is academia's application of wargaming techniques. Academic gaming is not new; for example, Dr. Martin Campion, an early advocate of educational wargaming and gaming in general, used print wargames to help teach history in the 1960s. However, it received little recognition until 2002, when Dr. Vernon L. Smith of George Mason University won the Nobel Prize for economics for his founding of the field of experimental economics. His methodology was similar to wargaming, in that the strategies of contending sides were adjudicated and fed back to the participants. His use of simulation gaming, both to develop insightful economists and to explore specific economic strategies, paralleled the primary military applications of wargaming.[82]

Civil/Military

In the years since 9/11, what had been a slow and uncertain trend in the U.S. military of taking the recreational software industry more seriously has become almost an "in" concept. Not only the military but civilian government agencies became increasingly interested in commercial wargames.[83] The author anticipated this "tipping point," as the commercial side of wargaming had always been willing to lead in the field of adjudication of human factors (after all, no lives depend on the correctness of their assumptions) and (to a lesser extent) of system effects that were often seen as a key to victory in the global war on terror. Ironically, though, it seems to have been a recruiting tool that finally captured the military's attention. In little more than a year after its release, America's Army had over 1.5 million registered users. For less than the cost of a few TV commercials, typically used by viewers as opportunities for snack breaks, the Army had created a wargame that has young people of recruiting age spending hours in virtual boot camps earning the right to play a first-person shooter in a scenario that imposes strict Army fire discipline.

Also, the Institute for Creative Technologies in Marina del Rey, California, which the Army helped create in the late 1990s, created two commercial-like wargames: Full Spectrum Warrior, designed to teach squad coordination in infantry combat; and Full Spectrum Command, to train light-infantry company commanders to lead in combat

and in peacekeeping. Even the CIA was working with the institute on a wargame to help its operatives understand how terrorist cells operate.[84] The Army, Navy, and Marine Corps continued to fund efforts to tailor commercial wargames to their needs. In at least one case, that of TacOps, all three services were funding modifications to the same commercial wargame.[85]

Mark Herman continued to bridge the military and commercial communities. In the early 2000s he was a vice president with Booz Allen Hamilton. He designed Cognitive Warfare, an operational-level joint wargame adjudication engine to address the full spectrum of conflict, with particular emphasis on the global war on terror.[86] He had also designed several innovative commercial print wargames—most notably We the People (Avalon Hill, 1993), which introduced "card-driven" print wargames.[87]

International Wargaming: Continuity and Change

The international wargaming community's reaction to the events of 9/11 was broadly similar to that of the U.S. military wargaming community, ranging from slight to searches for new techniques and more-relevant capabilities. The U.S. military continued to reach out to other militaries; simulations and wargames were important ways it did so.

U.S.-Supported Gaming

The Joint Warrior Interoperability Demonstration continued and was arguably more important than ever. Coalition members must talk among themselves; interoperability of command-and-control equipment becomes imperative. As an extra complication, the United States may be willing to share certain secrets with some long-term allies but not with the coalition partner of the moment, yet all members need to communicate and fight together. Little wonder then that JWID attracted not only our closest allies, like Australia, New Zealand, and NATO allies Canada and Great Britain, as well as other NATO allies, but other important partners as well, such as Japan, Korea, Singapore, and Thailand. As in the past, JWID looked like a wargame, with a scenario and Blue forces, but it was a demonstration: Red could not prevent candidate technologies from being explored by implementing strategies that would bypass them. As mentioned above, this is both a strength and a weakness of JWIDs.[88]

The U.S. Army specifically continued to conduct wargames with international partners. The Army conducted transformation/interoperability wargames with the British army and workshops to support the ABCA planning process from 2001 through 2004. Noteworthy efforts were made in 2005 and 2006 with the German army on irregular-warfare analysis and operations-research tools to support operational commanders. U.S. Army

leaders believed they made significant contributions to improving partner capacity and coalition interoperability.[89]

NATO

Wargaming was being used at the highest levels of NATO to develop new concepts and organizations. For example, on 23 January 2004, more than ninety NATO representatives from twenty-six nations met at the Joint Forces Command's Joint Training, Analysis, and Simulation Center. They wargamed the employment of a proposed twenty-thousand-strong NATO force in a scenario set in 2007. The importance placed on such exercises can be inferred from the seniority of the leaders attending: four-star flag and general officers from the United States, the United Kingdom, and Germany, and a three-star general from Canada.[90]

United Kingdom. Well before the turn of the millennium the United Kingdom's Wargame Infrastructure and Simulation Environment (WISE) was fully operational. Faster, more flexible, and less expensive to operate than Britain's previous leading analytical wargame software (Divisional Wargame), WISE was even able to begin supporting studies previously run on UK Janus, when that software was retired early in the century. But had WISE evolved enough to stay relevant, given all the changes in warfare following 9/11?

Of the many allies and partners who applied their wargaming capabilities to the emerging challenges of the wars in Afghanistan and Iraq, the British may well have made the single most important contribution. Shortly after British forces deployed to Afghanistan the Defence Science and Technology Laboratory started receiving requests for new wargames—some for training and planning for counterinsurgency operations, others to support counterterrorism, and others for insights into peace-support operations. In one of those "Aha!" moments for which the Brits have been famous since Newton's apple fell, they realized that all the requests were actually asking for the same thing: a way to adjudicate quickly the results of operations in the human dimension. Second-generation wargames adjudicated the military dimension of conflict; now what was needed was a game to examine *all* dimensions of conflict within a society—what the author calls a *third-generation* wargame.

Starting in 2004, Dstl began work on a true revolution in wargame-facilitation software, the Peace Support Operations Model (PSOM, pronounced "Possum"). From the start it was to be population-centric and scalable, a tool both sophisticated enough to be useful and easy enough to use to *be* used. PSOM attempted not to replace human decision making—indeed, PSOM-supported wargames had players for all major factions in the conflict space—but simply to help discern the consequences of a series of decisions by

independent actors. By 2007 the work was far enough along to share with the United States, specifically the J8 elements of the Joint Staff. In 2008 Dstl initiated a rigorous process of confirming the reasonableness of PSOM's outcomes. By 2010 Dstl felt ready to see whether PSOM could make a difference in an actual conflict.

During 2011, at the request of the International Security Assistance Force, volunteers from Dstl's PSOM-development team twice flew to Kabul, Afghanistan, then an active war zone. In March they enabled over 150 military and civilian leaders of the coalition to wargame draft plans for the coming summer. In November, as part of a British/American team, Dstl and PSOM supported the formulation and exploration of long-term campaign plans. The speed of PSOM's evidence-based adjudication made it possible to look deeper into the future at a pivotal time in the war.[91]

The senior British representative at the wargame, Col. (later brigadier general) Gary Deakin, commented, "Use of the tool, and critically the supporting team of civilian staff that made it work, enabled the planners to think at the strategic, operational and tactical levels identifying and developing an understanding of the risks to the plan and how they could be mitigated." Three years later he would say, "This [PSOM] is the most effective tool for wargaming at the highest levels I have experienced."[92]

Interestingly, these wargames were called not "wargames" but "conferences." There was a perception among the leaders that nongovernmental agencies would not participate in a "wargame."[93] In this case the name choice may have been not only helpful but more appropriate: after all, the objective was not to win in combat but to prevent combat from starting.

While the United Kingdom's PSOM was providing insights useful for developing alliance-wide and "all of effort"–wide (that is, drawing in charities, businesses, UN agencies, and all other groups that could influence outcomes for good or ill) strategy for future months, the Royal Air Force (RAF) was designing, developing, and executing a series of innovative wargames aimed at increasing the effectiveness of force structure decades in the future.

Collaboration among the RAF's Air Warfare Centre, Air Staff, and an exchange officer from the U.S. Air Force, Col. Rand Miller, produced an "end-to-end process" for developing alternative-force options and anticipating their relative impacts. The process began with building a picture of the likely future defense environment. A host of sources then developed concepts deemed likely to mitigate anticipated gaps or create opportunities. All were then rigorously reviewed for technical and fiscal feasibility. Surviving concepts would be gamed in the envisioned future. The results would then be analyzed; findings on relative military utility would be provided to decision makers, those on the concepts themselves to the originators.

By 2005 this process was sufficiently developed to be applied to a wargame for the first time—the Future Air and Space Operating Concepts (FASOC) wargame. FASOC05's objective was to explore synergies between persistent airpower and precision effects across a spectrum of contingencies. Set in 2020, FASOC05 attracted sixty-seven participants—a third from other British services. Even as a first effort, FASOC05 produced five high-level recommendations and was a factor in a procurement action.

FASOC06 attracted German and French participation. Its objective was to examine options for rapid global mobility, deployment and sustainment, C2, and engagement capabilities. Set again in 2020, the scenario focused on countering terrorism. The sixty-eight participants, over half sister service or allied, presented their findings to the Chief of Air Staff and twenty-two other flag and general officers. The four resulting recommendations included precision aerial delivery. FASOC07 explored the direction, collection, processing, and dissemination of intelligence, based primarily on surveillance and reconnaissance. The scenario was still set in 2020, but international attendance shifted to the United States and Australia. The fifty-seven participants again outbriefed the Chief of Air Staff and, this time, twenty-six flag and general officers. The next FASOC was more ambitious. The epoch year went to 2030, in which the game was to explore the spectrum of "novel technologies" in which the RAF might invest and also to carry out integrated air and space planning.

To allow time to meet these objectives fully, the wargame slipped to 2009. The RAF's project officers realized they had two challenges with FASOC09. First, exploring fully the spectrum of potential RAF technologies would require an equally broad spectrum of subject-matter experts. They would be difficult to assemble. Second, and more importantly, they realized the RAF's investment decisions should be informed by allied, especially American, decisions. Aside from avoiding redundancies, they would need to discern possible future gaps that they might need to fill or opportunities to achieve synergy. The next chapter will cover how both challenges were met through a single initiative.[94]

Dstl made many other advances during this period as well. It upgraded its wargames the better to depict differences in perception and the impacts of command-and-control capabilities. It also increased its use of old-fashioned paper-map wargames to facilitate team coordination and integration.[95] Finally, Dstl assigned Scientific Support in Crisis and War teams to one-star headquarters.[96]

Canada. In these years the Canadian Army Simulation Centre incorporated virtual elements into its constructive wargames. The Canadians, however, were not only wargaming with the United States and applying American methods but coming up with innovative approaches of their own. For example, early in 2011 Defence Research and

Development Canada conducted a two-part wargame, the Military Assessment of Disruptive Technologies (MAD). MAD I developed and vetted concepts deemed feasible ten years in the future. Then, during MAD II, four small wargames explored the impacts of those concepts. The Canadian military devised courses of action (COAs) against the four contingencies using current Canadian systems; it then devised another set of options for the same contingencies with the capabilities from MAD I. Afterward, both sets of COAs were gamed to conclusion, and the participants discussed the concepts' likely impact on future Canadian operations.[97]

China

During the late 1990s China brought the development of domestic computer-assisted wargaming under the leadership of an officer with impressive credentials in the military and scientific spheres. By the early 2000s that officer, Hu Xiaofeng, was already producing results. Shortly after the turn of the century his laboratory located at China's National Defense University produced Sword Sharpener, a series of operational-level wargames with computerized adjudication designed to improve the decision making of operational-level military commanders. Hu's next product, Absolute Victory, a computerized adjudication tool, incorporated military-political and economic elements. It was followed by a multiplayer, networked, strategic-level wargame. In 2007 his laboratory began work on a computerized wargame system that would link strategic and operational-level decision makers.[98]

As impressive as China's technical progress had become, how it applied wargaming may be even more impressive. Most of the world is adopting American wargaming methods, but China seems to be changing our methods the better to fit its theory of war.[99] As a result, Chinese gaming methods may, in some areas, be superior to ours. Most U.S. Department of Defense adjudication software started life as highly detailed one-on-one or few-on-few attrition engines. With bigger and faster computers, the United States has scaled these models up to depict theater-size conflicts. Still, it is difficult for most American software to adjudicate more than a few days of war in a reasonable amount of time. Chinese war theory begins with the calculation of the end state in China's best interest, then of the conditions that would bring about conflict termination on those terms. Unlike the Soviet Union, which was preoccupied by measurements of the correlation of military force, China's defense community believes that gaining or enhancing an advantage in comprehensive national power is the center of national strategy. Accordingly, China has devoted itself to comprehensive games that can adjudicate the interplay of all elements of national power right up to the achievement of favorable war termination—in other words, third-generation wargames. As one indication of this focus, China has computerized the comparatively comprehensive methods of combat adjudication of

the late Col. Trevor N. Dupuy, USA. Still, it also uses conventional American adjudication software, such as Janus, where it considers appropriate.[100]

Australia

The new century saw another expansion of Australia's wargame community with the establishment of the Combat Training Centre. This new center primarily supported command-post exercises and predeployment training. The new century also saw the retirement of Australia's domestically developed ComBatSim, in anticipation of converting to the Americans' Brigade/Battalion Battle Simulation. A delay until 2003 in fielding BBS caused a total gap in software support to Australian army CPXs.[101] At about the same time, Janus(AS), the Australian version of the American Janus software, was also to be replaced by a newer version. However, a pervasive flaw was discovered with the latter, and Janus(AS) was retained for an additional decade.[102] Janus(AS) was to be replaced by BBS at the Australian army's simulation centers, but as the decade progressed it became standard practice to use BBS for medium and large units and Janus(AS) for small ones. Toward the end of the decade, first at Darwin and then increasingly at all three centers, use of the commercial software Steel Beasts increased sharply, especially for predeployment training.

In 2003 the Australian Department of Defence established the Australian Defence Simulation Office as a single reference source for Australia's proliferating modeling, simulation, and wargaming activities. Over the next several years the office produced a number of useful publications, including *The Defence Guide to Simulation*.[103] Also in 2003, planning began for what would become a series of U.S./Australian live wargames called Talisman Sabre.[104]

In 2004 the American and Australian governments signed an agreement to create a Joint Combined Training Centre, which would link training sites across Australia with such sites in the United States. The agreement included a concept-validation event at the Talisman Sabre ("Saber," for the Americans) scheduled for 2007.[105] Following that proof-of-concept demonstration, Australia established a Joint Network for Experimentation, Simulation and Training; it became operational in 2008. This network immediately began enhancing Australia's live wargames and in 2009 even allowed Australians to participate in a U.S. Air Force Virtual Flag without physically leaving home. By roughly the end of this period the Australian and American networks had been permanently linked.[106]

Talisman Sabre 2005, the first of these bilateral live wargames, which would become biennial, took place 12–27 June 2005. It was conducted in Shoalwater Bay (in the Rockhampton area of Queensland), Townsville, and on the Coral Sea, with sixteen thousand

American and Australian troops. During the exercise, U.S. Pacific Command and Australian Defence Force Joint Operations Command jointly executed more than twenty-five trips by LCACs (landing craft, air cushion) and more than 1,300 Australian S-70A Blackhawk and MH-60S Knight Hawk landings and takeoffs.

The next Talisman Sabre, 10 June–25 July 2007, involved twenty-six thousand American and Australian troops. The area used also expanded, adding to Shoalwater Bay and the Townsville Field Training Area the Bradshaw Field Training Area in northwestern Northern Territory. The event also expanded the number of airfields used, to civilian airports at Sydney and Brisbane and Royal Australian Air Force Base Amberley. A climactic moment was a joint amphibious landing of 2,500 personnel from six ships on 20 June 2007.

The next Talisman Sabre was conducted 6–25 July 2009. The increase in size was more modest this time; there were ten thousand Australian land and naval personnel and twenty thousand U.S. troops. This time the exercise was led by the United States and was conducted primarily at Shoalwater Bay and the Townsville Field Training Area. It involved various amphibious-assault and ship-defense exercises.[107] Talisman Sabre 2011 was conducted in July of that year and was led by Australian forces. It incorporated "combined Special Forces operations, parachute drops, amphibious (marine) landings, land force maneuvers, urban and air operations and the coordinated firing of live ammunition."

Of course, not all Australian combined live wargames were conducted bilaterally with the United States. For example, Pitch Black, conducted biennially since 2006, typically drew forces from New Zealand, Singapore, and Thailand (the United States and United Kingdom have also participated in some years). While Pitch Black typically occurs in the Northern Territory, primarily at Royal Australian Air Force Bases Darwin and Tindal, in 2002 it was held on Australia's east coast, and in several years additional air bases have been opened.

These big live wargames were the most visible elements of Australia's growing capabilities, but more important in the long term may have been its innovations in defense planning. Between 2000 and 2004 Australia worked out most of the major elements of an approach to defense planning that integrated anticipation of future threats, development of technical and procedural options for countering them, and wargaming to assess the likely effectiveness of each.[108]

Elsewhere, American-style gaming was indeed becoming more universal and more sophisticated. Ireland began using wargaming at its Military College Command and Staff School. A 2002 exercise involving American and Polish forces employed both live and

constructive simulation. Perhaps most interestingly, a Swedish company built a virtual wargaming facility for the Norwegian army.[109]

Global Civilian Wargaming

During this period there were several major developments in civilian wargaming. Sales of miniatures and print and computer wargames continued to grow worldwide, in step with a global trend toward higher prosperity, connectivity, and education. But the big news was that for the first time more money was spent on recreational software in Asia than in the old leader—North America. At the forefront of Asia's growth was a phenomenal increase in online gaming in China. As of 2003 China had eighty million Internet users, fourteen million of them playing online games. While most of that software came from South Korea, China's government declared that by 2023 China would be the world's largest producer of recreational software. In 2003, little South Korea alone spent the equivalent of U.S.$3.9 billion on recreational software, as compared with seven billion in the much larger United States.[110]

The other major development was the political application of this technology—that is, the creation of games designed to convince the user of the correctness of a particular political agenda. These ranged from "Christian" video games to titles that, arguably, encouraged terrorism. The Lebanese branch of Hizbollah used an American game engine to create a first-person shooter, Special Force, that not only depicts Israelis as terrorists and war criminals but purports to "train" its users on how to attack Israelis without committing acts of terrorism. Two titles developed by a Syrian textbook publisher, Under Ash and Under Siege, were specifically designed to inculcate anti-Israeli passions in "the younger generation who no longer read newspapers but do play video games."[111]

Wargame design was also beginning to receive international recognition as an academically valid and effective discipline. In September 2003, King's College London began offering a course on conflict simulation. Taught by Professor Philip Sabin of the Department of War Studies, the course requires students to study both military and simulation material and then produce a functioning wargame. Several student projects have been published commercially.[112] Several of Professor Sabin's books, most notably *Lost Battles* and *Simulating War,* have made the case for the worldwide scholarly utility of wargaming.[113]

October 2004 saw two wargaming milestones, the Serious Games Summit in Washington, DC, and the Exploiting Commercial Games for Military Use conference in The Hague, Netherlands.[114] The objective of the Serious Games Summit was to catalyze application of technology developed for recreation to serious military and civil purposes. The conference brought together "applied gaming" providers and users from many different parts of the industry and many different parts of the world. While attending, your author read a very positive page-one notice of the summit in the *Washington Post* and

another, equally positive, in the *Congressional Quarterly*. The stature of these periodicals, the location of the conference, and the breadth of its participation all reflected how interest in the field was building.[115] Other indications included the facts that the conference's six hundred slots sold out weeks in advance and that the government of Maryland made a very visible effort at the conference to get serious-game providers to locate in that state. There is little wonder why, as sales of recreational software topped seven billion dollars in the United States the previous year, and American sales were less than half the global market. When all revenue streams are accounted for—online gaming, game-specific hardware, strategy guidebooks, etc.—computer gaming was then a twenty-billion-dollar-a-year global industry. By comparison, the previous year (2003) the U.S. military spent just over four billion on models, simulators, and wargame software and hardware.[116]

The Exploiting Commercial Games for Military Use conference in The Hague was designed to allow all NATO members to "cross-tell" their experiences with adapting commercial wargames. Progress in this area is particularly important to the new alliance members who could never afford to spend a billion dollars on a decadelong attempt like JSIMS but could find three million dollars to modify a commercial wargame in two years, as the U.S. Army did with America's Army.

By 2011, the tenth anniversary of 9/11, it seemed that if we had not reached the end of the global war on terror, we had at least reached the end of the beginning. The Serious Games Summit similarly indicated that if the divide between the worlds of defense and civilian wargaming had not closed, at least it had narrowed enough that the two communities know, respect, and support each other. Finally, The Hague conference was simply one more confirmation that wargaming, military and commercial, had indeed gone global.

Finally, near the end of this period Britain lost its unofficial dean of wargaming. Dr. Patrick "Paddy" Griffith passed away on 25 June 2010. His contributions in history, wargaming, and defense analysis would have been noteworthy even if his work in any one of those fields had been all he accomplished. But in fact, he applied wargaming to give him fresh perspective on history, applied history to envision fresh approaches to contemporary defense analysis, and applied (unclassified) defense-analysis techniques to improve civilian gaming. Yet his most important achievement may have been his work, both organizationally and in print, to facilitate the achievements of others. His influence will endure as long as free men must study war to remain free.[117]

This is the conclusion of this chapter and, in a way, of the entire history section. The next chapter offers a snapshot of wargaming "today" (late 2011 through early 2016) and primarily looks forward.

I chose 2011 as the final year of the section. Why 2011? Principally, 2011 was the two-hundredth anniversary of what is considered by many the first modern simulation wargame—that of Baron Leopold von Reisswitz. The two-hundred-year mark seems like a good spot to pause and think about the journey. Also, 2011 was something of a turning point. Early in 2011 the president of the United States, Barack Obama, made clear in a speech before the Australian parliament that there would be an increased American focus on the Asia-Pacific region. In December 2011 the final U.S. combat troops left Iraq.

So, as we come to this somewhat arbitrary spot on the road and look back along the way we came, what can we see to guide our steps on the road yet untraveled? Answering that question is a goal of chapter 6. But first it will take a look at wargaming "today" and try to anticipate likely future developments in the art, science, and practice of wargaming.

Notes

1. According to Bob Woodward, *Plan of Attack: The Definitive Account of the Decision to Invade Iraq* (New York: Simon & Schuster, 2004), p. 5, there was no "on the shelf plan" (which would have been wargamed several times as part of its development) for Afghanistan.
2. Ken "Coondog" Coons [Lt. Col.], interview, 2001. Colonel Coons personally used the simulators for mission rehearsal.
3. During the 2004 academic year most of the senior commanders of Operation Iraqi Freedom spoke at the Air Command and Staff College, where I taught. While their comments were not classified, they spoke on the condition of nonattribution—that is, comments could not be attributed to individual speakers without their specific permission.
4. Ted McKenna, "This Means War," *Journal of Electronic Defense* (December 2003).
5. Conversation with recently returned battalion commander, October 2004. He told me that wargaming has become an integral part of the planning and preparation process, from the lowest to divisional levels.
6. Daniel Flynn, e-mail, 19 May 2015. Flynn was the program's leader—Director, Global Security Program, National Intelligence Council, Office of the Director of National Intelligence.
7. Many of its functions were reassigned to the Joint Staff's J7 division.
8. See *Joint Warfare Analysis Center,* www.jwac.mil/. JFCOM's website has disappeared, but Wikipedia provides a good overview of its twelve-year history.
9. Jason Ukman, "U.S. Joint Forces Command Formally Dissolved," *Washington Post,* 4 August 2011.
10. Grover Myers, "Millennium Challenge 2002: Setting the Mark," *Joint Force Quarterly* (Winter 2002–2003), p. 25.
11. Ibid., pp. 23–29; Bruce Rolfsen, "Air Component Commander Calls War Game 'a Big Success,'" *Air Force Times,* 9 September 2002, p. 25. Both reported success.
12. Red play was constrained during some of the wargame elements as well, owing at least in part to the inability of the adjudication software to handle many of the situations Red presented.
13. Many, many e-mails over the DoD wargamer LISTSERV confirm comments made by Barney Rubel during his review of this manuscript: "Amen. I was with Van Riper during MC02 play and observed firsthand the problem with trying to combine a wargame with a field exercise. As far as I am concerned, Van Riper was right on. I interacted quite a bit with JFCOM J9 at the time and at the GO [general officer] level, the whole operation was politicized and the rank and file consisted of a bunch of retired Army colonels who all seemed to have personal agendas of one kind

or another. J9 grew explosively, with way more money being thrown at it than there were ideas for how to use it."

14. Jennifer Colaizzi, "Experimentation Director Looks Back on Tour, Reflects on What's Next for Directorate," 2 October 2004, originally available at www.jfcom.mil/.
15. Some DMSO papers remained (and may still be) accessible via Google. The successor site is at https://www.msco.mil.
16. In 2007 NSGC became the Center for Applied Strategic Learning. *Center for Applied Strategic Learning,* casl.ndu.edu.
17. Floyd Kennedy, "Experimentation: The Key to Transformation," *Undersea Warfare,* Fall 2002, originally available at www.chinfo.navy.mil/navpalib/cno/n87/usw/issue_16/experimentation.html.
18. *Army Modeling and Simulation Office,* www.ms.army.mil/. "AMSO's Mission," on the home page, is particularly informative.
19. James Allen, Edd Pyatt, and Mark Potter, "Vigilant Warriors 2002: Army Transformation War Game," *Engineer* (October–December 2002), pp. 17–18, 21.
20. Burkhart, comments.
21. Peter A. Wilson et al., *Joint Paths to the Future Force: A Report on Unified Quest 2004* (Santa Monica, CA: RAND, for the U.S. Army, 2005).
22. For more information see UQ04's unclassified executive report, "Unified Quest 2004: Win in a Complex World," *Army Capabilities Information Center,* 12 March 2015, www.arcic.army.mil/.
23. Gerry J. Gilmore, "Carlisle War Game Contemplates 'What If' Factor," American Forces Press Service, 5 May 2005.
24. Burkhart, comments.
25. This final seminar was called the "Senior Leader Forum." Senior Leader Forums I–VI (2006–2009) were led and managed by the Future Warfare Division. Key participants included General Wallace, General Keyes (USAF), Admiral Willard, Lieutenant General Curran, Lieutenant General Holder, Lieutenant General Mattis, Lieutenant General Van Riper (Ret.), and Brig. Gen. Shimon Neveah, IDF (Ret.).
26. Linda Robinson, "When the Game Is Afoot: An Army Exercise Tests Several Scenarios for Future Conflicts," *U.S. News & World Report,* 8 May 2006.
27. U.S. Army Dept., *Full Spectrum Operations: Unified Quest 2007,* TRADOC Pamphlet 525-5-300 (Fort Monroe, VA: Training and Doctrine Command, 22 April 2008) [hereafter TRADOC Pamphlet 525-5-300].
28. Karen DeYoung and Thomas E. Ricks, "Exit Strategies," *Washington Post,* 17 July 2007.
29. See TRADOC Pamphlet 525-5-300.
30. Chris Gardner, "'Unified Quest' Focuses on Future Persistent Conflict," *U.S. Army,* 7 May 2008, www.army.mil/.
31. "Today's Focus: Unified Quest 09 Results," *Stand-To!,* 15 October 2009, www.army.mil/standto/.
32. David Barno [Lt. Gen., USA (Ret.)], "A General Covers an Army War Game," *Best Defense* (blog), *Foreign Policy,* 17 May 2010, foreignpolicy.com/.
33. Dave Ross, a participant, described the capstone as "a wargame without a conflict, Kenya/Somali insurgency." It gave him enough spare time to read the Army's latest doctrine booklet.
34. U.S. Army Training and Doctrine Command, "Unified Quest 2011: Homeland Operations Wargame," YouTube video, www.youtube.com/.
35. Sydney J. Freedberg, Jr., "Tough Wargame Exposes Army Shortfalls," *Breaking Defense* (blog), AOL.com, 12 June 2012.
36. Megan Scully, "Transforming Training," *Defense News,* 8 December 2003, pp. 28–29.
37. See Ed Payne and Kevin Dietrick, "WARSIM Enters the Scene in Army Training," *Crosstalk: The Journal of Defense Software Engineering,* September 2005, and "Training for Future Conflicts," *Defense Science Board,* June 2003, www.acq.osd.mil/dsb/.
38. General Wallace was promoted on 13 October 2005; "Who Have Been TRADOC's Commanders?," *U.S. Army Training and Doctrine Command,* www.tradoc.army.mil/. He retired in 2008.
39. Andreozzi, e-mail.
40. "I hired a good man, Dave DellaVolpe, to run Wargaming and my job was to stay out of his hair. As dean, my primary function was to establish and maintain an ethical climate and obtain resources for gaming." Dean Rubel.
41. Rubel, telephone interview.
42. These two paragraphs are drawn from Dean Rubel's review of this manuscript.

43. I was one of those lucky enough to receive an offer. However, two of my mentors convinced me that the Air Force Research Laboratory needed my help more.
44. The following description of the Halsey Group is based on a short paper written for me by the faculty, a report written in July 2013 on its successor organization Halsey Alfa, and my memory of a 2005 briefing on and visit to the Halsey Group.
45. Samuel Gravely Jr. (1922–2004) was the first African American in the U.S. Navy to serve aboard a fighting ship as an officer, the first to command a Navy ship and the first to command one in combat, the first to command a fleet, and the first to become a flag officer, retiring in 1980 as a vice admiral.
46. Downes-Martin, e-mail; Rubel, comments.
47. *Wikipedia,* s.v. "Aggressor Squadron," en.wikipedia.org/.
48. My account of post-9/11 Marine wargaming is largely drawn from Simpson, "USMC Wargaming History."
49. For more information on the first EW, see Erwin, "'Expeditionary Warrior' Probes Marine-SOCOM Relationships."
50. "Expeditionary Warrior 2014: Quick Look Report" (Headquarters U.S. Marine Corps, Futures Directorate, Washington, DC, 28 March 2014), p. 1.
51. Simpson, "USMC Wargaming History, 1970s to the Early 2000s."
52. William Simpson, fact sheet and comments, provided to author, 2015.
53. Simpson, "USMC Wargaming History," pp. 6–7.
54. Walters, e-mail, 6 April 2014.
55. Paul Nichols, e-mail, April 2014. Nichols was a Marine Corps project manager; several Marines expressed similar sentiments to me.
56. Simpson, fact sheet.
57. For AF/XP, see "Wargames," Air Force Instruction 10-2305, 15 August 2003, available at www.e-publishing.af.mil/.
58. Fredrick Shiner III [Maj., USAF], e-mail, 2005. Major Shiner was a member of HQ USAF/XOXS.
59. That is, the transition between the early, "maximum-effort" days of a war and an operations tempo that can be sustained over the long haul. John Harris, comments on the manuscript, June 2015. Harris was a member of HQ USAF/A5/8.
60. Pollick, e-mail.
61. Jon Cupp, "USJFCOM Examines Key Insights from Unified Engagement 04," *United States Joint Forces Command,* 14 September 2004, originally posted at www.jfcom.mil/.
62. Rolleston, e-mail, 9 April 2015.
63. Though considered relatively small, FGs average 200–260 participants. FG05 was the most reported on; stories ran in Reuters, *National Journal and Defense News, National Journal, Nuclear Proliferation* ("Top-Secret U.S. Air Force War Game Tests Future Capabilities against Terrorism," 4 October 2005), and *Defense News* (Michael Fabey, "U.S. Air Force War Gaming Looks Out to 2025," n.d.).
64. See Jennifer D. P. Moroney and Jeffrey Engstrom, *Assessing the U.S. Air Force Unified Engagement Building Partnerships Seminars,* RAND Report DB-605-AF (Santa Monica, CA: RAND, 2011), www.rand.org/pubs/.
65. For Title 10 wargaming generally, see Mort Rolleston, "A Peek into the Future: Results of the 2007 USAF Future Capabilities Game," *Wright Stuff* 3, no. 22 (26 November 2008).
66. Harris, comments.
67. Carl Bergquist, "Air Force Wargaming Institute Hosts CSAF Wargame," *Air Education and Training Command,* www.aetc.af.mil/; Rolleston, e-mail, 10 April 2015.
68. Harris, comments.
69. Rolleston, e-mail, 10 April 2015.
70. Pollick, e-mail.
71. See Matthew Caffrey and Justin Sorice, "Integrated Decision Systems: Command and Control of the Future," *AFRL Technology Horizons,* April 2004, pp. 12–13.
72. ACE was first envisioned by Rudy Martinez, who ran the program within AFRL for almost a decade.
73. Harris, comments.
74. Drawn from material originally posted at www.amwc.af.mil/mob_ops/glomo/index.asp.
75. Daryl Mayer, "JEFX 04 Spiral 2 Deemed a Success," *AFMC Public Affairs Link,* 16 April 2004.
76. In the fall of 2003, AFAMS was under the command of Col. David "V8" Votipka.

77. In the fall of 2003, AFWI was led by Col. Craig "Brakes" Goodbrake.
78. AFWI has brought in lecturers on nonstate actors and the evolving DoD mission and structure.
79. The above two paragraphs are based on Ron Sweat [Lt. Col.], then chief of operations for the Air Force Wargaming Institute, e-mail, 1 March 2005, via Colonel Goodbrake.
80. Based on a historical video accessed 27 June 2015 at "Curtis E. LeMay Center for Doctrine Development and Education," *Air University,* www.airuniversity.af.mil/LeMay/.
81. Mo contributed to the development of the military edition and two subsequent commercial releases (War over Vietnam, published 2004, and War over the Mideast, published 2009). Lt. Col. Gary "Mo" Morgan, USAF (Ret.), passed away in 2013, a great loss to the military and commercial wargaming communities.
82. See "Press Release" (announcing the winner of the Nobel Prize for economic sciences), Nobelprize.org, 9 October 2002.
83. Michael Peck, "Successful War Games Combine Both Civilian and Military Traits," *National Defense,* November 2003, pp. 24, 26–27, reviews arguments for and against the DoD use of commercial wargames and describes related initiatives.
84. "Military Training Is Just a Game," *Wired News,* 3 October 2003.
85. "The 16th Cavalry Regiment at Fort Knox commissioned the development of TacOpsCav v3 and v4 and a distribution license for the Department of the Army with a contract on 28 September 2000. TacOpsCav v3 was delivered in November of 2000. TacOpsCav v4 was delivered in January of 2002. TacOpsCav was widely distributed by the Armor School at Fort Knox and by peer to peer transfer. NAVAIR and MARCORSYSCOM [Naval Air Systems Command, Marine Corps Systems Command] commissioned the development of TacOpsMC v4 and v5 and a distribution license for the Department of the Navy. TacOpsMC v4 was delivered in March of 2003. TacOpsMC v5 was delivered in February 2004. TacOpsMC v5 is now one part of 'The Marine Corps Tactical Decision Making Simulations Tool Kit.'" Holdridge, e-mail.
86. Mark Herman, comments, Serious Games Summit, 18–19 October 2004, and e-mail.
87. Card-driven print wargames put instructions for some game functions on cards that, when drawn from a deck, initiate those functions. This technique, which allows users to start playing sooner, has since been used by several other designers.
88. Sharon Berry, "Far-Reaching Scenario Reflects Changing World," *Signal,* September 2003, pp. 73–76.
89. Andreozzi, e-mail.
90. Jack Dorsey, "NATO Leaders in Suffolk to Test New Force Concept," *Virginian-Pilot,* 23 January 2004.
91. See Patrick Rose and Colin Marston, "From Operational Research to Operational Planning: Shaping the NATO Plan for Afghanistan," *IFORS News,* March 2013.
92. For more on PSOM and Dstl's work developing it, see Brian Clegg, "Shaping Peace Support Operations in Afghanistan (2011)," *Impact,* March 2015. For *much* more on PSOM, see "The Peace Support Operations Model: Stabilization Strategy," special issue, *Journal of Defense Modeling and Simulation: Applications, Methodology, Technology,* April 2011.
93. Colin Marston, e-mail, 13 February 2015.
94. Col. Rand P. Miller, "USAF/RAF Strategic Air Staff Exchange Program Update" (briefing, n.d.) (Colonel Miller was a member of the USAF Directorate of the Royal Air Force's Air Staff); Simon Kippin and Wing Commander Gerry Doyle, manuscript comments, 27 March 2015 (both of the RAF).
95. Pearce, briefing to Connections UK 2014.
96. Higgins, e-mail.
97. "Canadian Forces MAD-II Exercise: Summary and Feedback," n.p., n.d.
98. Cheng, "People's Liberation Army on Wargaming."
99. See Hawkins, "Chinese War Termination Calculus."
100. Ibid., p. 24.
101. Mason, e-mail, 27 January 2015. The majority of this information on Australian defense wargaming is drawn from e-mails from, and papers (such as "War Gaming in the Australian Army") by Todd Mason, a longtime practitioner in that country.
102. This is a very condensed version of the situation described to me in ibid.

103. Ibid.

104. Talisman Sabre was meant to combine elements of previous exercises Tandem Thrust, Kingfisher, and Crocodile. There have been many articles on Talisman Sabre over the years but the only source for its origin seems to be *Wikipedia,* s.v. "Exercise Talisman Sabre," en.wikipedia.org/.

105. No article on the center seems to have adequate depth, but the most informative is "Joint Combined Training Centre (JCTC)," *Nautilus Institute for Security and Sustainability,* nautilus.org/.

106. *Calytrix Technologies,* www.calytrix.com. Calytrix is the principal support contractor.

107. In 2009 Australia discontinued funding development of Janus(AS). Nevertheless, Janus(AS) has continued in use up to the time of this writing.

108. C. van Antwerpen and D. K. Bowley, "An Australian Approach to Concept Development and Experimentation: Linking Strategy with Capability," *Journal of the Operational Research Society* 63, no. 2 (2012), pp. 278–92.

109. Examples from McKenna, "This Means War."

110. Most of the above information is from a briefing given by Jason Robar, "An Introduction to Computer Wargames" (presentation, Connections Conference, Colorado Springs, CO, 24 August 2004).

111. Ibid.

112. *King's College London,* https://www.kcl.ac.uk/sspp/departments/warstudies/people/professors/sabin/consim.aspx.

113. Philip Sabin, *Lost Battles: Reconstructing the Great Clashes of the Ancient World* (New York: Continuum, 2008); Sabin, *Simulating War: Studying Conflict through Simulation Games* (London: Continuum, 2012; repr. London: Bloomsbury Academic, 2014).

114. Jose Antonio Vargas, "For Game Makers, a Serious Concern," *Washington Post,* 18 October 2004, p. 1.

115. Roger D. Smith, *Military Simulation & Serious Games* (Orlando, FL: Modelbenders, 2009), is a broad overview of the movement toward serious gaming.

116. Vargas, "For Game Makers, a Serious Concern."

117. John Curry, "Paddy Griffith Obituary," *Simulation and Gaming Journal* (December 2010), was one of the publication's most downloaded articles in 2011 and was republished in an academic gaming journal.

CHAPTER SIX

Wargaming in Transition
2012–2016 and Beyond

Predictions are hard, especially about the future.

OFTEN ATTRIBUTED TO YOGI BERRA

I was originally going to call this chapter "Wargaming Today." Then I remembered a book I had seen in a used-book store in Normal, Illinois. The book was on the history of Japan. It was organized into five sections, each with five chapters. The final section was titled "Japan Today." One of that section's chapters was called "Formosa, Japan's Tropical Paradise." The book had been written in 1927—not quite "today."

The problem with all books ending at "today" is that even on the way to the printers, the material written stops being "today." So instead I will provide some thoughts on where wargaming may be going. As it is hard to know where you are going if you do not know where you are, I'll start by describing some (currently) recent developments and take stock of where wargaming is at the time of writing (2016, with some updates into late 2017). Next, as we have seen that advances in wargaming have required motive and opportunity, I will examine first what factors may now motivate the evolution of wargaming and then examine factors that may make that evolution feasible. In the conclusion of this chapter I will describe some of the wargaming developments I deem likely in the near term. Finally, in the overall conclusion of this book I will propose some directions in which we may want to nudge the evolution of wargaming.

A Snapshot of Contemporary Wargaming, 2012–2016

Before we begin, I need to confess that the picture I will paint will not be complete. The closer to 2017 a development occurred, the more likely at least some of the information will be classified, "close hold," or both. As you saw in previous chapters, information on some wargames was not in the public domain until decades after the fact. Also, very recent developments, even in the commercial and academic fields, may simply not have

been published yet. Finally, I'm sure I will miss some available information. That said, let's start with wargaming in the nation that in 2016 led the world in most of its aspects.

Wargaming in the United States

Any doubt that wargaming was in a period of transition during this period was eliminated by three memorandums from the Office of the Secretary of Defense (see appendix E). The subject of the first was "The Defense Innovation Initiative." Dated 15 November 2014 and signed by the secretary of defense, this two-page memo announced a broad spectrum of initiatives to accelerate effective innovation throughout the U.S. defense establishment. The third of six main points stated, "A reinvigorated wargaming effort will develop and test alternative ways of achieving our strategic objectives and help us think more clearly about the future security environment."

The second memo was released 9 February 2015 and was signed by Robert Work, the deputy secretary of defense. The subject was "Wargaming and Innovation," and it began by declaring that the department's wargaming abilities had "atrophied." It went on to argue the importance of reversing that atrophy: wargaming could "potentially make the difference between wise and unwise investment trajectories and make our forces more successful in future conflicts." The memo described several major initiatives and outlined how they would be implemented. The initiatives included a four-star summit on reinvigorating wargaming.

The third was released 8 May 2015, again signed by Deputy Secretary Work. The memo began by describing the current critical period and by asserting that wargaming is an important aid for making sound decisions and spurring effective innovation. Mr. Work then described the purpose of the Wargaming Summit that he and the vice chairman of the Joint Chiefs of Staff, Adm. James A. Winnefeld Jr., had cochaired on 23 April 2015, to align the wargaming "enterprise" more closely with DoD decision making. The memo then laid out the resulting sets of tasks.

First, because you can't determine what you need until you know what you have, the third memo directed the Cost Assessment and Program Evaluation (CAPE) office in the Office of the Secretary of Defense to create a wargaming repository to be populated with game capacity, capability, and insights from across the enterprise. Gaps were to be identified and mitigation options prioritized. Second, the Joint Staff and the Office of the Secretary of Defense offices of Policy, CAPE, and Net Assessment would review all findings and report findings as appropriate to senior leadership. Third, leaders from the Joint Staff, Policy, CAPE, and OSD/NA were to serve as "quad chairs" of a Defense Wargaming Alignment Group, to align wargaming with leadership's priorities and promote dissemination of game information. Fourth, Policy and CAPE would conduct

wargames exploring capacity and capability options, as well as possible risks and solutions. Fifth, the wargaming quad chairs would develop a senior wargame series and strive to make wargaming a standard element of the play-review process again. Secretary Work concluded with a list of other high-level meetings he was convening and a pledge to stay engaged in wargaming improvement.

If we judge by this series of memos, calling this a period of "transition" may be too mild. Earlier chapters of this book reported on service and combatant-command wargaming but little that was truly U.S. defense wargaming. Grassroots bodies such as Connections and the Military Operations Research Society tried to build a U.S. wargame community but with small-scale success. These memos evoked a "wargaming enterprise" and initiated structures and processes to make it a reality.

A second "transition" in early 2015 was also more major than that mild word implies. For the first time since its establishment during the presidency of Richard Nixon, the Office of Net Assessment was not led by Andy Marshall. Andrew Marshall was ninety-three when he retired on 2 January 2015. Working directly for the secretary of defense, Mr. Marshall and his small staff of about a dozen had a huge but hard-to-document impact. He was called the second-most-powerful man in the Pentagon by many; most of his writings are still classified. Perhaps the highest praise came from outside the United States. In an interview with *The Economist* in 2012, Gen. Chen Zhou, author of several Chinese defense white papers, recalled, "Our great hero was Andy Marshall in the Pentagon. We translated every [unclassified?] word he wrote."[1]

Deputy Secretary Work reached out to the wargame community. He agreed to speak to Connections 2015, at the National Defense University. Though in the event the talk was given by his speechwriter, his expressed support contributed to an all-time Connections participation record at 171 individuals physically attending (with others participating online). He also encouraged MORS to hold a special wargame workshop. In the spring of 2016 (15–18 March) Secretary Work called the first DoD Analytical Wargaming Workshop. Called the "practitioners summit" by many, the event was led by OSD/CAPE and hosted by the Army War College.[2] That done, Mr. Work helped fund, and then addressed, a second MORS-run special wargame workshop. By paying for the registration of American defense personnel and speaking (not necessarily in that order of importance) he encouraged a record turnout for a MORS special event: over 260 professionals from six nations. As important was that the workshop produced a ninety-five-page final report that could be used as a text for defense wargaming.[3]

During this period OSD/CAPE also began using wargames internally. It started by hiring Dr. Jon Compton. To communicate the contribution wargaming can make to an organization with a long history of sophisticated operations research, Dr. Compton

wrote a paper, "Analytical Wargame."[4] He then founded CAPE's wargaming team, the Complex Problems Shop. His team provided wargame services throughout CAPE, incorporating wargaming as one element of "soup to nuts" research programs. The team and its process gained a lot of favorable recognition within OSD and some of the combatant-command staffs.[5]

The Joint Community. The wargaming office that arguably occupies the next-highest position on the U.S. military's organization chart is the Joint Staff's Studies, Analysis and Gaming Division.[6] SAGD has evolved in recent years. While its dozen professionals (roughly three-quarters of them operations researchers, the rest political scientists) continue to conduct highly classified and (often very) "close hold" pol-mil wargames, they now conduct a spectrum of games, recently a few not classified at all.

The best known of their new types of wargames is the chairman of the Joint Chiefs of Staff (CJCS) Strategic Seminar Series. Started in 2012 by the CJCS, Gen. Martin E. Dempsey, these one-day games quickly produced insights that were briefed by General Dempsey to the president. Held four times in 2012, these games bring together the service chiefs and the combatant commanders to look at challenges that seem plausible roughly five years into the future. In so doing these wargames close a "seam" in defense wargaming. Services, headed by four-star generals or admirals, organize, train, and equip their forces. Combatant commanders (COCOMs), also led (typically) by four-star officers, employ the forces of all services (i.e., joint forces) in both war and military operations other than war. As the research, development, acquisition, and fielding of a new weapon system can take decades, the services attempt to anticipate threats and opportunities decades into the future. But the combatant commands may have to go to war tomorrow; they prefer to look no farther than two years out. These games are conducted in a way with which Field Marshal Bernard Montgomery would have been familiar, all participants discussing likely Red actions, likely Blue responses, and likely net outcomes.[7]

Since 2011 the Joint Staff has added a second wargame unit, the Joint Wargames Division (JWD) within the Joint Force Development Directorate (J7). The JWD runs the "Chairman's Joint Wargame," Iron Crucible. Set in the near future (five or six years hence) and using global scenarios that involve more than one combatant command, Iron Crucible is designed to explore joint concepts and operational-level issues.

Iron Crucible 2014 was concerned with "global agility" and "flexible joint command and control." It was held 5–9 May at Joint Base Andrews, just outside Washington, DC. There were 116 players and 127 control and support personnel. Thirty-four American organizations participated; the United Kingdom, Australia, and Canada sent observers. The Blue team included nine two-star officers or civilian equivalents, while in

adjudication were two retired four-star and two retired three-star generals.[8] Of course, the findings went to the CJCS.

The Joint Staff also does a lot of ad hoc games, in response to "pop-up" queries. Some meet needs of the Joint Staff itself and COCOMs, under J8's "force structure, resources, assessment" mandate, especially where computer models and analytical processes have gaps to fill. Every four years SAGD and the other Joint Staff wargame elements put a great deal of effort into supporting the Quadrennial Defense Review. Also, owing to its long-standing expertise in running top-secret pol-mil wargames, it has been called on also to do unclassified ones in support of "the interagency." (In one recent development, during the Pentagon's renovation SAGD moved from its perennial basement home to the "mezzanine." Though still below the first floor, the new spaces *are* above, and no longer look like, the basement.)

J8's Warfighting Analysis Division conducts wargames too. This small office works with high-end simulations in what are often called "analytical" games. Analytical wargames are typically computer based and are often used for "sensitivity analysis"—that is, change one element of Blue or Red strategy or equipment and then run the game over and over again to see what difference it would likely make.

Looking back on the wargaming of the OSD and Joint Staff, we know relatively few of the individuals who made a difference. Vincent Roske made a critical difference for years. Maj. Roy "R2" Rice had an important impact at a critical time. Few others are known beyond their community—but they know the difference they made.

It is a tough call as to which wargames are at the next higher level, as the U.S. military has a dual organizational structure. Given their different concerns, as we saw above, the services and the joint community have evolved very different wargames. Let's look at the services first. At the highest level are the Title 10 games (see chapter 4). Service chiefs take very active roles in the planning, execution, and aftermaths of these wargames. They typically attract between two and twelve hundred participants, principally from the sponsoring service but all other services too, as well as other government agencies. A few Title 10 wargames have been "United States only," but close allies are often represented, less often a spectrum of friendly nations, and once as many as fifty-one.[9] Each service also conducts smaller wargames, below the Title 10 level. Such games may help prepare for a Title 10 event, directly support the needs of the sponsoring organization, or both. However, each service conducts these games in its own ways. Each service has also continued to apply wargaming in the military education and training systems.

The joint community's games emphasize evaluation and rehearsal of near-term plans, as well as joint education and training. The Joint Chiefs of Staff, their chairman, and the Joint Staff provide guidance for these wargames. Most joint games are actually

conducted by the combatant commanders. Within the U.S. military there are six geographic commands and three functional commands. The geographic commands are (at the time of writing)

U.S. Africa Command (USAFRICOM),

U.S. Central Command (USCENTCOM),

U.S. European Command (USEUCOM),

U.S. Northern Command (USNORTHCOM),

U.S. Pacific Command (USPACOM), and

U.S. Southern Command (USSOUTHCOM).

Each is responsible for joint (multiservice) training and operations in its assigned geographic "area of responsibility." The functional commands are

U.S. Special Operations Command (USSOCOM),

U.S. Strategic Command (USSTRATCOM), and

U.S. Transportation Command (USTRANSCOM).

Each is responsible for performing a specific function globally. For example, USTRANSCOM provides strategic lift (via air, sea, or land) worldwide.

Two principal documents tell the COCOMs what wargames they are to conduct. The first is the Joint Strategic Capabilities Plan. This classified document tells each combatant command what contingencies it is to prepare to address.[10] For each the COCOM either updates an existing plan or creates a new one. Wargames are conducted at two points in this process. First, after a small strategy cell develops (typically) three alternative strategies, courses of action, the team conducts a fast, informal wargame of each. The outcome becomes the principal basis on which a single COA is recommended to the combatant commander. The COA selected, and often modified, by the combatant commander is then developed by his or her (the commander of Northern Command, as this is prepared for press, is Gen. Lori J. Robinson, USAF) own joint staff into a draft plan. When the draft plan is fairly complete, a second, much larger wargame is conducted to look for errors and gaps.

The second document is the annual plan for CJCS's Exercise Program. This program is the chairman's principal vehicle for joint and multinational training. Many listed exercises involve the militaries of friendly nations and are also tools for strengthening international cooperation. A fraction of these exercises are also wargames. An exercise in the program preparing for a humanitarian mission is not a wargame: no armed opposition is anticipated. When the required exercise prepares for an armed conflict,

the COCOM "stands up" a Red cell to play likely adversary responses to Blue actions and an adjudication cell to estimate the net effects of Blue and Red actions. In short, the exercise becomes a wargame. In some cases the timing is such that the exercise can contribute to a JSCP-required new or updated plan.

Some joint commands conduct wargames not called for by JSCP. For example, as we have seen, USSTRATCOM, in conjunction with the Naval War College, conducts DEGRE (Deterrence and Escalation Game and Review), an operational/strategic-level game on escalation dynamics when approaching or crossing the nuclear threshold. Also, USSOCOM, which has "organize, train, and equip" responsibilities similar to those of a service, conducts a Title 10–like game, Shadow Warrior, annually. Shadow Warrior 2014's capstone was held 26 October through 6 November, with participants from across the U.S. government as well as international partners. The purpose was to explore unconventional warfare (specifically, supporting insurgents) as a strategic policy option.[11]

Most COCOMs have a dedicated wargaming/exercise center. For example, the Warrior Preparation Center supports U.S. European Command. U.S. Special Operations Command has the newest, most futuristic wargaming facility.[12] U.S. Pacific Command has two, the Pacific Warfighting Center in Hawaii and the Korean Air Simulation Center.[13]

The chairman is also responsible for education and training in joint functions. Joint education is conducted through the Joint Flag Officers Course, National Defense University (specifically the Joint Forces Staff College), and service schools—wargaming plays a role in all. The seniormost program is the Joint Flag Officers Course, which officers are selected to attend on being chosen to receive second stars. They are selected on the basis of whether they can be expected to command joint forces in the future. Many students go on to become joint force commanders and members of the Joint Staff. Roughly half of the two-week course is a wargame. The National Defense University is the senior service school for all likely candidates for joint assignments. Many members of the Joint Staff are NDU alumni. NDU's Center for Applied Strategic Learning runs wargames for NDU's core curriculum and electives. The Joint Forces Staff College, the "phase two" school for officers bound for joint jobs, offers a spectrum of courses, each designed to prepare students for a different type of joint position. Operational-level games are key elements of most of the courses. "Phase one" of joint training is received at the service school, through core curricula and electives. The most prominent joint elective is still JLASS (see chapters 3 and 4).

Even fewer names are known from wargaming in the combatant commands—only Col. Gary Ware, USAF, and he because of the Gulf War. Due to the often-classified nature of

their work they are seldom known beyond their circle of colleagues and the commanders who have come to rely on the insights they provide.

The Air Force. The Air Force has continued to conduct two "standing" Title 10 wargames, one set typically ten to twelve years in the future, the other typically twenty to twenty-four. The Air Force Chief of Staff establishes each wargame and designates a Deputy Chief of Staff as "executive agent," who in turn designates a directorate and a division for planning and execution. Headquarters, Air Force's Directorate of Plans and Requirements until recently conducted the Air Force's "midterm" wargame, Unified Engagement, which we introduced and brought up through 2011 in chapter 5. Since 2006 its location has alternated between Europe and the Pacific. This is done to involve Air Force major commands directly that would have to fight and to secure joint theater-warfighter participation and insights.[14] In 2016 the Air Force's midterm Title 10 wargame returned to its original name, Global Engagement.

During most of this period Headquarters, Air Force's Directorate of Strategic Plans and Programs was the executive agent for the other Air Force Title 10 wargame, the Air Force Future Capabilities Wargame—Futures Game for short or FG for still shorter. (See chapters 4 and 5 for the earlier FGs.) It is still set in the "far-term" future, twenty to twenty-four years from the year conducted; for example, Futures Game 2015 was set in 2035.

Unified Engagement 2012's capstone game was held 3–14 December 2012 at the Edelweiss Conference Center, Germany, after twenty pregame events extending over eighteen months. More than 360 military and civilian representatives from the United States, the United Kingdom, Canada, Australia, Germany, France, Denmark, and the Netherlands participated. The nearly two years of effort gave its cyber warfare play in particular scope and credibility beyond that of previous Unified Engagements.[15] Concepts explored included AirSea Battle, operational access, integrated air and missile defense, and strategic capabilities. Perhaps most interesting were the implications of having a single air commander support two combatant commanders.[16]

In 2013 the Futures Game's full name, which for a while had been reduced to those two words, returned to something similar to its original, longer one, but most continued to refer to it as "FG." The capstone of what was properly *Air Force Future Capabilities Wargame 2013* was held at Maxwell AFB from 10 to 15 March.[17] Its two hundred–plus participants represented all U.S. services, the Department of Defense and Joint Staff, the intelligence community, and our British, Australian, and Canadian allies. Objectives included examination of basing, countering missiles, execution speed, and threats to airpower. The scenario was set in 2032, in the U.S. Pacific Command area of responsibility, and it involved coping with a Red antiaccess/area-denial (A2/AD) strategy.

On 6 October 2014, as part of an overall headquarters reorganization, the two Air Force Title 10 wargaming executive agents merged into one directorate, AF/A5/8. Thereafter both Air Force Title 10 games were executed by a single division, the Wargaming Division (A5SW). The future-force and operational-concepts strengths remained mostly intact, but after Unified Engagement 2014 and Futures Game 2015, headquarters wargaming would directly serve the new Air Force Strategy, Planning, and Programming Process and operate in close partnership with other Air Force wargaming centers.

The capstone of *Air Force Future Capabilities Wargame 2015* was held during March at Maxwell. The 230-plus participants again came from across the U.S. services and government as well as from the United Kingdom, Australia, and Canada. The scenario was very similar to that of FG13, with intelligence projections extended to 2035. As is the norm for FGs, there were two cost-neutral Blue teams—that is, the alternative force had fifteen potential future systems added and an equal cost in programmed forces subtracted. Objectives again were basing and missile defense, as well as long-range operations and autonomy.

With *Global Engagement 2016,* the Air Force's midterm Title 10 wargame reverted to its original name. Once again the actual game was the culmination of many preparatory events. The capstone, held 10–13 September at the Warrior Preparation Center in Germany, had nearly three hundred participants from across the Air Force, the other services, combatant commands, the intelligence community, Australia, Canada, the United Kingdom, and several American defense-related organizations. They focused on operational agility.

When the secretary of defense and deputy secretary issued the memorandums we examined above, the Air Staff, partly in response, expanded its wargaming repertoire. For example, A5SW designed, developed, and provided the capabilities to execute a wargame campaign in support of an enterprise capability collaboration team on future air superiority. The culminating wargame was held 25–29 January 2016 at LCWI. The Plan Blue game series was another initiative, a recurring forum for senior Air Force leaders to develop and refine strategies and concepts of operations. The focus of Plan Blue 2016, closely supported by RAND Project Air Force, was on basing, antiaccess / area denial, and escalation-risk management. Actually, there were two wargames: one for O-6s (colonels) was held in April 2016, both to test the game play and generate insight; the all-general/flag game was held 9–13 May.

Finally, A5SW demonstrated a capability to develop and execute a number of smaller, highly focused "quick turn" wargame–type events that meet specific requirements. These have been collectively dubbed the "Agile" series, in Headquarters, U.S. Air Force lexicon.

It is clear this was a time of transition and opportunity, both at and below the headquarters level. The Air Force itself is organized into "major commands." Most have functional responsibilities (Air Force Space Command, or AFSPC, is responsible for space; Air Mobility Command is responsible for the air transport of forces and for aerial refueling). A few have geographic responsibilities (e.g., Pacific Air Forces, or PACAF, is responsible for the Pacific region). Most functional major commands conduct annual or biennial wargames covering all areas of warfare but primarily anticipating future needs and opportunities in respective missions or areas of responsibility. Here are thumbnail descriptions of each.

The mission of *Air Combat Command* (ACC) is to provide Air Force component units for U.S. Central Command, Southern Command, Northern Command, and Strategic Command. Accordingly, ACC wargames are primarily for training. They also provide expertise on combat air forces to both Air Force Title 10 games. ACC's best-known live wargame is Red Flag (see chapters 3–5), but it is just one of several "flag" wargames. The next best known is Blue Flag, which trains participants to fight at the operational/theater level.

The *Air Education and Training Command* recruits, trains, and educates airmen to deliver airpower for America. The command's wargame element is the LeMay Center Wargaming Institute, whose mission is to provide wargame support to courses offered by Air University, including the Air War College, Air Command and Staff College, Squadron Officer College, Commanders' Professional Development School, and the Air Force Judge Advocate General's School. LCWI also hosts the Air Force's far-term Title 10 wargame and Air Force Space Command's Schriever wargame, as well as supporting games for allied nations.

LCWI undertook a transformational effort starting August 2013 aimed at delivering the full spectrum of wargame content and technological capacity envisioned in LCWI's 1983 charter. On the wargame front, the emphasis has been on exporting "tradecraft" to operational clients in addition to educational wargames to PME schools. Recent successes include clients from PACAF, Global Strike Command, Eighteenth Air Force, and the Air Force Research Laboratory. These events range from hosting games or tabletop exercises to "turnkey" operations involving game design, scenario development, technical support, and postevent analysis. On the technology front, a major effort has been under way to distribute wargaming tools via the Air Force's unclassified network. A number of clients already use LCWI's wargaming "Gateway" to utilize these tools. Additionally, LCWI is updating its classified wargaming network with the same suite of tools.

With the recent emphasis on wargaming by the former secretary of defense, the future looks very bright. In April 2015, AFWI hosted a SecDef (secretary of defense) Defense

Innovation Initiative, where a number of clients tested technologies and concepts that could be strategic "game changers." According to Col. Walter H. Ward Jr., LCWI's director, speaking in 2015, "The creativity and imagination of American Airmen have always been the engine of innovation, but the growth of wargaming tradecraft will bring those ideas to life faster and change the equation of time in our favor where adversaries will now be trying to adapt and keep pace with us . . . [which is] as it should be."

LCWI's tools include the SIMWAR engine, a discrete-event combat-simulation system. It was designed to support the Air University schools in teaching combat doctrine. It allows instructors to define scenarios that support specific educational goals. LCWI is currently (2017) evaluating Joint Theater Level Simulation–Global Operations as a replacement to SIMWAR.

The *Air Force Global Strike Command* (AFGSC) develops and provides combat-ready forces for nuclear deterrence and global strike. AFGSC's wargame branch supports wargames at the OSD, service, and major-command levels, ensuring the accurate depiction of nuclear or global-strike forces through all phases of conflict. In 2013, AFGSC hosted and executed its first command wargame, Strategic Vigilance. Held biennially for operational-level planning, its findings are briefed to the AFGSC senior staff and entered into the DoD Wargame Repository for wide dissemination. A companion game to Strategic Vigilance is USSTRATCOM's Deterrence and Escalation Game and Review, which considers strategic-level planning of nuclear and other national-level assets.[18]

It is the *Air Force Materiel Command* (AFMC) that conducts the research, development, testing, evaluation, acquisition management, and logistics support necessary to keep the service's weapon systems ready for war. Its wargame branch supports Air Force Title 10 wargames by ensuring that theater impacts of weapons are faithfully represented and assessing the technical and cost plausibility of any depicted future system. AFMC also leads the Agile Combat Support / Science and Technology Wargame / Alternate Force Workshop (held every other year at LCWI), both in the preparation for the Futures Game and for its own use.

The creation of the Agile Combat Support / Science and Technology Wargame / Alternate Force Workshop required three organizations to join forces. In 2011 Simon Kippin of the Royal Air Force was finding it difficult to assemble sufficient resources to continue the RAF's Future Air and Space Operating Concepts game (see chapter 5). At the same time the author was trying to find sufficient resources to maintain a similar game conducted by AFRL and initiate another to serve AFMC's interests. Meeting at a Futures Game preparatory event, we realized that by conducting the game together we could achieve a "critical mass."

The first AFMC wargame was held in 2012 at Maxwell and drew fifty-two participants from across the U.S. Air Force, the Royal Air Force, and the U.S. Navy. It explored forty American and a dozen British concepts and tried new methods of adjudicating the impact of "agile combat support." The second AFMC game, held in 2014 also at Maxwell, with eighty participants from all U.S. services as well as the air forces of the United Kingdom, Canada, and Australia, explored fifty-two American and nineteen British concepts. Also, AFMC partnered with the Air Mobility Command to expand its GLOMO workshop/wargame to depict more fully the challenges of deploying forces into forward bases, especially in an A2/AD environment. In 2016 AFMC held the first, groundbreaking Long Duration Logistics Wargame. Eighty participants over nine days extended wargame play a full six months into the conflict, generating insights into the logistical and infrastructure status of U.S. forces after six months of warfare. These insights were of direct interest to AFMC and contributed to those produced by the Air Force's Global Engagement 2016.[19]

The *Air Force Reserve Command* provides combat-ready units for active duty whenever there are not enough trained units in the regular component of the Air Force to perform a national-security mission. Individual reservists are often called up to meet the workload of large wargames, but there seems to be no command role in gaming.

The *Air Force Space Command,* as we've seen, is devoted to the development and operation of military space and cyberspace technologies. AFSPC's wargame branch supports Title 10 games by ensuring that Blue, Red, and Gray (neutral) play in the space and cyber domains is authentic. AFSPC also leads the Schriever wargame (see chapters 4 and 5), both, again, in preparation for the midterm Title 10 game and to generate insights of relevance across the U.S. space and cyber communities and specifically for AFSPC itself.

The *Air Force Special Operations Command* provides Air Force component units for the U.S. Special Operations Command. Its wargame branch primarily supports USSOCOM gaming and the two Air Force Title 10 wargames.

The wargame branch of the *Air Mobility Command* (AMC), whose mission we mentioned above, provides global air mobility through airlift and aerial refueling for all of the U.S. armed forces. AMC supports both Air Force Title 10 games. It also conducts an internal event, the Global Mobility Exercise (see chapter 5). In 2014 GLOMO was jointly hosted by AMC and AFMC and its scope was expanded from examining strategic mobility to include basing at forces' forward destinations. This more comprehensive look at the challenges of deploying forward required the participation to increase from typically fifty to seventy.

The mission of *Pacific Air Forces* is to supply Air Force components for the U.S. Pacific Command. PACAF's wargaming primarily supports USPACOM gaming. However, when Unified Endeavor is held in the Pacific, PACAF is heavily involved.

U.S. Air Forces in Europe provides Air Force units to the U.S. European Command, and its gamers primarily support USEUCOM, except when Global Engagement is held in Europe.

The Air Force, of course, also uses games to educate and train. Educational wargames are under the direction of the Air Education and Training Command and are predominantly run at the LeMay Center Wargaming Institute for Air University (see chapters 3–5), although the university's schools sometimes create or contract for their own games. Air Force wargames used for advanced training come under the Air Combat Command: Red Flag, Blue Flag (chapters 3 and 4), and Virtual Flag (chapter 5). This period also saw the final Joint Expeditionary Force Experiment, in 2012. (It was disestablished in 2013 with the closure of the Air Force Command and Control Integration Center.)[20] It is clear that from George Kenney (as a captain, later as a general) to Col. Richard "Moody" Suter, to Col. Dean Pappas, and to Gary "Mo" Morgan (as a captain, later lieutenant colonel), the Air Force has had a long history of wargame innovation.

The Navy. Perhaps more than any other service, the Navy has experienced transition in wargaming in this period. During the summer of 2014, Dean Robert Rubel, who had been, as we've seen, the enabler of wargaming success at the College for over a decade, retired. While missed, he had built and nurtured a strong team who continued to innovate after his departure.

Naval wargaming as a whole, in fact, had achieved many successes. The U.S. Navy entered this time of transition with a more appropriate menu of wargame activities than any other American service. It continues to be conducted principally at the Naval War College, by its War Gaming Department. It was perhaps the wargaming department most ready for the transition toward conventional war against a roughly equal adversary, yet it continues to explore the types of highly asymmetric threats that have not gone away.

The Navy's resurrected Title 10 wargame, the Global War Game (sometimes now called Navy Global), continues to explore whatever issues are most pressing to the Navy's senior uniformed officer, the Chief of Naval Operations. In all cases the CNO's "executive agent" is, as it has been, the College's War Gaming Department. As have all of them since the first in 1979, Global continues to be held there. During Global 2012 over two hundred participants explored command and control while commanding forces in

multiple domains against a "net peer."[21] The game indicated that then-current C2 structures were inadequate for cross-domain operations at the operational level.

Global 2013 explored three options for commanding such operations better. Informed by two pregame workshops that explored first hardware and then procedural options, the seventy-two players split into three teams, each employing one of the options. For example, one team played "Domain [surface, subsurface, etc.] Commanders," another "Cross-Domain Commanders." Red play was a preplanned series of vignettes, all featuring high-stress A2/AD environments. Insights were reported to nineteen American and international flag and general officers.[22]

By 2014 there was a draft concept for command and control of cross-domain forces in an A2/AD environment. The need was to explore and refine it. In early September over eighty individuals from all U.S. services and those of Australia, Canada, Japan, and the United Kingdom participated in Global 2014 at the Naval War College's wargame center.[23] The results argued a need for commanders of not only cyber and space domains but of logistics forces as well. Finally, the postgame analysis concluded, successful implementation would require education, training, and practice.[24] During 2015 and 2016, Global continued to explore challenges faced by our Pacific Fleet. Instead of single large annual wargames they each comprised several smaller games, four in 2015 and three in 2016. As all these games were run at the top-secret level, little information was released.[25]

Games are also conducted at the request of the Navy's "communities"—surface, subsurface, and air. Many of these are run by the War Gaming Department, others by the College's Strategic and Operational Research Department or defense contractors, such as the Center for Defense Analyses. The Naval War College has expanded its internal wargames that both educate students and generate insights for decision makers (see the previous chapter). These now include several Special Advanced Research Programs: *Halsey Alfa,* which examines potential near-future air/sea warfare in the Pacific theater, is one of the seminars into which the original Halsey Group was subdivided (see chapter 5). It still may be the most successful, with influence that may be second only to Global's. *Halsey Bravo* now focuses on potential near-future naval and air combat in the U.S. Central Command area of responsibility. The *Gravely Group,* led by Dr. William F. "Will" Bundy, still concerns itself with ballistic missile defense and conflict avoidance, as well as integration of air and missile defense. In 2013, Japanese students attending the Naval War College joined the group. The *Mahan Scholars* seminar explores nuclear deterrence and escalation; its work is classified top secret. Its faculty leader, Dr. Stephen Downes-Martin, developed many innovative techniques for analyzing how decisions are

made, by both players and adjudicators. Dr. Downes-Martin retired on 31 March 2015, but his techniques are now applied across the Naval War College.

Wargaming also supports the Navy's education and training missions, beyond the College. It is part of the curriculum at the Naval Academy, in Annapolis, Maryland, as well as of the senior and intermediate courses at the Naval War College. A wargame, for example, is the capstone event of the core curriculum's Joint Military Operations trimester. Wargaming also supports several elements of naval training. Best known are the live wargame elements such as Top Gun, but ships' crews often participate in games set in what will soon be their deployment areas, from on board their ships, alongside the pier.

Finally, wargames, particularly at the Naval War College, continue to provide a benefit that is often overlooked yet is important and likely to become more so in the coming years—socialization. Naval War College wargames have fostered maritime cooperation among the world's navies, improved cooperation between the Navy and the Department of Homeland Security, and helped raise cooperation between the American, Canadian, and Mexican navies to a new level.

Looking forward, the War Gaming Department faculty foresees the need of and opportunity for still greater contributions from gaming. In the near term, the department plans to focus more on the human decision-making process as was advocated by Professor Downes-Martin.[26] Not neglecting technology, it is developing software that will make communication among the players faster and easier and introducing really large maps (twenty-four by forty-four feet, in one case).

Other needed changes are anticipated to take longer. The demands of joint accreditation have squeezed space for wargaming in the College's curriculum. For reasons that will be explained in chapter 10, that trend needs to be reversed. The College's gamers also feel the Navy needs to look deeper (in terms of game time) into campaigns; few contemporary games now play more than a week of game time. The history of wargaming includes example after example of leaders misled by games that did not look deep enough into a conflict. The Naval War College is the "motherhouse" of wargaming in the U.S. military.

This period did see one Navy wargame effort terminated. Founded in 1981, the Chief of Naval Operations' Strategic Studies Group (see chapters 3 and 4) used wargaming to explore the Navy's toughest challenges. Its eighteen to twenty-two members conducted two wargames a year to explore future operational and warfighting concepts generated in response to the CNO's annual theme. The program was terminated in mid-2016.[27] Still continuing, however—as part of a program at the Naval Air Weapons Station China Lake, California—is the Navy's pioneering live wargame made famous by the movie *Top Gun* (see chapters 3–5).

From the father of American wargaming, William McCarty Little, to all those who fought and refought War Plan Orange during the interwar years, to Dennis Callan, Francis McHugh, Orville "Bud" Hay, Larry Bond, Robert "Barney" Rubel, and Stephen Downes-Martin, the Navy too has produced generations of wargame innovators.

The Marine Corps. During this period the U.S. Marine Corps conducted wargames from the fire-team level up. However, the bulk of its gaming continues to be conducted at the Quantico Marine Corps Base, Virginia. The two major (but not exclusive) homes of wargaming there are the *Marine Corps University* and the *Marine Corps Warfighting Laboratory.*

The Marine Corps University consists of two colleges, three courses, and several classes. The application of wargaming within each part varies with its mission. The *Marine Corps War College* prepares its students to assume senior leadership positions in an increasingly complex and dangerous world. The *Marine Corps Command and Staff College* equips officers to serve as commanders and staff officers of combat units in joint, interagency, and coalition environments. The *School of Advanced Warfighting* attempts to forge the next generation of Marine Corps strategists. The *Expeditionary Warfare School* is the Marines' school of combat leadership, where young Marine officers learn how to "fight the force." The *School of MAGTF* (Marine Air-Ground Task Force) *Logistics* is particularly important to the Marine Corps, which often needs ways to deliver logistical support where it appears impossible.

The Marine Corps Warfighting Laboratory conducts wargaming through its *Marine Corps Wargaming Division*.[28] The division remains the only major gaming function in the U.S. defense establishment not subordinate to a war or staff college. The mission of the Wargaming Division continues to be to plan and execute the Marines' Wargaming Program and act as the service's cognizant entity for gaming matters. Assigned tasks (aside from those already discussed or that might be presumed) include supporting experimentation and other combat development and assisting the Warfighting Laboratory in creating conditions that allow risk taking and reduce later real-world surprises in ways that are difficult to reproduce in experimentation, exercises, or operations.

However, running the Marine Corps's Title 10 wargame, Expeditionary Warrior, continues to be the division's single largest task. The purpose of EW11 reflected the transition then ongoing. Instead of focusing on terrorism or unconventional conflict it was to examine employment of Marine forces within a joint context in an access-challenged environment. EW11's themes also reflected this change; they were joint operational access and enhanced MAGTF operations.

EW11 also "fed" EW12, which examined the joint and naval force's ability to overcome antiaccess/area-denial challenges.[29] EW13 examined a very different situation. Instead of examining how forces could best fight their way into a contested theater, it explored the benefits and risks of having some Marine forces in theater before any crisis. EW13 looked at how a modest force could maintain awareness of the operational environment and act early in a crisis, in a variety of ways. The game's insights contributed to the development of Expeditionary Force 21, the Marines' capstone concept, one that would guide their development of capabilities over the ten years following the wargame.[30]

Expeditionary Warrior 2014 looked at how the Marines and the Navy might reorganize the command and staff elements of their combat forces to increase their effectiveness in peace and war. Specifically, EW14 depicted the employment of an integrated maritime operations center so as to improve the effectiveness of a Navy/Marine force, as well as a regionally focused Marine expeditionary brigade headquarters, with the expectation of improving both peacetime engagement with friendly nations and crisis response with those same nations. The Blue participants were divided into three cells of roughly thirty-five, each organized around a different option for an integrated maritime operations center and a regionally focused MEB headquarters. Each Blue cell then planned and executed operations, all three against identical Reds and in identical scenarios. While all Blue cells seemed to show that greater integration and closer cooperation had merit, much work remained. EW14's "quick-look report" advocated additional exercises and experiments to help find the optimal level of integration and the modifications to doctrine, procedures, and regulation needed.[31]

EW15 examined the impact of concepts, capacities, and capabilities bearing on the Marines' ability to conduct, as part of a joint, combined task force, littoral operations in an A2/AD situation. Its capstone took place 23–27 February 2015, the senior leader outbrief that May.[32] Finally, EW16, held 14–18 March 2016, continued to explore A2/AD in the context of increased Russian aggression in the Baltics and a NATO response. This shift from USPACOM to USEUCOM tested the Marine Corps's ability to conduct expeditionary operations as part of a composite force in any clime and place.

During this time the Marines also initiated a Title 10–like wargame called Elegant Potential. Designed to explore potential conflicts from a whole-of-government, whole-of-resources-available (i.e., nongovernmental organizations) viewpoint, Elegant Potential brought together leaders from a broad spectrum of organizations.[33]

The training of Marine higher headquarters staffs and their commanders remains the responsibility of the MAGTF Staff Training Program.[34] The program serves all three "numbered" Marine air-ground task forces—I MEF, II MEF, III MEF—as well as their subordinate Marine amphibious brigades.[35] For wargames these headquarters are often

augmented by personnel from other services (making the games joint), officers from allied and friendly countries (making them combined), and individuals from non-DoD government agencies (and so interagency). The training is designed to be realistic and challenging, largely by virtue of a tough, smart Red. The value of the training is further enhanced in frank, detailed after-action reviews of the performance of the commanders and their staffs. The Staff Training Program's complement of active-duty and reserve Marines (and six retired lieutenant generals who serve as mentors) is large enough to run each of the Corps's higher headquarters through the training roughly every twenty-four months.

The Marines have also been working to expand and modernize their modest live wargaming. Among the options they are considering is an augmented-reality system that superimposes images of threat forces on real terrain.[36]

Command elements from MAGTFs to companies also used wargaming in operational planning, with methods similar to those used by the geographic combatant commanders. Following the guidance of Marine Corps Warfighting Publication 5-1, *Marine Corps Planning Process,* unit leaders and their staffs conduct fast, (relatively) simple games on each of their final three COAs and maybe a longer game of the nearly completed plan if time permits.

During this period the Marines have continued their time-honored tradition of innovating on a shoestring. In April 2015, Paul Nichols, retired gunnery sergeant and project officer with PM TRASYS Contractor Support, secured 260 old Marine Corps computers that were scheduled to be destroyed and provided them to a single battalion. As the computers were excess, there were no restrictions on software. This allowed Mr. Nichols to load a broad range of wargame software that allowed all levels of battalion leaders to build, tailor, and execute games appropriate to their authority. The games proved so popular with all ranks that a drop in disciplinary issues was observed. More importantly, the battalion was repeatedly recognized for its effectiveness in exercises.[37]

It appears at this writing that Marine Corps wargaming for the training of individual Marines and small units is at something of a crossroads.[38] Some are advocating using contractors to push the boundaries of technology to create high-end games that can execute "live, virtual, and constructive" (LVC) at the same time. Others are advocating simpler wargames that Marines can learn and create scenarios for at schoolhouses and bring back into the field with them after graduation. The U.S. Army has shown that LVC wargames at places like the National Training Center can enhance training. The Marines' own experience with the Deployable Virtual Training Environment (DVTE) and individual game initiatives demonstrates the importance of accessibility.[39] Perhaps the best answer is to do both. Whatever happens, if past is prologue to future, wargaming

in the Marine Corps will be characterized by individual initiative, innovation, common sense, and putting the rifleman first.

From John Schmitt to former commandant Gen. Al Gray, to William "Bill" Simpson and Dr. William "Bill" Lademan, the U.S. Marine Corps has produced a long line of wargame advocates and innovators.

The Army. Unified Quest (see chapter 5) remains the Army Chief of Staff's annual Title 10 wargame. It is still designed to examine issues critical to current and future force development. Like all Title 10 games there is much more to Unified Quest than the wargame itself. The Army refers to the overall effort as a "campaign of learning." After a dozen years without dedicated deep-future games, Unified Quest 2013 returned to the 2030–40 time frame.[40] UQ13 was held 15–20 September 2013 at the Army's Center for Strategic Leadership.

The Army also added a second "futures wargame." Called the Army Warfighter Assessment this new annual wargame addresses emerging technology-enabled concepts in a joint environment. The first was held in 2016 and involved sister services and six allied nations.[41]

The Army continued to make extensive use of wargames to educate and train. Wargaming is an integral part of the curricula at the Army War College, Command and General Staff College, and the School of Advanced Military Studies, attached to the Army Combined Arms Center at Fort Leavenworth. While most of the center's students are junior officers being instructed in their specialties (armor, communications, etc.), some are learning to be Red team gamers. The pinnacle of Army training remains the National Training Center. Through LVC wargaming, the Army trains entire brigades there. Virtual wargaming is also used at Army bases that are home to maneuver units.

From the foundations of U.S. Army wargaming by Major Livermore through the early faculty at the Command and General Staff College, to Col. Raymond Macedonia, to the Army's best-known wargame innovator, Col. Casey Wardynski, the U.S. Army has produced key players in the evolution of wargaming.

Other Government Wargaming. There is a modest amount of gaming outside the Department of Defense but inside the government, and it has increased, again modestly, in the last dozen years. One cause is the attacks of 9/11 and the resulting emphasis on homeland security. The Department of Homeland Security conducts games to help anticipate and explore options for reacting to threats. A second cause is the increased emphasis in DoD on finding interagency strategies to deal with challenges ranging from counterinsurgency and counterpiracy to the building of partner capacity. There are a handful of other applications. For example, the CIA uses a wargame to help its civilian analysts learn about U.S. and non-U.S. military power.

Commercial. While the American military has largely transitioned from terrain-table and manual map wargames to computerized constructive, virtual, and live ones (along with expert panels at the operational and strategic levels), many private gamers continue to play the miniatures and paper varieties, though the lead of computer wargames continues to grow. As for types, constructive and virtual are rebounding, and there is some movement toward live games.

Miniatures, the first form of civilian second-generation wargame, continues its slow but steady growth. Despite predictions that first print, then computer, wargames would make miniatures obsolete, a small but noticeable number of new people attend miniatures conventions each year. Sales of new products mirror this mini-trend.

Print/paper/board wargames have continued to struggle back from their near-death experience of the late 1990s. For the first time in decades, new publishers are entering the market, and stores that had stopped carrying print wargames are doing so again. However, few of the customers lost to computer and role-playing games have returned, and the number of young people starting to play paper wargames remains small. The engine for the recovery continues to be advances in desktop publishing, now augmented by the new channel of downloadable wargames. Publishers have discovered they can make a profit on smaller print runs. Selling fewer copies of more titles can increase their overall sales. The result is more choices for consumers.

Something similar is starting to happen to computer wargames. The "Hollywood effect" that captured the recreational software/video-game industry around the turn of the century is as strong as ever. As the cost of producing the top-tier games continues to rise, publishers continue to think like their moviemaker counterparts: they go with sequels (Grand Theft Auto) and other titles they expect to have the huge sales they need to recoup their outlays. Nevertheless, the recovery of computer wargames is being aided by what I call the "iTunes effect." Just as musicians discovered that making songs easier and cheaper to buy increases sales, so computer wargame developers are discovering the benefits of selling online. Lately, some have dropped their prices, expecting to make up the loss in volume. The incremental cost of a download is negligible. As some games are starting to be made/adapted for smartphones and tablets, I expect that volume to increase further. More about this below.

Of course, the number of consumers participating in virtual games—the massive, multiplayer online games—is huge today. However, most are set in fantasy worlds, not simulating real armed conflict. However, there seems to be a modest increase in the number of consumers logging on to virtual spaces with military themes and, say, flying their B-17s over the heart of the Nazi empire.

There even seem to be early indications that live wargaming may become popular. Reenactors have been around for years, but they would concentrate on ensuring that their uniforms were authentic. Now, Martin van Creveld reports, some are refighting battles.[42] Similarly, paintball and laser tag have been around for years. Most sessions continue to be free-for-alls, simulating anarchy more than warfare. However, there have been recent reports of team play that looks a bit like contemporary warfare.

American commercial wargaming has been a major force in the advancement of wargaming: from Charles Roberts, who introduced second-generation wargaming to the civilian community; to Jim Dunnigan, who catalyzed an explosion in the numbers of designers and publishers; to the early computer wargamers Chris Crawford, Gary Grigsby, and John Tiller; to Joe Miranda, who pioneered wargaming human factors; and to Mark Herman, an innovator who did more than anyone else to bring together the commercial and military wings of wargaming.

Academic. One of the first applications of second-generation wargaming was in the military's academic institutions. After discussions with military people from roughly sixty nations, I have yet to learn of a single war or staff college that does not use wargaming as a teaching tool.[43] A few, such as the German war college, as we've seen, actually teach their students how to run games as an integral part of planning after they graduate.

There continues to be only limited wargaming in American civilian academia. See appendix C for the few exceptions. Again, most of what does take place is in courses on military history and defense and diplomatic studies. Seeing the billions of dollars in annual sales of computer games, a small but growing number of civilian colleges are beginning to offer courses in how to create computer games, including wargames. In most cases, these courses teach "bricklayers, not architects"—that is, they instruct in programming to code a game, not design one. There are a few exceptions.[44]

International Wargaming

A significant percentage of American military wargames include international participants. More often than not, Title 10 games invite allies. The most frequently seen participating nations are the United Kingdom, Canada, and Australia. However, participation by other countries is not unknown. A fairly recent Global involved the navies of fifty-one nations. Even the typically classified wargame and exercises conducted in response to the Joint Strategic Capabilities Plan sometimes draw representation by regional allies. None are more closely knit than the U.S. / South Korean live and constructive games. Red Flag brags about how many of the world's air forces have participated in one or more of its events.

Multinational Military/Governmental Wargaming. Nor are all international wargames hosted by the United States. A great many are run by NATO, including games in Sweden specifically designed for nations belonging to the Partnership for Peace. Other nations conduct live games similar to Red Flag, and they too invite the air forces of friendly nations. Two examples: Canada has long held Maple Flag, inviting the U.S. and other friendly air forces, and the Israelis have recently begun a live air wargame they are calling Blue Flag and have invited the U.S. Air Force to participate. Finally, many nations (like the United States) invite officers from friendly nations to attend their war and staff colleges. These students play their host nations' wargames. Hence, when American officers attend Germany's or the United Kingdom's war college they play that nation's games—and vice versa.

Where a nation mostly sends its officers abroad to war and sometimes staff colleges can be a window into how that nation conducts its own wargames and war planning. Smaller nations, "developing" or not, often do not have a war college and maybe not a staff college. Nations that once sent their officers to Soviet war colleges still, in many cases, game using Soviet methods. Nations that were once part of the British Empire tend to send all or many of their top officers to British schools, where they learn British wargaming methods.

Finally, not all international wargaming involves the United States. Since 2005, Russia and China have held an annual live wargame/exercise called Peace Mission.[45] Russia's contribution to Peace Mission 2013 was the largest to a wargame since the Soviet era: 160,000 troops, five thousand tanks, 130 aircraft, and seventy ships.[46] This was a true wargame, with phases for planning, deployment, and simulated combat.[47] Also, in 2012 two Israeli papers reported on plans for a live wargame/exercise that would include forces from Russia, China, Iran, and Syria.[48]

National Military/Governmental Wargaming. Here is a little of what is known about the wargaming activities of specific nations.[49] Many South American navies participate in *Argentina*'s Jupiter naval wargame. The last few years have also been a time of transition for the *Australian* wargaming community. In 2011 Australia produced a new Simulation Strategy and Roadmap. Change came fast; in December 2012 a proposal was made to create the Australian Defence Simulation and Training Centre, under a one-star, and, by merging the Australian Defence Simulation Office and the Joint Combined Training Capacity, to establish the core simulation capability of a defense synthetic environment. Just a few months later, in March 2013, the government approved this proposal.[50] That September, the Simulation and Training Centre became operational, consolidating the Simulation Office, Training Capacity, and several other entities.[51]

Australia has made increasingly sophisticated use of wargames as part of a major effort to evolve its military capabilities to meet future needs. At the beginning of the century (see previous chapter) it set out to develop a system to anticipate what would be needed by the time new systems could be developed and fielded, Concept Development and Experimentation. A spectrum of wargames was critical for this process, offering insight into concept effectiveness in the face of likely countermeasures.[52]

Other elements of Australian wargaming demonstrate both continuity and change. In July 2013, for the fifth time, the combined U.S./Australian live wargame Talisman Sabre was held. It drew roughly the same numbers of military personnel as in previous years (twenty-one thousand American and seven thousand Australian) but saw a major increase in participation by other government agencies (of both governments) and nongovernmental organizations. Australia is also continuing to use wargaming to strengthen cooperative relationships with other militaries around it. For example, the 2012 Pitch Black saw participation by the Indonesian air force for the first time. Australia also continued to participate in many U.S. wargames.

Australia, finally, is one of the few nations with domestic publishers of all types of commercial games—miniatures, print, and computer. Perhaps in part because of that, in December 2014 Australia became the third nation to host a Connections wargaming conference, through the initiative of Todd Mason, Mariana Zafeirakopoulos, and Marcus Carter. This inaugural event attracted thirty-eight participants.

Canada participates extensively in U.S. and NATO wargames. Canada is represented in American Title 10 games and in games with the other navies of North America—the U.S. and Mexican. Its Maple Flag live wargames host many friendly nations, including the United States.

In *China,* the study of war and the use of wargaming extends back to the dawn of history. The Chinese have used modern wargaming since at least the Korean War. While China has periodic concerted efforts to learn American wargaming methods (some mentioned in previous chapters, others in recent years), some elements of Chinese wargaming are indigenous and unique. The wargaming laboratory at China's National Defense University has turned out modern game-support software.[53] It has conducted pol-mil wargames extending four to six decades into the future.[54] In recent years it has repeatedly announced efforts to expand wargaming throughout the armed forces, both to address the declining combat experience of its military and to catch up with the West.[55]

China has also announced its intention to catch up to the United States in the first-person shooters and other virtual-environment wargames. Perhaps the first product of this effort is Glorious Mission, a first-person shooter game described as the Chinese

answer to America's Army. While no "bad guy" is named, players fight an enemy who employs American weapons.[56] On the other hand, China appears to have lagged behind the United States in live wargaming, with respect to both technology and procedures. American commanders know they will probably lose at the National Training Center; China is not known to have facilities where that might be true. Perhaps because "losing" a large exercise would be too public a loss of face, China's live exercises are choreographed affairs that the good guy (China) always wins. However, recently it has been learned that the "good guy" does sometimes lose in constructive wargames, where outcomes are not made public.

Germany's national wargaming capability is centralized at the Military Academy of the German Armed Forces (Führungsakademie der Bundeswehr, Hamburg).[57] Its Wargaming Center is an impressive, state-of-the-art facility. The academy especially trains and educates staff officers and flag officers. Therefore, the wargaming there mainly deals with the operational and strategic levels. The officer schools of the armed forces (Bundeswehr) cover tactical command and control and hence wargame at that level. The German army also runs a Battle Training and Exercise Center (Gefechtsübungszentrum Heer), which allows "real" simulations of land-combat units up to brigade size. The live exercises include soldiers, their arms, vehicles, etc., all applying a specific duel-simulation system (Ausbildungsgerät Duellsimulator). They make for excellent wargaming—combat elements such as artillery fire, close air support, firefights, etc., are brought to bear very efficiently and effectively.

Still, wargaming in the Bundeswehr is only nascent. It is limited to the use within NATO, and "rolling dice in front of German flag officers is still a daring adventure." This is for historical and now legal reasons: while Germany has come to dominate the world family-game market (many board games Americans assume are American were actually designed in Germany), it cannot publish wargames, in any medium.[58]

India, which learned wargaming as part of the staff process from the British, now conducts a spectrum of games similar in scope to those of the United States. Its navy's wargaming is particularly robust. India also makes extensive use of live wargames/exercises.

Of the world's thirty-five strongest militaries, *Iran*'s (at twenty-second) is the only one for which there seems to be no reference to military or governmental wargaming.[59] In fact, the only mention of wargaming in connection with Iran I know of is the following curious story. In early 2012, an Iranian court sentenced to death a former U.S. Marine of Iranian descent on charges of working for the U.S. Central Intelligence Agency. One of the counts against him was that he worked for a computer-wargame company funded by the CIA. The purpose of the games, it was charged, was to manipulate domestic and

world public opinion against the Iranian government by depicting Iran as the enemy. While the individual did work for a computer-game publisher that did produce three titles in which the Iranians were the "bad guys," CIA funding is doubtful. Computer games are far too profitable to need government funding.[60]

Israel has a long history of extensive application of wargaming.[61] But other than Israel's relatively new live wargame, Blue Flag, little is known of recent developments. There are several Israeli computer-game development houses.

Japan has, since at least the early 1990s, participated in U.S. naval wargames and has conducted its own gaming of roughly equal sophistication and scope.[62] During this period of transition the Japan Maritime Self-Defense Force staff has begun conducting wargames similar to the U.S. Title 10 games.

Mexico, in addition to working with the U.S. Naval War College to improve the wargaming element of its own war college curriculum, participates in games with the other navies of North America—the U.S. Navy and the Royal Canadian Navy.

Little direct information is available on *Russia*'s current wargaming methods. History would suggest that it continues to use Soviet-era practices.[63] If so, Russian wargames make maximum use of historical data and are conducted as single moves, adjudicators determining the outcome of the full plan for the battle or campaign being gamed. It is known that wargaming in the Russian navy is very poor, being both procedurally and technologically primitive. However, Russia has been making increasing (and widely reported, and quite recent) use of live wargames/exercises. Finally, President Vladimir Putin has stated that Russia would develop a wargame similar to America's Army.

Sweden, the second nation to incorporate second-generation wargaming into its planning and military education systems, is currently taking the lead in NATO in the use of wargames to develop military cooperation with the other Partnership for Peace nations. Sweden's wargaming center (Försvarets Krigsspelscentrum—literally, War Case Center) is situated at the Armed Forces Headquarters in Stockholm. In 2006 the center was relocated and combined with the Command Combat Center (Ledningsstridsskolan) in Enköping. The Command Combat Center's contemporary activities include simulator support to large, high-level (brigade and above) staff exercises, such as the annual two-week Combined Joint Staff Exercise organized by the Swedish Defense University and attended by the Staff Course and Senior Staff Course. Notably, the Command Combat Center's role is to provide exercise facilities and simulation support (computers, software, and networks), not pedagogical frameworks.[64]

The *United Kingdom,* like so many nations, saw in the period following the coalition withdrawal from Iraq both continuity and transition in its wargaming. The emphasis

placed on wargaming by the United States had an effect on the British. One British defense official has written,

> In my discussions with the US Deputy Secretary of Defense, I was struck by how central and influential wargaming has become to DoD. As such, I am keen to understand how I can reinvigorate wargaming across UK Defence. To do this, I would like to benchmark the UK's Defence wargaming capability against the US's in order to learn valuable lessons from the US and to understand how we can further strengthen our collaborative efforts in this area. To that end, your participation in this survey would be greatly appreciated.[65]

As one product of this increased emphasis, during August 2017 the United Kingdom's Ministry of Defence published Britain's first wargame doctrine, the *Wargaming Handbook*.

The Defence Science and Technology Laboratory (see chapter 3) continued developing its PSOM (chapter 5) software.[66] By 2014 it was debugged and documented sufficiently well to be employed with little if any Dstl support.[67] Other British games moved increasingly toward hybrid adjudication, with computers for combat and manual methods for relevant but "soft" factors that are difficult to quantify: terror, loyalty, confidence, and love.[68]

On 27 October 2016, Sir Gordon Messenger, vice-chief of the Defence Staff, met with the U.S. deputy secretary of defense, then Robert O. Work, in Washington. General Messenger produced a "tasker" memo on 4 November 2016 to determine the state of British defense wargaming and solicit recommendations. In response Dstl and Maj. Tom Mouat, MBE, British Army, produced a thirty-page report. At a follow-up meeting on 24 November 2016 in the Ministry of Defence, the vice-chief called for more effort on wargaming.[69]

The British military continues to use wargames for combat training, force planning, operations planning, staff training, and military education. It also still participates extensively in NATO and U.S. wargames. In each of these areas there has been innovation.

The British army still employs ABACUS (see chapter 4). The original code is over thirty years old, but continuous development has kept it highly capable.[70] Aside from that economy, the United Kingdom spends, far and away, more money on wargames and simulations that train leaders and troops than on all other applications combined. These systems are explicitly designed to permit not only standard procedural training (simulation) but also two-sided free play (wargaming). This training has a "crawl, walk, run" pattern, employing in turn constructive, virtual, and live wargames. Of course, the same systems can be used without a wargame as such—on purpose, when training for humanitarian missions, and perforce, when corners must be cut and only preparation for combat is exercised.[71]

Command and Staff Training (CAST) is the "crawl" stage. At its heart is a constructive wargame; only the command element (typically a battle-group commander and staff) is trained, the troops, equipment, terrain, and effects all being represented by the computer. Even though it cost seventeen million pounds (roughly U.S.$25 million) to design and install it at three training locations, this is by far the least expensive of the three phases. A sixty-person command staff can be trained for a week at a cost of just £25,000 ($36,500) and the time of a sixty-person support staff.[72]

The Combined Arms Tactical Trainer (CATT) is the "walk" stage. CATT is a virtual wargame/simulation; all members of the command participate, in vehicle-command-post simulators that move across a virtual battle space. CATT provides great training for entire organizations but at a high price. The United Kingdom's two CATT locations (one in Britain, one in Germany) cost far more than the three CAST facilities. But the highest cost is incurred during training: one week costs £250,000, which is equivalent to ten times a week of CAST training. Its hardware and software are very similar to the American CCTT system, but the two nations use the technology in very different ways. The U.S. Army built lots of company-sized simulator suites, while the British army has only two centers, both for full battle groups, with supporting arms. Both British centers provide outstanding training that integrates actions across an entire group.[73]

The "run" element of the British ground-combat training trilogy is the Tactical Engagement Simulator (TES). Like the National Training Center in the United States, TES is a live wargame, most easily understood as "laser tag on steroids." Actual troops use their actual equipment to maneuver on real terrain. Only the effect of their fire is simulated. While outstanding training, TES's one location was by far the most expensive of all to establish, and the recurring cost is likewise. Depending on the unit being trained, one week at TES may cost from just under two million pounds to well over two and a half million, roughly ten times the cost of a week's training with CATT and a hundred times that of CAST.

At the height of the war in Afghanistan TES cost even more, sometimes much more—as much as eight million pounds ($11,666,666). It depended on what new equipment was being tested (there was little opportunity before deployment) and whether live role-play support from Pashto speakers was needed.[74]

The point of all this detail on cost is that CAST, CATT, and TES are so expensive that access to them is limited; they tend to be used less than once a year. In addition, a requirement that the units and headquarters be assessed means that the facilities are typically used for procedural rather than two-sided, adversarial training (in which trainees might "lose," disastrously for their assessments). U.S. CCTT training cannot match the scope of its British counterpart, but, for example, the average American tanker gets to

train more often.[75] Still, together these systems produce better-trained leaders, soldiers, and units than any one of them could alone.

Wargames are also a part of Royal Air Force and Royal Navy training. The Royal Air Force possesses many high-resolution flight simulators. The RAF is gradually linking them so it will be able to run the equivalent of a Virtual Flag. The Royal Air Force also collaborates with the U.S. Air Force on both Title 10 games and the games conducted by the U.S. Air Force Materiel Command. The RN possesses both bridge simulators for training commanding officers and bridge crews, and ship simulators to train entire ships' complements. Again, when these systems are used for training on procedures (such as emergencies) they are not wargames. When they are used to simulate combat operations against a Red force, they are.[76]

The United Kingdom has replaced both programs it once used to automate, largely, the adjudication of wargames—the Divisional Wargame and UK Janus—with the Wargame Infrastructure and Simulation Environment. It has introduced the Close Action Environment to support company-level conventional wargames. Finally, the United Kingdom has applied new software to gaming of unconventional operations, the support or suppression of insurgent forces. Called the Peace Support Operations Model, it is designed to facilitate the adjudication of all the "soft" (hearts and minds) and "hard" (combat) elements that affect the success of such efforts.[77]

One distinctive kind of British wargaming, one that goes back at least as far as Field Marshal Montgomery, is what I call "very free *Kriegsspiel*." That is, essentially, military experts talking through the operation being planned and deciding Blue moves, Red moves, and outcomes by consensus. Formally referred to as "COA wargaming" today, even this bedrock of British practice is evolving. British COA wargaming doctrine was substantially rewritten in the middle to late 1990s and has constantly evolved and improved since then. It is the form of wargaming most practiced in the British military; virtually no money is spent on it, because it is 99 percent manual. Every headquarters, single-service and joint, from battle group through the Allied Rapid Reaction Corps to the Standing Joint Force, conducts one or more COA games every time it develops a plan.[78] At this writing Britain is continuously working to keep COA gaming fast enough for a rapidly developing crisis, with improved processes and tools that can be learned quickly, are credible, and add significant value.[79]

This pattern of continuity and change is also seen in wargaming at the Royal Military Academy at Sandhurst (RMAS), one of the United Kingdom's service academies. Like other academies, Sandhurst continues to use gaming to reinforce traditional instruction, enabling students to apply what they have learned and to learn through experimentation and debate. (One particularly interesting innovation is that they now follow

up their staff ride over the Normandy battlefields with a wargame of specific parts of the D-day invasion.) Unlike other service academies it explicitly considers gaming a way to gain an edge over adversaries by enhancing the speed and flexibility of decision making, especially in the face of friction, surprise, and a thinking adversary. The RMAS's most recent initiative is to encourage its students to become lifelong wargamers, as many other academies encourage their students to continue reading military history and theory after graduation. To do so, it has founded wargame clubs and encouraged student participation after duty hours—though uptake remains disappointingly low.[80]

Many of the above innovations and more were the work of the Defence Science and Technology Laboratory. During the first Connections UK in 2013 (see below) participants from Dstl realized that it had no plan to advance and sustain Britain's wargaming capability. As a result Dstl revised, and briefed at Connections UK 2014, a multiyear plan to get British wargaming "where we want to be."[81]

Senior ministry and joint and service leaders understand the scope and value of wargame applications. As we saw, the vice-chief of the Defence Staff requested more effort on wargaming:[82] a cadre of experienced individuals to lead the improvement and sustainment of wargaming; individuals on every staff trained on when and how to apply gaming; and tools for wargaming that will help implement the above and make it faster and easier to learn and execute.

At Connections UK 2014, Colin Marston of Dstl argued the need for the Ministry of Defence to establish a "wargaming hub." The hub would act as the primary point of contact for customers within MoD. It would be a "one-stop shop" for collating, understanding, and developing wargaming requirements. The hub would have the necessary wargaming expertise and networks (e.g., through events like Connections) to provide both advice on how to meet the requirements and what sources to draw from within MoD, industry, or academia. It would be a place to develop and maintain a corporate knowledge base and record observations, insights, and lessons. Marston also felt more needed to be done to sustain and develop a cadre of experienced, professional wargamers within MoD. By 2016 Colin had become the head of the Dstl Wargaming Team. There he provided continuity, corporate memory, and wargaming expertise in the ministry. Colin and his team continue tirelessly to advocate good gaming practice.[83]

As in other militaries, not all British wargaming initiatives come from the top. At Connections UK 2014, Lt. Col. Ivor Gardiner, commanding officer of the 1st Royal Irish Regiment, described how he was using the American print wargame Squad Leader to develop the effectiveness of the leaders within his command. While feedback indicates his initiative had been very effective, Colonel Gardiner voiced worry that unless gaming

became an official part of the United Kingdom's training cycle the initiative would not survive his departure.[84]

Analogously, by 2015 the military of the United Kingdom was benefiting from quite probably the most-effective wargaming in its history. One the other hand, British gamers had concerns. Unlike in Germany, which trained its general staff officers to conduct wargames, in Britain military gamers were self-taught, most having started with civilian games in their youth. Universally, they had volunteered to work in the gaming area. Like their American counterparts some had begun noticing that they were, as a group, increasingly "hair pigment challenged," and these graybeards were worried about who would lead wargaming in the future. Worse, much British military wargaming was not directed from above; they, like Colonel Gardiner, worried about the chances of those initiatives to survive the departure of their originators.[85] It was issues such as these that had given rise to a British edition of the Connections conference (about which, more below).

In the area of popular wargaming, Britain continues to lead the world in the creation of rules for miniatures games and in the sale of miniatures games. In 2015 the United Kingdom's largest miniatures wargame publisher, Games Workshop, alone, earned $124,000,000 in export sales, primarily to Europe, North America, and Australia.[86] England is still the home of one of the few courses in wargame design, taught by Professor Sabin at King's College London. On the civilian side the major new initiative was John Curry's History of Wargaming Project. The name of his project is perhaps misleading; rather than telling the history of wargaming he strives to preserve it, by keeping groundbreaking civilian and military wargame publications (rules, manuals) in print.[87]

As for military/civilian cooperation, in late 2011 a British defense official, Andrew Poulter of Dstl, candidly admitted the need for it. New recruits, having played contemporary commercial wargames, found the military's games visually primitive. This made it hard for them to engage fully in the games. The British military, Mr. Poulter said, had to "catch up" to the commercial state of the art, by adapting a commercial program for defense use.[88]

Perhaps this was one reason for the major development of this period, which came in 2013 when King's College London hosted the first "Connections UK." This first Connections conference outside the United States was the vision of Graham Longley-Brown, an unduly modest and terminally self-effacing ex–British army officer who was already fully employed running wargames for the British and overseas militaries. He adapted the format of the original Connections conference to suit British needs and preferences better. Professor Sabin secured a venue (King's College London); Major Mouat helped arrange military participation; and Colin Marston obtained Dstl's support and participation. Thanks to them, the hard work of many others, and Graham's own

organizational skills, Connections UK was an immediate success. The first keynote speaker was Maj. Gen. Andrew Sharpe, an inspirational advocate of military wargaming throughout his army career.[89] The stature of the leaders of the British wargaming community who helped launch the country's first Connections was truly humbling.[90]

The first Connections UK attracted seventy-five people from eight nations, leaders in the military, academic, and commercial elements of wargaming. Connections UK 2014 increased those numbers to 111 participants from ten nations. The program continues to grow, with 124 delegates from eleven nations in 2015, 156 from sixteen nations in 2016.[91] (This was more than triple the international participation the same years for Connections US.) Even more important than numbers of participants, the British had proved that the Connections format can be exported, prompting by 2015 new Connections conferences in Australia and the Netherlands. In this way and others, Britain remains a leader in the development of new ways of wargaming, doing pioneering work in such areas as matrix games, confrontation analysis, and cyber wargames.[92]

But in British civilian wargaming too, this was also a period of transition. In 2013 the senior statesman of British commercial gaming, Donald Featherstone, passed away. It would be difficult to exaggerate the impact he had had on wargaming, not only in the British civilian world and military, but worldwide. James Dunnigan said, four years before Featherstone's death, "Donald Featherstone is one of the dozen or so people who, in the twentieth century, turned wargaming into both a hobby and a more useful tool for military professionals." In his last decades he became a kind of senior ambassador for wargaming. Respected for his work in military history as well as gaming, he addressed conferences and classes around the world. He left behind over fifty books and a standard of clear, executable game rules that may never be equaled and will never be surpassed.[93]

So there you have it: a rundown of wargaming from BC to PC. Each service has, and most nations have, produced wargame innovators and advocates. Overcoming the discipline's new challenges will not be easy, but the wargamers of the future will be standing on the shoulders of giants.

Motive, Opportunity, and Next Moves

John Keegan and Andrew Wheatcroft assert that war, like murder, requires motive and opportunity.[94] Their prescription for anticipating future wars is to look for countries with motive that are on track to acquire opportunity and for countries with opportunity that seem likely to acquire a motive.[95] This kind of dualism is probably true of all high-profile inventions: if necessity is the mother of invention, feasibility is the father.

This is certainly true for wargaming. Second-generation wargaming had motives: it was developed to produce genius to counter Napoleon, and even more to educate an officer corps that included many who had not learned their trade at their fathers' side. It also resulted in part from the opportunity provided by topographic maps and an increased understanding of probability and statistics. Similarly, third-generation wargaming was motivated by the need for a strategy to preserve the independence of an early interwar Germany too weak to defend itself through military means alone. The opportunity sprang from the close relationship between the elements of German national power and the writings of Hans Delbrück. Hence, we should be able to anticipate the future evolution of wargaming by spotting long-standing or emerging motives and matching them with long-standing or emerging opportunities.

Some motives for the continued evolution of wargaming are enduring, while others are new. From the dawn of civilization, wargames have been used by decision makers to develop the minds of future decision makers. Four thousand years ago those leaders were called "kings," "pharaohs," or "emperors." Today they are called "presidents," "prime ministers," or "voters." Developing the "down-board thinking" of a few rulers in the art of war is very different from developing the ability in millions of voters.

One motive for reinvigorated wargaming in this country is to help the United States preserve and expand its military edge. The American advantage in conventional military technology, especially smart bombs, contributed to the coalition's fast, cheap victory in the First Gulf War. Now, with that technology, again especially smart bombs (and wargaming), available to plausible adversaries we need again to widen our edge in gaming and use that edge to catalyze innovation in military technology.

Another motivation for the future evolution of wargaming is the increasing awareness that national security and international competition extend far beyond purely military affairs. Empires as diverse in time and substance as the Byzantine and the Soviet fell for reasons at least as much economic as military. A few wargames—starting in Germany in the 1920s, Japan in the 1930s, the United States in the 1950s, and China in the 2000s—have acknowledged the importance of economic and political factors. As globalization advances and writers like Thomas L. Friedman reach a fairly broad audience, the power of the motive to include such factors in future wargames, in government, academic, and popular games, will increase.[96]

In no country will this be truer than in the United States. The growing economic, military, and political strength of China presents the United States with an unprecedented dilemma. During the 1800s the United States had to compete economically with larger, more developed economies. One of the ways it did so, being secure behind two oceans,

was to allocate relatively smaller resources to its military. Then for almost half a century the United States faced the very real military threat of the Soviet Union, but the Soviet economic threat was negligible. Coping with China will require a strategy that includes all elements of national power. Wargaming will need to evolve to a fourth generation, depicting all of their impacts, if it is to provide to such comprehensive strategies that it has always given military ones.

Just as advances in cartography, probability, and statistics enabled the emergence of second-generation military simulation wargames, so several technical and other current trends will facilitate the evolution of a fourth generation. For instance, it would be difficult to find a book or article on future technological trends that did not cite Moore's law, which predicts that the number of transistors on integrated circuits will double approximately every two years. This forecast has proved accurate, at times conservative, over the last fifty years. But the growing power of computers may not be the technical trend that will most directly enable the evolution of wargaming but their increasing *ubiquity.* Why?

As you will recall, in 1811 there was exactly one simulation wargame in the world, and the users totaled one family, the royal family of Prussia. By 1824, topographic maps and a relatively elegant design made wargaming accessible to the entire officer corps of one nation. Still, the games were so cumbersome that most officers had to be ordered to play them. Substituting the military judgment of umpires for rules increased the frequency of use, but to an extent limited by the number of trained umpires. Increasing the percentage of trained umpires in the officer corps allowed the proliferation of wargaming in Germany between the world wars. Extensive gaming played a key role in Germany's remarkable military effectiveness in World War II; moreover, no other nation had invested so much time in training its officers to organize and conduct wargames. The fast-approaching omnipresence of computers will provide a practical opportunity for ubiquitous wargaming.

At the time of this writing, an unprecedented percentage of the Earth's population carries around a camera, typically a video camera, twenty-four hours a day. This is because smartphones come equipped with such devices. We should really invent a new word for them, as they are not only phones and cameras but alarm clocks, calculators, photo albums, music players, atlases, compasses, carpenters' levels, web portals, barcode scanners—and wargame platforms. As more and more people, even in the developing world, have such phones, the number who can access wargames increases. These games are physically accessible (they can simply be downloaded), they are economically accessible (many today are free or very inexpensive), and they are rapidly executable for people

with no time or patience to learn complicated rules (the smartphone's processor handles the complex adjudication and allows the user to focus on decision making).

As both books and wargames are downloaded onto phones and tablets in increasing numbers, the integration of books and wargames becomes highly feasible. The integration of a paper wargame with a paper magazine in the early 1970s caused an explosion in the number of game titles in print and significant growth in the number of individuals using print wargames. What secondary effects might the integration of wargames and books have?

The centuries-old resistance to wargaming of many nations' militaries is declining. This is largely due to a generational shift. Kids who grew up playing computer games, including wargames, are now approaching flag- and general-officer rank.[97] However, it may also be that even military games are becoming less user hostile—in part owing to complaints from troops that the multimillion-dollar/pound/euro wargame they were issued was neither as easy to use nor, sometimes, as accurate as the games they had played before enlisting (a claim that caused a scandal in the United Kingdom).

Finally, I believe there is a particular opportunity for an increase in the number and quality of wargames, especially commercially published ones. First, game designers, even in print, tend to be comfortable with computers. This facilitates desktop publishing, selling often "niche" titles over the web and collaborating internationally. Perhaps the most remarkable example of such international collaboration is a print wargame publisher located in rural Scotland. He has one full-time employee, two part-time employees, and several unpaid researchers scattered across five nations. Further, in the last few years several governments have realized that the modeling, simulation, and gaming industry is an environmentally clean source of well-paying jobs. Nations such as China and South Korea and states such as Virginia and Florida have announced initiatives to encourage it. Finally, even without such encouragement many of the best and brightest of the emerging generation are going to work there. They are lured by the "cool factor" of working on games and the incredible wealth of the top designers.[98]

So, we know where we are, where we want to go, and where we can go. Can we make some reasonably safe projections about wargaming's next developments? I think so. If the evolution of wargaming has been driven by opportunity and motive, we can look forward and clearly see areas where these factors align.

We've seen that the oldest motive for wargaming has been to develop the abilities of decision makers to make better decisions. The reason that only a small percentage of humans gamed until fairly modern times was because only a small percentage of humans

made the decisions for their societies and few others had the leisure or resources to wargame. In more-recent centuries the motive for and feasibility of more-widespread wargaming changed together. Where in the early 1800s the apparatus of a wargame would be a very expensive, one-of-a-kind museum piece, by the late 1800s militaries around the world were using published rules, off-the-shelf topographic maps, and standard kits of counters.

Also, since World War II the percentage of the world's people living in democratic states has been increasing, albeit very unsteadily. Even in established democracies, let alone the new ones, the percentage of civilians playing second-generation simulation wargames has increased each decade as their cost has declined—both in money (adjusted for inflation) and time needed to learn and play. It seems a safe bet that the percentage of people living in democracies will continue to grow, however unevenly, and with it the percentage that are middle class. The new members of the global middle class will have increased motive and opportunity to learn to think strategically—or just have fun playing games. The effect will be the same.

With the explosive growth as a percentage of the world's population in people who own smartphones and have access to the World Wide Web, within a decade the majority will be able to download and play the same wargame. What will happen when they do? Our conclusion will ask, and indirectly answer, a related question: What do we *want* to happen?

Notes

1. "Andrew Marshall, the Quiet American: An Enigmatic Futurist at Last Calls It Quits," *Economist,* 10 January 2015.
2. See Matthew Caffrey, trip report to HQ AFMC/A8OW, 23 March 2016.
3. Phillip Pournelle, ed., "MORS Wargaming Special Meeting, October 2016: Final Report" (Military Operations Research Society, 31 January 2017).
4. Dr. Jon Compton, "Analytical Wargame" (Simulation Analysis Center, Office of Cost Assessment and Program Evaluation, Office of the Secretary of Defense, Washington, DC, n.d.).
5. Jon Compton, e-mail, 23 March 2017.
6. Formerly the Studies, Analysis and Gaming Agency (SAGA). Some may argue that J7, the Joint Staff division that interfaces with the COCOM games (see the following discussion), is tied with J8 as the second-most-senior wargaming office.
7. Thom Shanker, "Mapping Military Needs, Aided by a Big Projection," *New York Times,* 11 September 2012.
8. "Iron Crucible" (unclassified briefing, USQCJWC, 22 May 2014).
9. At one time the Global games drew participants from the navies of fifty-one nations. When you consider there are only around two hundred nations in the world total, many of them landlocked or coastal states with no navy, fifty-one represented a very significant percentage.
10. COCOMs can also develop plans not required by the JSCP, as General Schwarzkopf did when he initiated planning for a U.S. response to an Iraqi invasion of Kuwait seven months before a real one took place.

11. The description of Shadow Warrior is based on the May 2015 "War Game Community Update," produced by J7's Joint Wargame Division.
12. Howard Altman, "SOCOM Seeking Latest Tech, Even Holograms, for Wargaming Center," *Tampa Bay Times,* 26 March 2017.
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14. Harris, comments.
15. Mark Hizer, "AFNIC Engineers Play Key Role in CSAF's Unified Engagement 2012 Wargame," *Air Force Print News,* 28 March 2013.
16. Based on the unclassified Unified Engagement 2012 (UE12) Executive Report.
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18. Tim Moench, lead wargaming, AFGSC, e-mail, April 2017. Confirmed as current by Tim on 6 November 2017.
19. William Blankenship [Senior Airman], "AU Hosts Long-Duration Wargame," 42nd Air Base Wing Public Affairs news release, 21 November 2016.
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21. A net peer is a power whose strength may be less than, more than, or about equal to that of the United States in various areas but overall is about the same.
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23. Ibid.; "Navy Completes Successful Global War Game 2014," Naval War College Public Affairs Office release NNS140913-01 Release, 13 September 2014.
24. "U.S. Naval War College Global 2014 Game Report" (War Gaming Department, Naval War College, Newport, RI, February 2015), www.usnwc.edu/Research---Gaming/War-Gaming/Documents/RAGE/Gaming/-Global-Title-X-Series/Global_14_Game-Report-(Final-PDF).aspx.
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28. William "Bill" Simpson, "An Overview of the Art of Game Design V4," 29 October 2010, 4th rev. 6 January 2014. Also see the following by Bill: "Information about Game Design Philosophy and Elements," 29 October 2010; "FLO Wargame Design Final," 14 December 2013; and "Illustrations of Game Design," 1 February 2005, rev. 6 January 2015.
29. "Expeditionary Warrior 2014: Quick Look Report," p. 1.
30. Ibid.
31. Ibid., passim.
32. "War Game Community Update," May 2015.
33. Jody E. White [Lt. Col.], telephone conversation, on or before 19 June 2015. Colonel White was a member of the Futures Directorate, Marine Corps Warfighting Lab, Wargaming Division.
34. William English, e-mail, 31 March 2014. Mr. English was Deputy Operations Officer, MAGTF Staff Training Program.
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39. As of April 2014 the DVTE's laptops needed to be replaced with current models, but only two in five were, primarily owing to lower than initially anticipated accessibility and subsequently declining use. Ibid.

40. Many UQs deal with the midterm future, ten to twelve years out; UQ08 set one scenario far in the future, twenty to twenty-four years. Burkhart, comments.
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43. I taught at the Air Command and Staff College for eleven years. During that time a typical class included about eighty international officers from some sixty nations. I was never able to talk to all of them in any one year but over the years got to know at least a few students from each participating country.
44. Professor Philip Sabin teaches wargame design at King's College London, and Alan Emrich teaches the design and business aspects of computer games at the Art Institute of California.
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50. Charles McHardie [Commo.], "Australian Defence Simulation and Training Centre (ADSTC): Interaction with the Synthetic Environment Working Group" (briefing, 4 March 2014). Commodore McHardie is Director General, ADSTC.
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53. Cheng, "People's Liberation Army on Wargaming."
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60. "How Global Conflict Shows Up in Computer Games."
61. Hanley, "On Wargaming."
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63. The wargame methods used by the tsarist army were adopted by the Red Army and survived Stalin's purges of military leaders.
64. Based in part on discussions with center members during Connections UK 2014 and 2015 and in part on Elg, e-mail.
65. Gen. Sir Gordon Messenger, KCB, DSO, OBE, ADC, Vice Chief of Defence Staff, requesting U.S. participation in a Ministry of Defence survey of wargaming activities worldwide. Received from Colin A. Marston, Lead for Wargaming, Dstl, e-mail, 8 November 2017.
66. See "Peace Support Operations Model."
67. See Clegg, "Shaping Peace Support Operations in Afghanistan (2011)."
68. Pearce, briefing to Connections UK 2014.
69. Tom Mouat [Maj.], e-mails, 9, 10 April 2017. Major Mouat was appointed MBE (Member of the Most Excellent Order of the British

Empire) by Queen Elizabeth II for outstanding service. He ran the COTS training system VBS2 and was a tireless designer and practitioner of matrix gaming in both the military and the Wargames Developments hobby group.

70. Mouat, e-mail, 5 January 2015.
71. Tom Mouat [Maj.], briefing to Connections UK 2014. This paragraph and the next three are based on this presentation.
72. Costs in pounds based on QinetiQ, *Report on the Costs of Conducting Collective Training Exercises* (Farnborough, U.K.: 2005). U.S. dollar figures derived using a 2017 exchange rate.
73. Mouat, e-mail, 5 January 2015.
74. Ibid.
75. Mouat, e-mail, 3 April 2017.
76. Mouat, briefing to Connections UK 2014, and e-mail, 3 April 2017. An officer in the British army, he freely admitted that his knowledge of wargaming in the other services was probably incomplete.
77. Mouat, briefing to Connections UK 2014.
78. Graham Longley-Brown, e-mail, 2 April 2017. Mr. Longley-Brown was a member of LBS Consultancy UK.
79. Marcus Myles [Maj.], briefing to Connections UK 2014. Major Myles was a member of the Directorate of Land Warfare, Royal Military Academy at Sandhurst.
80. Ibid.
81. Colin Marston, briefing to Connections UK 2014. The presentation was written by Tony Hopkins; both were members of the Defence Science and Technology Laboratory.
82. Mouat, e-mail, 3 April 2017.
83. Longley-Brown, e-mail.
84. For more on Colonel Gardiner's initiative, see his slides and MP3 audio at "Connections UK 2014—Day 1: Wednesday 3 September 2014—Plenary 1: How the British Army Uses Wargaming," *Connections UK*, professional wargaming.co.uk/.
85. Mouat, e-mail, 13 February 2015. Similar comments were made by many participants at Connections UK 2013 and 2014.
86. John Curry, e-mails, 8 April 2017.
87. Curry, e-mails, fall 2014.
88. Richard James, "Ministry of Defence Simulations Updated to Keep Up with Xbox Titles," Metro.co.uk, 29 December 2011.
89. Now retired from the military, General Sharpe is now setting up a new center at Camberley that will be key in focusing on army wargaming initiatives in the future.
90. For additional information on the leaders of the British wargaming community mentioned above and on many of the accomplished participants in all the Connections UK conferences, go to their website: www.professionalwargaming.co.uk/index.html.
91. Longley-Brown, e-mail.
92. Curry, e-mail, 2 April 2017.
93. See Curry, "First in the Field."
94. John Keegan and Andrew Wheatcroft, *Zones of Conflict: An Atlas of Future Wars* (New York: Simon & Schuster, 1986).
95. They use two examples to illustrate their point. First, Bolivia has all the motive in the world to take back territory lost to Chile but being far weaker in every measure of national power has zero opportunity. Conversely, the United States has every opportunity to conquer Canada but, as the two nations enjoy one of the friendliest and most mutually beneficial relationships on the planet, has no motive.
96. All of Tom Friedman's books are worth reading, but *The World Is Flat: A Brief History of the Twenty-First Century* (New York: Farrar, Straus, Giroux, 2005) may be the one to read first.
97. The "bow wave" of computer-native officers has been gaining in seniority for some time. In the summer of 2001 I was recruited by Air University's Squadron Officer College to participate in "senior officer prospective seminars," first with second lieutenants (typically aged twenty-three), then with new captains (typically twenty-seven). The idea was to give them the chance to talk to a colonel (me) about careers, promotion, professional development, or pretty much whatever they wanted. In my session with the lieutenants, the computer game Civilization came up. All thirteen had heard of it and ten had played it, several apparently a lot. I brought it up with the captains: only three of the thirteen had played it, and only two others had any idea what it was.
98. A friend who is an attorney with the Internal Revenue Service once estimated for me,

literally on a napkin, that one computer-game designer had made $150,000,000 in royalties on a single title (it had gone into multiple editions). Of course, such wealth goes only to the designers—and few of them. A joke popular among print wargame designers goes something like this: "The surest way to make a small fortune in print wargaming is to start with a large one."

PART TWO

Toward More-Effective Wargaming

CHAPTER SEVEN

The Taxonomy of Wargaming

It has been said the foundations of science are observation and classification. Together they enable the forming of hypotheses that enable later applications. Having read the history part of the book, you have completed the observation function. This chapter will propose the classification aspect.

FIGURE 2
Wargaming: Translating Reality into a Useful Depiction

Created by Col. Uwe Heilmann, German Air Force, for your instructor in 1999

Before we can learn to apply wargaming, we must first define what a wargame is. A favorite analogy of mine is to think of wargames as "flight simulators for decision makers"—wargames can train the mind to react to changing situations in the same way a flight simulator can prepare aircrews to respond correctly and quickly to emergencies. Still, wargaming is much more. We must also understand that the scope of wargaming has expanded over the last two centuries.

FIGURE 3
The Hierarchy of Abstraction, Models, Simulations, and Games

Let's start by describing what wargames are *not*. Many people in today's military use the terms "modeling," "simulation," and "wargaming" as if they were interchangeable. They aren't. *Models* are proportional representations of the real world. An impressionistic painting is not a model, but an architect's plans are. Models, however, are static. They may be two-dimensional (such as maps) or three-dimensional (an object, such as a plastic aircraft replica), but they lack a fourth dimension: time. Models are representations at a fixed moment, like a photograph.

When a model is examined over time, it becomes a *simulation*. Place an aircraft model in a wind tunnel and observe how it behaves at different airspeeds at different moments, and you have a simulation. The military uses simulations to train a wide spectrum of individuals, from pilots who fly to the mechanics who maintain the aircraft. Several of the first "hits" in the recreational computer-game market were flight simulators.

When sides compete against each other within a simulation, they're in a *simulation game*. An increasing number of MBA programs use simulation games in the classroom. In the entertainment-game market, simulations such as Railroad Tycoon, where players use financial wizardry to build nineteenth-century railroad empires, have sold millions of copies. When a simulation game involves armed factions in conflict, it is a *wargame*.

It is important to remember that wargames are not reality. No wargame ever has or ever will capture the full scope and complexity of the real world.

Definitions of Wargaming—and Misnomers

Just as in the old story of the blind men describing an elephant, definitions of wargaming tend to reflect who is doing the defining.[1] Here are four examples:

> Wargame: A simulation, by whatever means, of a military operation involving two or more opposing forces, using rules, data, and procedures designed to depict an actual or assumed real life situation *(DoD Dictionary of Military and Associated Terms)*.[2]

> War Game:
>
> 1. A simulated battle or campaign to test military concepts or use. Conducted in conference by officers acting as opposing staffs.
>
> 2. A two-sided umpired training maneuver with actual elements of armed forces participating *(Webster's Dictionary)*.

> Wargame: A warfare model or simulation whose operation does not involve the activities of actual military forces, and whose sequence of events affects and is, in turn, affected by the decisions made by the players representing the opposing sides (Dr. Peter P. Perla, *The Art of Wargaming*).[3]

> Wargame: A simulation game depicting armed conflict (AFMC Wargame Course).

> War game: A multisided depiction of conflict in which participant decisions influence future outcomes. (An emerging definition within the wargaming community.)

Not only is there a range of definitions of wargaming, but the word itself appears two ways in print. "War game" (two words) and "wargame" (one word) are both widely used. This book uses "wargame," mostly. This determination was made for two reasons. First, "wargame" is by far more commonly seen in the press and has been the form most often used by military figures, like Deputy Secretary of Defense Bob Work; Adm. Chester Nimitz, USN; Gen. Al Gray, USMC; Gen. Curtis LeMay, USAF; and Gen. Robert Wallace, USA. It is also the term used by the United Kingdom, NATO, and most (perhaps all) of our allies. Second, the term "war game" is less precise, as it may mean either of two things. "War game" refers to the military application of game theory. "War game" is also used by many in the operations-research community and some members of the U.S. military to mean "wargame."

I maintain that wargaming has gone through three generations and is entering a fourth. Further, each of these generations needs its own definition. A *first-generation* wargame is an abstract competition in which outcomes are determined primarily by the decisions

of the participants. This generation began before the Christian era and continues today in wargames like chess and Go. A *second-generation* wargame is a simulation game depicting combat. This generation began in the early 1800s and is represented today in most tactical and operational and many strategic games. A *third-generation* wargame is a simulation game of armed conflict depicting all (or most) elements of power. This generation began with the Weimar Republic's political-military wargames and continues today in political-military games, the more comprehensive strategic games, and some insurgency/counterinsurgency games.

The emerging *fourth generation* can be called "peace games," as they depict the spectrum of competition between nations or groups in which peace is one plausible path to victory. It is tough to pick a starting date, though some of the more comprehensive political-military wargames and the commercial software game Civilization clearly fit in this generation.

Elements of a Wargame

Some elements are common to all wargames. For instance, *Blue* is normally thought of as the friendly side. Still, this may vary. When a Chinese major general and his team were briefed at the Air Force Wargaming Center in the late 1980s, he was told that the sides in our games were Blue and Red. He remarked on the coincidence, that the two sides in China's wargames were also Blue and Red, "though in our case Red are the good guys."

FIGURE 4
Principal Elements of Wargames: Red, White, and Blue

Red is typically the adversary side. This side is sometimes also called the "opposition force" (or OPFOR) or the "aggressors." A thinking adversary is what differentiates a wargame from a simulation. In fact, when flight simulators are networked into a virtual battle space to fly against opposing aircraft, they become parts of a wargame.

White varies in composition depending on the size and complexity of the wargame. For small, simple wargames it may simply be "adjudication." For medium-to-large wargames adjudication is just one element of a White team that includes game control, analysis, and higher headquarters, or "the rest of the world." In any event, this is the component of the wargame that determines the net effect of Blue's and Red's actions. In some games White would be represented by the rules and data embedded in documentation or software. Some larger games include additional factions. Red's allies may be *Orange;* Blue's allies may be *Light Blue*. Neutrals (civilians or neutral armed forces) are often called *Gray* or *Green*.

Such semantical issues can make researching historical wargaming and keeping up with its contemporary iterations more difficult. Reporters typically call anything the military does that does not involve actual combat "wargames." On the other hand, many military members find all sorts of words to use for wargames other than "wargames."

FIGURE 5
When Is an Exercise a Live Wargame?

The most common term they use is *exercise*. By the above definitions, an exercise may or may not be a wargame. If an exercise involves incorporating the net effects of decisions by friendly forces and a thinking opponent, it is a live wargame; if it does not, it is a live simulation. For example, a simulated enemy integrated-air-defense system makes the Red Flag an exercise and a wargame, while the lack of thinking adversaries or adjudication of interactions with opponents in virtually all mobility exercises makes them live simulations.

Another source of confusion is that wargames are sometimes called "experiments"; occasionally you will even hear of an "experimental wargame." Within the classical scientific method there can be no "experimental wargames," as a wargame requires both a thinking, reacting Blue and a thinking, reacting Red. Experiments require all variables to be held constant except the control variable. True, some maintain that advanced design of experiment techniques can accommodate multiple variables. Still, when a wargame is referred to as experimental, it is often a new wargame being tested. At other times the term implies a particularly rigorous game.[4] Just because things are not confusing enough as it is, the U.S. Air Force includes many wargames within its experimentation programs. If experimentation is defined broadly as "all efforts to gain insights before final decisions," wargaming actually does fit, being one tool for such purposes.

FIGURE 6
Experiments, Wargames, and Experimentation

FIGURE 7
Wargame Process: Beginning

The Wargame Process

In addition to having common elements, wargames tend to follow the same process. Game materials begin with a description of the *initial conditions,* how game-world matters stand at the start. Usually called the "scenario," this element of games typically includes a "road to war" describing how the situation has developed, orders of battle for both sides, the objectives of both sides, and information on where the battle/campaign/war will be fought. Typically, Blue and Red have different understandings of what the start conditions are—Red, say, may have a weapon Blue is only generally aware of, or Blue may have more ammunition stockpiled than Red believes.

FIGURE 8
Wargame Process: One-Turn or Vignette Open Wargame

Blue's actions describe how the Blue side decides to employ its resources to change the conditions "at start" toward its goal for the "end state." How that plan is communicated, briefed to the adjudication team, or typed into a computer varies with the wargame. *Red's actions* are the same for the opposing force, and again, the format or mode of that input varies from game to game.

Adjudication determines the net effect of Red's and Blue's actions, the new "game (or ground) truth"—that is, what has "actually" happened. Adjudication must establish that Red's and Blue's intentions are physically possible to accomplish. Next, adjudication determines what effect Blue has on Red and Red on Blue. The last step is to determine what elements of ground truth each side knows.[5] Finally, the *end state* is the state of the game world at the end of play, as determined by adjudication.

FIGURE 9
Wargame Process: One-Turn or Vignette Closed Wargame

This is how "open" wargames work. Such games provide Blue and Red with complete and accurate knowledge of the situation. During "closed" wargames, sometimes called "double-blind" wargames, Red and Blue know only what the adjudication determines they ought to know, to reflect the limitations of both sides' ability to observe the entire battlespace, or, sometimes, to serve the games' goals and objectives. In this case there are three initial states: game truth, Red perception, and Blue perception. There are also three end states: game truth and what each of the two teams perceives. Finally, in many wargames, when adjudication determines that certain Blue or Red planned actions could not actually be carried out, there are planned moves and actual moves. A graphics depiction of such games is far less elegant.

In most (if not all) Soviet wargames, this one cycle would be the entire game. In the case of the United States and most other nations the end state for move 1 becomes the at-start condition for move 2. The end state of the second move becomes the initial state of the third, and so on. The end state of the final move is the end state for the game.

Some wargames are played through a series of *vignettes*—that is, one-move, Soviet-like games, each set in the same theater with Red and Blue representing the same belligerents. Vignettes are typically used when a sponsor wants to examine different phases of a campaign in detail but not the entire campaign. The danger is that although each vignette's at-start state is independent of previous vignettes' end states, some may think the outcome of the final vignette indicates the outcome that would have been produced by a continuous wargame.

FIGURE 10
Wargame Process: Multiturn, Closed Wargame

FIGURE 11
Wargame Process: Series of Vignettes, Closed Wargame

Types of Wargames

The key to defining the various flavors of "wargame" is how they represent reality. The oldest form of wargame is the *constructive* game, in which actual forces are not

FIGURE 12
Types of Wargames: Constructive, Live, Virtual

maneuvered (as in live wargames) but are represented by some symbol—a chess piece, a cardboard square, glowing pixels on a monitor. Everything from chess to the latest wargame used to test our campaign plans for future conflict is considered constructive, as no actual forces are involved.

Live wargames are the next oldest. Everything from medieval jousts to Red Flag exercises are live wargames because actual forces engage in (simulated) combat, adjudicated by nonlethal means.

Virtual is the newest form; in it, combatants use electronic simulators. From inside the simulators (which are physically located feet or thousands of miles apart) they all look out on the same virtual battle space. They can see other friendly forces—and their adversaries. Obviously, this type of game was not possible until first simulators, then the computer networks to connect them, were invented.

Technology has even made it possible for constructive, live, and virtual elements to be linked in the same exercise. For example, for at least a decade the U.S. Army's National Training Center at Fort Irwin, California, was a live wargame providing exceptionally realistic training to one battalion at a time. In the late 1990s, the Army decided to train entire brigades at once. Unfortunately, as big as Fort Irwin is, the ranges of modern weapons and sensors are such that no more than two maneuver battalions could fit on the range at once. Brigades have three. The solution was for the third battalion to use simulators at its home station. The participants look out their viewports into a virtual battle space that looks like Fort Irwin. In fact, they see elements of the two deployed battalions as if they themselves were actually there at Fort Irwin. All three battalions report to the brigade headquarters. Folks who have participated in such a game report it is difficult for the brigade headquarters to tell which units are live and which are virtual. Then, to add even more realism, the Army places constructive units (Blue and Red) on the flanks. This forces the brigade to coordinate with adjacent headquarters.

FIGURE 13
Media of Constructive Wargames: Terrain Table / Miniatures, Map/Chart/Print, Computer

Media of Constructive Wargames

Constructive wargames employ three media. *Terrain tables* (on which the landscape is modeled) and *miniatures* were used in the earliest constructive game and are still popular, both in the general public (a type of recreational wargaming called "miniatures" in the United States, "figures" in the United Kingdom) and in the military (for tactical and even some higher-level games).

Maps, charts, and *print* are almost as old as terrain tables; the original map wargames used topographical maps and naval charts. Typically, but not always, maps are now overlaid with a hexagonal or other grid for convenience. Most commercial wargames fall into this category.

Computer wargames use software to perform elements of the game. Many early computer wargames were actually aids to map or terrain-table manual games. The computer programs adjudicated the engagements, but the locations of units continued to be shown on a map or terrain table. Today almost all computer wargames display the current situation on the computer screen, eliminating the need for a map or terrain table. Some use artificial intelligence to make some (subordinate) or all Red or Blue decisions or both.

The Scope of Wargaming

Many assert that form follows function. We see this often in architecture and the design of common objects, automobiles, planes, and packaging containers. Form follows function in wargaming as well. The wide spectrum of wargame uses has led to a proportionately wide spectrum of wargames. That spectrum can be categorized in three main ways: application, level of combat, and time period.

Application

The cause of much of the variation in wargaming is the reason a given game is being conducted. The purposes of most wargames fall between pure *decision support* and pure *development.* In the former group fall wargames designed exclusively to aid decision

FIGURE 14
Scope of Wargames

makers in making specific decisions. These decisions typically impact human lives and national resources; accuracy of adjudication is usually the first priority. Still, even these games need to be user-friendly enough to be completed in time to influence the decisions they are designed to support. These wargames are mostly used by armed forces and are sometimes created by contractors. The latter, at the other end of the spectrum, are wargames designed to develop some mode of inquiry or skill. For example, educational games are intended to establish a synthetic decision-making environment to help students develop their skills as strategists. Another developmental wargame might explore possible future systems to gain a sense of how potential adversaries could attempt to minimize their effectiveness.

Most wargames conducted by the military function to some degree in both areas. Decision-support wargames tend to develop the skills of their participants, and developmental games examining potential future systems are likely to influence procurement decisions.

Level of War

Wargames for all these applications may be tactical, operational, or strategic. *Tactical* games focus on battles and firefights. The geography tends to be fairly small, the time covered short, and the forces on both sides limited. As examples, tactical wargames may depict combat between a submarine and a destroyer or between two fighter jets, or an infantry battalion being attacked by an armored brigade.

Operational games are concerned with conflict at the operational level—that is, large operations and campaigns. They embrace entire regions, periods of from days to months, and all forces that are in or can affect the region. As examples, operational wargames may play campaigns meant to drive an adversary from a specific area, gain air superiority in a theater, or break the blockade of an ally.

Strategic wargames depicting conflict at the strategic level focus on national wars or the gaining of national objectives without war. The geography depicted may be the planet, or at least the entire territories of all the combatants. The time covered will be relatively long, years to decades, and the forces depicted all those the belligerent nations can bring to bear. As examples, strategic games may depict World War II or current global defense challenges.

Time Period

Commercially published wargames depict conflict in times selected from an exceptionally broad spectrum, but even military decision-support games look at a broader range than you may think. Wargames have been published on conflicts occurring in the earliest civilizations, in far-future interstellar settings, and everything between. Many wargames have been published depicting what seems every war in human history. Most military decision-support games depict the current military situation, or at most the situation anticipated within the next two years. However, as the lead time to develop and manufacture new weapon systems grows ever longer, some decision-support wargames now look out five, ten, or twenty-five years. Educational and training games tend to depict the same time settings as decision-support games, but many military schools use wargames to help extract insights from historical conflicts. For example, for many years the National Defense University curriculum included a game on the Peloponnesian War.

Other Variables and Nomenclature Matters

Time Available to Produce. Some wargames are thrown together in a few days and tossed out after a single session. Others can take years to develop and are used year after year.

Time Needed to Execute. A few wargames can be completed in about an hour, while the total time needed for other games, preparation through reporting, can extend over two years.

Geographic Extent. Not surprisingly, tactical wargames tend to focus on a very small area, while strategic games often encompass all or much of the Earth.

Classification. While commercial wargames are of course unclassified, it often surprises civilians that many games used by the military too are unclassified, most frequently (but not only) those that are used for educational purposes. A few wargames are not only very, very highly classified but are tightly "close hold" as well.[6]

Size of User Base. Commercially published wargames are available to the whole world, and the best-selling titles are played by millions worldwide. Some military games are so sensitive that their very existence, their insights, even the names of their participants are known only to a very few individuals, on a strict need-to-know basis.

Source. In recent decades commercial wargames have begun to be designed, developed, and published in many nations and to be played worldwide. Computer wargames were a founding element of the huge global computer/video-game industry. On the military side, all major powers use games. I am unaware of any military service that does not. Academically, wargames are used not only in military schools worldwide but also in civilian classrooms, at least in the United States, the United Kingdom, and Canada. Finally, many corporations routinely engage in gaming to understand the implications of different marketing or financial strategies.

Level of Detail. How a wargame will be used is an important factor in determining what its level of detail should be. A tactical wargame attempts to include as much of reality as practical. This level is often a good fit for examining tactical situations or system-attribute trade-offs. A contrasting approach is *distillation,* in which rules, maps, and markers include only selected relevant elements of reality. This level of detail is often used for exploring the operational and strategic levels of war, when too much detail can obscure the big picture. Or game designers can choose *abstraction,* dispensing with most elements of reality and leaving only the essentials of competition. Games with high abstraction tend either to develop an individual's strategic thinking ability or to prevent participants in strategic games from getting "down into the weeds."

Proof, Prediction, Forecast, or Indication. There is considerable disagreement within the wargame community on what to call any insights drawn from the end state of a wargame, though there is a solid consensus among professionals about what *not* to call them: "proof." They believe it is intuitively obvious that wargames do not "prove" anything. Defense professionals cringe when individuals who don't know better—or worse, do know better—say this wargame or that proved anything. Often these individuals are trying to sell a product or a strategy. Many leaders in the field also recommend avoiding the word "predict," as it conjures up images of crystal balls, implies more confidence than is justified, and is popular with the snake-oil crowd.[7]

For a few years I advocated using "forecast," as a way both to get people not to use "predict" and to emphasize that wargame outcomes are more indications of relative likelihood than predictions. After all, weather forecasts almost never say, "It will rain"; instead, they give estimates of the likelihood of rain. However, recently I've been convinced I was as misguided as Bess Truman.[8] "Forecast" too implies a precision that wargaming does not possess. Also, the weather is not a thinking adversary consciously trying to deceive and defeat weather forecasters. The term we will use is "indication." Wargame outcomes are at best a plausible indication of what future outcomes may be.

BOGSATs. There is one final element of semantics: while the term "BOGSAT" is used frequently in defense wargaming, different people mean different things when they say it. Literally, BOGSAT is an acronym for "bunch of guys sitting around a table." Some use BOGSAT as shorthand for any expert-panel method of adjudication. For others it means folks sitting around discussing a scenario and calling the event, incorrectly, a wargame. Still others use BOGSAT pejoratively for any adjudication performed by humans. Others yet use the term for any poorly designed wargame. This book has avoided using "BOGSAT," because it means so many different things to different people, but if you are involved in military wargaming for any length of time, you will hear it. When you do, it would be best to ask the speaker what he or she means.

Cast of Characters. For purposes of this book I define a wargame's cast as the *leader,* who directs wargaming activities without, typically, participating in or creating games him- or herself; *participants* (sometimes *players*), who execute a game; and *practitioners,* experts on wargaming who can advise on, design, develop, and conduct games. Some wargames, often the larger military ones, also include "subject-matter experts" (SMEs). As the name implies, they are individuals with expertise in areas of relevance to the wargame. They typically advise the White, Blue, and Red teams, or some of them, on the likely impacts in their areas. Sometimes they also serve as players.

Notes

1. For those who have not heard the story: one blind man felt an elephant's side and pronounced that elephants were much like walls; another felt the elephant's leg and asserted that elephants were much like tree trunks; and yet a third felt its trunk and declared that elephants were much like snakes.
2. This definition was dropped sometime around 2015 and as of 10 November 2017 had not been replaced.
3. This definition has evolved since published in Perla, *Art of Wargaming,* p. 164.
4. To make things even more confusing, as mentioned below, the U.S. Air Force now includes wargaming in its *experimentation* program. This approach uses a host of tools to forecast the likely benefits of changes to tactics, techniques, and procedures of new systems, before any training or acquisition money is spent. Wargaming can be a good fit in such work,

but the wargames are not themselves scientific experiments.

5. The term "game truth" is also widely used. Both refer to what game design and adjudication process have established the actual state of affairs to be.

6. Within the U.S. military and the defense community in general, classified information is shared with only those who "need to know" it. "Close hold" information is available only to an extremely small and predetermined set of individuals; people not on the access list, even if they have appropriate security clearances, will typically not know the information exists.

7. While I usually scrupulously avoid the word "predict" myself, I'm not above using it to tweak colleagues who are dismissive of the ability of wargaming to generate any insights into plausible future states. To them I point out that it is literally true that all wargames predict the future (in that they always produce an end state), and several times in a century (as history shows) their predictions turn out to be correct.

8. The story goes that shortly after Harry Truman assumed the presidency, a number of reporters approached his wife, Bess. "Ma'am," they said, "you have got to get your husband to stop saying 'manure' all the time—he's president now." "Gentlemen," she replied, "you have no idea how many years it took me to get him to say 'manure.'"

CHAPTER EIGHT

The Utility of Wargaming

Now, after describing the subset of the history of wargaming that I could both find and relate in the space available, it is time to continue the "Caffrey Loop" and attempt to draw theories that are both useful and consistent with that history.

What broad conclusions can we draw? Wargames can save lives. They can also, under some circumstances, make the difference between victory and defeat. These statements are supported by both natural experiments and the extrapolation of widely accepted theories. This chapter will provide that support, but first let's consider war itself. We will start by doing what Einstein called a "thought experiment" to generate some hypotheses about winning wars and then use military history to check the validity of those hypotheses.

How to Gain an Edge in Warfare

Let's envision a war between two ancient Greek city-states. They have roughly equal populations, use the same type of weapons, and both employ what is in effect a national guard of citizen soldiers with the same moderate level of training. Both common sense and the historical record suggest that a clash between these two city-states would at first produce a bloody tie, more and more casualties taken and inflicted. Finally, one side would gain some small advantage, and the fighting would end, the winner almost as bloodied as the vanquished. If you were the leader of one of these city-states you would not want either outcome, especially the defeat. Much of generalship, then and today, is setting up subordinates for success. But with such equal forces, how do you get an edge? Let's look at some alternatives (hypotheses) and what the historical record suggests about their validity.

- *Improve training.* This was the strategy Sparta followed; its soldiers trained far harder and far longer than any others. In anything like an even fight, Sparta won. Still, as Sparta's defeat at Thermopylae demonstrated, sufficient numbers (once they could be brought to bear) could defeat superior training.

- *Increase numbers.* This was the strategy Athens followed; its diplomatic skill and economic strength typically allowed it to bring the biggest navy and often the biggest army to the fight. Still, Athens lost the Peloponnesian War.
- *Field better weapons.* This has been a principal element of the American way of war from the long rifles of the American war for independence through the smart bombs of Operation Enduring Freedom. Still, we were defeated by a far lower-tech enemy in Southeast Asia, and history includes many other examples as well of the side with inferior weapons winning.

From the above, two things are clear, one about war and the other about using history for natural experiments. On war, while it is clear there are several ways to get an "edge" in warfare, all advantages are relative (relatively better training, better weapons, etc.) and finite (an edge can be overcome by an enemy with relatively greater advantages in other areas). On natural experiments, history seldom provides the clear, conclusive proofs provided by laboratory experiments. I am unaware of a single case where all elements of a fight remained the same except for one single element that could therefore be said to be *the* cause of a different outcome. Of course, the sheer number of historical cases available to examine can increase our confidence some. But as any statistician will tell you, even very large samples can produce misleading results.[1]

Testing Hypotheses on Wargaming

So, history can be used to test hypotheses but will seldom, if ever, provide the proof positive that is characteristic of a laboratory experiment. With that proviso, I will now state some hypotheses about wargaming and look to the historical record for (tentative) confirmation or rejection.

Hypothesis 1: Other factors being equal, the relative quality and quantity of wargaming conducted by a side provide it a finite edge. To assess the accuracy of this statement historically, we must examine the relative level of wargaming by each side and then try to correct for any other elements that might have influenced the outcome. Doing so indicates that gaming does indeed supply a finite edge.

During the wars of German unification, Prussian wargaming appears to have provided a significant advantage. How else can Prussia's lopsided victories be explained? Prussian forces were more often than not outnumbered, weapon advantages were mixed, and training methods were similar, though some think Prussia had an advantage in the education of staff officers. At this time, though, the Prussian military had a monopoly on second-generation wargaming and had integrated it into its staff education and its staff planning methods, especially at the higher levels.

World War I illustrates the relative advantage wargaming represents. By then all major combatants were employing wargaming to varying degrees. While the Germans' greater sophistication and scope in wargaming appear to have contributed to their greater effectiveness, allied advantages in manpower, industry, and technology overwhelmed that modest edge. The German experience in World War II, however, illustrates how much advantage accrues from significantly higher quality and quantity of wargaming used. Between World Wars I and II, gaming became much more pervasive at all levels of Germany's armed forces than it had been. The benefits appear to have enabled Germany to be successful in 1940 against Britain and France. However, it is clear even this greater advantage was of finite utility: ultimately, the combined resources of the United States, United Kingdom, and the Soviet Union defeated Germany.[2]

More-recent conflicts also seem to support the hypothesis. Use of wargaming by the communist side in the Korean War appears to have contributed to its successes, especially in its first two offensives.[3] The comprehensive use of wargames by the communist side in Southeast Asia seems to have brought greater advantage than the far less frequent use by the United States of more-sophisticated wargames.[4] In Iraq's war with Iran, Iraqi wargaming seems to have been a principal element in breaking the stalemate.[5] The 1990–91 Gulf War illustrates that the edge gained through wargaming is based not on the absolute effectiveness of your wargaming but on its effectiveness relative to your opponents'. In 1990 and 1991 the Iraqi armed forces gamed at least as effectively as they had a few years previously, but now they were up against a coalition that made far more sophisticated and widespread use of wargaming than Iran had (assuming Iran had wargamed at all).

Hypothesis 2: The advantage provided by wargaming is finite and can be overcome by advantages in other areas. The examples above are sufficient examples to prove this point. Several of the sides with clear advantages in wargaming lost their wars.

Hypothesis 3: Wargames do not predict the future—wargames don't even forecast *a potential* future—but they do produce outcomes that may (or may not) suggest plausible futures. Most wargame professionals can tell you of at least one case, and often several, when a contractor or, worse, a government official cited a wargame as proof that some product should be procured or some policy adopted. This is particularly bad when the individuals involved helped "cook the books" so the wargame would seem to confirm their preexisting positions. Still, even when conducted with honesty and professionalism the large majority of games do not correlate to later events.

Many of my friends and colleagues, especially those in the operations-research community, like to say wargames can *never* accurately predict the future. The problem with this statement is that, as you know from the earlier chapters, two hundred years of history

offers several examples of wargames whose outcomes matched future events, occasionally with "eerie" precision.

Still, wargame outcomes are not even like weather forecasts. A typical weather forecast will tell you that there is an 80 percent chance of rain tomorrow. Game outcomes are much more tentative: they tell you that if situation A occurs and if Red does B and if Blue does C, it is more likely than not that D will be the outcome. This sounds a lot less useful than a weather forecast, but it is actually more useful—you can't do anything about the weather, but you normally can do something to prevent a wargame outcome you do not want. In several cases history turned out the same as had been gamed in part because the losing side took no action to prevent in the real world a wargame outcome that would be disastrous.

Given all that, what can be said? First, wargame professionals should avoid the word "predict," as it is evocative of crystal balls and suggests a certainty that wargaming does not deserve. For years I advocated using the word "forecast," until colleagues convinced me even this word implied greater confidence than is typically warranted. The most-neutral terms that seem to fit are simply "indicate" and "outcome." How much confidence any outcome warrants is a separate, and later, discussion.

Hypothesis 4: Wargame outcomes vary from later events because the depicted situation does not occur (or not as depicted); Red does not act as depicted in the game; Blue does not act as depicted in the game; the adjudication was wrong; or the game succeeded in determining the most likely outcome but in the actual event one side was extraordinarily lucky or unlucky.[6] History shows that the first reason is far and away the most frequent reason for mismatches between game outcomes and later real outcomes. During the Cold War the U.S. Army defended the Fulda Gap in West Germany in wargames played from Fort Leavenworth to, well, the Fulda Gap. Thankfully, the Warsaw Pact never invaded, and so all those games were at best untested—but in another sense, they were all wrong. Wargames have also been wrong because the real Red did not do what the Red player anticipated. Almost no interwar U.S. Navy wargames anticipated the kamikaze or the midwar change in Japanese strategy. Similarly, the Army wargame on the first phase of Operation Iraqi Freedom correctly anticipated Iraqi strategy but neither the timing nor the nature of Iraq's shift in strategy.

It is often overlooked in discussions of why wargames produce "wrong" outcomes, but a major reason is Blue following a different course of action during the actual conflict. Blue players are typically junior to the individuals who will make the actual decisions. Even actual decision makers who participate in the wargame, studies have shown, tend to make different decisions when the stakes are real.[7] More importantly, Blue may do so because the decision makers, not liking how a wargame turned out, have addressed

the reason, in order to change how the actual event will turn out. The British reacted to their 1905 wargame by creating the capability to reach the continent sooner; the United States reacted to negative Gallant Knight outcomes with a host of actions; and General Wallace reacted to the outcome of his first game on the invasion of Iraq by changing his line of advance.

Finally, the historical record does support the assertion that incorrect adjudication can produce wrong wargame outcomes. Still, for the cause that gets most of the attention, the number of cases is rather modest. The Army's pre–World War II overstatement of the effectiveness of tank destroyers and understatement of airpower effects had real consequences in North Africa. Still, not adjudicating at all some aspect of a conflict seems to have worse impacts than getting the adjudications not very correct. By the time the Germans began adjudicating logistics in gaming the Schlieffen Plan, it was too late to fix the identified problems fully. During the First Gulf War, the failure of American games to adjudicate the prospect of Iraqi units surrendering or disbanding contributed to the overestimation of friendly casualties. We know these estimates resulted in the stripping of America's emergency rooms of reservist medical personnel for no benefit, and they appear to have contributed to a shortage of POW facilities and to the shipment of far more supplies than needed. They may have also influenced the American administration's decision to suspend offensive operations when it did (see chapter 4).

Hypothesis 5: Wargames are a cost-effective way to acquire a military advantage. This last assertion may be the hardest to support through historical examples. After all, we have already established that wargaming is just one of several ways in which nations have acquired military advantages over their opponents. How can the historical record show that resources spent on gaming might not have produced an even greater advantage had they been committed to other options? Still, I believe the case can be made.

Consider Prussia during the period when it had a monopoly on wargaming. Just a few years earlier it had been humiliated by Napoleon. What could Prussia do to increase its military effectiveness? It could not significantly increase the size of its armed forces; it already had the largest army relative to civilian population in Europe. Prussia tried to gain a technological advantage, but its economic and scientific bases were only so large. It took it years to reequip its army with a new rifle, and during that time its potential adversaries were modernizing their artillery. It could and did redouble its training, but most training is expensive, and in the opinion of many military observers, Prussia's troops had been the best trained in Europe when they were defeated by Napoleon. The principal change was wargaming, now integrated into its war college and operational planning. The incremental costs of wargaming were negligible, well within even Prussia's tight budgets.

Now let's consider interwar Germany. It had been so weakened by the Great War that it feared being conquered by Poland. How could it increase its military effectiveness? The Treaty of Versailles limited the size of its armed forces. The same treaty forbade tanks, aircraft, submarines, and other weapons that might have given it a technological edge. It already had the best-trained army, so further improvement there would provide diminishing effects. It also had the most advanced wargames, but they had been used only by a small fraction of its force and for a limited number of applications. At a negligible incremental cost, Germany greatly increased the depth and scope of wargaming in its armed forces. This had the added benefit that when the armed forces were allowed to expand, buy new weapons, and activate new units (or did so anyway), they knew from their wargames what weapons and forces would have the greatest impact. It is difficult to find an explanation for Germany's 1940 victories that does not stem from its expanded wargaming. The British and French had more divisions, more troops, much more heavy artillery, and much greater economic strength. Germany's edge came from its wargames and the wise doctrinal and technological choices to which they pointed.

Testing Hypotheses on the Application of Wargaming

The historical record can also be used to test assertions on specific applications of wargaming. While wargaming can be applied in a range of often overlapping ways, they can be divided into two broad categories with several subcategories each.

Hypothesis 1: Wargames can be useful as aids in making specific decisions on the acquisition of military forces and militarily significant infrastructure. The historical record is particularly strong in this area. From Teddy Roosevelt's use of wargaming on the potential value of a Cape Cod canal to the change in German plans for invading the West to gaming's impact on both Gulf Wars, the evidence is overwhelming. Admittedly, most historical evidence is at the strategic and operational levels. But then, historical records are more likely to be kept at those levels. What little tactical evidence there is comprises a few reports of the use of wargaming in tactical planning by the Vietnamese communists and by U.S. forces in the First Gulf War. Yet these support the assertion that wargaming is useful for planning combat at the tactical level also.

Hypothesis 2: Wargaming can be useful in developing the potential of individuals, technology applications, and ideas. Here it is best to examine the indications in the historical record by type: individuals, technology applications, and ideas.

Hypothesis 2a: Wargaming can be useful in developing the potential of individuals. This being the oldest application of wargaming, one might assume that its usefulness has the most historical support. Unfortunately, if history includes an account of a prince with a record of losing battles taking up chess and then going on to victory, I have yet to find

it.[8] The increase in military effectiveness with the founding of staff and war colleges might be seen as pertinent. Still, wargaming made up just one part of the individuals' studies, making the effect of gaming alone difficult to isolate.

The best evidence can be found in the impact of the U.S. Navy's Top Gun, the Air Force's Red Flag, and the Army's National Training Center. Top Gun is a particularly good case, as there just happened to be a control group: The Navy instituted live wargaming during the Vietnam War and saw its loss ratio improve dramatically. No similar improvement in the Air Force loss ratio occurred. True, the turnaround in performance between Vietnam and the Gulf may be attributable to many causes. Still, many reports from U.S. forces that participated in the Gulf War credit their effectiveness at least in part to prior participation in live wargames.

Hypothesis 2b: Wargaming can be useful in developing the potential of technology applications. The interwar years offer the most examples of successful wargaming in this respect. The German army used wargames to help anticipate what properties of tanks would be most useful once it could possess them. The German navy used games to identify what should be the attributes of its future submarines. Similarly, the U.S. Navy used wargaming to help understand what attributes of aircraft carriers had the greatest impact on their military effectiveness. Finally, the Marine Corps included wargaming in its efforts to anticipate what hardware it would need to achieve an amphibious capability.

Hypothesis 2c: Wargaming can be useful in developing the potential of ideas. The Marines' interwar wargaming of their hoped-for amphibious capabilities illustrates that it is sometimes difficult to untangle the use of wargames to explore ideas from wargaming exploring the technology needed to implement those ideas. The Marines first envisioned what would be necessary procedurally, organizationally, and technically to land on a hostile shore and developed those ideas through constructive and live wargames. The German navy used wargames to develop the idea of wolf-pack tactics, while the German army used them to help develop and refine an idea it called "mobile operations." The rest of the world would soon call this new type of warfare *blitzkrieg*.

Admittedly, nothing in the historical record proves any of my assertions with the level of certainty at which controlled physics experiments have repeatedly proved that $F = ma$. Still, I trust that by now you will agree that the preponderance of the evidence supports the proposition that wargaming can provide a potent military advantage and that the size of that advantage depends on the effectiveness, breadth, and depth of your wargaming—relative to that of your adversary.

But why is this so? History can easily tell us what happened, but it doesn't so clearly tell us why. While I hope this chapter so far has convinced you that there is ample evidence

of the impact of wargaming, the record offers few clues about why wargaming's impact has been so strong. In 2005 an explanation occurred to me. I can offer no proof that I am right, but I hope you will find my reasoning compelling and my explanation helpful.

Why Wargames Work

Taken together, three theories, or models, can help explain why wargames work. They are the OODA Loop, military technical revolutions (MTRs) / revolutions in military affairs (RMAs), and the Strategy Cycle, also known as the Innovation Cycle and the Caffrey Loop.

Boyd and His OODA Loop

John Boyd was an unlikely theorist.[9] Growing up in a family of limited means in Erie, Pennsylvania, he enlisted in the Army Air Forces late in World War II. After getting a degree through the GI Bill he returned to what was now the U.S. Air Force as an officer. He fought as a fighter pilot during the closing months of the Korean War.

After the armistice a series of events occurred that would lead to his development as a theoretician and to his formulation of the OODA Loop. He was one of several American pilots who examined a MiG-15 fighter that had landed behind United Nations lines. Boyd learned that the MiG was more heavily armed and could fly faster and climb more quickly than the F-86 Sabre jets he flew. Yet he understood the United States had shot down ten MiGs for every Sabre it had lost.[10] That paradox stuck in his mind and would not go away.

An outstanding pilot, Boyd was selected to attend the Air Force's prestigious Fighter Weapons School. He did so well that he was selected to stay on its faculty. He did so well on the faculty that he was placed in charge of the school's core course—on air-to-air warfare. Finding no true textbook, no unified theory on air-to-air warfare, he developed the principles and wrote the textbook himself. That work led him back to school, for a master's in industrial engineering, to acquire the math skills he needed to develop his theory of energy and maneuverability. His eventual paper on that theory remains a cornerstone of fighter design and tactics worldwide to this day. It led then to a Pentagon job defining fighter requirements, and there, more than any other individual, he earned recognition as the father of the F-16.

Through it all, the paradox of Korean air combat kept coming back to him. How could a better aircraft suffer more losses? Perhaps it was not better in the ways that really mattered in air combat. In time, Boyd realized the F-86's more-experienced pilots, bubble canopy, and hydraulically boosted controls allowed its pilots to observe, orient, decide, and act (OODA) faster than their adversaries. That, not top speed, made all the

difference. In time he realized that staying a move ahead of your adversaries was at least as important at the operational and strategic levels of war also. This led to the gradual development of his "Discourse on Winning and Losing" (a presentation available online). This final theoretical work goes as much beyond his "OODA Loop" as Einstein's general theory of relativity goes beyond $E = mc^2$.

A fundamental reason why wargames "work" is that the side that makes more-effective use of them can (all other things being equal) complete OODA loops more quickly than an adversary that does not use wargaming as effectively or at all.

Let's consider two combatants, at any level of warfare. As the fighting continues, Blue gains combat experience. Each OODA loop gets a little faster. It would be easy to jump to the conclusion that Blue could win by simply "hanging in" long enough for its increasingly tight OODA loop to become decisive. However, a little more thought makes the fallacy of such reasoning obvious: Red's OODA loops are getting a little faster each time too. As in all warfare, the only advantage that matters is a relative advantage. If both adversaries tighten their OODA loops equally, neither gains an advantage. The U.S. military saw something much like this in Iraq, when it would develop a better way of defeating improvised explosive devices only to see the insurgents develop a counter to the American counter, which the United States would counter, and so on and on.

But what if you could shrink your OODA loop faster than your adversary can his, or better yet, what if you could shrink your OODA loop while your adversary's remains unchanged? Either would provide a great relative advantage—and of the type that matters. Wargaming can shrink OODA loops faster and do so without prompting an improvement in an adversary's speed. Before I can explain how wargames can shrink OODA loops faster than war can, I need to explain why Wilbur was wrong.

In 1901 Wilbur and his brother Orville Wright had been trying to invent controlled human flight for several years. They had made significant progress, but as Wilbur considered their rate of progress and how far they still needed to go, he concluded that man would not fly for fifty years. Wilbur should have known better than anyone (except possibly Orville) how long it would take. How could he have been so wrong?

Wilbur based his estimate on their speed of progress thus far. Until 1901 they had been traveling to Kitty Hawk, North Carolina, each summer, seeing what worked and what did not meet expectations, then traveling back to Dayton, Ohio, each fall and working through the winter on an improved device. Each cycle of improvement took a year. If they were fifty cycles of improvement away from developing a working aircraft, then it would take fifty years to produce one. But in 1901, the Wrights started using a wind tunnel. It was not much to look at, a rectangular box that would fit in most dining rooms. Yet it included delicate instruments, designed by the Wrights, that could measure the

lift and drag of various wing shapes. Now, instead of a year, wing shapes could be evaluated in seconds. Now, fifty cycles could take much less than fifty years. Just two years later, man took flight.

Now let's consider how armies traditionally got better at war. Inexperienced commanders gradually gained experience—if they lived. Green troops gradually turned into veterans—those who lived. Battles took days to fight, campaigns took seasons, and wars took years to bring to conclusion. Today live and virtual wargames still take days but constructive games can be completed much more quickly. A six-month campaign can be executed in six days, or six hours, or six seconds. The synthetic experience derived from all types of wargames can create virtual veterans far faster than actual combat creates real ones—and at a fraction of the cost in lives, time, and treasure.

The reason I said above that wargaming helps shrink friendly OODA loops without affecting the speed of potential adversaries' is that the adversary is not gaining the same experience. This is what happened during the interwar period, when German submarine doctrine became more and more effective while British antisubmarine warfare doctrine remained unchanged.

Wargaming, MTRs, and RMAs

The theories of *military technical revolutions* and *revolutions in military affairs* also help explain the effectiveness of wargaming. But first we must briefly describe yet another contribution by Andy Marshall and others from Col. Trevor Dupuy. First, by the late 1980s Colonel Dupuy's analysis of military history had revealed that the number of casualties per thousand combatants per hour engaged tended to remain constant. This is quite counterintuitive, as weapons have obviously become more lethal over time. Dupuy's explanation was that soldiers have been getting better at not dying. He also identified several spikes in history when a new weapon temporarily increased casualties (per thousand per hour) until defenses caught up. His findings were interesting, but it was not obvious how such knowledge could give your side a military edge.[11]

Then Andy Marshall, as head of the Office of the Secretary of Defense's Office of Net Assessment, learned of work done by the Soviet General Staff and had it translated into English. The Soviets too had reviewed military history and had identified conflicts in which one side suffered far fewer casualties (per thousand per hour) than the other. The advantaged side, they had found, was relatively more advanced in an MTR. They were able to show that maturity in an MTR requires much more than just a new weapon. Maturity is the sum of advantages in weaponry (or support systems), the employment of the weapon, and the organization that facilitated the use. A nation could achieve a very strong edge over its adversaries by fielding new weapons first, developing the best tactics

for them first, and devising the best way to organize around them first. The sum of the parts of an MTR was greater than its individual parts—that is, a fully mature MTR had far more impact than a new weapon alone. Marshall realized here was a way the United States could acquire a useful edge. The strength of our research efforts would make us likely to field more effective systems first. If we could also develop effective tactics and appropriate organizations for them quickly, our advantage would be multiplied.

Later Soviet thinking, also acquired by Mr. Marshall, extended the concept to include revolutions in military affairs. In this case a new concept of operations comes first, but as with MTRs, maturity requires new equipment/technology and an organization that facilitates effective employment.

Strategy Cycle: The Caffrey Loop

In both cases the greatest advantage comes not simply from having more advanced technology or a more effective doctrine but by maturing all elements of an MTR or RMA more quickly than your adversary. The Caffrey Loop can be used to illustrate how wargaming can help make that happen. As originally drawn, the Caffrey Loop describes how MTRs/RMAs typically mature.

FIGURE 15
The Cycle, a.k.a. Strategy Cycle, Caffrey Loop, Innovation Cycle

The British experience during World War I illustrated the normal process. When the United Kingdom invented the tank, both tank technology and its overall MTR structure were very immature. Still, the British were able to draw on both their experience of land warfare before and during the present war and their history in employing armored naval vessels. They formed initial theories of how tanks could best be employed, and crafted from the most-convincing theories informal doctrine that shaped their initial plans. They then employed their tanks, in a small way—and found that much of what they thought they knew was wrong. This new history was added to their body of history,

and the process was repeated. Gradually the British MTR matured—but then German countermeasures also matured.

FIGURE 16
The Cycle, with Synthetic History

The version of the Caffrey Loop in figure 16 illustrates how wargaming can speed up maturation while *not* facilitating the maturation of enemy counters. The German experience during the interwar period illustrates this process. The Germans wanted to adapt their "lively" way of war to take best advantage of technologies that had emerged during World War I; in other words, they wanted to initiate and mature a revolution in military affairs. However, they had two problems. First, the peace treaty forbade them even to possess tanks or aircraft. Second, as they were at peace, they could not use experience in battle to feed cycles of improvement. Wargaming solved both these problems. Their map wargames simply attributed to units known or anticipated capabilities. Their live wargames used surrogates: motorcyclists as aircraft, torpedo boats as submarines. The outcomes of these games were used as "artificial history" to fuel revisions in theory and doctrine, as well as the planning for the next wargame.[12] This process not only allowed Germany to mature its mobile-operations RMA but prevented its future adversaries from developing counters in advance.

Of course, the German army did not have a monopoly on employing wargaming to create synthetic history and therewith continue the cycle. As you will recall, both the U.S. Navy and Marine Corps employed much the same cycle during the same period. The Navy clearly used numerous types of wargames within its cycle, which included relatively low-risk constructive games at its war college that explored new ideas, followed by much more expensive and rigorous live wargames—the roughly annual fleet maneuvers.

The maneuvers provided crucibles for strategies and socialized new concepts across the fleet.

Nor is this just a practice of the interwar years. The Center for Naval Analyses has advocated a cycle of research in which wargaming feeds and is fed by other analytical techniques. The Marine Corps continues to describe its wargaming as part of a cycle.

So, we have completed the history and theory elements of our Caffrey Loop. Our final chapters will provide something of a wargame doctrine. The material is partly derived from the history and theory presented above, and partly from my almost half-century of experience with wargaming. The planning and execution phases will be up to you.

Notes

1. For how history can best be used to extract useful knowledge and why wargame outcomes can be viewed as artificial history, see Robert C. Rubel, "The Epistemology of War Gaming," *Naval War College Review* 59, no. 2 (Spring 2006), pp. 108–28, esp. p. 117.
2. Ironically wargame errors may have also hastened German defeat. Hitler's decision to end the pol-mil games denied him a source of insight into the plausible diplomatic and ultimately military consequences of his actions. The General Staff's failure to allow sufficient time for Operation Otto, the wargaming of the invasion of the Soviet Union, in turn, denied it insight into the impact of the Germans' first winter in Russia.
3. An attendee at one of my "history of wargaming" talks later mailed me several pages from a book on the Chinese intervention in the Korean War. The brief mention of wargaming seemed to indicate the Chinese were using Soviet-style games. For years I couldn't cite the book: he did not send its title page. See chapter 3, note 10, for the rest of the story.
4. While a lieutenant stationed at Pope Air Force Base in North Carolina, I joined the Fort Bragg wargame club. Several of the noncommissioned officers who had served in Vietnam told me of having frequently come across, when overrunning base camps, models of the kind used in Soviet-style wargames. Conversely, I've been able to find only one account of a wargame conducted by the Army in Vietnam. It was run by an officer with a PhD in operations research on a "micro"—a refrigerator-sized computer.
5. Col. Charles "Westy" Westenhoff, USAF (Ret.), served as an air attaché in Baghdad during the Iran-Iraq War. Following Iraq's victory at Fish Lake the Iraqi government took him and many other attachés on a tour of the battlefield. During that tour he observed classic Soviet-style wargame terrain models. The late offensives like Fish Lake followed the pattern of those planned with Soviet gaming methods.
6. Dean Rubel makes this case better than I can: "Or any number of subsidiary things produced actual outcomes different from the games. It's kind of like the butterfly effect—or Richard III's 'for want of a nail the horse lost its shoe . . .' The point is that any wargame is a distillation of reality to one degree or another. Rules, dice rolls, algorithms, etc. are simplistic representations of complex phenomena. Some enlisted man forgetting to flip a switch might create a cascading series of events that tip the whole battle, even if all the conditions and decisions of the real event mirror those depicted in the game."
7. See Downes-Martin, "Adjudication."
8. Many successful rulers, such as Elizabeth I of England, have been serious chess players, but I am unaware of any attempt to correlate chess playing with success.
9. As Boyd never wrote a book on his theories, we do not have a definitive source. Still, a good overview, integrated into a biography of Boyd's professional life, is Grant T. Hammond, *The Mind of War: John Boyd and American*

Security (Washington, DC: Smithsonian, August 2004).

10. Decades later, when we gained access to Chinese and Soviet archives we learned that we had done very well—but not quite *that* well.
11. See Dupuy, *Numbers, Predictions and War*.
12. Dean Rubel argues that wargame outcomes can be usefully thought of as artificial history. See his "Epistemology of War Gaming" for how intellectual tools used to extract useful knowledge from history can be applied to game results.

CHAPTER NINE

Wargame Participation

We begin our three "doctrine" chapters with what history and practice seem to indicate is the most effective way to participate in wargames. To paraphrase a former Chief of Staff of the U.S. Air Force, there is a 0 percent chance that the following is 100 percent right. The following will also not even apply 100 percent of the time. Still, like actual doctrine, it will provide a point of departure.

Most folks who participate in a wargame either want to enjoy themselves and hope they also learn something or want to learn something and hope they will also enjoy themselves. How to get the most out of it does not depend very much on whether an individual is carrying out a military tasking, completing a class assignment, or just having fun. I have worked to make this advice universally applicable, although the branches of wargaming call for some variation. There is actually more variation in the preparations needed for the various roles within a wargame than among wargame applications.

Each side (individual or team) must develop an idea of how it will win. While there are many types of wargames and an almost infinite number of scenarios, the knowledge and skills needed to develop a strategy apply to all. It has been my experience playing commercial wargames for over fifty years that individuals who win games set during World War II generally also win games set in ancient Rome, and in the Cold War, and during the Napoleonic Wars, and between Klingon and Federation fleets.[1] I once taught someone to play his first wargame and very nearly lost the game to him. My pride largely recovered when I learned he was a nationally ranked chess player. Being an effective strategist increases your odds of success if you are playing the wargame for military, academic, or recreational purposes. I suspect the ability to develop strategies can be applied to business, politics, or any competitive field. But how does someone develop the ability to develop effective strategies? My "loop" describes one path.

The foundation of it all is history. If you could learn all of military history, what has worked and failed in the past, you would have a very large quiver of ideas that could be drawn out to adapt to future situations. However, history is the largest block of the

Caffrey Loop because there is so much of it. In a lifetime, no one can read all history books (although some of my colleagues at the Air Command and Staff College made impressive attempts to do so, and you can find some suggestions on what to read below).

But there is a "CliffsNotes" for history—theory. Theory is created when people who have read, and typically lived, a great deal of history write down generalizations that they believe are consistent with all they know. Theory is invaluable, but it has two problems—problems that doctrine addresses. First, different people accept different elements of theory. If an organization is to fight in a coordinated manner, all its members need to accept the same ones. (I once suggested to the Air Force Doctrine Center that it change the definition of doctrine to "those theories we accept as an organization." The center said my definition was too short.) Second, theories are general. National doctrine and service doctrine select or establish theories of warfare that apply to nations' and services' specific needs and abilities.

Of course, even doctrine is rather general. That is why plans are developed to cope with specific contingencies. Dwight D. Eisenhower once said, "Plans are nothing; planning is everything." That is, the greatest value of planning may be that the act of planning develops an individual's abilities as a strategist, to be able to adjust plans quickly and effectively when the enemy "votes." Most plans stay "on the shelf," but a few are executed. Success and failure in war are the ultimate test of the soundness of all the steps that produced them. War also becomes one more event in history that can then be studied in the context of history. And so the cycle begins anew.

That is how I taught the cycle for years, until I noticed that nuclear theory continued to evolve without nuclear weapons being used and so with no new history to work from. I also learned that German theory and doctrine had improved greatly between the world wars with little or no new history. I soon realized both the American nuclear theorists and the German strategists had been using wargaming to create synthetic history to keep the cycle going during peace.

You can apply this cycle yourself, to become, perhaps, a more effective participant in wargames.

Start with military history—not all of it but enough to check your later learning against. Look for books that do more than recount the events, ones that get into numbers and analysis. Books by Col. Trevor Dupuy and James Dunnigan tend to be strong on numbers and analysis.[2] Other media for learning history include magazines (*Strategy & Tactics* also "does" numbers and analysis), videos (many now available online), visits to battlefields, and conversation with combat veterans.

As for theory, by far the best *first* book to read is Sun Tzu's *The Art of War.*[3] After more than two millenniums no one has come close to matching the breadth, clarity, or brevity of this work. Of course, many consider *the* military theorist to be Clausewitz and hence the first book to read to be *On War.* While small parts of his masterwork discuss elements of nineteenth-century warfare that are no longer relevant, most of his writing, especially on war and politics, will be relevant as long as mankind makes war. Still, *On War* is a much harder and longer read than *Art of War.* It is well worth the effort, but a more accessible choice for a second book on strategy would be *Makers of Modern Strategy;*[4] it provides an overview of the ideas of Clausewitz and those of many other of the most influential strategists. *Makers* puts Clausewitz into context and may allow you to get more out of *On War* later. The most valuable theorist who is missing from *Makers* is John Boyd, I suspect in part because his work became well-known after the book went to press and in part because Boyd never wrote a book. (However, you can find his key briefings on the *Air Power Australia* website.) There are also theorists who focused partly or exclusively on one domain: John Warden on airpower (his later works theorize on competition overall) and Julian Corbett on sea power (though much of what he wrote can be adapted to airpower).

But there are also "CliffsNotes" on theory, and as someone who taught theory for eleven years and studied it for the majority of my lifetime, I offer here some of my own. First, *my two fundamental rules of strategy:* never, never, never fight an even fight; and always, always, always remember that you are up against a thinking adversary who is at least as determined to win as you are.

On joint campaigns, my advice includes the following. First, *think like an architect*—but know your bricks. Easily the most common mistake among new strategists is getting bogged down in detail and not seeing "the full board." They fail to take in the entire conflict or to anticipate how the situation is likely to evolve. Future architects are required to take courses in civil, mechanical, and electrical engineering so they can determine whether their designs are feasible. (As long as a design is feasible, engineers can usually work out the details.) Similarly, strategists must understand operations and logistics well enough to be sure their strategies are feasible. (As long as a strategy is basically feasible, operators and logisticians can usually work out the details.)

Know your enemy and yourself. All enemies have centers of gravity—attributes, locations, capabilities attacking which successfully will do disproportionate harm. Of course, your side has them also. Understanding both sides' centers of gravity helps you understand where to attack and where to make your defense strongest.

Start with your end state and your enemy's and work backward. While commercial wargames typically lay down "victory conditions" for both sides, strategists in the real

world need to work a bit harder to understand just what end state each side is fighting for. It is worth the effort, as knowing your adversary's victory conditions will help you anticipate his actions. Knowing your own helps you focus your efforts.

Develop as many edges as you can. The side with the most combat power does not necessarily win; the side with an edge in combat power at the point of contact tends to. Open up an information edge. Good intelligence helps only so much if your adversary has intelligence just as good on you, but seeing your enemy clearly while deceiving or blinding him can be decisive. And of course, open a wargame edge by wargaming more often and more effectively.

Turn inside your adversary's OODA loop. What is true for air-to-air dogfights is true for nations. If your adversary is kept busy getting out of check he cannot check you. In other words, your organization and application of power should strive to deprive your opponent continuously of freedom of action to the end that you impose on him your preferred outcome.[5] Wargaming is particularly helpful in anticipating enemy options and exploring strategies to preclude those options.

Some of my advice is domain specific. On ground power, I can offer three observations and three rules of thumb.

- Having the bigger army is not decisive; having significantly more combat power at the point of contact can be.
- Combat power is the sum of all your "edges": numbers, training, tactics, terrain, morale, leadership, and equipment.
- Defense is tactically stronger, but offense is needed to win. If an army tries to be strong everywhere, it can be strong nowhere. Hence some risk must be accepted so enough power can be focused at the point of decision.
- Defense is usually successful against up to twice its combat power.
- Offense usually needs at least a three-to-one advantage in combat power to succeed.
- Engagements at between two and three to one (in either side's favor) are unpredictable and should be avoided if possible.

As for naval power, sea power exists so that the sea can be used by friendly commerce and forces or so that its use can be denied to an adversary. Much less today a separate domain than it was a century ago, sea power can engage targets deep within continents and can be engaged by air and missile forces based well inland. As a sunken ship cannot return fire, getting in the first shot has always been important, sometimes decisive, in naval warfare. As in all domains, the biggest navy might not win, but the navy with the most combat power at the point of combat tends to.

The specific application of sea power is heavily influenced by the combatant's objectives and capability. While most commentary is focused on command of the sea, in some cases a combatant may need only to deny its use to the adversary; if your navy is the weaker, that is all you may be capable of. Navies seldom have the need or means to exercise command of the sea everywhere at all times. A navy may need absolute command of the sea while protecting an invasion fleet or to deny the enemy the use of the sea rigorously enough to keep an isolated enemy garrison isolated.

Finally, more people seem to have a better feel for warfare on land than at sea. If you are such a person, this may help:

- Think of ships as infantry. Through their ability to remain on station they accomplish the naval equivalent of the infantry holding terrain.
- Think of aircraft as artillery. They conduct strikes.
- Think of submarines as cavalry. They conduct raids and collect intelligence.

For its part, airpower is similar to sea power in that it exists so that the air can be used by friendly commercial or military aviation or denied to an adversary. Today airpower can involve forces spread over continents. As with other domains, the side with the larger air force may not win, but the one that can focus the most airpower at the point of decision usually can. While keeping ships and tanks in working order has a big impact on sea and land combat power, it does even more with airpower. Smaller air forces have repeatedly won because they were able to generate many more flights (sorties) than their opponents.

As sea power focuses on command of the sea, much of the emphasis on airpower is on command of the air—that is, air superiority. Also similarly, in some cases a combatant may need only to deny the use of the air to an adversary, and an adversary whose airpower is weaker may be capable of doing only that. Air forces seldom have the means to exercise command of the air everywhere at all times, nor do they typically need to.

As air forces can be employed almost anywhere but are finite, it is particularly important to think through their employment. Phrases like matching "end state to aim point" and "strategy to task" emphasize the importance of first deciding what airpower is to accomplish and then working backward to specific tasking. Sequencing too is very important in airpower. Just as ground forces try to "soften up" an enemy's defenses before moving forward, so air forces try to take down an adversary's radars first and then dis-integrate its integrated air-defense system before employing nonstealthy aircraft.

Finally, the classic mistake young officers make is concentrating purely on offense. While the aircraft *is* an inherently offensive weapon it does need somewhere to land and

prepare for the next mission. Air strategists need to consider the necessity and means of defending their airspace and their bases from all threats.

Of course, these few paragraphs alone can no more make you a strategist than an hour of instruction can qualify you to fly an aircraft. These few words can only serve as the beginning of your studies, studies that should continue throughout your lifetime. Yet even reading theory will not be enough; you will need to go back and read enough history to enable you to ask yourself whether the theories you have read are consistent with what has actually happened in the real world. Finally, you must make opportunities to apply and develop your skills as a strategist by actively seeking to participate in wargames of all kinds, including commercial ones. It has always puzzled me that military people are encouraged to read commercially published books on military history and theory yet are very seldom encouraged to play commercially published wargames—sometimes from the same authors.

Yet even a lifetime of study and personal development will not fully prepare you for participation in major wargames. Also, these games are conducted in teams, so "playing well with others" can have a huge impact on an individual's effectiveness. Regardless of what role an individual will play in a wargame, it is important to arrive early, ready and rested. Military, academic, and commercial wargames require preparation. Military wargames typically provide "read-aheads," academic games list required reading, and commercial games, rules. As the time available to execute wargames is precious and limited, any preparation that allows play to start sooner and proceed more smoothly is invaluable. Wargames can begin no sooner than the last key player is ready to start—thus the importance, to the entire undertaking, of being early.

At the wargame, especially when playing in teams, it is almost as important to learn about the other players as about the game itself. Players who quickly develop an appreciation for the strengths and weaknesses of their teammates can help make the entire team more effective.

Now that we've looked at how you can improve your performance as a wargame participant in general, let's look at how you can improve your performance in specific functions: on the Blue team, the Red team, and the White team.

Playing Blue

The task unique to Blue participants is devising and "implementing" (that is, submitting to adjudication in the format needed) a Blue strategy that is close to what the real Blue would devise and implement. This may seem easy; after all, participants are generally from the country represented by Blue. However, participants are also generally junior to those who would be in charge in wartime. Following the Strategy Loop will not allow

junior players to develop dependably the strategies that would be produced by their more senior comrades, but it should help them be less wrong and will certainly help them develop more-effective strategies. In the below I'll assume Blue is the United States of America. I do so because as an American I know the USA best and because I suspect the majority of my readers will be Americans. If you are not, you can still follow this process, substituting information on your country or for playing Red.

One more issue before we get started on playing Blue: I originally developed the below for brilliant engineers and scientists. Previously, we had sent them into wargames without preparation. Without knowing the vocabulary of wargaming or how to play Blue, they were not able to participate effectively, especially early in the game. (They did tend to be fast learners.) This section, and to a degree this book, was written to help such people be effective from the beginning of their first wargame. If you are already experienced in planning U.S. operations and believe you already understand the American way of war, you can probably skip to the next section, on playing Red.

As always, history is the firm foundation on which all strategic study needs to be built. If you read only one book on American military history, I would recommend *From Lexington to Desert Storm,* a good overview of America's wars at all levels from the national through the operational.[6] In selecting other books on American military history, keep in mind that books with maps and orders of battle tend to teach the most about warfighting. It is also useful to study all periods in American history, though the more recent, the more you should read.

Is there an American way of war? Is there an American theory of war? I think so. First, throughout our history we have demonstrated a preference for forging a win-win peace. We have not always won, nor when a member of a coalition have we always been able to implement the type of peace we would have liked, but when we can, Americans prefer a "soft" peace. We prefer a peace in which the people of our former adversary do not have a motive to overturn the outcome of the war, because their lives are better than before the war. I used to tell my students, just slightly in jest, that we have not achieved the highest level of victory unless our former adversary is now a willing military ally, an important trading partner, and a popular vacation destination.

There is also a distinctive American approach to casualties. Before 9/11 there was widespread belief within the United States and around the world that Americans were "casualty averse." Even before the "Black Hawk Down" incident in Somalia, many believed that if terrorists, say, killed a few dozen Americans our people would protest and the government would order our forces out of that part of the world. It should not have taken 9/11 to show how wrong that was. During the American Civil War, 620,000 Americans lost their lives, yet Lincoln was reelected, and the United States fought on.[7]

This number is even more amazing than it seems, as we suffered those 620,000 deaths at a time when our population was thirty-two million. In 2005, by when the American population exceeded three hundred million, almost seven million, mutatis mutandis, would have had to die for a voter to have the same chance of losing a son or a father, a husband or a fiancé. Unlike in dictatorships, our voters are our fighters and our fighters' parents and families. When "government of the people, by the people, for the people" is at stake, we will fight on despite horrific losses. When we lose a few soldiers trying to distribute food in a country whose name most Americans can neither spell nor find on a map, we will leave.

The above aligns with the theory of the greatest American general most Americans have never heard of. Gen. Fox Conner served in a variety of senior posts between World Wars I and II. He never led a great army in combat, but he did mentor an amazing percentage of the men who would during World War II. He told a young Capt. Dwight Eisenhower that America should never fight unless it has to, should never fight alone, and should never fight for long.

A final consistent element of the American theory of war is the conviction that technology and hardware can reduce casualties and speed victory. From the American Revolutionary War to the present, Americans have seen time and time again that this belief is accurate, though often overstated.[8]

The next part of being ready to play Blue is knowing Blue's doctrine. Much U.S. joint and service doctrine is available online. Many civilians are surprised to learn how easy it is to get copies of doctrinal publications (more on this below). This is important because move planning is an opportunity to ensure that Blue play is close to what the actual decision makers would do. In the armed forces, actual senior decision makers more commonly review plans than participate in entire wargames. Following Blue doctrine on military decision making and planning will help all Blue players both improve the effectiveness of their strategy and bring it more in line with practice.

Our final step is execution. Is this step applicable to all readers? Of course, civilians don't "execute" actual forces, but then, neither do military people, very often. However, all parts of the wargaming community can execute wargames. As most commercial wargames have historical settings, the entire cycle can be built around them. For example, you could read a book or article about World War II in Western Europe, think through how the American approach to war could shape our strategy, find and read some period doctrine, then plan and write down your strategy. After all this you would execute an appropriate commercial wargame against an opponent who was diligently working to understand how the Germans fought. A postgame discussion, with appropriate refreshments, would afford additional learning opportunities.

Playing Red

Rommel, you magnificent bastard—I read your book!

GEORGE C. SCOTT, PLAYING THE TITLE ROLE IN *PATTON* (1970)

One of the most important elements of decision-support wargames is ensuring that Red reacts as the real adversary would react. Though perhaps less critically, academic wargames also benefit from accurate Red play; truer representation of the conflict being depicted results from Red play consistent with the practices of the real Red. Even recreational wargames can be enhanced by realistic Red play.

Nevertheless, many argue that it is impossible to "get inside the head of" your adversary. I have argued in my various wargame courses for years that there is good news and bad news on realistically playing Red. Some steps that can be taken to that end are easy, fast(ish), and readily available through open sources. Other steps are less easy and less accessible. Other elements of Red decision making may indeed be unknowable. Still, getting close will likely produce far better results than not trying. It is probably impossible to get Red exactly right. Still, by doing all the above and consciously trying to anticipate what Red would do, the Red team is likely to be less wrong.

The Easy Part

Learn Red's history. Just as you can infer an American way of war from American history and a German way of war from German history, so the history of any country speaks to how it will tend to act in a spectrum of circumstances. Such information is readily available to anyone, on the Internet, in libraries, and at bookstores.

Learn Red's culture. Not every society defines war, peace, and victory in the same ways. Not every culture accepts the same laws of war. An understanding of an adversary's culture can be invaluable, especially in circumstances without historical precedents. Again, such information is readily available.

Assess possible foreign influences. This one is not quite as easy. Historically, militaries are influenced by those from whom they buy or otherwise acquire their equipment. With equipment comes contact: training classes and maintenance agreements. Nations also tend to send their officers to the staff colleges of the nations from which they buy most of their stuff. The Internet and good libraries should hold information on who is getting equipment from whom. Nations may also continue to be influenced by their former colonial masters (including Soviet neocolonialists) and current allies. Such information is in your old history books and on the evening news. The trick is assessing how strong that influence is. A nation's history and culture can provide clues.

The Hard Part

Learn Red's doctrine. As a guide to how a nation plans to fight, and therefore to how it will train and equip and organize to fight, doctrine is invaluable. The difficulty of this method of understanding Red depends on who Red is and who you are. Many nations realize that to be effective doctrine needs to be widely available and so do not even try controlling access to (classifying) their doctrine. Even in such cases, it may take a little digging by any military, academic, or recreational gamers to hunt down copies of Red doctrine. Unfortunately, some silly countries actually think they can keep their doctrine secret. This represents a minor inconvenience for Blue military gamers, as documents that need to be distributed as broadly as doctrine are easy to . . . well . . . acquire. However, academic and recreational gamers will not be able to find copies.

Learn Red's objectives. If you know where Red wants to go, you have a good start on figuring out how it will try to get there. One problem is that Reds tend to be dictatorships and do not broadcast competing objectives during election campaigns. Still, one-man dictatorships are rare; even Soviet leaders needed to sell the Politburo on major decisions. Most dictators are actually leaders of very narrow oligarchies that need to be convinced. This convincing can sometimes be learned by reporters or intelligence professionals.

Learn Red's planning methods. How an organization plans influences how it executes. As stated previously, the Soviets used a very slow, methodical planning process that tended to produce very effective initial attacks but impeded adjustment to unanticipated developments. The curriculum of the staff college to which a nation sends its officers is often the best single source of insight into staff procedures. Reviewing that nation's doctrine can also help.

The Hardest Part

Learn how Red organizes, trains, and equips. Knowing how potential adversaries do these things may not tell you what they will do, but it can tell you what they cannot do well. Just as an orchestra cannot play a composition for which it does not have all the instruments or the score, so militaries cannot carry out operations for which they do not have the needed training, equipment, or organizational structure. Actually, it's easy to learn some aspects of how a potential adversary organizes, trains, and equips. Most parts of military organization are public knowledge, and several online and print sources describe what equipment nations possess.[9] Manufacturers of equipment sold on the international market often freely issue glossy sales brochures listing all its characteristics. Still, some militaries succeed in keeping some of their organizations secret, and many classify the specific capabilities of their equipment. It can be even harder to find information on the topics and standards of adversary training.

Learn Red's perception of Blue. Just as our plans are shaped by our perception of the adversary, so our adversary's plans are shaped by his perception of us. It does not matter whether these perceptions are wrong: if they are believed, they will shape how an enemy acts.[10] It is often hard to tell whether what an adversary is saying about us is propaganda, meant to motivate the adversary's population, or what Red really believes. There have also been cases of adversaries coming to believe their own propaganda. Discerning the real Red's perception of Blue is hard, but a diligent Red team may be able to find clues in open or closed sources.

Anticipate the timing and nature of changes in Red's strategy. Red is at least as determined as Blue to win. If its plan, strategy, or doctrine is not working, Red will change it. This is clearly the hardest aspect of playing Red. History, culture, and doctrine may offer some clues about how flexible a particular Red tends to be. It may even be helpful to study the careers of the Red leader or leaders who would likely direct changes.

Playing White

The White team (for control, adjudication, and analysis) is the brain and the heart of major wargames. So why am I covering it last? I do so because commercial games almost never have White teams. There, White-team functions are accomplished by rules or computer software. (Sometimes even Red is represented by a rule set for manual games or by artificial intelligence for computer wargames.) Still, if the branch of wargaming in which you are most interested does not use White teams you should keep reading anyway, both to see how the other half lives and because some of what is covered may be relevant to those who are their own White teams.

Control

Every orchestra needs a conductor, every engine a governor, and every large wargame an element that keeps all the other elements on track. (A computer wargame may not need a human control element, but the software needs a sophisticated routine to ensure that all actions are executed chronologically.)[11] The game director, the senior mentor (typically a retired flag or general officer), if mentors are used, and the project officer for the facility where the game is played typically make up the control element of a major wargame.

The control cell is in charge of all aspects of the execution of the wargame, but its three principal duties are making sure the game stays aligned with its goal and objectives, keeping the game on schedule, and leading the preparation of the postgame outbrief and "hot wash." Every Blue and Red team believes it can produce a better product if it has a few more minutes. Control holds folks to the schedule, determining when, if ever, the benefit of a schedule slip outweighs the cost. Also, unintended implications

of the scenario or unexpected moves by a Red or Blue team can easily move the direction of play in such a way that a game objective will not be explored. Control needs to detect that and then find and implement a way to get game play back on track, without distorting outcomes (generating false insights) or so disrupting play that players lose momentum and perhaps heart. Finally, Control needs to collect and package the outbrief for senior decision makers, balancing the value of providing the entire picture with the need to be respectful of the senior's time, while also preparing for the much more freewheeling hot wash.

Adjudication

Clausewitz wrote, "War is very simple, but in war the simplest things become very difficult";[12] he could well have been talking about adjudication too. After all, adjudication seems simple: determine the net effect of Blue's and Red's plans. But in fact, even before adjudication begins adjudicators typically perform the functions of both the Blue and Red staffs, answering questions on items not in the game materials but that would reasonably be known by Red or Blue. When moves are turned in, adjudication has much to consider. If in the real world a subordinate of either the Blue or Red team would add detail to Blue's or Red's move—or react to unexpected developments—adjudicators need to "play" as subordinate Blue and Red team members. For example, Blue's plan may direct the bombing of a particular target but not specify the type of bomb. Adjudication determines that in the real world experts at the squadron level determine the best munitions to use. So the adjudication results will be those appropriate for the best munition. (This is an area in which computerized adjudication tends to be inferior to human.) Then they must determine whether each part of each plan is even possible to execute. (Some may not be, either owing to the submitting team's mistake or because of an action taken by the opposing team.) If possible, could or would the other team oppose it?

Finally, they need to determine what each side would know of the interaction just adjudicated. To that end, adjudicators need to review beforehand reference materials on the point they will be adjudicating. They also need to keep these materials at hand during adjudication. When a first draft of the adjudication is complete they need to work with Control both to check the quality of their work and to determine what, if any, changes are needed to keep the wargame aligned with its goal and objectives.

Analysis

One of the most common mistakes in the organization of major wargames is not getting around to forming an analysis element until just before or even during the game. Since you cannot analyze data that have not been generated or collected, Analysis needs to be involved from the beginning: in wargame design, throughout the preparation process,

and from the first minute of execution. Before the game starts, Analysis needs to have prepared a collection plan keyed to game objectives. During the wargame it needs to collect information relevant to both the outbrief and the hot wash. Finally, it needs to work with Control on the outbrief and later reports.

You now have the general and specific knowledge needed to serve in each major role within a major wargame. To become truly proficient, you will need actually to participate in wargames. If you do well (and perhaps even if you don't), after several games your colleagues will start thinking of you as an expert on gaming. You will start answering questions about it and helping the new guys participate more effectively. Almost without knowing it, you will be filling the role of a wargame practitioner.

Notes

1. Yes, there are many science-fiction wargames set in the imagined future. One of the more popular is Star Fleet Battles, designed by Stephen V. Cole and first published by Task Force Games in 1979.
2. An excellent example is Phillips Payson O'Brien, *How the War Was Won: Air-Sea Power and Allied Victory in World War II* (Cambridge, U.K.: Cambridge Univ. Press, 2015).
3. There are many translations of *The Art of War,* and it is likely that new editions will continue to be released. I recommend checking online for the edition that best fits your tastes.
4. Paret, *Makers of Modern Strategy*.
5. My thanks to Dr. William "Bill" Lademan, technical director of the U.S. Marine Corps Wargaming Division.
6. Donald M. Snow and Dennis M. Drew, *From Lexington to Desert Storm: War and Politics in the American Experience* (Abingdon, U.K.: Routledge, 1994).
7. Many books on the Civil War estimate casualties, and many of their totals differ. The high estimate is over one million total casualties, the low about 600,000. The most-quoted total seems to be 620,000, given by James M. McPherson, *Battle Cry of Freedom: The Civil War Era* (Oxford, U.K.: Oxford Univ. Press, 1988). Even the low estimates exceed casualties of all other American wars combined.
8. This belief started early. During the American War of Independence many believed the Kentucky/Virginia long rifle would bring us a swift and cheap victory. This advantage was real but overstated. After Bunker Hill the British developed tactics that minimized our advantages at range and maximized theirs close in. By the end of the war we had developed tactics that partially countered their counter.
9. *Jane's* was the first, but today it is just one of many, from free online sources like Wikipedia to expensive subscription e-services available at only a few libraries.
10. For example, during World War II the Japanese knew our submarines were physically able to reach their merchant shipping lines but believed Americans were too soft to undertake such grueling missions. Hence they did not plan to defend their shipping.
11. See Smith, *Military Simulation & Serious Games*.
12. There is much to be said for reading an English translation of *On War,* but, as mentioned above, as an alternative, Paret, *Makers of Modern Strategy,* pp. 186–216, is a good survey of Clausewitz's time, insights, and continued relevance.

CHAPTER TEN

Wargame Practitioners

Wargame practitioners are deceptively important. We have already established that a nation (or a company) that games more effectively than its opponents can gain a significant edge. The group most responsible for the effectiveness of wargaming is that comprising its practitioners. Who are wargame practitioners? They are those who work for the leaders, providing wargames to participants and the insights to strategists. I deliberately chose the word "practitioner" instead of "professional," as the latter implies someone who has completed a formal course of instruction and is working in the field full-time. Most practitioners meet neither criterion.

Given the importance of wargaming more effectively than our adversaries, it is curious that most American and other Western wargame practitioners are self-taught, or at best have been trained on the job. Up through World War II, the Germans taught their war college graduates how to conduct games. Today Russia and China appear still so to train all their war/staff-college graduates. The United States does not. Those who are assigned to do wargaming or would like to be can find in this chapter a start to their educations.

Few of the practitioners work on wargaming full-time. Aside from a relatively small number of military members and civil servants assigned to wargame organizations, a few government contractors, and a few exceptionally successful (mostly computer) wargame designers, most work in the field part-time. Most military wargame practitioners are also assigned other duties; most contractors also provide operations research, information technology, or other services; most academic gamers also teach; and most commercial wargame designers also have day jobs. In fact, the designer of one of the best-selling print wargames of all time served as an officer in the Central Intelligence Agency until retirement.

Wargame practitioners are a very broad group: wargame managers, designers, programmers, graphic designers, artists, researchers, analysts, play testers, reviewers, and many more. They may work for the government/military, academia, or a publisher / development house. Some practitioners are civilians who in their teens started as play testers and now

have been designing wargames for forty years. Others are military people who, when told that their next assignment would be running a wargame branch, asked, "What's a wargame?"

Nearly all practitioners, whether paid well, barely paid, or unpaid, military or civilian, full- or part-time, work very hard to do the best they can. This is important, as the quality of their work can have a huge impact. Why is their work so important? An analogy may be useful. Your chance of surviving a massive heart attack depends in part on which hospital your ambulance delivers you to. Survival rates are affected in part by budgets and technology, but some hospitals have simply developed more-effective ways of employing their resources. Of course, the medical community, knowing that new life-saving techniques are always emerging, goes to great lengths to "cross tell" best practices to make your outcome less dependent on which hospital you arrive at. Still, there is always some time lag between an initial success somewhere and getting the word out.

A similar situation exists in the wargame community. The confidence given the insights generated by a wargame and the effectiveness of a wargame in creating virtual veterans depend greatly on who is running the game. The wargame community knows that it will never achieve completely reliable indications or complete effectiveness in developing strategists, anticipating military utility of possible future systems, or evolving more-effective tactics for or against current and future systems. But it also knows that developing and sharing best practices can increase the community's effectiveness in all applications.

This chapter goes beyond simply outlining what wargame practitioners most need to know; it is also about best practices. It is not about the leaders who set game goals and allocate resources to achieve them. Nor is it about actually participating in wargames. This chapter focuses on the wargame practitioners who translate the guidance from leaders into practical actions. It is focused on those who work to set up wargame participants for success. Even if you are not a wargame practitioner and see no prospect of becoming one, do read on. The craft of wargame practitioners is an interesting one. What follows will also offer a glimpse into the current and emerging capabilities and limitations of wargaming.

One final issue before we get into specifics: so much wargaming is being done in so many countries that the odds of what follows being really *the* best practices are very poor. Even if I somehow managed to capture the best practices today, new and better ones would start to appear as the book was in production. This chapter will conclude with a few words on continuing to learn emerging best practices and perhaps contributing some yourself.

Tasks of a Wargame Practitioner

The first task of a wargame practitioner is to be an authority on wargaming. If you work directly for someone whose primary responsibility is not wargaming or who is new to it, you really need to be that person's expert. If you work for a lead wargamer, you need to build the depth and breadth of your gaming knowledge as quickly as you can. Given turnover, you may be advising the boss yourself before you know it.

Your fundamental advice will be when to wargame and when not to. If the boss wants to conduct procedural training, perhaps a scripted exercise is best. If the boss wants insights into a particular area, perhaps someone else has already conducted a wargame that produced them and all you need to do is get a copy of the report. In other cases your boss's goal and objectives can be achieved by participating in a wargame being run by someone else. Your participation influences its outcomes and is probably less work than developing and conducting a game yourself. But sometimes creating a wargame is the right answer.

Given the breadth of wargaming's principal areas of application (defense, education, and entertainment) and of the functions that practitioners perform in each, few best practices apply equally to all. We will therefore focus on best practices for people assigned to a defense/military wargame function and mention when advice applies more broadly. However, we start with a best practice that transcends wargame application and indeed wargaming itself—be guided by your boss's values and priorities.

Defining a Wargame

There is an old joke about the ancient Greek hero who navigated a labyrinth, killed a monster, and survived a shipwreck to bring his queen a golden fleece. When after several years he marched triumphantly into her throne room with her prize she looked up and exclaimed, "Gold? I distinctly said I wanted a silver fleece! Take it back!" The most important best practice for wargaming—within the government, the military, academia, the marketplace, or indeed any endeavor—is to understand fully what your boss is looking for. Bosses do not care how hard you worked, nor do they care much what others think of your accomplishments. They do care how closely what you achieved matches what they wanted done. As Col. John Warden, initial architect of the plan that became Desert Storm, liked to say, "It really does not matter how fast you climb a ladder if it is leaning against the wrong building."

Hence, it is highly advantageous to draw from leaders their overall goals, not only their objectives for wargaming. Practitioners, as their bosses' experts on gaming, may see ways in which gaming can help their leaders reach their goals that they have not anticipated. It is equally important that they explain to their bosses when wargaming is a

bad fit. Even when wargaming is a good fit, it is equally important to educate your boss on both its capabilities and limitations. For example, if a game is being used to support decision making, it is imperative that you provide the boss your assessment of the overall confidence that can appropriately be given a particular wargame and also whether elements of a wargame's outcome are significantly more or less likely to anticipate actual outcomes closely than the outcome overall.

Therefore, the most important step in the wargaming process is the initial conversation between the wargame practitioner and the leader directing the game. "Conversation" is exactly the right word; regardless of difference in rank, there needs to be a two-way conversation. While the leader knows what he or she wants and has an initial idea of what resources can be expended to get it, the practitioner almost always has a better grasp of what is possible and what resources will be needed. So that conversation, about what can be achieved by when and with what, needs to happen as soon as practical, especially since the leader's initial guidance may be unexecutable or better achieved by other methods. Bad news does not improve with age. When the wargame practitioner believes an understanding has been reached, it is critical that the understanding be repeated back to the leader, in writing if time permits, to confirm that a clear understanding has been achieved.

If such conversations are vital for individual projects, they are even more important when planning out gaming over a year's time. It is well worth the extra effort to get clear guidance on annual objectives, as it is very useful to plan game activities for a whole year. Doing so can not only decrease the average time to execute games, by anticipating needs, but also suggest measures that improve the wargaming capabilities of the organization generally, principally with regard to training and resources. Again, it is extremely important to "backbrief" the leader, to ensure the plan is in harmony with the leader's intent.

Conducting a Literature Search

It is prudent, before delving into the design, planning, and execution of a wargame, to consider whether all that would be cost-effective. With your boss's goal and objectives in mind, as well as a good idea of the resources available, you have the information you need to evaluate other options. It is important to conduct a literature search at the same time you are defining your wargame. Learning whether similar wargames have been conducted before gives you an idea of whether such a wargame is possible. It may also help you anticipate costs as well as identify elements of the previous wargame that it may be useful to, ah, incorporate into your own wargame.

Though James F. Dunnigan is best known within the community as the world's most prolific wargame designer, he may well also be the most prolific speaker on the design

and application of wargames.[1] His presentations have varied in length from half an hour to half a week, but their fundamental point has always been the same—plagiarize. While he is mainly referring to print, commercial wargame design ("so many wargames have been designed on so many subjects you can always find some game element to steal for your design"), his advice applies across all types and all stages of wargaming. The old cliché "Don't reinvent the wheel" applies on many levels to wargaming. (Though a revised cliché may be even more appropriate: "Invent no more of the wheel than you have to.") Here are some examples.

The best way to minimize the cost of a wargame is not to conduct one at all. When leaders ask for wargames on particular subjects what they typically really want is the insights from a wargame on that subject. Practitioners need to check to see whether planned or completed wargames can provide such insights. Even if existing wargame reports do not provide everything desired, getting some can still be valuable.

To take an example from the Air Force, that service is required by Title 10 of the U.S. Code, as we have seen, to organize, train, and equip air, space, and cyber forces. To do that the Air Force prepares budgets. These budgets affect Air Force capabilities in the short, middle, and long terms. Hence, the Air Force has used wargames to assess risks and gain insights at various depths of time in the future. Decades ago the Air Staff realized that the combatant commands were already conducting wargames set in the present and in the near future. As their headquarters were generally located in the parts of the world in which their games were set, their wargames were likely more accurate than anything the Air Staff could develop.[2] So the Air Staff decided to develop and execute only wargames set in the mid- and far-term future and for the near term simply acquire the insights from the combatant-command wargames. The taxpayers save money, and the Air Staff gets better material than it could have generated itself.

Still, when you are considering using insights generated by someone else's wargame, caution needs to be exercised. Wargames are not black boxes that produce answers with validity across all organizations. They are designed to maximize their utility to their sponsors. In the Air Force's case the respective purposes of the two sponsors appear to be similar enough for the same insights to be useful to both, but in other cases what is useful to the sponsor can be misleading to others.

Unfortunately, in many cases, wargame practitioners cannot identify a game being conducted by another organization that provides what is needed. In such cases the practitioner will need to design, develop, and execute a wargame that does. Even then it is often possible to gain better results at lower cost, through partnering or reuse (a euphemism for plagiarism).

Partnering with another organization with similar needs can save money and perhaps even create a better wargame. For example in 2012, both the Royal Air Force and the U.S. Air Force Materiel Command needed to look at possible future systems before employing them in a major wargame. Neither had the resources to conduct an effective wargame itself, but together they could. Better still, they were able to spot potential synergies that would have gone unnoticed had each organization played a separate game.

Through "plagiarism" a practitioner can avoid reinventing the entire wheel, by acquiring parts of other wargames. Here are two very different examples. The British-American wargame just mentioned used the draft scenario of the U.S. Air Force's Future Capabilities Title 10 wargame and an off-the-shelf Red order of battle from the LeMay Center Wargaming Institute. Not only were time and effort saved but the scenario got a test run before the Title 10 game. On another occasion, the U.S. Air Force Squadron Officer College needed a new instructional wargame. A review by the school's wargame practitioners turned up no government-owned or commercially published games that exactly met their needs, but one commercial design came close. The Squadron Officer College paid the commercial publisher to modify its game to suit—and for far less money than it would have spent programming a game from scratch.

Of course, sometimes plagiarism is *not* helpful. Many individuals who have worked in government or military wargaming for over a year have stories of an (often expensive) piece of adjudication software that was plagiarized from another game, where it worked well, only to prove out of scale with the new game.[3] The most common fatal flaw of an existing adjudication program is more detail than is needed in the new game, making it slower than needed, hence unable to game the full event in the time available.

Designing, Development, Execution, and Follow-Up

The work to be done in a given wargame function varies between the major applications of wargaming (government/military, academic, and commercial/recreational) and within each application. (Department of the Navy wargaming is very different from that done by U.S. European Command, which is very different from that of the Office of the Secretary of Defense / Office of Net Assessment.) Nevertheless, all forms of wargaming share certain elements: design, planning/scheduling, and execution. So there is where we will start.

Design Considerations

The task before a wargame designer is similar in several ways to that of an architect—both art and science. Both strive to meet the customer's goal and objectives while staying within budget and obeying the laws of physics. The success of both depends in no small part on making wise choices between alternatives. In the case of the architect,

those choices include building materials and construction techniques. In the case of the wargame designer, the choices are the options within the various elements of a game.

Only one element of wargame design is universal (that the design must serve the sponsor's goal and objectives within resources available). Others vary in each design: medium (live, virtual, constructive); type, if constructive (3-D models, print, computerized); and application (government/military, academic, commercial). But design in most wargames follows one of two sequences: designing an "event" wargame is substantially different from designing a "turnkey," or item, wargame. We will consider each design choice in turn.

Perhaps your first design choice is how to balance speed, detail, and scope. Speedy execution is good; it allows more moves and deeper delving into a conflict, and simply demands less of the participants' time. "Granularity" (close-up detail) is also good; while it does not necessarily follow that greater detail provides greater accuracy, it may help, and it does seem to increase the credibility of wargames. "Scope" refers to how many aspects of the conflict are depicted. For example, will the game address only force-on-force issues, or will it include the impact of logistics too? Broader scope can also increase accuracy. However, just as folks in procurement point out that there is a relationship between cost, performance, and schedule (a change in one changes the others), so in wargaming greater speed comes at a price in detail and scope, and greater detail tends to slow down execution.

FIGURE 17
Design Trade-Offs: Depth, Detail, Scope-Duration

There is no one right balance. Academic and course-of-action wargames lean toward speed, as the time available for either is limited. Political-military games prioritize scope and, secondarily, speed. Wargames that are integral parts of months-long studies tend to need and to be able to incline the balance toward detail. Designers need to find a balance that fits their goals, objectives, and resources.

Once that balance is selected, the next step is typically to choose a method of adjudication, deterministic or stochastic. *Deterministic* adjudication attempts to identify the most likely outcome of each action and settle on that. However many times a deterministic adjudication is run, the same input will always produce the same output. *Stochastic* adjudication estimates the range of likely outcomes for each action and assigns a (typically varying) probability to each possibility within it. A random-number generator (computer or dice) picks between these outcomes. Deterministic adjudication is often chosen when a wargame can be conducted only once; some believe the outcome will be closer to what would actually occur than would one execution of stochastic adjudication. The stochastic method tends to be preferred when it is possible to run the adjudication, or the entire game, several times. Most will produce different results, and after enough executions an "envelope" of outcomes and their relative likelihoods seems to emerge. However, if stochastic adjudication is conducted just once, its outcome could be one of the less likely ones, and the people conducting the wargame would have no way of knowing that. Stochastic adjudication is also typically used in education wargames, as it illustrates the uncertainties of war, and by commercial wargames, as it makes them more exciting.

Again, neither method should be viewed as predicting or even forecasting the future. Among the reasons stated previously, many historical events were improbable.[4] Either type of adjudication can be performed by *judgment,* by *rule,* or by a hybrid of both. Each method has its advantages and disadvantages. Neither works best for all objectives: determining which method is the best fit with your goal and objectives is a matter of art.

Adjudication by judgment is simply allowing the expertise of the adjudicator or team (an "expert panel") to determine either the net effect of Blue and Red moves or the relative probabilities of plausible outcomes. Its advantages include the considerations that it tends to be faster and less resource intensive to set up and that it can deal with interactions that are difficult to reduce to rules (diplomacy, human interactions, the will of combatants). As disadvantages, it is not entirely repeatable, as judgments evolve; it tends to be more expensive, an issue if the wargame must be run many times (e.g., educational games for forty-four seminars or twelve thousand correspondence students); and it requires adjudicators with the necessary expertise, of whom there is a finite number.

Adjudication by predetermined rules requires that all the types of interactions between Red and Blue be anticipated and the net effects determined in advance.[5] It has some advantages. It tends to be faster, assuming the adjudicators are familiar with the rules, and even faster if all those rules are in a computer program. Also, there is no need for scarce experts to accomplish the adjudication—or even, if computerized, humans at all. Third, it may be feasible to play enough runs to produce (if the rules contain stochastic elements) an outcome distribution.

But adjudication by rule has disadvantages. It tends to take more time and more resources to set up, especially if rules are to be computerized. Also, interactions in warfare that are only just starting to be understood probably can't be captured yet in fixed rules and are likely more suitable for adjudication by expert panel. For instance, training and morale were once considered too amorphous for rules, though now even commercial wargames have fixed rules for them. Today some feel we do not understand cyber warfare well enough for rules; probably by the time rigid adjudication of cyber effects becomes routine, there will be some new element of war needing expert adjudication.

Combinations of these adjudication choices are common, and different types of wargame tend to use different ones, as can be seen in figures 18 and 19.

FIGURE 18
Spectrum of Adjudication

Next let's examine the choice of type and method of wargaming. With respect to the overall game, there are three types (one with three subtypes) and two methods. The three types of wargame are *live, virtual,* and *constructive*. During live wargames, participants actually do what they would do in war: moving, shooting, and communicating (minimizing real casualties). On one hand, live wargaming offers the highest levels of detail and (because most of the game play is real) plausibility, and excellent training. On the other hand, they are the most costly in time and money, and they may be visible to real-world hostile intelligence collection (in some cases, foreign observers are required by treaty). Casualties due to accident are always possible; efforts to minimize them may create conditions not present in wartime, creating a danger of "dis-training." Action can proceed no faster than real time, making it unpractical to explore effects that take time to develop. Finally, participants might cheat (such as walking across "blown-up" bridges instead of building tactical replacements).

FIGURE 19
Applications by Adjudication Choice

During virtual wargames in contrast, the participants experience their wartime actions without actually performing them. They offer, of these choices, the second-highest level of detail. They can game actions too dangerous for live wargames, and in areas off-limits to them, so outcomes may actually be more accurate than live wargames. There is no danger of fatal accidents or overhead observation, and the training is still excellent. Virtual gaming, however, is also the second most expensive, in time and money. Also, as in live wargames, the action (for the most part) can proceed no faster than real time, ruling out exploration of issues that develop slowly.

Finally, players in constructive wargames assume the roles of commanders, directing the actions of individuals or units. They can depict entire campaigns or even wars. They can game second-order and delayed effects, so outcomes may be the most accurate. They are highly educational, the least costly of the three, and typically the fastest to initiate and complete. But they may ignore logistical constraints that are inescapable in live wargames, and they are almost always less granular than live and virtual wargames.

In constructive wargames, the current state of the wargame situation can be represented in three ways. The first involves *terrain tables* and *miniatures* or *figures*. Terrain is physically modeled, much like a model-railroad layout. Either soldiers (or ships, or whatever) are individually modeled or units are represented by shapes that cover area proportional, in the scale being used, to what the actual unit would occupy. While supporters of this type of display correctly point out it boasts the ultimate in 3-D graphics, it also tends to be the most expensive constructive option. (In the future, 3-D printing may cut steeply into the cost and time constraints.)

The second way is the use of *maps, paper, boards,* or *charts*. Here, terrain is depicted on a two-dimensional surface, often overlaid by a hexagonal ("hex") or other grid, though conventional maps or charts are sometimes used. Individuals and units are represented by markers, typically small cardboard squares. A supporter of this option has noted that it is far less expensive to create the first copy of such materials than their equivalents on a computer and that each additional copy is less expensive than miniatures. Games run this way are also typically faster than miniatures, although slower than computers.

The third, of course, involves *computers, tablets, smartphones,* or the like. Supporters assert that computer wargames are the wave of the future. Terrain is displayed on a screen, as are individuals or units. The initial cost of hardware and software is relatively high, but the needed hardware is often already owned, and each additional copy of the software (if you own the rights) is virtually free. Wargames can be set up instantly and saved at any point, and the map can be "zoomed" in or out to see detail or the big picture better.

Whatever type of wargame is selected, there are two options for conducting the adjudication, *manual* and *computerized*. *Manual adjudication* simply means that humans determine the net effects of Blue and Red actions. They may do so on the basis of professional judgment or predetermined rules. In live and constructive wargames, manual adjudication is provided by "umpires." During constructive games, umpires may rely on judgment or predetermined rules—or the Red and Blue players themselves might use rules to resolve each move themselves. Manual adjudication tends to be slower and less granular than computerized adjudication, but it can be faster to set up and does not need the hardware and power sources computerized adjudication does.

The other option, *computer adjudication,* requires sets of predetermined rules that can be represented as computer code. In the "extreme case," virtual games, adjudication is performed entirely by computer in response to participants' inputs as they travel through the virtual space, and the running outcomes are incorporated in what they experience there.

An element of adjudication in larger wargames is performing the functions of the "competent subordinate." That is, individuals in the adjudication cell would play the collective part of subordinate Blue and Red commanders, adding detail to the moves submitted by the Red and Blue players. This had always required live adjudicators, though fairly recent computerized wargames have achieved some success in assessments that would seem to require human judgment; they did so with sophisticated rule sets or computer artificial intelligence. Computer adjudication may require the longest lead time (i.e., if there is no existing program that can be used as is or easily adapted), but once programmed such wargames are often the fastest.

Before we leave design choices and computers, we should address one false choice and a very real one. There are people who think all wargames are computer simulations. Still others believe that one of the first design choices is between a "computer wargame" and a "manual wargame." When many people speak of "computer wargames," they really are thinking about games in which the scenario and graphics are on a computer, moves are entered into the computer, and the new game state (as each side is to perceive it) is adjudicated and provided to each side by the computer. The real design choice, though, is to what degree, if any, computers should be part of your game. In a given wargame, they can be used for *information:* since the 1950s computers have been used to store, create, and transmit game information—scenarios, maps, moves, and so on. In another game, they could be used for both *information and adjudication*.

FIGURE 20
Spectrum of Computerization

In yet another, they can be used for *information, adjudication, and Red inputs*. There are many important reasons to program computers to play Red. The military saves on travel funds, since no Red players need to be brought to games; civilians do not need to find (which may be hard for them) live opponents to play. However, success in creating artificial opponents that replicate Red's decision making has been mixed.[6] Or, finally, a wargame might employ computers for *information, adjudication, and both Red and Blue inputs*. Success in computerizing the entire wargame process would allow many, many runs to be accomplished quickly, generating an "envelope" of outcomes with relative probabilities. The challenge is creating artificial intelligence routines that do well enough.

Before we move on, let's look at four examples of how differences in objectives and resources can prompt different design choices.

Case 1. A service school for midcareer officers decided to add a wargame to its correspondence course. The objective was to give students an opportunity to apply what they had learned during the conventional part of the course. The staff had a modest budget and eleven months before the wargame was to start. It selected stochastic adjudication, as it would better introduce students to the uncertainties of war. The school chose a rule-based system, as it had neither the personnel nor the travel budget to provide expert adjudicators for each student. Next, as its curriculum focused on the operational level of war, the school selected a constructive wargame, so that it could be played deep into the campaign. Next, the staff decided to use a computer to display the situation and adjudicate each turn; the code needed to play the wargame could simply be downloaded by each student. This is an example of a "turnkey," or "item" (entirely self-contained), wargame.

Case 2. A fighter pilot was assigned to a wing's headquarters staff a few months before an operational readiness inspection (ORI). During an exercise conducted to prepare for the ORI, he observed that the intelligence officers debriefing the fighter pilots simply took down what the pilots were saying without *understanding* what they were saying. He decided that if the intelligence officers could, through a wargame, engage in air-to-air combat themselves, they would understand well enough to ask more-appropriate questions. With no budget and only a few months to go before the inspection, he acted fast. He selected stochastic adjudication, to illustrate the uncertainty of air combat. He then selected the rules-based method, feeling that learning the rules would enhance the intelligence officers' overall understanding. He then decided on a constructive wargame; he had neither the budget nor time for a live or virtual game, and he wanted to illustrate the impact of "packages" of aircraft. How did he produce such a game in time? He bought one. He picked an off-the-shelf print wargame with manual adjudication: he could start gaming sooner and allow the participants to see how adjudication was done. (A postscript: this is based on a real case, and the impact of the wargame was striking: during the ORI the intelligence officers and fighter pilots actually had conversations!)[7]

Case 3. A combat-arms Army officer was assigned as the deputy to a research-and-development division. She soon realized that the civilian workforce had no clue about ground warfare. How could these folks spot technology to help the warfighter if they did not understand the challenges faced by the warfighters? The division chief already permitted two ninety-minute "brown bag" lunch sessions each week; she decided to devote every other one to wargames that might correct this problem. She "went stochastic" to illustrate the element of chance in war, and rules-based so the game could be played on days she was not there. She then picked constructive, there being no facilities for live or virtual and she wanting to show the impact of various weapons and other equipment.

Finally, she looked for a print wargame to keep the sessions short, and she found one that was structured to start simply and gradually add more elements of modern warfare. However, because the games would have to be played over several fairly short segments, she selected a computerized display. This allowed instantaneous setup at the start of each "brown bag" and instantaneous wrap-up at the end.

Case 4. U.S. intelligence had finally located six Drug Enforcement Administration officers who were being held deep in the jungle of a South American state. We would have one chance to rescue them, since once their captors knew the hostages had been located they could move them or even split them up. The rescue team chose to wargame its plan several times with stochastic adjudication; it wanted to identify where combinations of various chance events could derail it. It chose to have those probabilities determined through judgment, having been promised any subject-matter expert it requested, including operators recalled from retirement. Next, it selected a constructive wargame, as a live game might be detected by an adversary and virtual technology was not yet mature enough. The team members created a terrain model, and on it they manually adjudicated the mission over and over again, injecting different things that could go wrong each time. They even "killed" the mission commander to see whether his deputy could execute the mission, then "killed" the deputy, and so on until half the team had practiced leading the mission.[8]

These outcomes should not be considered "school solutions." One reviewer came up with a very different, and perhaps better, solution for Case 4. What I am trying to illustrate with the above is that choices in the design of a wargame should be made on the basis of each set of goals, objectives, and resources. One size most definitely does not fit all.

It is also important to point out that sometimes the best way to meet a need is not a single wargame but a series of linked wargames (see figure 21).[9] For example, if the sponsor's goal is to identify potential future systems that are likely to provide a significant military advantage, no one game may be capable of meeting it. Many "exploration" wargames would be needed to sort out the highest-impact concepts. As bad ideas tend to outnumber good, such wargames would need to be conducted many times; each repetition would need to be cheap in terms of time and cost. Once apparently useful future systems were identified, "deep-dive" wargames would be needed to pursue the findings of the earlier, less rigorous ones. Those future concepts that continued to look promising would then be explored in an "integration" wargame that would look for synergies and redundancies among all the surviving future systems.

FIGURE 21
Spectrum of Decision Support / Concept Development Wargames

Based on slide by Maj. Eric Frahm, Air University / LCWI

So after considering your alternatives and concluding that you need to create a wargame, there remain many decisions on the nature of the game you will employ. Event-type wargames require the designer to plan the execution of the game as well as its creation. Turnkey/item wargames must be designed so that they can be executed at any time and without the assistance of the designer.

Development/Planning

Planning a wargame is largely a matter of scheduling—that is, what element of the effort needs to be completed by when to meet the completion date. As the planning and scheduling of event and turnkey wargames differ widely, we shall consider the sequence of each in turn. Both types exist in both the military and commercial worlds, but event-type wargames are more common in the military, so we'll cover them first.

Event-game design is as much about designing a process and an event as it is about designing the wargame itself. Event wargames tend to be conducted once—for example, Gallant Knight 1987 or Futures Game 2015. While typically used by the military, as noted, event-type games may also take place at civilian wargame conventions or in the classroom. Here are the typical steps in their design and execution. Much more detail on

FIGURE 22
Wargame Cycle, Event

Inspired by graphic from the Naval War College's *War Gamers' Handbook*

conducting an event wargame is available in the U.S. Naval War College's *War Gamers' Handbook*.[10]

1. Tasking. This step includes the documentation and confirmation of management's goal, objectives, and resource allocation. This is the universal foundation (or should be) for the design of all types of wargames, for all applications. Whether your direction comes from your commander, your publisher, or your dean, it is vitally important that there is agreement on the goal and objectives and that sufficient resources will be available. The most important and the most irreplaceable resource is time. This is when the wargame practitioner needs to draft a schedule of when each of the below steps will be completed and when the overall project will be done. Practitioners need to update management whenever developments impact the expected completion.

2. Literature Search. If nothing else, reviewing previous wargames tells you whether the goal you are pursuing has ever been in a wargame—and thereby proven possible. It can also suggest what worked previously and what pitfalls you should look out for. The search may also turn up wargames from which you can incorporate elements. For the U.S. military, the first stop in any literature search is the Office of the Secretary of Defense's Cost Assessment and Program Evaluation Wargame Repository. Military and civilian designers who wish to search for commercial wargames should review BoardGameGeek and the StrategyPage, both free online services.

FIGURE 23
Design Trade-Offs, Detailed

3. Design. During this step the designer reconciles the sponsor's objectives with available resources and makes the fundamental decisions concerning the wargame. This is the point when the decision should be made on the medium of the wargame—constructive, live, virtual, or a mix. If constructive, will the wargame use an expert panel or rules-based adjudication? What, if any, elements of the wargame will be supported by computer software? As this is an event wargame, a schedule of pregame events (this game being the capstone) and a schedule of the game (capstone) itself, as well as any postcapstone analysis, report writing and coordination, and archiving, must also be drafted. This is also when the game scale is established. Typically the wargame should end when the event being wargamed does. If the goal calls for wargaming a battle, the game could continue until the outcome of the battle was clear. The same applies for campaigns and wars. Once the length of the capstone and the duration of the conflict games are established, an experienced designer can estimate the trade-off among detail, scope, and depth to meet the sponsor's goal and objectives. For example, a wargame designer determines that after in-briefings and out-briefings she has thirty-four hours in which actually to conduct the game. As the part of a campaign to be wargamed is expected to last forty days, a combination of granularity, depth, and scope must be selected that can play, on average, more than a day each hour of execution.

4. Alpha Test. During this phase the designer and a few colleagues walk through the wargame. The purpose is to determine whether the "big rocks" fit and will achieve the game objectives. If not, the basic design can be adjusted with little if any wasted effort.

5. Development. Development is about playability. The basic design is a sealed matter; now it is time to create the "game kit"—the materials that the players and adjudicators will need to execute the wargame.

6. Beta Test. During the Beta test a small team will attempt actually to execute a part of the game. If the wargame calls for six moves in three days but the Beta test of one move takes nine hours, a significant reworking of the game kit, and perhaps of the design, is needed. This test should reveal any gaps or unclear elements in the game kit. The results of the Beta test will seldom change the basic design but should result in improvements to the game kit.

7. Participant "Prep." The first step in preparing participants is deciding what mix of skills and backgrounds you will need in your participants. Recruiting for an event wargame is a little like casting a play. You know what you want, and you get as close to that as you can. Some deficiencies can be mitigated through pregame training: area experts can be taught about operations, operators taught about the theater. Then there is the writing (or selection) and distribution of read-ahead information for all participants. Read-aheads need to cover everything from dress code to where to park, to readings on the focus of the wargame.

FIGURE 24
Tailoring Red Play, "The Caffrey Triangle"

8. Red Team Definition and Prep. One group of participants requires special consideration and special preparations—the Red team. There are three schools of thought on Red teams. One holds they should play as close to what the real Red would do as possible, strictly following Red doctrine and cultural norms. The second school believes that because the real Red will want to win, the Red team should do anything and everything of which the real Red is physically capable. (This is the view followed by Lt. Gen. Paul Van Riper during Millennium Challenge 2002.) The final school believes that Red

FIGURE 25
Tailoring Red Play, Examples

is simply a tool of the White team, used to stimulate play bearing on game objectives regardless of what the real Red might do. Many proponents of each school believe that they and only they are right.

In actuality, the employment of the Red team should fit game objectives. The Red team for a Joint Strategic Capabilities Plan–prompted wargame should follow the current doctrine of the Red addressed in the operations plan. The Red of a war-college wargame should do whatever is feasible to win, to be a challenging sparring partner. The Red for a command-post exercise should be close to the White team approach—that is, inserting moves designed to meet the sponsor's goals and objectives. Still, if Red just ticks off items on a checklist, there is no wargame at all and training suffers. Finally, often the best approach for Red is a mix of these elements. For example, most Title 10 wargames are set some amount of time in the future, by when Red doctrine will likely have evolved; those Red teams tend to play between "stick to doctrine" and "win any way you can," with a little bit of "stimulating game objective" thrown in. As almost all Red teams place some weight on playing as the real Red would act, the study of Red becomes the most important element during their preparations.

9. Event Prep / Rehearsal. Event preparation is very unsexy—ensuring that everything from name badges to refreshments is ready. Still, it's important; for one thing, participants do better work when they are fed. (There can be complications here. For instance, where supporting foundations exist, they might be requested to pay, with "gift funds," for dining-related needs to which appropriated funds cannot be applied. But gift funds too have restrictions on what they can be spent for. The rules are arcane, yes, but you can be sure that auditors know all about them.) The rehearsal is all about ensuring that the execution goes smoothly. This is the final test. It should be conducted where the actual wargame will be played, and it should use all the software and execute all the steps of the actual game.

10. Execution. Something will go wrong. Good planning will minimize problems, but some problems will occur. Preplanned leadership meetings will make coping go more smoothly. Maintaining a reserve is vital—some extra time in the schedule, a little extra manpower. Finally, remember an event wargame is an event, and social activities should be thought of as part of it.

11. Analysis. Analysis falls into two categories: search for insights into wargame objectives and for insights into the game. While many educational wargames do not generate insights into warfare, all wargames should generate insights into how the next game can be more effective. Planning for analysis should begin during step 1 and should be a consideration throughout; you can't analyze data you did not generate through the wargame, and you can't analyze generated data you did not think to collect.

12. Reporting. All the insights generated need to get down on paper. Writing the report is just half the process. The wargame practitioner needs to help ensure the report gets to all who would benefit from it.

13. Archiving. Sometimes a wargame's insights mature with age. The game report needs to be not only preserved but preserved in a way and place that facilitates access by those who would likely benefit from reviewing it.

FIGURE 26
Wargame Cycle, Event or Turnkey

Inspired by graphic from the Naval War College's *War Gamers' Handbook*

A successful turnkey project is a wargame that is, by virtue of its design and development, robust enough to be executed without the intervention of the designer.[11] Turnkey

wargames are typically intended to be played over and over again. While usually produced for the recreational wargaming market, turnkey games are sometimes used by the military—for example, in PME distance-learning courses and for individual professional development.

1. Kickoff. Again, this step includes the documentation and confirmation of management's goal and objectives and resource allocation, and everything I said in step 1 for an event game still goes. But also—and unless the objective is to test a particular adjudication program or the publisher only deals in, for example, miniatures games—leadership should specify objectives, not how those objectives are to be met.

2. Big-Rock Research. Wargame research is best done in stages, as the emerging game itself makes clear what information is pivotal, given its scenario and nature. Still, "big rock" (basic) information on the theater and combatants is needed early. Just enough information needs to be collected to build and conduct a rough expert-panel prototype.

3. Prototype. When old pros like James Dunnigan describe how to design a wargame they tend to leave out this step, perhaps because after their first few dozen game designs they could accomplish it subconsciously. In a similar case, for decades Walt Disney Studios never storyboarded its films, with no ill effect. After Disney's death the studio's new movies stopped flowing so well. In time his successors realized that the earlier movies *had* been storyboarded—in Walt's head. A prototype is the wargame-design equivalent of a storyboard. The designer, alone, or better with a few core members of the development team, reviews the game objectives and then walks through the game's starting conditions, likely Blue and Red moves, and the likely outcome of the game. For us mortals, creating an even largely mental prototype does a marvelous job of focusing research on what is truly needed.

4. Fundamental Design Decisions. As form follows function in architecture, so the fundamental design decisions of the wargame should be made to achieve the best fit with the leader's goal, objectives, and resources. Sometimes, especially in the government or military, it is assumed that a wargame will be adjudicated by computer, because . . . because, well, aren't they all? Actually, though not everyone will consider these "games," a great deal of wargaming goes on inside the heads of commanders and around tables in strategy cells. A key early decision will be choosing an adjudication type and method, game type, and game scale that meet your objectives and yet will be executable given your constraints of time and money. Decisions on adjudication method and type of wargame are interrelated and too multifaceted to describe here.

As for the basic game-scale parameters, you need to establish the following: How much real time should a single run of the wargame take? What level of command-role will the players occupy? What would be the length of the real-world decision at that level? (For some higher-level games this question is replaced by, What is the typical interval between updates of campaign plans by either side?) How much real-world time will it take to game to its conclusion, with high probability, the action depicted? Dividing the total duration of the action by the length of one decision loop will produce how many decision loops need to be accomplished during the time available. This indicates how much time is available for each turn and gives a sense of how complicated each turn can be. (For some higher-level wargames the question is how many campaign-plan updates are typically made during the duration of the conflict. Dividing this number by the available time indicates how much time there is for each turn, hence how complex each turn can be.) This knowledge drives other basic decisions: the size of units depicted and the map scale.

5. Main Research. Now that the basic parameters of the wargame have at least been tentatively settled, detailed research can be productive. It is easy to be seduced by archives or intelligence terminals. Research should be limited to what is needed to execute a game at the scale and in the medium selected. There will be time for more research as the game demonstrates what information is needed.

6. Manual Prototype. Regardless of the final medium you select, a manual prototype is invaluable. Some do not see the value of a manual prototype if the final wargame will be computerized. Consider: all prototypes—be they for an aircraft, a computer wargame, or a washing machine—are constructed because people have discovered, sometimes at great cost, that some problems do not become apparent until a prototype is built. In the case of a computer wargame, you more or less have to build the final version to have a digital prototype. When such a prototype indicates that a change needs to be made, the code will have had to be written three times: to create the prototype, to delete the faulty code, and to write the patch. Such work is not only manpower intensive but also increases the chances for bugs. If you use a manual wargame to help discern the final nature of the computerized game, the code need be written only once. The manual game can also be saved and used as a test bed for contemplated future enhancements.

Manual prototypes for computerized wargames do have their shortcomings; larger menus of choices and greater granularity of play are possible in a computerized wargame with little impact on the duration of moves. Such differences need to be kept in mind during internal testing (the next step). Still, manual prototypes serve as a check on the depth of the designers' understanding of the subject matter. Several experienced designers have told me that if you do not understand the dynamics of a situation well

enough to create a manual wargame, you will not be able to create a computerized one. Finally, tweaking a manual game until it is right will reduce the expense of software changes that would be needed.

7. Internal Testing. Members of the wargame organization need to play-test the prototype to anticipate all the ways real players may try to break it. Are there any elements of game play that could be exploited to obtain unrealistic outcomes?

8. Development, "Final" Research. Development is what separates functional wargames from great ones. During development, practitioners work hard to use graphic-design principles and common sense to build "elegance" into the game. There is a rule of thumb that the more detail in a game, the slower the play. Design elegance tries to bend that rule by setting up the users for efficient play. Information that needs to be consulted frequently might be printed right on the game map; a feature that allows previous moves to be edited and re-input for the next move instead of retyped from scratch might be added. Finally, all this work invariably reveals the need for some bit of data that had been missed during previous research. Folks like to call research at this point "final" research, and sometimes it even is.

9. Documentation, Programming. While computer and manual wargames seem very different—and *are* very different in cost to develop and many other ways—this is the only step they don't have in common. Even here, there is significant symmetry. In this step, instructions on how to execute the wargame are documented. When those instructions are written for people, they are called "rules"; when those instructions are written for computers, they are called "code" or "programs." Even many of the principles are the same; both types of instructions need to cover all possible actions, be free of contradictions, and be executable.

10. Internal > External Testing. No matter how much internal testing is done, it is extremely important that the wargame be tested by individuals not assigned to or employed by the organization designing it. Individuals who already know the jargon, already know something about the game, are likely to fill in mentally gaps in the rules without even realizing it. Gaps will exist, and they can be found either by outside testers or by the end users. Perhaps ironically, this is one area where commercial publishers typically have a big advantage over their military counterparts. Commercial designers have no trouble finding testers who work for pizza or simply for the glory of seeing their names in the credits. The military can't use random teenagers to test classified or even "official use only" games. So you are likely to encounter more bugs (the software kind, not the spy kind—one hopes) at high-budget classified games than at weekend wargame conventions.

11. Refinement, Production. Outside testing always turns up some software bugs to be squashed, oversights in the rules, or contradictions in the introduction or scenario. Some coding or editing will be needed. Once that work is confirmed to be complete, it is finally time for production. For the government or military this typically means actually conducting a wargame; almost as many man-hours may be expended in administrative, logistical, and protocol arrangements as it took to create the game. For academics, this means producing sufficient handouts and game materials for the number of students registered. For the commercial folks, this means publishing the game.

12. Feedback. Wargaming is a competitive field. The "best in breed" military, academic, or commercial wargame one year is often eclipsed within a few years or sooner. A key to pulling away from the pack and staying there is feedback. First and foremost, you need both frank closed-door and also official written feedback from the leader who initiated the wargame. Remember, Lee Iacocca had plenty of positive indicators on his work at Ford, but he was fired—because he did not meet the expectations of his boss.[12] Feedback from game participants is also important. The clearest insights seem to come from a mix of informal "hallway" conversations and formal or statistical feedback vehicles. The hallway provides answers to the question that was not asked; the formal feedback can show trends and tends to be valued by management. Hallway feedback is easy for military and academic practitioners to collect, but commercial wargame publishers need to attend conferences where open (pickup) and competitive wargaming takes place to get theirs. Finally, formal feedback may be able to prove that negative rumored "feedback" is wrong (as I have seen happen, related later in the chapter).

For much more on designing turnkey wargames (and wargame design in general), see *Wargame Design,* by the staff of *Strategy & Tactics* magazine, published in New York by Simulations Publications in 1977 (and cited in chapter 1).

Execute

The "execute phase" is principally the province of military event-type wargames. Why? The three main branches of the wargame field vary most after their games are "complete." When a commercial game publisher ships a product or adds it to online inventory it is not finished—but it is nearly so. Most customers will use their new wargames without contacting the publisher, except perhaps to send in a feedback card. However, inevitably, a few have problems executing their games. The quality publishers continue to support their titles with corrections to their instructions, bug fixes for computerized wargames, and rules errata for print and miniatures. When academic wargame practitioners complete their "wargame kits" they still need to execute the game in class and

gauge how much learning has taken place. However, for government/military wargame practitioners, in most cases only a fraction of their work is complete yet.

This is because military wargame practitioners not only create or adapt wargames themselves but manage their preparation, execution, and documentation. While some government/military wargames are held in reaction to developing situations and must be planned, prepared, executed, and briefed in hours, most are scheduled months, if not years, in advance.[13] Government and military wargame practitioners often need to hold numerous pre- and postgame meetings, conferences, and workshops aside from the capstone.

Planning the execution of a wargame is not so different from planning any other event. The amount and formality depend on the type and size of game. If you are getting together with friends for some fun or professional development, maybe all the planning you need is making sure you have a location, the wargame, and sufficient refreshments. If you are conducting a wargame as a classroom practicum, you should probably inventory your "wargame kit" to make sure you still have enough read-aheads, handouts, and game components. After making any additional copies needed, you will need to ensure a room is available, read-aheads are distributed well in advance, and the game components are ready. However, if you are, as we say in the Air Force, the "officer of primary responsibility" (OPR) for a major military game you may be in for more work than was expended to create the wargame itself.

In such a case, before the actual planning the OPR needs to do four things. First, review the goal and objectives; they should influence your planning in both obvious and subtle ways. Second, learn what you can about the planning and execution of previous wargames conducted by the organization. Next, compare the objectives with the time and resources available. The sooner objectives, time, and resources are brought into balance the less painful the adjustments will be. Next, if the game is a major annual or biennial (every other year) event there will almost always be notes from the hot wash (see below) or a section on lessons learned in the game report. For a smaller wargame there may not be a formal report, but the OPR can still find and talk to the previous game's OPR. If a wargame is being executed for the first time, talking to the OPR of a similar game should be helpful. If the OPR's organization is conducting a truly unique wargame and for the first time, the OPR should read this section twice.

The first step of actual planning should be the construction of a "countdown calendar" like those we've discussed above, for what needs to be done by when and on what date the tasks were actually accomplished. Such calendars can be created with any word-processing program, but if you have the software, spreadsheets work better, and project-planning software works best.

We already discussed the pivotal importance of a full, clear, and mutual understanding of objectives. Here are some other specific planning tips. First, when possible, plan a little more time than is needed at several points during preparations. These interludes work like planned "holds" during a countdown for a space-vehicle launch: if delays are encountered, they provide time to make them up. If a facility is needed for the wargame, reserve it as early as practical. If external participants are needed, deconflict your dates with other wargames that may draw the participants you want, and get invitations out early, because the more valuable the participants, the faster their calendars fill up.

Other elements may or may not be needed for your wargame. Here are a few examples:

- Who has a need to know the insights generated by this wargame? Who has sufficient need to be invited to the outbrief? Who should receive a copy of the report?
- Does an analysis plan need to be developed?
- Do any of your materials need to be reviewed for classification or declassification?
- Will there be participants sufficiently senior to warrant working with the organization's protocol office?
- Is there sufficient chance of interest by the media to warrant working with public affairs specialists? Do you want media attention?
- Do you need to hand select any of your participants? Examples might be team leaders or an adjudicator in a particularly challenging area.
- Do any of your teams need . . .
  - To meet (in person or virtually) before the wargame?
  - To be trained?
  - To receive read-aheads?
- Should food be catered, allowing teams to work through lunch (or dinner)? Doing so creates an additional administrative burden but increases the time available in each day.

Learning from Your Outcomes and from Others'

At major military games insights tend to be discussed in two different events. Typically, first there is an outbrief for the sponsor of the game. Its focus is what happened during the wargame and what real-world insights can be drawn. The second and typically last event on the agenda is the hot wash. Less formal, with less "rank" in the room, the hot wash goes over what went right and what went wrong during the wargame. While some of the discussion invariably touches on the quality of the food and other logistical issues,

most of it centers on issues that affect the reliability of the game's insights: the accuracy of the adjudication, correctness of Blue or Red employment, plausibility of the scenario, and others.

There are good reasons for this split. Hot-wash participants will talk more freely and those who ran the wargame will listen less defensively in a more junior group. Also, many doubt that senior leaders want to listen to how the sausage was made. Still, I've long felt that these two events are kept a bit *too* separate, because, as just now implied, some of the comments in the hot wash are relevant to the level of confidence that should be given to insights arising in the outbrief. Nevertheless, we will address learning from the game's insights into warfare first, then the lessons learned on wargaming.

As listed above, before a wargame is ever conducted the practitioners need to determine who is likely to need the insights it generates, and how badly. An individual or organization with great interest may want to be involved in the planning and execution. Those with a lesser but still substantial need may want to attend the outbrief, while still others may simply want a copy of the report. Finally, there are those who need to know but don't realize it yet. For them, some form of outreach, targeted or blanket, is often needed.

It is also important to package insights in a way that meets different types of need. Wargame outcomes are typically treated as news, something to be reported but not referred to later. However, many individuals will need to refer back to them later, so it is important to establish an easy-to-use depository. Finally, wargame insights are sometimes most valuable when combined with insights from other games. Just as the outcome of an experiment is given more credibility when repeated independently, so a wargame insight also produced by other independent wargames should be and is taken more seriously. A trend across several wargames may be a more valuable insight than the insight from any one wargame.

Still, this can be dangerous ground. Multiple wargames all using the same faulty assumptions can produce the same misleading insights. Even a set of truly independent wargames may include ones that were conducted poorly or were driven by incompatible objectives.[14] Multiple wargames may also have used the same deterministic adjudication method; no value will have been added through repetition. My favorite Benjamin Franklin quote (Otto von Bismarck said something similar) is "A smart man learns from his mistakes, a wise man learns from the mistakes of others." When it comes to improving your abilities as a wargame practitioner it is best to be smart *and* wise.

As with an analysis plan to produce wargame insights, you can most effectively compile lessons learned by planning for it before the game starts. First, determine what information you will need from what individuals. Next think how best to collect that

information. Except for very small, informal wargames, it is almost always wise to construct a feedback form beforehand; it can be printed or made available online. The form works best when it seeks a mixture of quantitative inputs and narrative comments. Quantitative inputs are best for showing trends, like improvement from one game to the next, while narrative comments may actually contain quotable compliments or ideas on how to improve. A block for comments on the hot-wash agenda and simply asking "How're we doing?" over doughnuts can also provide useful feedback.

Such surveys also serve a defensive purpose. It is a sad fact of human nature that dissatisfied individuals are more likely to make the time to talk to your boss than satisfied ones. A boss once told me to cut a section out of my wargame course as one of the students had told her that all the students hated that block and found it useless. Fortunately, I had my survey results showing that the block in question had received the highest overall score and had been marked "below average" by only one student.

There are basically two ways to learn from others about conducting more effective wargames: participating in other organizations' wargames and attending gatherings of practitioners. Participation in others' games also increases the odds that the host will participate in your next one. Actually, how you learn in another's wargame is not terribly different from how you learn during yours. Try to get the report of the survey, if the host conducts one and is willing to share the results. Attend and take notes during the hot wash. Finally, solicit the views of other participants throughout the game.

There are several venues in which wargame practitioners get together and exchange best practices. In the United States, Connections has been attracting military, commercial, and academic wargamers from throughout the country and around the world since 1993. Connections' mission is to advance and sustain the art, science, and practice of wargaming. A tutorial offered the day before brings those new to the field sufficiently up to speed to benefit from the rest of the event. The keynote speakers are leaders in the field. The agendas also include speaker panels, working groups, "demos," and a "game lab." Finally, Connections maintains a website (Connections-Wargaming.com) that provides a forum for and a reference source for wargaming 24/7/365.

Also in the United States, the Military Operations Research Society's annual symposium includes a wargaming working group and typically between one and three other wargame-related events. In the past the requirement for at least a U.S.-recognized secret clearance has blocked almost all commercial and academic attendance and complicated international participation. However, it also allows the discussion of classified processes and outcomes that cannot be covered at Connections.

Finally, since 2013 there has been a British/European edition of Connections. International participation in Connections had always been modest because of the high cost of

air travel, but the first Connections UK attracted seventy-five participants from eight nations. By 2017 participation in Connections UK had grown to almost two hundred participants from nineteen nations.

While all of these events are great venues to learn best practices, they also provide opportunities to "give back" to the field. Volunteering to share your successes is both the right thing and the smart thing to do. Franklin also spoke of "doing well while doing good"—that is, sometimes when you help others you may also be benefiting yourself. Building a talk for any of these gatherings will clarify the subject of your briefing in your own mind. The question-and-answer period following your talk, not to mention "sidebar" discussions, can sharpen your understanding further. Finally, becoming better known in the community can provide benefits difficult to anticipate.

In this chapter we covered how wargame practitioners can best identify what work they have before them, plan and conduct that work, and learn how to improve their performance continually. I have tried to make my guidance as general as I could, but of necessity it is most relevant within a military or defense environment. Our next chapter will address how leaders can gain the greatest value from their practitioners and from gaming in general. Again, much of that will apply to all forms of wargaming, though we will deal with the military side in the most detail. In the chapter following that I will specifically address how a wide range of people can ideally benefit from wargaming.

Notes

1. Starting with Jutland in 1966, James Dunnigan designed well over a hundred wargames before going into semiretirement (from wargame design) in the 1980s. His record for total designs was not surpassed (by Joseph Miranda) until well after the turn of the century.
2. CENTCOM is the exception in terms of headquarters. While its area of responsibility is roughly the Middle East, its headquarters is located in Tampa, Florida.
3. This generally happens when adjudication software that works well for one use is applied to a very different purpose. The most frequent examples are attempts to use for wargames depicting theater campaigns software with a proven track record for only a few analytical studies, or even just one. If it can be made to work at all, it is likely to take a week to adjudicate something like three hours of a six-month campaign.
4. Erik Durschmied has written several books on the impact of the unlikely on history, including *The Weather Factor: How Nature Has Changed History* (New York: Arcade, 2001), and *How Chance and Stupidity Have Changed History: The Hinge Factor* (New York: Arcade, 1999).
5. Frank McHugh calls this "rigid assessment" *(Fundamentals of War Gaming)*.
6. During Connections UK 2014, one of the senior leaders of Dstl told me it had had good results with computer routines replicating decisions of doctrinaire Soviet commanders but not much success automating the decision-making processes of terrorist groups.

7. This story was told to me by "Mo" Morgan, then a captain, at Nellis AFB in the mid-1980s. He had done as the story describes, except that he did not buy a constructive paper wargame but designed and developed one himself. The wargame would later evolve into Check Six!, the first wargame funded by the Air Force's Project Warrior.
8. Of course, all this is very time-consuming. Simple sensitivity analysis can identify many of the same potential problems much more quickly.
9. Figure 21 is based on a slide in a presentation by Maj. Eric Frahm of the Air University LeMay Center War Gaming Institute. He originally called it the "Caffrey Triangle," having based it on a conversation we had had. I told him the name was already taken (variables to Red play) and suggested he use Caffrey "Pyramid" or "Equip Pyramid" instead.
10. Shawn Burns, ed., *War Gamers' Handbook: A Guide for Professional War Gamers* (Newport, RI: Naval War College, War Gaming Department, n.d. [2015?]), www.usnwc.edu/getattachment/Research---Gaming/War-Gaming/WGD-HB---Complete-2.pdf.aspx.
11. These steps are based partly on the ten steps of print wargame design in Dunnigan, *Complete Wargames Handbook*. Jim advised me to "plagiarize" the list, and I could only obey.
12. For readers born after roughly 1970, Lee Iacocca is best known for spearheading the development of the Ford Mustang, while at the Ford Motor Company in the 1960s, and for reviving the Chrysler Corporation as its chief executive officer during the 1980s.
13. For example, when I checked the schedule for the Air Force's Future Capabilities Game 2015 in the summer of 2013, a Title 10 game scheduled for spring 2015 had already been available for three months.
14. For a number of years students played against a Red order of battle that had been doubled, to pose a greater challenge. The wargames met their educational goals but any insights they generated would have been worthless for anyone trying to anticipate how fighting in the depicted theater might actually develop.

CHAPTER ELEVEN

Leaders and Wargaming

Wargames can help leaders gain an edge on their competitors—if they use games more extensively or more effectively than competitors do. This chapter will address how leaders—especially of defense-related organizations, leaders from the platoon to national level—can maximize the odds that their organizations will in fact wargame more effectively than their adversaries.

Does this mean that someone who is not a leader within the defense establishment should skip this chapter? Not necessarily. Leaders in the defense-contractor community may find some of the below useful in understanding and communicating with their clients. Citizens may be better able to understand defense work conducted on their behalf. Leaders in the economic or political realm may find some of it adaptable to getting an edge on the competition. Finally, folks who are not yet leaders may find this useful, both to help them anticipate what their leaders need and to prepare for when they become leaders themselves.

Anticipating Wargaming's Biggest Payoffs

Just as we needed to describe what we mean by "gaining an edge" in war and what its value is before describing how wargaming can help do that, so now we must discuss what leaders do before we can describe how wargaming can help them do those things better. But before doing even that, we need to acknowledge that leaders do not actually achieve things themselves. Leaders do not take hills, bring the iPhone to market, or turn around failing schools. It is their followers who actually do those things. Successful leaders set up their followers for success. Their followers are the ones who throw the dice, but leaders can affect the odds of success. Leaders do that in four ways: developing and communicating goals and objectives, securing resources, anticipating the likely outcome of actions in a competitive environment, and developing their followers. Let's look at each in turn.

Leaders sometimes establish goals and objectives themselves, though more often they tailor and elaborate those set by leaders above them, either in a military chain of command or a civilian organizational structure. This tailoring typically involves focusing on the leader's part of a larger effort. The edge that wargaming can provide in setting goals more effectively may not be immediately obvious, but actually wargaming can help in several ways. Higher-level goals may have been developed in part through gaming; knowing about those games can help leaders better understand the goal. For example, U.S. naval wargames in the late 1920s and 1930s indicated that if war came with Japan, the capability to capture Japanese-held islands would be of strategic importance. Developing such a capability became a goal of the Marine Corps. Wargaming can also be used to refine and develop goals at the leader's level. It can help anticipate their feasibility and clarify their contribution (or lack of it) to higher goals.

Leaders also work to provide their followers the resources needed to obtain their goals. From the strategic level (justifying placing an item on an "Integrated Priority List") to the tactical level (perceiving the need for reserve "lift" should a helicopter in a raid have to turn back), wargames are very useful. They help identify gaps and opportunities, and they communicate the likely impact of resource decisions.

For example, prior to retiring from the Air Force Reserve, I had to keep my weight within the limit stated for my height. To help, I often used a cheap, noisy exercise machine. One evening I turned on C-SPAN and began watching a U.S. Air Force major general testify to Congress. I caught words like "megajoules" and "gigawatts," but I could not make out, over my exercise machine, all that the general was saying. So I stopped exercising, but I still could not understand what he was talking about. Then an Army major general testified. He began by saying something very much like this: "Thank you for the opportunity to talk to you about an American tragedy, all-too-unfriendly friendly-fire incidents, where Americans are accidentally killing other Americans. The Army is seeking funding to equip one division with what we are calling Blue Force Tracker, a system that will let our soldiers know where they are, where their buddies are, and where all known enemies are. To gain insights into possible impacts of this system we wargamed a brigade 'meeting engagement' with and without this system. Without Blue Force Tracker we suffered fourteen friendly-fire fatalities; with it we suffered none." The committee members were not only supportive of Army procurement plans but even explored the feasibilities of speeding up the procurement. One asked, "Why don't we just take the money away from the Air Force? They want to spend it on gigajoules." The committee members probably did not understand the science behind Blue Force Tracker any better than they understood gigajoules, but they did understand fourteen lives.

Leaders can use wargames to help them arrive at more-effective strategies. This help may come in several ways. Over the long term, games can help leaders develop their

own ability to envision effective strategies. Conversely, wargames may well make their most important contribution by identifying strategies that are unlikely to succeed. They offer enough insight into outcomes to allow alternative strategies to be compared and the most effective to be selected. Finally, they can point out dangers and opportunities before operations begin, so that measures can be taken to avoid the one and exploit the other. Of course, exactly how wargames are used will vary.

In the case of preparing for a specific endeavor, the type and scope of wargaming will be determined by the level and size of the leader's organization and the time remaining until the earliest time of execution. The level and size of a leader's organization or unit will determine what resources (principally people) can be dedicated to planning and wargaming. As for time, a balance must be struck: the more time taken to prepare instructions, the more time the leader will have for concurrent wargaming and improving his or her instructions in a host of other ways as well. However, the less time a leader takes to provide guidance the more time subordinates will have to prepare. It is generally a good rule of thumb that a leader should take no more than one-third of the time remaining to develop instructions to subordinates. The importance of giving subordinates time to prepare applies at all levels, from the commander in chief to the platoon leader.

The payoff of such wargaming is an increase not only in the chances of developing the most effective plan but also in your organization's understanding of the plan, which should increase the speed and accuracy of execution. Wargames can also promote faster, more effective execution of operations when conducted long before an operation is conceived of. They can help leaders develop themselves and their people, help develop an understanding of an adversary and the projected operational environment, help develop tactics, and finally, help identify the best use and overall utility of new and proposed equipment.

Wargames can also help you answer the "So what?" question concerning intelligence information. Intelligence, from open and closed sources, typically does a good job of informing defense organizations on the evolution of adversary capacity and capabilities. It is less consistent in making clear why it matters. "Intel" may tell us that an adversary's new surface-to-air missile can hit targets a thousand feet higher than his current missile. But would this new capability be devastating or inconsequential? The leader's wargame professionals can help identify the most cost-effective game alternative to gain such insight.

Wargames can also help develop new tactics to reduce the impact of current adversary capabilities or to respond to emerging ones. Bad ideas outnumber good ideas, and many good ideas become good only as they are refined. Casualties tend to be high

(per thousand per hour) early in wars as both sides sort out the good ideas from the bad. Wargames provide a bloodless, if somewhat less than foolproof, way to sort the ideas into "good," "great," and "seemed like a good idea at the time." Again, a leader's wargame practitioners can turn up the most cost-effective wargame for the purpose.

Similarly, wargames can help clarify both the utility and best application of new or proposed equipment. Lower-level leaders tend simply to receive new equipment that was selected at a higher level. But they can still use games to find and communicate its best use more quickly. If you are a leader at a higher level, you can use wargames to help assess the relative military utility of various hardware proposals. With most defense budgets falling and all budgets finite, it is important to pick out those items that will most increase military effectiveness. Here, perhaps more than in any other form of wargaming, it is critical that leaders work closely with their wargame practitioners.

Another way leaders can use wargaming to help set up their subordinates for success is to educate and train them. As stated earlier, wargames can help create virtual veterans, by providing synthetic experience—even on systems that do not yet exist in the real world. When the time comes actually to execute a mission, be it combat or disaster relief, followers who have "done it before" during games will have a tremendous edge.

As you know by now, the development of the strategic abilities of leaders is the most ancient of wargaming's application. Chapter 12 provides detailed advice on wargaming as part of a broad program of self-development. For now it is enough to say that leaders should lead by example and use games as an important avenue for personal development and encourage their subordinates to do the same. Leaders should also work with their wargame practitioners to explore the cost-effectiveness of holding unit wargames.

Leaders can also use wargaming to develop their own and their organizations' understanding of current and potential adversaries. Even junior leaders can arrange for an intelligence briefing, but even the best briefings do little to develop an intuitive feel for how Red fights. But fall for a Red deception plan just once, in a wargame, and a leader will be much more wary in a real encounter. Done right, wargames can help leaders start developing counters to Red systems even before they enter Red's inventory.

It is a truism of modern warfare that the first tactics used, developed before or during a conflict, are never the ones considered most effective by the conflict's end. Wargames can help leaders identify ineffective tactics before such information must be purchased with lives. Places like the U.S. Army's National Training Center and the Air Force's Red Flag have a history of developing tactics that later proved effective in actual combat.

Most people outside a nation's defense establishment, and many within, seem to assume that decisions about what new systems to research or procure are made at the highest

levels. While this may be formally true, over the years a surprisingly large number of surprisingly junior individuals have had major impacts on such decisions. Wargames can help leaders at any level influence such decisions by demonstrating the likely impacts of such systems. As we've seen, leaders can also use wargames to anticipate the best employment for new hardware before it is delivered.

Wargames can also familiarize players with environments in which they will operate. Historians often note the military advantage enjoyed by the side with superior knowledge of the ground. How can the members of our increasingly expeditionary military gain an understanding of ground to which they have not deployed? Fighting over terrain in a wargame does a remarkable (and all too seldom acknowledged) job of imprinting that terrain on the participants' brains.[1] Even where there is no opponent, a "ROC drill" (see note 3 below) can reveal relationships among factors that would otherwise be obscured. Sometimes "Nature" can be Red. Umpires playing Nature can toss at the Blue players "wild cards" that force them to adapt, replan, etc. The Naval War College's War Gaming Department used this method to good advantage in the Strategic Foundations Game that underpinned the development of the 2007 CS21 game.[2]

Finally, the leader should never automatically assume that a wargame is the answer for any given objective. If your challenge does not involve a thinking adversary, perhaps a simulation or some other OR technique will be a better fit. If your goal is to train your subordinates for just that type of challenge, perhaps a scripted exercise is your best option. At other times the best answer may be a series of wargames or a game embedded in a larger process. While wargaming can help you and your organization in many ways, just how much it actually does help will be largely a function of how effectively your wargame practitioners are employed.

Making Effective Use of Wargame Practitioners

Before they can make effective use of wargame practitioners, leaders need to determine with which practitioners they will work. Your basic options as a leader are to use an external wargame organization, use subordinates, or accomplish the wargame yourself. A leader's choice will be influenced by need, time, and resources available. Sometimes all that is needed is a quick idea of how a likely adversary would affect the success of a decision being contemplated. Sometimes a decision is needed quickly; on other occasions there is plenty of time. Finally, different leaders have access to different levels of support, but all can conduct wargames themselves.

Regardless of how big or how small the wargame will be, the critical first step is always the same: a leader needs to state clearly the wargame goal and objectives and the resources (time, money, personnel, and facilities) available. Such wargame taskings,

again, work better when the wargame professionals are told what leaders want, not how to achieve it. For example, leaders should generally not specify a particular adjudication method or wargame tool but allow their professionals to recommend the best fit with their goals and objectives. It is even better if the leader and the wargame practitioners enter into a dialogue, even before a goal and objectives can be defined: the nature of the problem should be clarified so as to determine whether a game is actually needed. If a wargame is indicated, the game's goal must be identified, and only then can its objectives and resource needs be established. Finally, a leader is prudent to have the wargame professionals "repeat back" the guidance to ensure that it was interpreted accurately.

External Organization

Often the best option, when time, resources, and organizational level allow, is to give the job to an external wargaming organization. Most militaries have wargaming organizations whose mission includes wargame support. For example, in the United States the Naval War College's War Gaming Department and the Air Force's LeMay Center Wargaming Institute dedicate half their capacity to supporting professional military education (PME) and half to supporting leaders throughout their respective services.

Whether or not your service has such organizations, your best choice (or your only choice) may be a contractor. In such cases, if you have sufficient funds, your best option may be contracting with a commercial wargame provider. The cost of such contracts as well as their success has varied widely. Multimillion-dollar projects have been terminated without producing value, while other contracts (typically modifications of existing commercial games) have provided significant value at very low cost.

Between the service and the contractor options is working with a "federally funded research and development corporation" (FFRDC), such as RAND or the Center for Naval Analyses. Sometimes an FFRDC does a set amount of support work each year, so if your effort can get on the list the work may cost your budget nothing. If you must pay, and you probably will, the FFRDC's support is still typically faster to secure than that of a commercial entity.

To get the best results from any type of external wargame organization, it is especially important to describe clearly at the outset your goal, objectives, and resources to be allocated. With contractors it is important to establish exactly what will be government property at the termination of the contract. It is always important also to conduct periodic reviews of progress.

Internal Practitioners

Who are a leader's wargame practitioners? Wargame practitioners are typically present at every level within defense organizations, but trained, long-serving specialists are more likely to be found at higher headquarters, while self-taught, self-identifying, additional-duty volunteers are the norm at the lower levels. The wargame abilities of people assigned to your unit but not in wargaming positions will vary greatly, from a former staff-college faculty member who ran wargaming for three years to recreational gamers who have been waiting their entire careers to work on wargames during duty hours. Just how far down the organizational chart trained wargame practitioners are assigned fluctuates over time and between armed forces. The interwar German armed forces probably still hold the record for sending trained practitioners deepest into their organization, while the U.S. military of the late 1950s and 1960s is a contender for the shallowest.

Oneself

While flag and general officers may choose to play mental wargames to help themselves crystallize their initial guidance, for junior leaders running such a wargame themselves may be the only option. In almost any military, leaders who command small units, such as platoons, typically have no staff and typically little notice of operations. If this is your case, the next chapter constitutes important reading. But here is some advice on the two principal game applications: decision support and education/training.

In the case of decision-support wargames, no matter how little time leaders have or how small their staffs, they should always make time to wargame the situation in their own heads. The leader starts by thinking through a course of action (COA) that the adversary is most likely to adopt and what the adversary is capable of. Next, because the adversary can wargame too, a leader needs to think of an adversary course of action that would be more dangerous, though still feasible. Finally, the leader should try to think of an enemy COA that is *less* dangerous, one the leader's organization might realistically induce the adversary to choose.

The leader would then consider his or her own options. Each option must be *suitable* and *feasible*. That is, to be suitable it must actually fulfill the mission if successfully executed. To be feasible, the training, logistics, infrastructure, and technology necessary to accomplish it must be at hand. Each COA must be *acceptable*—that is, in accordance with international law and consistent with your nation's values and those of any allies or coalition partners or both. All options must also be *effective,* as determined by at least a mental wargame. Typically, leaders quickly think of one option—probably the most

likely option and one likely to occur to the adversary also. Leaders need to keep thinking until they come up with at least two more suitable and feasible COAs.

Finally, the leader needs to think through the most likely outcome of a collision of each friendly (Blue) course of action with each adversary (Red) course of action. Now he or she thinks through the likely casualty rates, time, and other costs of each set of Blue and Red options. In particular, he or she tries to anticipate which would be the most risky and which the least. Finally, the leader decides which option is most advantageous overall.

When time and resources are tight this mental wargaming may be all that is possible and the leader will make a decision based in part on it. When there is some additional time and staff, the same mental work can help the leader provide initial guidance to a small planning team. In these cases the leader needs to identify who will be developing the plan and fix how much time they will have to develop and recommend a course of action. The leader needs to keep the team small. That's easy at the lower levels, where there is little staff, but even at the highest levels, where more staff is available, a small team seems to work better—and faster.

When they are available, the leader would include at least one wargame practitioner, a Blue strategist/planner, a logistician, and someone capable of anticipating Red choices. Next the leader provides the guidance the unit has received, any additional information that has been developed, and the insights gained through the leader's mental wargame. Leaders should never tell their teams the specific option they should pick, as this would bias their subsequent thinking. Now the team members follow essentially the same steps the leader did. They develop feasible adversary options: most likely, most dangerous, and most advantageous. They then develop friendly options. The greatest difference from the leader's earlier work will be in their wargaming of the collisions of adversary and friendly options. Depending on time and resources available, they would game each set of options at some higher level of rigor than the leader could have. Even when time and resources are tight, the group may form small (often one-person) Red, Blue, and White teams, which will then game each major phase of each collision of Red and Blue COAs. At the time designated, the team will come back to the leader with the courses of action it developed and its recommended one. It is the leader's decision whether to pick the recommended COA, take one of the others, modify one of them, or tell the team to try again (if there is time). The option picked will be forwarded to subordinates and for more detailed planning at their levels.

If time permits, the leader may run one more wargame/rehearsal, toward the end of planning, when the detailed plan is almost complete, involving the entire staff. The staff members would walk through what they will need to do when, much like a rehearsal for responding to natural disasters with no adversary. However, in the defense community

a Red team is formed (even if it's a team of one) and provides inputs; a White cell then determines the net effect of Blue and Red actions. This outcome typically reveals unanticipated needs and vulnerabilities, prompting modifications to the plan.[3]

The other wargame application a leader may need to implement directly is a wargame for educational or training purposes. The actual experience of a friend and colleague of the author may illustrate both the why and the how of such games. At the time, my friend was a young lieutenant commanding a platoon in America's single ranger regiment. He and his men had been on an exercise (one-sided drill) all week. Now they were waiting for trucks to take them back to base to clean and stow their gear and begin their weekends. And they waited and waited for the trucks. My friend's rangers were becoming restless. He realized he needed to do something to maintain his standing with his men, so he stood on a tree stump and called them together. He told them they were going to be in another exercise (this time a two-sided live wargame) the next week. The platoon would wargame its mission now, which should improve its performance next week and perhaps speed up the exercise. Sections two and three would play Blue, section one would play Red, and he and his platoon sergeant would serve as White. He briefed Blue and Red separately and gave them a fixed amount of time to tell him what they would do. After assessing the net effect of the Blue and Red moves (trucks still not having arrived), he backbriefed each team separately and gave them a fixed amount of time to brief him on their new plans. When the trucks finally arrived, four hours late, the men looked up and got right back into the game. After a few minutes one of the drivers blew his horn. One of the men looked up and called, "We waited for you four hours! You can wait until we're done."[4]

Did this wargame meet its objective? Yes: instead of wasting time, his rangers participated in an engaging, useful activity. Was it a credible wargame? Yes: each team was well qualified for its tasks. I like to tell this story for another reason: How much money did this wargame cost the American taxpayers?

While a self-created educational wargame can be very effective, leaders can, working with their wargame professionals, develop plans to maximize the ability of wargaming to create virtual veterans while minimizing any negative effects on their organizations' day-to-day missions. Options include encouraging the individual play of relevant commercial wargames, encouraging formal professional development (that includes wargaming), piggybacking on wargames conducted for other reasons (and often by other organizations), and conducting internal wargames with subject matter, type, and timing selected to maximize benefit and minimize negatives.

Assessing Confidence in Wargame Outcomes

Leaders are responsible for making decisions. They must make them when those decisions are needed. All leaders sometimes need to make decisions when the information available is incomplete, uncertain, and possibly misleading, but this situation is particularly common in the defense area. Sir Winston Churchill liked to say, "In war the truth is so precious it must always be surrounded by a bodyguard of lies." In war, cold war, and what are called times of peace, adversaries try to deny information and deliberately mislead—and yet decisions have to be made.

George Edward Pelham Box once observed that "all models are wrong, though some are useful."[5] The two-dimensional models we call maps illustrate this point. The most accurate and detailed topographical map does not show all that is present on the ground it depicts, yet we all use maps, because they are detailed enough, accurate enough, for our purposes. They are useful. It can reasonably be said, on the basis of the history of wargames, that all are at least a little wrong, in that the end states of wargames never exactly match later events. Even the "eerily accurate" U.S. Marine Corps wargame (mentioned earlier) was off by a few casualties, and history offers many examples of wargames being very wrong. Yet it also indicates that wargames have often been very useful, sometimes providing key edges over opponents. How can a tool that is always wrong, and wrong to varying and unpredictable degrees, be useful to decision makers?

So if a game's outcome may or may not match the future reality, should wargames be ignored by decision makers? No. In war, in all matters defense, decisions must always be made under conditions of less than certainty. Actually, all of us make decisions based on information that is less than certain. No one believes weather forecasts are infallible, yet most of us grab an umbrella when we hear there is an 80 percent chance of rain.

Actually the defense establishment has long adopted a methodology for coping with uncertain information. The intelligence community routinely includes confidence assessments with the products it provides to decision makers. Analysts may say, "We have high confidence in this report, as it is based on multiple highly trusted sources," or, "We have low confidence in this report, as it is based on a single fairly new source."

At the time of this writing, it is still unusual for reports on wargames to include explicit statements of their assessed levels of confidence. Even if such statements become as common for wargame reports as they are today for intelligence reports, it is important that leaders make up their own minds about how much credence they should give to any wargame. To do so, a leader needs to consider the two principal factors: the difficulty of what is being gamed and the quality of game execution. On one hand, wargaming even the easiest subjects can never prove, predict, or even forecast, and on the other, gaming even the most challenging areas can produce useful insights; so confidence in the

relative accuracy of outcomes can and should vary. Here are some categories of variables with the greatest impact on confidence. Let's look at each.

FIGURE 27
Situational Influences on Confidence

More Confident	Less Confident
• Tactical	• Strategic
• Physics	• Human Factors
• Kinetics	• Nonkinetics
• Red Similar Culture	• Red Dissimilar Culture
• Short Duration (Battle)	• Long Duration (War)
• Many "Runs"	• Single or Few "Runs"
• Attrition	• Effect

- All other things being equal, it is appropriate to have relatively more confidence in the outcomes of wargames at the tactical level than those at the strategic. Wargamers typically have much more data on which to base their adjudication at the tactical level. It is typically appropriate to have relatively less confidence in strategic games, as they tend to be on the low end in terms of confidence in many of the areas covered below.
- While political science, economics, sociology, and other "soft" sciences have made important contributions to human understanding, none have produced equations with the precision of $F = ma$. Wargames that deal principally with ballistics, such as aircraft-versus-missile duels, produce outcomes that engender greater confidence than games dealing with a hearts-and-minds campaign in unconventional warfare or a counterinsurgency campaign. That is to say not that wargaming insurgencies is not important (it is) but that outcomes of those wargames should inspire relatively less confidence.
- In a similar vein, wargames that deal with kinetic effects (breaking things) tend to produce findings that inspire greater confidence than those dealing with nonkinetic effects (morale, training, second-order-and-higher effects). Again, this is not to say that nonkinetic effects should therefore be ignored. Some games in the First Gulf War did not attempt to adjudicate when Iraqi units would stop offering effective resistance and so depicted all Iraqi units fighting to the last man. Leaving out nonkinetic effects that will be present in the actual conflict because they are hard to wargame will just make outcomes less accurate and generate lower confidence.
- If our adversary's culture is similar to ours, it is relatively easier to "think Red" accurately than if his culture is substantially different. Hence, wargames with Reds of similar culture, all other things being equal, tend to elicit higher confidence.

- The less time covered by the wargame, the higher the confidence. Simply, there are fewer opportunities for the game to go off in the wrong direction.
- When a wargame is executed once, there is no way of knowing whether the outcome is the most likely or one of the outliers. When a wargame is executed (equally well) a number of times, a sense of which outcomes are relatively more and less likely emerges. Of course, when and if the gamed operation takes place, a "black swan" may occur—a freak weather event or any number of unlikely developments—which may produce a real outcome on the edge or even outside the spectrum of those produced by the multiple runs of the wargame.[6]
- While the very first American wargame adjusted its attrition tables to reflect actual battlefield rates of attrition, our experience adjudicating effects is much more recent. Therefore, wargames that principally explore attrition elicit more confidence than those that focus on effects.

It should now be clear why strategic wargames are so hard and accordingly inspire less confidence than others. Strategic-level conflicts are of long duration, human factors can be decisive in them, and effects can be critical. Many of the categories that are difficult to adjudicate individually are present together in strategic wargames.

Finally, factors that help assess relative confidence in a wargame overall can also be considered for relative confidence in outcomes within a single game. For example, an indication in a wargame that a theater has too little ramp space for all planned Blue aircraft should be viewed with more confidence than an indication from the same game about how and when Red would modify its tactics.[7]

The other major factor influencing confidence levels is the quality of game execution. Much of the previous two chapters deals with ways to improve the execution of wargames. But here are some of the things that can go wrong in major aspects of wargames. One is the *starting condition*. Most wargames that produce outcomes that differ from future events do so because their "scenarios," the situations at the start of the game, did not match reality or never actually happened. Here are examples of each case. The German wargames prior to the invasion of the Soviet Union relied on Soviet maps. These maps tended to exaggerate the quality of the roads. When the invasion took place, German forces were often unable to move as fast as the wargames indicated they would.

Or the scenario may never "come to pass." For decades the U.S. Army, and to a lesser extent NATO, forces conducted wargames depicting a Warsaw Pact attack through an area of central Germany called the Fulda Gap. They were all "wrong," inasmuch as Soviet-led forces never attacked. These cases result from several causes. Sometimes a situation that is viewed as unlikely is wargamed anyway, because Blue suspects there is potential for

great harm should it occur; because the event poses an interesting problem; or because the situation is representative of a type of problem that is believed likely to occur in some part of the world. Some assert that unlikely situations are selected deliberately to make a particular service or proposed weapon system look good. Finally, a starting situation of a game may not occur because the conflict depicted in the wargame looked so dangerous that leaders decided that the best way to win it would be to ensure it never took place. Some of the wargames depicting global strategic nuclear war with the Soviet Union may fall into this category.

When considering potential causes of wargame outcomes differing from later events, *Blue play* typically comes to mind last, if at all. After all, we *are* Blue—how could the decisions we make in the game differ from those we would make in a war? There are several reasons. Often, as we've seen, though not always, Blue players are making decisions one, two, or more grades above their own. Actual presidents and flag officers are very busy people. Also, the participants know that no casualties will actually occur, no campaign will be lost, and so tend to be more aggressive than actual decision makers in the real world.[8] Even when conditions may seem favorable for authentic Blue play, differences are common.[9]

Often overlooked is that it is not uncommon for Blue to take concrete steps to make sure the indicated outcome of a wargame will be wrong. As Microsoft is often alleged to say, "This is not a bug; it is a feature." The ability to avoid a future that might have been is possibly the most valuable "feature" of wargaming. Wargaming can only indicate possibilities. If outcomes prompt subsequent decisions and actions, leaders can increase their odds of achieving or avoiding certain eventualities.

The second-most-often-cited reason for game outcomes that do not match future outcomes is *Red play:* failure of the Red team to make the same choices as the real Red decision makers turn out to make. Therefore it is curious that efforts to play Red realistically have been very uneven. While it is probably impossible to re-create exactly an adversary's decision-making processes, preparation can help Red players get closer to thinking like Red than if they do not prepare at all. How this can be achieved was described in an earlier chapter and will arise again in the next. As for assessing how much confidence should be placed in a wargame's outcome, how hard it is to play Red accurately and whether an explicit effort is made to do so should be important factors.

It is not surprising that there are several ways White play can contribute to misleading results: White, after all, has three functions—control, adjudication, and analysis. White as control—this is almost never discussed yet is sometimes disastrous—may not ensure the wargame runs for the full duration of the conflict being examined. (Why will be discussed below.) From the German wargame on the invasion of the Soviet Union to the

coalition invasion of Iraq, wargames have missed elements of a conflict that later turned out to be important simply because they had not gotten that far yet.[10]

As adjudication, White may contribute to misleading results by failing to consider factors that in the actual conflict turn out to be important or even decisive. The clearest case is the 1990–91 Gulf War, when several U.S. wargames adjudicated coalition casualties on the assumption that every Iraqi unit would fight to the end. Uncertain at what casualty level Iraqi units would become combat ineffective, they ignored the issue. Clearly, it is not practical for wargames to consider every element in every conflict, which is why pregame analysis, to identify which elements will likely be most important, is so critical.

White can also contribute to misleading results by getting specific values wrong. This is far and away the area that gets the most attention. Certainly, the importance of getting right such values as the probability of one platform killing another seems self-evident, but I have been able to find only one case where such an error produced misleading results. It is one mentioned before: the pre–World War II U.S. Army wargames that overstated the effectiveness of tank destroyers and so led to the development of tactics that proved disastrous a few months later in North Africa. Prior to combat it was probably not possible for the Army to get these values exactly right. Still, there were things it could have done to be less wrong. Just a few years earlier the U.S. Navy had gone to great lengths to anticipate the likely future effectiveness of air attacks on naval vessels.[11] Data from World War II were to show it did not get the values exactly right, but it was close enough to avoid grossly misleading outcomes.

There is also a widespread implicit belief that if accurate values are good, more-precise values are better. So instead of using a probability of kill (p_k) of 0.9, great effort is expended to derive a value of 0.88 and even greater effort to derive a value of 0.881. I have not found a single case where misleading results were produced because the wargame adjudication used p_k of 0.88 but the actual value turned out to be 0.881. Worse, devotion of effort to increasing precision is likely to mean that values as or more important are ignored and wargames are not played through to the conclusion.

Finally, White may not make sufficiently clear what the input (scenario) is and what the output is (adjudicated outcomes).[12] This has resulted in some reports citing as insights from the games conditions that were actually starting assumptions.

After reading all the ways in which wargame results can be thrown off, you may be thinking that it is a minor miracle that wargames produce outcomes that match future reality even a few times a century. The good news is a wargame does not have to indicate

the future with complete accuracy to be useful. Consider the Gallant Knight wargames conducted in the decade preceding the Gulf War. These games got the enemy wrong and enemy's objective wrong yet still accurately pointed up the military utility of increasing ramp space and prepositioning in the Gulf region, which proved to matter a lot. To paraphrase Professor Box, all wargames are at least a little wrong but can still be useful. If you are a leader, your staff may recommend a confidence level to you. The above should give you a basis on which to decide ultimately for yourself.

Finally, how effectively leaders can use wargaming depends in great measure on the effectiveness of their subordinate game practitioners. Whether your gamers comprise a single additional-duty volunteer or a wargame department, here are two things leaders can do to help them provide the most effective assistance practical.

First, the importance of providing clear guidance to your wargame practitioners cannot be stressed often enough. In many cases wargames that are viewed as unsuccessful had objectives that were unstated, unclear, or changing. The best thing you can do to ensure success is to state clearly your goal, objectives, and the resources (especially time) your practitioners will have. If military necessity requires your goal or some of your objectives to change, the resources allocated (especially time) need to change as well.

Second, leaders need to encourage and support the professional development of their wargamers. Just as ace fighter pilots get much more out of their jets, wargamers who really know wargaming will help their leaders get more out of wargaming. Encouraging and supporting their efforts to increase their individual knowledge and to support the advancement in the field of wargaming will pay rich dividends over time. If you think you do not need to develop your wargame practitioners because you plan to use contractors, think again. Yes, contractors have produced some of the biggest breakthroughs in wargaming and some of the most influential insights. But others have taken millions of dollars and produced nothing of value. Sharp internal practitioners can help you spot the snake-oil salesmen and help the excellent contractors surpass themselves.

Notes

1. My evidence of effect is all anecdotal but, I believe, convincing. As one example, a college history course I once took gave a map quiz to see whether students could locate geographic features mentioned in our readings. I had never visited any of the locations covered in the quiz but had fought several commercial wargames over the terrain. I answered correctly twenty questions out of twenty. The second-highest score was seven.
2. Rubel, comments. "CS21" was the "Cooperative Strategy for 21st Century Seapower," a new U.S. Navy maritime strategy introduced that year.
3. According to Dean Rubel: "The Army calls such a walk-through a 'rock drill' because they used to use rocks to represent units. At other times it is called a ROC drill, for 'required operational capabilities.' This last seems to be

too stilted and not really an accurate title for what is going on."

4. The story was told to me by Bill Gibbs, cofounder of Omega Games, a small print wargame development and publishing company.

5. George Edward Pelham Box, 18 October 1919–28 March 2013, a British mathematician and professor of statistics at the University of Wisconsin, was a pioneer in the areas of quality control, time-series analysis, design of experiments, and Bayesian inference. See *Wikipedia,* s.v. "George E. P. Box," en.wikipedia.org/.

6. For examples of the huge effect of the improbable on military outcomes, see Durschmied, *How Chance and Stupidity Have Changed History,* and, of course, Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable,* 2nd ed. (New York: Random House, 2010).

7. The idea that insights from the same wargame should sometimes be treated with different levels of confidence is not mine but Robert Rubel's (in his comments on the manuscript): "*If—in advance of a war*—you were forced to bet on certain things, would you feel better placing money on the utility of ramp space or the prospect of Iraqi unit integrity? I would go with the ramp space bet as I would be far more confident in that—almost a sure thing—than I would be in Iraqi unit integrity either way."

8. See Rubel, "Epistemology of War Gaming."

9. Downes-Martin, "Adjudication."

10. Often this is not really the fault of White but can be traced to a sponsor who did not ask for a game of sufficient duration or to a designer whose structure set up White for failure.

11. See Nofi, *To Train the Fleet for War.*

12. Anyone who has wargamed for a substantial amount of time will have heard at least one person say that a game "proved" something that was either part of the original scenario or was added during the wargame to address a game objective better.

CHAPTER TWELVE

Wargaming and Your Personal Objectives

Up to now this book has focused principally on military applications of wargaming, with occasional asides on other types of users and other types of applications. This chapter addresses how almost anyone can apply wargaming to help meet goals. Specifically, it will address how different groups of people can best use wargaming.

For Parents: A Tool for Active Learning That Kids Will *Want* to Use

Most of us are or someday will be parents. Many of those who never will be parents are, or someday will be, aunts and uncles. All of us have a stake in the development of the next generation. All of us need to understand how wargames and related simulation games can help our children compete more effectively in an increasingly competitive world.

Of course, some see games, especially computer-based games, as a threat. When mass shootings take place in the United States some advocate controlling access to video games. It is easy to forget that one generation tends to blame all that is perceived as negative in a younger generation on what is popular with that generation. At one time or another the perceived decay in the morals of the then-younger generation was blamed on ragtime music, horseless carriages, jazz, comic books, rock and roll, Dungeons & Dragons, rap, and now computer-based games of all types.

Still, like a broken clock that is right twice a day, each generation of critics has occasionally been right. It probably was unwise for a fourteen-year-old girl to go for a ride with an older boy in a horseless, or horse-drawn, carriage. Some rap lyrics are inappropriate for early teenagers. (Some are inappropriate for senior citizens.) It may be prudent to conduct additional studies to see whether the type of video game called "first-person shooter" has any statistically significant impact on reducing a player's inhibitions against shooting real people in the real world. As of this writing, studies seem to suggest the opposite.[1]

It is clear that many wargames and other simulation games can have enormous positive effects on the development of young people. Here is one bit of anecdotal evidence that illustrates several of the ways they are helpful. In the first grade, my son Matthew started playing the computer game Civilization. Designed for adults, Civilization was, and is, a simulation game that depicts all areas of a civilization's development: war, diplomacy, invention, exploration, expansion, and trade.[2] At first I played it with him, but he very quickly began playing it on his own, though he would sometimes come and get me, usually if there was a word he did not yet know. One evening, close to the end of the school year, I realized he had been standing next to me. I said, "I'm sorry, Matt, I didn't see you, is there a word you need help with?" "No," he answered. I asked, "Do you want advice on what to invent next?" Again he said, "No."

Finally I said, "Well, then, what is it?" Matt said, "Dad, do you remember a while ago I invented railroads?" "Yes." "Well," he replied, "a lot changes when you invent railroads." "Yes," I said, "tell me about the changes you've seen." "Well," he said, "my cities seem to be growing a bit faster and I think I'm building stuff faster, but that's not what I want to talk to you about. You've always told me to keep two military units in each of my cities on the border with another civilization and one unit in each city next to those cities, so they can move up quickly if needed. You also told me to always connect all my cities by railroad. Well, I'm almost done, and, well, I can now get my units very far very fast. Do I still need to keep as many units one city back from the border?" I looked at my son with pride and wonder. "You are not yet six years old and you have grasped the effect increased mobility has on the size of a reserve you need to maintain?"

I tell this story for several reasons. I will not deny it, a father's pride is one reason. But this story also illustrates some of the key strengths of gaming. Is there another medium that would have caused a first grader to care about the impact of railroads in human development, let alone discern impacts for himself?

War and other simulation games promote personal development in several ways:

- Motivation of learning. All kids want to win; when kids see that learning about railroads, or profit and loss, or strategy helps them win, they are motivated to learn about those things.
- Provision of context. As a kid I had trouble learning free-floating facts—the names of national capitals, the spelling of words. Wargames can provide or create synthetic context and artificial relevance. Facts become part of the player's virtual, but also personal, experience.

- Facilitation of application. It has been said the best way to learn something is to do it. Few of us have the time or money (OK, mainly money) to travel the world or set up a business. Games make both feasible in simulation.
- Immersion. This is a feature bragged about by many of the newest, highest-resolution, first-person computer games, but it is not limited to the latest graphics or even computers. Decades ago I read a review of a text-based computer wargame on the 1973 fighting on the Golan front. The reviewer had played the part of one of the two Israeli brigade commanders on the front at the time the fighting started. The computer wargame came with a paper map, but the screen was simply a black screen with a prompt for writing text. The viewer would type in orders to units of his or her brigade and receive text messages back from them, as well as from higher headquarters. Far into the night, all was not going well for the reviewer's units. Several times reinforcements arrived only just in time to save units from being overrun. Finally, he received a message from one of his battalion command posts: "There is an enemy tank driving up onto my bunker, tell Ruth I love h——." The reviewer reported he had broken into a cold sweat: *"How can I tell Ruth?"* Then he realized: there was no Ruth, no command post was being overrun, and it was now 4:20 AM. Presenting someone with the decisions, the dilemmas faced by George Washington, Abraham Lincoln, or a platoon leader on D-day is more immersive than the best book or movie, regardless of the wargame medium.
- "Down-board" thinking. We live in a world where life choices can close before we know they were ever open. Wargames, since before the invention of chess, have trained the mind to anticipate the likely impacts of actions several moves later.

So war and other simulation games can be good for your kids. Do you just let them play? Well, you could do worse—but you can also do better. When I was in second grade, I fell behind in my reading speed. My father bought me comic books. He knew I liked them, so I would read them, and my reading speed would go up. It worked. Still, the time I spent reading comic books was not spent reading history, science, or great literature. Almost any game your child plays will have some positive effect, but just as all books are not equally beneficial, not all games will develop your children's abilities equally well. In fact, a mix of developmental activities, game and nongame, may be the most beneficial of all.

First, before you can use wargames, or other simulation games, to help your child get a personal edge in this highly competitive world, you will need to get smart on wargaming yourself. Reading this book is a great start, but it's not sufficient. A walk through a print or computer game store would be helpful, if you have either or both in your area. Pick up a few titles. Publishers put a lot of information on the box, to help sales. This will also give you a feel for what is being sold. If there are no stores in your area you are

at only a small disadvantage. The Internet provides a far larger selection of wargames—computer, print, and miniatures—than the largest game store. Even better, many sites post reviews. The websites milgames.com, BoardGameGeek and StrategyPage are all good places to start.

Once you have a feel for what is available, your next step is to talk to your child. It is easier to get children to play a game on a subject they are already interested in. It may also be useful to find out (if you don't already know) whether there are subjects they are struggling with. It may be possible to find a game that helps correct a specific weakness. A weakness in geography may be reversed somewhat by a strategic-level wargame set in the geography that needs to be learned. If history is a problem, a game set in the period being studied should help. Finally, your child is probably already playing some games already; ask about them. Especially ask how he or she decides which games to play.

Next, pick one more game for your child. It is important that you play it yourself and become proficient at it before introducing it to your child. Your help will make it easier for your child to start playing it, hence more likely. It will also earn you some credibility that will help in your next steps. That is: once you have taught your child how to play, you should shift to teaching how to win. Your head start on the wargame should help, but you will likely need to supplement your experience with online strategy articles.

As children work to beat you or their previous best scores, you should start to lead them beyond needing your advice, to finding out more about the situation being depicted in the game. This should be easy, as the game will likely have sparked their interest in the subject. Still, start easy, perhaps with a documentary or even a movie.[3] Point out that knowledge of the situation should improve their strategies and so their chances of winning. Chances are, though, that the film will be enjoyable but will lack the detail your child really needs. Soon he or she should turn to books.

There are two final steps. First, look for opportunities to enrich your child's game-related learning through additional avenues: say, a visit to a battlefield depicted in one of his or her wargames, or a lecture (podcast or live) by an expert on a related subject. Second, as your child looks for new games, continue to be part of both the search for the game and your child's search for his or her own path to strategy advice and then on to learning about the subject being depicted.

There are also an increasing number of simulation games on the market (SimCity, Zoo Tycoon, etc.) that will allow children to continue to learn down-board thinking and will expand their learning into more-peaceful pursuits. A successful adult will need to have developed many skills. While playing games can help develop many of those skills, learning how to learn (initially to get better at a game) may well be the most valuable of all.

For Educators: A Catalyst and Tool for Learning

Many of the reasons wargames are effective tools for parents trying to help their kids develop are also reasons wargames are effective in education. However, the classroom is a very different environment from the home, so there are also many differences. My own experiences illustrate some of the potentials and problems with using wargames in a classroom.

The Air Command and Staff College told me it had a problem with its block on the Defense Department's Planning, Programming, and Budgeting System (PPBS). Most students (midcareer officers) found the material exceptionally boring. Worse, PPBS was the last block of the course, so most students already knew what their next duty assignments would be; their heads were in their household moves and their next jobs. ACSC wanted me to make PPBS exciting. I have seldom felt such an overwhelming feeling of doom—*make PPBS exciting?* But as I thought about it, I realized the boring part was trying to memorize all the names of the system's elements. The actual process was high strategy: What weapons will we buy, and what forces will we maintain?

I realized the key to making this block interesting was to make the material relevant. The key to doing that was to require the students actually to build DoD budgets and then employ the forces they built to cope with contingencies. I then guessed that eight years was about the minimum time needed to change the U.S. force structure significantly. To game that far, one move for each year, in the class time allowed, I needed to minimize the time needed to play each move. I rounded all "costs" to the closest hundred million. I gave students only a limited number of budget choices: a dozen research, development, and acquisition programs to be pursued or not; brigades, wings, and battle groups to be kept active or placed in reserve; and "expendables" (fuel, spare parts, and munitions) to be purchased. Maj. Dan "Dano" Novak (now lieutenant colonel, retired) and I created identical files for every seminar, each with eight linked Excel spreadsheet tabs, on which to explore alternatives and document each move, rapidly.

In execution, our success can most charitably be described as mixed. Excel had just been released; in most seminars no one, faculty or student, knew how to use it. Frustration was high, many seminars spending much more time fighting the software than learning. But in seminars where at least one individual was, or became, comfortable with Excel, the outcomes exceeded my most optimistic expectations. Students not only stayed engaged but became passionate, doing outside research to support their positions, continuing to debate their decisions long after class was dismissed.[4]

As I said it would, this story demonstrates both the potential and the pitfalls of using wargames and other simulation games in the classroom. On the potential side, a good wargame can hold, or increase, student interest when no other teaching method can.

High school seniors who have already been accepted to college, fourth graders the week before Christmas, and eighth graders the week before graduation can all become passionate learners, determined to win. Wargames can also help students see beyond the facts to the underlying principles; in addition to hearing about Washington's crossing of the Delaware, they can see the impact it had. All simulation games can also motivate students to learn more by conventional means. They also serve as application exercises for information taught more conventionally. On the negative side: any simulation game can fail far more spectacularly than any lecture; the time that goes into learning the game is not available for learning the subject. Computer games with glitches and print wargames with ambiguous rules or missing components can cause frustration to soar and learning to plummet.

So, how can a curriculum developer or teacher reap the benefits of games in the classroom without suffering any of the pitfalls? First, it is important to understand that there is no "best" wargame or any other type of simulation game for the purpose, any more than there is one best book. There are only games and books that fit your learning objectives and your class well, and those that don't. Don't assume the wargame raved about by a fellow teacher will work for your own school or class.

Just as military wargame practitioners do, you need to start with your objectives and the resources you are willing and able to provide to achieve them. Like the military, you will need to explore whether your best option is to purchase an existing wargame to use as is, purchase and then modify a game to make it a better fit, or design a game from scratch. Do not overlook low-tech options; for some applications you can simply divide your students into factions and adjudicate their moves by your own judgment.

Finally, keep in mind the best use of wargaming may be to get your students not to play them but to create them. Professor Philip Sabin of King's College London has had great success teaching military history in part through assigning his students the task of creating wargames. Delving into a situation deeply enough to create a simulation game that can reproduce historical outcomes seems to produce a depth of understanding achievable by few other means.[5]

For Military Members: The Role of Wargaming in Personal Development

For our readers who are or will be members of their nation's profession of arms, remember that we never know when or whether we will stand at a hinge of history, when the decision we make will determine the outcome. Not all of us ever will. Some of us serve our entire careers during peacetime. Still, even someone so fortunate may be called on to make a decision that many years later results in peace being preserved or his or her nation going to war at a disadvantage. Nor do we know when in a career such events

may happen. Majors George Washington and Moody Suter had huge impacts while they were still fairly junior.[6] When and if you find yourself standing at a hinge of history, will you be ready?

Of course, each nation's and each service's formal military education systems work to prepare their military people to choose wisely at such times of testing. That is the point: *every* nation does that, and so both sides in a conflict will be led by people with such education and training. For you to gain an edge, if your nation is to gain an edge, you need to do more than attend service schools.

This is not a new truth. George S. Patton Jr. read as many books each year of his life, from sixteen on, as a student attending the U.S. Army's Command and General Staff College would.[7] Many of the famous Army Ground Forces and Army Air Forces generals belonged as young captains to a military history book discussion group while stationed in the Philippines between the world wars.[8] What is new is that it is now easier than ever to add wargaming to the mix of tools in your self-development.

Indeed, to gain the greatest benefit, spectra of subjects need to be explored, using a mix of tools. My personal modification of Col. John Warden's admonition holds true: "Think like an architect, but know your bricks."[9] While warfare today is more than ever the collective province of joint (multiservice), combined (allied/coalition), whole-of-government (intelligence, development agencies), and even nongovernmental (from the United Nations to Doctors without Borders) organizations, it is still important for military members to have deep understandings of their own branches. You cannot contribute to the orchestra if you do not know your own instrument.

Hence, soldiers should focus first on learning land combat; sailors, maritime warfare; and airmen, war in the air. In each case a mix of media works best. For example, an airman might read *Air Warfare in the Missile Age* to gain an initial appreciation for modern air warfare, then play some of the described operations using Modern Air Power.[10] Documentaries, articles, and websites should also be in the mix. Each source of information should be critically compared with the others. Does a documentary claim that a different decision would have led to a radically different outcome? A wargame can help you explore the feasibility and likely impact of such an alternative. Similarly, an article may describe a factor in a conflict that the wargame apparently completely overlooked. For experienced wargamers, it may be possible to modify the game to add the omitted factor.

However, still fairly early in their careers, military members need to expand their horizons to an understanding of joint operations. One good place to start is the Pacific theater during World War II. The same tools should be used: good books like *Eagle against*

the Sun and *General Kenney Reports;*[11] good wargames like Victory in the Pacific, Flat Top, and Uncommon Valor;[12] and a mix of documentaries, articles, and websites.

Once they begin to feel comfortable with joint operations, it is time for them to press on to exploring war at the strategic level. Now, it is important to open their perspective in both scope and time. As strategic principles are relatively timeless and tend to become clearest over time, the study of long periods of history, even of earlier eras, can be helpful. However, the value of a mix of media holds at this level also. For example, reading *Battle Cry of Freedom* and then playing For the People will yield insights into the U.S. Civil War era available through neither one alone.[13] As always, also include in your mix documentaries, articles, and websites.[14]

World War II is also a good source of insights, given its scope and the amount published on it, both book and wargame. I will not attempt to single out any one book on that war, but there are three commercially available wargames that provide a good range of ways to explore it. Axis & Allies is an easy-to-learn, easy-to-play print game.[15] While the game's mechanics are literally simple enough for a twelve-year-old, it does a great job of depicting the "big rock" factors in the war, precisely because so many of the details are stripped away. At the opposite extreme, the print wargame Third Reich and its companion game for the Pacific theater, taken together, provide an in-depth view of the military, logistical, and industrial aspects of the conflict.[16] However, be warned, the rule book for each is longer than some compact histories of the war.[17] Finally, the computer wargame Hearts of Iron covers all theaters of the war and allows play to begin sufficiently before the war so that the impact of various options for research and development can be explored.[18] Using both Third Reich and Hearts of Iron will also vividly clarify the trade-off between paper and computer games: paper games are more transparent, computerized faster to learn and use.

Again, you may never be tested by war. But if you are, the work of your lifetime may well help you help your nation to win its war faster, with less loss of life and at a lower cost in national treasure—not a bad investment of your time. It will also help you become a more discerning voter.

For Voters and Citizens: Understanding Military Dynamics

In the United States, every four years, voters hire a new, or extend the contract of the current, commander in chief of the armed forces—the president of the United States. Between elections the president is sensitive to the views of the folks who hired him. His choices may also be constrained by members of Congress, most of whom will be running for reelection soon. So the voters have a strong voice in determining military policy, but with less than 0.5 percent of the American people serving in uniform, how

do they know what to say, how can they be sure they are speaking wisely?[19] This is an important question. As Hans Delbrück realized over a century ago, because sovereignty rests with the people of democracies, it is vitally important that the people of democracies understand war.[20]

It was not always such a problem. In 1945 most of the 16.1 million Americans returning from World War II understood war. So did our World War I veterans, many of whom were by then only in their forties. Today the "Great War" generation is gone, and there are fewer World War II veterans each year. How can the voters form insightful positions on military matters when fewer and fewer voters understand war firsthand? Congress has more military experience, but there percentages are declining also, from 70 percent with military experience in 1975 to 20 percent in 2013. What can be done?

Months after the end of the First Gulf War, I was speaking at the Origins gaming convention on the history of wargaming. After my talk several members of the audience came up and asked questions. After a while I asked them a question. After the Vietnam War, I said, when the military was so unpopular, many of us were criticized for playing wargames. Did they feel, I asked, that the time since Vietnam and our success in the Gulf had diminished the criticism for playing wargames? The answer I received was a resounding *"Yes!"* I will never forget what one of them said: roughly, "Far from being criticized, I've received calls from other dentists from all across southern Indiana asking for my views on the conflict." It was clear from their comments that friends, family, and colleagues viewed these folks—civilians all—as having greater than normal insight into military affairs.

It is easy to see why. Wargaming provides artificial experience in war. When Tom Clancy wanted a better appreciation of what all the statistics on submarine warfare meant, he turned to Larry Bond and his Harpoon wargame.[21] After reading *The Hunt for Red October* many U.S. Navy submariners had trouble believing Clancy had never served in their branch.

Granted, the artificial experience of wargaming cannot come close to matching actually being on the ground. Still, artificial experience gained through gaming has some advantages over the real kind. It is not possible to be shot. You will never have to consume a meal-ready-to-eat. Also, while truly addictive (or just long) wargames may delay your sleep, you will sleep each night in your own bed. Most importantly, service members have limited control over the types of experience they gain in war. One individual may serve on the Allied staff planning the D-day invasion while another may shovel out stables in Louisiana. With wargames you get to pick the type of artificial experience you receive.

What types of wargames are most relevant for voters? In brief, games depicting conflict at the strategic level are most relevant. Voters hire and pay for the training of military folks to handle the tactical elements of war. Voters have their greatest influence, hence should focus most, on the big questions such as defense spending and when to commit military forces. Also, as stated previously, wargames are most effective as part of a set of media. The single best book I know of for a voter to read is the second edition of *From Lexington to Desert Storm and Beyond;*[22] it is a great overview of American military history from the strategic and high operational levels. While any book on military history and theory may be helpful, those on entire wars, and better yet the preparation for and execution of wars, should be the best fits.[23] As for wargaming, the computer wargame Civilization is a great introduction to both wargaming and national strategy. At the intermediate level of difficulty and relevance, the computer game Victoria (from Paradox Interactive) provides a look at national strategy during the 1800s. Finally, Hearts of Iron III (2009) is probably the most relevant but also among the most difficult.

Wargames can also help you develop a sense of what you need to learn through more-conventional sources. They can help you develop your views on national and defense policy. You still may be wrong, or your voice may still be drowned out by others. Still, if nothing else, as crucial decision points approach you may get calls from colleagues all over your state.

For Historians (Professional and Armchair)

There is a range of ways in which wargaming can help historians: checking the plausibility of purported facts, identifying gaps in information, providing substance to what is now speculation, and enriching the development and communication of insights.

Though it is not well-known, most historians already owe a debt to one application of wargaming. Hans Delbrück, considered the father of modern military history and to a lesser extent of modern systematic history, adapted his techniques (techniques still used today) from planning and wargaming techniques he learned as a Prussian staff officer. In brief, he used norms developed to plan future operations to check the credibility of previous historical accounts. To a limited degree he also worked backward, to fill in gaps in the record—we know *b* happened, but *b* is only possible if *a* happened first. Historians today can use wargames as an edit check of the facts they have, uncovering gaps and errors not obvious through conventional methods.

Since the introduction of double-entry bookkeeping in the closing years of the Middle Ages, one field after another has developed ways to check its work. The Wright brothers' wind tunnel allowed them to check the effectiveness of their ideas far more quickly than by annual trips to Kitty Hawk. Today, modeling and simulation help companies identify

errors that could previously be detected only through building and testing prototypes, a process always more time-consuming, usually far more expensive, and in the case of the 1950s for test pilots, sometimes deadly.

How can wargames provide an edit check for historians? They have already done so. Speaking years ago, James Dunnigan, then editor of *Strategy & Tactics* magazine and the world's most prolific wargame designer, told of his attempts to create a game on one of the World War II battles of Kharkov. As a check on his work, his colleagues attempted to follow the strategies of both sides, expecting to arrive at the actual outcome. After repeated attempts they had not come close. After checking their orders of battle on both sides and much of their other data, they finally discovered that the map used in all the American histories of the battle was significantly wrong. When they substituted the true map and repeated their tests, the historical outcomes were achieved. By creating (or using an existing) wargame in parallel with your research and writing, it would be possible to conduct similar edit checks. Such a process would also help to make more readily apparent (and before you publish) any gaps in your data.

Of course, good history goes beyond simply reporting the facts. Even before the popularity of "what-if" books and alternative histories, good historians have attempted to look down roads not taken. These attempts sometimes result from comments made by participants during or after the conflict and sometimes from the historian spotting what appears to be an option not realized, or at least not taken, at the time. At best, historians have had to limit themselves to checking logistical feasibility. In a recent book John Prados clearly describes how he adapted a previously published print wargame to check the likely accuracy of claims made by participants in the campaign in question.[24] Similar techniques can be used to explore the likelihood of one force or the other taking Cemetery Hill late on the first day of the battle of Gettysburg or many other such questions.

Finally, scratch-built, adapted, or "off-the-shelf" wargames on the subjects of historians' work can enrich the perceptions of both historians and readers. Imagine having a wargame you can use, as you research and write your book, for sensitivity analyses, to determine what factors truly were decisive. Now imagine your readers following the progress of that war, campaign, or battle trying for themselves various options described in the book.

Of course the application of simulation gaming need not be limited to the study of military history. Imagine how much more immersive (and popular) a book on the history of Shakespeare's London would be if the reader could walk the streets of the city as a person of the time and interact with other inhabitants. With the rate of progress being

made on hardware and software, the book and all of London Town may soon be able to fit on your phone. Such a book/game/environment would be, well, historic in itself.

For Businesspeople: Indirect and Direct Application

Given the well-deserved outpouring of praise for Steve Jobs following his untimely death, many have forgotten that he was once fired by Apple's board of directors. The mind boggles when trying to imagine the state of personal computing today (and the value of Apple stock) if it had not done so.[25] Then there was the case of New Coke, when a company took one of the most popular products on the planet off the market and replaced it with something truly dreadful. These are only a few of the most famous cases of truly bad business decisions. Given that 25 percent of small businesses fail during their first year, it is clear bad decisions are quite common.[26] Can the study of military strategy provide an edge in business competition? Many seem to believe so. Several books have been written advocating the application of military strategy to business.[27] Today it seems more businessmen read Sun Tzu than military officers.

I believe a very strong case can be made for the use of abstract wargames like chess for developing a business leader's ability to think down-board, see the entire board, and generally think like a strategist. On the other hand, simulation wargames, though they can produce similar benefits, would typically take more time to learn and execute than abstract games. Typically they would also provide insights into specific business environments and choices; businesspeople should decide for themselves whether this added benefit provides a good incremental return on an incremental increase in time invested.

Wargaming can provide the greatest benefit to business leaders not by the direct use of actual combat games but as suggesting the types of benefits that would likely be available through the adaptation of wargaming to the bloodless (well, almost) combat of business. While war and business are very different, they also have much in common. Like war, business is a competition between two or more thinking competitors. Like war, the success of a business strategy depends largely on what strategies are implemented by competitors. These similarities make it conceptually quite easy to adapt wargame procedures to business, and many such adaptations have already been accomplished. Still, it takes a touch of genius and usually a lot of hard work to develop business-competition simulation games to the effectiveness level of current military decision-support games.

Nevertheless, in some cases a relatively easy, relatively low-resource wargame can provide valuable insight. In part to make adaptation of wargame techniques to business easier to understand, let's start with a notional description of such a business game. Most individuals with business experience who have read to this point should be able to

conduct the equivalent of a "tree-stump" business wargame. Here is one way it could be accomplished. Take as our scenario that a hardware-store chain is exploring the profitability of opening a store in a new area. Three of the managers involved could conduct a wargame equivalent in an afternoon. As they are actively considering an expansion, they already have on hand all the competitor, cost, and demographic information they will need to plan and adjudicate their moves. The most junior executive, who would actually execute the expansion, is assigned to play Blue. A slightly more senior manager, one who survived the launching of one new store, is assigned to play Red. The most senior executive assigns him- or herself to play White.

Blue and Red first plan their actions before the new store opens, and each briefs White separately. White estimates the net outcomes of Blue's and Red's plans and tells Blue and Red only what each would know. Blue and Red then plan actions for the opening week of the new store. Red recalls how competitors actually reacted when he opened a new store and plays variations on their actions and some of his own ideas. Blue inputs more or less the actions she is actually planning for her first week. Again White estimates the net effect of both Blue's and Red's actions and briefs them only what they each would know. The business game continues for three more turns, covering, respectively, the first month, the next three months, and the first anniversary of the store's opening. Following the assessment of the final moves, White, Blue, and Red discuss what they have learned. Blue will be more aware of how her competitors are likely to react to the new kid on the block and will have an idea of which choices are likely to be more effective.

As with the military application of wargaming, there is potentially a broad range of business-game applications as well as a spectrum of methods and tools for them. Also as with military wargames, it is unlikely any one tool or procedure will fit all applications. Other potential business applications of wargaming and wargame-like techniques include:

- Professional development: provide new and relatively new leaders with the experience (virtually) of veteran leaders.
- Anticipating future environments: simulate conducting business under likely future market conditions, such as after you and competitors have introduced new products.
- Decision support: try out several business strategies against thinking, reacting adversaries.
- Execution development: try out selected strategies against thinking, reacting adversaries to refine your plan further.

Tools could include a cadre of semiretired leaders who can play Red or serve as White-team members, consultants with experience in adapting wargaming to business applications, and software specifically designed to replicate your industry.

Perhaps war and business are most similar in that in both, you need an edge. You do not want to compete with a product of quality, functionality, and cost equal to that of your competitors. Even less do you want to compete with leaders and managers who have taken the same business courses that your competitors' have. You do *not* want your competitors and yourself to be equally effective. Wargames have been providing an edge to monarchs and emperors, to generals and admirals, for centuries. With several books on the subject and many contractors willing to provide as much or as little assistance as you believe you need to get started, now is a great time to use wargaming to find an edge for your business.

And All the Others . . .

The above groups are just a few of those who can benefit from wargaming, especially if we adapt gaming techniques. Other groups could benefit too.

First Responders. Exercises for first responders are conducted today, but they often fail to uncover flaws in plans, and they do not always prepare their participants for the chaos of real disasters. All too often such exercises simply follow a script, which is adjusted little, or not at all, in response to the decisions the participants make. By designing into their exercises elements of wargaming, such as a Red team to look for what could go wrong and a White team to estimate ground truth and what part of ground truth the participants would know, both plans and participants would be more effective when a real disaster occurs.

Politicians. Politics already uses a lot of military vocabulary, such as "political campaigns," and military strategists are assigned reading at many political science departments. It is easy to see why. If, to modify what Clausewitz said, war is the continuation of politics by violent means, then it could be said that politics is war by peaceful means.[28] In both, success depends in very great part on the actions of your adversary. Wargaming political campaigns before they get under way could refine a candidate's strategy and provide synthetic experience for the participants.

Government Officials. Elected, appointed, and civil-service employees all have parts to play in governing. Techniques similar to those developed in adaptations to national disasters and elections games can be developed that could help participants anticipate likely outcomes of policy options. Again, plans and people could benefit from virtual experience.

Promoters of Tourism. Your first reaction might be—what! How can tools originally developed for war be adapted to promote tourism? Today, tourism is marketed by trifold pamphlets and thirty-second TV spots. In the fairly recent past, travelogues on TV, and, earlier, between features in movie houses, were popular, but comparatively few watch them today. What people are doing, especially what young people are doing, is playing games. They play on their smartphones, on their computer tablets, on their computers, and on their game consoles. Imagine using the technology that makes first-person shooters so immersive applied to making the user feel as if he or she is at some vacation destination. How many, after an enjoyable, immersive experience, would want to go back to that destination—this time for real? True, this is not really a wargame, but it would use technology developed for wargaming.

I strongly suspect that the most lucrative, the most beneficial application of wargame technology has yet to be imagined, yet to be realized. Given what you know now, you may be the person who comes up with that application.

Notes

1. A "first-person shooter" (FPS) is one of a very popular type of close-combat, tactical computerized wargames that depict the player as actually acting within the game environment. This is different from most wargames, in which the player decides what actions will be taken by subordinate units. Multiple studies indicate that users of FPSs, who can work off their anger against pixels, tend to be calmer and less frustrated than other gamers. (Literature search by colleague Dave Ross.)
2. As of this writing Civilization is in its sixth edition. Graphics and interfaces have improved with each edition, but the basic game play remains unchanged, and Civilization is still an extremely popular game.
3. My son and I watched the movie *A Bridge Too Far* (1977) together and then played the print wargame Market Garden. We had a great discussion on how events in the game both differed from and paralleled the movie.
4. One naval officer actually stood on one of the seminar tables and delivered an eloquent case for the seminar not shifting a carrier battle group into reserve.
5. See Sabin, *Simulating War.*
6. The 1754 report of Major Washington fed British interest in the Ohio country, and Major Suter's briefing to the commander of Tactical Air Command secured funding for Red Flag.
7. See Roger H. Nye, *The Patton Mind* (New York: Avery, 1993). For those of you who saw the movie *Patton,* the real Patton really did read Rommel's book.
8. How I was told about this informal group is a story itself. Captains (that is, O-3s, as opposed to Navy captains, O-6s) are not normally summoned to their nations' military headquarters to brief, but I received such a call while serving at Nellis Air Force Base, in Nevada. The Chief of Staff of the Air Force, then Gen. Lew Allen Jr., had decided that his service had become too "stovepiped"—that is, while in their hearts all Marines are infantrymen, Marines first and their specialties second, we in the Air Force, General Allen believed, thought of ourselves as F-15 pilots, missileers, or logisticians first. To remind all Air Force members that they were part of a common mission, he had decided to institute "Project Warrior." I and several others had been invited to brief on how various options, from base libraries to military bands, could help. I briefed on how wargaming could contribute. During our initial meeting to plan the launch of Project Warrior, General Allen had planned to speak to us

but at the last minute he was preempted and sent Brig. Gen. (later a general and commander in chief of the Strategic Air Command) John T. Chain to pass on his remarks. General Chain related a story General Allen had told him about a reading group in the Philippines between the world wars. The group lasted only a few years; it never had more than nine members, and over its life its participants totaled about thirty-five—but their names read like a who's who of World War II's leading American generals. General Allen wanted to convey that though one might think informal meetings of a handful of officers could not have much impact, in fact, these officers gained a grasp of strategy that paid dividends during World War II. Hence, even if Project Warrior convinced only 1 percent of Air Force members to study war, its impact on future wars could be disproportionate.

9. Colonel Warden liked to tell his ACSC students, "Think like an architect, not like a bricklayer." He felt many Air Force officers "had trouble getting out of the cockpit," that they continued to think tactically when they were in positions that required strategic thought. I did and do agree with him, but I went to an engineering school with an architecture school, and all the future architects were required to take enough engineering to ensure their beautiful designs would not fall down. So I added "Know your bricks" to Colonel Warden's dictum.

10. Lon O. Nordeen, *Air Warfare in the Missile Age* (Washington, DC: Smithsonian Institution, 2010); Modern Air Power (the Over the Mideast and Over Vietnam editions), designed by John Tiller, HPS Simulations, 2004.

11. George C. Kenney, *General Kenney Reports: A Personal History of the Pacific War,* 2nd ed., USAF Warrior Studies (Washington, DC: Headquarters U.S. Air Force, Office of Air Force History, 1987); Spector, *Eagle against the Sun*.

12. Uncommon Valor, Matrix Games and 2 By 3 Games, 2002; Flat Top, designed by S. Craig Taylor, Battleline and Avalon Hill, 1977; Victory in the Pacific, designed by Richard Hamblen, Avalon Hill, 1977.

13. McPherson, *Battle Cry of Freedom;* For the People, designed by Mark Herman, GMT Games, 2000.

14. Of course, the documentary *The Civil War,* by Ken Burns, 1990, is a must-see for students of the American Civil War, or war generally.

15. Axis & Allies, designed by Larry Harris, Nova Game Designs, 1981. (Since 1984 it has been published by the Milton Bradley Company.)

16. Rise and Decline of the Third Reich, designed by John Prados, Avalon Hill, 1989; Empire of the Rising Sun, designed by John Prados, Avalon Hill, 1995.

17. An alternative to Third Reich with a less-thick rule book is World in Flames (especially the third edition) by Harry Rowland of the Australian Design Group, published in the early 1990s. This physically big wargame covers the entire world fairly simply, and, with its add-on Days of Decision, runs from 1936 to 1946.

18. Hearts of Iron is a grand-strategy wargame set in 1936–48, designed in the Paradox Development Studio and published by Strategy First. A player can control any one nation as World War II unfolds. It was first released in 2002 for Microsoft Windows–compatible personal computers. Since then Paradox has issued significantly enhanced editions every four or five years. Mac versions have also been released.

19. Karl W. Eikenberry and David M. Kennedy, "Americans and Their Military: Drifting Apart," *New York Times,* 26 May 2013.

20. For Delbrück, see Paret, *Makers of Modern Strategy,* pp. 326–53.

21. I've heard a few moderately differing versions of the story from Larry and mutual friends but have seen in print only Michael Peck, "The Name Is Bond, Larry Bond," *Foreign Policy* (October 2013).

22. Donald M. Snow and Dennis M. Drew, *From Lexington to Desert Storm and Beyond: War and Politics in the American Experience,* 2nd ed. (London: Routledge, 2000).

23. For example, for the American Civil War, McPherson's *Battle Cry of Freedom* is written at the appropriate level—it is simply an excellent, readable book.

24. John Prados, *Normandy Crucible: The Decisive Battle That Shaped World War II in Europe* (New York: NAL Caliber, 2011).

25. Still, there is a school of thought that views that firing as a formative moment, critical to his growth, which got Jobs to reevaluate himself and his life.

26. Only 1 percent of those that fail do so because of natural disasters, crime, or other factors beyond their control. Most failures are attributed to various flavors of lack of experience that manifests in bad decisions. For more details go to "Startup Business Failure Rate by Industry," *Statistic Brain Research Institute,* www.statisticbrain.com/startup-failure-by-industry/.

27. The earliest I've found is Barrie G. James, *Business War Games* (Boston: Abacus, 1984); the most insightful, John A. Warden III and Leland A. Russell, *Winning in Fast Time: Harness the Competitive Advantage of Prometheus in Business and Life* (Montgomery, AL: Venturist, 2002); the most recent, James D. Murphy, *Flawless Execution: Use the Techniques and Systems of America's Fighter Pilots to Perform at Your Peak and Win the Battles of the Business World* (New York: ReganBooks, 2005); best for the scope of possible adaptation of wargame procedures to business, Mark Herman, Mark Frost, and Robert Kurz, *War Gaming for Leaders: Strategic Decision Making from the Battlefield to the Boardroom* (New York: McGraw-Hill for Booz Allen Hamilton, 2009); best for describing how to make those adaptations, Benjamin Gilad, *Business War Games: How Large, Small, and New Companies Can Vastly Improve Their Strategies and Outmaneuver the Competition* (Wayne, NJ: Career, 2008). The last two, read together, do a fair job of covering the spectrum of approaches to business wargaming.

28. The quote varies with translation. Some give "the continuation of *policy,*" not politics. "By violent means" is more frequently translated as "by other means."

Conclusions: Toward Peace Gaming

We have come a long way since that first wargame in that first city. In the over four millenniums since then we have developed democracy, free markets, and flush toilets. We are now in a time, as President Kennedy said during his inaugural address, in which "man holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life." Can wargaming play a part in making the first alternative more likely and the latter less?

Where Have We Been?

As we look back on the broad sweep of the history of wargaming, some constants and some trends become evident. One constant is the utility of wargaming. From Ramses through Queen Elizabeth I to Ronald Reagan, heads of state with many other demands on their attention have found wargaming worth their time. It is also clear that the benefit gained from gaming varies with both the scope and the sophistication of our wargame use relative to those of our adversaries'. So the Prussians' simulation wargames gave them an edge on Europeans using abstract games, while the increased sophistication and breadth of the Germans' wargaming before World War II gave them an edge over their early adversaries, whose gaming had not changed significantly since 1900.

The dominant trend of this book is the expanding use of wargames. True, for millenniums wargaming was the province of royalty and military elites, but when their use began to expand, the expansion just kept on going. So when Franklin encouraged "the people" to play chess, not every backwoodsman bought a chess set, but chess playing did grow. When Lieutenant von Reisswitz figured out how his father's wargame could be produced cheaply enough that each regiment could be equipped with one, the explosion in its use was such that even his tragic death could not put the genie back in the bottle. When after World War I Germany kept a disproportionate number of officers trained in conducting wargames, there was yet another explosion, this time in the applications and hence types of games.

Just look at the United States since the 1950s. The growth of wargaming in the armed forces has been dwarfed by the increase among civilians. In the 1950s few consumers had the money for miniatures wargames, and fewer still had heard of the single print wargame then existing, Tactics. By the 1960s an increasing standard of living, less expensive miniatures, and more print wargames more widely available increased

civilian gaming by more than an order of magnitude. That rate of growth continued into the 1970s, fueled by more choice and lower costs, thanks largely to magazines with print wargames enclosed. By the 1980s, computers and role-playing games had expanded participation yet more. The late 1990s saw an explosion of computer games. By the early years of the following decade, computer gaming had surpassed Hollywood in revenues. Since then we have seen the Internet and small computing devices bring the cost of wargames down and the spectrum of platforms on which they can run broaden. Meanwhile the spread of democracy and free markets has enabled the growth of a global middle class. We seem to be approaching a point where the majority of the human race will have the time and technology to play sophisticated simulation wargames.

Where Do We Want to Go?

> *The best way to predict the future is to decide what you want the future to be and make it so.*
>
> COL. JOHN WARDEN III, USAF (RET.)

So, what do we want the future to be? At the conclusion of the history section of this book I reported my views on the most likely direction of the future evolution of wargaming. Now I will suggest what direction would be in our best interest. I will conclude with two fictional vignettes illustrating how better wargaming can help produce a better world for our children and their children.

First, Win

I will argue below that there is a distinctive American way of *peace,* and that it is the best way of peace for all sides. To implement such a peace, the good guys first have to win the war. We have established that wargaming is one way to gain an edge to help win wars. Having looked at what has worked and not worked so well across the world's militaries, across the centuries, I offer here my views on the six steps needed to allow wargaming to provide its maximal edge:

1. Train all military leaders on how to conduct wargames. Top Gun enabled the U.S. Navy to turn around its air-to-air loss rate using the same aircraft, sensors, and weapons it had used previously. Germany led the world in wargaming for a century because all its war college graduates were expected to conduct wargames upon graduation. Only if military leaders have hands-on experience conducting games can all the useful applications of wargaming be spotted and realized.
2. Use wargaming at all levels. The PhDs at RAND created some amazing wargames that may well have been the most sophisticated in the world at the time. These

games did little good for the infantryman in Vietnam, who faced an adversary who used far-less-capable wargames but used them to plan even attacks of modest size. During the interwar period, Germany widened its edge in wargaming; most officers knew how to conduct games and did so at every level and for purposes previously undreamed of. Ubiquitous wargaming will catalyze innovation and help the most militarily effective innovations bubble up.

3. Wargame to the conclusion. From the Nazi invasion of the Soviet Union to the American combat involvement in Vietnam, wargames have misled when not played to the conclusion of the event being gamed. Battles need to be played until one side wins or a stalemate develops. Campaigns need to be played to their conclusion, wars to their end. This will require design discipline, as many believe that if granularity is good, more granularity is better. But when granularity comes at the price of not wargaming the full event, the cost outweighs the benefit.

4. Adapt the intelligence community's practice of assessing confidence. I used to tell my students that the two biggest problems in wargaming were outcomes being taken too seriously and outcomes not being taken seriously enough. Consciously assessing confidence merited by game outcomes will help solve both problems. It will also help identify ways to make wargames just a bit more worthy of confidence.

5. Use wargaming as a key element in the continuous professional development of military leaders. Fortunately, most military members spend more of their careers in time of peace than in active combat. Hence, folks who are best at managing peacetime operations tend to get promoted. Many think of war for only a year or two out of their careers, if they get to go to a staff college or a war college. Even at these schools, much of the curriculum is in becoming a better manager, writer, and briefer. Wargaming can allow leaders to become virtual combat veterans at every stage of their careers. Wargaming can put war back into the war colleges. If wargaming is at the core of the curriculum, all other instruction can be designed to make the students more effective at gaming during school and more effective at war after graduation. Sets of books should accompany wargames, so that between schools leaders can continue their development as virtual veterans. These texts can be created by the military, purchased from commercial sources, or adapted from a commercial source. Finally, militaries should hold wargame competitions. While the whole person should continue to be the criterion for promotion, such competitions would allow a leader's effectiveness at winning wars to be one of the factors.

6. As platforms become cheaper and more powerful and code becomes more portable, the defense community should be vigilant in spotting applications that just a few years earlier were impossible or cost prohibitive. We may be in a time when new

applications are constrained more by the limits of our imaginations than those of technology. Even today, millions of Americans could be playing the same wargame, at the same time, at a negligible cost to the government.

It is probably impossible to anticipate all the potential uses of such widespread wargaming. You can imagine several applications. Here is one I imagined: "The First Peace Fighter."

The dust of the access road quickly covered the dark-blue government car. Aside from the dirt road, the trailer park did not look too bad. Most trailers were well maintained and nicely landscaped. The entire park was among pines; there was even a small pond in the back with a boat dock, but no boats. The colonel wondered, absentmindedly, "Would this be considered working poor, or working class, or just toward the bottom of the middle class . . . ?"

Soon they arrived at number 61, one of the nicer trailers, down by the pond. As the two men got out of the car they were instantly grateful for the shade of the trees. It was much too warm to be wearing a "Class A" uniform or a suit and tie. Dr. Archer had commented earlier that morning at the Lexington airport, "I didn't think Kentucky got this hot."

They were greeted at the door of the trailer by Mrs. McCoy and her daughter, Mary Ann. Both looked younger than their ages. "Please come in," said Mrs. McCoy. "You came a long way to just hear me say no in person." Both men entered, Colonel Kenney removing his hat. Dr. Archer spoke first. "Ma'am, we understand your position . . ." "Do you?" interrupted Mrs. McCoy. "So you also lost your husband in Afghanistan, who died without ever seeing your daughter?" Dr. Archer replied, "As I tried to tell you, we are not trying to recruit Mary Ann into the military." For the first time, Mary Ann spoke. "Mama, these men came a long way, and they are guests in our home. Don't you think we should be courteous enough to let them have their say?" Mrs. McCoy looked at her daughter with a curious sadness and simply nodded her head.

After everyone had sat down Dr. Archer began. "Two years ago the U.S. government decided to form a twelve-person interagency strategy cell. The cell's mission is to develop 'all of government' strategies to enhance both our military security and economic prosperity. I convinced the planners that the best way to pick folks to develop strategies was to see how good they were at developing strategies. We built the 22nd-Century America computer game as a test for candidates. Participants would play the game by setting American policy through the end of this century. The twelve candidates with the highest composite score for peace and prosperity would be offered positions. Halfway through development we realized that we had a pretty addictive game on our hands, so we made it available as a free download online. Your daughter was one of sixteen million Americans who played the game."

Mrs. McCoy turned to Mary Ann. "You never told me you were taking a government test." Dr. Archer jumped in. "She never told you because she never knew; we did not want anyone to be intimidated by the purpose of the game and not play." Dr. Archer continued, "We are very glad that we opened up the game to whoever wanted to play. As things turned out, only five of our twelve were already working for the government. Only two were serving military. Colonel Kenney here makes three military, but he had retired by this time last year, so we arranged to have him brought back on active duty. Five of our top twelve scorers are in their twenties. Your daughter is the youngest, but not by much."

Mary Ann beamed when she learned how well she had done. She had known her score was way higher than any of her friends', but one of the top twelve . . . Mrs. McCoy looked a little proud but mainly still troubled. "But she can't just go off and do this," Mrs. McCoy said. "She won a full scholarship to our local community college; she starts in the fall. She needs to get a degree first. I never did get my degree, and I still regret it." Colonel Kenney leaned forward: "Ma'am, your daughter will get her degree. As part of her compensation package we will be paying one hundred percent of her college costs. I've already spoken to a few DC-area colleges about her starting as a night student next fall."

As Mrs. McCoy's opposition softened, her look of sadness grew more intense. She was a widow with an only child; Dr. Archer finally realized Mary Ann's departure would leave her alone. "Well, this is all very good, but Mary Ann is still so young, you could hire whoever came in thirteenth instead," said Mrs. McCoy; "Mary Ann will go to college here." It was a long time before anyone spoke. Finally Colonel Kenney reached out to put his hand on Mrs. McCoy's hand. "The loss of your husband left a void that has not, cannot, ever be filled. I've never lost a spouse, but I have lost men and a woman while they were under my command. The letters I had to write to their spouses were the hardest things I've done in my entire career. I came back from retirement because if this cell works as well as I hope and believe it will, then we will find ways to achieve our national objectives with far fewer husbands and mothers, sons and daughters getting killed." Looking intently at Mrs. McCoy, Dr. Archer said, "I need Mary Ann. You do not yet fully understand: She did not have the twelfth-highest score, doing little better than the thirteenth. Mary Ann had the highest."

Next, Make a Better Peace

> *The supreme art of war is to subdue the enemy without fighting.*
>
> SUN TZU

For many years I have argued that the American way of peace is to make our defeated enemies willing military allies, important trading partners, and popular vacation

destinations. This is not purely or even principally due to altruism; a defeated population that is better off than ever before is unlikely to start another war a generation later. To make such a peace more likely America attempts to fight its wars while minimizing the cost in time, lives, and treasure (on all sides).

Again, this is not purely or even principally due to altruism. The shorter the war, the less time there is for something to go wrong (like bombing the Chinese embassy), the less time for our adversary to develop a new weapon or gain a new ally. The fewer casualties among our troops, the less opposition there is to the war; the fewer enemy civilians and even enemy fighters killed, the easier the transition to peace. The less treasure lost by our adversary, the easier the transition to peace and the sooner that nation will be an important trading partner. The less treasure lost by the United States, the stronger we will be for our next challenge. If you take U.S. objectives to their extreme, the highest kind of military victory is one with zero time spent at war, zero casualties, and no loss of treasure. Hence, the highest form of victory is *peace,* a peace where our former adversary becomes a willing military ally, an important trading partner, and a popular vacation destination *without any war at all.*

From Win-Lose to Win-Win

Another constant in wargaming over the past several millenniums is that wargames have universally been exercises in "win-lose." One side is checkmated; the other wins. One side gains a beachhead on the continent of Europe; the other loses. In sports, for every thrill of victory there is the agony of defeat. Win-lose is so pervasive we do not even think about it. Yet as every sports fan knows, there is always next year, and in enough "next years" even the Chicago Cubs can win again—that is one of the most enjoyable aspects of sports. Yet in war, the determination to win next time leads to more war, more death, and more destruction. Perhaps the time has come for us to evolve wargames into *peace* games: playing for peace.

This book started with a story of a real wargame; it was retold to the best of my memory, based on the words of a general who asked to be quoted. This book will conclude with a short work of fiction. If it, or something like it, is to become nonfiction, then many readers of this book must decide to envision a future they want—and work to make it so.

After all these years, videos of cats doing funny things can be counted on to go viral on the Internet. Some of the other things that go viral are harder to anticipate. Who would have thought a game on the current Taiwan crisis would go viral? Sure, it was a free download, but there are so many free apps online that there are apps to sort through them all. Then again, given the global concern that this crisis might end the long peace, perhaps it was not so surprising.

Even in today's plugged-in world, few spotted the beginning of the crisis. Owing to quiet campaign contributions from the mainland, ethnic Chinese candidates did very well in several Taiwanese national elections. Before the next election, a host of laws were passed, each justified for a different reason but all having the effect of suppressing the ethnic Taiwanese vote. With each succeeding election voter-suppression measures became more naked and more effective. Soon the Taiwan government, now ethnically Chinese, began moving to "reunify with the rest of China."

Early Taiwanese resistance actions were within local laws, nonviolent, and largely unreported by the Taiwanese and the international media. The story was picked up early on social media, but even there it was one thread among many. As protests started to become more violent, first social then traditional media started paying more attention.

As both peaceful civil disobedience measures and violent clashes increased, attitudes on both sides hardened. Ethnic Taiwanese saw the struggle as their last best hope to avoid cultural if not physical genocide. The ethnic Chinese on Taiwan increasingly came to believe they would quickly become a persecuted minority if they compromised. More ominously, attitudes were also hardening in China and the United States. China had long sought "reunification" with Taiwan. Reports and especially videos smuggled out of Taiwan struck a chord with the American public; commentators drew parallels to the civil rights movement and even the American Revolution. As tensions grew, many historians worldwide likened the current situation to the summer of 1914—none of the leaders wanted war, but no one seemed to know how to avoid it.

Then the Taiwan Crisis app began going viral. The app allowed users to play any side in the crisis. Opponents could be played by the app's artificial-intelligence routine or by online opponents. The app took off among the Taiwanese first. After many replays they found a strategy that usually brought victory but would take decades and destroy much that they hoped to preserve. Almost at the same moment, the app became an obsession with the ethnic Chinese on Taiwan. It took most of these players much longer to find a winning strategy, and it seemed that any winning strategy required the genocide or near genocide of the Taiwanese people. Would they, could they, really kill all the Taiwanese and still consider themselves civilized? The story was similar for Chinese and American players. Made curious by the reports coming out of Taiwan, many millions downloaded the app. Some never found a strategy that would bring their nation victory; most eventually did but at a price that made the word "victory" ring hollow. Similar results were obtained in nation after nation, increasing international concern over the crisis still further.

Then, also starting on Taiwan, a different type of outcome started to be reported. A website listing top scorers started to be dominated by players who had not achieved total victory but had scored highest overall because their costs were far lower. The ethnic

Taiwanese players discovered that if they allowed the ethnic Chinese to retain political power disproportionate to their numbers the ethnic Chinese would not fight as hard. Ethnic Chinese started playing a strategy that allowed the ethnic Taiwanese to regain much of their political power while retaining for the Chinese enough to have in effect a veto over any initiatives that threatened their position. Again, similar insights emerged in China and the United States.

Almost as suddenly as it had burst on the world's consciousness, the Taiwan Crisis, real and digital, had dropped from the headlines. There were still stories of flare-ups and small acts of reconciliation on Taiwan, but there was no longer the feeling that the long peace would soon end. Commentators who had not moved on to the next hot story expressed amazement at the impact a single app seemed to have had.

His Holiness was relieved but not surprised. When he had been a boy growing up in Mumbai, radicals had tried to convince him and his fellow youths that Americans were trigger-happy fiends who cared nothing about the lives of others. Some of his friends contradicted the radicals; they had played America's Army, a game created by the Americans for Americans. In the game, shooting innocents landed your character in the brig. Certainly Americans would not be trained to be cautious if that was not how they were supposed to be. At that young age the future pope learned how powerful, how credible, lessons learned from games could be. When the Taiwan crisis first started to look as if it might spiral out of control the pontiff became concerned. Had so much of the world's population gone so long without war that the horrors of war were no longer real? If they were reminded, would they not work hard enough to avoid such a war? He decided the world needed a way to make the costs of war seem real before they became real.

His Holiness smiled when he remembered that Stalin had asked dismissively how many divisions the pope had. Without any divisions he had helped stop what could have become a world war before it started. There was just one thing that truly surprised him. Although the app had been given away for free, the sites that distributed it had been supported by advertisers and had paid a very small royalty for each download. With just over two billion downloads the royalties had exceeded the costs of producing the app. The Vatican had made a profit.

Appendix A: Contemporary and Historical Wargames

Contemporary

Advanced Concepts Event (ACE). This virtual wargame/demonstration uses mostly Virtual Flag infrastructure to explore the impact of proposed platforms, munitions, and other systems.

Air Force Future Capabilities Wargame, a.k.a. Futures Game (FG). This expert panel–adjudicated constructive wargame is the U.S. Air Force Chief of Staff's far-term Title 10 wargame. It is held on odd-numbered years at the LeMay Center Wargaming Institute, Maxwell Air Force Base, Alabama.

Blue Flag. This computer-adjudicated constructive wargame trains the staffs of air operations centers in the planning and execution of joint/combined air campaigns and the air elements of theater campaigns.

Expeditionary Warrior (EW). The Marine Corps's Title 10 wargame series is conducted annually by the Wargaming Division of the Marine Corps Warfighting Laboratory to examine issues relating to the future of the force. Representatives from every U.S. service, combatant commands, and multinational partners participate.

Global Engagement. This expert panel–adjudicated constructive wargame is the U.S. Air Force Chief of Staff's midterm Title 10 wargame. It is held on even-numbered years, rotating between Europe and the Pacific. From 1997 to 2014 the wargame was known as Unified Engagement.

Global Game, a.k.a. Navy Global. The first U.S. Title 10 wargame. Global has been held since 1979, at the Naval War College, Newport, Rhode Island.

Maple Flag. Established in 1978, Maple Flag is the Canadian air force's live wargame/exercise. Maple Flag is conducted twice a year at Cold Lake Canadian Forces Base, Alberta, Canada. Maple Flag has hosted the air forces of over a dozen nations.

National Training Center. The U.S. Army's center for training entire brigades through live, virtual, and constructive wargaming. It is located at Fort Irwin, California.

Red Flag. Called the "ultimate wargame," this live wargame/exercise is based at Nellis Air Force Base and held several times a year in the skies of southern Nevada.

Unified Engagement (UE). This expert panel–adjudicated constructive wargame is the U.S. Air Force Chief of Staff's midterm Title 10 wargame. It is held on

even-numbered years, rotating between Europe and the Pacific. It was known before 1997, and has been since 2014, as Global Engagement.

Unified Quest (UQ). The U.S. Army's Title 10 wargame, held at Carlisle Barracks, Pennsylvania.

Historical

Big Stick. U.S. Air Force, 1961. Computer-assisted wargame of nuclear warfare between the Soviet Union and the United States. Used in Air Command and Staff College's curriculum for decades.

Charge! Brigadier Peter Young, Col. J. P. Lawford. Influential miniatures wargame rules.

Dungeons & Dragons. E. Gary Gygax and David L. Arneson. This game started the role-playing wing of wargaming.

Little Stick. U.S. Air Force, 1960s. Computer-assisted wargame of conventional warfare between the Soviet Union and the United States. Used in Air Command and Staff College's curriculum for decades.

Little Wars. H. G. Wells, 1913, London, United Kingdom. First published second-generation land wargame intended for a civilian audience. First published land miniatures wargame for a civilian audience.

Panzer Blitz. Jim Dunnigan, 1970, Avalon Hill, Baltimore, Maryland. The first true board-based, tactical-level wargame to be published and one of the best-selling of all time.

Space War. MIT, 1962. First computer wargame.

STAGE (Simulation of Total Atomic Global Exchange). U.S. Department of Defense, 1960–63. Wargame of total war between the United States and the Soviet Union. It required three years to develop and six months to execute one run.

TACSPIEL. U.S. Army, 1960s. Wargame for the division level and below. Computer assisted, but thirty minutes of game time took eight hours to play.

Tactics / Tactics II. Charles Roberts, 1954/1958, Baltimore, Maryland. First unambiguously second-generation board wargame for a civilian audience.

THEATERSPIEL. U.S. Army, 1960s. Theater-level, computer-assisted wargame.

War Games. Donald Featherstone, 1962, United Kingdom. First unambiguously second-generation miniatures wargame rules for a civilian audience.

Appendix B: Chronology

2000 BC Date of an Egyptian mural that depicts two men apparently playing an abstract wargame. Later evidence indicates the game was called *T'au.*

600 BC Likely date of oldest surviving complete abstract wargame. Found in ruins of Ur, an important Sumerian city-state, located in modern-day Iraq.

400s BC Greek citizens begin playing *Petteia,* an abstract wargame.

300 BC Earliest known Chinese abstract wargame, *Weiqi,* now called *Go* in the West.

168 BC With the conquest of Greece, Rome acquires *Petteia,* renames it *Latrunculi.* The game spreads throughout the empire, as evidenced by a set found in Britain.

400s *Weiqi* spreads to Korea, where it is called *Baduk*.

500s Earliest Indian abstract wargame. Called *Chaturang,* it is the earliest known ancestor of chess.

600s *Weiqi* spreads to Japan, where it is called *Igo*.

Chaturang spreads to Persia.

644 Following the Muslim conquest of Persia, *Chaturang* spreads throughout Muslim territory.

800s Earliest known use of *Chaturang* in Europe.

925 Earliest written mention of the Viking wargame *Hnefatafl;* oral tradition suggests it is much older, plausibly an evolution of the Roman game *Latrunculi.* The Vikings go on to spread *Hnefatafl* to lands they settle.

1000 *Chaturang* is played throughout Europe.

1400s *Chaturang* evolves into chess. Earliest known chess sets.

1664 Christopher Weikhmann, a German, introduces a variant of chess he calls "the Kings Game."

1780 Helwig, master of pages at the court of Brunswick, introduces a game with a playing board of 1,666 squares, the color of a square representing the type of terrain.

1798 *Neues Kriegsspiel* is developed by Georg Vinturinus. The board depicts the border region of France/Belgium, and the sixty pages of rules include logistics.

1809 Schnorr von Carolsfeld develops military chess for the Saxon court.

1811 Herr von Reisswitz, the Prussian war councilor at Breslau, invents the first "modern" wargame—that is, simulation game of combat, not abstract.

1816–17 Herr von Reisswitz's wargame is played by Prussian and Russian princes.

1824 Lieutenant von Reisswitz adapts his father's wargame so it can be played on topographical maps, making the wider use of wargames practical.

Lieutenant von Reisswitz demonstrates his wargame to the Chief of Staff of the Prussian army. Result: each regiment is ordered to procure a copy of the wargame. Reisswitz is promoted to captain.

1827 Captain von Reisswitz takes his own life.

1828 First known occasion of Lt. Helmuth von Moltke advocating the use of wargames.

1835 Captain von Moltke teaches German staff procedures, including wargaming, to the Ottoman army.

1837 Moltke, now a general, becomes the Chief of Staff of the Prussian army and orders increased use of wargaming.

1846 First wargame handbook is published in Prussia.

1866 Wargaming adopted by the Austro-Hungarian military.

1871 Prussian victory in Franco-Prussian War leads to international imitation of the Prussian military, including wargaming.

1872 Captain Baring publishes a simplified version of German *Kriegsspiel* for use by the British army. Its rules are likely the first rules used by the British army.

1873 Rigid wargaming is adopted by the Italian military.

First publication in Germany arguing for the adoption of "free *Kriegsspiel,*" the use of professional judgment to speed adjudication.

1874 First known advocacy of wargaming in France.

1875 Tsar of Russia approves use of wargaming for instruction.

1877 Captain Naumann of Saxony publishes rules for what are now called "break points," at which units cease to attack or defend despite orders.

1878 Capt. Philip Colomb, Royal Navy, patents earliest known naval wargame.

1883 Maj. W. R. Livermore, U.S. Army Corps of Engineers, publishes first set of wargame rules within the United States. The Army does not adopt his rule set.

First formal decision by the British army to adopt wargaming. Members of the "volunteer movement" (reservists) have already used the German game for some time for informal training.

1884 U.S. Naval War College is founded.

1886 First lecture on wargaming at the U.S. Naval War College.

1887 Major Livermore and Captain McCarty Little conduct the first joint (Army/Navy) wargame. They are told by their superiors never to do so again.

1888 The Royal United Services Institute plays the tactical-warfare board game Polemos in its London headquarters—a learned academic society playing a wargame to learn.

1889 Adoption of wargaming by the French military.

First wargame becomes part of the U.S. Naval War College curriculum.

1894 U.S. Navy first uses wargaming to evaluate tactical impacts of design options.

First known international participation in a U.S. naval wargame: two Chinese observers.

U.S. Navy wargame is played assuming hostilities between the United States and the United Kingdom.

Wargaming begins uninterrupted presence in the U.S. Naval War College curriculum, extending to the present.

1895 Wargaming helps persuade the U.S. Congress to fund the Cape Cod Canal.

F. W. Kitchener publishes wargaming rules in the United Kingdom.

1896 U.S. Navy orders fleet experiments to confirm wargame indications of benefits from converting ships from coal to oil.

1898 Second edition of Livermore's *American* Kriegsspiel appears.

1900 U.S. Army War College is founded, incorporating wargaming in its curriculum from the start.

In France the use of wargaming for staff planning down to the regimental level becomes standard practice.

1902 Decrease in wargaming by the British military. One explanation: contemporary wargames had not addressed factors that proved critical to the outcome of the Boer War.

1903 U.S. Navy wargame indicates merit in keeping fleet concentrated.

Earliest reported use by Russia of wargames for operational planning.

1905 Schlieffen conducts his final staff-ride wargame, which ends in a German victory over France before Britain can intervene. Schlieffen begins advocating this strategy should Germany go to war.

Unofficial wargame played in England ending in a German victory over France before Britain can intervene apparently influences decision to enhance British readiness.

1906 First U.S. use of wargaming in development of a battle plan, sent to fleet for "examination and testing." (Was this a live wargame?)

Moltke the Younger becomes the chief of the German general staff, improves wargaming.

1908 Capt. Farrand Sayre, U.S. Army, writes *Map Maneuvers and Tactical Rides,* to be published in 1911.

1911 U.S. Navy wargame conducted examining ships versus coastal defenses.

1912 Article by McCarty Little on wargaming published in the U.S. Naval Institute *Proceedings*. It is still one of the best papers on the subject.

1914 (April) Russian general staff conducts a wargame of its planned invasion of East Prussia. Adjudication indicates that the Russian army would be destroyed, approximately where it actually would be four months later, but plan is not changed.

1916 Frederick Lanchester devises differential equations modeling power relationships between opposing forces. Lanchester's equations are at the heart of many computerized wargames today.

1922 U.S. Navy upgrades its tactical wargaming with actual weapons data.

1927 Under leadership of Lt. Cdr. Sokichi Takagi, the Japanese navy wargames an attack on a U.S. fleet at Pearl Harbor, Hawaii. It goes badly for Japan.

1929 First Link Trainer built.

First wargame of the type later called "political-military," or "pol-mil," played in Germany.

1933 Wargame at the U.S. Naval War College indicates that war with Japan will require four to five years, principally owing to logistical restraints.

1938 In an effort to persuade Hitler not to invade Czechoslovakia, German army chief wargames the plan. Outcome points to a Pyrrhic victory that would leave Germany vulnerable to attack.

1939 German army given so little notice that it cannot wargame the invasion of Poland, its only major operation in World War II not gamed.

1940 Germany conducts four months of wargames to refine plans for attacking the Netherlands, Belgium, and France. The games lead to significant changes.

German wargame of Operation Sealion, the planned invasion of Britain, identifies many difficulties and contributes to the decision to cancel.

Germany wargames the imminent invasion of the Soviet Union. The game, Operation Otto, is unprecedented in length and, probably, depth. Led by Lt. Gen. Friedrich Paulus, the game plays the first six months of the war on the Eastern Front. The game situation for November 1941 seems to indicate near victory but also that the Wehrmacht has neither strength nor logistical support to conquer Russia in one short campaign.

1942 Allies use wargames in planning the Torch landings in French North Africa.

1942–45 Capt. Gilbert Roberts, Royal Navy, uses wargaming for anti-U-boat training and operational analysis in the Western Approaches Tactical School.

1944 Allied and German wargames of the invasion of Normandy project Allied success. Germany orders reinforcements; two of three units arrive by D-day.

German wargame of the defense of the Ardennes interrupted by actual U.S. offensive but wargame continues using actual development as inputs.

1945 Combined U.S., British, and Soviet wargame in Moscow indicates feasibility and likely success of a Russian attack on Japan.

1946 Stanford Research Institute is founded.

1948 RAND is founded.

1954 Charles Roberts publishes Tactics, considered by many the first second-generation board wargame for a civilian audience.

1958 First computerized wargame, Navy Electronic Warfare Simulator (NEWS), becomes operational; it costs $7 million and takes up three floors.

Charles Roberts publishes Tactics II, the first unambiguously second-generation board wargame for a civilian audience. He also founds Avalon Hill, which will be for over a decade the leading publisher of second-generation print wargames for the civilian market.

1962 First civilian computerized wargame, Spacewar, programmed by students at MIT.

In Britain, Donald Featherstone writes his classic *War Games,* inspiring a generation of hobbyists and professional wargamers. Its impact is greatest in the United Kingdom but is significant in the Commonwealth nations and the United States. At least some copies will be sold in most nations.

1964 Sigma II, a pol-mil wargame of the Vietnam conflict, is played in the Pentagon basement and indicates a likely initial stalemate.

1969 The U.S. Navy establishes its Fighter Weapons School, better known as "Top Gun," with live wargaming at its core. The school will be credited with improving the Navy's air-to-air loss ratio in the closing years of the Vietnam War, during which the Air Force's loss ratio remains nearly unchanged.

1977 Dunn/Kempf wargame sets with 1 : 300–scale models are widely issued in the American army as training tools.

1981 U.S. Army activates at Fort Irwin, California, the National Training Center, which will push the envelope of live wargaming.

1982 The Warrior Preparation Center opens, as a U.S. Air Force–only wargaming facility.

1983 The movie *War Games* opens.

1984 U.S. Army joins the Warrior Preparation Center, making it the first joint Air Force / Army wargame facility in Europe.

Tactical Training Group activated at Hurlburt Field, Florida, Air Operations Center Wargames.

Air Force Wargaming Center opens at Maxwell Air Force Base, Alabama.

Center for Applied Strategic Learning founded, consolidating all National Defense University wargame branches.

1986 Joint Warfare Center opens at MacDill Air Force Base, Florida.

1990 USCENTCOM wargames the Iraqi invasion of Kuwait and Saudi Arabia.

1993 First "Connections" wargaming conference held at Maxwell AFB, brings together all wings of U.S. wargaming community; international participation follows shortly.

1995 U.S. Marine Corps modifies the commercial computer wargame Doom to serve as a virtual game for a four-Marine fire team.

1996 U.S. Navy joins Warrior Preparation Center.

1999 USCENTCOM conducts the Desert Crossing wargame, which identifies problems of a post-Saddam Iraq, as well as solutions—findings that will be ignored by U.S. leadership when planning Operation Iraqi Freedom.

Wargame Center opens at the German War College.

2003 (March) The Army component of USCENTCOM wargames the invasion of Iraq. Game results that suggest high casualties in Iraqi cities prompt changes in the Army's plan.

2004 British army adopts a commercial personal computer–based game, VBS2, as a key infantry training tool.

2008 Pentagon begins developing a $130 million simulated Internet for live cyber wargames.

2012 The chairman of the U.S. Joint Chiefs of Staff initiates Strategic Seminar Series, conducted as a very free *Kriegsspiel*.

2013 First Connections UK wargame conference, high international participation.

2014 USSTRATCOM Wargame Center opens at Offutt Air Force Base, Nebraska.

First Connections Australia conference.

2015 Deputy Secretary of Defense Robert O. Work calls for the reversal of the atrophy of wargaming in the U.S. military.

First Connections Netherlands conference.

2017 The United Kingdom's Ministry of Defence publishes its first wargame doctrinal publication, the *Wargaming Handbook*.

Appendix C: Wargaming Organizations

Military

United States

Office of the Secretary of Defense (OSD)

Office of Net Assessment (NA), Pentagon. Wargaming is just one of the tools it uses.

Office of the Under Secretary of Defense for Policy, Pentagon.

Cost Assessment and Program Evaluation (CAPE), Pentagon. Uses wargaming as one tool to understand trade-offs between cost and impact.

Joint Staff

J-7 Joint Wargaming Division, Suffolk, Va.

J-8 Studies, Analysis and Gaming Division (SAGD), Pentagon.

U.S. European Command (USEUCOM)

Warrior Preparation Center, Einsiedlerhof, Germany. Founded in 1982 by Col. "Moody" Suter; the U.S. Army joined in 1984, the Navy in 1996.

U.S. Pacific Command (USPACOM)

Pacific Warfighting Center, Honolulu, Hawaii.

Korean Air Simulation Center, Korea.

U.S. Special Operations Command (USSOCOM)

USSOCOM Wargame Center, Tampa, Fla. Principal wargame is Shadow Warrior.

U.S. Strategic Command (USSTRATCOM)

USSTRATCOM Wargame Center, Offutt Air Force Base, Neb.: opened 5 June 2014.

National Defense University

Center for Applied Strategic Learning (CASL), Fort McNair, Washington, D.C. Since 1984 CASL has been responsible for providing wargame services to all the university's colleges and schools except for the geographically

separated Joint Forces Staff College, which was served by its own wargame branch. During a 2013 reorganization that function became part of CASL (per Tim Wilkie of CASL).

U.S. Air Force

Air Staff (HQ USAF).

HQ USAF/A5SW, Pentagon. Runs the Air Force Title 10 wargaming enterprise.

HQ USAF/A10, Pentagon.

Air Combat Command (ACC).

HQ ACC/A9LW Wargame Branch, Langley Air Force Base, Va.

414th Combat Training Squadron (Red Flag), Nellis Air Force Base, Nev.

505th Combat Training Squadron (Blue Flag), Hurlburt Field, Fla.

705th Combat Training Squadron (Blue Flag), Kirtland Air Force Base, N.Mex.

Pacific Air Forces (PACAF). Integrated with USPACOM wargaming.

U.S. Air Forces in Europe (USAFE). USAFE's wargame operation evolved into the USEUCOM capability.

USAF Special Operations Command.

War Gaming Office, AFSOC/A8XC, MacDill Air Force Base, Fla.

Air Education and Training Command.

LeMay Center Wargaming Institute (LCWI), Maxwell Air Force Base, Ala. LCWI supports Air University and the entire U.S. Air Force.

Blue Horizons, Maxwell Air Force Base, Ala. Focuses on science and technology (S&T) gaming.

Air Mobility Command (AMC).

AMC Wargaming, AMC/A8XC, Scott Air Force Base, Ill.

Air Force Global Strike Command (AFGSC).

Wargaming and Strategic Studies, AFGSC/A8XC, Barksdale Air Force Base, La.

Air Force Materiel Command (AFMC).

Wargame Branch, AFMC/A8OW, Wright-Patterson Air Force Base, Ohio.

USAF Research Laboratory (AFRL).

Strategic Planning and Transformation Division, AFRL/XPT, Wright-Patterson Air Force Base, Ohio. S&T support for the USAF wargaming enterprise.

Air Force Space Command (AFSPC).

Wargame Office, AFSPC/A3TG, Peterson Field, Colo.

U.S. Army

Army Staff.

Strategy & Tactics Analysis Group (STAG), Pentagon. Analytical wargaming and decision support.

Center for Strategic Leadership, U.S. Army War College, Carlisle Barracks, Pa. Conducts Army Title 10 wargames.

Center for Army Analysis, Fort Belvoir, Va. Provides high-level wargaming and analysis in support of the Army Staff.

Training and Doctrine Command (TRADOC).

TRADOC Analysis Center (TRAC). Conducts analytical wargaming in conjunction with studies, primarily at four of its centers: Fort Leavenworth, Kans. (Wargaming and Simulation Directorate, Scenarios and Data Directorate); White Sands Missile Range, N.Mex. (Models and Simulation Directorate); Fort Lee, Va. (wargaming and similar support to the Army's Combined Arms Support Command and the Sustainment Battle Lab); Naval Postgraduate School, Monterey, Calif.

Centers of Excellence. All, though heaviest users are the Battle Lab Centers.

National Simulation Center, Fort Leavenworth, Kans. Advocates, develops, and provides live, virtual, and constructive wargames and one-sided simulations.

Educational wargaming:

U.S. Army War College, Carlisle Barracks, Pa. Wargames conducted throughout the curriculum.

Department of War Gaming.

Command and General Staff College, Fort Leavenworth, Kans.

Digital Leader Development Center, Simulations Division.

U.S. Military Academy, West Point, N.Y.

Warfighting Simulation Center.

Department of Military Instruction. Curriculum employs wargames and simulations throughout.

Unit-training wargaming (live, virtual, and constructive):

National Training Center, Fort Irwin, Calif.

Joint Readiness Training Center, Fort Polk, La.

Joint Multinational Readiness Center, Hohenfels, Germany.

Most major Army installations for decision support, education, and training (constructive gaming) and unit training (virtual gaming).

U.S. Navy

Chief of Naval Operations.

Assistant for War Gaming Matters, Pentagon.

Center for Naval Warfare Studies, Naval War College (NWC), Newport, R.I.

War Gaming Department. High-quality research, analysis, gaming, and educational support to the NWC mission, 1887–present. Forty employees in purpose-built 110,000-square-foot facility, McCarty Little Hall, conduct approximately fifty educational and decision-support games annually. Executive agent for the Navy's Title 10 wargame, Global. www.usnwc.edu/Research---Gaming/War-Gaming.aspx.

Naval Postgraduate School, Monterey, Calif. Teaches wargaming and conducts wargame-related research and development.

U.S. Marine Corps

Marine Corps Warfighting Laboratory

Marine Corps Combat Development Command

Wargaming Division, Quantico Marine Corps Base, Va.

Marine Corps University

International

Australia. The center of Australian wargaming is the Australian Defence Simulation and Training Centre. The Australian Defence Force Warfare Centre (ADFWC), at RAAF Williamtown in New South Wales, is another important center of wargaming, playing joint games for both training and experimentation. Australia also has wargame centers near Darwin, Brisbane, and Townsville, collocated with major ground units. Wargaming is used as a teaching aid at staff and war colleges. Finally, Australia conducts several annual live games, at least in part on instrumented ranges.

China. Wargames are developed at a Wargame Laboratory located at China's National Defense University. They are then used at headquarters and military schools across the country.

Germany. Educational wargaming is conducted at the Führungsakademie der Bundeswehr, also known as the General Staff College or the Senior Military Academy, near Hamburg. It has had a wargaming center since 1999.

India. India's Joint Staff includes an operations-research organization that conducts some wargames but no office specifically dedicated to them.

Indian Army

HQ Army Training Command

Wargame Development Centre, DGIS Enclave, New Delhi

Indian Air Force

War Gaming Centre, to begin operations in 2014

Indian Navy (unknown)

New Zealand. Wargaming is conducted at Army Simulation Centres at Linton, Waiouru, and Burnham.

Sweden. There are two wargaming organizations, one in the general staff to conduct games, one in the war college to support both educational wargaming for the war college and the NATO Partnership for Peace.

United Kingdom. This outline is based primarily on a 4 May 2015 e-mail from Maj. Tom Mouat, British Army.

Ministry of Defence (MoD)

Development, Concepts and Doctrine Centre. Located at the Defence Academy at Shrivenham, it performs high-level, decision-support wargaming and doctrinal development for gaming.

Defence Science and Technology Laboratory (Dstl). Conducts most MoD analytical wargaming to ensure that innovative science and technology contribute to security.

Royal Military Academy Sandhurst, Surrey.

Air Warfare Centre, Royal Air Force Waddington, Lincolnshire.

Maritime Warfare School, HMS Collingwood, near Portsmouth.

Defence Academy of the United Kingdom (formerly the Royal Military College of Science), near Swindon, Wiltshire.

Principal garrisons (e.g., Warminster, Wiltshire; Catterick, North Yorkshire; Paderborn, Germany) have facilities for constructive, virtual, and live wargaming.

Defense Contractors

(All the below are or have been actively supporting defense efforts through wargaming.)

Abt Associates.

BAE Systems.

Bendix Corporation.

Boeing Company.

Booz Allen Hamilton.

BreakAway Games. A computer-wargame development and publishing company since 1998, pursues a strategy of bridging the defense, serious games, and popular wargaming markets. See www.breakawayltd.com.

Center for Naval Analyses. Prolific producer of innovative wargames.

Center for Strategic and Budgetary Assessments. RAND-like organization, works closely with OSD's Office of Net Assessment.

Decisive-Point. One of the oldest and most prolific developers of serious games for the military. Since the development of its first serious game, a tank-identification game in 1990, it has sold more than ten game titles to the U.S. Army for professional military education and training. Allied armies (e.g., those of the United Kingdom, Australia, and Ukraine) have purchased

Decisive-Point games. Decisive-Point has developed games for military research and development. It produces critically acclaimed commercial wargames through HPS Simulations.

Dupuy Institute.

IBM.

John Tiller Software.

Lockheed Martin.

Mäk Technologies. Parent company of the National Center for Simulation. With Lockheed Martin hosts a wargame seminar for STEM (science, technology, engineering, and mathematics) teachers. See mak.com.

RAND Corporation. Nonprofit organization "dedicated to furthering and promoting scientific, educational, and charitable purposes for the public welfare and security of the United States." Name is portmanteau of "research and development." See www.rand.org.

Raytheon.

Research Analysis Corp (RAC).

Riverview Artificial Intelligence LLC.

Science Applications International Corporation.

Sonalysts. Begun in 1973 as a consulting firm for sonar-related analysis, now provides support in engineering, planning, analysis, software, and training. It has produced several commercial wargame titles; one, Dark Waters, is the only commercial wargame of which I am aware that is used without modification by one of the U.S. armed services.

Stanford Research Institute.

Technical Operations. Designers of STAGE, an air-defense command-and-control system that in the 1960s included an embedded computer wargame.

Publishers and Developers

Most American consumer wargame publishers receive their product from in-house design/development departments or freelance designers—often both. However, many wargames, especially computer games, are created by development companies. Some of the below organizations are no longer in business but are included for historical purposes. As wargame publishers and, especially, development houses can be quite small I'm sure there

are active companies that I missed. Also, companies come and go. I will attempt to keep the list up to date at Connections-Wargaming.com.

1A Games. American print and miniatures wargame and book publishing, since 2013. Titles include America Divided, Gettysburg, and Rebel Rail. See 1AGames.com.

Activision Blizzard. American computer-game developer and publisher founded in 2008, now second largest by sales volume. In 2012 it had revenue of $5 billion and seven thousand employees. A few titles fit the definition of wargames—for example, Call of Duty: Ghosts. See www.activisionblizzard.com.

Advanced Gaming Systems. American computer-game developer, 1990 to the present. Developed the contemporary naval wargame Harpoon, sold by Matrix Games. See www.advancedgaming.biz.

Against the Odds. American developer and publisher of a magazine with a print wargame in each issue. Its titles cover all time periods, as well as all warfare domains: air, sea, and land. As of early 2014 it had published forty-two wargames and issues of the magazine. See ATOMagazine.com.

Avalanche Press. American developer and publisher of print wargames, founded in 1994, in Irondale, Alabama. Most of its seventy (as of early 2014) depict aspects of World War I or World War II land or sea warfare, though a few are set in the American Civil War, the early gunpowder era, or the Roman era. See AvalanchePress.com.

Avalon Hill (AH). American print-wargame developer and publisher and the first print-wargame maker, it was founded in 1954 as the Avalon Game Company, in Avalon, Maryland, producing Tactics. In 1958 the firm changed its name to Avalon Hill. It is now a subsidiary of Wizards of the Coast, itself a subsidiary of the toy and game maker Hasbro. In the 1960s the only publisher of second-generation print wargames, AH continued to dominate the field in the 1970s and ’80s. Many of its innovations became standard industry practice, and many of its designs (such as Panzer Blitz and Squad Leader) set records for sales. AH founded the first magazine on print wargaming, *The General* (1964–98), which spread information on wargame design and built the self-awareness of the wargaming community. See www.avalonhill.wizards.com.

Battlefront.com. An American developer and publisher of computer wargames for “Macs” and PCs, principally set in World War II. See battlefront.com.

Bayonet Games. American print-wargame publisher, mostly on contemporary conflicts. Markets to the troops. Only print wargame of which I know that depicts the U.S. Army's live wargames at the National Training Center. Website performs many of the functions of a company magazine: bayonetgames.com.

Blue Sky Enterprises. Publisher of World War I and World War II miniatures rules.

Breakaway Games. Computer wargame-development company, since 1998. Attempts to bridge the defense, serious, and popular wargaming markets. See www.breakawayltd.com.

Clash of Arms Games. American developer and publisher of print and miniatures wargames and family games. Titles cover all periods of history, as well as air, sea, and land warfare. See www.clashofarms.com.

Collins Epic Wargames. Publisher of historical and science-fiction wargames in paper, card, and miniatures media. As of early 2014 it had only eight titles but had distributors for not only the United States but Canada, Germany, the United Kingdom, and Spain. See www.collinsepicwargames.com.

Columbia Games. Wargame developer and publisher since 1972. Its system, which uses paper for maps and wooden blocks for counters, allows, without a computer, limitation of intelligence input and incremental loss of unit strength. As of early 2014 it offered about thirty titles and roughly a dozen alternative maps; the website offers almost fifty videos, mostly tutorials, and also "Ten Best Wargames for a Beginner." See columbiagames.com.

Compass Games. Publisher of print wargames since 2004, with twenty-six titles covering all eras. Over eighty issues have appeared of its magazine, *Paper Wars,* with a wargame in each. See www.compassgames.com.

Consim Press. Publisher of print "consim" (conflict simulation) games, a division of ConsimWorld LLC. In 2017 it had no titles immediately available but five listed for preorder, as well as two out of stock. See www.consimpress.com.

Decision Games. Print and computer wargame publisher since 1988, has issued numerous updates of SPI classics. Many are "monster" games; for instance, Atlantic Wall has a forty-two-square-foot map of Normandy, at two miles per inch, and over four thousand playing pieces representing all battalions and companies. Most popular recent title is D-day at Omaha Beach, by John Butterfield. It produces each year two or three boxed games and eight to sixteen "folio" (simplified, standardized rules

and formats) and "mini" games (small, easy to learn, quick to play). See shop.decisiongames.com.

Diffraction Entertainment. A British publisher of print wargames, in "The Second World War" and "Foxhole" series. See www.tsww-online.com.

Eidos Interactive. See *Square Enix Europe.*

Electronic Arts. Large developer and publisher of computer games, founded in 1982, headquarters in California. In 2017 it reported net revenue of $4.8 billion. A pioneer in all types of home computer games, Electronic Arts has major development studios in the United States and Canada. See www.ea.com.

FASA Games. Founded in 1980 in the United States, it is now part, with Ral Partha Europe, of the FASA Corporation. FASA Games is focused on pen-and-paper role-playing and tabletop-miniatures games. See fasagames.com.

Flying Buffalo. Founded in 1970, develops a wide spectrum of innovative print games. They include a unique "Ace of Aces" series of close, tactical World War I air-to-air wargames. See www.flyingbuffalo.com.

Forgotten Fronts. Early American computer-game developer and publisher. Its titles ran in DOS; two are available from archive.org, one set on the eastern front of World War I, the other a "what-if"depicting Czechoslovakia fighting the German occupation in 1938.

Fresno Gaming Association. A small (nine titles) print-wargame developer and publisher, operated 1991–92. Known for perhaps the best graphics and worst rules editing in the industry.

Game Designers Workshop. A prolific developer and publisher (on average one every twenty-two days) of print wargames from 1973 to 1996. It also produced several miniatures rules systems and well-received role-playing games. At its demise it was probably the third-largest print-wargame publisher.

Games Workshop. Founded in 1975, it is the largest publisher of miniatures wargaming materials in the United Kingdom, probably in the world. See www .games-workshop.com.

Gathering of Developers. American computer-game developer, 1998–2004.

GMT Games. Founded in 1990, it is now one of the largest print-wargame developers and publishers. It prospered in the 1990s when so many wargame publishers failed, thanks in part to its pioneering preordering program, "Project 500." Titles include all eras across a spectrum of size and

complexity, as well as several science-fiction and family games. See gmtgames.com.

Hexagon Interactive. "Designing and developing software tools for the US Military." See umahexagon.com.

High Flying Dice Games. American print-wargame publisher, games set in World Wars I and II (Europe and Pacific), American Civil War, pre-1800, Cold War, and contemporary conflicts. See www.hfdgames.com.

HPS Simulations. Computer wargame publisher, founded in 1990 by Scott Hamilton. Over ninety titles, of which one, Point of Attack 2, was adapted for U.S. Air Force use. See hpssims.com.

John Tiller Software. Small group of computer-wargame developers founded by Dr. John Tiller in 1995. Over ninety commercial titles (some for HPS Simulations and other houses) and twenty wargames developed under contract for the U.S. Air Force and Navy. See johntillersoftware.com.

Judges Guild. Founded in 1976, it flourished until 1983, producing, especially, "play aids" for Dungeons & Dragons. It closed in 1983 but reopened for business in 1999 and since has published many role-playing titles. See judgesguild .org.

Kuma Reality Games. American publisher of computer wargames founded in 2003. Its titles are mostly first-person shooters (World War II, science fiction, tank, aircraft, ship); all are available for download free. See kumagames .com.

Legion Wargames. Print wargame publisher founded in 2009. Twenty-six titles are in print, several dealing with events in the military histories of the United Kingdom, Canada, or Australia. See www.legionwargames.com.

Lock 'n Load Publishing. Developer and publisher of board and computer games, especially strategy and wargames, as well as of *Line of Fire* magazine. See store.lnlpublishing.com.

Lost Battalion Games. Publisher of miniatures wargames on paper maps, subjects from ancient history to the twentieth century and science fiction. See www .lostbattaliongames.com.

Matrix Games. Prolific computer-wargame publisher, now owned by Slytherin UK. See matrixgames.com.

Mayfair Games. American designer, publisher, and distributor of print games, founded in 1981. Of over a hundred, about a dozen deal with war or national strategy. See www.mayfairgames.com.

MicroProse. An American video-game publisher and developer that operated from 1982 to 2001. It was founded by pioneer computer wargame and flight-simulator designer "Wild Bill" Stealey, who in 1993 hired Sid Meier, designer of Civilization. See *Wikipedia,* s.v. "MicroProse," en.wikipedia.org/.

Modern Conflict Studies Group. Modern Conflict Studies Group, founded in 2007, is a small print wargame publisher, marketing to both the general public and serious gamers. Titles include Battle for Baghdad. See MCSGroup.org.

NovaLogic. American computer-game developer and publisher founded in 1985. Its many wargames include first-person shooters, flight/fight (i.e., combat flight) simulators, and titles that combine both. See www.novalogic.com.

Omega Games. Small publisher of print wargames on modern subjects and the wargame review magazine *Paper Wars,* as well as U.S. distributor for Simulations Canada. See OmegaGames.com.

Phalanx Games. A publisher of print wargames founded in 2009, with a London address but a website with a Polish domain extension. Formerly cooperated with a Dutch house of similar name. See www.phalanxgames.pl.

Quarterdeck Games. Small publisher of detailed yet playable naval and World War II wargames. Founded by Jack Green, it operated until 1989. Several titles were also published in Japan.

Schwerpunkt. American computer-wargame developer and publisher, founded in 1995 by two people—still the only employees, working part-time. Its four titles depict the World War II Eastern and Western Fronts and conflict in the Middle East, 1948–2010. See schwerpunktgames.com.

Sierra Entertainment. Founded in 1979 as On-Line Systems, its name changed to Sierra On-Line and then to Sierra Entertainment before it was transferred to Activision in 2008 and ceased operation. It was a pioneer in computer gaming, including some wargame titles. Activision revived the name in 2014 for marketing, among others, legacy Sierra titles. See *Wikipedia,* s.v. "Sierra Entertainment," en.wikipedia.org/.

Simulations Publications Inc. SPI was an American print-wargame pioneer, developer, and publisher operated from 1969 to 1982. It was first to include a wargame in each issue of its magazine, *Strategy & Tactics*. Founder James

Dunnigan innovated many methods that are now standard and for decades held the record for the most wargames designed. Art director Redmond Simonsen developed many now-standard graphic conventions. SPI titles included all historical eras, ranging from national-strategic to close-tactical and from small "introductory" wargames to the first of the "monster" games. See *Wikipedia,* s.v. "Simulations Publications, Inc.," en.wikipedia.org/.

Sonalysts. See listing under Defense Contractors.

Square Enix Europe. British computer-game developer and publisher, with titles that include the first-person shooter Commando. Originally Square Enix, its name changed when in 2009 it merged with Eidos Interactive. Developers and studios in California, Denmark, Canada, London, and China. See eu.square-enix.com.

Steve Jackson Games. An American designer and publisher of print games—war, family, role-playing, card—founded in 1980. Many of its titles are small games, and many are satirical. It also publishes the magazine *Pyramid*. See www.sjgames.com.

Strategic Simulations Inc. An American computer-wargame developer/publisher, arguably the first one; its Computer Bismarck is considered the first computer wargame produced for the consumer market. Founded by Joel Billings in 1979, by 1985 it had a dozen titles and sixty employees and by the end of 1987, eighty-seven titles and annual sales of $5 million. When it closed in 2001 it had published about 180 titles, mostly wargames, but also the officially sanctioned computer version of Dungeons & Dragons. See *Wikipedia,* s.v. "Strategic Simulations," en.wikipedia.org/.

Strategic Studies Group (SSG). SSG is an Australian computer-wargame developer and publisher, founded in 1982. Long a world leader in artificial intelligence, it also publishes *Run 5* magazine. Its products are distributed in the United States by Matrix Games. See www.ssg.com.au.

Strategy & Tactics Press. Publisher of board wargames and military-history magazines; the oldest, *Strategy & Tactics,* was the first to include a game in every issue. Founded in 1991, it now produces, under publisher Dr. Christopher Cummins, two additional magazines, also enclosing games: *World at War,* with a focus on World War II, and *Modern War,* on the Cold War and modern and future conflict. *Modern War* recently featured "Target: Iran," by Joseph Miranda, looking at possible military intervention in Iran. These three magazines (with print runs of fifteen to twenty

thousand) appear bimonthly, meaning eighteen magazine games per year. See strategyandtacticspress.com; contact Christopher Cummins, at doccummins@strategyandtacticspress.com.

Take 2 Interactive. An American developer and publisher of computer games founded in 1993, it produces war, national-strategy, and sports games, as well as educational games for young children. It is best known for Civilization and Grand Theft Auto. See www.take2games.com.

TalonSoft. An American computer-wargame developer and publisher that operated 1995–2005, it produced roughly forty titles, from the Napoleonic era to contemporary conflicts. Most focused at the battle or campaign level. See *Wikipedia,* s.v. "TalonSoft," en.wikipedia.org/.

Task Force Games. From 1978 to 1996 an American publisher of print wargames, it is best remembered for the popular tactical space science-fiction wargame Star Fleet Battles. But many of its titles had naval themes, and many were small. See *Wikipedia,* s.v. "Task Force Games," en.wikipedia.org/.

TSR. Founded as Tactical Studies Rules and now best known as the original publisher of Dungeons & Dragons, TSR also published twenty-three wargames and even more fantasy, science-fiction, and economics titles. Operated 1973–97. See *Wikipedia,* s.v. "TSR (company)," en.wikipedia.org/.

Turning Point Simulations. An American publisher of print wargames, founded in 2012. Its intention is to publish a wargame on each of the "twenty decisive battles of all time." As of 2017 fifteen seem to have been in print. See turningpointsimulations.com.

UbiSoft. A French computer-game developer and publisher founded in 1986, it now has 9,200 employees in twenty-nine design studios in nineteen nations and an annual revenue of €1.25 billion. See www.ubisoft.com.

Victory Games. A division of Avalon Hill, it existed 1982–83. Founded in New York, it developed print wargames and family games. Probably best known for Gulf Strike, a contemporary campaign-level wargame, which was quickly but extensively modified on the day Saddam Hussein invaded Kuwait and was used to analyze the actual military situation. See boardgamegeek .com.

Victory Point Games. An American print wargame developer and distributor founded by Allen Emrich in 2007. In early 2014 it had forty titles in print; in mid-2017 it listed ninety-nine best sellers alone. Most are on military themes, some science-fiction, and one a simulation game of a campaign

for the presidency of the United States. Its front office is converted entirely to telework ("Virtual VPG"), all manufacturing and shipping to be contracted out. See www.victorypointgames.com.

West End Games. An American developer and publisher of print games, 1974–2008. Its best-known wargame was Tank Leader. It also published several role-playing games, each set in a different era or environment. Its best-known non-wargame title was Paranoia, a spoof on science fiction and role-playing. See *Wikipedia,* s.v. "West End Games," en.wikipedia.org/.

Worthington Publishing. A print wargame developer and publisher founded in 2009. In 2017 its site lists twenty-three games for sale. See worthingtonpublishing .com.

Yaquinto Publications. An American developer and publisher of print wargames and family games, operated 1979–83. Yaquinto was probably best known for its innovative packaging and the wargame Ironclads. See *Wikipedia,* s.v. "Yaquinto Publications," en.wikipedia.org/.

Academic

(All these institutions and individuals use wargames to teach, teach how to create wargames, or have advanced the state of the art of wargaming.)

Air University, U.S. Air Force

LeMay Center Wargaming Institute, Maxwell Air Force Base

Squadron Officer School, Squadron Officer College, Air University

Army Command and Staff College, Maxwell Air Force Base

Army War College, Carlisle Barracks, Pa.

Art Institute of California, Orange County

Emrich, Allen (Teaches the art and business of wargaming.)

German War College, Germany

Harvard, Cambridge, Mass. (A pioneer in game theory.)

Massachusetts Institute of Technology, Cambridge, Mass. (Leader in the development of political-military wargames.)

McGill University, Montreal, Quebec (Especially the work of Professor Rex Brynen, Department of Political Science. He used war/peace operation gaming in my POLI450 [Peacebuilding] course since 1998, with approximately a hundred students per year. The simulation is fully described in *PS:*

Political Science & Politics [January 2010]. He won the International Studies Association's Deborah Gerner Innovative Teaching Award in 2011 for that and his work with PAXsims.)

Naval War College, Newport, R.I.

Northwestern University, Evanston, Ill. (Uses computer games for the study of international relations.)

Princeton University, Princeton, N.J. (A pioneer in game theory.)

Appendix D: Key Contributors

Contemporary

(The below are brief bios of selected current key contributors to the field of wargaming. For a periodically updated list with fuller biographical information, when available, see Connections-Wargaming.com.)

Larry Bond, wargame designer, author, analyst, coauthor of *Red Storm Rising*

Rex Brynen, originator of the PAXsims website, pioneer in adapting WG to peace building and political analysis

Matthew Caffrey, Colonel, USAF (Ret.), founder of Connections, designer, author, teacher, advocate

Jon Compton, political scientist, wargaming of violent nonstate actors, lead of CAPE wargame function

John Curry, publisher, founder of the History of WG Project, documenting the history and developments in WG

Stephen Downes-Martin, former professor at NWC, wargame innovator, theorist, advocate

James F. Dunnigan, prolific wargame designer, editor, publisher, author, now semiretired

Michael W. Garrambone, past president of MORS, SME in OR and WG, analyst, educator

Peter Garretson, Lieutenant Colonel, USAF, chief of ACSC wargaming, wargame advocate, innovator

Uwe L. Heilmann, Colonel, German air force, advocate and innovator in the application of WG

Mark Herman, past partner in BAH, WG designer, publisher, innovator of military, recreational, and business wargaming, now semiretired

Graham Longley-Brown, father of Connections UK, wargame SME, advocate

Jim Lunsford, Lieutenant Colonel, USA (Ret.), wargame designer, educator

Michael R. Macedonia, vice president and chief scientist for SAIC

Colin Marston, head of the Defence Science and Technology Lab Wargaming Team, UK

Rudy "Silver Fox" Martinez, founder of the Air Force Research Lab's Advanced Concepts Event, centered on a virtual wargame

Joseph Miranda, the most prolific print wargame designer, editor, writer

Tom Mouat, Major, British Army, wargame SME, advocate, innovator

Dr. Al Nofi, wargame researcher, designer, author

Michael Peck, journalist, most prolific writer on wargames and all computer gaming

Dr. Peter P. Perla III, wargame theorist, designer, author, manager, advocate

David O. Ross, wargame SME, advocate, innovator

Robert "Barney" Rubel, Captain, USN (Ret.), former dean at NWC, wargame advocate and innovator

Philip Sabin, professor, educator of and with wargaming, cofounder of Connections UK

William "Bill" Simpson, principal wargame designer for USMC Wargame Division, pioneer of open adjudication

John Tiller, designer and publisher of computerized wargames, commercial and military

Brian Train, Canadian wargame designer, writer, veteran

Eric Walters, Colonel, USMC (Ret.), principal wargame advocate in USMC

John Warden, Colonel, USAF (Ret.), originator of Connections, author, strategist

Casey Wardynski, Colonel, USA, originator of America's Army wargame

Christopher Weuve, wargame designer and analyst, naval analyst

Tim Wilkie, NDU, wargame SME, cochair of Connections

Dr. Yuna Huh Wong, leader in advancing the MS&G of irregular warfare

Robert O. Work, U.S. Deputy Secretary of Defense, American who has arguably done most to advance wargaming in the DoD, wargame practitioner while at CSBA

Historical

(The list includes contemporary individuals who have fully retired. For updates and unabridged biographies see Connections-Wargaming.com.)

David Lance "Dave" Arneson, codesigner of first published role-playing game, Dungeons & Dragons

Lincoln Bloomfield, MIT professor jointly responsible for bringing pol-mil wargaming to United States

Philip Howard Colomb, Captain, Royal Navy, inventor of modern naval WG

Trevor Dupuy, Colonel, USA, historian, champion of historical data in wargaming

Donald Featherstone, father of miniatures and British second-generation WG, prolific wargame designer, editor, publisher, author

Benjamin Franklin, proponent of chess playing by the public, among many, many other things

Herbert Goldhamer, RAND, codeveloper in 1950s of American pol-mil WG

Charles Grant, wargame designer and author, helped popularize miniatures wargaming

Gary Gygax, codesigner of first published role-playing game, Dungeons & Dragons

Sterling Hart, first director of NDU's War Gaming and Simulation Center

Orville E. "Bud" Hay, chief of wargaming, Naval War College, 1985–99, a father of Global

John Hill, designer of the best-selling print wargame Squad Leader and many others

Fred Jane, wrote first clearly second-generation naval combat wargame rule set for civilian audience

William Jones, Colonel, USAF, founder of U.S. Joint Staff wargaming

F. W. Kitchener, author of 1895 British rule set on wargaming

Charles C. Krulak, General, USMC, directed commercial WG use for professional development

Frederick William Lanchester, creator of Lanchester's equations

Harris Laning, Admiral, USN, live and constructive wargame innovator, president of NWC 1930–33

J. P. Lawford, Colonel, coauthor of *Charge!,* an influential miniatures wargame rule set

Edwin Link, first volume designer and builder of flight and other simulators

W. R. Livermore, Major, USA, first in United States to advocate, improve wargaming

Raymond Macedonia, Colonel, USA, founder and chairman of the Army War College Wargame Department

William McCarty Little, father of American wargaming, 1846–1915

Francis McHugh, wargame designer, cofounder of Global, the first Title 10 wargame

Helmuth von Moltke, Field Marshal, Prussian Army, adapted wargaming for planning

Gary "Mo" Morgan, Lieutenant Colonel, USAF, wargame designer, USAF and commercial

Joseph Morschauser, early miniatures wargame designer and innovator

Captain Naumann, first to publish rules on what are today called "break points"

Constantine "Dean" Pappas, Colonel, USAF, father of USAF Wargaming Center

Fletcher Pratt, designer of first U.S. naval wargame intended for civilian audiences

Georg H. R. J. von Reisswitz, Lieutenant, created first widely used modern wargame

Leopold von Reisswitz, Prussian war councilor, invented first modern wargame

Charles S. Roberts, founding father of commercially available print wargames

Ed Rotberg, in 1980 designed Battlezone and later Army Battlezone, the first FPS

Steve Russell, originator of Spacewar, programmed in 1962, first civilian computer wargame

Farrand Sayre, Captain, USA, author of *Map Maneuvers and Tactical Rides,* 1908

Alfred von Schlieffen, General, German army, conceived Schlieffen Plan, advocate of wargaming

Redmond Simonsen, pioneer in the art of intuitive graphics conventions

Richard "Moody" Suter, Colonel, USAF, father of Red Flag, Warrior Prep Center

Jack Thorpe, father of virtual wargaming, convinced DARPA to network simulators

Charles Totten, Lieutenant, USA, author of *Strategos,* early series of U.S. wargames

Adolf von Trotha, Prussian officer who asserted wargaming contributed to Prussian success

Gary Ware, Colonel, USAF, Director of Wargaming for CENTCOM during Gulf War

H. G. Wells, author, wrote early ground-combat wargame rule set for civilian audience

Spenser Wilkinson, British volunteer officer, advocate of staff system and wargaming, early advocate of the British adoption of wargaming, father of 1905 wargame that showed British inability to intervene against a fast German offensive

Peter Young, Brigadier, coauthor of *Charge!,* an influential miniatures wargame rule set

Abbreviations

ACSC	Air Command and Staff College
BAH	Booz Allen Hamilton
CAPE	Cost Assessment and Program Evaluation
CENTCOM	Central Command
CSBA	Center for Strategic and Budgetary Assessments
DARPA	Defense Advanced Research Projects Agency
DoD	Department of Defense
FPS	first-person shooter
MIT	Massachusetts Institute of Technology
MORS	Military Operations Research Society
MS&G	modeling, simulation, and gaming
NDU	National Defense University
NWC	Naval War College
OR	operations research
pol-mil	political-military
Ret.	retired
SAIC	Science Applications International Corporation
SME	subject-matter expert
UK	United Kingdom
USA	U.S. Army
USAF	U.S. Air Force
USMC	U.S. Marine Corps
USN	U.S. Navy
WG	wargame, wargaming

Appendix E: Documents

DEPUTY SECRETARY OF DEFENSE
1010 DEFENSE PENTAGON
WASHINGTON, DC 20301-1010

MAY 0 8 2015

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
COMMANDERS OF THE COMBATANT COMMANDS
DIRECTOR, COST ASSESSMENT AND PROGRAM EVALUATION
DIRECTOR, NET ASSESSMENT

SUBJECT: Wargaming Summit Way Ahead

We are entering a critical period for the United States. While resetting and reconstituting the Joint Force after 13 years of war, we must turn our attention to numerous emerging challenges to U.S. global leadership. In this dynamic environment, Department leaders are now making important programmatic decisions to meet these challenges. Wargaming is an important means of informing those decisions and spurring innovation.

Accordingly, Vice Chairman Winnefeld and I co-hosted a Wargaming Summit on April 23, 2015, to explore how we could better align the wargaming enterprise with Department decision-making. As a result of feedback from summit participants, I direct the following tasks:

First, in order to understand the existing capacity and capability available throughout the wargaming enterprise, all Services, Combatant Commands, and wargaming centers will populate a wargaming repository with information about wargaming organizations and available tools, as well as a summary of recent and planned wargames (2014-2016). The information on wargaming organizations will include associated personnel, funding, and focus. Cost Assessment and Program Evaluation (CAPE) will make the initial instantiation of the wargaming repository available on May 11, 2015 at https://wargaming.osd.smil.mil/home. The Repository should be populated no later than July 31, 2015. CAPE will use the list of available tools to identify methodological gaps, which will help prioritize tool development.

Second, the Joint Staff, CAPE, and Office of Net Assessment (ONA) will use this data to summarize wargame findings for the three wargaming horizons (1st FYDP, 2nd and 3rd FYDP and 4th FYDP and beyond). The Joint Staff will then synthesize findings across all time horizons, integrate those findings with the existing lessons learned database, and report relevant findings to senior stakeholders in the Department on a regular basis.

Third, the Joint Staff, Policy, CAPE, and ONA "Wargaming Quad Chairs" will refine the alignment and incentive concepts based on senior stakeholders' feedback provided at the summit. My intent is to form a Defense Wargaming Alignment Group (DWAG) to better link wargames with senior leader priorities, with a strong focus on information dissemination. With input from the DWAG, the wargaming enterprise will be designed to share senior leader priorities with wargame sponsors and the community of practice, incentivize wargames associated with those priorities,

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collect and shares wargaming best practices, and highlight wargame results in appropriate senior leader forums. The Quad Chairs will coordinate with the Services, Combatant Commands and other stakeholders to develop and review the alignment and incentive concepts and present them to the DWAG. If this structure and process produces useful results, it will be codified in a subsequent Department of Defense Directive.

Fourth, we will use wargaming to reinvigorate Support for Strategic Analysis (SSA). Policy will run wargames to inform SSA scenario development; the Joint Staff will run wargames to inform SSA Concepts of Operation and forces development; and CAPE will manage the development of force capability and capacity excursions in SSA scenarios to allow a broader exploration of risks and solutions.

Fifth, the Wargaming Quad Chairs in concert with the Services, will develop a proposal for a senior wargaming series by June 1, 2015. A representative example of this would be a Defeat/Deny Table Top Exercise. The Joint Staff and Policy will also work with the Combatant Commands to use wargaming to support operational plan review. The intent is for wargaming to become a standard element of the plan review process.

I intend to stay engaged throughout the process and work with other senior stakeholders within the Joint Staff, Services, and Combatant Commands on reinvigorating wargaming by connecting and aligning our efforts. In addition, I will schedule a wargaming Deputies Management Action Group this summer and convene a follow-on summit within six months to review progress and determine any course corrections needed to improve the process.

DEPUTY SECRETARY OF DEFENSE
1010 DEFENSE PENTAGON
WASHINGTON, DC 20301-1010

FEB 09 2015

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
VICE CHAIRMAN OF THE JOINT CHIEFS OF STAFF
CHIEFS OF THE MILITARY SERVICES
CHIEF OF THE NATIONAL GUARD BUREAU
COMMANDERS OF THE COMBATANT COMMANDS
DIRECTOR, COST ASSESSMENT AND PROGRAM EVALUATION
DIRECTOR OF THE DEFENSE INTELLIGENCE AGENCY
DIRECTOR, NET ASSESSMENT

SUBJECT: Wargaming and Innovation

I am concerned that the Department's ability to test concepts, capabilities, and plans using simulation and other techniques—otherwise known as wargaming—has atrophied. To most effectively pursue an innovative third offset strategy, avoid operational and technological surprise, and make the best use of our limited resources, we need to reinvigorate, institutionalize, and systematize wargaming across the Department. Reinvigorated wargaming across the defense enterprise fits within the Defense Innovation Initiative, which aims to bolster the credibility of U.S. security guarantees at home and abroad through innovative and agile thinking and actions.

Military-relevant systems and technologies are changing quickly and new tactical and operational challenges are intensifying and proliferating, all during a period of fiscal pressure. During similar periods of technological and geostrategic flux, wargaming proved to be a useful tool both for improving our understanding of complex, uncertain environments and the changing character of warfare. When done right, wargames spur innovation and provide a mechanism for addressing emerging challenges, exploiting new technologies, and shaping the future security environment. They can potentially make the difference between wise and unwise investment trajectories and make our forces more successful in future conflicts.

Our new wargaming program will focus on three time horizons: near-term (0-5 years); mid-term (5-15 years); and long-term (beyond 15 years). Near-term wargaming will focus on the execution and improvement of current operational plans and the reinvigoration of Joint combined-arms expertise. While an important purpose of these wargames will be to enhance current concepts of operation, they will also help expose problems and solutions applicable in both the near- and mid-term, including the development of innovative operational and logistical approaches. Led by the Combatant Commands (COCOM) and Services with Joint Staff and Policy oversight and support, this effort should consider the use of workshops, red-teaming, table-top exercises (TTXs), and modeling and simulation to provide direct input to plans, programs, power-projection experiments and demonstrations, and rapid prototype development.

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Mid-term wargaming will focus on the development of new capabilities as well as operational and organizational concepts (for example, joint power projection in anti-access/area-denial environments), with an eye toward incorporating innovative approaches or technologies into the future force and identifying potential portfolio offsets. A reinvigorated Support for Strategic Analysis (SSA) process will continue to incorporate wargaming and will also seek innovative approaches to support the broader Departmental effort. SSA scenarios and Concept of Operations (CONOPS) will provide a basis for a wide range of wargaming to inform concept development and force planning. The output of these wargames will be a feedback mechanism for refining existing SSA products. Led by the Joint Staff with significant participation from Policy, Cost Assessment and Program Evaluation (CAPE), COCOMs, and the Military Departments, this effort will rely primarily upon workshops, seminar-style wargames, and portfolio-rebalancing exercises, while using modeling and simulation where feasible. These wargames will leverage SSA-approved scenarios, future projected U.S./adversary orders of battle, and analytic tools as starting points for operational innovation.

Long-term wargaming, like that of the mid-term, will assess the operational impacts of technology trends, future challenges, and military competitions. Led by Net Assessment, it will use this information to identify how the Department might exploit new opportunities, hedge against potential discontinuities, and craft long-term competitive strategies.

These broad guidelines will allow for Department-wide, cross-game analysis in each of the notional time frames, which will be compiled and analyzed by designated leads for regular reports to senior leadership concerning the health and balance of the enterprise. I am particularly interested in wargaming the kinds of challenges that cross COCOM responsibilities in order to better address threats that would benefit from a more global strategic perspective. Discipline and structure in the wargaming enterprise will ensure accountability, flexibility and balance. Incentives must exist within each tier to stimulate the exploration of innovative approaches and longer-term looks. All wargaming should adhere to a broad set of guidelines concerning strategic and operational scenarios, blue and red force structure, and the wargame's experimental design. Institutions and time frame leads should also work to advance the wargaming state-of-the-art by using pathfinder wargames that incorporate innovative approaches, and throughout we need to make red-teaming endemic to our approach and work to advance the quality and impact of red teams as part of a broader Departmental approach to innovation.

Wargaming across different time horizons will also serve a crucial educational function by bringing together teams of defense professionals to think critically about potential future challenges. Therefore, I encourage the Military Departments to reinvigorate wargaming in Professional Military Education to restore their historical role as a source of doctrinal innovation. Promoting operational excellence and strategic thinking among students in this way will generate ideas and insight that can directly inform policymakers. In that same way, effort must be made to incorporate commercial and defense industry expertise into the larger wargaming effort. Integrating disparate institutions and approaches into a broader, more purposeful Departmental wargaming enterprise will ensure its vitality and flexibility.

Wargaming, in concert with operational analysis, and experimentation, cannot stand apart from the budget process; rather, it should feed into other dimensions of strategy development as

well as our Planning Programming, Budgeting and Execution (PPBE) process. Insights will inform portfolio-rebalancing exercises, competitive strategy path games, and senior leader decision-making. Portfolio-rebalancing exercises will examine how trades might be made across research and development, force structure, procurement, and readiness accounts over the next two decades to better align the joint force to the challenges posed by the future security environment. In particular, a hybrid approach that combines seminar-style wargaming with portfolio-rebalancing exercises would be a highly effective means to identify deficiencies in the current program and potential budget offsets. Initial findings will be integrated into the PB17 Program and Budget Review to ensure we have a strategy-driven budget.

Our wargaming program will need your attention and involvement to be successful. Within forty-five days I will convene a wargaming summit co-chaired by the Vice Chairman of the Joint Chiefs of Staff. We will collectively discuss the key elements of this initiative and establish the broad guidelines that will be applied across the planning horizons.

Innovation can be highly disruptive and creates relative winners and losers. It thrives in a culture that embraces experimentation and tolerates dissent and risk-taking. We must generate an environment that encourages exactly this type of thinking, and building a reinvigorated wargaming enterprise will be a major step forward. I look forward to working with each of you on this important initiative.

DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
2 NAVY ANNEX
WASHINGTON, DC 20380-1775

MCO 1500.55
C46MS
12 Apr 97

MARINE CORPS ORDER 1500.55

From: Commandant of the Marine Corps
To: Distribution List

Subj: MILITARY THINKING AND DECISION MAKING EXERCISES

1. Purpose. To implement Military Thinking and Decision Making Exercises throughout the Marine Corps.

2. Background

a. There is a critical need for all Marines to prepare themselves mentally and physically for the rigors of combat. Physical preparation has long been ingrained in our culture and Marines are well known for their physical conditioning. Mental preparation needs to receive the same emphasis. Since success in combat depends in large part on our collective capability to make and execute effective military decisions under physical and emotional stress, it is imperative that all Marines make every effort to exercise and develop their decision making abilities.

b. Two means by which decision making skills could be developed are through the use of tactical decision games and through daily discussions about warfighting. This Order brings these two together in a single, wide ranging program entitled Military Thinking and Decision Making Exercises.

c. Knowledge gained through individual reading and study provides the intellectual framework for warfighting study and the raw material necessary to develop critical thinking skills. This Order outlines the means to hone that raw material by daily exercise.

d. The use of technological innovations, such as personal computer (PC)-based wargames, provide great potential for Marines to develop decision making skills, particularly when live training time and opportunities are limited. Policy contained herein authorizes Marines to use Government computers for approved PC-based wargames.

e. Decisions made in war must frequently be made under physical and emotional duress. Our mental exercises in peacetime should replicate some of the same conditions. Imaginative

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MCO 1500.55
12 Apr 97

combinations of physical and mental activities provide Marines the opportunity to make decisions under conditions of physical stress and fatigue, thereby more closely approximating combat.

3. Resources. The following resources are available:

a. Professional periodicals and journals, such as the Marine Corps Gazette (which publishes a monthly Tactical Decision Game) and Leatherneck Magazine, provide a wide selection of articles and vignettes to stimulate warfighting discussions. Commercial books and board-based wargames provide excellent scenarios for this program. Many of these commercial products, as well as the professional reading list, are available through the Marine Corps Association and base libraries.

b. The Marine Corps University's Staff Ride Handbook enables Marines to organize on-site studies of battlefields. Designing Tactical Decision Games: A Tactical Decision Games Workbook, another Marine Corps University product, teaches Marines how to write useful and thought-provoking exercises. These resources are available electronically via the Internet from the Marine Corps University.

c. The Marine Corps Modeling and Simulation Management Office, Training and Education Division maintains the PC-based Wargames Catalog of commercial computer wargames which have been evaluated and found suitable for Marine Corps use. This office also identifies customized commercial games for specific Marine Corps usage and is developing additional customized and original wargames. These resources are also available electronically via the Internet from the Marine Corps Modeling and Simulation Management Office.

4. Policy

a. Regardless of MOS, duty assignment, or location, Marines will participate in daily Military Thinking and Decision Making Exercises.

b. All commanders and staff supervisors have a fundamental leadership responsibility to implement this policy and allocate resources for implementation. Accordingly, commanders and supervisors will develop and institute programs that will institutionalize daily warfighting discussions within their respective organizations.

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12 Apr 97

c. The Commanding General, Marine Corps Combat Development Command will provide Military Thinking and Decision Making Exercises materials to support the above efforts and continue development of new training tools. Individual Marines and units are encouraged to identify or develop additional Military Thinking and Decision Making Exercises training resources and submit them to Commanding General, Marine Corps Combat Development Command, (Marine Corps Modeling and Simulation Management Office), 2006 Hawkins Avenue, Quantico, VA 22134-5069 for Marine Corps validation and distribution.

d. Use of PC-based wargames on Government computers is the subject of some necessary restrictions. This Order supersedes previous policy which prohibited playing of games on Marine Corps computers. Commanders may now authorize the use of government computers for the games listed in the PC-based Wargames Catalog. Marines finding games which support Military Thinking and Decision Making Exercises objectives can request approval for their use by submitting a recommendation, complete with supporting justification, to Commanding General, Marine Corps Combat Development Command (Marine Corps Modeling and Simulation Management Office), 2006 Hawkins Avenue, Quantico, VA 22134-5069. Software installed on Government computers must be legitimately procured and licensed in accordance with all copyright restrictions. To avoid introduction of computer viruses, only commercial shrink-wrapped software or software downloaded from trusted Government network sites shall be installed. The unit S-6/G-6 must be consulted before installing software to avoid impact on mission-essential operations and network traffic.

5. Action

a. Commanding Generals, Commanding Officers and Officers-in-Charge. Develop and implement Military Thinking and Decision Making Exercises program. Ensure PC-based wargames are employed consistent with the policy delineated above.

b. Commanding General, Marine Corps Combat Development Command

(1) Assume responsibility for the development, exploitation, and approval of PC-based wargames. In addition, maintain the PC-based Wargames Catalog on the Internet accessible via a world wide web browser. As new games are reviewed and approved, update the on-line catalog providing Marines the most current information. Collect and post Military Thinking and Decision Making Exercises materials and information on the Internet as they become available from Marine Corps schools and organizations.

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12 Apr 97

(2) Assume responsibility for Designing Tactical Decision Games: A Tactical Decision Games Workbook and the Staff Ride Handbook. Incorporate material from these publications into the curriculum at Marine Corps University schools. Determine distribution and review the guides periodically for currency and continued relevance.

c. Public Affairs Officers. In concert with local commanders, provide a forum in base publications for sharing ideas and experiences related to Military Thinking and Decision Making Exercises.

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SECRETARY OF DEFENSE
1000 DEFENSE PENTAGON
WASHINGTON, DC 20301-1000

NOV 15 2014

MEMORANDUM FOR DEPUTY SECRETARY OF DEFENSE
SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
DEPUTY CHIEF MANAGEMENT OFFICER
CHIEFS OF THE MILITARY SERVICES
CHIEF OF THE NATIONAL GUARD BUREAU
DIRECTOR, COST ASSESSMENT AND PROGRAM EVALUATION
DIRECTOR, OPERATIONAL TEST AND EVALUATION
GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE
INSPECTOR GENERAL OF THE DEPARTMENT OF DEFENSE
ASSISTANT SECRETARIES OF DEFENSE
DEPARTMENT OF DEFENSE CHIEF INFORMATION OFFICER
ASSISTANTS TO THE SECRETARY OF DEFENSE
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: The Defense Innovation Initiative

I am establishing a broad, Department-wide initiative to pursue innovative ways to sustain and advance our military superiority for the 21st Century and improve business operations throughout the Department. We are entering an era where American dominance in key warfighting domains is eroding, and we must find new and creative ways to sustain, and in some areas expand, our advantages even as we deal with more limited resources. This will require a focus on new capabilities and becoming more efficient in their development and fielding.

At a time of constrained and uncertain budgets, the demand for innovation must be Department-wide and come from the top. Accordingly, I am directing Deputy Secretary of Defense Bob Work to oversee this effort. He will report back to me quarterly on progress we have made, and I will remain actively involved in overseeing all aspects of this effort.

We have always lived in an inherently competitive security environment and the past decade has proven no different. While we have been engaged in two large land mass wars over the last thirteen years, potential adversaries have been modernizing their militaries, developing and proliferating disruptive capabilities across the spectrum of conflict. This represents a clear and growing challenge to our military power.

I see no evidence that this trend will change. At the same time, downward fiscal pressure will constrain the way we have traditionally addressed threats to our military superiority and demand a more innovative and agile defense enterprise. We must take the initiative to ensure that we do not lose the military-technological superiority that we have long taken for granted.

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History is instructive on this 21st Century challenge. The U.S. changed the security landscape in the 1970s and 1980s with networked precision strike, stealth, and surveillance for conventional forces. We will identify a third offset strategy that puts the competitive advantage firmly in the hands of American power projection over the coming decades.

We must accelerate innovation throughout the Department in several linked areas:

- The 21st Century requires us to integrate leadership development practices with emerging opportunities to re-think how we develop managers and leaders.
- A new long-range research and development planning program will identify, develop, and field breakthrough technologies and systems that sustain and advance the capability of U.S. military power.
- A reinvigorated wargaming effort will develop and test alternative ways of achieving our strategic objectives and help us think more clearly about the future security environment.
- New operational concepts will explore how to employ resources to greater strategic effect and deal with emerging threats in more innovative ways.
- This effort will include many DoD components, particularly Policy; Acquisition, Technology and Logistics; Intelligence; the Joint Chiefs of Staff; and the Military Departments.
- Finally, we need to continue to further examine our business practices and find ways to be more efficient and effective through external benchmarking and focused internal reviews.

All these areas will be overseen, integrated, and managed by an active and engaged governance structure led by Deputy Secretary Work which will include the Department's senior leaders. Their focus will be to ensure these combined initiatives achieve maximum traction in our system, that institutional barriers are overcome, and that our Department rapidly integrates real concepts and capabilities to improve its effectiveness.

America's continued strategic dominance will rely on innovation and adaptability across our defense enterprise. This will build the foundation for American leadership well into the 21st Century. I consider this a catalyzing effort that will spread and grow throughout the entire Department.

Thank you.

THE SECRETARY OF THE NAVY
WASHINGTON DC 20350-1000

May 5, 2015

MEMORANDUM FOR CHIEF OF NAVAL OPERATIONS
COMMANDANT OF THE MARINE CORPS

SUBJECT: Wargaming

Wargaming is an invaluable method used to assess new ideas, question existing practices, stimulate innovation, and develop new operational concepts in a risk-friendly environment. This type of exercise informs national policy, prepares our warfighters for successful combat operations, and contributes to the development of our Sailors and Marines as professionals and as strategic thinkers. The wargaming approach can be used at all command levels and across every mission area in the Department of the Navy (DON).

We must evolve our approach to wargaming so that it contemplates the future challenges our Sailors and Marines will encounter, and the types of decisions they must make. In order to do so, the Navy and Marine Corps shall:

- Establish a virtual community of practice for Sailors, Marines, and Civilians with an interest in wargaming to further develop and expand this competency across the DON.
- Conduct a series of smaller, iterative analytic games in FY 2016-17 to better inform naval strategy development, campaign analyses, and fleet experimentation. These events will include key leaders and junior officers from across the DON.
- Ensure wargaming influences the Planning, Programming, Budgeting and Execution System process.
- Reestablish the Office of Naval Research Technology Innovation games.
- Incorporate emerging technology, probabilistic models, and data analytics into gaming techniques.
- Establish a mechanism to share actionable insights from wargames across the department, with a particular focus on cross-event and longitudinal analysis.

Diversity of thought is fundamental to game design and execution. Using the inventive thinking of the DON workforce – from all ranks, backgrounds, and professional and academic communities – we will create solutions to complex problems and significantly enhance the outcome of games.

SUBJECT: Wargaming

The Services will develop an integrated, detailed implementation plan, reviewed and approved though the Naval Board, to the Under Secretary of the Navy no later than September 30, 2015.

Ray Mabus

cc:
USN
ASN's
DUSN's
DoD GC
DA&M
JAG
NAVINSGEN
DNS
AUDGEN
NCIS
DMCS
DON/AA
DONCIO
DON SAPRO
OIG
OLA
CNR
OSBP
CHINFO

2

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LBS Consultancy. lbsconsultancy.co.uk. (Articles on military wargaming, primarily in the United Kingdom.)

PAXsims (blog). paxsims.wordpress.com. (Articles on wargames applied to conflict resolution, as well as military operations.)

StrategyPage. www.strategypage.com. (This site covers contemporary military affairs, military history, and wargaming—defense, recreational, and to some extent, educational.)

Wargaming Connection (blog). wargamingcommunity.wordpress.com. (Principally dialogues between wargaming practitioners.)

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Colonel Caffrey is the designer of AFMC's Agile Combat Support science and technology wargame, the AFRL / Royal Air Force Agile Combat Support science and technology wargame, the Air Force Research Laboratory wargame, the Engineer/Strategist Exercise, the Joint Resource Allocation Exercise, the Joint Deployment Employment Exercise, and several others.

He is a coauthor (with Frank Chadwick) of *Gulf War Fact Book* (Normal, IL: Game Designers' Workshop, 1991) and has written several chapters and many articles on wargaming, airpower, and defense issues. He has spoken on wargaming at the German War College, at the United Kingdom's Defence Research Establishment, and in the United States from the Pentagon to Silicon Valley. A former member of the Air University Red team, he has served on Blue, Red, or White teams for Air Force, Navy, and Army Title 10 wargames.

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