Naval War College Review

Volume 43
Number 1 *Winter*

Article 12

1990

Book Reviews

The U.S. Naval War College

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Recommended Citation
War College, The U.S. Naval (1990) "Book Reviews," *Naval War College Review*: Vol. 43 : No. 1 , Article 12.
Available at: https://digital-commons.usnwc.edu/nwc-review/vol43/iss1/12

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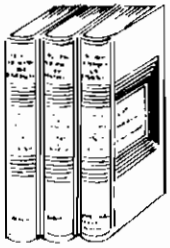
PROFESSIONAL READING



A book reviewer occupies a position of special responsibility and trust. He is to summarize, set in context, describe strengths, and point out weaknesses. As a surrogate for us all, he assumes a heavy obligation which it is his duty to discharge with reason and consistency.

Admiral H.G. Rickover

Frank C. Mahncke

Hawking, Stephen W. *A Brief History of Time*. New York: Bantam Books, 1988. 198 pp. $18.95

One of the magnificent characteristics of the human intellect is its ability to engage in an open-ended quest for understanding of the universe not for gain but for knowledge alone. This is the life and work of Stephen Hawking, professor of mathematics at Cambridge University and inheritor of Issac Newton's chair (This is appropriate, for Hawking is widely regarded as the most profound physicist of the 20th century).

Although Hawking's body is cruelly crippled by amyotrophic lateral sclerosis, his mind is at the very edge of human understanding of the physical origin of the universe. His research in fundamental physics is directed at that deceptively simple question, How did the universe form and why is it like it is? In this short but important book, his objective is to give to the average reader a qualitative grasp of the physical ideas that hold the answer to that question.

Forswearing all equations save Einstein's—for his editor told him that each equation would halve the book's sales—Hawking leads us through the wondrous world of physics and ideas about the formation, state, and fate of the universe. He begins with the first-cause concept so central to the history of Western science: "Within the universe, you always explained one event as being caused by some earlier event, but the existence of the universe itself

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could be explained in this way only if it had some beginning." Thus the question becomes, What was the beginning?

In searching for the answer to that question, Hawking's intellect and the work of experimental physicists have pushed the edge of our knowledge back to the smallest fraction of time between the big bang and the formation of the laws of physics as we now understand them. From space and time universe as we can imagine, is the domain of modern physics. It is filled with black holes, strings, virtual mass, quarks, and curved spaces, each of which leads Hawking to show us the most intriguing ideas.

Consider black holes. The remains of a collapsed star, a black hole is a chunk of matter so dense that its gravitational field will pull into it anything that comes near. Passing light is bent towards it and no light can escape. Thus no information or sense of it can reach us, yet we know it is there.

If the universe began with a big bang from which all interchangeable matter and energy were flung out to form the universe, will the universe eventually reverse its direction and fall back into a big crunch? Hawking describes the search for the mass needed to generate the gravitational force necessary to overcome the present outward movement of all the universe. How indeed can a universe be expanding equally in all directions with the farthest parts departing most rapidly? Think of a balloon. As you blow it up, every point on its surface moves away from every other point no matter from where on the balloon's surface you observe.

Why does time move in the direction we observe? Because entropy moves it in that direction. Increasing entropy is increasing disorder. For the layman and parent, proof of the universality of entropy lies in the simple observation of a teenager's room. That the arrows of time and entropy are parallel is demonstrated by the falling teacup. We see it fall and break, but we cannot see it assemble itself and leap from the floor to the table. When it comes to imaginary time, only a physicist of Hawking's expository skill can enable us to accept the reality of that concept.

Ere we think that modern man has imposed order on the universe, consider the computer memory. Vast order is put into it, but the act of putting order there requires electrical energy. Hawking demonstrates that "this energy is dissipated as heat, and increases the amount of disorder in the universe. One can show that this disorder is always greater than the increase in the order of the memory itself." Thus this review, written on a computer, has increased the disorder of the universe.

At the microscopic end of all this is the wonderful world of the quark, that apparently fundamental subatomic particle from which are constructed neutrons and protons. They in turn are surrounded by the laws of chance, more commonly known as electrons. The electron is an ephemeral thing: sometimes seeming a particle of no mass, sometimes a wave, sometimes a shell bound by the laws of chance, sometimes a packet of energy existing

everywhere and nowhere. Hawking is at ease with these seeming contradictions and shows us how each is equally useful and leads to a better understanding of the larger concepts.

One of the unique aspects of subatomic physics is that each subatomic particle is first postulated as a necessary condition to satisfy higher level observations and then found by clever experiments. For readers of this review, it is worth noting that one of the first crucial experiments in modern physics, the determination of the invariance of the speed of light, was done by Albert Michelson of naval and Nobel fame.

Ultimately, Hawking ties all this together in the two great themes of modern physics: the search for an understanding of the origin and fate of the universe, and the search for a grand unified theory. The latter, which has attracted but eluded physicists throughout the 20th century seeks to link the four fundamental forces of physics: gravity, which causes Newton's apple to fall and the planets to remain in orbit; the electromagnetic force, which governs all that we know as electricity and magnetism; the weak nuclear force, which gives rise to radioactivity; and the strong nuclear force, which binds the atomic nucleus. Gravity is the problem; though apparently simple, it does not seem to yield to the laws of quantum theory. Hawking poses and dissects the question, Can we get there or is the search confined to one of better and better approximations?

Physicists seem closer to understanding the origin of the universe than its ultimate fate. There are several promising theories to account for how that dense and homogeneous cauldron of energy and mass at the big bang clumped itself into the bits of discontinuity that have become the galaxies, suns and planets. If we can get our minds into that initial microsecond after the big bang, we will have come close to the mind of God. Physics, as Hawking describes it, may ultimately tell us how it began and where it goes. Religion and philosophy tell us how to comport ourselves along the way.

Reading Hawking is like his search for the grand unified theory of physics: it requires great imagination, and a complete understanding seems near but always elusive. Along the way, one deals with the most extraordinary and challenging ideas and concepts. For these alone, the trip is worth the intellectual exercise.

Gleick, James. *Chaos: Making A New Science*. New York: Penguin Books, 1987. 352pp. $8.95

In the spring of 1919, legend has it, two veteran sergeant-majors from the Austro-Hungarian army met in a Viennese cafe. After tearful embraces, they began to reminisce. Recalling their glory days, they waxed nostalgic about the shined

shoes of the enlisted, the polished swords of the officers, the brushed splendor of the horses. "What an army!" exclaimed Hans. "Yes," said Franz. "And what did they do with that army?" asked Hans. "They sent it to war!" cried Franz.

The story is intended to poke fun at the military, but it could serve equally well for ridiculing much of science. In both cases, there is an unspoken differentiation between the manageable and the unmanageable, the predictable and the chaotic. Science, like the military, has traditionally preferred the orderly and the predictable. Both establish artificial and arbitrary rules for maintaining control. Whenever reality intrudes into either domain, whether in the form of war for the soldier or nonlinearities for the scientist, the explosion of understandable phenomena into new, unexpected behaviors has mostly been dismissed as "noise."

Unfortunately, the world beyond parade grounds and textbooks has more noise than order. For that reason, both conventional military machines and traditional scientific disciplines have had a rough time in the twentieth century. Neither has been able to escape with its contrived idealizations unscathed. The story of how science is responding to punctured illusions is told in James Gleick's *Chaos: Making A New Science.* It is a story rich with lessons for the military.

Written with style and verve by a well-informed *New York Times* reporter, this history of the "chaos revolution" begins about a generation ago when several scientists and mathematicians began to encounter strange bodies of data and to generate new concepts. Straddling the boundaries of established disciplines, they were all rebelling against professional restraints, excessive quantification, and irrelevant theorizing. Inspired to find underlying uniformities between the sciences, to deepen their qualitative understanding, and to make practical contributions, men like Edward Lorentz, Stephen Smale, James Yorke, and Christopher Shaw independently, and sometimes unwittingly, stumbled into new ways of thinking. Their ideas often depended upon the increasing computational power of electronic computers, whose graphic capacities helped make the chaos revolution possible.

Advanced computers could create visual images of immensely complex phenomena. The results bore little resemblance to traditional scientific or mathematical charts and graphs. Indeed, they looked "chaotic." But beneath the appearance of disorder, scientists found hidden patterns. These patterns were irregular, their details never exactly repeating themselves, and they leaped from place to place in unpredictable ways. Despite the deep structure, catastrophic effects were often precipitated by insignificant causes. Many of these results resembled the earsplitting, mind-destroying screeches caused by positive feedback in public address systems—or, perhaps, the sounds of battle.

The science of chaos deals with such unpredictable leaps and nonlinear relations in a logical manner. It is a branch of dynamical systems theory, which describes systems whose evolution is controlled by deterministic rules. It deals with peculiar kinds of "attractors"—the geometric forms toward which these processes are drawn—and with the dramatic transitions, the "bifurcations," occurring when complex structures evolve to new levels of complexity. Remarkably, these geometrical beasts seem to describe the kinds of realities that previously eluded scientific analysis: examples include the weather, the rhythmic behavior of animal hearts, and the firing of neurons in brains.

It is possible that complex social structures, ranging from battles through institutions to civilizations, may also be chaotic attractors. All are self-organizing processes whose iterated behavior can become incredibly complex even when the rules directing it are relatively simple and clear. The navy has used the science of chaos effectively in technical applications, e.g., naval architecture, but only a few pioneers, such as Gottfried Mayer-Kress at Los Alamos and The University of California, Santa Cruz, have begun to examine complex human experiences. Mayer-Kress' work on arms races, however, indicates that this new science has reached the level of subtlety necessary to probe social processes accurately.

Successes like these, combined with readable volumes like Gleick's, are bound to create a chaos fad. Such bandwagon effects, themselves examples of chaos, are usually to be lamented because they are fueled by assumptions that some new ideal will solve all the world's problems. But chaos has built-in checks on excess enthusiasm, which make the prospects of popularity less dangerous than usual. Chaos, for instance, tells military planners that there are obstacles—not just limitations—to predictability. Even though the formulas are deterministic, the behavior characterizing chaotic attractors is inherently unpredictable. Complex structures laced with nonlinearities, they are so sensitive to knowledge of initial conditions that even the slightest observational error will quickly lead to unpredictable results. Thus, no true believer can deceive us with claims that chaos models make long-range predictions certain.

If the new science will not enable us to control the world, why, then, all the hubbub? I think the reasons are threefold. First, the models produce beautiful pictures (some of which are included in Gleick's book), and esthetic considerations often drive scientific enthusiasms. Second, planners and executives see in chaos a device for locating the deep structures hidden in extremely complex phenomena, while the obstacles to prediction reinforce the value of their otherwise inarticulable "gut reactions." Finally, and most importantly, the results of analyzing problems using chaos models vastly deepen our appreciation of natural

and social processes. We may not be able to control events, and every run made by our computers may produce different results, but when we study these models and their results we can begin to understand intellectually what was previously appreciable only after years of experience.

The computer programmed with chaos models may be the peacetime substitute for experience that was lacking in the Austro-Hungarian Empire—and the Cold War Pentagon. It is a school whose knocks are realistic without being devastatingly hard. Chaos models have the ability to show us how the unpredictable happens; they remind us that information is generated bottom-up, from the "bloomin' buzzin' confusion" of thermodynamic reality. Using chaos models may even nurture concepts of leadership more attuned to the demands of a technologically dynamic, continually evolving environment.

Gleick's book introduces readers to some of the subtleties, most of the themes, and all of the major figures involved in the chaos revolution, but it does not show how the science of chaos can be practically applied. There are no mathematics here. However, the book will whet appetites for similar works.

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O'Connell, Robert L. *Of Arms and Men: A History of War, Weapons, and Aggression*. New York: Oxford Univ. Press, 1989. 367pp. $24.95

Evangelista, Matthew. *Innovation and the Arms Race: How the United States and the Soviet Union Develop New Military Technologies*. Ithaca, NY: Cornell Univ., 1988. 300pp. $34.95

Given the proliferation of books addressing the relationship between technology, weapons, and warfare, a good historiographical introduction would be a welcome addition to one of them. Although Robert L. O'Connell's *Of Arms and Men* features no such introduction, it does contain a prefatory justification for its existence. As a historian, civil servant and member of the U.S. delegation to the Conference on Disarmament in Geneva, O'Connell was dissatisfied with the way weapons had been studied. He was predisposed to believe "that the relationship between man and his weapons is a great deal more intimate and complex than heretofore has been admitted." Our intimacy with weapons has developed over the millennia and is more the consequence of prehistoric man's existence in a state of nature (the hunt) than our experience with total war. O'Connell examines how these aptitudes have governed innovation and warfare from ancient Sumeria to the present.

The particular insight which distinguishes Mr. O'Connell's work from others is his examination of human belligerence from a perspective normally reserved for anthropologists and biologists. Central to his analysis is the distinc-

tion they draw between predatory aggression and intraspecific aggression (i.e., aggression among members of the same species).

Although O'Connell advises his readers that the question requires much more work, he nevertheless believes that it is instructive to compare our warlike proclivities with those of other animals. He notes that animals normally prey upon other species, but largely ritualize and consequently minimize the lethality of aggression within their own species (the piranha, for example, uses its teeth against other species, but strikes other piranhas with its tail fin). Man, however, is not only a predator of other animals, but also preys upon his fellow man to a degree which distinguishes him from other animals. Nevertheless, O'Connell focuses his attention upon the body of evidence which indicates that man often has chosen intraspecific restraint.

Controlled aggression within our species probably existed long before Homer's *Iliad* dramatized and imprinted it in our collective memory. Yet it was Homer's heroes, fighting in close, face-to-face combat against worthy opponents of equal rank, using similar weapons on a neutral field (away from women and children), who captured the European imagination. The warrior ethic of the Ancient Greeks influenced the martial activities of both the Roman legionaries and the Medieval knights (whose choice of the lance over the more lethal crossbow, O'Connell asserts, was attributable to that ethic).

The gunpowder revolution all but nullified this heroic code. Soldiers became subordinate to weapons, wars were fought at greater, impersonal distances, and massive firepower created casualties of staggering proportions. Yet evidence of our intraspecific impulses persisted well into the twentieth century. These impulses influenced us to build dreadnoughts rather than submarines ("the whole manner of its attack implied skulking, treachery, and deception — qualities warriors traditionally disdained"), and directed aircraft technology towards the heroic (and relatively non-lethal) dogfight. But technology, predictably, surmounted such intraspecific constraints. Submarine warfare became acceptable, the airplane was utilized for bombing cities ("wholesale warfare against noncombatants"), and in the end, nuclear weapons were not only developed but actually used at Hiroshima and Nagasaki.

Given the focus of his study, O'Connell cannot offer us much hope. Notwithstanding the weak optimism of his final chapter, one concludes that nuclear weapons will probably be used again.

Matthew Evangelista's *Innovation and the Arms Race* offers us a startling alternative. Although he confines his analysis to the events of the last forty years, Evangelista's attempt to discover a "parsimonious" theory to explain the Soviet-American arms

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race is as much all-inclusive as it is reassuring.

In brief, the professor (political science, University of Michigan) demonstrates that the United States, with its strong, diverse economy and decentralized political system, has a high capacity for innovation. Having high incentives, U.S. scientists normally initiate the process of weapons innovation by promoting their latest discoveries. At a second stage, the scientists generate interest within the military-technical community, often by advertising the new technology as all things to all people. At the third stage, the technology becomes a weapon. Advanced research and development is authorized, and bureaucratic turf battles erupt over whose weapon (and of what specific type) it will be. In the fourth stage, external threats (real or projected) are cited as justification for production of a certain weapon by a specific military service, and production of prototypes is authorized. At the fifth stage the weapon's promoters seek high-level endorsement in order to begin large-scale production.

In the Soviet Union (a weaker economy with a centralized political system), scientists seldom initiate the innovative process. They have almost no incentive to take risks, while numerous disincentives exists. There is almost no analogous second-stage consensus building, because the Soviet state's penchant for secrecy bottles up the few low-level ideas that emerge. Thus the initiative to innovate usually occurs at the third stage, and after the Soviet leadership becomes aware of an external threat. They usually respond by directing short-term counters to the threat and approve long-term plans of symmetrical weapons development. At the fifth stage, large-scale production begins. Eventual quantitative superiority is the normal result.

Having introduced the reader to his theory, Evangelista then grounds it in a case study of the origins of tactical nuclear weapons, a study that consumes almost half of the book. He then devotes a chapter to examining the extent to which the histories of other American and Soviet weapons fit the theory. With but a few exceptions, they do.

Evangelista's study persuasively demonstrates not only that the United States has driven the arms race, but also that the United States consistently has "fallen victim to the fallacy of the last move — the belief that the Soviets would not choose, or would not be able, to match a U.S. initiative in the arms race." He therefore proposes a different approach: The U.S. should accept limits upon its technology in return for Soviet limits on quantity (e.g., Star Wars technology for SS-18 missiles).

Evangelista's study does contain a few shortcomings. It addresses neither the matter of incremental innovation nor the process which brings U.S. scientists to one discovery rather than another. Nevertheless, *Innovation and the Arms Race* is an extremely important work. Not only

is Matthew Evangelista's theory parsimonious, it is also definitive.

WALTER C. UHLER
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Moodie, Michael. *The Dreadful Fury: Advanced Military Technology and the Atlantic Alliance*. New York: Praeger, 1989. 160pp. $34.95

Michael Moodie has written an important book. The title however, is deceiving. He has focused more on policy aspects of technology and the Atlantic Alliance than on the military operational aspects of technology advances. His book addresses four questions that challenge Nato: 1) How can Nato cope with rapid and extensive technological change? 2) How can Nato's military structures adapt to take advantage of advanced technology? 3) How can Nato both share technology with allies and protect it from adversaries? and 4) How should Nato organize its industries to respond to technological changes?

The technical substance of the book is frustrating. It has the feel of commercial brochuremanship: positive and upbeat about the potential of new capabilities, generally nonspecific, overly simplified, and full of contemporary buzzwords ("quality vs. quantity," "hi-tech vs. low-tech," "revolution vs. evolution," etc.). More substantial are the policy and political discussions which address industrial and defense policy dimensions of technology protection and technology transfers. The complexities of international arms cooperation are treated with insight, both in regard to potential benefits and possible problems for domestic industry. U.S. policies behind the Balanced Technology Initiative and Competitive Strategies programs and their implications for Nato are explored in the concluding chapter of the book.

The author is a senior fellow at the Center for Strategic and International Studies and spent four years as a special assistant to the U.S. ambassador to Nato. His perspective, therefore, is more that of the alliance than American, which makes this book different from most of those published in this country on this subject. Three significant case studies are used to highlight Moodie's points: the potential for "Follow-on Forces Attack" that may result from technology advances is used to illustrate the options that technology may offer commanders in the future; the "Toshiba-Kongsberg Affair" is used to illustrate technology transfer challenges; and the "European Fighter Aircraft" is used to examine arms cooperation.

Moodie's clear enunciation of both the obstacles to and potential benefits from wise choices in regard to technology may help Nato policymakers (and their advisors) steer a more steady course through the turbulent 1990s.

D.K. PACE
The Johns Hopkins University

Clark, Asa A., IV, and Lilley, John F., eds. *Defense Technology*. New York: Praeger Publishers, 1989. 304pp. $49.95

This book is the result of the 22nd Annual Senior Conference of the United States Military Academy, an informal seminar designed to facilitate an open exchange of ideas on important defense issues. Those experienced in military research and development (R&D) will find this book largely tutorial and remedial, but others may find very valuable its brief, cogent descriptions of how weapons research and procurement have evolved in this country, and how military, technological, and political interests interact with military R&D.

The book provides definition of and context for defense technology, treats the implications of technology on both strategic and conventional forces, (including those of the Nato alliance), and then addresses management of defense technology. Abundant notes and an excellent index will prove valuable for students, but the selected bibliography contains a large amount of old material (apart from the historical classics) and nearly omits all of the contemporary (i.e., mid-1980s and later) work on advances in military technology.

The editors of the book and some of its authors are current or former members of West Point's faculty. The book is therefore oriented toward Army interests, although it attempts to treat defense technology as a generic entity instead of focusing upon individual service R&D. Surprisingly, few of the book's 18 contributors could be classified either as technologists or senior R&D managers or advisors. The flavor of the book is that cautious perspective of the military operator or strategic planner who knows the repeated disappointments from only partially fulfilled technological promises.

Although those intimately involved in defense technology will be familiar with much of the material covered in this book, even they will find their thinking stimulated and deepened by Colin Gray's chapter on the implications for defense technology of the United States' strategic culture. It is far too easy for technologists and defense planners to ignore the bigger picture within which they work. In the changing world in which we live, this may no longer be a viable way of doing business. As Gray puts it, "the United States has only recently perceived the necessity to live by its wits in an unforgiving security environment." The entire defense community must come to appreciate this reality.

DALE K. PACE
The Johns Hopkins University

Brauch, Hans Gunter, ed. *Military Technology, Armaments Dynamics, and Disarmament: ABC Weapons, Military Use of Nuclear Energy and of Outer Space and Implications for*

International Law. New York: St. Martin's Press, 1989. 569pp. $55

This book is "the first result" of the International Peace Research Association (IPRA) Study Group on Weapons Technology and Disarmament that was established after the IPRA's Eleventh General Conference in 1986. Much of it consists of revised versions of papers presented at that conference. The IPRA is a global scientific organization associated with the International Social Science Council and supported by UNESCO. The book's fourteen authors come mainly from Great Britain and West Germany, with one or two each from the United States, the Soviet Union, Hungary, Japan, Norway, and Barbados. Their formal training draws from six main academic disciplines: physics, aerospace engineering, chemistry, history, international relations, and international law. All have impressive academic backgrounds and have published extensively, and several of them have held important positions within their countries, such as science advisors to their heads of state.

This book is interesting, but it tries to cover so many topics that it left me somewhat frustrated. It focuses on relationships among military technology (one of several driving forces in the arms race), armaments dynamics (a set of hypotheses to explain both national and international aspects of the armament process), and disarmament (a goal of containing arms races among nations). Military technology is viewed as a stimulus to the arms race and an impediment to arms control and disarmament. The presuppositions of several of the authors, if not most of them, and their general world view seem representative of those associated with various "peace" movements. Although only two of the authors are from the United States, the majority of the book deals with U.S. military technology and the U.S. approach to armaments and disarmament.

The book is organized into five parts. The first develops the context for analyzing military technology in terms of armaments dynamics. The second provides three case studies of military technology developments: third generation nuclear weapons, biotechnology and genetic engineering, and chemical armaments. The third part of the book addresses the history of the nuclear-powered bomber, and the fourth considers ballistic missile defense, especially SDI. The final part contains the views of three lawyers concerning the implications of the military use of outer space on international law.

The book is designed to serve as a resource for university courses in international security, peace, and conflict studies, and probably will be of more interest to students than to other readers since it tends to be a bit pedantic. It contains a number of valuable and useful insights, especially for those who have not yet experienced the complexities of how military and other governmental establishments really work. For example, not only is military tech-

nology advanced by the familiar twins of "technology push" and "requirements pull," but it also is impelled forward by the financial and institutional interests of both industry and the military R&D community. This insight is reflected in the editor's analysis of the SDI program, which addresses political, military, technological, and philosophical factors, including the geographic and organizational distribution of SDI contracts.

For me, the primary value of this book was its stimulation to think more deeply about the relationships among the varied forces and factors that drive armament dynamics. I also found a number of its anecdotes fascinating.

D.K. PACE
The Johns Hopkins University

Garden, Timothy. *The Technology Trap: Science and the Military*. New York: Brassey's Defense Publishers, 1989. 148pp. $31.50

The title of this book intrigued me. I had hoped it would be a hard-hitting, candid, rigorous examination of those instances in which the military had bought operational concepts based upon faulty technological premises, from which insights could be gained about how to avoid such traps in the future. But that is not the book the author intended. Instead, he explores the past importance of science for the military and suggests some areas in which technology may influence future warfare. Instead of the lion I had hoped to meet, I encountered only a rather tame pussycat.

Air Commodore Timothy Garden appears well qualified to write a book on science and the military. A pilot with degrees in both physics and international relations, he was Director of Defense Studies for the Royal Air Force from 1982 to 1985. Garden begins the book with lessons from the past about science and warfare. He then discusses science today: high energy physics, computing science, nuclear physics, space technology, chemistry, materials science, biotechnology, and electronics; and concludes with a consideration of warfare in the future: the sea-air battle, the land-air battle, and the aerospace battle.

Although *The Technology Trap* covers a lot of topics and has a number of useful insights, the book is bland. It lacks the detailed discussions which one expects in a serious treatment of the interactions between science and the military. Instead, it reads more like a newspaper article filled with platitudes.

D.K. PACE
The Johns Hopkins University

Spector, Leonard S. *The Undeclared Bomb: The Spread of Nuclear Weapons 1987-1988*. Cambridge, Mass.: Ballinger Publishing Company, 1988. 499pp. $12.95

Many in the defense community are concerned about the possibility of nuclear war, yet we focus our

attention almost exclusively on the use of nuclear weapons in a war between the United States and the Soviet Union. There is another possibility of nuclear war which we largely ignore. This book is valuable in that it addresses that possibility; it deserves our attention.

Leonard Spector is a senior associate of the Carnegie Endowment for International Peace and has more than a decade's experience in the field of nuclear nonproliferation. He assisted in drafting the 1978 Nuclear Nonproliferation Act, the basic law governing U.S. policy today. This is the fourth volume in Spector's series on the spread of nuclear weapons among the countries that do not officially acknowledge their possession of such weapons. It is a yeoman work, demonstrating both familiarity with the material available on the subject and judicious interpretation of that material. It is probably the most authoritative unclassified source on this topic.

The book does more than simply catalogue the current status of nuclear weaponry in countries around the world. It also addresses trends in nuclear proliferation, the impact of other weapons (such as chemical munitions and long-range rockets) on national interest in nuclear weapons, and the state of nuclear control and safeguard mechanisms.

Spector has done a masterful job of presenting succinct summaries of masses of information about the emerging nuclear weapon nations of Argentina, Brazil, India, Iran, Iraq, Israel, Libya, North Korea, Pakistan, South Africa, and Taiwan.

He is concerned about the trends that he reports, and we should be also. More nations are moving into nuclear power status. Old control and safeguard mechanisms seem less capable today than in the past. The likelihood of combat nuclear weapon use by one of these countries seems to be increasing. Spector concludes that efforts to curb the spread of nuclear arms and to develop mechanisms to constrain undeclared existing nuclear arsenals will be an increasingly difficult challenge.

D.K. PACE
The Johns Hopkins University

Shaker, Steven M. and Wise, Alan R. *War Without Men: Robots on the Future Battlefield.* Washington, D.C.: Pergamon-Brassey's, 1988. 196pp. $19.95

This is the second volume of Pergamon-Brassey's Future Warfare Series. The purpose of the series is to provide policymakers with knowledge concerning emerging warfighting technologies and possibilities. Steven Shaker and Alan Wise have done a very creditable job in their survey of the emerging classes of robots for potential military uses. They have brought between the covers of their book descriptive material on scores of robotic and remotely operated vehicles. This feat alone must have been a herculean task, since much of the information is normally hidden away in obscure

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project documents of very limited circulation.

The necessity to categorize and list the various types of vehicles and approaches makes this work more a catalogue than an analytical study. Furthermore, the authors and their editors seriously damage continuity of expression by adopting the practice of inserting in parentheses behind each organization, system or component title the military abbreviation. That is good practice if the object is going to be repeatedly referred to; but, since repeated reference is rare in the text, the practice is an annoyance. In like manner they insist in giving both English and metric units for all dimensions. A literate style should be an objective even in a technical volume.

The titles of the seven chapters demonstrate the scope and organization of the work and, given the recent date of publication, should convince the military professional or hobbyist that the book belongs in his reference library:

1. War Without Men?
2. The Evolution of Military Robotic Systems
3. Current Operational Use and Development of Unmanned Ground Vehicles
4. Current Operational Use and Developments in RPVs (Aircraft)
5. Current Operational Use and Developments in Unmanned Naval Vessels
6. Space-based Robotics
7. Robots on the Future Battlefield.

It seems to this reviewer that the last chapter expanded should be the book, and that the first six chapters should be relegated to the role of technical appendices.

It is important to note that the authors discuss these developments on a worldwide basis—not only American. Perhaps because of security restrictions, they avoid drawing comparisons among the various military establishments with regard to their receptivity to the use of these new military systems. There is brief mention of some ethical questions that arise when robotic systems are injected into the human battlespace, but there is another point that needs to be made in this review and possibly given more emphasis in the book. Shaker and Wise make clear distinction between RPVs—vehicles that are piloted remotely by wire or radio—and robots. The distinction that is not forcefully drawn is between those vehicles that are "rule based" as opposed to those that truly exploit "artificial intelligence." A system based on artificial intelligence is one that can synthesize inputs or data and develop a course of action for which it has not previously been programmed. When the era of these systems begins, it will become incumbent upon the systems designer to give careful thought as to whether man or his robot will be in charge in any given situation. This is one of the dilemmas that we are soon going to encounter in the Strategic Defense Initiative.

Steven M. Shaker and Alan R. Wise deserve our thanks for pre-

paring this useful and thought-provoking reference work.

ALBERT M. BOTTOMS
Alexandria, Va.

Andriole, Stephen J. and Hopple, Gerald W. ed. *Defense Applications of Artificial Intelligence: Progress and Prospects*. Lexington, Mass.: Lexington Books, 1988. 385pp. $65

Over the next few years, smart computer systems will become ubiquitous. They will impact all aspects of the defense world: policy and strategy, resource and force structure decisions, system design and production, and operational planning and execution. Thus, it is important that the entire defense community have at least some level of understanding of artificial intelligence (AI), a topic that many have hitherto relegated to the arcane domain of computer specialists.

Andriole and Hopple have provided us with an excellent introduction to AI as it pertains to defense and a succinct, yet surprisingly comprehensive, status report on defense applications of AI. Consequently, this book is a very valuable resource for both the uninitiated and the person with substantial AI knowledge. It is not AI hype, nor is it overly technical. It is a candid, balanced, well-written, and authoritative assessment. Its score of contributors come from several universities and major defense-related organizations as well as a variety of government R&D activities.

The book is divided into four main sections. The first provides a foundation for understanding AI and its tools and techniques. The second presents the technology-push side of AI's spread within the defense world by presenting a number of specific AI research areas that relate directly to military operations (such as intelligent training systems). The third (and largest) section focuses on the applications-pull of defense needs by presenting a number of AI defense applications, including management of the air-land battle, tactical planning and replanning, SDI, logistics, and tactical command and control. The final section of the book addresses future prospects for AI in defense.

Although the book is oriented toward Air Force and Army applications of AI, this does not diminish its importance for naval officers because its primary value lies in its presentation of the general principles and potential of AI rather than in its descriptions of specific AI applications.

Readers should find this book stimulating.

D.K. PACE
The Johns Hopkins University

Hampson, Fen Olser. *Unguided Missiles: How America Buys Its Weapons*. New York: W. Norton & Company, 1989. 370pp. $19.95

Idealists should avoid this book. It will depress them.

There are a number of recent books that deal with the weapon acquisition process. This book is different from the rest because it is mainly a collection of case studies.

Hampson begins with a tutorial about how defense acquisition works. He briefly describes the formal stages of the weapons acquisition cycle and indicates peculiar aspects of it for each of the services. He then addresses the way that the Pentagon and Congress work the defense budget. In this tutorial he indicates fundamental problems, recent and current reform efforts, and trends.

With the stage thus set, Hampson then presents detailed case histories of the following programs: the Trident submarine and missile, the MX and Midgetman missiles, the B-1 bomber, the air-launched cruise missile, the M-1 Abrams tank, and SDI. None of these case histories is a pretty picture. They provide stories of services clinging tenaciously to old technologies and outdated missions, of turf battles that lead to irrational compromises of system technical characteristics, of military leaders deliberately thwarting the desires of the President, and so on.

Predictable, *inevitable*, and *wasteful* are the words Hampson uses to summarize the bungling way America buys its arsenal of weapons. It is a story of failed leadership and of institutions which have gotten out of control. He believes this results from the competitive-cooperation of the political and bureaucratic interests that (mis)manage our nation and its defense establishment. He does not limit his call for reform to DoD, but also includes the President, Congress, and the entire DoD-related community—those who must do better if we are to extract ourselves from the present quagmire.

The case studies are fascinating. They reveal the multiplicity of pressures and decisions that shaped the programs described, each of which had its share of shameful and embarrassing aspects. It is unfortunate that Hampson does not include for comparison any case studies of "successful" programs, i.e., ones without such faults. The weakest part of Hampson's book is his approach to improving the weapon acquisition process. He allocates only a few pages in his concluding chapter to this subject, and his suggestions struck me as trite, neither demonstrably workable nor necessarily adequate.

The case studies make this book important reading for leaders in the defense community. They should challenge us all to do what we can to make things better in the future.

D.K. PACE
The Johns Hopkins University

Werrell, Kenneth P. *ARCHIE, FLAK, AAA, AND SAM: A Short Operational History of Ground-Based Air Defense.* Maxwell Air Force

Base, Alabama: Air Univ., 1988. 198pp.

This book is filled with interesting historical data, but is singularly depressing in a most fundamental way. It demonstrates again that the American military has a hard time learning from its wartime experiences — both in tactics and in force planning. For example, the minimum bombing altitudes used early during the Korean conflict ignored the wealth of data from World War II, with substantial aircraft losses as a result. Likewise, over Vietnam during the late 1960s, "America fought a conventional air war with tactics and aircraft designed for nuclear war." Sadly, Werrell's book offers no indication that we have become wiser. Instead, our leaders appear to be following the paths of their predecessors. Up to now, leadership assumptions about future conflicts have proven to be in error (at least relative to ground-based air defense), and airmen have failed to appreciate the impact of ground-based air defense until it was too late. (In every conflict this century except World War I, the U. S. lost more aircraft to ground-based air defense systems than to hostile aircraft, with no indication that the future will be different).

Werrell touches on a few instances of artillery fire against balloons during the 19th century and notes that the first aircraft downed in combat fell during the Italo-Turkish War of 1912. He then describes ground-based air defense during the First and Second World Wars, the Korean War, Vietnam, the Arab-Israeli wars, the American air strikes in the Middle East (1983-86), the Indian-Pakistani wars, and the Falklands conflict in 1982; and he concludes with a few recent aspects of air defense. The author's treatment offers many insights. He addresses the crucial technical and operational factors of ground-based air defense, their effectiveness, and the counters to them. His look to the future is very cautious—he does not allow himself to speculate very much.

This is an important book. It offers in concrete form a challenge to break our historical pattern of preparing for the wrong war. Careful examination of how and why this happened in the past in the narrow field of ground-based air defense may give insights about how to avoid a continuing repetition of folly.

D.K. PACE
The Johns Hopkins University

Kreis, John F. *Air Warfare and Air Base Air Defense 1914-1973*. Washington, D.C.: Office of Air Force History, United States Air Force, 1988. 407pp.

Projection of air power in contemporary warfare is a complex endeavor. Unfortunately, American defense analysts have not fully explored the insights of combat history relative to these activities, including air base air defense. Consequently, some of America's past approaches to air power appli-

cations have been less than the best. This book was written at the request of the Air Force Director of Plans. It is a one-volume condensation of insights from the experiences of the air forces of various nations in defending air bases against attacks from the air. As a result, Air Force planners now have a sounder basis for their decisions about air base structures, command and security arrangements, locations of defensive systems, repair and support services, and base personnel training. Their challenge will be to effectively use the insights this book offers.

Air base air defense has four basic facets: 1) active defense using AA guns, SAMs, and fighter aircraft; 2) passive defense with camouflage, decoys, revetments, and hardened facilities; 3) dispersal over a wide area at a single base or over several bases; and 4) rapid repair capabilities. Kreis examines all of these in his book. He selects a large number of cases with varied geographic and operational circumstances to provide a broad basis of experience, both good and bad, for his observations. From the material presented, it is possible to trace the origins of air base air defense in the British and American air forces as well as those of the Soviet Union, Israel, Egypt, and other nations.

Kreis avoids being blinded by the mass of detailed information available and adroitly places air base air defense in its larger campaign context. The result is his discussion of command structures, resource allocations of guns and other materials among various air bases and other units, and a number of other factors such as geographical influences and technical capabilities of aircraft and other weapons. Some readers will be frustrated by the absence of some details in the descriptions of individual attacks on air bases, but all will find that the material presented is most pertinent and well illustrates the ideas set forth by the author. Of particular importance is the way that Kreis shows the devastating potential for disaster from bickering within and among the military services in regard to air base air defense.

I gained much from this book. I had not realized that Soviet factories produced 140,000 aircraft in 1941-1945 (about half as many as built in the U. S. during that period and almost as many as both Japan and Germany combined). That industrial capacity had a major impact on World War II's progress on the Eastern Front. Nor had I been aware of the secret German-Russian cooperation on aircraft design and testing during the 1920s, an effort which allowed Germany to skirt Versailles Treaty restrictions and which gave Russia much-needed technical capabilities. Likewise, I had not realized how large an impact Japan's failure to develop radar more fully in the late 1930s had on its air defense capabilities. No doubt other readers will also find many gems in this book.

D.K. PACE
The Johns Hopkins University

Huenecke, Klaus. *Modern Combat Aircraft Design.* Annapolis, Md.: Naval Institute Press, 1987. 254 pp. $28.95

Beautifully illustrated and filled with elegant diagrams, Huenecke's book appears to be just another coffee table book on combat aircraft, but it is not. It is a solid technical book that provides a comprehensive treatment of the aerodynamics and engineering realities that govern the design of specialized combat aircraft.

Huenecke opens with a discussion of the performance requirements associated with each of the basic missions of air superiority, battlefield interdiction and close air support. Fundamental aerodynamics for combat aircraft is introduced with treatments of both high subsonic and supersonic flow, and forces on wings and control surfaces. The issues of longitudinal, lateral, roll and directional stability and control are covered with a special focus on the problems of high-speed maneuvering flight. Gas flow in jet engines is explored along with the problems of the design of high-speed air intakes. A section on the air intake designs for the F-15 and F-16 is included, illustrating two quite different approaches to the problem. Finally, consideration is given to cockpit and avionics design, the effect of aircraft armament on wing performance, and artificial stability.

The text, translated from the original German, is clear and concise. This is a book that will be of particular value to test pilots, aeronautical engineering students and those involved in the preparation of specifications for the selection of modern combat aircraft.

FRANK C. MAHNCKE
Naval Surface Warfare Center
Silver Spring, Maryland

Braybrook, Roy. *V/STOL: The Key to Survival.* Osceola, Wi.: Motorbooks International, 1988. 224 pp. $39.95

V/STOL, an acronym for Vertical/Short Take-Off and Landing, appears to be a practical way of operating aircraft. Prime real estate is not needed for airfields; military bases need not impose on the civilian sector for any more room than a parking lot; ships no longer need the dangerous, expensive, and hell-to-maintain catapult and arresting gear. Why then, any discussion on V/STOL? If the technology is there, build the thing and move on! This proposition is examined in depth by Roy Braybrook in his well-researched book, *V/STOL: The Key to Survival.*

Despite the title, the author remains objective as he takes the reader through a clear, comprehensive, and well-illustrated discussion of V/STOL capabilities versus those of conventional aircraft. As it turns out, there are significant trade-offs, even with today's technology.

Braybrook makes the case for V/STOL by examining the vulnerability of airfields. He uses the Falklands/Malvinas conflict in 1982

as one example, focusing on the single runway at Port Stanley. The British had V/STOL capability in their tactical aircraft, the Argentines did not. He very effectively leads you to his conclusion, then shares the frustration that exists.

An authoritative piece of work, this book leaves you with the feeling that we are about to break through into a new realm of aviation. However . . . .

DONALD A. GERRISH, JR.
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Orange Park, Florida

Kotz, Nick. *Wild Blue Yonder.* New York: Pantheon Books, 1988. 313 pp. $19.95

Subtitled *Money, Politics and the B-1 Bomber,* Kotz's book is a look at the political machinations among the air force, the airframe manufacturers, the Congress, several administrations and the anti-defense lobby over the development and deployment of the B-1 bomber. Having been killed several times, the program proved to have more lives than an alley cat—whose social style and wiliness were adopted by the several parties to the matter.

The B-1 has its roots in the transitional debates about long-range air power that occurred in the 1960s as intercontinental missiles began to take on the primary load for deterrence and nuclear retaliation. With increasing Soviet air defense capability, it became clear that the B-52 fleet could no longer be relied upon to penetrate Soviet air space. Yet many felt that a manned bomber offered a flexibility not found in ICBMs.

The first solution was the B-70, which proved too vulnerable (at its high altitudes) to radar detection and destruction. The B-1 grew out of various proposals for a bomber capable of both high altitude, high speed penetration and low altitude, terrain-following penetration. Leaving aside the likelihood of such aeronautical virtuosity, the B-1 appeared to many to be poorly positioned between two new technologies: the stand-off launched cruise missile and the stealth bomber. The B-1 seemed to do nothing that was not better done by one or another of these. Why then was it built in spite of several cancellations?

Kotz's thesis is that the B-1 was built as a result of the tenacity of those with self-serving interests. The air force wanted a manned bomber and funneled research and development money to the program to keep it alive after cancellation by several administrations and congresses. North American Rockwell needed the bomber production to stay in the military airplane business. Many other companies across the nation stood to benefit from subcontracts. Production was spread across an impressive number of congressional districts, with the attendant concerns for employment.

Kotz builds his book around tales of influence-seeking and jockeying. The air force, North American Rockwell and the major subcon-

tractors mounted a major campaign to keep the program going, with people assigned to "cover" each congressman, track his votes and opinions, and inform him of the benefits to his district. Although North American Rockwell made lavish use of its several vacation retreats, Kotz does not offer any evidence of corruption. What he describes is simply the less attractive side of the defense business when big dollars are at stake.

At first glance, the B-1 affair seems to have strong parallels to the scandals which surrounded the Navy's construction of the 688 and *Ohio* class submarines. Not so, for none of the players in the B-1 affair had the kind of picturesque and personal venality that was rampant in the submarine matter. Instead, they seem to have been driven by nothing more interesting than ordinary and predictable institutional imperatives.

For those who still believe that the acquisition of major defense systems is based on pure reason, this book will be a depressant. For the cynical, it will be a reaffirmation. For the experienced, there is little new here.

FRANK C. MAHNCKE
Naval Surface Warfare Center
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Nye, Joseph S., Jr., and Schear, James A., ed. *On the Defensive? The Future of SDI*. Lanham, Md.: Univ. Press of America, 1989. 222 pp. $12.75

This book is a "must read" for those who want a comprehensive, balanced, and authoritative discussion of the Strategic Defense Initiative (SDI).

The Aspen Strategy Group, which produced the book, is a bipartisan committee organized under the auspices of the Aspen Institute for Humanistic Studies. William J. Perry, former undersecretary of defense, and Brent Scrowcroft, now President Bush's national security advisor, serve as co-chairs for the group and contributed to the book's introduction. The other contributors, including a former director of the Lawrence Livermore National Laboratory, are also eminently qualified to discuss the complex aspects of SDI with a depth of understanding that can only be obtained by a very broad perspective about SDI and the issues related to it.

There has been a great deal of heated and misinformed or distorted discussion of SDI. The delightful aspect of this book is the calm, thorough way that it covers nearly all the important aspects of the program. In addition, the book is well written, concise, extensively documented, and contains a good index.

The purpose of this book is to identify and explain the key security issues raised by the SDI program. These issues include questions such as, What changes in Soviet strategic policy are likely to occur in response to SDI through the early 1990s, or What impact will the pursuit of SDI

have on the overall U.S. defense posture? The book's answers to such questions address both the obvious and the not so obvious considerations. For example, some defense research programs would suffer if SDI were accelerated significantly and began to consume a much larger portion of the limited pool of scientific talent; on the other hand, other defense research programs would benefit from SDI spin-offs.

Many books get so bogged down in detail that one cannot see the forest for the trees. Others are so general that they leave one uneasy that conclusions and assertions may not be based on fact. This book avoids both extremes and allows the reader to see both the forest and the trees. The significant issues it identifies are the real ones.

Constraints on future defense spending will cause many questions to be raised about SDI and its relation to other U.S. forces. This book will help those within the defense community to be in a better position to address these questions by enabling them to understand the real issues about SDI.

D.K. PACE
The Johns Hopkins University

Lin, Herbert. *New Weapon Technologies & the ABM Treaty*. New York: Pergamon Press, 1988. 95 pp. $12.95

The Antiballistic Missile (ABM) Treaty of 1972 is regarded by many as the most important arms control agreement currently in force between the United States and the Soviet Union. The premise of Lin's book is that certain weapons developments since 1972 may erode the effectiveness of this treaty unless the United States and the Soviet Union explicitly take these developments into account in the future. He describes how these developments could impact the treaty and suggests actions that could be taken to retain the treaty's benefits. An appendix of the book contains the treaty along with agreed statements and common understandings about it.

Herbert Lin holds a doctorate in physics from the Massachusetts Institute of Technology and has been involved in its Center for International Studies, which cooperated in the publication of this book. He has a good grasp of the technological issues and is currently working with the House Armed Services Committee.

The basic problem addressed by this book is that surface-to-air missile (SAM) systems as well as antisatellite weapon systems have progressed to the point where these systems could have ballistic missile defense (BDM) capabilities. In Lin's view, this situation would have a deleterious impact on the ABM Treaty's continued utility. He therefore suggests ways that verifiable limits on these developments could be used to retain the benefits of the treaty.

Lin spends little time on the Strategic Defense Initiative (SDI), since he believes that the develop-

ment and testing of such a system would signal America's unmistakable intent to abandon the ABM Treaty and thus make moot questions of how the treaty might be strengthened by limitations on various technological developments. Likewise, he is less concerned with the impact of "exotic technologies" (e.g., lasers and particle beams) because they have less "creep-out" potential in the immediate future.

What this book purports to do, it does well. However, its narrow focus restricts its usefulness to those interested specifically in those technological developments that threaten the viability of the ABM Treaty regime in the immediate future.

D.K. PACE
The Johns Hopkins University

Gregory, William H. *The Defense Procurement Mess: A Twentieth Century Fund Essay*. Lexington, Mass.: Lexington Books, 1989. 219pp. $19.95

Do not dismiss this book with a "Ho hum, another one of these muckrakers." Mr. Gregory presents a skillful tutorial on the defense systems procurement labyrinth. He identifies the issues from the competing perspectives of the various participants, he provides many examples of recent procurements, and he offers prescriptive suggestions for corrective actions.

Defense procurement has been a nightmare of horror stories about cost and schedule overruns and performance shortfalls. Everyone has heard about the toilet seats and hammers, about amphibious vehicles that can't swim and aircraft that can't fly to specification. The American people have become justifiably critical of the stewardship practiced by the Defense Department and its component military services. No one has been spared. It is scant comfort that criticism and blame also attach to the Congress and to American industry. There is the stench of scandal—of violations of the public trust—by high officials. Mr. Gregory draws apt parallels to the tawdry reputation of the sutlers who supplied and provisioned the army during the Civil War and the Indian Wars.

Mr. Gregory brings to this work a lifetime of involvement with the defense systems acquisition world as a journalist and as editor-in-chief of *Aviation Week and Space World* (a position that he held for thirty years). His presentation is even-handed. He provides a clear description of the environment and the pressures that impinge upon people at every level. At the same time, his measured cadences of illumination land like hammer blows. How, the reader asks, can we in the United States permit this farce to continue? How indeed!

If there is a central thrust to the cures that Mr. Gregory proposes, it is to curb the penchant for overmanagement and overregulation. It would do the author an injustice to characterize his approach as one of

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laissez-faire toward industry. But it is more that than not. The question then arises as to whether the modern American business community with its MBA-focused, next quarter profit and loss statement fixation possesses the ethical and conceptual capabilities required to regulate itself. On the other hand, does Congress? Do we in the defense systems acquisition community?

The defense professional (in or out of uniform) can scarcely afford to be ignorant of procurement policy developments. William Gregory and the Twentieth Century Fund have provided a valuable contribution to understanding what is wrong and what the consequences may be if we don't fix the system.

ALBERT M. BOTTOMS
Melbourne Beach, Florida

Dertouzos, Michael L. et al. *Made In America: Regaining the Productive Edge*. Cambridge, Mass.: MIT Commission on Industrial Productivity, 1989. 344pp. $17.95

The harmful effects that could arise from an eroded capacity for timely industrial response have been repeatedly demonstrated during war games. The health of American industry is fundamental to our pursuit of viable national security policies.

Still, in real life, product lines such as consumer electronics, steel, and automobiles have all but disappeared from the American manufacturing base; and the disappearance of American-made end items has been accompanied by atrophy in the supplier tiers. The implication for war is that our industry may not be able to produce. The implications for peace are found in our continuously worsening balance of trade, in our shrinking economic opportunities, and in the ultimate threat to our standard of living.

The authors of *Made in America* examine what went wrong with America's industrial productivity and propose ways to return the U.S. economy to the path of high productivity growth. Their proposals will require major restructuring of thought and practice in government, industry, labor, and education. The tone is positive and exciting—almost Rooseveltian!

The authors open with a multiple-count indictment of American industry: its inferior products; its inefficiency; its indifferent, ill-trained work force; the focus of its management on quick, short-term profits; and its design, engineering, and research community whose achievements have been surpassed in a growing number of fields. They document these charges through a series of industrial sector studies: automobile, chemical, commercial aircraft, consumer-electronic, machine-tool, semiconductor, and so on. They seek to establish causative factors, to identify "best practice," and to generalize indications of potentially corrective policies and actions.

Among these "best practices" are *simultaneous* improvement in quality,

cost, and delivery, with the operative word being simultaneous; staying close to both the customers and the suppliers; using technology for strategic advantage; and flatter, less compartmentalized organizations. The obstacles to the diffusion of "best practices" are complacency, adherence to outmoded practices, superficiality, and lack of commitment on the part of top management.

These things, the book says, are essential:

- Industry must both improve product quality and shorten the cycle from technological discovery to the marketplace. A key element is continuously educating and training the work force. Another is to abandon the adversarial relationship with suppliers. A third is to search worldwide for industrial "best practice" and incorporate it in our processes.
- Union leaders must become champions of cooperative and innovative industrial relations practices.
- Government must emphasize both reduction in the cost of capital for private investment and the pursuit of free trade. It must support education and training. It should also support research and development, including product and process engineering. And it must improve its own efficiency in military research, development, and procurement.
- The strategies for the universities have far-reaching implications for curricula and for the length of time required to receive adequate multidisciplinary preparation. Those who adhere to Thomas Jefferson's belief that education is distinctly a local responsibility may have some qualms about the proposed federal role in education, but what is the alternative?

AL BOTTOMS
Melbourne Beach, Florida

Gansler, Jacques S. *Affording Defense*. Cambridge, Mass.: The MIT Press, 1989. 417pp. $24.95

Since the mid-1980s, many books have been written on weapon system acquisition and the cost of American defense. Gansler's book is by far the best of the lot. It addresses the three basic questions facing American defense leadership: 1) how to determine what forces and weapons systems America needs, 2) how to procure those forces and systems within constrained budgets, and 3) how to keep special interests (in the public, Congress, a military service, or elsewhere) from preventing the accomplishment of the first two. Gansler explores the entire context of defense decision making. He identifies the fundamental cause of problems in weapons acquisition and suggests what actions must be taken to solve these problems.

Gansler provides ample evidence that short of revolution, there will be no quick fixes for the many serious problems in American defense. No reform effort within the defense establishment seems to have long-term staying power because special interest groups are able to sabotage

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or subvert it before the reforms are completed.

Gansler begins with a brief discussion of the numerous dilemmas facing defense leadership, including the potential conflicts for which our nation must be prepared. He then describes the process by which America selects its weapons. The relation between defense spending and the national economy is discussed, as is the development of the defense budget. He describes how military equipment is bought, and highlights the deleterious impact of the numerous efforts to regulate the process which have been counterproductive. Unlike some other treatments of defense acquisition, Gansler does not neglect R&D, the industrial base, or personnel (both military and civilian). He covers them all. His suggestions for improvement come from his own analysis of the defense system, from the recommendations of numerous reform studies, and from careful consideration of the approaches of other nations to weapons acquisition and force structure planning. The current efforts of the president and the secretary of defense to improve DoD management are similar to many of Gansler's suggestions.

Gansler understands his subject well. He is a senior vice president of The Analytic Sciences Corporation (which works extensively for DoD) and a member of the faculty of the John F. Kennedy School of Government at Harvard University. His earlier book, *The Defense Industry* (1980), is one of the standard textbooks on weapons acquisition. This book should also become a standard text. I strongly recommend it for every serious student of American national security.

D.K. PACE
The Johns Hopkins University

Fitzgerald, A. Ernest. *The Pentagonists: An Insider's View of Waste, Mismanagement, and Fraud in Defense Spending*. Boston, Mass.: Houghton Mifflin Company, 1989. 316pp. $19.95

This is a disturbing book. It presents a disgusting tale of malevolence, deception, and waste. If even a small portion of the numerous allegations in this book are true, some of our military, governmental, and industrial leaders are the greatest threat to our national security, for in their drive for power and position they have saddled us with expensive weapons of dubious military utility.

The author, A. Ernest Fitzgerald, is a "whistle blower." He served as deputy for management systems in the air force in the late 1960s and was fired because of his whistle blowing to Congress. He was reinstated in the mid-1970s after a prolonged legal battle, and continued to be a whistle blower, which resulted in much bureaucratic infighting and legal battles with his superiors.

The Pentagonists is too heavily bent toward sensationalism for my taste, but it presents such a large number of specific charges of mismanage-

ment, waste, and fraud (with names, dates, and particulars) that it leaves an indelible impression that much is amiss in DoD. If its allegations are valid, then it is high time to clean house in the defense establishment (although experience indicates this would be an extremely difficult task). We should rise in righteons indignation that the military personnel who put their lives on the line iu combat must do so with inferior and costly systems because we tolerate a defense acquisition process that operates on a "smoke and mirrors" basis.

Fitzgerald addresses problems associated with the C-5A program (the source of his original whistle blowing), the B-1 bomber, the F-5 and F-16 fighter aircraft, spare parts for the Phoenix missile, and major defense contractor bribes and kickbacks. He even documents such abuses, as General Dynamics charging for boarding a dog in the travel expenses of one of its executives.

The tone of this book is so vitriolic that I view its perspective with suspicion, but we dare not ignore the problems that it identifies. It reminds us of the need for "trouble-making" whistle blowers who will keep us from complacency and disregard of systemic problems.

D.K. PACE
The Johns Hopkins University

Brinkley, David. *Washington Goes to War: The Extraordinary Story of the Transformation of a City and a Nation.* Alfred A. Knopf, Inc., New York. 1988. 286pp. $18.95

David Brinkley has performed a needed service in capturing the flavor of wartime Washington in the turbulent days leading up to the Second World War. Some of the messages from that time are relevant today as our country strives to be comfortable with the mantle of world leadership. Once again the lesson is emphasized that history is made by people, who embody enormous capacities for vision and self-sacrifice and for myopia and the pursuit of selfish goals.

Washington in the mid-thirties was a bucolic Southern town with all of the class distinctions, tolerances, and intolerances that were the hallmark of the post-Civil War South. Social mores were the province of the "cave dwellers" on upper Connecticut Ave. and on Massachusetts Ave. Taxicab zones were gerrymandered—and still are—to minimize commuting costs for congressmen. Washington, then as now, was resistant to change. Brinkley points out that men of action from the very beginning of the Republic found Washington hard to understand. Most military officers can relate to that.

This book is about change, about the process of "moving mountains" that began with the New Deal of Franklin Delano Roosevelt and was accelerated by Pearl Harbor. It sketches the good, the bad, and the ugly as well as the hilarity and bathos involved in the metamorphosis of the

city and the country. It is a story of leadership, with numerous examples of political skill and raw political courage. The modern era likes to use sports metaphors; some of the early wartime planners wrote the book on such arts as "hardball" and "stonewalling." Brinkley introduces masters of deviousness and duplicity—and effectiveness.

Much of the charm of this best-seller is its readability. It is a series of vignettes skillfully woven together to form the message. For example, Brinkley credits Roosevelt's magical rapport with the American people to his ability to "state his thoughts in simple, homely phrases, in the language of the working neighborhood." Brinkley provides concrete illustration with Roosevelt's words that introduced the Lend-Lease Program in 1940. Senator Taft's response is also instructive: "Lending arms is like lending chewing gum. You don't want it back."

Given the current renascence of interest in mobilization and industrial preparedness, the reader so oriented will particularly enjoy the chapter entitled "Bureaucracies at War," which provides insight into Roosevelt's management style: "He . . . only wanted to make the great, historic decisions, yet he was always reluctant to delegate power to those who could relieve him of tedious details. And so issues remained unsettled until they became more troublesome, more expensive, and finally had to be dealt with, usually hurriedly." The recipe for action seemed to be the application to the "civilian economy of the old philosophy of the U.S. Army—if enough men and weapons are poured into a confused battle situation, an enemy can be overwhelmed rather than defeated." The modern question is, Can we find enough resources to follow this recipe?

Brinkley notes the frustration of young officers who attempted to awaken their superiors to the growing German threat. "They seemed busy with the details of their office. They didn't seem to grasp what I was trying to bring out." Sound familiar?

The mobilization of the late thirties was one of the greatest logistics miracles of all time. However, it was anything but smooth and orderly. As fast as one group would be established it would be dissolved, so as to diffuse power. The president wanted neither the military nor industry to be in charge of resource allocation. He wanted no "czars" or "poobahs." Today there are two executive orders in the process of final coordination that seek to assign emergency preparedness responsibility. Will they work? Can they be implemented? Stay tuned. Many of the same forces are at work today as in 1940.

Brinkley recounts the chaos of the various alphabet-soup agencies and the charges of profiteering that led to the Truman Committee's investigation of defense procurement and contracting fraud. How much better is our current defense system's acquisition process?

Present issues have recent antecedents. The military reader would be well advised to stock his library with some historical material so as to obtain perspective without having to relive past experience. *Washington Goes to War* could certainly be a valuable addition to this library.

AL BOTTOMS
The George Washington University

Hynes, Samuel. *Flights of Passage.* Annapolis, Md.: Naval Institute Press, 1988. 270pp. $16.95

"Every generation is a secret society. The secret that my generation—the one that came of age during the Second World War—shared was simply the war itself. We grew up on active duty."

Samuel Hynes was eighteen when he became a naval aviation cadet in 1943; by the time he was twenty-one, he had flown a hundred combat missions as a Marine TBM pilot. Now a professor of literature at Princeton University, he has given us a remarkably engaging memoir of his secret society.

His is the classic story of a young man's passage from the gentle world of the upper Midwest in the 1930's through the masculine bonding of flight training and life in a training squadron and then to the grinding reality of air combat. Hynes grew up in a comfortable and secure world where teenage boys hung around the local airport absorbing the romance of aviation. Joining the Marines, he joyfully discovered and reveled in the pleasures of flying, drinking and chasing girls. With the boundless energy of a young pilot, he pursued all three without favor or discrimination. Squadron life in California was a long fraternity party, with flying as an added benefit.

The war in the Pacific was another matter: enormously boring and dangerous. Hynes quickly became a careful and cagey pilot, a survivor who grew up fast. He had a typical war, earning a couple of medals, losing some friends, having some close scrapes and discovering that war is not all that it is advertised to be. There was neither glory nor bonhomie in the war.

Hynes' descriptions of flying capture that special sense of oneness that can exist between a pilot and his aircraft. After all, a high performance aircraft is the best toy that can be given to a young man of spirit. Read his account of being aloft with a buddy in a pair of F6F's on a glorious Pacific day with nothing to do but play at inverted formation flying.

Hynes tells his story with the immediacy and perspective of a young man sharing a grand adventure while growing up. He seems to have been a genuine Willie Keith.

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Durch, William J. *The ABM Treaty and Western Security.* Cambridge,

Mass.: Ballinger Publishing Co., 1988. 161pp. $19.95

Considering the emotionalism engendered by the public and scholarly debates on the possible effects of the Strategic Defense Initiative (SDI) on strategic arms control, it is refreshing to find a pro-arms control text that attempts to outline the issue through the use of cool logic. William Durch does exactly that in *The ABM Treaty and Western Security*. The result is a very persuasive argument for preserving the Antiballistic Missile Treaty in the face of technical advances in strategic defense capabilities.

This is not to say that Durch's argument is flawless, or that the book is a balanced study that arrives at its conclusions only after the most rigorous application of unbiased logic. While the author appears to be impartial in the initial explanatory chapters, the perceptive reader can detect shadings of preconceived support for the status quo. For example, the arguments for the "broad interpretation" of the treaty (i.e., permitting SDI development) are said to have resulted from an assessment by a "former CIA lawyer"—implying a somewhat murky, clandestine and reactionary origin. In contrast, the arguments for interpreting the treaty as "narrow" or "restrictive" are portrayed as generated by public-spirited former negotiators and arms control officials intent on presenting an accurate public record. Never mentioned is the fact that many of these former officials may have a personal interest in seeing their handiwork preserved.

A point that Durch misses—and one that thoroughly confuses anyone attempting to interpret the Treaty's actual negotiation record via unclassified public documents—is that in 1972 the meaning of the terms "broad" and "narrow" were the reverse of their current usage. "Broad" then meant "broadly restrictive," that is, incorporating a ban on all ABM future development. "Narrowly restrictive" then implied that the Soviets—with an eye to future development—were willing only to agree to a ban on the here-and-now.

Since none of this confusion can be resolved until the actual negotiation record is declassified, Durch's interpretation of what was really meant during treaty negotiations is probably as reliable as any other. He simply assumes that the treaty means what its proponents say it does and that the Reagan administration's interpretation was a major revolution in thought. From this assumption the preservation argument gains considerable force: Why destroy an honorable agreement that has served American interests for the last eighteen years?

Durch's study is concerned with SDI's effects on the ABM Treaty; it is not a study of the feasibility of SDI. It is therefore easy for him to portray the treaty as a solid bulwark preventing a strategic defense arms race and not as an impediment to increased Western security. The author adopts the self-serving logic

that SDI can never be 100 percent effective in defending cities and would therefore be ineffective, whereas the ABM Treaty does not need to be 100 percent effective in preventing violations in order to be effective. Nowhere does he address the issue of strategic deception, or the possibility that national technical means are insufficient to police the treaty.

The author's argument for maintaining the "narrow interpretation" of the treaty cites five explicit "costs" associated with the "broad interpretation": the increased cost of procuring strategic defenses; the possibility of a "renewed arms race"; the possibility of Soviet preemption; a possible increase in "strategic uncertainty"; and a possible breakdown in Nato's cohesion if a "fortress America" were to be developed. All of these are considerations that must be addressed prior to the decision to deploy strategic defenses. While Durch's conclusions rely on a very particular set of assumptions, his conceptual organization is a useful point of departure for additional research into these issues.

For the reader interested in analyzing the ABM Treaty vs. SDI debate, *The ABM Treaty and Western Security* is indeed an excellent introduction. William Durch should be applauded for his logical approach and his effort to keep the debate a discourse and not a shouting match. It is not, however, the final word.

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Editor's Note

The Autumn 1989 issue of this journal carried a review of *Soviet Naval Theory and Policy: Gorshkov's Inheritance*, by Robert Waring Herrick, which was published in limited quantity by the Naval War College Press in 1988. The book is now available in hardback from the Naval Institute Press, Annapolis, Maryland, at a price of $23.95.