International Law Studies - Volume 87
International Law and the Changing Character of War
Raul A. "Pete" Pedrozo and Daria P. Wollschlaeger (Editors)

X

New Technology and the Law of Armed Conflict

Darren M. Stewart*

Technological Meteorites and Legal Dinosaurs?

The tacit contract of combat throughout the ages has always assumed a basic equality of moral risk: kill or be killed. Accordingly violence in war avails itself of the legitimacy of self-defence. But this contract is void when one side begins killing with impunity.[1]

Introduction

The issue of new technology and its implications for the law of armed conflict (LOAC) is not a new question. For centuries nations and their militaries have had to respond to developments in the means and methods of warfare. These have ranged from hardware developments, such as the crossbow and gunpowder, to the development of tactics, such as asymmetric warfare or doctrines like the effects-based approach to operations (EBAO). In response to each of these challenges, belligerents have either developed enhanced weapons or tactics, or suffered defeat. Usually technological change has been of a relatively minor, evolutionary

* Colonel, British Army; Director, Military Department, International Institute of Humanitarian Law (IIHL). The views expressed in this article do not reflect those of the IIHL, the British Army, the United Kingdom Ministry of Defence or Her Majesty's Government and are the author's personal views.

The opinions shared in this paper are those of the author and do not necessarily reflect the views and opinions of the U.S. Naval War College, the Dept. of the Navy, or Dept. of Defense.

nature, affording localized tactical or operational advantage. Occasionally developments have been profound, changing the strategic balance in the favor of one side over the other. History provides examples of these in the form of the crossbow, gunpowder and nuclear weapons in the case of hardware. Similarly the Greek hoplite phalanx, the Roman legion and the development of the corps structure by Napoleon are all examples of innovations which have shaped tactics.

The question frequently posed today is whether the current nature of developments in military technology constitutes a similarly seismic shift in the military paradigm. Will the development of unmanned systems in the land, air and maritime environments be recorded in history in the same revolutionary terms as those previously mentioned? This article will consider this question in the context of the implications that flow from these developments for LOAC.

Over the centuries LOAC, in its various guises, has always had as its focus the regulation of armed conflict so as to protect the victims of war.[2] During the nineteenth century, in response to both the development of military technology and the prevailing social mores of the time, LOAC rules started to become formalized and began to reflect the format that we are familiar with today.

One of the notable features of LOAC has been its evolutionary flexibility. This flexibility has allowed LOAC to evolve in a manner that adapts to the developments in both technological capabilities (means) and tactics (methods) employed in armed conflict. This has included specific measures to ban weapons[3] and tactics[4] when seen as appropriate. More important, LOAC has demonstrated its flexibility through the defining principles underpinning its operation. These principles—military necessity, humanity, distinction and proportionality—are of an enduring quality and provide a benchmark against which developments in technology and tactics can be assessed as to their lawfulness. When applied in the context of prevailing international mores, LOAC proves itself both flexible and responsive to changes in the armed conflict paradigm.

The changing character of weapons systems and their impact on the law is neither one-dimensional nor negative. In fact, technological advances in weaponry frequently work to *enhance* application of LOAC, particularly in the areas of distinction and proportionality. Challenges usually arise when such developments raise wider questions as to what are the acceptable ethical limits in the application of technology to military purposes. In this context LOAC, operating as a system regulating what is inherently a human activity within a prevailing set of international mores, becomes an important consideration.

This article will consider whether the changing character of weapons systems, particularly unmanned systems and vehicles, is such as to call into question LOAC's ability to respond to the introduction of new technology onto the

battlefield. In considering this question, the paper addresses three aspects: current developments in technology, the impacts on LOAC standards arising from new technology and the implications for accountability.

Part I will consider current developments in military technology, including unmanned systems that are either remotely controlled, have automated elements to their operation or can act in an autonomous manner. What are the military drivers in the development of such technology? Do developments in artificial intelligence constitute a turning point in technology such as to warrant a bespoke response from the law? What then of the existing legal framework for the assessment of new weapons for their lawfulness as articulated by Article 36 of Additional Protocol I (AP I)?[5] These questions will all be addressed in Part I.

The impact of new technology in armed conflict brings with it, even under the extant legal paradigm, an obligation on belligerents to apply the rules such that applicable standards of behavior may be at variance between those who possess new technology and those that don't. Whether this calls for a change in the law to acknowledge common but differentiated responsibilities[6] or simply a renewed interpretation of what the applicable LOAC standards are will be considered in Part II.

Of course the question of standards in turn raises the issues of accountability and the means by which set standards are to be measured. Does the law of unintended consequences mean that the changing nature of weapons systems will result in an increased level of attention and scrutiny applied to senior levels of the chain of command as the only "humans in the loop"? Have States, by removing humans from the operation of weapons systems, created a whole new set of implications for accountability? Part III looks at whether civilian leaders and military commanders, in their quest to employ newer and better technology, have considered the consequences of placing themselves more squarely in the focus for breaches of LOAC when these (as they invariably will) occur.

Finally, the article will conclude by addressing whether LOAC has been able to adequately respond to the challenge of the changing character of weapons or if a fundamental root-and-branch reassessment is required.

Part I. Current Developments in Technology: Unmanned Systems and Unmanned Vehicles

Definitions

The combination of technology and military jargon can be a dangerous distraction in the context of terminology and precision in its use. This article will therefore use terminology in line with that the United States has developed in its FY2009–2034 Unmanned Systems Integrated Roadmap (hereinafter referred to as

the Roadmap).[7] The Roadmap contains a multitude of acronyms used in this area, which are usefully consolidated at Annex H to the document.

It should come as no surprise that the accepted term that applies generically to all vehicles and systems that are either remotely controlled, automated or exhibit a degree of autonomy is "unmanned vehicle systems" (UVS).[8] UVS are broken down by environment: land (unmanned ground vehicles (UGVs)), maritime (unmanned maritime systems (UMS)) and air (unmanned air systems (UASs)).

UGVs are those that are either armed (ground combat vehicles (GCVs)) or unarmed. UMS include unmanned undersea vehicles (UUVs) and unmanned surface vehicles (USVs). UASs include unmanned air vehicles (UAVs), tactical unmanned air vehicles (TUAVs) and unmanned combat air vehicles. Some commentators break UASs into three broad categories: TUAVs, stealth UAVs and agile or expendable UAVs,[9] however, this structure has not received widespread endorsement. There have been some attempts by NATO Systems Concepts and Integrations panels to seek standardization in this area, including terminology; however, this is yet to produce a definitive guide.[10]

Equal in importance to the requirement that terminology used with respect to new technology is of a uniform nature is the requirement to understand the wider military context in which new technology is employed.

Military Doctrine as a Driver for the Development of New Technology

While the development of terminology in relation to new military technology is relatively straightforward, what is less so is the drivers for its development and use. The desire to develop a decisive hardware advantage over an opponent is but one of these. As military doctrine evolves in relation to the employment of unmanned systems, technology is seen as a key enabler rather than a panacea to the challenges posed by the paradigm of the contemporary operating environment. The manner in which technology is used by the military is therefore critical. As Air Commodore Julian Stinton puts it:

> [L]etting the thinking drive the technology could lead to more coherence in approach and more commonality in capabilities under an overall concept, but less potential for exploitation of novel game-changing technologies. This is the steady, analytical, non-ephemeral approach, requiring just as much technological capability in information management, prioritisation, automation, pattern seeking, relational activity using staring arrays, change detection, wide-area scanning and cueing, as the adrenalin[e]-laden, higher-buzz technological demands of real-time ISR.[11]

For those in the military, this will, of course, be an obvious statement; however, the benefits derived from recent developments in new military technology have

been distorted by a perception that the quest for newer and better technology is virtually an "end in itself," rather than being one of a number of "means to an end." Air Chief Marshal Sir Brian Burridge describes the challenge in somewhat blunter terms:

> Those who are lured by expensive technologies without a deeper understanding of how to use them, task them and integrate them will be left with empty pockets and shiny toys—the "esoteric chimera" I referred to earlier. Those that understand their limitations, benefits and the most important of all, the human dimension, will be left with a little more money to spend elsewhere and an essential capability that they can use effectively.[12]

With the widespread introduction of EBAO by Western militaries into their operational doctrine, the use of new technology has become but one (albeit sophisticated) component of an increasingly integrated, multifaceted campaign plan. As such, new military technology cannot be simply viewed as an upward trending graph of enhancement in capabilities. It is the manner in which the myriad capabilities afforded by new technology are employed by commanders and their staffs that is becoming the decisive factor in differentiating opponents and, as a consequence, their ability to prevail in armed conflict.

Advocates for the employment of automated or even autonomous systems argue that the phenomenon of information overload, which is prevalent on the modern battlefield, underscores the requirement for systems that can process information and make decisions far more efficiently than humans. Such an approach fails to consider two important elements. First, the processing of information into intelligence requires a broad array of skills, including intuitive, experience-based analysis and cognitive functions of which automated or autonomous systems are incapable. Second, and perhaps most important, is the fact that the battlefield is a complex system of interlinked actions, each of which may impact differently on an opponent depending on the context in which it occurs, and which will not have the same effect each time. It is the management of this complex network, seeking to influence the effect actions have in a coordinated manner toward a certain set of campaign objectives, that is at the heart of effects-based operations. As such:

> To the extent that it works, the place of the human in the system seems to have changed dramatically. The important judgement is now made at a data fusion or intelligence centre—or, alternatively, by a forward observer aware of how dynamics of a battle have made a particular target temporarily important.[13]

Thus, the use of new technology in this context, while enabling greater efficiencies and providing potentially decisive effect, does so within a wider campaign construct that requires the exercise of clear human direction and control.

Types of New and Evolving Technology

Broadly speaking, UVS operating types fit into three categories. First are those that are remotely controlled, also known as tele-operated, where an operator will control the UVS by some form of direct radio signal (line of sight or satellite). The operator can be either relatively close, such as in the same operational theater, or many thousands of miles away as in the case of Predator/Reaper operations in Afghanistan.[14]

The second category is automated UVS, meaning that functions are carried out within preprogrammed parameters without the requirement for a command from a human. There are many examples of this type of UVS currently employed by militaries around the world. For example, Global Hawk is a UAS, most of whose flight commands are controlled by onboard systems without recourse to a human operator. Similarly in the land environment, automated sentry systems that respond to movement in, or breaches of, security perimeters are often used in relation to minefields or other installations, and provide an automated response without human intervention. In the maritime context, the close-in weapons systems used to defend surface warships from anti-ship missile attack are, due to the speed of response required to defeat the threat, largely automated.

Finally, work is being carried out to develop autonomous systems for military application that incorporate forms of artificial intelligence, allowing the UVS to operate independently of humans and carry out all of the functions that otherwise would have involved human action.

Perhaps the best single official source of data on the types and employment of UVS is the US Roadmap.[15] Not only does it contain an analysis of future requirements (including detailed descriptions of individual system characteristics) for the US military (the largest single user and developer of UVS), but it places these requirements within an operational context focusing on the how and why of UVS employment. The investment in terms of resources and effort by the United States in developing new UVS technology is impressive; the funding for this project alone over a five-year period (2009–13) is projected to be a staggering $18.9 billion.[16] This commitment to the development and use of UVS is underscored by the 2001 US congressional mandate that one-third of military aircraft and ground combat vehicles be unmanned by 2015.[17] The size and scope of the US unmanned systems program bring into sharp focus the impact such new technology has, and will continue to have, on US military capability. Other nations can ill afford to ignore such

a development. Professor Jack Beard paints the US fascination with technology in a rather more somber light:

> The U.S. military-technological experience represents a consistent, but exaggerated, variation of the historical trends in this area, as Americans have displayed an almost boundless confidence in the power of science and technology to promote "progress" and have tended to trust in the power of military technology to translate into success in war.[18]

It is not possible to list the myriad of types and names of systems that are being developed or will become spin-offs of the programs covered by the US unmanned systems program. The table below illustrates the number and types of UVS that the United States assesses as having a force application capability (i.e., capable of offensive action). These systems span the ubiquitous Predator and Reaper UAVs to GCVs and the newly developed littoral combat ship (LCS). The LCS is the latest addition to the US Navy and is designed to operate on a modular basis with several unmanned systems loaded on board, including the Remote Mine Hunting System and MQ-8B Fire Scout Vertical Takeoff Unmanned Air Vehicle.

Table 1
Named Unmanned Systems Associated with Force Application[19]

Air-to-Air UAS	WMD Aerial Collection System (WACS)
Automated Combat SAR Decoys	Autonomous Expeditionary Support Platform (AESP)
Automated Combat SAR Recovery	Contaminated Remains/Casualty Evacuation & Recovery
Combat Medic UAS for Resupply & Evacuation	Crowd Control System (Non-lethal Gladiator Follow-on)
EOD UAS	Defender
Floating Mine Neutralization UAS	Intelligent Mobile Mine System
High Altitude Persistent/Endurance UAS	Next Generation Small Armed UGV
High Speed UAS	Nuclear Forensics Next Generation UGV
Micro Air Vehicle (MAV)	Small Armed UGV Advanced
MQ-1	Small Unmanned Ground Vehicle (SUGV)
MQ-9 Reaper	UAS-UGV Teaming
Next Generation Bomber UAS	Amphibious UGV/USV

Table 1 Named Unmanned Systems Associated with Force Application (continued)	
Off Board Sensing UAS	Autonomous Undersea Mine Layer
Precision Acquisition and Weaponized System (PAWS)	Bottom UUV Localization System (BULS)
SEAD/DEAD UAS	Harbor Security USV
Small Armed UAS	Hull UUV Localization System (HULS)
STUAS/Tier II	Mine Neutralization System
Unmanned Combat Aircraft System–Demonstration (UCAS-D)	Next Generation USV with Unmanned Surface Influence Sweep System (USV w/US3)
Vertical Take-off and Landing Tactical Unmanned Air Vehicle (VTUAV Firescout)	Remote Minehunting System (RMS)
WARRIOR A/I-GNAT	SUSV with Unmanned Surface Influence Sweep System (USV w/US3)
Weapon borne Bomb Damage Information UAS	VSW UUV Search, Classify, Map, Identify, Neutralize (SCMI-N)

To illustrate that not all developments have focused on offensive capability, the table below illustrates that an even greater number of UVS are being developed that are associated with protection capabilities. These systems include harbor security UASs, explosive ordnance disposal (EOD) UASs and battlefield casualty extraction robots designed to reduce risk to military medics by carrying out the traditional stretcher-bearer function.

Table 2 Named Unmanned Systems Associated with Protection[20]	
Automated Combat SAR Decoys	MK 3 MOD 0 RONS
Automated Combat SAR Recovery	MK 4 MOD 0 Robot, EOD
Combat Medic UAS for Resupply & Evacuation	Mobile Detection Assessment Response System (MDARS)
EOD UAS	Multi-function Utility/Logistics and Equipment (MULE) ARV Assault Light (ARV-A(L))
MQ-1	Multi-function Utility/Logistics and Equipment (MULE) Countermine (MULE-C)

Table 2 Named Unmanned Systems Associated with Protection (continued)	
MQ-5B Hunter	Multi-function Utility/Logistics and Equipment (MULE) Transport (MULE-T)
RQ-7 Shadow	Next Advanced EOD Robot
STUAS/Tier II	Next Generation Maritime Interdiction Operations UGV
Unmanned Combat Aircraft System–Demonstration (UCAS-D)	Next Generation Small Armed UGV
Vertical Take-off and Landing Tactical Unmanned Air Vehicle (VTUAV Firescout)	Nuclear Forensics Next Generation UGV
WARRIOR A/I-GNAT	PackBot Explorer
Advanced EOD Robot System (AEODRS)	PackBot FIDO
All Purpose Remote Transport System (ARTS)	PackBot Scout
Anti-Personnel Mine Clearing System, Remote Control (MV-4B)	Route Runner
Automated Aircraft Decontamination	Small Armed UGV Advanced
Automated Bare Base/Shelter Construction UGV	Talon Eng/3B
Automated Facilities Services	Talon EOD
Autonomous CASEVAC & Enroute Care System (ACES)	Talon IV
Autonomous Expeditionary Support Platform (AESP)	UAS-UGV Teaming
Battlefield Casualty Extraction Robot (BCER)	xBot (PackBot Fastac)
CBRN Unmanned Ground Vehicle Advanced	Autonomous Undersea Mine Neutralization
CBRN Unmanned Ground Vehicle Advanced Concept Technology Demonstration	Bottom UUV Localization System (BULS)
Combat Engineering & Support Robotic System	Harbor Security USV

Table 2 Named Unmanned Systems Associated with Protection (continued)	
Contaminated Remains/Casualty Evacuation & Recovery	Hull UUV Localization System (HULS)
Crowd Control System (Non-lethal Gladiator Follow-on)	Mine Neutralization System
Defender	Next Generation Surface-launched Mine Counter-Measures Unmanned Undersea Vehicle (SMCM UUV)
F6A-ANDROS	Next Generation USV with Unmanned Surface Influence Sweep System (USV w/US3)
HD-1	Remote Minehunting System (RMS)
MARCbot	SEAFOX USV
Maritime Interdiction Operations UGV	Surface-launched Mine Counter-Measures Unmanned Undersea Vehicle (SMCM UUV)
Mine Area Clearance Equipment (MACE)	USV with Unmanned Surface Influence Sweep System (USV w/US3)
MK 1 MOD 0 Robot, EOD	VSW UUV Search, Classify, Map, Identify, Neutralize (SCMI-N)
MK 2 MOD 0 Robot, EOD	

Other nations have not been idle in the face of the incredible pace of UVS development and the unprecedented resource allocation that the United States has committed to the task. Both the United Kingdom and Israel have long been pioneers in UVS development, albeit in slightly different areas. In response to the Irish Republican Army terrorist threat in the second half of the twentieth century, which regularly manifested itself through either remotely detonated or time-delayed improvised explosive devices, the United Kingdom pioneered the development of a remotely operated EOD capability. Similarly, it was Israeli application of UAS capability in the Bekaa Valley in Lebanon in the 1970s that showed the potential for the future development of such systems.[21]

However, development in these countries has not been restricted solely to these types of systems. The United Kingdom is actively developing its capability in TUAVs, with the early prototype Phoenix TUAV having been replaced by both the Hermes 450 TUAV and Desert Hawk (a handheld TUAV).[22] Further development

of the Watchkeeper TUAV will see the capability for automated takeoff and landing being deployed.[23] In addition, the United Kingdom has invested in developing longer-range stealth UAS with offensive strike capability as part of the Taranis project, as well as in developing other offensive strike capability in the form of loitering munitions[24] and cruise missiles such as Brimstone.[25]

In addition to its vibrant UAS industry, Israel has also developed capabilities in the land environment with point-defense systems, such as the Guardium System, which illustrates increasingly enhanced and sophisticated levels of automation.[26] South Korea has developed a similar concept with its Samsung Techwin SGR-A1 Sentry Guard Robot[27] designed to perform surveillance and sentry duties of minefields along the Korean Demilitarized Zone. China is also widely assumed to be developing UVS technology following the unveiling of the Anjian (Invisible Sword) prototype pilotless combat aircraft by the China Aviation Industry Corporation I at the sixth International Aviation and Aerospace Exhibition held in Zhuhai, in October 2006.[28]

As one would expect when technology develops at such a rate, there are also prototypes that suggest either bizarre or incredible future developments. These include the suggestion of using implants in crickets to aid in the detection of the presence of either explosive chemicals or carbon dioxide emissions in order to detect explosives and humans, respectively.[29] Other prototypes include LAPCAD Engineering's FOOT vehicle, the Fly Out of Trouble jet-engine-powered supercar, and the aquatic robot named Ghost Swimmer that mimics the propulsion drive of a bluefin tuna.[30] While these developments may seem incredible to many, other previously dismissed systems such as FIST (Fully Integrated Soldier Technology), which consists of a combination of special e-textiles, exoskeletons and nanotech armor, are being developed beyond mere prototype sketches into credible programs by defense research agencies such as the US Defense Advanced Research Projects Agency (DARPA). Indeed, such are the advances in nanotechnology that a prototype ultramicro UAV called the Maple Seed Flyer is being developed by Lockheed Martin as a means of providing persistent ISR stealth capability.[31]

Legal Consequences of New Technology

While much of the new technology discussed in the preceding section is of an automated or semiautonomous nature, the area giving rise to the greatest controversy, including legal consequences, is that of autonomous systems. These are UVS programmed to act independently of human control. A leading proponent of this technology is Professor Ron Arkin of the Georgia Institute of Technology.[32] Arkin's hypothesis is that not only can robots that are programmed with an ethical code outperform humans in terms of their ability to process complex, fast-moving

scenarios, but they will consistently behave in a manner that is *more* humane. This is not merely the zealous utterance of an extreme fringe of the unmanned system development community. Arkin has been commissioned by DARPA to conduct a study on the feasibility of his hypothesis and whether it, in fact, has any military application. In relation to his research for DARPA Arkin states: "This effort has an over-arching goal of producing an 'artificial conscience,' to yield a new class of robots termed *humane-oids*—robots that can perform more ethically in the battlefield than humans are capable of doing."[33]

Clearly the suggestion of robots performing tasks, including offensive operations, without recourse to human controllers raises not only legal, but considerable ethical questions. Support for these systems, of course, presumes that programming code can be produced that will allow robots to act in accordance with LOAC—a matter that is yet to be determined. However, the mere claim that robots can act in accordance with LOAC does not test the difficult, if not problematic, question of operating UVS in armed conflict, where the fog of war creates ambiguity and unpredictability beyond the imagination of even the most gifted programmer.

These concerns have not gone unnoticed by States in their analyses of the development and employment of this type of technology. The US Roadmap states:

> Because the DoD complies with the Law of Armed Conflict, there are many issues requiring resolution associated with employment of weapons by an unmanned system. For a significant period into the future, the decision to pull the trigger or launch a missile from an unmanned system will not be fully automated, but it will remain under the full control of a human operator. Many aspects of the firing sequence will be fully automated but the decision to fire will not likely be fully automated until legal, rules of engagement, and safety concerns have all been thoroughly examined and resolved.[34]

One could add that the "significant period into the future" referred to will also include an element of the international community becoming familiar with, and unconcerned about, the operation of such UVS, assuming, of course, that the technology will develop in such a way as to satisfy all the operating criteria of the military. This may well mean that for the foreseeable future we will continue to see human control being exercised over UVS, even where these systems may have the capability of operating independently of human control. The United States Air Force Unmanned Aircraft Systems Flight Plan 2009–2047,[35] essentially a single-service plan to implement the strategic guidance provided in the Roadmap, clearly anticipates the existence of this continued human control when it makes the following assumption: "Agile, redundant, interoperable and robust command and control (C2) creates the capability of supervisory control ('man *on* the loop') of UAS."[36]

The questions to be resolved by policymakers in the military application of UVS are set out in the Air Force's UAS Flight Plan as follows:

> Authorizing a machine to make lethal combat decisions is contingent upon political and military leaders resolving legal and ethical questions. These include the appropriateness of machines having this ability, under what circumstances it should be employed, where responsibility for mistakes lies and what limitations should be placed upon the autonomy of such systems. . . . Ethical discussions and policy decisions must take place in the near term in order to guide the development of future UAS capabilities, rather than allowing the development to take its own path apart from this critical guidance.[37]

Quite apart from the ethical questions posed by the employment of autonomous systems, perhaps the most overt extension of the application of UVS technology, there remain real concerns as to the ability of such weapons to comply with LOAC. The autonomous system's ability to distinguish a military objective from a protected person or object, and its ability to weigh the proportionality test in a holistic manner,[38] is yet to be adequately addressed. The question of accountability for the actions of autonomous systems also cries out for an answer and will be addressed in Part III.

The quest to develop the newest, best and most capable military technology (the Holy Grail of decisive effect) can often result in the relegation to the backseat of considerations as to whether such technology is not only needed but, indeed in a broader perspective, even *desirable*.

Existing Legal Control Mechanisms

As military technology development continues to progress at an unrelenting pace as States strive to achieve the next level of technological advantage over one another, how does the law cope with these new developments and seek to regulate them? AP I is clear in articulating those types of methods (including weapons) that are prohibited in armed conflict.[39] Indeed, the prohibitions contained in Article 35(2) are relatively non-contentious, representing as they do the customary law on the subject.[40] Similarly, the provisions of Article 36[41] have been accepted, even by States who are not parties to AP I, as either reflective of best practice or as an obligation flowing from the customary law norm articulated by Article 35(2)—although it is by no means as clear that Article 36 has the status of customary law. Not that Article 36 is particularly controversial in its terms, which require States to determine the lawfulness of new weapons and means and methods of warfare. Rather, it is in the *obligation* to comply with its operation that disparate State practice seems to have developed. As Professor Jacobsson observes, "Unfortunately, very few

States undertake such an examination before employing new means and methods of warfare, despite the fact that the obligation relates to the initial stages, i.e., the 'study' and 'development' of a new weapon."[42]

Proving Professor Jacobsson's assertion empirically is problematic, given that even those States, such as the United States, that have sophisticated weapons testing programs do not publish the results of their analyses. The very nature of certain new UVS technology will mean that not all States will even have the *capacity* to conduct adequate testing were they to acquire the technology. Notwithstanding this, it can be assumed that those States that do possess the wherewithal to develop new technology should also have the concomitant ability to carry out the necessary analysis required by Article 36. Of course, given that it is arguable whether Article 36 is declaratory of customary law, those States not party to AP I are under no specific obligation to comply with its provisions. However, as the sole purpose of the Article 36 requirement to assess LOAC compliance of new weapon systems prior to introduction relates to customary law obligations as codified in Article 35, it would appear *a fortiori* that best practice suggests a State would be prudent to ensure that it is not in breach of its LOAC obligations by assessing the introduction of new weapons systems. Evidence of this approach can be seen in the existence of what is probably the most sophisticated assessment process for the introduction of new weapons carried out by a State—and this by a country that is not a State party to AP I, namely, the United States.

It is another matter, however, whether the output from these reviews should be published. This is certainly not current State practice, notwithstanding the fact that there have been calls from a number of differing organizations for greater transparency in the review of new weapon systems. These have ranged from representatives of States[43] to human rights institutions.[44] These arguments include questions of confidence measures in relation to international arms sales and exports in the case of States, or the characteristics of weapons systems and their effect on civilian populations in the case of human rights activists. What is consistent is the argument that there is a public right to know that the State that oversaw the development of the new technology giving rise to the production of a new weapon system correctly assessed its impact for LOAC compliance.

This debate aside, it is clear that if the law is to keep pace with technological developments, then it is through the weapons review process that the initial fitness-for-use test in LOAC terms can be established. While the requirement to carry out the test, whether as a binding legal obligation or as an exemplar of best practice, would appear to be entirely consistent with an approach illustrating the law's ability to keep pace with new technology, the concerns raised by an increasing number of interested parties within the international community over whether such reviews are

actually conducted would seem to give rise to justifiable concerns that this important component of LOAC application is not being given the effect it should have.

The existence of new military technology, possessing capabilities far beyond those anticipated when the LOAC paradigm was first formally constructed in the nineteenth century, has resulted in calls that LOAC is no longer "fit for purpose" in fulfilling the role of regulating armed conflict and, in particular, providing protection to those it is designed to protect. Increasing levels of weapon system automation, coupled with claims that robots can behave "more humanely" than humans, create an uncomfortable juxtaposition of concepts leading to further reflection as to LOAC's suitability in its current guise. These calls fail to address the fact that, in part, LOAC does provide a framework to address these issues. In many senses it is the failure of States to apply the principles of AP I's Articles 35 and 36 in a consistent manner that results in a perception of new technology being allowed to proceed without any form of checks and balances.

It is clear that in theory, if not in practice, adequate control mechanisms do exist to ensure LOAC compliance during the development and procurement phases. It is, however, appropriate to consider whether the changing character of weapons systems has had the effect of altering the applicable LOAC standards in terms of their employment. Part II will consider this question and whether calls for the development of LOAC to respond are warranted.

Part II. Impacts on LOAC Standards Arising from New Technology

The enhanced capabilities brought about through the development and employment of the new technologies referred to in the preceding part bring with them not only the ability to achieve decisive effect on the battlefield but an unprecedented ability to give effect to the application of LOAC. The changing character of weapons means that militaries possessing the relevant capability can not only target with unprecedented precision but, in addition, through the use of sophisticated persistent surveillance, assess with much greater accuracy the anticipated effects of incidental loss or damage to civilian persons or property and take appropriate remedial measures. The cumulative effect of this has been to enable, in certain circumstances, the achievement of much enhanced levels of protection for civilians by those nations employing such technology.

It is important to note the qualification "certain circumstances" in the preceding paragraph. Notwithstanding the aspiration to be able to conduct targeting in an environment that is as controlled as possible, both the nature of armed conflict and in particular the confused and often ambiguous environment of land operations mean that the conditions necessary to fully exploit the capabilities that new

technology offers commanders and their staff are frequently not met. This is a particularly challenging scenario in conflicts of a non-international character, where the blurring of the lines between civilian and military is a commonplace occurrence.

What effect, then, has the changing character of weapons had on the standards to be applied by States who possess the types of advanced technology of which UVS are an example? Have technological advances resulted in the effect of Article 57 of AP I changing?[45]

Some academics,[46] and indeed State practice,[47] suggest that the requirement to take all feasible precautions in attack to minimize incidental loss of life to civilians and damage to civilian objects should be seen in the context of a subjective analysis based on capabilities available to the relevant commander. This will mean that where a commander's technological capabilities exceed those of his opponent, a higher standard in relation to precautions in attack will apply. There are, however, those who would argue that an entirely new legal standard is now possible and that LOAC should be amended so as to speak to the question of common but differentiated responsibilities.[48]

Common but Differentiated Responsibilities

Professor Gabriella Blum argues that by comparing LOAC to international trade law or environmental law, parallels can be drawn between those regimes where differing standards are applied to countries that have greater means than to those who do not. Or otherwise put:

> While the equal application of the law has formally endured in [international humanitarian law], as in most spheres of international law, regulation has taken a different path in some areas of international law—most notably, international environment law ("IEL") and international trade law ("ITL")—by linking obligations with capabilities. This linkage has been accomplished in several ways: by defining obligations with reference to resources (such as ordering compliance by developed parties "to the fullest extent possible"), exempting weaker parties from compliance with certain obligations altogether, and even ordering more powerful parties to extend material assistance to weaker ones. Taken together, these provisions have been termed Common but Differentiated Responsibilities ("CDRs") . . . .[49]

Taken in the context of new technology, the concept of CDRs, applied in a minimalist sense, would support the extant requirement under LOAC for a State who possesses the technical capability to be obliged to consider its use as part of taking all feasible precautions in attack. In extremis, the CDR approach might well obligate States to share technology, where to do so would improve the overall level of protection afforded to the civilian population. Of course, the phenomena, often

characterized by new technology, of enhanced precision and distinction are motivated more by military considerations than necessarily the ability to minimize incidental loss, which is a welcomed spin-off. In such circumstances the obligation to share technology as part of some form of CDR may well prove problematic, even counterproductive to the development of the types of new technology that enable greater LOAC compliance. Nor is there a positive obligation under LOAC for States to develop and employ new technology possessing such characteristics.[50]

Therefore, CDRs that go beyond the current LOAC construct would require either a basis in treaty or some form of development in the customary law. Neither would seem to be likely in the short to medium term, nor does there appear to be any need for this. The current LOAC principle of proportionality coupled with the requirement to take all feasible precautions in attack would appear to be perfectly adequate not only in recognizing the differing means available to parties to a conflict, but in also requiring that higher standards be observed by those parties who can. The term "all feasible precautions" provides sufficient flexibility to address the relative disparities in capabilities between belligerents. As such, it can adequately accommodate the application of both extant and new technology.

To create a structure that seeks to codify a set of CDRs in LOAC not only is unnecessary, but would be quite impossible to achieve—impossible in the context of being able to adequately define such CDRs under treaty law (to an extent that provides any form of meaningful advance on the extant LOAC) and impossible in that State practice sufficient to point to such a development in customary law would be as elusive as the proverbial pot of gold at the end of a rainbow. Which State with the relevant capability is likely to conduct itself in a manner so as to create such practice?

Professor Mike Schmitt underscores this fact in his reference to the existence of a state of normative relativism:

> [A]s the technological gap widens, the precautions in attack requirements operate on the belligerents in an increasingly disparate manner. After all, the standards are subjective, not objective; a belligerent is only required to do what is feasible, and feasibility depends on the available technology. The result is normative relativism—the high tech belligerent is held to higher standards vis-à-vis precautions in attack than its opponent. It is, of course, normative relativism by choice because States are under no legal obligation to acquire assets that will permit them to better distinguish between military objectives and the civilian population.[51]

Evolution of Customary Law?

Notwithstanding Schmitt's clear statement of where the current law places differing obligations on belligerents (making the CDR approach somewhat moot), the recent International Committee of the Red Cross (ICRC) *Interpretive Guidance on*

the Notion of Direct Participation in Hostilities under International Humanitarian Law (DPH Study)[52] suggests that the ICRC view of the customary law position in relation to the use of force might in some limited manner support the premise behind CDRs. At chapter IX of the DPH Study the ICRC sets out its position on the permissible levels of force that may be used by parties to a conflict to achieve a military objective. It argues that technology can be determinative in defining the military necessity context within which particular levels of force are used. Indeed the DPH Study anticipates technology playing a limiting role where it provides the capability to achieve effect with the use of lower levels of violence.

The DPH Study is not without its critics, particularly with respect to the position it takes in articulating the existing law in chapter IX. Much of the criticism focuses on what is perceived as a conflation of a law enforcement paradigm governing the use of force under human rights law with the approach under LOAC, ignoring the accepted principle of *lex specialis*.[53] While it is not the place of this article to engage in a detailed debate of the DPH Study (the author would not be as critical as some commentators of the position articulated by the ICRC in chapter IX and finds much in the remainder of the study to commend it), it is conceivable that the DPH Study might be used to develop arguments in support of a CDR approach. Whether this is the intent of the DPH Study or not, there is a need to consider the consequences of such arguments on LOAC, particularly with reference to proportionality and precautions in attack. This is not a debate that impacts purely on questions of distinction and therefore is of questionable value in forming part of a discrete study on direct participation in hostilities.

Any consideration of the impact of new technology on LOAC standards runs the risk of being seduced by the same scenario that creates exaggerated perceptions of what new technology can deliver in terms of effect on the battlefield. Such a perception drives the argument that the law has failed to keep pace with change, is therefore redundant and requires change. However, such an approach fails to acknowledge the operation of LOAC as a flexible system in which the latest technological advances can be adequately accommodated without the need for root-and-branch change to the law. Professor Christopher Greenwood, writing in 1998, identified this quality as the key strength of LOAC:

> The flexibility of the general principles thus makes them of broader application than the specific provisions which are all too easily overtaken by new technology. If the speed of change in military technology continues into the next century (as seems almost inevitable), that capacity to adapt is going to be ever more important.[54]

Greenwood's assertion is, of course, predicated upon the assumption that the pace of technological development will make specific attempts to regulate particular developments either susceptible to redundancy, or reflective of a piecemeal attempt to ban individual weapons.[55] When one couples the AP I requirement to assess the implementation of new technology for the purposes of LOAC compliance in conjunction with the extant customary law obligations to assess proportionality and take all feasible precautions in attack, it is hard not to agree with Greenwood when he states:

> In this writer's opinion, it is both more probable and more desirable that the law will develop in this evolutionary way than by any radical change. With the law of weaponry, as with most of the law of armed conflict, the most important humanitarian gain would come not from the adoption of new law but the effective implementation of the law that we have. That should be the priority for the next century.[56]

If one accepts that the extant LOAC paradigm is adequate in addressing issues arising from both the development and employment of new technology, then it is right to consider whether the final part of the LOAC system—accountability—is similarly well placed to cope. Part III will consider the changing character of weapons and whether the LOAC accountability paradigm can adequately address the issues that arise from new technology.

Part III. Implications for Accountability

When considering new technology and its military application, any analysis will invariably turn to the question of accountability. While mechanization of the battlefield is neither new, nor something the international law dealing with criminal responsibility is unaccustomed to addressing, the potential for autonomous weapon systems to effectively remove the human, either from the loop or even on the loop, poses challenges.

Remotely Controlled and Automated Systems

The question of accountability in the case of tele- or remotely operated vehicles is relatively straightforward. An operator controls the device and as a consequence the actions of that device can be attributed to that operator, or indeed to his/her commander in the context of directing action that constitutes a breach of LOAC or where the commander fails to act to either prevent or punish LOAC breaches.

Similarly, even automated systems will generally be employed within either a context that is controlled by humans, directing the vehicle to a particular task, or

one in which humans can intervene in the event that the device were to act outside its mission or the permitted LOAC paradigm. The premise underpinning automation is that the operation of the relevant device is capable of being accurately predicted based on the programming and commands inputted.

Barring deviant behavior, on behalf of either the computer programmer or operator, it can be assumed that the vehicle will generally act within the permitted legal framework. Of course malfunction can never be excluded, nor can the consequences of ambiguity on the battlefield. However, there is generally sufficient nexus of control or operation in the cases of both remotely operated and automated vehicles such that the international criminal law can attribute accountability for culpable behavior in cases of LOAC violations.

Autonomous Systems

This equation becomes much more problematic in the case of autonomous systems. The very nature of autonomous systems implies that they have an artificial intelligence capable of analyzing information, determining a course of action based on this analysis and then executing that response, all without the intervention of a human operator. The operation of the autonomous device creates considerable challenges for the would-be LOAC violation prosecutor in terms of establishing the relevant nexus of culpable behavior by a human such as to give rise to criminal liability. The tele-operator of remotely controlled vehicles or even the command programmer for automated equipment can both be seen as having direct roles in determining the actions of the devices they control. They are capable of direct responsibility, even if that control is exercised at distance—sometimes a considerable one.[57]

This cannot be said of those involved with autonomous systems. Neither the programming nor the command data inputted to these vehicles prior to their deployment on a particular operation will necessarily result in a specific outcome in response to any given set of circumstances; this is the essence of autonomy. Absent the aberrant behavior of either the data or command programmers, which would be considered in the same context as for remotely or automated vehicles, it would be almost impossible to attribute the autonomous system's behavior *directly* to a particular human. That is not to say autonomous vehicles are incapable of LOAC breaches. Indeed, even the most ardent supporters of autonomous systems do not argue that breaches can be completely removed, just that autonomous systems can perform better (including more ethically) than humans.[58]

The notion of accountability is of course a uniquely human one. Under any system of law the commission of a crime (such as a breach of LOAC) should give rise to an investigation and where sufficient evidence exists, the prosecution of the

alleged perpetrator. What happens then when the perpetrator is incapable of being prosecuted because it is a machine? Other than reprogramming or scrapping equipment there is little point in carrying out a futile exercise of finding the relevant piece of equipment guilty of a LOAC breach. Such a scenario offends not only the notion of the rule of law, but also the more visceral human desire to find an individual accountable. Given this, it would appear highly unlikely that a breach of LOAC by an autonomous system is something that would go without some degree of human accountability. Indeed there is a strong argument that States should not be able to employ such systems and rely upon the relative impunity with which their operations might be conducted in the event that the question of accountability fails to be resolved.

States and Commanders in the Dock

There are, of course, two alternative means of accountability: State responsibility under human rights mechanisms and command responsibility.

To take these in order: The extent to which States will be held responsible for what might constitute a human rights violation that is equally one under LOAC will depend on not only the character of the conflict concerned,[59] but also the respective State obligations under international human rights law. This will produce significantly disparate effects in terms of sanctions, e.g., in the case of States who are parties to the European Convention on Human Rights as compared to that of those States who have obligations under the International Covenant on Civil and Political Rights alone. This is largely due to the enforcement mechanisms in place in relation to each of these treaty structures. While this difference may well have an impact on the formal aspects of enforcement (e.g., court rulings and pecuniary awards against States in the case of the former), one cannot avoid the implications for States that flow from judgments of courts like the European Court of Human Rights and Inter-American Court of Human Rights, or bodies such as the United Nations Human Rights Council. Such pronouncements, influencing as they do in the age of mass communication the court of public opinion, may well have a determining effect on the preparedness of States to employ autonomous systems ahead of the creation of any corresponding permissive environment, whether this be political or social.

Perhaps one of the unintended consequences of the development of autonomous weapons systems is the potential that they may have to focus greater attention on civilian leadership and military commanders at the operational or strategic level for the actions of autonomous systems. It is useful here to remind oneself that the increased levels of sophistication and complexity that new technology introduces to the battlefield are part of a systemic approach to leveraging technology to

achieve decisive effect. As such, any future employment of autonomous systems must be seen in this context. It would be naïve, therefore, to think of circumstances where a commander would allow the deployment of autonomous weapon systems in a manner where their operation was not in accordance with his or her particular campaign design and where the purpose behind the use of these systems would not be to achieve consistent, predictable effect.

Given the unpalatable outcome of alleged breaches of LOAC going unpunished, it is far more likely that in the future the concept of command responsibility under international criminal law will be seen as an appropriate recourse for attributing accountability for LOAC breaches by autonomous systems. The arguably lower threshold test in terms of culpability for command responsibility contained within the Rome Statute,[60] requiring merely that a commander "should have known" of the possibility of the alleged breach of LOAC, places in sharp focus a commander's potential liability. This is particularly the case in circumstances where the removal of subordinates in the command chain results in fewer individuals who might otherwise be accorded the substantial responsibility for LOAC breaches.

It remains to be seen whether this increased risk is a "real" one or whether it is no different than that which exists in cases where such systems are not employed. It is, however, a consequence that has received little, if any, attention from legal advisers in armed forces. It is certainly deserving of greater consideration. Such attention should focus not only on the technical aspects of attributing responsibility based on the requisite elements of offenses being satisfied, but on the broader public policy issues associated with the possibility of military operations being conducted in a "blameless environment."

Conclusion

In one sense, the changing characters of weapons and armed conflict, seen in the specific context of unmanned vehicles and systems, represent nothing more than the natural evolution of technology in its application to the battlefield. However, in other respects the introduction of new technology creates challenges for the application of LOAC, if only in the sense that what is unusual or different is often seen as complex and difficult.

This article posed the question of whether the changing character of weapon systems, including unmanned systems and vehicles, is such as to question the ability of LOAC to adequately cope with the introduction of new technology to the battlefield.

Fundamental to this question is the consideration of new technology in the context within which it is to be employed. New technology often has a symbiotic

relationship with the evolution of new tactics and stratagems. The capabilities it brings to the battlefield have aided in shaping new approaches to the practice of the "art of war." It is important to remind oneself in this respect that the tail should not be wagging the dog. Enhanced capability and new hardware, bewildering as they are in the scope and reach of their effects, should be seen as means to an end, not ends in themselves.

Just as military doctrine has demonstrated its flexibility in coping with the relentless development and introduction of new technology, LOAC has provided—and will continue to provide—a framework for the regulation of armed conflict. Calls to create new standards or to interpret the law in ways that seek to regulate the unknown, or at least the not yet known, do not stand up against an assessment of what LOAC provides in terms of a system of law that regulates not just the introduction of new technology, but also its application.

Useful processes, such as those forming part of the AP I Article 36 weapons review, seem purpose designed not only to act as initial control valves to ensure that military methods and means can advance in a coherent and effective manner but also to act as red flags to possible LOAC issues associated with the employment of new technology. It is unfortunate that too few States engage actively in the weapons review process, an area where greater effort to comply with the law should occur.

Generally the existing LOAC rules would seem sufficiently flexible to adapt to the deployment of new technology on the battlefield. In many respects new technology has greatly aided the application of LOAC and contributed to an *increase* in the protection of civilians. In this sense, the story is a good news one. The extant LOAC paradigm has responded in a flexible manner, benefiting from the positive synergies afforded by technological advances. The virtue of such a system, however, comes with compliance rather than the creation of new standards or responsibilities, such as CDRs, or use of the capabilities afforded by new technology to argue that a human rights paradigm is more appropriate. Armed conflict continues to be an unpredictable, often base affair, where significant ambiguity prevails, notwithstanding the employment of considerable technological capability. The benefits afforded by new technology in such circumstances are significant if they can ameliorate even some of the suffering caused by armed conflict, but they are by no means a panacea.

New technology creates its own challenges in the context of accountability, particularly with respect to autonomous systems. The perverse effect for States and the senior civilian and military command echelon who promote the development and implementation of new technology as a means of "casualty free" warfare is that they may well find themselves with nobody to stand between the actions of such autonomous systems and themselves when things go wrong. It is hoped that the

associated discomfiture from this realization may well act in a positive capacity to focus minds as to the need for such new technology, and manner in which it is employed.

Consider the mutually assured destruction scenario, which hung over the world during the Cold War and led to the notion that nuclear weapons should be treated as a "special case." This was largely due to the nature of such weapons, dehumanizing war and giving rise to massive destruction on a wide-scale basis. Autonomous weapons systems as an example of the changing character of weapons may not involve such destruction; indeed one of the consequences of their use is that it avoids such a scenario. However, an increasing reliance upon technology clearly has the potential to dehumanize armed conflict, creating a perception of low or no risk and, in doing so, possibly convincing States of the viability of the recourse to the use of force to resolve disputes.

In the face of this, LOAC continues to offer a balanced, civilizing effect as part of a system of law providing a broad regulatory framework intended to afford protection to the most vulnerable. In this context, flexibility (of course coupled with compliance) is its greatest strength. Whether the current developments in technology will constitute a "watershed" or defining moment in the evolution of warfare remains to be seen. What is clear is that LOAC is capable of keeping pace and continuing to meet its mission of protection and humanity.

Notes

1. MICHAEL IGNATIEFF, VIRTUAL WAR: KOSOVO AND BEYOND 161 (2000).
2. United Kingdom Ministry of Defence, The Manual of the Law of Armed Conflict ¶ 1.8 (2004) [hereinafter UK LOAC Manual].
3. *Id.*, ¶ 6.1.4.
4. See *id.* at 66–80 for an analysis of prohibited methods of warfare.
5. Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts, June 8, 1977, 1125 U.N.T.S. 3 [hereinafter AP I].
6. Gabriella Blum, *On a Differential Law of War*, 52 HARVARD INTERNATIONAL LAW JOURNAL 163 (2011).
7. Office of the Secretary of Defense, Department of Defense, FY2009–2034 Unmanned Systems Integrated Roadmap (2d ed. 2009), *available at* http://www.acq.osd.mil/psa/docs/UMSIntegratedRoadmap2009.pdf [hereinafter DoD/OSD Roadmap].
8. *Id.*, Annex H, at 193.
9. Michael Franklin, *Unmanned Combat Air Vehicles: Opportunities for the Guided Weapons Industry?*, Sept. 2008, *available at* http://www.rusi.org/downloads/assets/Unmanned_Combat_Air_Vehicles.pdf.
10. *Id.* at 3.
11. Julian Stinton, *The 'Find' Function – An Airman's Personal View*, RUSI DEFENCE SYSTEMS, Feb. 2009, at 57, 59.

12. Brian Burridge, *Post-Modern Warfighting with Unmanned Vehicle Systems – Esoteric Chimera or Essential Capability?*, RUSI JOURNAL, Oct. 2005, at 20.

13. Norman Friedman, *UCAVs: A New Kind of Air Power?*, RUSI DEFENCE SYSTEMS, June 2010, at 62, 63.

14. Franklin, *supra* note 9, at 3 (the UAV operators are located at Creech Air Force Base, Indian Springs, Nevada).

15. DoD/OSD Roadmap, *supra* note 7.

16. *Id.* at 4, Table 1.

17. Jack M. Beard, *Law and War in the Virtual Era*, 103 AMERICAN JOURNAL OF INTERNATIONAL LAW 409, 413 (2009), *available at* http://www.law.georgetown.edu/faculty/userfiles/file/foreign%20relations%20law%20colloquium/Beard_first_proofs_(7-13-09).pdf.

18. *Id.* at 411.

19. DoD/OSD Roadmap, *supra* note 7, at 10, Table 4.

20. *Id.* at 11–12, Table 5.

21. Burridge, *supra* note 12, at 20.

22. Claire Button, *Unmanned Aerial Vehicles on Operations: Overcoming the Challenges*, RUSI DEFENCE SYSTEMS, June 2009, at 76.

23. *Id.* at 77.

24. Simon Deakin, *Joint Fires – The Challenges to Come*, RUSI DEFENCE SYSTEMS, Feb. 2010, at 82, 84. Loitering munitions are small cruise missiles that can be launched and left to "loiter" or "stack" for calling forward and being designated on target when it appears.

25. For a discussion of Brimstone's capabilities, see *Libya: RAF Unleashes Hellfire and Brimstone*, DEFENSEMANAGEMENT.COM (Mar. 10, 2011), http://www.defencemanagement.com/feature_story.asp?id=16132.

26. James Masey, *From Pack Mules to Fighting Scouts*, RUSI DEFENCE SYSTEMS, Oct. 2007, at 40, 41.

27. *Samsung Techwin SGR-A1 Sentry Guard Robot*, http://www.globalsecurity.org/military/world/rok/sgr-a1.htm (last visited Sept. 10, 2010).

28. A concept model of a pilotless combat aircraft was unveiled by China Aviation Industry Corporation I (CAIC1) during the 6th International Aviation and Aerospace Exhibition held in Zhuhai on China's southern coast. The aircraft, dubbed "Anjian" (Invisible Sword), is being designed by CAIC1's Shenyang Aeroplane Design Institution for future aerial combat according to an introduction by CAIC1. *Invisible Sword: China's Pilotless Aircraft*, CHINA VIEW, http://news.xinhuanet.com/english/2006-10/31/content_5270824.htm (last visited Sept. 5, 2010).

29. *Pentagon Cyborg-insect Program Could Save Quake Victims*, CAFESENTIDO.COM (July 14, 2009), http://www.casavaria.com/cafesentido/2009/07/14/3579/pentagon-cyborg-insect-program-could-save-quake-victims/.

30. *Boston Engineering's Ghost Swimmer SUV Spotted in the Wild*, MASSHIGHTECH.COM (Aug. 24, 2009), http://www.masshightech.com/blog/tag/boston-engineering/.

31. *Nano Air Vehicle*, LOCKHEEDMARTIN.COM, http://www.lockheedmartin.com/products/nano-air-vehicle.html (last visited Sept. 5, 2010).

32. Professor Ron Arkin is the Director of the Mobile Robot Laboratory, Georgia Institute of Technology, Atlanta, Georgia.

33. RONALD C. ARKIN, GOVERNING LETHAL BEHAVIOR IN AUTONOMOUS ROBOTS 16 (2009).

34. DoD/OSD Roadmap, *supra* note 7, at 10.

35. Headquarters, United States Air Force, United States Air Force Unmanned Aircraft Systems Flight Plan 2009–2047 (May 18, 2009).

36. *Id.* at 14.

37. *Id.* at 41.

38. That is, other than to simply attempt to predict the expected number of casualties and then determine engagement on the basis of whether the number is less than or exceeds a given programmed benchmark.

39. AP I, *supra* note 5, art. 35 (Basic rules):

> 1. In any armed conflict, the right of the Parties to the conflict to choose methods or means of warfare is not unlimited.
>
> 2. It is prohibited to employ weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering.
>
> 3. It is prohibited to employ methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment.

40. *Cf.* AP I, *id.*, art. 35(3). The United States, United Kingdom and France are to varying degrees persistent objectors to the adoption of this principle as a norm of customary IHL.

41. *Id.*, art. 36 (New weapons):

> In the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party is under an obligation to determine whether its employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party.

42. Marie Jacobsson, *Modern Weaponry and Warfare: The Application of Article 36 of Additional Protocol I by Governments*, *in* THE LAW OF WAR IN THE 21ST CENTURY: WEAPONRY AND THE USE OF FORCE 184 (Anthony M. Helm ed., 2006) (Vol. 82, US Naval War College International Law Studies).

43. *Id.* at 189. Jacobsson states the aspiration that "[t]here are a number of critical issues that need to be addressed at an international level. . . . [G]iven the obligation imposed on all States to evaluate the legality of the weapons used, it is reasonable to discuss the matter in a multilateral context."

44. Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, *Study on Targeted Killings*, Human Rights Council, U.N. Doc. A/HRC/14/24/Add.6 (May 28, 2010) (by Philip Alston), *available at* http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.Add6.pdf. In it, Alston addresses the questions of transparency and accountability. *Id.*, ¶¶ 87–92.

Although the report focused on the use of drones in the context of targeted killings, Alston's comments on transparency would appear to have much wider implications for the introduction of new technology. In paragraph 89 he refers to not only an obligation to take steps to consider the effects of weapons to be used but an obligation for States to disclose such procedural safeguards. Reference is made to the *HPCR Commentary* in support of this assertion. HARVARD PROGRAM ON HUMANITARIAN POLICY AND CONFLICT RESEARCH, COMMENTARY ON THE HPCR MANUAL ON INTERNATIONAL LAW APPLICABLE TO AIR AND MISSILE WARFARE rule 32(c) (2009), *available at* http://ihlresearch.org/amw/Commentary%20on%20the%20HPCR%20Manual.pdf.

While the *Commentary* articulates the requirements for precautions in attack, it does not support the contention that procedural safeguards taken by States to give effect to this obligation are required to be disclosed. There is little evidence to support Alston's assertion. As a consequence it must be viewed as an aspiration similar to that articulated by Jacobsson, *supra* note 42.

45. AP I, *supra* note 5, art. 57 (Precautions in attack) provides as follows:

1. In the conduct of military operations, constant care shall be taken to spare the civilian population, civilians and civilian objects.

2. With respect to attacks, the following precautions shall be taken:

(a) those who plan or decide upon an attack shall:

(i) do everything feasible to verify that the objectives to be attacked are neither civilians nor civilian objects and are not subject to special protection but are military objectives within the meaning of paragraph 2 of Article 52 and that it is not prohibited by the provisions of this Protocol to attack them;

(ii) take all feasible precautions in the choice of means and methods of attack with a view to avoiding, and in any event to minimizing, incidental loss of civilian life, injury to civilians and damage to civilian objects;

(iii) refrain from deciding to launch any attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated;

(b) an attack shall be cancelled or suspended if it becomes apparent that the objective is not a military one or is subject to special protection or that the attack may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated;

(c) effective advance warning shall be given of attacks which may affect the civilian population, unless circumstances do not permit.

3. When a choice is possible between several military objectives for obtaining a similar military advantage, the objective to be selected shall be that the attack on which may be expected to cause the least danger to civilian lives and to civilian objects.

4. In the conduct of military operations at sea or in the air, each Party to the conflict shall, in conformity with its rights and duties under the rules of international law applicable in armed conflict, take all reasonable precautions to avoid losses of civilian lives and damage to civilian objects.

5. No provision of this article may be construed as authorizing any attacks against the civilian population, civilians or civilian objects.

46. Michael N. Schmitt, *War, Technology and the Law of Armed Conflict*, *in* THE LAW OF WAR IN THE 21ST CENTURY, *supra* note 42, at 137.

47. UK LOAC Manual, *supra* note 2, at 85. The Manual supports this contention by stating that in assessing whether a decisionmaker has discharged his responsibilities in terms of precautions in attack, "[t]his means looking at the situation as it appeared to the individual at the time when he made his decision." When taken in conjunction with the factors listed at page 83, which include the weapons available, it is clear that UK State practice requires a subjective judgment on behalf of a decisionmaker taking into account any enhanced technological advantage in weapons he may possess. There is no obligation to use such weapons; however, the fact that they were available will *count* toward whether the decisionmaker took all *feasible* precautions.

48. *See, e.g.*, Blum, *supra* note 6.

49. *Id.*

50. YORAM DINSTEIN, THE CONDUCT OF HOSTILITIES UNDER THE LAW OF INTERNATIONAL ARMED CONFLICT 126–27 (2004).

51. Schmitt, *supra* note 46, at 163.

52. NILS MELZER, INTERNATIONAL COMMITTEE OF THE RED CROSS, INTERPRETIVE GUIDANCE ON THE NOTION OF DIRECT PARTICIPATION IN HOSTILITIES UNDER INTERNATIONAL HUMANITARIAN LAW 77–82 (2009).

53. W. Hays Parks, *Part IX of the ICRC "Direct Participation in Hostilities" Study: No Mandate, No Expertise, and Legally Incorrect*, 42 NEW YORK UNIVERSITY JOURNAL OF INTERNATIONAL LAW AND POLITICS 769, 797–99, *available at* http://www.law.nyu.edu/ecm_dlv2/groups/public/@nyu_law_website__journals__journal_of_international_law_and_politics/documents/documents/ecm_pro_065930.pdf.

54. Christopher Greenwood, *The Law of Weaponry at the Start of the New Millennium*, *in* THE LAW OF ARMED CONFLICT: INTO THE NEXT MILLENNIUM 185, 221 (Michael N. Schmitt & Leslie C. Green eds., 1998) (Vol. 71, US Naval War College International Law Studies).

55. E.g., the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction, Sept. 18, 1997, 2056 U.N.T.S. 211 and the Convention on Cluster Munitions, Dec. 3, 2008, 48 International Legal Materials 357 (2009).

56. Greenwood, *supra* note 54, at 222.

57. Franklin, *supra* note 9, at 3.

58. ARKIN, *supra* note 33, at 16.

59. Human rights law will continue to apply in times of armed conflict, subject to the application of the *lex specialis* rule in relation to LOAC or where States have made derogations under applicable treaties.

60. Rome Statute of the International Criminal Court, July 17, 1998, 2187 U.N.T.S. 90. Article 28 (Responsibility of commanders and other superiors) provides as follows:

> In addition to other grounds of criminal responsibility under this Statute for crimes within the jurisdiction of the Court:
>
> (a) A military commander or person effectively acting as a military commander shall be criminally responsible for crimes within the jurisdiction of the Court committed by forces under his or her effective command and control, or effective authority and control as the case may be, as a result of his or her failure to exercise control properly over such forces, where:
>
> (i) That military commander or person either knew or, owing to the circumstances at the time, should have known that the forces were committing or about to commit such crimes; and
>
> (ii) That military commander or person failed to take all necessary and reasonable measures within his or her power to prevent or repress their commission or to submit the matter to the competent authorities for investigation and prosecution.
>
> (b) With respect to superior and subordinate relationships not described in paragraph (a), a superior shall be criminally responsible for crimes within the jurisdiction of the Court committed by subordinates under his or her effective authority and control, as a result of his or her failure to exercise control properly over such subordinates, where:
>
> (i) The superior either knew, or consciously disregarded information which clearly indicated, that the subordinates were committing or about to commit such crimes;
>
> (ii) The crimes concerned activities that were within the effective responsibility and control of the superior; and
>
> (iii) The superior failed to take all necessary and reasonable measures within his or her power to prevent or repress their commission or to submit the matter to the competent authorities for investigation and prosecution.