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New Technologies and the Law of Armed Conflict

Hitoshi Nasu
Robert McLaughlin *Editors*



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Foreword

Since adoption of the 1977 Protocols Additional to the 1949 Geneva Conventions, the law governing armed conflict has developed primarily through the jurisprudence of international tribunals or by means of treaties setting forth restrictions and prohibitions on the weaponry of war. The latter have included conventions on non-detectable fragments, mines, booby-traps, incendiaries, blinding lasers, chemical weapons and cluster munitions. Other new treaty laws in the field have generally been limited to conventions enhancing the protection of especially vulnerable persons and objects, such as children and cultural property. Indeed, no treaties developing the general principles of law governing the conduct of hostilities have been adopted since the Additional Protocols. All indications are that this trend towards relying on weapons law to limit warfare will continue.

Interestingly, efforts to craft new weapons legal regimes are increasingly led either by states that have a low likelihood of ever using these weapon systems in combat or by non-governmental organisations. In other words, the process appears to be slipping from the hands of those states which have the greatest immediate vested interest in the weapons in question and that best understand when and how those weapons are likely to be employed. This trend appears to be accelerating. Paradigmatic examples include anti-drone advocacy and the campaign to ban autonomous weapon systems. The former is paradoxical since most experts agree that although drones, like all weapons, may be used in violation of the law of armed conflict, their unique characteristics, especially their sensor suite and ability to loiter over a proposed target, usually render them more discriminate than manned systems. The latter is likewise enigmatic in the sense that the critics seem to have adjudged autonomous weapons unlawful *per se* based purely on speculation as to how they might perform and without consideration of how they could be employed tactically to minimise civilian harm. As these examples illustrate, contemporary weapons campaigns are often characterised by counter-factual and counter-normative assertions that are often laden with emotion. With the stakes so high and the debate so confused, informed dialogue by serious legal experts is badly needed.

The publication of this book, therefore, could not have been more propitious. *New Technologies and the Law of Armed Conflict* offers a highly sophisticated legal examination of four new technologies that will dramatically alter the face of future warfare—cyber, space, nano and unmanned systems. The editors and authors have clearly grasped the essential point that the relationship between law

and weaponry is synergistic; new technologies of war inevitably affect the content and understanding of the law of armed conflict and the law equally serves to constrain their development, availability and method of use. This being so, it is crucial that legal thinkers stay ahead of this dynamic. Working closely with operators and technical experts, they must identify the valid legal issues that new technologies raise, seek to understand how the weaponisation of new technology might influence the extant normative regime, and try to ascertain whether new law is needed to address unique characteristics of the systems. Such an understanding is especially imperative when, as in the case of each weapon examined in this book, the technology used to conduct military operations serves both civilian and military purposes. *New Technologies and the Law of Armed Conflict* aptly achieves these goals.

To examine the impact of the four new technologies on the legal battlefield, the editors convened a carefully crafted group of scholar-practitioners for a forum at the Australian National University in 2012; the product of the event is this book. It is an approach that allowed for a robust peer vetting of the issues and the various perspectives thereon. Of particular note in this regard is the composition of the forum and of the authors invited to contribute to the book. The editors include an experienced retired senior military legal officer with impressive scholarly credentials and an accomplished academic with a deep understanding of military affairs. Joining them are serving and retired legal officers and distinguished academics. What sets this effort apart from others is that many of the authors have extensive practical experience in dealing with the legal issues that the weapons and weapons systems raise. They are therefore uniquely situated to help remedy the knowledge, applicability, interpretation and perspective deficit which presently plague much of the legal analysis with respect to these systems.

Simply put, *New Technologies and the Law of Armed Conflict* is a book that matters. It will undoubtedly shape the development of the legal regimes that emerge through interpretation of existing law and promulgation of *lex scripta* to govern the weapons examined. As importantly, the book offers a mature application of weapons law that can be used as a blueprint for examination of other new technologies. I recommend it unreservedly to those who are involved in the ongoing weapons debates, as well as those interested in the broader relationship between law and war, and congratulate the editors and authors on this fine work.

Newport, Autumn 2013

Michael Schmitt
Charles H. Stockton Professor
United States Naval War College

Acknowledgments

This book records the outcomes of a forum held at the Australian National University in September 2012, which asked scholars and practitioners working in the field of the law of armed conflict to critically examine what they held to be the primary legal challenges arising from the use of certain new technologies in armed conflict, and future directions of legal development in light of the specific characteristics and challenges each technology presents for both the law of armed conflict and the battlespace. Many of the chapters which appear in this book were first presented at this forum, and we thank all who presented and contributed to discussions. Many of the speakers at the forum subsequently developed their work into a chapter of this book, based on lively discussions at the forum, and additional authors became involved in the book project.

We gratefully acknowledge the Australian Centre for Military and Security Law, the ANU College of Law and its College Outreach Activities Support Team (COAST) for their support in convening the forum. We thank various governmental departments, in particular the Commonwealth Attorney-General's Department, Australian Defence Force, Department of Defence, and Department of Foreign Affairs and Trade, Australian Red Cross and the International Committee of the Red Cross for their generosity in allowing their staff to share their expertise and specialist knowledge at the forum. We are also grateful to the Australian Research Council for supporting research by Hitoshi Nasu, Margaret E. Kosal and Thomas A. Faunce and helping us complete the manuscript under its Discovery Project funding scheme (Project ID 110102637).

We thank our Assistants, Kiri McEwan, Natasha Purvis, Helen Trezise, Michael Keefe and Shiang Ye, who helped put together this book. Kiri McEwan took the admirable leadership in managing the editorial assistance team, particularly during the difficult time while the editors were away in Europe. Michael Keefe and Shiang Ye diligently kept the verbatim record of the forum discussions and Shiang also helped in the final stages of the preparation of the manuscript. Natasha Purvis and Helen Trezise provided exceptional research and proofreading assistance to the editors.

Last, but certainly not least, we express our gratitude to Prof. Michael N. Schmitt for his friendship, guidance and inspiration that kept the editors and many of the contributors inspired throughout this project.

Geneva and Vienna, June 2013

Hitoshi Nasu
Robert McLaughlin

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Abbreviations

ABM	Anti-Ballistic Missile
ABMT	Anti-Ballistic Missile Treaty
AMW	Air and Missile Warfare
ASL	Archipelagic Sea Lane
AWS	Autonomous weapon system
CIA	Central Intelligence Agency
COLREGS	International Regulations for the Prevention of Collisions at Sea
COPUOS	Committee on the Peaceful Uses of Outer Space
CTS	Consolidated Treaty Series
CTBT	Comprehensive Test-Ban Treaty
DARPA	Defence Advance Research Projects Agency
DDoS	Distributed Denial-of-Service
DNA	Deoxyribonucleic Acid
EF	Edema factor
ENMOD	Environmental Modification Techniques
FDA	Food and Drug Administration
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
HCOC	Hague Code of Conduct Against Ballistic Missile Proliferation
HRAW	Hague Rules of Air Warfare
IADC	Inter-Agency Space Debris Coordination Committee
ICJ	International Court of Justice
ICOC	International Code of Conduct for Outer Space Activities
ICRC	International Committee of the Red Cross
ICTY	International Criminal Tribunal for the former Yugoslavia
ILM	International Law Materials
IED	Improvised explosive device
ISR	Intelligence, Surveillance and Reconnaissance
LAR	Lethal autonomous robotics
LF	Lethal factor
LOSC	Law of the Sea Convention
MIC	Metastable Intermolecular Composite
NATO	North Atlantic Treaty Organisation
NPT	Nuclear Non-Proliferation Treaty

PA	Protective Antigen
PAROS	Prevention of an Arms Race in Outer Space
PCIJ	Permanent Court of International Justice
PPWT	Prevention of the Placement of Weapons Treaty
PTBT	Partial Test-Ban Treaty
RCA	Riot Control Agent
RNA	Ribonucleic acid
RNEP	Robust Nuclear Earth Penetrator
RPA	Remotely Piloted Aircraft
SATCOM	Communications satellite
SCADA	Supervisory Control and Data Acquisition
UAV	Unmanned Aerial vehicle
UCAV	Unmanned Combat Aerial Vehicle
UK	United Kingdom
UN	United Nations
US	United States

Treaties and Cases

Treaties

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- Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space*, 22 April 1968, 672 UNTS 119 (entered into force 3 December 1968).
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- Convention on the International Regulation for Preventing Collision at Sea*, 20 October 1972, 1050 UNTS 16 (entered into force July 1977).

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- Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field*, 12 August 1949, 75 UNTS 31 (entered into force 21 October 1950).
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- Hague Convention (II) with respect to the Laws and Customs of War on Land*, 29 July 1899, 187 CTS 429 (entered into force 4 September 1900).
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- Hague Declaration (II) on the Use of Projectiles the Object of Which is the Diffusion of Asphyxiating or Deleterious Gases*, 29 July 1899, 187 CTS 453 (entered into force 4 September 1900).
- Hague Declaration (III) Concerning Expanding Bullets*, 29 July 1899, 187 CTS 459 (entered into force 4 September 1900).

- Limitation of Anti-Ballistic Missile Systems Treaty*, 26 May 1972, 944 UNTS 14 (entered into force 3 October 1972, no longer in force due to US withdrawal, effective 13 June 2002).
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Chapter 1

Introduction: Conundrum of New Technologies in the Law of Armed Conflict

Robert McLaughlin and Hitoshi Nasu

Abstract This introductory chapter outlines the general relationship between technological development and the conduct of warfare in the historical context. It then introduces the objective of the book, which is to critically examine the potential legal challenges arising from the use of new technologies in warfare, and future directions of legal development. It proceeds on the premise that the fundamentally transformative impact of new technologies on the means and methods of warfare, and on the broader environment in which warfare is conducted, cannot be understood without specific characteristics of the technology and challenges each technology presents for both the law of armed conflict and the battlespace. Each chapter of this book is introduced in the broader context of the four thematic issues that emerged during the discussion among scholars and practitioners working in the field, held at the Workshop at the Australian National University in September 2012.

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1.1 Introduction

Technological development has often been stimulated by, and dedicated directly to, addressing military requirements. On other occasions, however, technological developments outside the military sphere have influenced or informed the conduct of warfare and military expectations. In either case, the ever expanding capacity to employ evolving technology in warfare serves not only to render existing means and methods more destructive and/or more precise, but also to leverage or create new means and methods. The scope and pace of these evolutions—and in some cases revolutions—in the application of technology to the battlefield have radically and rapidly expanded over the last century and over the last several decades in particular.

Technology has enhanced traditional means and methods—in range, detectability, precision, and destructive power, for example. It has also created new means and methods options.¹ The application of computing and software innovations to military purposes has enabled exponentially greater intelligence, surveillance and reconnaissance (ISR) accuracy, for greater fidelity in identification serves the purpose of removing doubt—and thus a restraint in targeting—as equally as it can confirm civilian status. Satellite navigation and global positioning systems (GPS) have enabled the use of precision-guided munitions and the remote operation of unmanned aerial vehicles (UAVs). It even presages yet further evolution in the rapidly evolving challenge of ‘human-out-of-the-loop’ decision-making for traditional conceptions of command and control, as well as means and methods—such as fully autonomous fire control systems. The rapid growth of nanotechnology across a number of different fields—including fabrication, materials, photonics, and electronics—is expected to filter into military applications designed to enhance soldier survivability, force protection, force mobility, and force application capabilities.

Additionally, technology continues to generate options for employment of means and methods beyond the millennia-long focus on the land and maritime environments, and the historically recent addition of air as a battlespace. The development of space technologies heralds the potential to utilise outer space for military purposes. Outer space—particularly in the realm of ISR—and cyberspace have now come to be recognised as the fourth and fifth combat environments, as technology has opened these environments to armed conflict.

Technological development with novel military applications is expected to influence the application and interpretation of the existing rules of the law of armed conflict. In this book, scholars and practitioners working in the field

¹ See generally, Boothby 2009, Chap. 20.

critically examine the potential legal challenges arising from the use of those new technologies, and future directions of legal development in light of the specific characteristics and challenges each technology presents with regard to foreseeable humanitarian impacts upon the battlespace.

1.2 Technology and the Law of Armed Conflict

This modern backdrop of rapid technological change and expanding technological realms has sorely tested the applicability—but never the viability—of the law of armed conflict. The constant need for the law of armed conflict to respond and evolve was not always the norm. For millennia, the piecemeal precursors to the modern law of armed conflict existed in relatively stable and slowly evolving equilibrium with the means and methods that they were tasked to govern. Certainly, the especially shocking or awe-inspiring employment of a new technology or tactic would occasionally act as midwife to a period of rapid re-adjustment in both tactics and—to a much less evident extent—attitudes as to what was fair or chivalrous or honourable or right (which was, in many senses, what the early law of armed conflict grew from).

Equally certainly, injunctions against certain weapons, or limitations in their use, were often of minimal effect. The *Decree of the Emperor Henry IV Concerning a Truce of God*, in 1085, for example, was an ineffectual attempt to limit the feud-based conflict gnawing at the cohesion of the Empire, by prohibiting the bearing ‘as weapons a shield, sword, or lance-or, in fact, the burden of any armour’ on certain days and over certain periods:

...from the Advent of our Lord to the 8th day after Epiphany, and from Septuagesima until the 8th day after Pentecost... Likewise on the other days – namely, on Sundays, Thursdays, Fridays, Saturdays, and on the eve and day of each of the apostles, and on every day canonically fixed, or to be fixed, for fasting or celebrating.²

The *Canons of the Second Lateran Council* of 1139 (during the Pontificate of Innocent III) decreed that ‘[w]e prohibit under anathema that murderous art of crossbowmen and archers, which is hateful to God, to be employed against Christians and Catholics from now on’.³ Yet crossbowmen and archers continued to form a key element of most armed companies in Europe for the next several centuries.⁴

² *Decree of the Emperor Henry IV Concerning a Truce of God* (1085), <http://avalon.law.yale.edu/medieval/dechenry.asp>. Accessed 27 May 2013.

³ *Canons of the Second Lateran Council* (1139), para 29, <http://www.papalencyclicals.net/Councils/ecum10.htm>. Accessed 27 May 2013.

⁴ See, Keen 1965; Meron 1994, which are two well-regarded studies of the law of war during the Middle Ages in Europe, although they do not specifically contain extensive analyses of weapons law issues. For a brief survey of elements of pre-nineteenth century weapons law, see, Boothby 2009, pp. 8–9.

The last 200 years have evidenced a more negotiated, and arguably more effective, era in the ongoing relationship of the law of armed conflict with the employment of technology in the battlespace. With the modern advent of negotiated, technology-focused arms regulation—encapsulated in the 1868 *St Petersburg Declaration* (explosive projectiles under 400 g weight),⁵ the 1899 *Hague Declaration II* (concerning asphyxiating gases) and *Hague Declaration III* (concerning expanding bullets)⁶—the relationship between the law of armed conflict and many specific instances of emergent technology was given greater technical precision. The relationship was further internationalised, formalised, and proceduralised in the form of international treaties.⁷

The broader application of technology-based rules of warfare through exegesis and analogy has contributed to the evolution of a distinct regulation of means and methods, which forms the sub-discipline of weapons law within the law of armed conflict. This interpretive endeavour has relied upon both legal text and historical practice and example. The United States (US) War Department's Field Manual, FM 27-10 of October 1940, for example, explained the US interpretation of Article 23(e) of the 1907 *Hague Regulations* (prohibiting the employment of, inter alia, 'arms...calculated to cause unnecessary suffering') as applying to 'lances with barbed heads'.⁸

The increasingly greater pace of militarised technological development, accompanied as it was by professionalisation amongst many militaries and military bureaucracies, brought with it an increased focus on regulation of technology in terms of its employment in the battlespace. The Institute of International Law's Oxford Manual on the Laws of War on Land, published in 1880,⁹ was an early example of an explicit attempt to state general principles derived from custom and practice of states, which included prohibition on the 'use of poison, in any form whatever'.¹⁰ However, the clear trend remained that law continued to lag behind technological development, although not necessarily for want of trying. For each

⁵ *St Petersburg Declaration Renouncing the Use, In Time of War, of Explosive Projectiles Under 400 Grammes Weight*, 11 December 1868, 138 CTS 297 (entered into force 11 December 1868) ('*St Petersburg Declaration*'), reproduced in Roberts and Guelff 2000, pp. 54–55.

⁶ *Hague Declaration (II) on the Use of Projectiles the Object of Which is the Diffusion of Asphyxiating or Deleterious Gases*, 29 July 1899, 187 CTS 453 (entered into force 4 September 1900) ('*Hague Declaration II*'), reproduced in Roberts and Guelff 2000, pp. 60–61; *Hague Declaration (III) on the Use of Bullets Which Expand or Flatten Easily in the Human Body*, 29 July 1899, 187 CTS 459 (entered into force 4 September 1900) ('*Hague Declaration III*'), reproduced in Roberts and Guelff 2000, pp. 64–65.

⁷ See, for example, *Regulations Concerning the Laws and Customs of War on Land, Annex to the Hague Convention (IV) Respective the Laws and Customs of War on Land*, 18 October 1907, 205 CTS 277 (entered into force 26 January 1910) ('*Hague Regulations*'); *Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare*, 17 June 1925, 94 LNTS 65 (entered into force 8 February 1928).

⁸ US War Department 1940, para 34.

⁹ Institute of International Law 1880.

¹⁰ Institute of International Law 1880, Article 8(a).

Mahanian success in ‘limiting limitation’,¹¹ there were equally significant instances of negotiated agreement to prohibition—such as the eventual British accession to 1899 *Hague Declaration III* concerning expanding bullets, which was, after all, fundamentally concerned with the British ‘dum dum’ round.

Today, the changing conditions of warfare—particularly the introduction of ‘game changer’ or ‘force multiplier’ with new technologies such as information technology, space technologies, robotic and automated decision-making technologies, and potentially nanotechnology—have challenged the currency and scope of the law of armed conflict in a much more constant, radical, aggressive and exhaustive manner. For some of these technologies or categories of technology—such as anti-personnel landmines,¹² blinding lasers,¹³ cluster munitions,¹⁴ and incendiary weapons,¹⁵ as discrete means of warfare; as well as biological,¹⁶ and chemical weapons,¹⁷ as categories—specific regulations have been established. Whilst being subject to highly variable levels of ratification, those instruments evidence a clear trend towards reducing the time-lags and legal lacunae created by constant and increasingly rapid technological development.

Nevertheless states are still reluctant to accept any form of regulation in relation to military applications of new technologies and, in many areas, are yet to develop (and indeed, in some cases, are yet to even decide to develop) new rules regulating the application of a range of new technologies in the context of armed conflict—cyber being but the most current example. As a consequence, operators, lawyers, and advisers have generally sought solace in the capacity of the enduring general principles to offer at least some clarification on the application and interpretation of the law of armed conflict in relation to the employment of new technologies in

¹¹ Captain Alfred Thayer Mahan, as a member of the US delegation to the 1899 Hague Peace Conference, was instrumental in the defeat of a proposed prohibition on the use of projectiles the sole purpose of which was, on bursting, to spread asphyxiating or deleterious gases: Mahan 1899.

¹² *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction*, 18 September 1997, 2056 UNTS 211 (entered into force 1 March 1999).

¹³ *Protocol on Blinding Laser Weapons (Protocol IV) to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to Have Indiscriminate Effects*, 13 October 1995, 1380 UNTS 370 (entered into force 30 July 1998).

¹⁴ *Convention on Cluster Munitions*, 30 May 2008, 48 ILM 357 (2009) (entered into force 1 August 2010).

¹⁵ *Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III) to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to Have Indiscriminate Effects*, 10 October 1980, 1342 UNTS 171 (entered into force 2 December 1983).

¹⁶ *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*, 10 April 1972, 1015 UNTS 163 (entered into force 26 March 1975).

¹⁷ *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction*, 13 September 1992, 1974 UNTS 317 (entered into force 29 April 1997).

the battlespace, or indeed in creating new battlespaces. Yet, the elasticity of the general principles is not limitless, and there can be no question that whilst the law of armed conflict continues to lag behind technological development, the need for instances of greater specificity, and technological sensitivity in law-making, application and interpretation, exists. Indeed, the UN Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions has recently recommended that until lethal autonomous robotics (LARs) technology is better understood—and its legal regulation provided for—states should ‘[p]lace a national moratorium on LARs’.¹⁸ In the meantime, it is to the timeless relevance of the general principles, and once again to exegesis and analogy, that we routinely turn for guidance.

Another significant and timely illustration of using general principles and the law of armed conflict exegeses and analogies to fill perceived legal lacunae, where there is little political will to address the gap through traditional treaty-making mechanisms, is through scholarship by experts, exemplified most prominently by the Tallinn Manual on International Law Applicable to Cyber Operations.¹⁹ As an incident of soft law—be it clarification of rules, guidance, commentary or policy direction—this scholarship represents a relatively new phenomenon in the law of armed conflict,²⁰ in relation to which (apart from the work of the International Committee of the Red Cross) the interpretive ground has long been held by military legal officers and military operational manuals.²¹ A recent increase in academic literature on discrete issues of new technologies and the law of armed conflict forms a secondary layer to the response by scholarship to this ongoing lag between technological development and legal regulation. Some of the discipline’s more visionary scholars have recognised and analysed earlier incidents of this conundrum—such as Daniel P O’Connell’s treatment of technology and the law of naval warfare.²² In response to rapid development of modern technologies, new scholarship has also emerged within a very short period of time, with publication of monographs,²³ edited volumes,²⁴ and special editions of law journals dealing with specific aspects of new technologies in armed conflict.²⁵

¹⁸ Heyns 2013, para 118.

¹⁹ Schmitt (ed) 2013 (‘Tallinn Manual’).

²⁰ The fundamentally important and highly influential San Remo Manual on International Law Applicable to Armed Conflicts at Sea (Doswald-Beck et al. 1995) is arguably the modern template for this new soft law format.

²¹ For example, the enduring utility and status of US Navy, US Marine Corps and US Coast Guard 1995.

²² O’Connell 1975, for example, Chaps. VI, VII, and XIII.

²³ Dinniss 2012; Melzer 2011.

²⁴ Saxon (ed) 2013; Mancini (ed) 2013; Heintschel von Heinegg and Beruto (eds) 2012; Schmitt and O’Donnell (eds) 2002; Lewer (ed) 2002.

²⁵ See, for example, *Journal of Conflict and Security Law* (Volume 17, Issue 2, 2012), *Israel Law Review* (Volume 45, Issue 3, 2012), *International Review of the Red Cross* (Volume 94, Issue 886, 2012).

1.3 Overview of This Volume

The fundamentally transformative impact of new technologies on the means and methods of warfare, and on the broader environment in which warfare is conducted, cannot be understood without specific characteristics of the technology and challenges each technology presents for both the law of armed conflict and the battlespace. This book records the outcomes of a forum held at the Australian National University in September 2012, which asked scholars and practitioners working in these fields to critically examine what they held to be the primary (either manifest or potential) legal challenges arising from the use of certain new technologies in armed conflict, and to provide some indications as to the likely or possible legal ‘next steps’ in light of the specific characteristics and challenges each technology presents for both the law of armed conflict and the battlespace.

In each area, the experts adopted a two-step approach to analysis reminiscent of a weapons review under Article 36 of *Additional Protocol I*:²⁶ first, briefly outline actual or potential military applications of the technology (via hypothetical scenario or case study); second, provide legal, ethical and/or policy analysis of its actual or anticipated deployment in the battlespace. Whilst some of the chapters combine both steps, other contributions dealing with less well recognised technologies—such as space technology and nanotechnology—focus more heavily upon the first step, in order to set the scene for other contributors, and the reader, to undertake well informed analysis for the application and interpretation of the law of armed conflict.

By way of introducing each chapter in the broader context of the theme of this book, four thematic issues that emerged during the discussion at the September 2012 Workshop are outlined below, together with the variety of views expressed by the scholars and practitioners—without attribution, as the forum was convened under the ‘Chatham House Rule’. Those four themes contextualise the specific technological, legal, ethical and policy issues that are examined in the following chapters, rather than providing an overview of each chapter.

1.3.1 The ‘Dual-Use’ Nature of Technology

Many modern technologies with battlefield applications—including the internet, transponder (communication) satellites, and engineered nanomaterials—are ‘dual-use’ technologies, in that they are used for both civilian and military purposes.²⁷

²⁶ *Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, 12 December 1977, 1125 UNTS 3 (entered into force 7 December 1979) (*‘Additional Protocol I’*).

²⁷ For different ways of defining ‘dual-use’ technologies, see, for example, Forge 2010; Miller and Selgelid 2007.