

**THE LAW GOVERNING AEROSPACE WARFARE
IN THE TWENTY-FIRST CENTURY**

by

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For Stephanie, Kaitlyn and Sean.
May they forever be spared the horror of war.

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ABSTRACT

The world is in the midst of a revolution in the conduct of military operations wherein modern military aerospace information systems, weapons and their associated weapon systems are changing the conduct of warfare. Aerospace power has become the dominant, if not decisive, factor in modern warfare. Yet, there are currently no treaties dealing specifically with the law of armed conflict in the air and space environments. Chapter I describes the evolution to date of the law governing aerospace warfare. Chapter II analyzes the relevance of military interventions in Iraq and Yugoslavia (Bosnia; Kosovo) to the law of air and space warfare. Chapter III discusses the impact of "humanitarian intervention" on the law of aerospace warfare. Chapters IV and V explore the role and effect of earth-based and space-based military assets respectively. This thesis concludes that although the existing law of armed conflict is capable of evolving to cope with the legal issues posed by aerospace warfare in the twenty-first century, the conclusion of multilateral agreements to deal with some of those issues is advisable.

RÉSUMÉ

Le monde est au milieu d'une révolution dans la conduite des opérations militaire, dans lesquels les systèmes informatiques aérospatiale militaire, les armes et leurs systèmes, sont en train de changer la nature de combats. L'aérospatiale est devenu la force dominante, sinon décisive dans les combats moderne. Pourtant, il n'y a pas de traités qui traite spécifiquement avec les lois de conflits dans les air et l'environnement spatial. Le Chapitre I décrit l'évolution jusqu'à date sur la loi qui gouverne la guerre aérospatiale. Le Chapitre II analyse les conséquences des interventions militaire en Iraq et en Yugoslavie (Bosnie; Kosovo) sur les lois sur les conflits aérien et spatial. Le Chapitre III discute l'impact des "interventions humanitaire" sur la loi dans les conflits aérospatiale. Les Chapitres IV et V explorent le role et les effets des instruments militaire sois basé sur terre ou dans l'espace , respectivement. Cette thèse conclut que même si les lois existantes sur les conflits armée sont capable d'évolué pour faire face aux sujets légaux, causé par les conflits aérospatiale du vingt et unième siècle, la poursuite d'accords multilatéraux pour faire face à ces sujets est recommandé.

ACRONYMS AND ABBREVIATIONS

ABL	Airborne Laser
ABM	Anti-Ballistic Missile
AEW	Airborne Early Warning
ALCM	Air-Launched Cruise Missile
ASAT	Anti-Satellite
AWACS	Airborne Warning and Control System
BSA	Bosnian Serb Army
C2	Command and Control
C3	Command, Control and Communications
C4	Command, Control, Communications and Computers
CALCM	Conventional Air-Launched Cruise Missile
CAS	Close Air Support
CEM	Combined Effects Munitions
CEP	Circular Error Probable
COMINT	Communications Intelligence
COPOUS	Committee on Peaceful Uses of Outer Space
DMPI	Desired Mean Point of Impact
DMSP	Defense Meteorological Support Program
DoD	Department of Defense
DSCS	Defense Satellite Communications System
DSP	Defense Support Program
ECM	Electronic Counter Measures
ECS	Electronic Combat Systems
EHF	Extremely High Frequency
ELINT	Electronic Intelligence
EMP	Electromagnetic Pulse
FAE	Fuel/Air Explosive
GPS	Global Positioning System
HARMS	High-Speed Anti-Radiation Missile
HPM	High-Power Microwave
ICBM	Intercontinental Ballistic Missile
ICJ	International Court of Justice
ICRC	International Committee of the Red Cross
IR	Infrared
ISR	Intelligence, Surveillance and Reconnaissance
JASSM	Joint Air-to-Surface Standoff Missile
JDAM	Joint Defense Attack Munition
JSOW	Joint Standoff Weapon
JSTARS	Joint Surveillance Target Attack Radar System
KTO	Kuwaiti Theater of Operations
LANDSAT	U.S. Land Satellite Remote Sensing System
LANTIRN	Low Altitude Navigation Targeting Infrared for Night
LGB	Laser Guided Bomb

MAD	Mutual Assured Destruction
MILSTAR	Military Strategic/Tactical Relay Satellite Communications System
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological and Chemical
NMD	National Missile Defense
NPS	Nuclear Power Source
OAS	Offensive Air Support
PAC	PATRIOT Advanced Capability System
PGM	Precision Guided Munition
POW	Prisoner of War
RADINT	Radar Intelligence
RCA	Riot Control Agent
RMA	Revolution in Military Affairs
SAR	Search and Rescue
SBIRS	Space-Based Infrared System
SEAD	Suppression of Enemy Air Defenses
SHF	Superhigh Frequency
SIGINT	Signals Intelligence
SLAM	Standoff Land Attack Missile
SLAR	Side-Looking Airborne Radar
TBM	Theater Ballistic Missile
TELINT	Missile Telemetry Intelligence
THAD	Theater Air Defense System
TLAM	Tomahawk Land Attack Missile
TMD	Theater Missile Defense
UAV	Unmanned Aerial Vehicle
UCAV	Unmanned Combat Aerial Vehicle
UHF	Ultrahigh Frequency
UN	United Nations
UNGA	United Nations General Assembly
U.S.	United States of America
WCMD	Wind Corrected Munitions Dispenser

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INTRODUCTION

The military have used aerial instrumentalities in armed conflict for over 200 years.¹ Yet, unlike armed conflict on land and at sea, no specific treaty dealing with the law of armed conflict in the air has ever come into force. Similarly, the military have utilized space assets since the infancy of the space age. Yet, no specific treaty dealing with the law of armed conflict involving outer space exists.

As the twenty-first century dawns, it is evident that the role of aerospace power in international and internal armed conflicts has become extensive if not dominant. Never before has the impact of air and space mediums been so significant, even decisive, as in Iraq in 1991 and Yugoslavia in 1995 and 1999. Space-based military assets are playing an increasingly important role in armed conflict and it may only be a matter of time before these assets are targeted and space-based weapon systems are employed.

According to the former commander of the United States Space Command, General Joseph W. Ashy, "It's politically sensitive, but it's going to happen ... we're going to fight *in* space. We're going to fight *from* space and we're going to fight *into* space ..."²

Military technology will likely continue to develop at a rapid pace. The advent of weapons such as cruise missiles and unmanned aerial vehicles (UAVs) have begun to mechanize aerial armed conflict as the role of human beings is gradually diminishing in the aerial war-fighting equation. New weapon systems are sure to be employed by military air and space forces of the major powers in the near future while current weapons, both conventional weapons and weapons of mass destruction, will continue to expand among the lesser powers.³

¹ A balloon was first used for aerial reconnaissance by the French army in 1794 and the first bombing raid took place in 1849 when the Austrians launched unmanned bomb carrying-balloons against Venice. See e.g. C.H. Gibbs-Smith, *Aviation: An Historical Survey from its Origins to the end of World War II* (London: Her Majesty's Stationary Office, 1970); G. Gurney, *A Chronology of World Aviation* (New York: Franklin Watts, 1965).

² Quoted in W.B. Scott, "USSC Prepares for Future Combat Missions in Space" *Aviation Week and Space Technology* 45:6 (5 August 1996) 51 [hereinafter "USSC Prepares for Future Combat Missions in Space"] at 51 [emphasis in original].

³ "Twenty-first century threats are forecast to be more diffuse, harder to anticipate and more difficult to neutralize than ever. The very nature of strife is predicted to run the gamut: pre-modern, modern and postmodern conflicts, encompassing tribal (Somalia), traditional (Korean peninsula), terrorist (the Middle East), guerrilla (Chechnya), cyber (anywhere) and space warfare." P. Mann, "Fathoming a Strategic World of 'No Bear, But Many Snakes'" *Aviation Week & Space Technology* 151:25 (6 December 1999) 61 at 61.

The purpose of this thesis is twofold. First, to examine the current state of international law governing aerospace warfare and, second, from that basis – taking into account the more recent employment in combat of aerospace weapon systems, to outline the probable future legal environment in which aerospace combat will be conducted. To achieve these objectives, particular emphasis is placed on the military assets of the United States (U.S.) as the U.S. is currently the world's leading military power and its weapon systems are the most technologically advanced. Chapter I describes the evolution of the law governing aerospace warfare. Chapter II analyzes the relevance of military interventions in Iraq and Yugoslavia (Bosnia; Kosovo) to the law of air and space warfare. Chapter III discusses the impact of humanitarian intervention on the law of aerospace warfare. In Chapter IV, the role and effect of earth-based military assets are explored. The role and effect of space-based assets are covered in Chapter V.

CHAPTER I

The Evolution of the Law

War is thus an act of force to compel our enemy to do our will ... Attached to force are certain self-imposed, imperceptible limitations hardly worth mentioning, known as international law and custom, but they scarcely weaken it.
--Carl von Clausewitz (1832)⁴

The law of armed conflict evolved in two separate and distinct categories, the *jus ad bellum* and the *jus in bello*. The *jus ad bellum* regulates the right of States to use force and engage in hostilities. The *jus in bello* governs the use of force and the way hostilities are conducted once they have begun. As air and space are potential war-fighting mediums, and the weapons and tactics employed in those mediums are methods and means of armed conflict, the laws of armed conflict specifically applicable to air and space are covered exclusively by the *jus in bello*. However, once the decision to use force has been made, aerospace assets are increasingly the means of choice. As a result, it is important to examine the evolution of both the *jus ad bellum* and the *jus in bello*.

The law of armed conflict has existed in some form ever since human beings first used force against one another.⁵ In modern times, the law of armed conflict was the first part of international law to be codified.⁶ The earliest attempts to codify the law of armed conflict took place in the second half of the nineteenth century.⁷ Numerous international treaties regarding the law of armed conflict were adopted in the late nineteenth century

⁴ C. von Clausewitz, *On War*, ed. & trans. by M. Howard & P. Paret (Princeton, New Jersey: Princeton University Press, 1976).

⁵ See A.C. Arend & R.J. Beck, *International Law & the Use of Force* (London: Routledge, 1993) at 11 [hereinafter *International Law & the Use of Force*].

⁶ See D. Schindler & J. Toman, "Introduction" in D. Schindler & J. Toman, eds., *The Laws of Armed Conflicts: A Collection of Conventions, Resolutions and Other Documents*, 2nd ed. (Dordrecht: Martinus Nijhoff, 1988) at 7.

⁷ The *Instructions for the Government of Armies of the United States in the Field*, General Orders No. 100, 24 April 1863 [hereinafter *Lieber Instructions*], reprinted in D. Schindler & J. Toman, eds., *The Laws of Armed Conflicts: A Collection of Conventions, Resolutions and Other Documents*, 2nd ed. (Dordrecht: Martinus Nijhoff, 1988) at 3, were the first attempt to codify the law of armed conflict. The *Lieber Instructions* were drafted by Francis Lieber during the American Civil War, promulgated by President Lincoln, and originally issued as General Orders No. 100 in 1863. They applied only to the armed forces of the United States but reflected many of the laws and customs of war that existed at that time and influenced later codification of the laws of armed conflict (see Schindler & Toman, *ibid.* at 3).

and throughout the twentieth century, the most extensive of which are the Hague and Geneva Conventions.

A. *Jus Ad Bellum*

1. *Historical Overview*

Historical justifications for the right to use force have ranged from divine ordination, to the inherent right of sovereign states to wage war at their whim, to outlawing war and the use of force altogether.⁸ The writings of ancient religions provide early evidence of attempts to justify the use of force.⁹ They generally reflect a “holy war” approach where the use of force was morally permissible when it was divinely ordained.¹⁰ Over time, reasons other than divine ordination evolved to justify the use of force and the “just war” doctrine arose.

The distinction between “just war” (*bellum justum*) and “unjust war” (*bellum injustum*) can be traced back to ancient Rome.¹¹ Under the just war doctrine, the use of armed force was permissible only when there was a just cause and various definitions of exactly what constituted just cause existed.¹² As the concept of state sovereignty developed in the late seventeenth and early eighteenth centuries, the doctrine of positivism¹³ replaced the just war doctrine.¹⁴ Concepts of just war were not completely abandoned. However, the general thinking during the positivist period was that sovereign States had the inherent right to wage war without any justification at all, the only prerequisite being a formal declaration of war.¹⁵ A distinction was recognized between actual war and uses of force short of war, such as reprisals, and the use of force in self-

⁸ For detailed discussions of the evolution of the *jus ad bellum*, see e.g. *International Law & the Use of Force*, *supra* note 5; I. Brownlie, *International Law and the Use of Force by States* (Oxford: Clarendon Press, 1963); M.S. McDougal & F.P. Feliciano, *Law and Minimum Public Order* (New Haven: Yale University Press, 1961).

⁹ See *International Law & the Use of Force*, *supra* note 5 at 11.

¹⁰ See *ibid.*

¹¹ See Y. Dinstein, *War, Aggression and Self-Defense*, 2nd ed. (Cambridge: Grotius, 1994) at 61.

¹² For discussions on what constituted just cause, see e.g. Brownlie, *supra* note 8 at 3-14; Dinstein, *supra* note 11 at 61-69; *International Law & the Use of Force*, *supra* note 5 at 11-15.

¹³ “Positivism asserted that since states could be bound by no higher law, the only law that could exist was that which they created by their consent. This they did through treaties, customs, and general principles.” *International Law & the Use of Force*, *supra* note 5 at 16.

¹⁴ See e.g. *ibid.* at 15; Brownlie, *supra* note 8 at 14-50.

¹⁵ See *International Law & the Use of Force*, *supra* note 5 at 17, citing W.E. Hall, *International Law* (Oxford: Clarendon Press, 1880) at 315.

defense. While war need not be declared in these instances, there were generally accepted legal requirements for uses of force short of war.¹⁶ In 1907, the requirement of explicit warning prior to the commencement of hostilities was codified in the Hague Convention (III) Relative to the Opening of Hostilities as a result of the outbreak of war without warning between Russia and Japan in 1904.¹⁷

The devastation caused by World War I renewed interest in the concept of *jus ad bellum*. At the Paris Peace Conference held in 1919, the League of Nations was born and with it new restrictions on the right to wage war. The League of Nations Covenant required State parties to submit any dispute likely to lead to a “rupture” of peace to arbitration or the League Council.¹⁸ The arbitration court was required to make an award within a reasonable time and the League Council had six months within which to produce a report.¹⁹ If an award was made or a report issued, State parties were prohibited from going to war so long as the opposition adhered to any such award or report.²⁰ However, under no circumstances could States resort to war until three months after the award or issuance of a report. In sum, State parties to the League Covenant could resort to war only when the opposing State would not conform to the decision of the arbitration court or League Council (and then no earlier than three months after the decision) or in the event that no such decision was rendered. These procedural restrictions dealt only with the recourse to formal war, they did not apply to uses of force short of war and as a result, restrictions on uses of force short of war from the positivist period remained.²¹ While the League Covenant established procedural requirements for resorting to war, it did not outlaw the use of force and it is debatable whether it outlawed or restricted waging wars of aggression.²²

¹⁶ See e.g. Brownlie, *supra* note 8 at 28-37; *International Law & the Use of Force*, *supra* note 5 at 17-18.

¹⁷ *Convention (III) Relative to the Opening of Hostilities*, 18 October 1907, (1908 Supplement) 2 A.J.I.L. 85 (Entered into force 26 January 1910), reprinted in Schindler & Toman, *supra* note 7 at 6. Article 1 of the Convention requires previous warning to the commencement of hostilities either in the form of a declaration of war, giving reasons, or of an ultimatum with a conditional declaration of war. Article 2 requires neutral powers be notified of the same.

¹⁸ *Covenant of the League of Nations [Treaty of Versailles]* 28 June 1919, 225 Consol. T.S. 188 at 199 (entered into force 10 January 1920) [hereinafter *League Covenant*] at Article 12.

¹⁹ *Ibid.*

²⁰ *Ibid.* at Articles 13, 15.

²¹ See *International Law & the Use of Force*, *supra* note 5 at 22.

²² See Brownlie, *supra* note 8 at 62-65.

Efforts to refine the *jus ad bellum*, especially the aggressive use of force, continued after the adoption of the League Covenant and a major breakthrough occurred on 27 August 1928 with the signing of the General Treaty for Renunciation of War as an Instrument of National Policy.²³ The so-called Pact of Paris, or Kellogg-Briand Pact, effectively outlawed war as an instrument of national policy. The contracting parties condemned the recourse to war to solve international controversies, renounced war as an instrument of national policy, and agreed that the settlement of any dispute or conflict would be sought only by peaceful means.²⁴ Though not specifically stated in the text of the treaty, the parties generally recognized that the use of force would be permissible in self-defense and many parties explicitly stated the same.²⁵ While a major step toward outlawing the use of force entirely, the Kellogg-Briand Pact contained some shortcomings. Like the League of Nations Covenant, the Kellogg-Briand Pact applied only to war and did not extend to uses of force short of war nor did it define or explain the right of self-defense.²⁶ Furthermore, as it only renounced war as an instrument of national policy, the possibility that war might be waged for other reasons, such as the pursuit of religious or ideological goals, remained open.²⁷ These shortcomings would be addressed during the Second World War.

2. The United Nations and Armed Conflict

a. The United Nations Charter

The outbreak of the Second World War demonstrated clearly the insufficiency of the restrictions on war contained in the League of Nations Covenant and Kellogg-Briand Pact as they were totally ignored by Germany. In 1945, the United Nations (UN) Charter was adopted “to save succeeding generations from the scourge of war ...”²⁸ The Charter requires all member states settle international disputes peacefully²⁹ and that they refrain

²³ *General Treaty for the Renunciation of War as an Instrument of National Policy*, 27 August 1928, 94 L.N.T.S. 59 (entered into force 24 July 1929).

²⁴ *Ibid.* at Articles 1, 2.

²⁵ See e.g. Dinstein, *supra* note 11 at 81-81; *International Law & the Use of Force*, *supra* note 5 at 23.

²⁶ See *International Law & the Use of Force*, *ibid.*

²⁷ See Dinstein, *supra* note 11 at 82.

²⁸ *Charter of the United Nations*, 26 June 1945, Can. T.S. No. 7 (entered into force 24 October 1945) [hereinafter *U.N. Charter*] at Preamble.

²⁹ *Ibid.* at Article 2, para. 3.

from the threat or use of force in international relations.³⁰ Unlike the League of Nations Covenant and the Kellogg-Briand Pact, the UN Charter applies to any inter-state use of force, not merely war. The Charter outlaws the use of force with five exceptions,³¹ only three of which are applicable today: 1) individual and collective self-defense; 2) UN enforcement actions; and 3) actions taken pursuant to regional arrangements or agencies authorized by the Security Council. The Charter recognizes the inherent right to individual or collective self-defense “if an armed attack occurs.”³² Chapter VII of the Charter empowers the UN Security Council to authorize the use of force with respect to threats to the peace, breaches of the peace, and acts of aggression. The Charter also permits the existence of regional arrangements or agencies for dealing with international peace and security provided their activities are consistent with the purposes and principles of the UN and the Security Council authorizes any enforcement action.³³

The language of the UN Charter seems crystal clear, any use of force is prohibited except in self-defense after an attack or when authorized by the UN Security Council. However, numerous issues have arisen dealing primarily with respect to the precise meanings of the terms “use of force” and “self-defense.” In the 54 years since its entry into force, many States have resorted to force, both independently and collectively, without UN authorization and prior to any attack. Justifications for these actions include the promotion of self-determination; anticipatory self-defense; the protection of nationals; just reprisals; response to terrorism; national liberation; humanitarian intervention and others. The enumerated justifications seem to signal a gradual return to the just war doctrine. However, States employing force under these circumstances argue that they fall within the legal framework of the UN Charter although the legality of such actions is often questioned.³⁴

³⁰ *Ibid.* at Article 2, para. 4. Article 2, para. 4 states in its entirety: “All Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the purposes of the United Nations.”

³¹ The five exceptions are: 1) Individual and collective self-defense. *U.N. Charter*, *supra* note 28 at Article 51; 2) U.N. enforcement actions. *Ibid.* at Chapter VII; 3) Certain actions taken pursuant to regional arrangements or agencies authorized by the Security Council. *Ibid.* at Chapter VIII; 4) Force against enemy states. *Ibid.* at Articles 53, 107; and 5) Collective use of force prior to the Security Council becoming functional. *Ibid.* at Article 106.

³² *Ibid.* at Article 51.

³³ *Ibid.* at Article 52.

³⁴ Much has been written regarding the use of force under the U.N. Charter. See e.g. A. Casse, ed., *The Current Legal Regulation of the Use of Force* (Dordrecht: Martinus Nijhoff, 1986); Brownlie, *supra* note

b. Relevant United Nations General Assembly Resolutions

In addition to the UN Charter, there are two United Nations General Assembly (UNGA) Resolutions relevant to the legal use of force which are of particular importance: 1) the Declaration on Principles of International Law Concerning Friendly Relations and Co-Operation Among States³⁵ and 2) the Definition of Aggression.³⁶ The Declaration on Principles of International Law Concerning Friendly Relations and Co-Operation Among States reiterates the UN Charter requirements that States refrain from the threat or use of force and that all international disputes be settled peacefully. In so doing, it establishes that States have a duty to refrain from forceful acts of reprisal and that wars of aggression are crimes against peace. At the time, there was no generally accepted definition of aggression although the International Law Commission had been working on one since 1947.³⁷ A consensus definition of aggression was finally adopted in 1974.

The Definition of Aggression Resolution not only defines aggression,³⁸ it also lists specific acts that qualify as aggression.³⁹ Under the Resolution, there is no justification whatsoever for aggression and wars of aggression are deemed crimes against international peace.⁴⁰ Although no act of aggression is justifiable, only a *war of aggression* constitutes a crime against international peace. Hence, while an aggressive act short of war violates international law, it is not necessarily a crime against international peace according to one eminent commentator.⁴¹

8; Dinstein, *supra* note 11; *International Law & the Use of Force*, *supra* note 5; McDougal & Feliciano, *supra* note 8. The more recent State practice supports the view that when a State commits cruelties against its own nationals in such a way as to deny them the fundamental human rights and to shock the conscience of mankind, armed intervention in the interest of humanity is legally permissible. Nevertheless, the legal status of "humanitarian intervention" in modern international law remains ambiguous at this time. This concept is discussed in greater detail in Chapter III of the thesis.

³⁵ *Declaration of Principles of International Law Concerning Friendly Relations and Co-operation Among States in Accordance with the Charter of the United Nations*, 24 October 1970, G.A. Res. 2625 (XXV), U.N. GAOR, 25th Sess., Supp. No. 28, U.N. Doc. A/8028 (1971), reprinted in (1971) 65 A.J.I.L. 243.

³⁶ *Definition of Aggression*, 14 December 1974, G.A. Res. 3314 (XXIX), U.N. GAOR, 29th Sess., Supp. No. 31, U.N. Doc. A/9631 (1975) 142, reprinted in (1975) 69 A.J.I.L. 480 [hereinafter *Definition of Aggression*].

³⁷ See Dinstein, *supra* note 11 at 123-124.

³⁸ "Aggression is the use of armed force by a State against the sovereignty, territorial integrity or political independence of another State, or in any manner inconsistent with the Charter of the United Nations, as set out in this definition." *Definition of Aggression*, *supra* note 36 at Article 1.

³⁹ See *ibid.* at Article 3.

⁴⁰ See *ibid.* at Article 5.

⁴¹ See Dinstein, *supra* note 11 at 125.

Article 7 of the Definition is quite controversial. It recognizes the right to self-determination, freedom and independence of peoples forcibly deprived of those rights. It also recognizes the right of any such peoples to struggle to achieve these rights and in so doing, seek and receive support. This article seems to legitimize wars of national liberation and the use of force for purposes of "humanitarian intervention." However, Article 7 also provides that any struggle for self-determination must be in accordance with the UN Charter and the Definition of Aggression. Furthermore, nothing within the Definition "shall be construed as enlarging or diminishing the scope of the Charter, including its provisions concerning cases in which the use of force is lawful."⁴² Thus, the use of independent or collective force in instances of self-determination must be still be grounded in self-defense or authorized by the UN Security Council.⁴³

B. *Jus In Bello*

Whether the use of force is deemed lawful or unlawful under the relevant rules of the *jus ad bellum* is irrelevant to the application of the of the *jus in bello*. The *jus in bello* applies in international armed conflicts regardless of whether or not the use of force was lawful at its inception.⁴⁴ The *jus in bello* can be found in both customary and codified international law. Current codification of the laws of armed conflict is largely based on the practice of States.⁴⁵ International instruments adopted in the late 1800s and throughout the 1900s did not displace customary law; in fact, many of their provisions expressly recognize that much of the law of armed conflict continues to exist in the form of unwritten customary law.⁴⁶

⁴² *Definition of Aggression*, *supra* note 36 at Article 6.

⁴³ See Dinstein, *supra* note 11 at 132.

⁴⁴ See A. Roberts and R. Guelff, eds., *Documents on the Laws of War*, 2nd ed. (Oxford: Oxford University Press 1989) at 4. The *jus in bello* applies as long as the conflict is international in nature. In non-international or internal conflicts, the customary international law is generally not applicable nor is the majority of codified international law. Certain fundamental humanitarian principles contained in the Common Article 3 of the 1949 Geneva Conventions apply to internal conflicts as does the 1977 Geneva Protocol II discussed in section 2(b)(2) below (see *ibid.* at 12-13, 447-448).

⁴⁵ See *ibid.* at 1.

⁴⁶ This express recognition in international treaties of the customary law became known as the "Martens Clause." The Martens Clause first appeared in the Preamble to the 1899 Hague Convention II. It reads as follows: "Until a more complete code of the laws of war is issued, the high contracting parties think it right to declare that in cases not included in the Regulations adopted by them, populations and belligerents remain under the protection and empire of the principles of international law, as they result from the usages established between civilized nations, from the laws of humanity and the requirements of the public

1. Customary International Law – The Basic Principles

The basic principles of customary international law are applicable to armed conflicts in general, including hostilities conducted in air and space mediums. Perhaps the most fundamental principle is that the scope of harm inflicted upon the enemy is not unlimited.⁴⁷ The principles of military necessity, proportionality, discrimination, humanitarianism and chivalry combine to better define this fundamental principle.

a. Military Necessity, Proportionality and Discrimination

The principles of military necessity, proportionality and discrimination are closely related and inextricably intertwined. The concept of military necessity authorizes only such damage and injury as is necessary, relevant and proportional to the prompt realization of legitimate military objectives.⁴⁸ According to a U.S. Air Force publication “[m]ilitary necessity is the principle which justifies measures of regulated force not forbidden by international law which are indispensable for securing the prompt submission of the enemy, with the least possible expenditures of economic and human resources.”⁴⁹ Under the principle of military necessity, inflicting damage and injury upon the adversary must further a specific military objective, targets may not be attacked indiscriminately. As such, the destruction of a power plant providing electricity exclusively to a civilian population and in no way in furtherance of the war effort would be unlawful under the principle.

conscience.” *Convention (II) with Respect to the Laws and Customs of War on Land*, 29 July 1899, 187 Consol. T.S. 429 (entered into force 4 September 1900) reprinted in Schindler & Toman, *supra* note 7 at 63 [hereinafter *1899 Hague Convention II*]. Provisions similar the Martens Clause appeared in the 1907 Hague Convention IV, the four 1949 Geneva Conventions and the 1977 Protocol (1) to the Geneva Conventions.

⁴⁷ See Roberts & Guelff, *supra* note 44 at 4.

⁴⁸ See McDougal & Feliciano, *supra* note 8 at 72.

⁴⁹ United States, Department of the Air Force, *International Law – The Conduct of Armed Conflict and Air Operations*, AFP 110-31 (Washington D.C., November 1976) [hereinafter *Conduct of Armed Conflict and Air Operations*] at para. 1-3a(1). According to the U.S. Air Force, the concept of military necessity has four basic elements: (1) the force used is capable of being and is in fact regulated by the user; (2) the use of the force is necessary to achieve as quickly as possible the partial or complete submission of the adversary; (3) that the force used is no greater in effect on the enemy’s personnel or property than needed to achieve prompt submission; and (4) that the force used is not otherwise prohibited. *Ibid.* The U.S. Army has a similar definition of military necessity: “That principle which justifies those measures not forbidden by international law which are indispensable for securing the complete submission of the enemy as soon as possible.” United States, Department of the Army, *The Law of Land Warfare*, FM 27-10 (Washington D.C., July 1956) [hereinafter *Law of Land Warfare*] at para. 3.

The proportionality principle further limits the use of force. Not only must the damage or injury inflicted be necessary to the realization of legitimate military objectives, the amount of damage or injury inflicted must be proportional to the legitimate military goal to be achieved. Stated another way, “[t]he anticipated loss of life and damage to property incidental to attacks must not be excessive in relation to the concrete and direct military advantage to be gained.”⁵⁰ Thus, destroying a village of 300 people, including its inhabitants, to eliminate a single enemy sniper would be a violation of the principle of proportionality. The sniper may well be a legitimate and necessary target. However, the harm inflicted in the process of destroying the target far outweighs any military advantage to be realized.

The discrimination principle deals with taking care in the selection of methods, weaponry and targets.⁵¹ The methods and weapons selected to destroy a target must be the most appropriate for the job at hand. While using a cluster bomb to destroy a command and control center in the heart of a large city may accomplish the military objective, it would violate the principle of discrimination in that a large amount of collateral damage would unnecessarily result. The discrimination principle would call for the use weapons such as laser guided bombs or cruise missiles, as they would effectively destroy the target without the resulting collateral damage. Regarding the selection of targets, the discrimination principle requires that combatants be distinguished from non-combatants and that legitimate military objectives be distinguished from protected property and places.⁵² Combatants and legitimate military objectives may lawfully be targeted while non-combatants and protected property and places may not. It is permissible, however, to attack combatants and legitimate military objectives even though some amount of non-combatant casualties or protected property damage may result. Such casualties or damage must be collateral (indirect and unintentional) to the attack on an otherwise lawful target.⁵³

⁵⁰ See *Law of Land Warfare*, *ibid.* at para. 41.

⁵¹ See Roberts & Guelff, *supra* note 44 at 5.

⁵² See *ibid.*

⁵³ See W.H. Parks, “Air War and the Law of War” (1990) 32 Air Force L. Rev. 1 [hereinafter “Air War and the Law of War”] at 4.

b. Humanitarian Considerations

Complementing the principles of military necessity, proportionality and discrimination are humanitarian considerations. Humanitarian considerations seek to minimize or eliminate unnecessary suffering and superfluous injury in armed conflict. As such, any damage or injury not actually necessary for the accomplishment of a legitimate military objective is prohibited not only by the principle of military necessity, but also by humanitarian considerations.⁵⁴ Moreover, while the infliction of damage or injury may legitimately be of a military necessity, such damage or injury may not be inflicted in such a manner as to cause unnecessary suffering or superfluous injury.

c. Chivalry

Concepts of chivalry have their origin in the Middle Ages and have survived to this day.⁵⁵ In the Middle Ages, it was felt that opposing combatants were entitled to some respect, as they were all brothers in the fraternity of knights in arms.⁵⁶ The principle of chivalry seeks to make armed conflict less savage for the individual combatants.⁵⁷ Hence, dishonorable and treacherous means of combat are prohibited. In practical terms that means prohibitions against killing or wounding combatants who have surrendered, the use of poisons and blinding lasers, and the misuse of enemy flags, uniforms and flags of truce.

2. Law of Armed Conflict and Related Treaties

Beginning in the late 1800s, several international treaties were adopted regarding the law of armed conflict, notably the Hague and Geneva Conventions. The Conventions are largely a codification of customary international law as it existed at the time. They not only embrace the basic principles of customary international law; they also contain detailed and specific rules. The Hague Conventions pertain primarily to the means and

⁵⁴ See *Conduct of Armed Conflict and Air Operations*, *supra* note 46 at para. 1-3a(2).

⁵⁵ For detailed discussions on chivalry, see e.g. M. Prestwich, *Armies and Warfare in the Middle Ages: The English Experience* (New Haven: Yale University Press, 1996) at 219-244; M. Strickland, *War and Chivalry: The Conduct and Perception of War in England and Normandy, 1066-1217* (Cambridge: Cambridge University Press, 1996); M. Vale, *War and Chivalry: Warfare and Aristocratic Culture in England, France and Burgundy at the End of the Middle Ages* (London: Gerald Duckworth, 1981).

⁵⁶ See *Conduct of Armed Conflict and Air Operations*, *supra* note 49 at para. 1-3a(3).

⁵⁷ See *ibid.*

methods of warfare while the Geneva Conventions deal with humanitarian concerns. While separate treaties governing the law of armed conflict in the air and in outer space do not exist, current and future aerospace combat operations must be conducted in conformity with existing customary international law as well as with relevant provisions of the law of armed conflict and related treaties.

a. The Hague Conventions

(1) The 1899 Hague Conventions

The work of The First Hague Peace Conference of 1899 took place in three commissions. Commission I addressed disarmament and new weapons issues and was divided into two sub-commissions, one for land warfare and one for naval warfare.⁵⁸ Commission II addressed problems regarding the revision and codification of the laws of war and Commission III addressed arbitration.⁵⁹ The Conference led to the conclusion of three Conventions⁶⁰ and three Declarations.⁶¹ Convention (II) regarding land warfare and the Regulations annexed thereto contained provisions relevant to the law aerospace warfare. Convention (II) was superseded by the 1907 Hague Convention (IV) Respecting the Laws and Customs of War on Land⁶² and is no longer in force.⁶³ Declaration (IV, 1) regarding the launching of projectiles and explosives from balloons and Declaration (IV, 2) concerning asphyxiating gases continue to be relevant to the law of aerospace warfare.

⁵⁸ See "Air War and the Law of War," *supra* note 53 at 9.

⁵⁹ See *ibid.*

⁶⁰ The three conventions were: *Convention (I) for Peaceful Adjustment of International Differences*, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 107, reprinted in L. Friedman, *The Law of War: A Documentary History*, vol.1 (New York: Random House, 1972) at 204; *1899 Hague Convention II*, *supra* note 46; *Convention (III) for the Adaptation to Maritime Warfare of the Principles of the Geneva Convention of 22 August 1864*, (1907 Supplement) 1 A.J.I.L. 159 (entered into force 4 September 1900, no longer in force) [hereinafter *1899 Hague Convention III*] reprinted in Schindler & Toman, *supra* note 7 at 289.

⁶¹ The three declarations were: *Declaration (IV 1) To Prohibit For the Term of Five Years the Launching of Projectiles and Explosives from Balloons, And Other Methods of a Similar Nature*, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 153 (entered into force 4 September 1900), reprinted in Schindler & Toman, *supra* note 7 at 202; *Declaration (IV 2) Concerning Asphyxiating Gases*, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 157 (entered into force 4 September 1900), reprinted in Roberts & Guelff, *supra* note 44 at 35 and Schindler & Toman, *supra* note 7 at 105; *Declaration (IV 3) Concerning Expanding Bullets*, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 155 (entered into force 4 September 1900), reprinted in Roberts & Guelff, *supra* note 44 at 40, Schindler & Toman, *supra* note 7 at 109.

⁶² *Convention (IV) (and Regulations) Respecting the Laws and Customs of War on Land*, 18 October 1907, 205 Consol. T.S. 277 (entered into force 26 January 1910) [hereinafter *1907 Hague Convention IV*] reprinted in Roberts & Guelff, *supra* note 44 at 43 and Schindler & Toman, *supra* note 7 at 63.

⁶³ The relevant provisions of the *1907 Hague Convention IV* are discussed in detail in Part 2a(2), below.

While only Declaration (IV, 2) remains in force, Declaration (IV, 1) must be analyzed as its 1907 successor is technically still in force today.

Whereas by 1899, balloons had been used for military purposes for over 100 years,⁶⁴ it was unclear at the time as to exactly how aerial instrumentalities were to be used in war; the airplane was yet to be invented. Many States desired an outright prohibition on the launching of projectiles and explosives from balloons and other aircraft while the major powers of the day including France, Germany, Great Britain and the United States opposed an outright and permanent prohibition.⁶⁵ A compromise was struck in Declaration (IV, 1) whereby the launching of projectiles and explosives from balloons or “new methods of a similar nature” was prohibited for a period of five years. The issue would be revisited in 1907 at the Second Hague Peace Conference.

In Declaration (IV, 2) Concerning Asphyxiating Gases, the contracting parties agreed to abstain from using projectiles where the sole object of the projectile was the diffusion of asphyxiating or deleterious gasses. Experiences of World War I led eventually to the adoption of a Protocol in 1925 extending the prohibition to bacteriological methods of warfare.⁶⁶ A 1972 Convention prohibits the development, production and stockpiling of bacteriological and toxin weapons and provides for their destruction.⁶⁷

(2) The 1907 Hague Conventions

By the time the Second Hague Peace Conference convened in 1907, it was becoming clear that aerial instrumentalities were to play a role in modern warfare. The Wright Brothers had successfully conquered the art of flight and France, Germany, Russia and Italy had already initiated programs for the production of military dirigibles.⁶⁸

⁶⁴ See *supra* note 1.

⁶⁵ See “Air War and the Law of War,” *supra* note 53 at 10.

⁶⁶ *Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare*, 17 June 1925, (1929) 94 L.N.T.S. 65, 26 U.S.T. 571, (1975) 14 I.L.M. 49, (1931 Supplement) 25 A.J.I.L. 94 (entered into force 8 February 1928), reprinted in Roberts & Guelff, *supra* note 44 at 139, Schindler & Toman, *supra* note 7 at 116.

⁶⁷ *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*, 10 April 1972, 1015 U.N.T.S. 164, 26 U.S.T. 583, (1972) 11 I.L.M. 309, (1972) 66 A.J.I.L. 451 (entered into force 26 March 1975), reprinted in Schindler & Toman, *supra* note 7 at 137.

⁶⁸ See “Air War and the Law of War,” *supra* note 53 at 16.

Thirteen Conventions and one Declaration were ultimately adopted at the Conference.⁶⁹ It would be the last time that any major multilateral agreements were concluded with regard to the means and methods of warfare. No subsequent agreement has been as broad or as extensive. The Declaration and two of the Conventions (IV and IX) are relevant to aerospace warfare.

The sole Declaration to come out of the Conference renewed the 5-year prohibition on launching projectiles and explosives from balloons. The Declaration prohibits the discharge of projectiles and explosives from balloons or "other new methods of a similar nature."⁷⁰ The phrase "other new methods of a similar nature" could be interpreted as prohibiting modern aircraft from launching projectiles and explosives. The Declaration was to remain in force only until the close of the Third Peace Conference. As the Third Peace Conference never took place, the Declaration is technically still in force, although of little if any significance today.⁷¹ The Declaration is only binding on contracting parties in case of war between them and ceases to be binding when a non-contracting party joins a contracting party in the conflict. France, Germany, Italy, Japan and Russia did not sign or ratify the Declaration and in 1942, the U.S. announced it would not observe its terms.⁷²

Since the Declaration was intended to apply only temporarily, to begin with, endeavors continued at the 1907 Conference to adopt some type of permanent prohibition on the discharge of projectiles from the air. These efforts led to the insertion of Article 25 in the Regulations annexed to Convention (IV) Respecting the Law and Customs of War on Land. Under Article 25, "[t]he attack or bombardment, by whatever means, of towns, villages, dwellings, or buildings which are undefended is prohibited."⁷³ The term "by whatever means" clearly encompasses aerial instrumentalities. It should be emphasized that Article 25 does not prohibit aerial bombardment in all circumstances. Rather, the bombing of towns, villages, dwellings or buildings is prohibited only if

⁶⁹ The titles and text of all 13 Conventions can be found in Friedman, *supra* note 60.

⁷⁰ *Declaration (XIV) Prohibiting Discharge of Projectiles and Explosives From Balloons*, 18 October 1907, (1908 Supplement) 2 A.J.I.L. 216 (entered into force 27 November 1909), reprinted in Schindler & Toman, *Supra* note 7 at 202.

⁷¹ See e.g. Roberts & Guelff, *supra* note 44 at 121; Schindler & Toman, *supra* note 7 at 201.

⁷² See Roberts & Guelff, *supra* note 44 at 121.

⁷³ *1907 Hague Convention IV*, *supra* note 52.

undefended. Regrettably, neither the Regulations nor Convention (IV) define “undefended.”

The Regulations annexed to Convention (IV) require that warning be given to the appropriate authorities prior to the commencement of any aerial bombing.⁷⁴ Moreover, the destruction of property is forbidden unless demanded by the necessities of war and all necessary steps must be taken to avoid bombing religious, art, science and charitable buildings as well as historic monuments, hospitals and places where the sick and wounded are collected.⁷⁵ However, the protection is lost if such buildings or places are used for military purposes. It is incumbent upon the besieged party to notify the enemy of any such buildings or places and to clearly mark them with distinctive and visible signs.

As Convention (IV) regarding land warfare, Convention (IX) regarding naval bombardment prohibits the bombardment of undefended towns, villages, dwellings or buildings and adds undefended ports to the prohibited list.⁷⁶ It also provides for a prior warning requirement and contains virtually identical prohibitions on the bombing of protected places as those contained in Convention (IV).⁷⁷ The key difference between the two Conventions is that Convention (IX) specifically identifies military targets subject to lawful attack. It also recognizes the inevitability of collateral damage should such attacks occur. Convention (IX) lists as legitimate targets: military works, military or naval establishments, depots of arms or war materials, workshops or plants which can be used for the needs of a hostile fleet or army and ships of war in a harbor.⁷⁸ This is significant in that the text of Convention (IX) specifically recognizes that lawful targets are not

⁷⁴ *Ibid.* at Article 26.

⁷⁵ *Ibid.* at Articles 23, para. g, 27. In 1954, two additional international instruments were adopted dealing specifically with the protection of cultural property as the protections in the 1907 Hague Conventions IV and IX proved inadequate during World War II. See *Convention (and Regulations) for the Protection of Cultural Property in the Event of Armed Conflict*, 14 May 1954, 249 U.N.T.S. 240 (entered into force 7 August 1956), reprinted in Roberts & Guelff, *supra* note 44 at 340, Schindler & Toman, *supra* note 7 at 747; *Protocol for the Protection of Cultural Property in the Event of Armed Conflict*, 14 May 1954, 249 U.N.T.S. 358 (entered into force 7 August 1956), reprinted in Roberts & Guelff, *supra* note 44 at 263, Schindler & Toman, *supra* note 7 at 777.

⁷⁶ *Convention (IX) Concerning Bombardment by Naval Forces in Time of War*, 18 October 1907, (1908 Supplement) 2 A.J.I.L. 146 (entered into force 26 January 1910) [hereinafter *1907 Hague Convention IX*] at Article 1, reprinted in Roberts & Guelff, *supra* note 44 at 93, Schindler & Toman, *supra* note 7 at 811.

⁷⁷ *Ibid.* at Articles 5, 6.

⁷⁸ *Ibid.* at Article 2.

limited to those purely military in nature but include industrial targets of value to the war effort.⁷⁹ Just as important, the treaty absolves the attacking party of any responsibility for collateral damage incurred as a result of such bombardment, although any such collateral damage would still have to be in accord with the basic principles of customary international law.

(3) *The 1923 Hague Rules of Air Warfare*⁸⁰

The use of aerial instrumentalities (aircraft, balloons, dirigibles) in World War I illustrated the need for a specific, comprehensive treaty on air warfare. In 1923 at The Hague, a Commission of Jurists drafted the 1923 Hague Rules of Air Warfare. Although the rules were never adopted in binding form, “they were regarded as an authoritative attempt to clarify and formulate rules of air warfare, and largely correspond to customary rules and general principles underlying the laws of war on land and at sea.”⁸¹ Articles 22-26 deal with aerial bombardment. The most important provision is most likely Article 22, prohibiting aerial bombardment to terrorize the civilian population, to destroy or damage private property or to injure non-combatants.⁸²

b. *The Geneva Conventions*

(1) *The 1949 Geneva Conventions*

Immediately following World War II the International Committee of the Red Cross (ICRC) sought to convene a conference aimed at revising the 1929 Geneva Conventions⁸³ and to address issues regarding civilians in war.⁸⁴ Following several preliminary conferences, in 1949 at Geneva, a Diplomatic Conference was convened

⁷⁹ See “Air War and the Law of War,” *supra* note 53 at 18.

⁸⁰ *Hague Rules of Air Warfare*, 1923, (1923 Supplement) 17 A.J.I.L. 245 (not in force), (1938 Supplement) 32 A.J.I.L. 12, reprinted in Roberts & Guelff, *supra* note 44 at 123, Schindler & Toman, *supra* note 7 at 208.

⁸¹ Roberts & Guelff, *supra* note 44 at 121; see also Schindler & Toman, *supra* note 7 at 207.

⁸² See Roberts & Guelff, *supra* note 44 at 122.

⁸³ *Convention for the Amelioration of the Condition of the Wounded and Sick in Armies in the Field*, 27 July 1929, (1933 Supplement) 27 A.J.I.L. 43 (entered into force 19 June 1931), reprinted in Schindler & Toman, *supra* note 7 at 325; *Convention Relative to the Treatment of Prisoners of War*, 27 July 1929, (1933 Supplement) 27 A.J.I.L. 59 (entered into force 19 June 1931), reprinted in Schindler & Toman, *supra* note 7 at 339.

⁸⁴ See e.g. Roberts & Guelff, *supra* note 44 at 169; Schindler & Toman, *supra* note 7 at 367; “Air War and the Law of War,” *supra* note 53 at 55.

where the ICRC presented four draft Conventions. The result of the Conference was the adoption of four conventions collectively known as the Geneva Conventions for the Protection of War Victims of 12 August 1949.⁸⁵ Common thinking is that the Conventions are now declaratory of customary international law.⁸⁶ The Conventions primarily address the treatment of those injured in war, the treatment of prisoners of war (POWs) and the treatment of civilians during war. They apply to contracting parties engaged in international armed conflicts. In an important innovation, common Article 3 of the Conventions established basic humanitarian considerations to be applicable in non-international conflicts.

In order to protect the casualties of war, whether military or civilian, the Geneva Conventions prohibit attacks on fixed medical establishments, mobile medical units, military hospital ships and civilian hospitals.⁸⁷ Responsible authorities must ensure such medical facilities are not situated in close proximity to legitimate military targets so as to avoid collateral damage. The protection may be lost if the relevant medical facility is used to commit acts harmful to the enemy.⁸⁸ However, even in cases where the facilities have been used to commit acts harmful to the enemy and the protection is asserted to have been lost, no attack may take place without prior warning. Attacks against medical transports on land, at sea or in the air are likewise prohibited; regardless of whether the transport is military or civilian.⁸⁹ To protect against bombardment and

⁸⁵ *Geneva Convention (I) for the Amelioration of the Condition of Wounded and Sick in Armed Forces in the Field*, 12 August 1949, 75 U.N.T.S. 31, 6 U.S.T. 3114, T.I.A.S. 3362 (entered into force 21 October 1950) [hereinafter *Geneva Convention I*], reprinted in Roberts & Guelff, *supra* note 44 at 171, Schindler & Toman, *supra* note 7 at 375; *Geneva Convention (II) for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea*, 12 August 1949, 75 U.N.T.S. 85, 6 U.S.T. 3217, T.I.A.S. 3363 (entered into force 21 October 1950) [hereinafter *Geneva Convention II*], reprinted in Roberts & Guelff, *supra* note 44 at 194, Schindler & Toman, *supra* note 7 at 403; *Geneva Convention (III) Relative to the Treatment of Prisoners of War*, 12 August 1949, 75 U.N.T.S. 135, 6 U.S.T. 3316, T.I.A.S. 3364 (entered into force 21 October 1950), (1953 Supplement) 47 A.J.I.L. 119 [hereinafter *Geneva Convention III*], reprinted in Roberts & Guelff, *supra* note 44 at 216, Schindler & Toman, *supra* note 7 at 429; *Geneva Convention (IV) Relative to the Protection of Civilian Persons in Time of War*, 12 August 1949, 75 U.N.T.S. 287, 6 U.S.T. 3516, T.I.A.S. 3365 (entered into force 21 October 1950), (1956) 50 A.J.I.L. 724 [hereinafter *Geneva Convention IV*], reprinted in Roberts & Guelff, *supra* note 44 at 272, Schindler & Toman, *supra* note 7 at 501.

⁸⁶ See Roberts & Guelff, *supra* note 44 at 170.

⁸⁷ *Geneva Convention I*, *supra* note 85 at Articles 19, 20; *Geneva Convention II*, *supra* note 85 at Articles 22, 23; *Geneva Convention IV*, *supra* note 85 at Article 18.

⁸⁸ *Geneva Convention I*, *supra* note 85 at Article 21; *Geneva Convention II*, *supra* note 85 at Article 34; *Geneva Convention IV*, *supra* note 85 at Article 19.

⁸⁹ *Geneva Convention I*, *supra* note 85 at Articles 35, 36; *Geneva Convention II*, *supra* note 85 at Article 38; *Geneva Convention IV*, *supra* note 85 at Articles 21, 22.

attack, fixed medical establishments, mobile medical units, military hospital ships and civilian hospitals must be clearly marked with distinctive emblems⁹⁰ and such markings must be visible from the air.⁹¹ Similar marking requirements apply to medical transports.⁹²

Protective measures were established for POWs and civilians as well. POWs are required to have shelters against air bombardment and may not be sent to, or detained in, areas where they may be exposed to the fire of the combat zone.⁹³ Moreover, detaining powers must provide information regarding the geographic locations of POW camps and where military considerations permit, camps must be marked with the letters PW or PG in such a manner as to be clearly visible from the air.⁹⁴ Geneva Convention (IV) provides for the establishment of safety and neutralized zones to protect civilians.⁹⁵ However, “the presence of protected persons may not be used to render certain points or areas immune from military operations,” that is, civilians may not be used as “human shields.”⁹⁶ Finally, should civilians be interned, places of internment may not be located in particularly dangerous areas; shelters from air raids must be provided; and internment camps must be indicated by the letters IC in such a manner as to be visible from the air.⁹⁷

(2) The 1977 Geneva Protocols

In 1977, two Protocols⁹⁸ to the 1949 Geneva Conventions were adopted to further

⁹⁰ Distinctive emblems include a red cross, red crescent or red lion and sun on a white ground. *Geneva Convention I*, *supra* note 85 at Article 38.

⁹¹ *Geneva Convention I*, *supra* note 85 at Article 42; *Geneva Convention II*, *supra* note 85 at Article 43; *Geneva Convention IV*, *supra* note 85 at Article 18.

⁹² *Geneva Convention I*, *supra* note 85 at Articles 36, 39; *Geneva Convention II*, *supra* note 85 at Article 39; *Geneva Convention IV*, *supra* note 85 at Articles 21, 22.

⁹³ *Geneva Convention III*, *supra* note 85 at Article 23.

⁹⁴ *Ibid.*

⁹⁵ *Geneva Convention IV*, *supra* note 85 at Articles 14, 15.

⁹⁶ *Ibid.* at Article 28.

⁹⁷ *Ibid.* at Articles 83, 88.

⁹⁸ *Protocol Additional to the Geneva Conventions of 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, 8 June 1977, 1125 U.N.T.S. 3 (entered into force 7 December 1978), (1977) 16 I.L.M. 1391, (1978) 72 A.J.I.L. 457 [hereinafter *Geneva Protocol I*], reprinted in Roberts & Guelff, *supra* note 44 at 389, Schindler & Toman, *supra* note 7 at 627; *Protocol Additional to the Geneva Conventions of 1949, and Relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II)*, 8 June 1977, 1125 U.N.T.S. 609 (entered into force 7 December 1978), (1977) 16 I.L.M. 1442, (1978) 72 A.J.I.L. 457 [hereinafter *Geneva Protocol II*], reprinted in Roberts & Guelff, *supra* note 44 at 449, Schindler & Toman, *supra* note 7 at 691.

develop the law.⁹⁹ Since the end of World War II, many of the armed conflicts that arose were non-international in nature. With the exception of common Article 3 of the 1949 Geneva Conventions, the law of armed conflict applied only to international conflicts. The need to clarify the applicable law in non-international or internal conflicts had become evident. Protocol I makes the Geneva Conventions applicable not only to the contracting parties but also to “armed conflicts in which people are fighting against colonial domination and alien occupation and against racist regimes in the exercise of their right of self-determination.”¹⁰⁰ Protocol II applies specifically to non-international armed conflicts.

Protocol I does more than simply expand the application of the Geneva Conventions; it details the protections enumerated in the original Conventions. In restating that medical facilities may not be attacked, Protocol I also makes it clear that medical units may not be used to shield legitimate military objectives from attack.¹⁰¹ Additionally, the precise type of medical transport vehicles that qualify for protection are expanded and clarified.¹⁰² Essentially, any type of vehicle qualifies so long as its sole purpose is medical transport and it is clearly marked as such.

Specific rules prescribe as to how medical aircraft are to operate.¹⁰³ Parties to the conflict are prohibited from using medical aircraft to attempt to gain any type of military advantage over an adversary and the use of medical aircraft to collect or transmit intelligence data is specifically prohibited.¹⁰⁴ Moreover, medical aircraft may not carry any intelligence equipment or armament except the small arms necessary for the self-defense of medical personnel and casualties on board.¹⁰⁵ To ensure compliance with the aforementioned rules, medical aircraft may be required to land and permit inspection.¹⁰⁶

Article 42 provides specific rules for aircraft occupants. Thus, no person parachuting from an aircraft in distress may be attacked and the parachutist must be afforded the opportunity to surrender once he lands. The key here is that the parachutist

⁹⁹ See Roberts & Guelff, *supra* note 44 at 387.

¹⁰⁰ *Geneva Protocol I*, *supra* note 98 at Article 1, para. 4.

¹⁰¹ *Ibid.* at Article 12.

¹⁰² *Ibid.* at Articles 21-24.

¹⁰³ *Ibid.* at Articles 24-30.

¹⁰⁴ *Ibid.* at Article 28.

¹⁰⁵ *Ibid.*

¹⁰⁶ *Ibid.* at Article 30.

must be in distress, such as exiting a damaged aircraft that is about to crash, as airborne troops are not entitled to the same protections.

Regarding civilians, Protocol I require parties to an armed conflict to distinguish between civilians and combatants and between civilian objects and military objectives.¹⁰⁷ Attacks are limited strictly to military objectives and attacks against the civilian population, civilian objects, cultural objects, places of worship and objects “indispensable to the survival of the civilian population” (such as foodstuffs, crops and livestock) are specifically prohibited.¹⁰⁸ Installations containing dangerous forces such as dams, dykes and nuclear electrical generating stations may not be attacked even if the objects are legitimate military objectives.¹⁰⁹ Moreover, military objectives located at or in the vicinity of these installations may not be attacked if such an attack would pose a risk to the release of the dangerous force. However, the installations lose their protection and may be attacked if they are used in regular, significant and direct support of military operations, provided an attack is the only way to terminate such support. Finally, Article 58 encourages taking precautions against the effects of an attack on civilians by removing the civilian population and civilian objects from the vicinity of military objectives and by locating military objectives away from densely populated areas.

While not nearly as exhaustive and detailed, Protocol II makes the basic rules of Protocol I and the Geneva Conventions applicable in non-international conflicts. Medical units and transports may not be the object of attack.¹¹⁰ Civilians, objects indispensable to the survival of civilians, cultural objects, places of worship and installations containing dangerous forces are protected from attack as well.¹¹¹

c. Other Relevant Issues

The Hague and Geneva Conventions represent the bulk of the codified law relevant to the law of aerospace warfare. There are, however, some additional issues

¹⁰⁷ *Ibid.* at Article 48.

¹⁰⁸ *Ibid.* at Articles 51-54.

¹⁰⁹ *Ibid.* at Article 56.

¹¹⁰ *Geneva Protocol II*, *supra* note 98 at Article 11.

¹¹¹ *Ibid.* at Articles 13-16.

meriting discussion.

(1) Limitations on Certain Conventional Weapons

It was the intent of the 1977 Geneva Conference to address issues regarding restrictions on certain types of conventional weapons although no specific instruments were adopted. In 1981, an agreement was reached on a Convention on Certain Conventional Weapons and three annexed Protocols.¹¹² Protocol (I) prohibits the use of any weapon that injures using fragments undetectable by X-rays; Protocol (II) prohibits the use of mines, booby-traps and other devices against civilians; and Protocol (III) prohibits the use of incendiary weapons against civilians. Note that Protocols (II) and (III) do not prohibit the use of said weapons against combatants, although Protocol (II) was amended in 1996 placing limitations on the use of mines, booby-traps and other devices against combatants. In 1995, an additional Protocol was adopted prohibiting the use of blinding lasers in combat.¹¹³

(2) Use of Chemical and Bacteriological (Biological) Weapons

In 1993 at Paris, a Convention was adopted prohibiting the use of chemical weapons and providing for their destruction.¹¹⁴ Chemical weapons are defined by the Convention as any toxic chemical “which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals.”¹¹⁵

¹¹² *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 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1523, reprinted in Roberts & Guelff, *supra* note 44 at 473, Schindler & Toman, *supra* note 7 at 179; *Protocol [to the Convention on Conventional Weapons] on Non-Detectable Fragments (Protocol I)*, 10 April 1981, 1342 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1523, reprinted in Roberts & Guelff, *supra* note 44 at 479, Schindler & Toman, *supra* note 7 at 185; *Protocol [to the Convention on Conventional Weapons] on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices (Protocol II)*, 10 April 1981, 1342 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1529, reprinted in Roberts & Guelff, *supra* note 44 at 479, Schindler & Toman, *supra* note 7 at 188, amended 3 May 1996, (1996) 35 I.L.M. 1209; *Protocol [to the Convention on Conventional Weapons] on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III)*, 10 April 1981, 1342 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1529, reprinted in Roberts & Guelff, *supra* note 44 at 484, Schindler & Toman, *supra* note 7 at 190.

¹¹³ *Protocol [to the Convention on Conventional Weapons] on Blinding Laser Weapons (Protocol IV)*, 13 October 1995, (1996) 35 I.L.M. 1218.

¹¹⁴ *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction*, 13 January 1993, (1993) 32 I.L.M. 800 (entered into force April 1997).

¹¹⁵ *Ibid.* at Article 2.

The Convention also prohibits the use of riot control agents (RCAs) as a method of warfare.¹¹⁶ RCAs are differentiated from chemical weapons in that RCAs merely produce sensory irritation or disabling physical effects in humans which disappear within a short time following termination of exposure.¹¹⁷

(3) Use of Nuclear Weapons

In 1996, the International Court of Justice issued an advisory opinion on the legality of the threat or use of nuclear weapons. The Court found:

- (1) "There is in neither customary nor conventional international law any specific authorization of the threat or use of nuclear weapons;"
- (2) "There is in neither customary nor conventional international law any comprehensive and universal prohibition of the threat or use of nuclear weapons as such;"
- (3) "A threat or use of force by means of nuclear weapons that is contrary to Article 2, paragraph 4, of the United Nations Charter and that fails to meet all of the requirements of Article 51 is unlawful;"
- (4) "A threat or use of nuclear weapons should also be compatible with the requirements of the international law applicable in armed conflict, particularly those principles and rules of international humanitarian law, as well as with specific obligations under treaties and other undertakings which expressly deal with nuclear weapons;"
- (5) "It follows from the above-mentioned requirements that the threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law;
- (6) However, in view of the current state of international law, and of the elements of facts at its disposal, the Court cannot conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defence, in which the very survival of a State would be at stake;" and
- (7) "There exists an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all aspects under strict and effective international control."¹¹⁸

In sum, the Court decided that the use of nuclear weapons is not unlawful *per se*.

However, it would take an extreme set of circumstances to justify their use and any such

¹¹⁶ *Ibid.* at Article 1.

¹¹⁷ *Ibid.* at Article 2.

¹¹⁸ *Legality of the Use By a State of Nuclear Weapons in Armed Conflict*, Advisory Opinion [1996] I.C.J. Rep. 4 [hereinafter *Advisory Opinion on the Use of Nuclear Weapons*] at 35-36.

use must otherwise comply with the UN Charter and other relevant international law. It would not be an exaggeration to conclude that the Court evaded the question of the legality of the use of nuclear weapons and, in essence, left the issue unresolved.

2. Space Law and Related Treaties

Physically, outer space is merely a continuation of airspace. The exact point where airspace ends and outer space begins cannot be determined by physical science and there is no agreed upon legal definition of the airspace/outer space boundary.¹¹⁹ The boundary issue is of import as the legal regimes governing airspace and outer space differ greatly. While airspace is subject to State sovereignty, outer space is not.¹²⁰ Moreover, outer space is free for all to use and explore and is not subject to State appropriation.¹²¹

a. The Peaceful Use of Outer Space – Non-Military or Non-Aggressive?

The first UNGA resolution on outer space (1148(XII)) of 14 November 1957, used the phrase “exclusively for peaceful purposes” regarding the use of outer space. The phrase “peaceful purposes” subsequently reappeared in numerous additional instruments and its precise meaning has long been debated.¹²² There are two general schools of thought as to the meaning of “peaceful use” of outer space: (1) non-military and (2) non-aggressive.¹²³ The non-military viewpoint would completely prohibit

¹¹⁹ For discussions on the airspace/outer space boundary issue, see e.g. M.N. Andem, *International Legal Problems in the Peaceful Exploration and Use of Outer Space* (Rovaniemi, Finland: University of Lapland, 1992) at 122-184; C. Voute “Boundaries in Space” in B. Jasani, ed., *Peaceful and non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race* (New York: Taylor & Francis, 1991) [hereinafter *Peaceful and Non-Peaceful Uses of Space*] at 19-34.

¹²⁰ *Convention on International Civil Aviation*, 7 December 1944, 15 U.N.T.S. 295, 61 Stat. 1180, T.I.A.S. No. 1591 (entered into force 4 April 1947) at Article 1; *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, 27 January 1967, 610 U.N.T.S. 205 18 U.S.T. 2410, T.I.A.S. No. 6347 (entered into Force 10 October 1967), reprinted in (1967) 6 I.L.M. 386 [hereinafter *Outer Space Treaty*] at Articles 1, 2.

¹²¹ *Outer Space Treaty*, *ibid.*

¹²² See I.A. Vlasic, “Space Law and the Military Applications of Space Technology” in N. Jasentuliyana, ed., *Perspectives on International Law* (London: Kluwer Law International, 1995) [hereinafter “Space Law and the Military Applications of Space Technology”].

¹²³ For an in depth discussion on the issue, see e.g. *ibid.*; I.A. Vlasic “The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space” in Jasani, B., ed., *Peaceful and non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race* (New York: Taylor & Francis, 1991) 37 [hereinafter “The Legal Aspects of Peaceful an Non-Peaceful Uses of Outer Space”]; B.A. Hurwitz, *The Legality of Space Militarization* (Amsterdam: Elsevier Science, 1986); C.Q. Christol, *The Modern International Law of Outer Space* (New York: Pergamon Press, 1982) at 344-348.

military activities in outer space. Conversely, the non-aggressive position is that only offensive (aggressive) military activities are prohibited while defensive (non-aggressive) military activities are permissible.

When the space age began in October of 1957, it appears the international community, including the major space powers, equated peaceful use to non-military use.¹²⁴ However, both the U.S. and former Soviet Union began using outer space for military purposes as early as the late 1950s. As a result, U.S. policy regarding the meaning of “peaceful use” of outer space changed. The U.S. and several other States have contended since 1959 that defensive or non-aggressive military activities are permissible in outer space while the former Soviet Union maintained until long after the adoption of the Outer Space Treaty in 1967 that military activities were completely forbidden.¹²⁵ Eventually, the former Soviet Union accepted the views that outer space may be used for military purposes although it still does not agree with the U.S. definition of peaceful use.¹²⁶ Military use of space has been the practice of States for over 40 years and in that time, neither the U.S. position nor that practice has ever been formally protested.¹²⁷

Present day reality is that outer space is used extensively by a growing number of States for military purposes. Having established that space may lawfully be used for military purposes, attention must now be focused on the type of military activity permissible under the law. Various international instruments are of assistance in better defining how outer space may be used by the military.

b. The 1967 Outer Space Treaty

The Outer Space Treaty is often referred to as the constitution of space law and is regarded by many as being representative of customary international law. Article III of the Treaty requires activities in space be conducted in accordance with international law, including the UN Charter, and in the interest of maintaining international peace and

¹²⁴ See e.g. “Space Law and the Military Applications of Space Technology,” *supra* note 122; “The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space,” *supra* note 123 at 37-40.

¹²⁵ See “Space Law and the Military Applications of Space Technology,” *supra* note 122.

¹²⁶ See *ibid.*

¹²⁷ See e.g. “Space Law and the Military Applications of Space Technology,” *supra* note 122; “The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space,” *supra* note 123 at 45.

security.¹²⁸ Note that space activities are to be conducted in the *interest* of maintaining international peace and that the phrase “*exclusively* for peaceful purposes” is omitted. The Treaty does explicitly state that the moon and other celestial bodies must be used *exclusively* for peaceful purposes.¹²⁹ Regarding space in general, however, the Treaty merely prohibits the placement of nuclear weapons or other weapons of mass destruction in orbit around the earth or stationing such weapons in outer space in any other manner.¹³⁰ Thus, while the moon and other celestial bodies must be used exclusively for peaceful purposes, meaning non-military use, space in general, including orbit around the earth, may be used for military purposes. Weapons not classified as nuclear or other weapons of mass destruction may lawfully be placed in outer space, including in orbit around the earth. Military reconnaissance, weather, navigational and communication satellites are likewise lawful.

c. The 1979 Moon Agreement¹³¹

The 1979 Moon Agreement contains provisions similar to those in the Outer Space Treaty. Under the Agreement, the moon must be used *exclusively* for peaceful purposes.¹³² The threat or use of force or any other hostile act or threat of hostile act is prohibited.¹³³ Moreover, the moon may not be used to commit any such act or engage in any such threat in relation to the earth, the moon, a spacecraft, the personnel of a spacecraft or man made space objects.¹³⁴ The agreement prohibits placing nuclear weapons or other weapons of mass destruction on or in the moon or in orbit around the moon. Furthermore, the testing of *any* type of weapons, the establishment of military

¹²⁸ The Outer Space Treaty therefore requires that any use of force comply with the existing state of the *jus ad bellum* discussed in Part A, above.

¹²⁹ *Outer Space Treaty*, *supra* note 120 at Article 6.

¹³⁰ *Ibid.* It should be noted that while the Treaty prohibits the placing nuclear weapons in orbit and stationing the same in outer space, it does not prohibit the use of intercontinental ballistic missiles (ICBMs). When ICBMs are deployed, they merely enter outer space and return to earth. They do not establish themselves in orbit around the earth nor are they stationed in space. Thus, their use would not be a violation of the Treaty.

¹³¹ *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 18 December 1979, 1363 U.N.T.S. 3; U.N. Doc. A/RES 34/68 (1979) reprinted in (1979) 18 I.L.M. 1434 (entered into force 11 July 1984) [hereinafter *Moon Agreement*].

¹³² *Ibid.* at Article 3, para. 1.

¹³³ *Ibid.* at Article 3, para. 2.

¹³⁴ *Ibid.*

installations, and the conduct of military maneuvers on the moon are forbidden.¹³⁵ It is permissible, however, to use military personnel and equipment for scientific research and other peaceful purposes.

While the language in the Moon Agreement regarding hostilities on the moon is more specific than the Outer Space Treaty, it adds little substantive value to the former and caution must be exercised in how much weight it is to be given. No major space power has ratified this Agreement and total ratifications number less than 15. In short, the Agreement is of minimal legal significance to the law of aerospace warfare.

d. Other Relevant Instruments

The testing of nuclear weapons is prohibited in outer space pursuant to the 1963 Partial Test Ban Treaty.¹³⁶ Under the 1977 Environmental Modification Convention, the contracting parties agreed not to engage in military or any other hostile use of environmental modification techniques in space.¹³⁷ The Convention defines environmental modification techniques as “any technique for changing – through the deliberate manipulation of natural processes – the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere, and atmosphere, or of outer space.” The Convention could have an impact as to the type of weapons used in or delivered to or from space.

In 1972, the U.S. and former Soviet Union concluded the Anti-Ballistic Missile (ABM) Treaty¹³⁸ to strengthen the cold war concept of mutually assured destruction (MAD). Under the ABM Treaty, as amended by the 1974 Protocol, each State is restricted to deploying only one ABM defense system.¹³⁹ The restrictions make it

¹³⁵ *Ibid.* at Article 3, para. 4.

¹³⁶ *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Underwater*, United States, United Kingdom and Soviet Union, 5 August 1963, 480 U.N.T.S. 43, 14 U.S.T. 1313 (entered into Force 10 October 1963, later joined by numerous additional states), reprinted in (1963) 2 I.L.M. 889 [hereinafter *Nuclear Test Ban Treaty*].

¹³⁷ *Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques*, 18 May 1977, 1108 U.N.T.S. 151, 31 U.S.T. 333, T.I.A.S. 9614 (entered into force 5 October 1978), (1977) 16 I.L.M. 88, reprinted in Roberts & Guelff, *supra* note 41 at 379, Schindler & Toman, *supra* note 7 at 164 [hereinafter *Use of Environmental Modification Techniques Convention*].

¹³⁸ *Treaty on the Limitation of Anti-Ballistic Missile Systems*, United States and Soviet Union, 26 May 1972, 23 U.S.T. 3435, T.I.A.S. 7503 (entered into force 3 October 1972; Protocol done 3 July 1974, entered into Force 24 May 1976) [hereinafter *ABM Treaty*].

¹³⁹ *Ibid.* at Article 3.

impossible to provide nation-wide ABM defense without violating the Treaty. The parties are also prohibited from developing space-based ABM systems or components.¹⁴⁰ Currently, the U.S. and Russia are negotiating, at American initiative, possible amendment to the Treaty which will allow the installment of a limited national ABM defense system.

Although not a binding text, UNGA Resolution 47/68¹⁴¹ enumerating 11 principles relevant to the use of nuclear power sources (NPS) in outer space could have an important impact on the employment of space-based weapons and other military systems designed to operate in outer space. The Principles, limited to nuclear power sources on board spacecraft for non-propulsive purposes, seek to minimize the quantity of radioactive material in outer space.¹⁴² To achieve that end, the Principles do not ban the use of NPS in space; rather, they require that NPS in outer space be “restricted to those missions that cannot be operated by non-nuclear energy sources in a reasonable way.”¹⁴³

C. Chapter I Summary

Aerospace warfare is governed by both the *jus ad bellum* and the *jus in bello*. The *jus ad bellum* dictates when force may be used and the *jus in bello* governs the conduct of hostilities once they have begun. The *jus ad bellum* evolved from early concepts of “just war” culminating in the famous Kellogg-Briand Pact of 1928 outlawing war altogether. Currently, under the UN Charter, force may only be employed in self-defense or with the approval of the UN Security Council, although recent military interventions seem to signal a return to the original just war concepts. The *jus in bello* consists of both customary and conventional international law. Once the decision to use force has been made, aerospace warfare must be conducted in accordance with customary law and the relevant provisions of conventional law. The Hague Conventions and related treaties, in conjunction with space law and related treaties, regulate the means and methods of

¹⁴⁰ *Ibid.* at Article 5.

¹⁴¹ *Principles Relating to the Use of Nuclear Power Sources in Outer Space*, 14 December 1992, U.N. Doc. A/Res/47/68 [hereinafter *Principles Relating to the Use of Nuclear Power Sources in Outer Space*].

¹⁴² *Ibid.* at Principle 3.

¹⁴³ *Ibid.*

aerospace warfare delineating types of weapons that may lawfully be employed and the types of targets that may lawfully be engaged. The Geneva Conventions codify humanitarian considerations and seek to protect victims of armed conflict. While nuclear weapons and other weapons of mass destruction are prohibited in outer space, space may otherwise be used for non-aggressive military purposes.

CHAPTER II

Relevance of Military Interventions in Iraq and Yugoslavia (Bosnia; Kosovo)

Gulf lesson one is the value of air power ... [it] was right on target from day one ... Our air strikes were the most effective, yet humane, in the history of warfare.
--President George Bush (1991)¹⁴⁴

Recent military interventions have demonstrated the dominant if not decisive role of aerospace power in modern armed conflict. In the summer of 1990, Iraq possessed the world's fourth largest army and sixth largest air force. On 2 August 1990, Iraq invaded Kuwait and within hours seized control of the country. Fearful that Saudi Arabia may be next, the U.S. and its allies immediately began an intense military build-up in the area. Many military experts questioned whether air power alone could be dominant or decisive, believing it to be unreliable and ineffective. Opponents claimed air power would cause too many civilian casualties; that imprecise aerial weapons would decimate Iraq's cultural treasures; that advanced weapon systems and "smart" weapons would not function properly in the desert environment; and that stealth technology could be defeated.¹⁴⁵ Wary of the likelihood of high casualties posed by an early ground attack and convinced that modern aerospace weapon systems were in fact reliable and would be effective, coalition leaders opted to begin the liberation of Kuwait with a massive aerial assault against Iraq. Under UN authority, the air campaign began on 17 January 1991 and 38 days later, on 24 February 1991, the ground campaign began.¹⁴⁶ Aerospace power proved to be so effective that the ground war ended only 100 hours after it had begun. The world's fourth largest army and sixth largest air force fell after only 43 days, primarily due to the dominance of modern aerospace warfare. Subsequent conflicts in the former Yugoslavia would prove aerospace power to be not merely dominant but decisive.

¹⁴⁴ Former President of the United States. Quoted in United States, Department of Defense, *Final Report to Congress: Conduct of the Persian Gulf War* (Washington, D.C., April 1992) [hereinafter *Report to Congress: Persian Gulf War*].

¹⁴⁵ See R.P. Hallion, *Storm Over Iraq: Air Power and the Gulf War* (Washington, D.C.: Smithsonian Institution Press, 1992) [hereinafter *Storm Over Iraq*] at 140, 159.

¹⁴⁶ *United Nations Security Council Resolution 678*, 29 November 1990, U.N. Doc. S/Res/678, authorized the use of force to compel the Iraqi withdrawal from Kuwait if it had not begun to do so by 15 January 1991.

Opponents of aerospace power could not have been more wrong. Modern “smart” weapons had proven to be effective not only from a military standpoint but were essential in gaining public support for the war in the Persian Gulf. Modern aerospace weapon systems saved civilian lives rather than taking them and spared cultural treasures rather than destroying them. The modern aerospace weapon systems employed in these three conflicts affect not only the way modern wars are fought and the public perception of those wars, they also impact the law of aerospace warfare. In each of these conflicts, specific military objectives were chosen. An analysis of the weapon systems employed and targets chosen to achieve those objectives will be of great assistance in charting the law of aerospace warfare in the twenty-first century.¹⁴⁷

A. Iraq 1991¹⁴⁸

The overall military objectives for the war in the Persian Gulf (code-named “Operation Desert Storm”) were: (1) attack Iraqi political-military leadership and command and control (C2); (2) gain and maintain air superiority; (3) sever Iraqi supply lines; (4) destroy known nuclear, biological and chemical (NBC) production, storage, and delivery capabilities; (5) destroy Republican Guard¹⁴⁹ forces in the Kuwaiti theater of operations (KTO); and (6) liberate Kuwait City.¹⁵⁰ In support of the overall objectives,

¹⁴⁷ The purpose of the present chapter is to highlight the type of weapons and weapon systems used in recent conflicts rather than discuss their specific characteristics. Current and future aerospace weapons and weapon systems are discussed in detail in Chapters IV and V, below. For a detailed description of U.S. and other Coalition weapons and weapons systems used in the Persian Gulf, see A.E. Cohen et al., eds., *Gulf War Air Power Survey*, 5 vols. (Washington D.C.: U.S. Government Printing Office, 1993) [hereinafter *Air Power Survey*] vol. 5 at 39-127.

¹⁴⁸ For an in depth discussion on the air war in the Persian Gulf, see e.g. *ibid.*; *Report to Congress: Persian Gulf War*, *supra* note 144; United States, House of Representatives, *Interim Report of the Committee of Armed Services* (Washington, D.C.: March 1992); United States, Department of the Air Force, *Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf War* (Report) (Washington, D.C.: September 1991); United States, Department of the Air Force, *Airpower in Operation Desert Storm* (USAF Fact Sheet 91-03) (Washington, D.C.: 1991); United States, General Accounting Office, *Operation Desert Storm: Evaluation of the Air War* (Report to Congressional Requesters) (Washington, D.C.: July 1996); F. Frostic, *Air Campaign Against the Iraqi Army in the Kuwait Theatre of Operations* (Santa Monica, California: Rand, 1994); B.S. Lambeth, *The Winning of Air Supremacy in Operation Desert Storm* (Santa Monica, California: Rand, 1993) [hereinafter *The Winning of Air Supremacy*]; *Storm Over Iraq*, *supra* note 145.

¹⁴⁹ The republican guard consisted of highly trained elite elements of the Iraqi army extremely loyal to Saddam Hussein.

¹⁵⁰ See *Report to Congress: Persian Gulf War*, *supra* note 144 at 75.

the Coalition¹⁵¹ air campaign established five objectives of its own: (1) isolate and incapacitate the Iraqi regime; (2) gain and maintain air supremacy to permit unhindered air operations; (3) destroy Iraq's NBC warfare capability; (4) eliminate Iraq's offensive military capability by destroying major parts of key military production, infrastructure and power projection capabilities; and (5) render the Iraqi army and its mechanized equipment in Kuwait ineffective, causing its collapse.¹⁵² To accomplish these objectives, 12 target sets were established including: (1) leadership command facilities; (2) electricity production facilities; (3) telecommunications and command, control, and communication nodes; (4) the strategic integrated air defense system (IADS); (5) air forces and air fields; (6) NBC weapons research, production, and storage facilities; (7) scud missiles, launchers, and production and storage facilities; (8) naval forces and port facilities; (9) oil refining and distribution facilities; (10) railroads and bridges; (11) Iraqi army units; and (12) military storage and production sites.¹⁵³

The air campaign was divided into three phases: (1) strategic attack; (2) establishment of air superiority over the KTO; and (3) attack the Republican Guard and Iraq's army in Kuwait.¹⁵⁴ The first air mission began almost 12 hours prior to the scheduled start of the air campaign when seven B-52G Stratofortresses loaded with air-launched cruise missiles (ALCMs) departed Barksdale Air Force Base, Louisiana and headed for Iraq.¹⁵⁵ The B-52s would not see downtown Baghdad that day but the 35 global positioning system (GPS) satellite guided ALCMs they were carrying would. So revered was the Iraqi IADS around Baghdad that coalition air campaign planners excluded all weapons systems save for F-117 stealth fighter-bombers and cruise missiles from striking it.¹⁵⁶ AH-64 helicopters delivered the first blow of the conflict, attacking early warning radar sites in southern Iraq with Hellfire missiles.¹⁵⁷ The AH-64 missions were made possible, in part, because of space-based navigational systems such as the

¹⁵¹ The "Coalition" consisted of the U.S. and its allies along with several States from the Persian Gulf region.

¹⁵² See *Report to Congress: Persian Gulf War*, *supra* note 144 at 95.

¹⁵³ See *ibid.* at 95-99.

¹⁵⁴ See *e.g. ibid.*; *Storm Over Iraq*, *supra* note 145 at 150.

¹⁵⁵ See *Storm Over Iraq*, *ibid.* at 163.

¹⁵⁶ See *ibid.* at 169.

¹⁵⁷ See *e.g. Report to Congress: Persian Gulf War*, *supra* note 144 at 115; *The Winning of Air Supremacy*, *supra* note 148 at 2.

GPS satellites.¹⁵⁸ Moments later, an F-117A delivered the first strike against downtown Baghdad, dropping a 2,000 pound hardened, penetrating laser guided bomb (LGB) on a telecommunications facility.¹⁵⁹ Six minutes after that, the first of 54 Tomahawk land attack missiles (TLAMs) hit Baghdad with the 35 ALCMs arriving shortly thereafter and that was just the beginning. "Within hours, key parts of the Iraqi leadership, C2 network, strategic air defense system, and NBC capabilities were neutralized."¹⁶⁰ In the first night alone, 668 aircraft attacked Iraq conducting over 1,300 combat missions.¹⁶¹ When the conflict ended only 43 days after it had begun, coalition forces had flown in the neighborhood of 110,000 missions.¹⁶²

Stealth technology and precision guided munitions (PGMs) were the headline stories of the conflict. Stealth technology provided precision weapon delivery capability and combined with its near invisibility, this meant fewer aircraft and fewer weapons had to be deployed against heavily defended targets in densely populated areas, reducing civilian casualties and collateral damage. Infrared (IR), electro-optical, electromagnetic radiation and laser guided PGMs further reduced civilian casualties and collateral damage.

PGMs were first used by the U.S. in the Vietnam conflict but had been significantly improved by the time the war in the Persian Gulf erupted. Various types of PGMs were used in Desert Storm. "Smart" bombs were widely known and impressed television audiences world wide with their accuracy. In fact, the "[a]ccuracy of smart bombs was such that successful strikes were the norm, not the exception."¹⁶³ American forces expended approximately 19,800 PGMs during the conflict equating to 7,400 tons of munitions. Laser guided Paveway bombs represented the highest percentage of PGMs expended, accounting for about 47 percent of the total.¹⁶⁴ Other notable PGMs used included the laser or IR guided Maverick and laser guided Hellfire tank killer missiles; the high-speed anti-radiation missile (HARMS); the TLAM and ALCM cruise missiles;

¹⁵⁸ See *Report to Congress: Persian Gulf War*, *supra* note 144 at 115.

¹⁵⁹ See *e.g. ibid.*; *Storm Over Iraq*, *supra* note 145 at 169.

¹⁶⁰ *Report to Congress: Persian Gulf War*, *supra* note 144 at 89.

¹⁶¹ See *Storm Over Iraq*, *supra* note 145 at 166.

¹⁶² See *e.g. ibid.* at 188; *Report to Congress: Persian Gulf War*, *supra* note 144 at 142.

¹⁶³ *Storm Over Iraq*, *supra* note 145 at 188.

¹⁶⁴ See *ibid.*

and other miscellaneous PGMs such as the standoff land attack missile (SLAM).¹⁶⁵

While PGMs attracted the majority of the media attention, they accounted for only about nine percent of the total tonnage of munitions expended in the conflict.¹⁶⁶ The untold story of the gulf war was the accuracy of conventional or “dumb” bombs.

Conventional bombing precision had improved remarkably since World War II and even since the Vietnam conflict. The average “dumb” bomb miss distance, or “circular error probable” (CEP), in World War II was 3,300 feet. During the Vietnam conflict the CEP had been reduced to 400 feet and in Desert Storm the CEP was reduced further to 200 feet.¹⁶⁷ To destroy a 60 x 100 foot target in World War II, 3,024 aircraft delivering 9,070 bombs would be required. In Vietnam, the same task would require 44 aircraft and 176 bombs. In Iraq, however, the same job could be accomplished with only eight aircraft delivering 30 conventional bombs.¹⁶⁸ Thus, the risk of collateral damage from conventional bombing was 300 times less likely in Operation Desert Storm than in World War II and six times less likely than in Vietnam.

Munitions were not the only areas where technological advances had an impact. Along with stealth technology, there were major advances in aircraft avionics, flight controls, engine technology, maneuverability and agility.¹⁶⁹ The Low Altitude Navigation Targeting Infrared for Night (LANTIRN) system allowed airplane pilots to make low-altitude high-speed night attacks where such attacks were previously only possible during day-light hours.¹⁷⁰ The Pave Low III system made nighttime operations by helicopters possible as well.

Desert Storm has been referred to as the first “information war” and modern battlefield information systems proved indispensable.¹⁷¹ Using secure voice communications, tactical display information, a friend or foe identification radar, and GPS, the Boeing E-3B Sentry Airborne Warning and Control System (AWACS)

¹⁶⁵ The Maverick accounted for 28% of all PGMs used, the Hellfire 14%, the HARMS 9%, the TLAMS and ALCMS 1.5% and the other miscellaneous PGMs 1%. See *ibid.*

¹⁶⁶ See *ibid.*

¹⁶⁷ See *ibid.* at 283.

¹⁶⁸ See *ibid.* at 282.

¹⁶⁹ See *ibid.* at 275-294.

¹⁷⁰ See *ibid.* at 314.

¹⁷¹ See *The Winning of Air Supremacy*, *supra* note 148 at 5.

provided timely information and warnings to airborne fighters and strike aircraft.¹⁷² The still experimental E-8A Joint Strategic Target and Attack Radar System (JSTARS) was able to locate and track ground moving targets and relay the information to air and ground commanders providing real-time ground surveillance and attack management.¹⁷³ Using a fixed side-looking airborne radar (SLAR), “[c]ontrollers in the JSTARS could data-link targeting information to tactical airplanes, missiles, and ground stations, and direct strikes on targets by airplanes, cruise missiles, tactical missiles such as the ATACMS [army tactical missile system], and battlefield rocketry and artillery.”¹⁷⁴ AWACS assisted in controlling the war in the air while JSTARS helped direct the war on the ground. U-2R, TR-1 and RC-135 Rivet Joint aircraft provided reconnaissance and UAVs were used to obtain battlefield intelligence and targeting information.¹⁷⁵ E-2C aircraft provided airborne early warning (AEW) and C2 assets.¹⁷⁶

Space-based assets were used extensively in combat for the first time in the Persian Gulf.¹⁷⁷ The U.S. utilized seven imaging satellites providing hundreds of images daily.¹⁷⁸ The French *Système Probatoire d’Observation de la Terre* (SPOT) and U.S. Land Satellite (LANDSAT) civilian remote sensing systems were used to update maps for operational forces.¹⁷⁹ Fifteen to 20 U.S. signals intelligence satellites intercepted Iraqi radio communications while the U.S. Defense Satellite Communications System (DSCS) provided secure communications for the Coalition.¹⁸⁰ The U.S. Defense Meteorological Support Program (DMSP) and its satellites provided high resolution near real-time weather information.¹⁸¹ Early warning of Scud launches was provided by the U.S. Defense Support Program (DSP) satellite constellation.¹⁸² Finally, Coalition forces had at their disposal 16 Navstar GPS satellites for navigation and munitions guidance.¹⁸³

¹⁷² See e.g. *ibid.* at 309; *Report to Congress: Persian Gulf War*, *supra* note 144.

¹⁷³ See e.g. *ibid.*; *Storm Over Iraq*, *supra* note 145 at 311.

¹⁷⁴ *Ibid.*

¹⁷⁵ See e.g. *ibid.*; *Report to Congress: Persian Gulf War*, *supra* note 144.

¹⁷⁶ See *Report to Congress: Persian Gulf War*, *ibid.*

¹⁷⁷ See *ibid.*

¹⁷⁸ See “Space Law and the Military Applications of Space Technology,” *supra* note 122.

¹⁷⁹ See *ibid.*

¹⁸⁰ See e.g. *ibid.*; *Report to Congress: Persian Gulf War*, *supra* note 144 at 176.

¹⁸¹ See *Storm Over Iraq*, *supra* note 145 at 314.

¹⁸² See *ibid.*

¹⁸³ See e.g. *ibid.* at 313-314; “Space Law and the Military Applications of Space Technology,” *supra* note 122.

Working in concert, the aforementioned aerospace assets proved extremely effective against the majority of the Coalition's 12 enumerated target sets. Leadership command facilities were bombed regularly, disrupting communication with troops in the field; Iraqi power and communications systems were severely damaged; and Iraq's IADS and air force were neutralized early in the conflict.¹⁸⁴ Furthermore, damage to known NBC facilities, naval forces, port facilities, oil refining and oil production facilities were extensive. Approximately three fourths of the bridges between central Iraq and the Kuwaiti theater of operations were severely damaged or destroyed.¹⁸⁵ The effect of continuous bombing on the Iraqi army was obvious as they surrendered by the thousands once the ground war began.¹⁸⁶ At least 30 percent of Iraq's conventional weapons production capability was destroyed and supply depots were attacked regularly throughout the war.

While the air campaign met its objectives and was highly successful against 11 of the 12 target sets, mobile Scud launchers and their missiles proved to be the exception. Although attacks on the Scud infrastructure were successful, the mobile Scud launchers were very elusive and the Coalition had difficulty locating them. Moreover, the Coalition lacked viable weapon systems to engage the missiles once launched.¹⁸⁷ The Patriot surface to air missile was capable, in a limited sense, of intercepting and destroying incoming ballistic missiles. However, the Patriot was designed as an anti-aircraft missile and cannot be considered reliable against ballistic missiles.¹⁸⁸ Iraq's willingness to violate the law of armed conflict and fire the unreliable Scuds toward heavily populated areas sparked a call in the U.S. congress for the testing and deployment of both ground-based and space-based anti-ballistic missile (ABM) systems.¹⁸⁹ The post-war discovery of a much more extensive Iraqi nuclear weapons program than originally believed and the confirmation of the existence of chemical warheads for Scud missiles served to increase the Congress's resolve.¹⁹⁰

¹⁸⁴ See *Report to Congress: Persian Gulf War*, *supra* note 144 at 149-161.

¹⁸⁵ See *ibid.* at 158.

¹⁸⁶ See *Storm Over Iraq*, *supra* note 145 at 231-240.

¹⁸⁷ See *e.g. ibid.* at 179; *Report to Congress: Persian Gulf War*, *supra* note 144 at 169.

¹⁸⁸ See *Storm Over Iraq*, *supra* note 145 at 300-302.

¹⁸⁹ See *e.g. ibid.* at 177-188; "Space Law and the Military Applications of Space Technology," *supra* note 122.

¹⁹⁰ Specific ABM systems and the legality thereof are discussed in Chapter IV, Part F, below.

Some charge that like Iraq, the Coalition did not act within the law of armed conflict, citing extensive damage to Iraq's infrastructure, the use of certain types of weapons such as cluster bombs,¹⁹¹ and the attack on retreating Iraqi troops near the end of the war.¹⁹² Others maintain that the Coalition did follow the law governing armed conflict, citing adherence to the basic principles of proportionality and discrimination.¹⁹³ The Coalition was well aware of its obligations under the law. According to the U.S. Department of Defense (DoD), "[f]rom the beginning, Coalition objectives made a clear distinction between the regime and the Iraqi populace – the regime and its military capabilities were the target; the Iraqi people were not."¹⁹⁴ Minimizing civilian casualties and collateral damage was part of Coalition targeting policy.¹⁹⁵ To avoid civilian casualties, only PGMs were used to destroy targets in downtown Baghdad.¹⁹⁶ Attacks on known dual (military and civilian) facilities were scheduled at night when fewer people would be present. A "joint no-fire target list" was produced placing cultural property such as mosques, religious shrines and archeological sites off limits. A six-mile radius around each target was analyzed for the presence of schools, hospitals and mosques to identify targets where extreme care was required. If the probability of collateral damage was calculated as too high, the target was not attacked.¹⁹⁷ "The weapon system, munition, time of attack, direction of attack, desired impact point, and level of effort all were carefully planned" to avoid civilian casualties and collateral damage.¹⁹⁸

As is the case in any armed conflict, civilian casualties and collateral damage occurred despite the best efforts of the Coalition. The law of armed conflict recognizes that such casualties and damage are an inevitable part of war and does not completely

¹⁹¹ For a list of cluster bombs used, see *Air Power Survey*, *supra* note 147 at 72-74.

¹⁹² See e.g. R. Clark & Others, *War Crimes: A Report on United States War Crimes Against Iraq* (Washington, D.C.: Mainsonneuve Press, 1992) [hereinafter *A Report on United States War Crimes Against Iraq*]; G.A. Lopez, "The Gulf War: Not So Clean" *Bulletin of the Atomic Scientists* 47:7 (September 1991) 30 [hereinafter "The Gulf War: Not So Clean"]; P.F. Walker, "...And the Dirty Little Weapons" *Bulletin of the Atomic Scientists* 47:4 (May 1991) 21 [hereinafter "...And the Dirty Little Weapons"].

¹⁹³ See N.G. Fotion, "The Gulf War: Cleanly Fought" *Bulletin of the Atomic Scientists* 47:7 (September 1991) 24.

¹⁹⁴ *Report to Congress: Persian Gulf War*, *supra* note 144 at 177.

¹⁹⁵ See *ibid.* at 99.

¹⁹⁶ See *ibid.*

¹⁹⁷ See *ibid.* at 100.

¹⁹⁸ See *ibid.*

prohibit them, rather, the law requires both parties use best efforts to avoid them.¹⁹⁹ The Coalition did so whereas Iraq reportedly chose to use civilians and cultural property as shields while indiscriminately launching inaccurate Scud missiles at densely populated civilian areas, clear violations of the law.²⁰⁰ Targeting dual use facilities such as roads, bridges and electricity production facilities does not violate the law of armed conflict so long as the restrictions of customary international law are observed. When dual use facilities were targeted by the Coalition, attempts were made to minimize the civilian impact. For example, when possible, switching systems of electricity producing facilities were targeted as opposed to generator halls as the former are easier to repair.²⁰¹ Moreover, as noted above, attacks on dual use facilities were scheduled at night. No unlawful weapons were used by the Coalition during the conflict and attacking a retreating army with the potential to regroup to fight again is certainly not unlawful, although attacking a surrendering army would be. Through proper planning, target selection and weapon selection, coalition forces operated within the law of aerospace warfare. The technological revolution described above made the task all the easier and the successful use of PGMs in the Persian Gulf set the parameters for future conflicts.

B. Yugoslavia (Bosnia; Kosovo)

1. Bosnia 1995²⁰²

The violent breakup of Yugoslavia in 1991–1992, and the atrocities that accompanied it, led to the creation of a UN Protection Force in the area in January 1992.²⁰³ “Safe areas” and “heavy weapons exclusion zones” were soon established in an effort to protect refugees and other civilians from the warring factions. The Bosnian

¹⁹⁹ See Chapter I, Parts B1a, B2a(2), above.

²⁰⁰ See *Report to Congress: Persian Gulf War*, *supra* note 144 at 611–617. For a detailed discussion on the legality of the war from the U.S. DoD point of view, see *ibid*.

²⁰¹ See *ibid*.

²⁰² For an in depth analysis on the air campaign in Bosnia, see R.C. Owen, ed., *Deliberate Force – A Case Study in Effective Air Campaigning: Final Report of the Air University Balkans Air Campaign Study* (Maxwell AFB, AL: Air University Press, 2000). For a condensed version of the foregoing, see R.C. Owen “The Balkans Air Campaign Study: Part 1” (1997) 11:2 *Airpower J.* 4 [hereinafter “Air Campaign Study: Part 1”]; R.C. Owen “The Balkans Air Campaign Study: Part 2” (1997) 11:3 *Airpower J.* 6 [hereinafter “Air Campaign Study: Part 2”].

²⁰³ Various atrocities were committed by all warring factions including massacres of civilians and captured soldiers, mass robbery and rape, and scorched-earth conquests. A new international term was coined

Serbs emerged from the breakup as the dominant military power. In June 1992, the UN Security Council resolved to provide peacekeeping forces in the area.²⁰⁴ The North Atlantic Treaty Organization (NATO) became involved about the same time as NATO aircraft were flying in support of previously imposed arms embargoes and economic sanctions against the former Yugoslavia. In October 1992, cooperative efforts between the UN and NATO began when the UN Security Council banned all military flight operations over Bosnia and NATO aircraft operated to observe and report violations of the ban.²⁰⁵ In the months that followed, NATO observed hundreds of no-fly violations, particularly by Bosnian Serb combat aircraft. As a result, on 31 March 1993, the UN Security Council banned all flights not specifically authorized by the UN.²⁰⁶ To enforce the ban, NATO simultaneously initiated "Operation Deny Flight." Additional air missions were soon added to the operation including close air support (CAS) missions to protect UN forces under attack; offensive air support (OAS) missions designed to punish factions violating UN Security Council Resolutions; and suppression of enemy air defenses (SEAD) missions to protect NATO aircraft flying CAS and OAS.

Warring factions in the former Yugoslavia continued to disregard UN resolutions and to attack UN and NATO forces. After attacks on several eastern Bosnian safe areas in the summer of 1995 by Bosnian Serbs, NATO threatened air strikes if any of the remaining safe areas were attacked. When the Bosnian Serb Army (BSA) shelled a Sarajevo market place on 28 August 1995, killing 37 civilians and injuring 85 others, NATO, acting under UN authority, responded with 12 days of air strikes on Serb targets between 29 August and 14 September 1995.²⁰⁷ On 14 September 1995, the Bosnian Serb Republic accepted the UN's terms and the bombing ceased. A sustained and robust air campaign accomplished in 16 days what international diplomacy, UN peacekeepers and limited air strikes had unsuccessfully attempted to accomplish over the previous three and one half years. The air campaign, dubbed "Operation Deliberate Force," was

encompassing all of these acts: "ethnic cleansing." "The Balkans Air Campaign Study: Part 1," *supra* note 202 at 7.

²⁰⁴ See *ibid.* at 8.

²⁰⁵ See e.g. *ibid.*; *United Nations Security Council Resolution 781*, 9 October 1992, U.N. Doc. S/Res/781.

²⁰⁶ *United Nations Security Council Resolution 816*, 31 March 1993, U.N. Doc. S/Res/826.

²⁰⁷ See e.g. J.A. Tirpak, "Deliberate Force" *Air Force Magazine* 80:10 (October 1997); "Air Campaign Study: Part 2," *supra* note 202 at 6, 8.

instrumental in arriving at a subsequent peace agreement in the region.

The objectives of Operation Deliberate Force were vastly different from those of Operation Desert Storm. The stated objectives were to protect UN established safe areas and UN peacekeepers.²⁰⁸ According to General Michael E. Ryan, the commander of NATO Southern Air Forces at the time who oversaw Operation Deliberate Force, “[w]e were not at war with any faction ... so it was not an attack that was meant to take away or destroy their [Bosnian Serb] army. It was an attack to take away the military capability they had ... that made them dominant.”²⁰⁹ The reasoning was that once the Bosnian Serbs realized that they were losing their edge against their enemies, they would comply with UN mandates fearing their enemies would move to take advantage of the disruption of Serbian forces.²¹⁰ Thus, while the primary objectives were the protection of UN safe areas and peacekeepers, and NATO was not technically at war with any faction, the air campaign focused on the Bosnian Serbs as they were the dominant military power in the region. As the objectives differed from those in Iraq, so would the means of achieving those objectives.

Rather than an all-out and relentless aerial attack as was the case in Iraq, NATO’s intentions were to build a campaign of air attacks using “substantial and decisive air power” designed to get the Serbs’ attention and compel them to stop the attacks on safe areas.²¹¹ Thus, air strikes occurred on only 12 of the 16 days of the operation and the total number of sorties flown (3,515) over the entire course of the operation equaled only one day’s air operations in Iraq. A break in the bombing occurred to facilitate peace negotiations. The 3,515 sorties were flown by nine different nations²¹² delivering a total of 1,026 weapons against 48 different target complexes including 338 desired mean points of impact (DMPI) (individual aim points).²¹³ Targets included IADS sites, heavy weapons (artillery, tanks), ammunition dumps, vehicle parks, command-and-control centers, dedicated military support facilities, and lines of communication. Some bridges

²⁰⁸ See *ibid.* at 14, 19.

²⁰⁹ Quoted in Tirpak, *supra* note 207.

²¹⁰ See *ibid.*

²¹¹ *Ibid.*

²¹² France, Germany, Great Britain, Greece, Italy, Netherlands, Spain, Turkey and the U.S. See “Air Campaign Study: Part 2,” *supra* note 202 at 8.

²¹³ See *ibid.*

and roads would be targeted as well but according to General Ryan “[w]e minimized that because we didn’t want to do any more damage to this poor nation that had been beat up so long.”²¹⁴ Moreover, bridges and roads were struck at night to avoid casualties. Due to the nature of the operation’s objectives, civilian casualties, collateral damage and even BSA casualties were unacceptable to NATO.²¹⁵ As a result, General Ryan personally approved the selection of every DMPI in every target complex as well as every weapon to be used against the DMPIs.²¹⁶

Deliberate Force by far surpassed Desert Storm in percentage of PGMs expended. While only nine percent of the total tonnage of munitions expended in the Persian Gulf consisted of PGMs, approximately 70 percent of the munitions used in Bosnia were PGMs. Of the 1,026 total munitions expended, 708 were PGMs.²¹⁷ Largely the same mix of IR, electro-optical, electromagnetic radiation and laser guided munitions were delivered as in Desert Storm, including laser guided bombs; Maverick missiles; HARMs; SLAMs; and TLAMs. AWACS aircraft once again assisted in controlling the air war while Predator and Gnat UAVs provided reconnaissance support.

Operation Deliberate Force clearly demonstrated that PGMs were becoming the weapon of choice. Most of the countries involved in the operation used PGMs and those that did not have them were assigned targets where the risk of collateral damage was low.²¹⁸ General Ryan is even reported as having said “dumb bombs are dead.”²¹⁹ While unguided weapons (dumb bombs) are not yet dead, they are quickly “becoming unnecessarily risky to use,” particularly in cases where “time and tolerance for unwanted effects are in short supply.”²²⁰ Even where time and tolerance for unwanted effects do not require their use, the law of aerospace warfare is likely to.

²¹⁴ Quoted in Tirpak, *supra* note 207.

²¹⁵ See “Air Campaign Study: Part 2,” *supra* note 202 at 9.

²¹⁶ See *ibid.*

²¹⁷ See *ibid.* at 12.

²¹⁸ See Tirpak, *supra* note 207.

²¹⁹ Quoted in “Air Campaign Study: Part 2,” *supra* note 202 at 12.

²²⁰ *Ibid.*

2. Kosovo 1999²²¹

Unfortunately, Operation Deliberate Force was not the end of NATO military intervention in the former Yugoslavia. Since the early 1980s, Kosovar Albanians had sought independence or a large degree of autonomy within Yugoslavia.²²² In response, Yugoslav authorities systematically began to strip away any autonomy that Kosovo enjoyed, removing Kosovar Albanians from virtually all positions of authority within Kosovo. Albanians reacted by building a parallel governmental system, boycotting all institutions of the Yugoslav State and in increasing numbers, resorting to armed resistance (the "Kosovo Liberation Army"). Serbian police unsuccessfully tried to break up the parallel state during the 1992-1995 Bosnian war. In February 1998, following years of building tensions between ethnic Serbians and ethnic Albanians, things turned violent when Serbian special police reportedly killed more than 20 ethnic Albanians initiating a series of ethnic cleansing. It is estimated that Serbian special police and military forces killed more than 200 ethnic Albanians between February and June 1998.²²³ In October 1998, under pressure of NATO military action, Yugoslavia agreed to reduce its forces in the area and begin negotiations towards an autonomous regime for Kosovo. However, the negotiations broke down and on 19 March 1999, "Serb forces launched a major offensive and began driving thousand of ethnic Albanians out of their homes and villages, summarily executing some while displacing many others and setting fire to many houses."²²⁴ On 21 March 1999, a final diplomatic effort to resolve the situation failed and on 24 March, without express UN Security Council authorization, NATO launched an air campaign against the Federal Republic of Yugoslavia aimed at ensuring full compliance with UN Security Council Resolution 1199 requiring, among

²²¹ For an in depth analysis of the Kosovo air campaign, see e.g. United States, Department of Defense, *Report to Congress: Kosovo/Operation Allied Force After Action Report* (Washington, D.C., 31 January 2000) [hereinafter *Kosovo After Action Report*]; United States, Department of Defense, *Joint Statement on the Kosovo Action After Review* (Washington, D.C., 14 October 1999); U.K., Ministry of Defence, *Kosovo: An Account After the Crisis*, by Lord Robertson of Port Ellen (London: Her Majesty's Stationary Office, 1999).

²²² See "Kosovo Background" online: Federation of American Scientists <http://www.fas.org/man/dod-101/ops/kosovo_back.htm> (date accessed: 31 March 2000).

²²³ See *ibid.*

²²⁴ *Ibid.* Some claim that the massive expulsion and ethnic cleansing did not begin until after the NATO air campaign started. See T.G. Carpenter, ed., *NATO's Empty Victory: A Postmortem on the Balkan War* (Washington, D.C.: Cato Institute, 2000).

other things, an immediate cease to all hostilities.²²⁵ The air strikes would continue until 3 June 1999, when Yugoslavia accepted the UN's terms. Under UN authorization, NATO ground forces deployed into Kosovo on 10 June 1999.

The objectives of the air campaign, designated "Operation Allied Force," were to: (1) demonstrate the seriousness of NATO's opposition to Belgrade's aggression in the Balkans, (2) deter the Belgrade government from continuing and escalating its attacks on civilians and create conditions to reverse its ethnic cleansing, and (3) damage Yugoslavia's capacity to wage war against Kosovo in the future or spread the war to neighbors by diminishing or degrading its ability to wage military operations.²²⁶ Over 78 days, 57 of which included actual bombing, NATO flew 38,000 combat sorties including over 23,300 strike missions. Once again, this was not a massive aerial assault like that in Iraq. "Constrained by the directive that collateral damage was to be avoided as far as possible, the concept of operations envisioned targeting based on a phasewise gradual, situation-adjusted application of NATO air forces, depending upon political and military developments."²²⁷ Initially, purely military targets were attacked including command and control facilities and the IADS. As Yugoslavia continued to refuse to capitulate after 30 days of air strikes, NATO intensified the campaign on 23 April 1999, adding military-industrial infrastructure, media responsible for propaganda, and other strategic targets to the target list.²²⁸ Over the course of the air campaign strikes were directed at approximately 7,600 fixed target DMPIs and just over 3,400 at "flex" or mobile

²²⁵ SC Res. 1199, UN SCOR, 53d Sess., U.N. Doc. S/Res/1199 (1998) [hereinafter SC Res. 1199]. While Resolution 1199 called for an immediate cease to all hostilities, it did not explicitly authorize NATO to use force to compel compliance with its terms nor did any other UN Security Council resolution. The U.S. and NATO maintain that such authorization was implicit in Security Council Resolutions 1160, 1199 and 1203 and that they legally intervened under the auspices of "humanitarian intervention." See A. Schwabach, "The Legality of the NATO Bombing Operation in the Federal Republic of Yugoslavia" (1999) 11 Pace Int'l L. Rev. 405 [hereinafter "Legality of the NATO Bombing"] at 407. SC Res. 1160, UN SCOR, 53d Sess., U.N. Doc. S/Res/1160 (1998) [hereinafter SC Res. 1160]; SC Res. 1203, UN SCOR, 53d Sess., U.N. Doc. S/Res/1203 (1998). For a more detailed discussion on the doctrine of humanitarian intervention, including the Kosovo intervention, see Chapter III, below.

²²⁶ See e.g. *Kosovo After Action Report*, *supra* note 221 at 7; United States, Department of Defense, *Introduction in Report to Congress: Kosovo/Operation Allied Force After Action Report* (Washington, D.C., 31 January 2000) [hereinafter *Kosovo After Action Report Introduction*] at 17.

²²⁷ "Operation Allied Force" online: Federation of American Scientists <http://www.fas.org/man/dod-101/ops/allied_force.htm> (last updated: 8 February 2000).

²²⁸ See *Kosovo After Action Report Introduction*, *supra* note 226 at 17.

targets.²²⁹ When Operation Allied Force ended, fixed targets destroyed or significantly damaged included: 11 railroad bridges; 24 highway bridges; 29 percent of all Serbian ammunition storage; 57 percent of petroleum reserves; all Yugoslav oil refineries; 14 command posts; over 100 aircraft; and 10 military airfields. NATO also attacked flex targets such as tanks, armored personnel carriers, artillery, mortars and military vehicles.

According to the U.S. DoD, "Allied Force was the most precise military operation ever conducted. No military operation of such size has ever inflicted less damage on unintended targets."²³⁰ The latest generation PGMs made it possible. Where nine percent of all munitions expended in Iraq were PGMs and PGMs accounted for 70 percent of those used in Bosnia, 90 percent of the weapons delivered in Operation Allied Force were PGMs.²³¹ The majority of the PGMs expended were the same as those used in Operations Desert Storm and Deliberate Force, with LGBs accounting for the largest percentage. However, GPS guided munitions were used much more extensively in Operation Allied force and new weapons and weapon systems were used for the first time. Unlike other PGMs, GPS guided munitions are not affected by weather and can be deployed above cloud cover. This was significant in Operation Allied Force as poor weather was often a factor in the Balkans. The U.S. Air Force used for the first time in combat their B-2 stealth bombers to deliver GPS guided munitions. The B-2s were equipped with the new GPS guided Joint Direct Attack Munitions (JDAM). Over the course of the Operation, 45 B-2 sorties delivered 656 JDAMs.²³² UAVs were used extensively in combat for the first time as well.²³³ While not used for the first time, combined effects munitions (CEM), which contain 150-200 soda-can sized bomblets and are used to attack "soft" targets, were expended as well.²³⁴ It has also been reported that new secret munitions dispensers filled with fine hair-like strings of electrically conductive material were dropped from F-117s on outdoor electrical grids.²³⁵ The result

²²⁹ See *Kosovo After Action Report*, *supra* note 221 at 87.

²³⁰ *Kosovo After Action Report Introduction*, *supra* note 226 at 13.

²³¹ See *Kosovo After Action Report*, *supra* note 221 at 89.

²³² See *ibid.* at 97.

²³³ See *Kosovo After Action Report Introduction*, *supra* note 226 at 22.

²³⁴ See *Kosovo After Action Report*, *supra* note 221 at 90.

²³⁵ See e.g. D.A. Fulghum, "Russians Analyze U.S. Blackout Bomb" *Aviation Week and Space Technology* 152:7 (14 February 2000) 59 [hereinafter "Russians Analyze U.S. Blackout Bomb"]; D.A. Fulghum, "Electronic Bombs Darken Belgrade" *Aviation Week & Space Technology* 150:19 (10 May 1999) 34 [hereinafter "Electronic Bombs Darken Belgrade"].

was electrical shorts tripping circuit breakers and shutting down electrical power without destroying the grids or causing any collateral damage. The use of such a device indicates that non-lethal weapons are being researched and developed.

Existing and new generation PGMs proved to be highly successful with little or no resulting collateral damage. After the bombing ended, an assessment team visited 38 fixed target sites. Of the 38, only one area had sustained any significant collateral damage. "At the other 37 sites, collateral damage was limited to broken windows, blown off roof tiles, and detached ceiling tiles."²³⁶ Of course, mistakes were made such as the bombing of the Chinese Embassy and the inadvertent attack on a civilian passenger train. A Human Rights Watch Report²³⁷ claims that there were 500 civilian casualties in 90 different incidents, more than three times higher than Pentagon figures but far less than the 1,200-5,000 deaths claimed by the Yugoslav government.²³⁸ The report also alleges "that NATO should have put restrictions on daylight urban attacks (when civilians were in the streets), prohibited the use of cluster bombs, exercised greater care in attacking mobile targets and been more meticulous in identifying military targets to reduce the number of civilian casualties."²³⁹ While any number of civilian casualties is regrettable, these numbers pale in comparison to World War II where 1,315-2,630 civilians were killed each day as a result of aerial bombing.²⁴⁰ Assuming the Human Rights Watch figures are correct, an average of 6.4 civilians were killed daily in Operation Allied Force. Thus, the rate of civilian casualties in World War II was 205-410 times greater than in Operation Allied Force. Granted, aerial bombing in World War II took place on a much larger scale. However, the statistics illustrate that the use of PGMs has directly contributed to a significant reduction in the rate of civilian casualties over the last 60

²³⁶ *Kosovo After Action Report*, *supra* note 221 at 84.

²³⁷ "Civilian Deaths in the NATO Air Campaign" *Human Rights Watch* 12:1 (February 2000) 1 [hereinafter "Civilian Deaths in the NATO Air Campaign"].

²³⁸ See D.A. Fulghum, "Rights Groups Claim Many Bombs Strayed" *Aviation Week and Space Technology* 152:6 (7 February 2000) 36 [hereinafter "Rights Groups Claim Many Bombs Strayed"]. Others claim civilian casualties were as high as 1,200-2,000. See C. Layne "Collateral Damage in Yugoslavia," in T.G. Carpenter, ed., *NATO's Empty Victory: A Postmortem on the Balkan War* (Washington, D.C.: Cato Institute, 2000) at 54.

²³⁹ "Rights Groups Claim Many Bombs Strayed," *supra* note 238.

²⁴⁰ Estimates on the total number of civilians who lost their lives to aerial bombardment during World War II vary greatly. However, estimates indicate that somewhere between one and two million civilians were killed between 1 January 1943 and 31 January 1945. See "Air War and the Law of War," *supra* note 53 at 1, n. 1. That equates to 1,315-2,630 civilian casualties per day.

years. The type of civilian casualties experienced in World War II would not be tolerated in modern warfare, either politically or legally.

C. Chapter II Summary

Recent military interventions in Iraq and Yugoslavia clearly demonstrate that aerospace information systems, space-based systems and most significantly, precision guided munitions will be used extensively if not exclusively by the major world powers in twenty-first century warfare. In less than a decade, the percentage of PGMs used in recent conflicts increased ten fold, from nine percent in Operation Desert Storm to 90 percent in Operation Allied Force. During the same period, new military information systems, military space systems and PGM systems have been developed and employed in combat. According to the U.S. DoD “[t]he success of these munitions [PGMs] strongly suggests that they will be employed at very high rates in future conflicts.”²⁴¹ While these systems certainly offer military advantages, one of the primary reasons for their development and use in combat is the reduction of civilian casualties and collateral damage. The technological advances in these areas could have a profound impact on the law of aerospace warfare. Adversaries in armed conflicts in the twenty-first century are likely to be legally bound to use PGMs against otherwise lawful targets located in densely populated areas, provided they possess the means to do so. State practice over the last decade has been to use PGMs against such targets when possible. Thus, if the use of PGMs is not already required under existing customary international law by the principle of discrimination, it can be safely argued that States are in the early stages of establishing a new rule of customary international law requiring their use in such circumstances. That is not to say that the use of conventional weapons will be completely prohibited against targets located in densely populated areas. Rather, any conventional weapon used would have to be as or more accurate than available PGMs. No longer will the type of bombing in or near heavily populated areas like that seen during World War II or even in the Vietnam conflict be legally permissible. As the accuracy of weapon systems continues to advance, the law of aerospace warfare will allow ever fewer civilian casualties and less and less collateral damage.

²⁴¹ *Kosovo After Action Report Introduction*, *supra* note 226 at 23.

CHAPTER III

Humanitarian Intervention

The centuries-old doctrine of absolute and exclusive sovereignty no longer stands, and was in fact never so absolute as it was conceived to be in theory. A major intellectual requirement of our time is to rethink the question of sovereignty.
--Boutros Boutros-Ghali (1992)²⁴²

When NATO began bombing the Federal Republic of Yugoslavia on 24 March 1999, it did so without the express authorization of the UN Security Council.²⁴³ Since the promulgation of the UN Charter in 1945, numerous military actions have been taken without Security Council approval. While humanitarian concerns were not always at the heart of these actions, States employing force without UN authorization generally asserted that their actions fell within the framework of the UN Charter, usually claiming some form of self-defense.²⁴⁴ NATO's military action, however, was one of the few instances where humanitarian concerns were enunciated as the primary justification for using force. NATO's action invigorated the already existing debates regarding the legality of "humanitarian intervention" in international law. Though various definitions exist, humanitarian intervention is essentially the threat or use of force by "one or more outside states into the affairs of another state that has as its purpose (or at least one of its principal purposes) the relieving of grave human suffering."²⁴⁵ Many observers maintain that under current international law there is no right to forcibly intervene in the affairs of

²⁴² The former Secretary General of the UN. Quoted in S.A. Garrett, *Doing Good and Doing Well: An Examination of Humanitarian Intervention* (Westport, Connecticut: Praeger, 1999) [hereinafter *Doing Good and Doing Well*] at 55.

²⁴³ The U.S. and NATO maintain that such authorization was implicit in Security Council Resolutions 1160, 1199 and 1203. See "Legality of the NATO Bombing," *supra* note 225 at 407.

²⁴⁴ "[I]n the three most famous examples of putative humanitarian intervention in the post-1945 period—East Pakistan in 1971 and Cambodia and Uganda in 1979—none of the intervenors actually defended their actions primarily in terms of a doctrine of humanitarian intervention, although India and Tanzania made a few nods in this direction." *Doing Good and Doing Well*, *supra* note 242 at 59.

²⁴⁵ *Ibid.* at 3. For a discussion on different definitions of "humanitarian intervention," see Abiew, *The Evolution of the Doctrine and Practice of Humanitarian Intervention* (The Hague: Kluwer Law International, 1999) at 18, 31-32.

a sovereign State for humanitarian reasons.²⁴⁶ Others assert that when a State commits cruelties against its own nationals in such a way as to deny them the fundamental human rights and to “shock the conscience of mankind,” armed intervention in the interest of humanity is legally permissible.²⁴⁷ “The dilemma posed by intervention for human rights purposes rests on competing claims of state sovereignty and humanitarian assistance.”²⁴⁸ States, either individually or collectively, and the United Nations have increasingly manifested their willingness to intervene in a sovereign State’s internal affairs for humanitarian purposes. The number of so-called “humanitarian interventions” has increased profoundly over the last 10 years. “Counting UN interventions alone there have been more since 1990 than in all the previous 45 years combined.”²⁴⁹ When the decision to intervene for humanitarian purposes is made, aerospace assets are increasingly the important means chosen to accomplish the task and the nature of these interventions could have an impact on the law of aerospace warfare in the twenty-first century.

A. The Legal Status of the Concept

Current international law, including the law of armed conflict, evolved as law between nation-states. At the heart of the nation-state system lies the concept of State sovereignty. While various definitions of sovereignty exist and distinctions have been

²⁴⁶ There is a strong position held by many “international legal scholars that humanitarian intervention has no foundation in the law of nations and, indeed, that such action is specifically proscribed by international legal norms ... [they emphasize] the absence of any general international convention allowing such intervention. Moreover, these scholars are quite unpersuaded that a customary right of humanitarian intervention has been or ever was established.” *Doing Good and Doing Well*, *supra* note 242 at 43.

²⁴⁷ This thesis analyzes the concept of humanitarian intervention as it exists under current international law, including the UN Charter. However, the concept of humanitarian intervention is nothing new. Many have asserted that prior to the adoption of the UN Charter, humanitarian intervention had long been accepted as customary international law. According to Lassa Oppenheim “[t]here is a general agreement that, by virtue of its personal and territorial supremacy, a State can treat its own nationals according to discretion. But there is a substantial body of opinion and practice in support of the view that there are limits to that discretion; when a State renders itself guilty of cruelties against and persecution of its nationals in such a way as to deny their fundamental rights and to shock the conscience of mankind, intervention in the interests of humanity is legally permissible.” *Doing Good and Doing Well*, *supra* note 242 at 42, citing L. Oppenheim, *International Law, A Treatise*, 7th ed. by H. Lauterpacht (London: Longmans, Green, 1948) at 279-280. For a discussion on humanitarian intervention prior to the adoption of the UN Charter, see e.g. Abiew, *supra* note 245 at 23-59; F.R. Teson, *Humanitarian Intervention: An Inquiry into Law and Morality*, 2d ed. (Irvington-on-Hudson, New York: Transnational, 1997) at 177-179.

²⁴⁸ Abiew, *supra* note 245 at 16.

²⁴⁹ H.A. Chayes & A. Chayes, *Planning for Intervention: International Cooperation in Conflict Management* (The Hague: Kluwer Law International, 1999) [hereinafter *Planning for Intervention*] at 9.

made between internal, external, legal and political, shared or exclusive sovereignty, a precise meaning has not been authoritatively defined.²⁵⁰ Essentially, State sovereignty connotes final and absolute authority of the State within its territory.²⁵¹ Thus, under an absolute theory of State sovereignty, human rights are a matter of domestic, not international concern.²⁵² The UN Charter recognizes and embraces the concept of State sovereignty. Article 2(1) of the Charter provides that the UN “is based on the principle of the sovereign equality of all its members.”²⁵³

“The complementary principle of State sovereignty in international law is non-intervention.”²⁵⁴ Like sovereignty, the term “intervention” has no precise definition. In general terms, it means any act of interference by one State in the affairs of another.²⁵⁵ The UN Charter also recognizes the principle of non-intervention. Article 2(4) of the Charter prohibits the “threat or use of force against the territorial integrity or political independence of any State ...”²⁵⁶ Furthermore, Article 2(7) provides that:

[n]othing in the present Charter shall authorize the United Nations to intervene in matters which are essentially within the domestic jurisdiction of any state or shall require the Members to submit such matters to settlement under the present Charter; but this principle shall not prejudice the application of enforcement measures under Chapter VII.²⁵⁷

Under Chapter VII of the Charter, the UN Security Council may authorize the use of force with respect to threats to the peace, breaches of the peace, and acts of aggression. The Security Council may authorize regional organizations to do the same pursuant to Chapter VIII. It should be noted that Chapter VII of the Charter permits the use of force to maintain or restore *international* peace and security, but it does not contemplate the use of force to maintain or restore non-international or internal peace and security.²⁵⁸

²⁵⁰ See Abiew, *supra* note 245 at 24.

²⁵¹ See *ibid.* at 25.

²⁵² See *ibid.*

²⁵³ *U.N. Charter*, *supra* note 28.

²⁵⁴ Abiew, *supra* note 245 at 64.

²⁵⁵ See *ibid.* at 21, 64.

²⁵⁶ *U.N. Charter*, *supra* note 28.

²⁵⁷ *Ibid.*

²⁵⁸ *Ibid.* at Article 42.

The UNGA's 1966 Declaration on the Inadmissibility of Intervention in the Domestic Affairs of States and the Protection of their Independence and Sovereignty provides that:

[n]o State has the right to intervene, directly or indirectly, for any reason whatever, in the internal or external affairs of any other state. Consequently, armed intervention and all other forms of interference or attempted threats against the personality of the State or against its political, economic and cultural elements are condemned.²⁵⁹

The same Declaration stipulates that "no State shall organize, assist, foment, finance, incite or tolerate subversive, terrorist or armed activities directed toward the violent overthrow of the regime of another state, or interfere in civil strife in another state."²⁶⁰

Although a non-binding resolution, the Declaration was adopted by a vote of 109 to none with one abstention (the United Kingdom). These provisions arguably outlaw State intervention for any purpose.²⁶¹ However, there is a stark contrast between what is "preached" (non-intervention) and what is "practiced."²⁶²

While seemingly unlawful under current international law, recent practice of the UN, as well as the individual and collective practice of States, has witnessed instances of "humanitarian intervention," although in most cases the intervening party has cited a justification other than humanitarian concerns for their action. Since the adoption of the UN Charter, interventions have taken place in the Congo, the Dominican Republic, East Pakistan, Cambodia, Uganda, Grenada, Iraq, Somalia, Liberia, Haiti, Rwanda, and twice on the territory of the former Yugoslavia. "A process clearly has been taking place wherein the perennial conflict between 'sovereignty and suffering' has increasingly been resolved in favor of the latter rather than the former."²⁶³ The theory of humanitarian intervention is that States have an international obligation to guarantee their nationals basic or fundamental human rights and that these rights are so universal and essential that their gross violations cannot be ignored by other States.²⁶⁴ The legal arguments both for

²⁵⁹ *Declaration on the Inadmissibility of Intervention in the Domestic Affairs of States and the Protection of their Independence and Sovereignty*, GA Res. 2131, UN GAOR, 20th Sess., Supp. No. 14, UN Doc. A/6014 (1966) 11 at Article 1.

²⁶⁰ *Ibid.* at Article 2.

²⁶¹ See Abiew, *supra* note 245 at 69.

²⁶² See *ibid.* at 71.

²⁶³ *Doing Good and Doing Well*, *supra* note 242 at 55; see also Abiew, *supra* note 245 at 71.

²⁶⁴ See Abiew, *ibid.* at 30.

and against humanitarian intervention differ depending on whether or not the intervention has been sanctioned by the UN Security Council. Thus, the legality of humanitarian intervention that has been authorized by the Security Council and the legality of humanitarian intervention absent such authorization must be examined separately.

1. Humanitarian Intervention Authorized by the UN Security Council

Opponents of the legality of UN authorized humanitarian intervention rely on the provisions discussed above and maintain that the original intent of the UN Charter was to prohibit forcible intervention in the internal affairs of a State, even in defense of human rights.²⁶⁵ In contrast, proponents of the legality of UN authorized humanitarian intervention argue that one of the primary purposes of the Charter is the promotion and protection of human rights, citing various Charter provisions.²⁶⁶ Indeed, the preamble of the Charter reaffirms “faith in fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women and of nations large and small ...”²⁶⁷ Article 1(3) specifically states that one of the purposes of the UN is “[t]o achieve international co-operation in solving international problems of ... humanitarian character, and in promoting and encouraging respect for human rights and for fundamental freedoms for all ...”²⁶⁸ Article 55 requires all UN Members to promote “universal respect for, and observance of, human rights and fundamental freedoms for all ...”²⁶⁹ Moreover, Article 56 requires all member Nations take action, both jointly and separately, in cooperation with the UN in order to achieve the purposes of Article 55.

The proponents further argue that since one of the primary purposes of the Charter is the protection and promotion of human rights, the Charter necessarily allows UN authorized forcible intervention to achieve that end.²⁷⁰ Although Article 2(7) of the Charter prohibits UN intervention in matters which are essentially within the domestic jurisdiction of any State, human-rights conduct is no longer a matter of exclusive domestic jurisdiction once the state has ratified international treaties governing such

²⁶⁵ See e.g. *ibid.* at 65-70; *Doing Good and Doing Well*, *supra* note 242 at 46-47.

²⁶⁶ See *Doing Good and Doing Well*, *ibid.* at 47.

²⁶⁷ *U.N. Charter*, *supra* note 28.

²⁶⁸ *Ibid.*

²⁶⁹ *Ibid.*

²⁷⁰ See *Doing Good and Doing Well*, *supra* note 242 at 47.

rights.²⁷¹ Under the traditional theory of sovereignty, individuals have no way to remedy human rights abuses save for an appeal to the very same governments committing the abuses. Once a State has ratified international human rights treaties, however, human rights conduct within that State become part of the State's international obligations subject to the supervision and sanction, including forcible intervention, of the international community.²⁷² Numerous international legal texts have established these basic human rights, including the UN Charter, the 1948 Universal Declaration on Human Rights,²⁷³ the 1966 Covenants on Human Rights, regional human rights treaties and the Hague and Geneva Conventions regarding the law of armed conflict, just to name a few.²⁷⁴ The cumulative result of all these human rights instruments is the protection of basic universal and inalienable human rights for everyone.²⁷⁵ "[I]t is now widely accepted that human-rights outrages are properly the concern of the international community as a whole."²⁷⁶

Humanitarian intervention proponents further maintain that gross human rights violations constitute a *prima facie* threat to international peace and security because they create vast numbers of refugees fleeing the offending State and/or making it possible that civil strife will spill across international borders.²⁷⁷ The UN Security Council may therefore authorize the use of force under Chapters VII or VIII to maintain or restore international peace and security when egregious human rights violations are occurring within a sovereign State. The majority of UN interventions have relied on this justification. Recent examples include the operation to protect the Kurds of Northern Iraq in the early 1990s as well as the 1992 intervention in Somalia.²⁷⁸ It is now widely

²⁷¹ See *e.g. ibid.* at 47; Abiew, *supra* note 245 at 98.

²⁷² See *e.g. Doing Good and Doing Well*, *supra* note 242 at 47; Abiew, *supra* note 245 at 75-90.

²⁷³ *Universal Declaration of Human Rights*, GA Res. 217 (III), UN GAOR, 3d Sess., Supp. No. 13, UN Doc. A/810 (1948) 71.

²⁷⁴ For a more complete and detailed list of the relevant human rights agreements, see *e.g. Doing Good and Doing Well*, *supra* note 242 at 66-68; Abiew, *supra* note 245 at 76-82.

²⁷⁵ See *Doing Good and Doing Well*, *supra* note 242 at 81-82.

²⁷⁶ *Ibid.* at 66.

²⁷⁷ See *ibid.* at 48.

²⁷⁸ See *ibid.*

accepted that UN authorized collective intervention in response to gross human rights violations threatening international peace and security is lawful.²⁷⁹

2. Humanitarian Intervention Absent UN Security Council Authorization

While the majority view is that UN sanctioned humanitarian intervention is legally permissible, such is not the case regarding intervention absent Security Council authorization. The prevailing position regarding “humanitarian intervention” absent UN authorization is that there is currently no legal justification for it.²⁸⁰ However, “some authorities assert that there is at least an implicit or nascent trend in the actual behavior of states that amounts to their sometimes grudging acceptance of certain unilateral interventions to protect human rights.”²⁸¹ Interventions in the Congo in 1964; the Dominican Republic in 1965; East Pakistan in 1971; Cambodia in 1978; Uganda in 1979; and Grenada in 1983 while condemned by some States were never condemned by the international community as a whole.²⁸² Post-Cold War interventions taking place over the last 10 years in Northern Iraq, Somalia, Liberia, Haiti, Rwanda, Bosnia, and Kosovo, although the majority were approved by the UN Security Council, indicate growing support for humanitarian intervention.²⁸³ The increase in the amount of interventions and tacit approval of them by a significant segment of the international community arguably indicates that such intervention is becoming an established practice and that a new rule of

²⁷⁹ See *e.g. ibid.* at 60; V.P. Nanda, T.F. Muther Jr., & A.E. Eckert, “Tragedies in Somalia, Yugoslavia, Haiti, Rwanda and Liberia – Revisiting the Validity of Humanitarian Intervention Under International Law – Part II” (1998) 26 Den. J. Int’l L. & Pol’y 827 at 862.

²⁸⁰ See *e.g. Doing Good and Doing Well*, *supra* note 242 at 59; J.I. Charney, “Anticipatory Humanitarian Intervention in Kosovo” (1999) 32 Vand. J. Transnat’l L. 1231 [hereinafter “Anticipatory Humanitarian Intervention in Kosovo”].

²⁸¹ “Anticipatory Humanitarian Intervention in Kosovo,” *ibid.* at 1240-1241. See also *Doing Good and Doing Well*, *supra* note 242 at 59.

²⁸² For a detailed analysis of these interventions, see *e.g. Abiew*, *supra* note 245 at 102-135; Teson, *supra* note 247 at 175-223.

²⁸³ For a detailed analysis of the Northern Iraq, Somalia, Liberia, Haiti, Rwanda, and Bosnia interventions, see *e.g. Abiew*, *supra* note 245 at 137-221; Teson, *supra* note 247 at 227-266. For detailed discussions on the Kosovo intervention, see *e.g. A. Schwabach*, “Yugoslavia v. NATO, Security Council Resolution 1244, and the Law of Humanitarian Intervention” (2000) 27 Syracuse J. Int’l L. & Com. 77; R.B. Bilder, “Kosovo and the ‘New Interventionism’: Promise or Peril?” (1999) 9 J. Transnat’l L. & Pol’y 153 [hereinafter “Promise or Peril?”]; “Anticipatory Humanitarian Intervention in Kosovo,” *supra* note 280; J.D. Godwin, “NATO’s Role in Peace Operations: Reexamining the Treaty After Bosnia and Kosovo” (1999) 160 Mil. L. Rev. 1 [hereinafter “Reexamining the Treaty”]; “Legality of the NATO Bombing,” *supra* note 225.

customary international law permitting intervention on humanitarian grounds without the authorization of the Security Council is developing.

Opponents of unauthorized intervention argue that Article 2(4) of the UN Charter prescribes complete prohibition on the use of force unless employed in self-defense or with the authority of the UN Security Council.²⁸⁴ The *Corfu Channel Case* is also cited support of their argument that there is no right to intervention.²⁸⁵ While the case did not specifically address humanitarian intervention, opponents of the doctrine assert that the case condemns *all* unilateral interventions.²⁸⁶ Proponents of the legality of humanitarian intervention, on the other hand, assert that Article 2(4) of the Charter is not a complete proscription on the use of force.²⁸⁷ Rather, the use of force is lawful if used in a manner which does not threaten the “territorial integrity or political independence” of a State.²⁸⁸ Since the purpose of humanitarian intervention is to compel the State to observe international norms regarding human rights rather than challenge the territorial integrity or political independence of the State, it is argued that humanitarian intervention is lawful under the Charter even absent Security Council authorization.²⁸⁹ The counter argument is, of course, that even a limited intervention for humanitarian purposes at least temporarily violates the State’s territorial integrity and political independence.²⁹⁰

Another argument forwarded to justify humanitarian intervention without the Security Council’s approval “lies in the failure of the UN realizing its original aims.”²⁹¹ It is claimed that the UN machinery for collective security and enforcement has proved largely ineffective.²⁹² The UN as an international security organization was designed

²⁸⁴ See Abiew, *supra* note 245 at 91.

²⁸⁵ *Corfu Channel Case (Albania v. United Kingdom)*, [1949] I.C.J. Rep. 4. In rejecting the argument of the United Kingdom that its use of force in Albanian territorial waters was consistent with the UN Charter because it “threatened neither the territorial integrity nor the political independence of Albania,” the court stated: “the alleged right of intervention as the manifestation of a policy of force, such as has, in the past, given rise to such serious abuses and such as cannot, whatever the present defects in international organization, find a place in international law” (*ibid.* at 35). Humanitarian intervention opponents also cite the 1986 Nicaragua case. *Case Concerning Military and Paramilitary Activities in and against Nicaragua, Merits (Nicaragua v. United States)* [1986] I.C.J. Rep. 14.

²⁸⁶ See Abiew, *supra* note 245 at 91-92.

²⁸⁷ See *ibid.* at 91-102.

²⁸⁸ See *ibid.* at 93-94.

²⁸⁹ See e.g. *Doing Good and Doing Well*, *supra* note 242 at 47; “Reexamining the Treaty,” *supra*, note 283 at 31-37. *Contra* “Anticipatory Humanitarian Intervention in Kosovo,” *supra* note 280 at 1234-1235.

²⁹⁰ See Abiew, *supra* note 245 at 95.

²⁹¹ *Ibid.* at 100.

²⁹² See e.g. *ibid.*; *Planning for Intervention*, *supra* note 249.

primarily to deal with conflicts between States whereas recent armed conflicts have typically arisen within a State.²⁹³ The UN is spread thin due to its involvement in ever-increasing problems around the world.²⁹⁴ As a result, the UN has increasingly turned to regional organizations for help and recent actions in Liberia, Sierra Leone, Haiti and Bosnia mark a trend toward cooperation between the UN and regional organizations.²⁹⁵ These actions arguably “demonstrate the creation of customary international law favoring regional action.”²⁹⁶

It has already been established that egregious human rights violations committed within the borders of a sovereign State are increasingly considered by a growing segment of the international community to be a threat to or breach of the peace. Thus, when the Security Council fails to act, Articles 1, 55 and 56 of the UN Charter, it can be argued, work cumulatively to establish the legality of intervention by individual States or regional organizations without Security Council authorization.²⁹⁷ There exists, assert two eminent commentators, “a coordinate responsibility for the protection of human rights: [UN] members may act jointly with the [UN] Organization ... or singly or collectively.”²⁹⁸ Was this not the case, the very purposes for which the UN was established would be destroyed.²⁹⁹ When the international community fails to act, intervention without the Security Council’s authorization may be emerging as a last resort action, lawful when other means have been exhausted.³⁰⁰ Such was apparently the case in Kosovo.

When the situation in Kosovo turned violent in February 1998 and violence continued through the spring and summer months, with ever-growing numbers of refugees escaping to neighboring countries, a serious threat to peace in the area emerged. In September 1998, the Security Council declared the situation a “threat to peace and

²⁹³ See *Planning for Intervention*, *ibid.* at 2.

²⁹⁴ See “Reexamining the Treaty,” *supra* note 283 at 4.

²⁹⁵ See *ibid.* at 5, 7.

²⁹⁶ *Ibid.* at 14.

²⁹⁷ See Abiew, *supra* note 245 at 100, citing W.M. Reisman, “Criteria for the Lawful Use of Force in International Law” (1985) 10 *Yale J. Int’l L.* 279 at 281. See also “Reexamining the Treaty,” *supra* note 283 at 48-49.

²⁹⁸ M.S. McDougal & W.M. Reisman, “Response by Professors McDougal and Reisman” (1969) 3 *Int’l Lawyer* 438 at 444.

²⁹⁹ See *ibid.*

³⁰⁰ See *Doing Good and Doing Well*, *supra* note 242 at 59, 130-133, citing R.B. Lillich, “Humanitarian Intervention,” in J.N. Moore, ed., *Law and Civil War in the Modern World* (Baltimore: Johns Hopkins University Press, 1974) at 230.

security in the region” but could not reach an agreement on a course of action.³⁰¹ Over the next six months as peace negotiations failed and the violence in that part of Yugoslavia escalated, the UN Security Council still failed to act. As a result, NATO took action by launching air strikes beginning in March 1999. Shortly after the bombing began, the Russian Federation called an emergency session of the UN Security Council charging that NATO had violated the UN Charter.³⁰² NATO members responded by claiming that every means short of force had been attempted to solve the situation and that the forcible action was necessary and legally justifiable in order to prevent greater humanitarian catastrophe.³⁰³ It is important to stress that the UN never condemned NATO’s actions. In fact, the Security Council defeated by a wide margin a proposed resolution of Russia, Belarus and India that would have condemned NATO’s actions as a “threat to international peace” and a “flagrant violation of the United Nations Charter.”³⁰⁴ By adopting Resolution 1244,³⁰⁵ after the bombing had ceased (reaffirming all previous resolutions and establishing an international security force), the UN Security Council arguably gave its approval to the NATO action.³⁰⁶ Moreover, notes one observer, “[s]ince the end of the war, and since Security Council Resolution 1244 ... there has been a high degree of tolerance of NATO’s conduct.”³⁰⁷ A lack of wider condemnation by the UN member States, the Security Council’s approval of NATO’s intervention, and growing support by States of NATO’s action work together to strengthen the claim that a new rule of customary international law is emerging, permitting humanitarian intervention in similar circumstances, as a last resort, when the UN fails to act.³⁰⁸

³⁰¹ SC Res. 1199, *supra* note 225.

³⁰² See “Reexamining the Treaty,” *supra* note 283 at 77-78.

³⁰³ See *ibid.* at 78, citing UN SCOR, 54th Sess., UN Press Release SC/6657 (1999).

³⁰⁴ See “Promise or Peril?,” *supra* note 283 at 159, citing UN SCOR, 54th Sess., UN Doc. S/PV 3989 (1999). Three members of the Security Council voted for the resolution (Russia, China and Namibia) and 12 members voted against it (Argentina, Bahrain, Brazil, Canada, France, Gabon, Gambia, Malaysia, the Netherlands, Slovenia, the United Kingdom, and the United States).

³⁰⁵ SC Res. 1244, UN SCOR, 54th Sess., U.N. Doc. S/Res/1244 (1999).

³⁰⁶ See Schwabach, *supra* note 283 at 80-81. *Contra* “Anticipatory Humanitarian Intervention in Kosovo,” *supra* note 280 at 1233, 1246-1247.

³⁰⁷ See Schwabach, *supra* note 283 at 83.

³⁰⁸ See *ibid.* at 82-83.

On 29 April 1999, Yugoslavia brought suit in the International Court of Justice (ICJ) against the ten NATO members involved in the intervention.³⁰⁹ Yugoslavia alleged, among other things, that each of those States had violated its obligations not to use force against, intervene in the internal affairs of, or violate the sovereignty of another State.³¹⁰ Yugoslavia requested provisional measures requiring those States to immediately cease their use of force.³¹¹ On 2 June 1999, the ICJ denied all ten requests for provisional measures stating that it had no *prima facie* jurisdiction to entertain Yugoslavia's applications and, at the same time, dismissed the cases against Spain and the United States on jurisdictional grounds.³¹² While the Court found it could not entertain the applications for provisional measures, it did not dismiss the other eight cases, asserting that its findings in no way prejudice the jurisdiction of the Court to deal with the merits of the case.³¹³ The cases are still pending and all pleadings must be filed with the Court by 5 July 2000.³¹⁴ It has been argued that while the ICJ Orders denying provisional measures convey a disapproval of the behavior of all parties, some provisions within the orders come close to an endorsement of the doctrine of humanitarian intervention.³¹⁵ If no decisions on the merits were ever reached, this "endorsement" would serve to bolster the argument that a customary rule of international law permitting humanitarian intervention, absent Security Council approval, is emerging. Should a decision on the merits be reached in favor of the NATO intervention, it will likely be a watershed in the post-UN Charter development of the controversial doctrine of humanitarian intervention. Conversely, should the ICJ arrive at a decision in favor of

³⁰⁹ A separate "Application of Yugoslavia, Legality of Use of Force" was filed against each of the ten countries including Belgium, Canada, France, Germany, Italy, the Netherlands, Portugal, Spain, the United Kingdom, and the United States. All ICJ documents regarding the action may be found online: International Court of Justice <<http://www.icj-cij.org>> (date accessed 1 May 2000) [hereinafter "Application of Yugoslavia"]. For a detailed discussion on the early stages of the case, see Schwabach, *supra* note 283 at 83-100.

³¹⁰ See "Application of Yugoslavia," *supra* note 309.

³¹¹ See *ibid.*

³¹² See each individual "Order Denying Request for Provisional Measures," online: International Court of Justice <<http://www.icj-cij.org>> (date accessed 1 May 2000).

³¹³ See *ibid.*

³¹⁴ See *ibid.*

³¹⁵ See Schwabach, *supra* note 283 at 95. *Contra* "Anticipatory Humanitarian Intervention in Kosovo," *supra* note 280 at 1233-1234.

Yugoslavia, the legality of a NATO-type humanitarian intervention would be seriously, though not fatally, weakened.

B. The Impact of Humanitarian Intervention on the Law of Aerospace Warfare

As the debate regarding the *jus ad bellum* of humanitarian intervention continues, issues have arisen regarding the *jus in bello* of such interventions as well. It has been suggested that, because of the humanitarian nature of such interventions, the *jus in bello* regarding targets and weapons should be more restrictive in humanitarian interventions than it is in other types of armed conflict.³¹⁶ The key issues are whether legal targets should be limited to targets purely military in nature (making dual use and infrastructure targets illegal) and whether the use of certain types of weapons (such as cluster bombs) should be impermissible. As the number of humanitarian interventions continues to grow, aerospace assets are increasingly the means chosen to accomplish the desired goals. As a result, the acceptance of the doctrine of humanitarian intervention will inevitably affect aerospace warfare in the twenty-first century by limiting the type of targets attacked and weapons employed by aerospace assets.

The current law of armed conflict permits the attack of dual use targets and the infrastructure as well as the use of weapons such as cluster bombs so long as basic rules of customary international law regarding armed conflict are adhered to.³¹⁷ It has been asserted that if the purpose of a humanitarian intervention is the alleviation of human suffering, attacking targets and using weapons harmful to the very population to be protected should be illegal.³¹⁸ Under this theory, any attack on dual use facilities and the infrastructure of a State, such as roads, bridges, factories, power plants, etc. would be illegal. The use of certain weapons would be illegal as well due to the possibility of unreasonable danger to the civilian population (e.g. the hazards of unexploded bomblets from a cluster bomb).

Special rules of the *jus in bello* need not be devised to deal specifically with humanitarian interventions. The existing laws of armed conflict adequately cover such concerns if applied correctly. Current principles of customary international law including

³¹⁶ See "Promise or Peril?," *supra* note 283 at 167-174.

³¹⁷ See Chapter I, Parts B1, B2a(2), above.

³¹⁸ See "Promise or Peril?," *supra* note 283 at 167-174.

military necessity, proportionality and discrimination require that the overall objectives of a conflict be taken under consideration when selecting targets and weapons.³¹⁹ Recent interventions in Bosnia and Kosovo clearly demonstrated that the humanitarian nature of such conflicts is taken into account when selecting both targets and weapons.³²⁰ The Bosnia and Kosovo interventions, particularly Kosovo, also demonstrated that in order for an aerial intervention to be effective, some dual use and infrastructure targets must be attacked.³²¹ Placing an absolute prohibition on the targeting of dual use facilities and infrastructure as well as prohibiting the use of certain types of weapons could prove to be more detrimental than beneficial. Regarding the Kosovo intervention, it has been suggested that had the military been “unleashed” to launch a massive and overwhelming assault rather than gradually escalate the bombing, Yugoslavia may have yielded more quickly effectively saving lives and reducing infrastructure damage.³²² While extra precautions may need to be taken in armed conflicts where the primary objective is the alleviation of humanitarian suffering (as was the case in both Bosnia and Kosovo), the development of a specialized *jus in bello* applicable only to humanitarian interventions is not only unnecessary but undesirable.

C. Chapter III Summary

Recent State practice supports the view that when a State commits massive and systematic cruelties against its own nationals causing widespread suffering and loss of life so as to shock the conscience of mankind, armed intervention in the interest of humanity is legally permissible. Nevertheless, the legal status of “humanitarian intervention” in modern international law remains ambiguous at this time. Although there is no generally accepted legal justification setting out the formal right of, and proper parameters for, such intervention, “it is unmistakable that there is, in practice, a growing *tolerance* for various forms of humanitarian intervention.”³²³ The cumulative weight of

³¹⁹ Military necessity, proportionality and discrimination principles are discussed in Chapter I, Part B1a, above.

³²⁰ See Chapter II, Part B, above.

³²¹ In Kosovo, NATO attempted bombing only military targets at the beginning of the intervention. However, as Yugoslavia continued to refuse to capitulate, it became necessary to attack dual use and infrastructure targets as well. For a more detailed discussion see Chapter II, Part B2, above.

³²² See “Promise or Peril?,” *supra* note 283 at 173.

³²³ *Doing Good and Doing Well*, *supra* note 242 at 66 [emphasis in original].

international human rights and humanitarian law and the precedents established by the Security Council itself justify military intervention in situations of extreme human rights deprivations and suffering (e.g. in cases such as genocide, war crimes and crimes against humanity). Intervention, absent UN authorization, is much more tenuous although there is a steady movement toward the establishment of a new rule of customary international law allowing for unauthorized intervention as a last resort when the international community has failed to act. The varying arguments presented in support of humanitarian intervention seem to signal a gradual return to the pre-positivist “just war” concepts of the legal use of force, at least where humanitarian concerns are at issue. Although it has been suggested that the *jus in bello* should be more restrictive regarding permissible targets and weapons in humanitarian interventions, the existing *jus in bello* seems to adequately govern the conduct of such interventions. Moreover, significantly restricting target and weapons options during humanitarian interventions could ultimately add to the human suffering rather than alleviate it. The imposition of such restrictions could produce the undesirable effects of extending the duration of an armed intervention and permitting those responsible for the human suffering to escalate their campaign of human cruelty, ultimately prolonging and exacerbating the suffering the intervention was intended to alleviate.

CHAPTER IV

Role and Effect of Earth-Based Assets

[P]recision engagement extends beyond precisely striking a target with explosive ordnance. Information superiority will enhance the capability ... to understand the situation, determine the effects desired, select a course of action, and reengage as necessary while minimizing collateral damage.

During conflict, the commander will use precision engagement to obtain lethal and nonlethal effects in support of the objectives of the campaign.

--United States Department of Defense (2000)³²⁴

Military experts believe the world is in the midst of a “revolution in military affairs” (RMA).³²⁵ RMAs occur whenever the nature of war and warfare fundamentally changes primarily due to radically new technologies.³²⁶ In the view of the U.S., a fundamental change is occurring in information operations, weapon systems and space.³²⁷ Technological advances in information, command and control, and weapon penetration and precision are spurring the revolution.³²⁸ Current military information systems provide military commanders with the unprecedented ability to collect, analyze and disseminate vast amounts of information in real or near-real-time. Using that information, commanders are then able to engage targets anywhere in the world with weapons capable of penetrating hardened structures and striking with great precision. Advances in weapons technology will make weapons of the near future not merely “smart” but “brilliant.”³²⁹

³²⁴ United States, Department of Defense, *Joint Vision 2020* (Washington, D.C.: US Government Printing Office, June 2000) at 22.

³²⁵ See e.g. M.N. Schmitt, “The Principle of Discrimination in 21st Century Warfare” (1999) 2 Yale Human Rts. & Dev. L.J. 143 [hereinafter “Principle of Discrimination in 21st Century Warfare”] at 143, 152.; M.N. Schmitt, “Bellum Americanum: The U.S. View of Twenty-First Century War and Its Possible Implications for the Law of Armed Conflict” (1998) 19 Mich. J. Int’l L. 1051 [hereinafter “Bellum Americanum”] at 1058-1059; J.R. Barnett, *Future War: An Assessment of Aerospace Campaigns in 2010*, (Maxwell Air Force Base, Alabama: Air University Press, 1996) [hereinafter *Aerospace Campaigns in 2010*] at 13-16.

³²⁶ See e.g. *Aerospace Campaigns in 2010*, *ibid.*; “Bellum Americanum,” *supra* note 325 at 1058. The most recent RMA occurred as a result of the advent of nuclear weapons.

³²⁷ See “Bellum Americanum,” *supra* note 325 at 1059.

³²⁸ See *Aerospace Campaigns in 2010*, *supra* note 325 at 15.

³²⁹ Current weapons are called “smart” because of their accuracy. Weapons of the near future will be even more accurate than those currently in use, hence the term “brilliant.” “Inertial navigation technologies, the incorporation of global positioning data, and other improvements in guidance systems will permit weapons

A relationship exists between RMAs and the law of armed conflict. Historically, fundamental changes in the nature of armaments and warfare have provided the impetus for the creation of new laws of armed conflict.³³⁰ Aerospace assets, both currently available and those in development, are already playing a leading role in the RMA and are likely to have a profound impact on the law of aerospace warfare in the twenty-first century. The impact of earth-based military assets on the law of armed conflict is addressed in the present Chapter while the impact of space-based assets on that law is discussed in Chapter V.

A. Information Systems

Information is transforming the use of air power in armed conflict.³³¹ Major military powers of the world have the ability to acquire and communicate huge volumes of information in real-time and to rapidly analyze the collected data.³³² In the twenty-first century, the adversary that can best obtain and exploit information while denying the enemy the ability to do the same will likely emerge victorious in armed conflict.³³³ Aerial assets play a large role in obtaining and analyzing information and in attempts to prohibit the enemy from doing the same. Aircraft perform intelligence, surveillance and reconnaissance (ISR), command and control (C2) and electronic combat functions.

1. Intelligence, Surveillance and Reconnaissance Systems

Intelligence gathering, surveillance and reconnaissance were the earliest military uses of aerial instrumentalities and remain a major function of modern military aircraft.³³⁴

to regularly strike within centimeters of the desired point of impact. Accuracy will further be enhanced by improvements in the overall 'weapon system,' which consist of the weapon, launcher, and other external components that make the attack possible." "The Principle of Discrimination in 21st Century Warfare," *supra* note 325 at 164.

³³⁰ See *e.g. ibid.* at 145-146; "Bellum Americanum," *supra* note 325 at 1058.

³³¹ Former U.S. Secretary of Defense William Perry. Quoted in *Aerospace Campaigns in 2010*, *supra* note 325 at 1. Much has been written about "information warfare." For a detailed analysis of information warfare, see *e.g.* Z.M. Khalilzad & J.P. White, eds., *Strategic Appraisal: The Changing Role of Information in Warfare* (Santa Monica, California: Rand, 1999); R.L. Pfaltzgraff, Jr. & R.H. Schultz, Jr., eds., *War in the Information Age* (Washington, D.C.: Brassey, 1997).

³³² Former U.S. Secretary of Defense William Perry. Quoted in *Aerospace Campaigns in 2010*, *supra* note 325 at 1.

³³³ See *ibid.* at 2.

³³⁴ See *supra* note 1.

In Yugoslavia in 1999, U.S. ISR capabilities provided unprecedented levels of information to NATO military officials.³³⁵ Sensors on aircraft, ships and satellites, as well as on the ground, produce data that can be readily transformed into information. New sensors are capable of looking through clouds, camouflage and foliage.³³⁶ Moreover, new-generation sensors may be able to locate mobile, well-hidden or buried targets.³³⁷ Aircraft such as the high altitude U.S. U-2 have been used for ISR purposes for some time and will likely continue operating well into the twenty-first century.³³⁸ However, unmanned aerial vehicles (UAVs) are quickly becoming the workhorses of aerial ISR.³³⁹ Although they have been used in an ISR role since the 1950s,³⁴⁰ UAVs were used extensively in combat for the first time in Yugoslavia in 1999.³⁴¹ UAVs are capable of relaying images via satellite³⁴² and their use for ISR is likely to increase in the twenty-first century as new UAV systems are currently under development.³⁴³

³³⁵ See *Kosovo After Action Report Introduction*, *supra* note 226 at 22.

³³⁶ See D.A. Fulghum, "Growing Intelligence Operation Focuses on New Types of Signals" *Aviation Week & Space Technology* 151:5 (2 August 1999) 50 at 50.

³³⁷ See D.A. Fulghum, "Sensors Combine Data, Plumb Hidden Details" *Aviation Week & Space Technology* 152:6 (7 February 2000) 56 at 56. See also D.A. Fulghum, "Future UAV Sensors To Scan Vast Areas" *Aviation Week & Space Technology* 152:6 (7 February 2000) 58.

³³⁸ The U-2 first entered service in 1955 and is expected to remain operational until at least 2020. See e.g. "USAF Fact Sheet 96-21: U-2R/U-2S," online: United States Air Force <http://www.af.mil/news/factsheets/U_2R_U_2S.html> (last modified: June 1996); D.M. North, "Venerable U-2 Forges on to Y2K and Beyond" *Aviation Week & Space Technology* 150:15 (12 April 1999) 60. The U.S. recently revealed that the U-2's ground surveillance radar is capable of producing images with one-foot spatial resolution. See D.A. Fulghum, "UAV to Carry U-2 Recce Unit" *Aviation week & Space Technology* 152:20 (15 May 2000) 28 [hereinafter "UAV to Carry U-2 Recce Unit"]. For a list and discussion of U.S. ISR aircraft, see "Specialized Forces: Military Aircraft" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/special.htm>> (last modified: 2 January 2000) [hereinafter "Specialized Forces: Military Aircraft"].

³³⁹ UAVs are discussed in more detail in Part D2, below.

³⁴⁰ See "Unmanned Aerial Vehicles (UAVs)," online: Federation of American Scientists <<http://www.fas.org/irp/program/collect/uav.htm>> (last modified: 4 May 2000) [hereinafter "UAVs"].

³⁴¹ See *Kosovo After Action Report Introduction*, *supra* note 226 at 22.

³⁴² See "Global Hawk Relays Images" *Aviation Week & Space Technology* 150:7 (15 February 1999) 45.

³⁴³ See e.g. "UAV to Carry U-2 Recce Unit," *supra* note 338; D.A. Fulghum, "Small Deck UAV Flies" *Aviation Week and Space Technology* 152:5 (31 January 2000); R. Wall, "U.S. Navy to Bolster Unmanned Aircraft Fleet" *Aviation Week & Space Technology* 152:4 (24 January 2000); D.A. Fulghum, "Ryan Designs UAV Helicopter for Navy" *Aviation Week and Space Technology* 151:21 (22 November 1999); R. Wall, "USAF Maps Out Future of Global Hawk UAV" *Aviation Week & Space Technology* 151:2 (12 July 1999) 53 [hereinafter, "USAF Maps Out Future of Global Hawk UAV"]; R. Wall, "NATO Expands Use of UAVs" *Aviation Week and Space Technology* 150:23 (7 June 1999) 55.

2. Command and Control Systems

To be of any use in armed conflict information must not only be collected, it must also be analyzed and quickly disseminated. Aircraft such as the U.S. E-3 Sentry AWACS and E-8C JSTARS are capable not only of performing surveillance functions, but also serve as command and control platforms that analyze and disseminate information while airborne. Airborne command and control aircraft such as the AWACS assist in managing the aerial battle while JSTARS helps to direct the war on the ground. Using a radar with a range of more than 200 miles and an identification friend or foe subsystem, AWACS can detect, identify and track both friendly and enemy aircraft.³⁴⁴ Other systems in the AWACS allow it to perform navigation, communication and data processing functions. AWACS is capable of gathering and presenting both broad and detailed battlefield information in real-time. The information can then be transmitted to command and control centers on land or aboard ships. AWACS is also able to provide information directly to fighter and attack aircraft, directing fighter aircraft to airborne enemy forces and attack aircraft to their targets.

Initially used in the Persian Gulf War while still experimental, JSTARS conducts ground surveillance to support attack operations and targeting on the ground.³⁴⁵ JSTARS gathers and displays broad and detailed battlefield information in real-time, including position and tracking information on enemy and friendly ground forces. The information is then relayed in near-real-time to army ground stations and other command and control facilities on the ground. The JSTARS radar can detect ground targets 50 to 250 kilometers from the aircraft and also has limited capability for detecting helicopters and slow moving fixed wing aircraft. Information obtained, analyzed and disseminated by JSTARS can be used to direct air-to-ground attacks by aircraft, naval surface fire, field artillery and can also be used to maneuver friendly forces.

³⁴⁴ See "USAF Fact Sheet 96-13: E-3 Sentry (AWACS)" online: United States Air Force <http://www.af.mil/news/factsheet/E_3_Sentry_AWACS_.html> (last modified March 1996).

³⁴⁵ See "USAF Fact Sheet: E-8C Joint Stars" online: United States Air Force <http://www.af.mil/news/factsheets/E_8C_Joint_Stars.html> (last modified: June 1999).

3. *Electronic Combat Systems*

While ISR and C2 systems serve to collect, analyze and disseminate information for an adversary, electronic combat systems (ECS) are designed to deny the enemy the capability of doing the same. Electronic warfare includes any action using electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy.³⁴⁶ Actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum are referred to as electronic countermeasures (ECM). Electronic attack and suppression of enemy air defenses (SEAD) can be accomplished through the use of specialized weapons such as the HARM³⁴⁷ missile or by electronically jamming enemy systems. Specialized airborne weapon systems are employed to accomplish both. For example, the U.S. military uses EC-130 Compass Call and EA-6B Prowler aircraft for jamming and F/A-18s, EA-6Bs and F-16s equipped with the HARM targeting system for lethal suppression.³⁴⁸ Whether accomplished electronically or through the employment of a weapon the ultimate goal is the same, to deny the enemy the ability to acquire and use valuable information.

Pentagon officials are considering the F-18, F-22, Joint Strike Fighter (JSF) and Global Hawk UAV as twenty-first century electronic combat aircraft.³⁴⁹ A derivative of the JSF is emerging as the likely jamming replacement for the EA-6B Prowler while the F-22 could have a role in lethal suppression, seeking out and destroying enemy radars deep within enemy territory. Both the JSF and F-22 employ stealth technology and are currently in development.³⁵⁰

To be capable of interaction, all of these weapon systems use computers, making

³⁴⁶ See "Electronic Combat Systems" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/equip/ec.htm>> (last modified: 9 January 1999).

³⁴⁷ The U.S. AGM-88 high-speed antiradiation missile (HARM) is designed to detect, attack and destroy enemy radar equipped air defense systems. See "USAF Fact Sheet: AGM-88 HARM" online: United States Air Force <http://www.af.mil/news/factsheets/AGM_88_HARM.html> (last modified: March 1997).

³⁴⁸ See "Specialized Forces: Military Aircraft," *supra* note 338. For additional information on the EC-130 compass call, see e.g. D.A. Fulghum, "Compass Call to Dominate Electronic, Info Warfare" *Aviation Week & Space Technology* 151:16 (18 October 1999) 50; D.A. Fulghum, "EC-130s Continue Upgrades for 21st Century Combat" *Aviation Week & Space Technology* 151:16 (18 October 1999) 54. For additional information on the EA-6B Prowler, see "EA-6B Prowler" online: Federation of American Scientists <http://www.fas.org/irp/program/collect/ea-6b_prowler.htm> (last modified: 23 April 2000).

³⁴⁹ See D.A. Fulghum, "USAF Sizes Up Next Electronic Combat Aircraft" *Aviation Week & Space Technology* 151:12 (20 September 1999) 28 at 28.

³⁵⁰ The JSF and F-22 are discussed in greater detail Part D1, below.

computer systems a high priority target in twenty-first century warfare. Computer systems are not made inoperative merely by destroying them with bombs or missiles but also by manipulating the computer systems themselves. Computer systems can be accessed through air-to-ground or air-to-air data channels making them vulnerable to manipulation.³⁵¹ It has been reported that the U.S. attacked Yugoslavian computers systems in such a manner in 1999, most likely by manufacturing and inserting false radar images or signals intelligence intercepts that automated air defense systems or radar operators would find believable.³⁵²

4. Impact of Information Systems on the Law Governing Aerospace Warfare

As a general rule, the ability to collect, analyze and disseminate mass volumes of information in real or near-real time enhances a combatant's ability to determine whether attacking a potential target would further a clear military objective. Information systems also enhance the ability to distinguish between legitimate military targets and protected objects. Information can also be used to significantly reduce civilian casualties and collateral damage. For example, information obtained from various sources may indicate that an enemy command and control center is located in a single room of a building in the center of a large city. Additional information demonstrates that if the building is struck at a certain point, the room will be destroyed but the remainder of the building will remain virtually in tact. Moreover, near-real-time information provided by ISR aircraft might reveal whether or not civilians are present. The sum of all of this information facilitates an attack on a precise point of the building with minimal collateral damage at a time when few civilians are present. Thus, information systems serve to enable a combatant to make fewer targeting mistakes (such as the bombing of the Chinese Embassy in Yugoslavia) and to reduce civilian casualties and collateral damage. In sum, information systems facilitate compliance with the basic principles of customary international law of

³⁵¹ See D.A. Fulghum, "Yugoslavia Successfully Attacked by Computers" *Aviation Week & Space Technology* 151:8 (23 August 1999) 31 at 32. Computer systems are also vulnerable to manipulation through more conventional avenues such as telephone lines and Internet links. See D.A. Fulghum, "Telecom Links Provide Cyber-Attack Route" *Aviation Week & Space Technology* 151:19 (8 November 1999) 81 [hereinafter "Telecom Links Provide Cyber-Attack Route"].

³⁵² See "Telecom Links Provide Cyber-Attack Route," *ibid.*

war (military necessity, proportionality and discrimination) as incorporated into The Hague and Geneva Conventions.

The resulting impact on the law of armed conflict will arguably be to permit fewer targeting mistakes, fewer civilian casualties and limit acceptable collateral damage. The law will likely require future combatants to strike the target in the manner described above, provided they have the ability to do so. Under the principle of military necessity, an object must further a specific military objective to be lawfully attacked and the striking party must be able to articulate the imperative military advantage to be gained.³⁵³ With mass amounts of information available in real or near-real-time, military officials will be much more capable of determining whether a target furthers a legitimate military objective. The discrimination principle requires that military objectives be distinguished from protected objects and places (civilians, civilian property and cultural objects).³⁵⁴ The use of information gleaned from information systems will allow military officials to better make that distinction. Finally, under the principle of proportionality, the amount of damage incidental to an attack may not be excessive in proportion to the concrete and direct military advantage to be gained.³⁵⁵ Information systems will enhance the ability to determine the likelihood and extent of any resulting civilian casualties and collateral damage. In short, twenty-first century information systems will arguably serve to enhance strict compliance with the law of armed conflict, altering the manner in which the law is interpreted and applied.

Paradoxically, while modern information systems will generally allow adversaries to reduce targeting mistakes and collateral damage, easing compliance with the law of armed conflict, the targeting of dual use systems could prove to make the law of armed conflict more difficult to comply with.³⁵⁶ Given the importance of information systems in twenty-first century warfare, such systems are sure to be key targets in future armed conflicts. In Iraq and Yugoslavia, telecommunications, command, control and other communication assets were primary targets.³⁵⁷ In addition to purely military information

³⁵³ See "Bellum Americanum," *supra* note 325 at 1083. The principle of military necessity is discussed in Chapter I, Part B1a, above.

³⁵⁴ See Chapter I, Part B1a, above.

³⁵⁵ See *ibid.*

³⁵⁶ See "Bellum Americanum," *supra* note 325 at 1075.

³⁵⁷ See Chapter II, above.

systems, the armed forces of the world increasingly rely on civilian information systems, causing military and civilian systems to become intermingled. Similarly, private companies rather than military establishments manufacture many of the components of modern military information systems, weapons and weapon systems. This intermingling could blur the lines between lawful targets and protected objects, ultimately making the principles of military necessity and target discrimination more difficult to adhere to.³⁵⁸

Although modern information systems and other dual use targets could make compliance with the law of armed conflict more difficult, perhaps restricting the number of lawful targets, dual use objects will most likely remain subject to lawful attack. The Hague Conventions make it clear that dual use targets of value to the war effort may be lawfully targeted and attacked.³⁵⁹ The ultimate legal problem posed by attacking such systems may rest not in articulating clear military advantages or distinguishing between military and civilian objects but in complying with the principle of proportionality. An attack on intermingled information systems or other dual use targets could destroy a significant portion of a nation's infrastructure including telecommunications, financial, transportation or energy systems resulting in widespread and excessive incidental damage and suffering. Moreover, attacks on objects indispensable to the survival of the civilian population are prohibited by the Geneva Conventions.³⁶⁰ In a world increasingly reliant on technology, it is not unreasonable to expect that certain portions of a State's infrastructure could be indispensable to the survival of the civilian population. If and when intermingled information systems and other dual use targets are to be attacked, great care must be taken in planning and executing such attacks to ensure that any resulting collateral damage and incidental injury is proportional to the military advantage to be gained. Proper weapon and target selection will become increasingly critical in ensuring compliance with the laws of armed conflict. While existing customary international law regarding the law of armed conflict is certainly capable of evolving to accommodate these concerns, the ultimate solution may well be to specify permissible and impermissible targets via multilateral agreement.

³⁵⁸ See e.g. "Bellum Americanum," *supra* note 325 at 1075; "The Principle of Discrimination in 21st Century Warfare," *supra* note 325 at 158-161.

³⁵⁹ See Chapter I, Part B2a(2), above.

³⁶⁰ See Chapter I, Part B2b(2), above.

B. Conventional Weapons

Numerous conventional weapons³⁶¹ exist in today's military arsenals including various types of freefall bombs and missiles. Conventional weapons can be classified into three categories: direct attack weapons, standoff weapons, and long range weapons.³⁶² Direct attack weapons must be delivered directly over or in close proximity to their intended targets. Standoff weapons can be delivered up to 15 miles from their intended targets and long-range weapons can be delivered from distances far greater than 15 miles.³⁶³ In fact, some cruise missiles can strike targets hundreds of miles away from the launching platform (naval craft, aircraft or land-based launcher).³⁶⁴ Modern conventional weapons employ three different types of guidance systems: unguided, man-in-the-loop-guidance, and GPS guidance.³⁶⁵ Unguided weapons are commonly referred to as "dumb" bombs, while man-in-the-loop and GPS guided weapons are referred to as precision guided munitions (PGMs) or "smart" weapons.

1. Unguided or "Dumb" Bombs

Unguided weapons are delivered to their target on a ballistic trajectory, that is, they follow a mathematically predictable course when released.³⁶⁶ Although recent conflicts in Iraq and Yugoslavia have demonstrated that PGMs are becoming the aerial weapon of choice by the major powers of the world, unguided or "dumb" bombs are a staple in every military arsenal.³⁶⁷ Unguided munitions are direct attack weapons, they

³⁶¹ The term "conventional weapon" as used herein denotes a standard explosive blast effect weapon as opposed to nuclear, chemical, bacteriological or other type of weapons. Conventional weapons include both bombs and missiles.

³⁶² See *Kosovo After Action Report*, *supra* note 221 at Table 1.

³⁶³ See *ibid.*

³⁶⁴ For the ranges of U.S. cruise missiles, see "Smart Weapons," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/smart/index.html>> (date accessed: 3 May 2000) [hereinafter "Smart Weapons"]. A detailed explanation of cruise missiles can be found at "Cruise Missiles," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/cm/index.html>> (date accessed: 3 May 2000). For a detailed list and description of all U.S. Missiles, see "US Missiles," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/missile/index.html>> (date accessed: 3 May 2000). For a list and description of missiles of countries other than the U.S., see "Rest-of-World Missile Systems," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/svs/missile/row/index.html>> (date accessed: 3 May 2000).

³⁶⁵ See *Kosovo After Action Report*, *supra* note 221 at 87.

³⁶⁶ See *Storm Over Iraq*, *supra* note 145 at 303.

³⁶⁷ For a list and description of dumb bombs in the U.S. arsenal, including general purpose, penetrating and cluster bombs, see "Dumb Bombs," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/dumb/index.html>> (date accessed: 3 May 2000).

must be delivered directly over or in close proximity to their targets. Dumb bombs can be delivered by a variety of strike aircraft including both bombers and fighter aircraft.³⁶⁸ Unguided bombs range in size from 250 to 15,000 pounds or more. While not as accurate as PGMs, improved navigation technologies, better aerodynamic bomb design, improved weapons-release computing systems, and improved aircraft cockpit displays have greatly increased the accuracy of unguided bombs since World War II.³⁶⁹ Bombs are classified according to the ratio of explosive material to total weight and there are four principle classes: general-purpose, fragmentation, penetration and cluster bombs.³⁷⁰

Approximately 50 percent of the general-purpose bomb's weight consists of explosive materials and general-purpose bombs typically weigh between 500 and 2,000 pounds.³⁷¹ The explosive content of the bomb causes a considerable blast effect and is the primary cause of damage to a target, although the bomb's one-half inch thick casing creates a fragmentation effect as well. Conversely, a fragmentation bomb's weight consists of only 10 to 20 percent explosive filler. The remaining 80 to 90 percent includes specially scored cases that break into predictably sized pieces. While the blast effect of a fragmentation bomb causes some damage, most of the damage results from the high velocity pieces or fragments. Penetration bombs have casings designed to penetrate hardened targets such as bunkers before exploding. Penetration is accomplished either by the effects of a shaped-charge or simply by the kinetic energy of the weapon itself. Approximately 25 to 30 percent of a penetration bomb's weight consists of explosive filler.

Cluster bombs consist of a number of submunitions that are housed and delivered by a dispenser (missiles, rockets or projectiles).³⁷² Dispensers are dropped from an aircraft and at a predetermined altitude, the dispenser disperses the submunitions over the

³⁶⁸ For a list of U.S. aircraft dumb bomb weapon loads, see "Dumb Bombs: Aircraft Weapon Loads," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/dumb/carry.html>> (last modified: 4 March 2000).

³⁶⁹ See *Storm Over Iraq*, *supra* note 145 at 282.

³⁷⁰ For a detailed description of unguided bombs, see "Bombs for Beginners," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/dumb/bombs.htm>> (last modified: 23 April 2000) [hereinafter "Bombs for Beginners"].

³⁷¹ See *ibid.*

³⁷² For a detailed description of cluster bombs, see "Cluster Bombs," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/dumb/cluster.htm>> (last modified: 26 June 1999) [hereinafter "Cluster Bombs"].

target. A single dispenser can house as few as three or more than 2,000 submunitions. Submunitions are small explosive or chemical filled munitions and are classified as bomblets, grenades or mines. Cluster bombs can be antipersonnel, antimateriel, antitank, dual purpose, incendiary or chemical. They may be used to slow or prevent enemy movement away from or through an area (area denial) or to destroy the enemy in place.³⁷³ If intended to destroy the enemy in place, the submunitions detonate upon impact with the ground. Area denial submunitions do not detonate upon impact with the ground. Like a mine, they detonate when pressure is placed upon them. Area denial submunitions are designed to have a limited active life and to self-destruct after their active life has expired.

Although not a separate class of unguided weapon, fuel/air explosives (FAE) are generally delivered by unguided bombs. FAEs disperse an aerosol cloud of fuel that is then ignited by a detonator producing an explosion.³⁷⁴ A rapidly expanding wave front develops flattening all objects near the epicenter of the fuel cloud and producing considerable damage well beyond the flattened area as well. FAEs are effective against soft targets such as minefields, armored vehicles, aircraft parked in the open and bunkers.³⁷⁵

2. Precision Guided Munitions

Because PGMs offer distinct military advantages and have the additional advantage of reducing civilian casualties and collateral damage, they have become the weapons of choice by the major military powers of the world. Since the war in the Persian Gulf in 1991, the U.S. Air Force has tripled the number of precision-capable platforms,³⁷⁶ increased PGM inventories by 25 percent above levels existing prior to the

³⁷³ See *ibid.*

³⁷⁴ For a detailed description of FAEs, see "Fuel/Air Explosive (FAE)" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/dumb/fae.htm>> (last modified 5 February 1998).

³⁷⁵ See *ibid.*

³⁷⁶ "Precision-Capable Platforms" refers to systems capable of delivering PGMs. For example, in the Persian Gulf war 229 U.S. aircraft, primarily F-111F and F-117 aircraft, were capable of delivering laser-guided munitions. Expanded installation of the low-altitude navigation and targeting infrared for night (LANTIRN) pods on F-15E and F-16 aircraft increased laser-guided capability in the U.S. Air Force to approximately 500 platforms by 1996. Eventually, all 210 U.S. Navy F-14 aircraft will be upgraded with the LANTIRN system as well. See "What's New With Smart Weapons," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/smart/new.htm>> (last modified: 4 March 2000) [hereinafter "What's New With Smart Weapons"].

war, and developed new generation PGMs autonomously guided with enhanced accuracy, standoff and adverse weather capabilities.³⁷⁷ Tens of thousands of PGMs are slated for delivery over the next ten years.³⁷⁸ PGM technology is developing at such a pace that PGMs of the near future will not only be “smart” they are likely to be “brilliant,” that is, their accuracy is likely to continue to increase. Moreover, future cruise missiles are likely to have a much greater range.³⁷⁹

a. Man-In-The-Loop Guided Munitions

Man-in-the-loop guidance systems require aircrew input during the employment of the weapon. Crewmembers may identify the target via a seeker, steer the weapon during flight, point a laser at the target, or alter the aim point just prior to impact in order to maximize the weapon’s effect on the target.³⁸⁰ The most numerous PGMs in current arsenals are laser-guided bombs (LGBs).³⁸¹ LGBs are maneuverable, free-fall weapons requiring no electronic interconnect to the aircraft deploying them.³⁸² A LGB’s internal semi active guidance system detects laser energy and guides the weapon to a target illuminated by an external laser source.³⁸³ The external laser source can be located in the delivery aircraft, another aircraft, or on the ground. Various types of both direct attack and standoff weapons employ man-in-the-loop-guidance.³⁸⁴ Man-in-the-loop systems generally require line of sight from the sensor to the target and their effectiveness is degraded by bad weather.³⁸⁵ However, unmanned aerial vehicles can be used to

³⁷⁷ See e.g. *ibid*; W.B. Scott, “Bad Weather No Deterrent for Long-Range Weapons” *Aviation Week & Space Technology* 150:18 (3 May 1999) 66. New generation U.S. PGMs include the Joint Stand-off Weapon (JSOW), the Joint Direct Attack Munition (JDAM), the Wind Corrected Munitions Dispenser (WCMD), and the Joint Air-to-Surface Stand-off Missile (JASSM). For a detailed list and description of PGMs in the U.S. inventory, See “Smart Weapons,” *supra* note 364.

³⁷⁸ See “What’s New With Smart Weapons,” *supra* note 376.

³⁷⁹ See e.g. R. Wall, “Long-Range Calcm Proposed for Future B-52 Use” *Aviation Week & Space Technology* 151:13 (27 September 1999) 60; D.A. Fulghum, “USAF Eyes New Cruise Missile” *Aviation Week & Space Technology* 150:12 (22 March 1999) 84.

³⁸⁰ See *Kosovo After Action Report*, *supra* note 221 at 87.

³⁸¹ See “What’s New With Smart Weapons,” *supra* note 376.

³⁸² See “Laser Guided Bombs,” online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/smart/lgb.htm>> (last modified: 12 February 2000). For a detailed description of how LGBs work, see *ibid*.

³⁸³ See *ibid*.

³⁸⁴ Direct attack munitions include LGBs and the U.S. Maverick missile (AGM 65). Standoff weapons include the U.S. AGM 130 and HAVE NAP (AGM 142) missiles. See e.g. “Smart Weapons,” *supra* note 364; *Kosovo After Action Report*, *supra* note 221 at Table 1.

³⁸⁵ See *Kosovo After Action Report*, *ibid*. at 87.

overcome the problems bad weather poses by flying below cloud layers to direct LGBs after they are released from manned aircraft flying safely above the clouds.³⁸⁶

b. GPS Guided Munitions

The expansion of the U.S. PGM arsenal is largely due to the introduction of relatively inexpensive and highly accurate GPS guidance systems.³⁸⁷ U.S. GPS guidance weapons incorporate receivers for the Navstar Global Positioning System and use satellite input to track to specific target coordinates.³⁸⁸ GPS guided munitions provide accuracy comparable to that of laser-guided bombs, are capable of all weather employment, and do not require line of sight target designation systems.³⁸⁹ GPS guidance systems are incorporated into direct attack, standoff and long-range weapons.³⁹⁰ Unlike man-in-the-loop guided weapons requiring line of sight, GPS guided munitions allow for higher altitude delivery without sacrificing accuracy.³⁹¹

3. *Impact of Conventional Weapons on the Law Governing Aerospace Warfare*

Together with the information gleaned from modern information systems, PGMs will arguably work to ease compliance with the basic principles of the law of armed conflict. Recent armed conflicts have demonstrated a preference for the use of PGMs against targets located in populated areas where the risk of civilian casualties and collateral damage is high.³⁹² Where a warring party has the means to do so, the law of

³⁸⁶ See D.A. Fulghum, "Kosovo Conflict Spurred New Airborne Technology Use" *Aviation Week & Space Technology* 151:8 (23 August 1999) 30 [hereinafter "Kosovo Conflict Spurred New Airborne Technology Use"].

³⁸⁷ See "What's New With Smart Weapons," *supra* note 376. New-generation GPS guided munitions recently used by the U.S. in Yugoslavia in 1999 include the JDAM and the JSOW. For technical information on the JDAM and JSOW, see e.g. "Smart Weapons," *supra* note 364; W.B. Scott, "Bad Weather No Deterrent for Long-Range Weapons" *Aviation Week & Space Technology* 150:18 (3 May 1999) 66 at 67. U.S. GPS weapons under development include improved versions of the TLAM and the new Joint Air-to-Surface Standoff Missile (JASSM). See *Kosovo After Action Report*, *supra* note 221 at 87. For a detailed description of the TLAM and JASSM, see "Smart Weapons," *supra* note 364.

³⁸⁸ See e.g. "Smart Weapons," *ibid*; "What's New With Smart Weapons," *supra* note 376.

³⁸⁹ See e.g. "What's New With Smart Weapons," *ibid*; *Kosovo After Action Report*, *supra* note 221 at 87-88.

³⁹⁰ Direct attack GPS guided weapons include the new U.S. JDAM, a 2,000 pound bomb employed for the first time in Yugoslavia in 1999. Standoff weapons include the U.S. SLAM and new 1,000 pound Joint Standoff Weapon (JSOW) that delivers combined effects bomblets. Long range GPS guided cruise missiles include the TLAM and CALCM. See *Kosovo After Action Report*, *ibid*. at Table 1, 91-92.

³⁹¹ See "What's New With Smart Weapons," *supra* note 376.

³⁹² See Chapter II, above.

armed conflict, specifically the principle of discrimination, may require the use of PGMs against such targets.³⁹³ Moreover, as PGMs become increasingly accurate, the principle of proportionality is likely to allow ever-fewer civilian casualties and less and less collateral damage.

The use of PGMs in future combat will increasingly reduce the number of civilian casualties and collateral damage resulting from aerial attacks. The principle of proportionality and the Geneva Conventions recognize the inevitability of collateral damage caused by a lawful attack.³⁹⁴ However, the law of armed conflict in the twenty-first century might require civilian casualties and collateral damage to be the exception rather than the rule. According to one commentator, “information systems and brilliant weaponry is likely to push traditional proportionality calculations towards a point where immediately foreseeable collateral damage and incidental injury is unacceptable, at least when caused by a technologically advanced military.”³⁹⁵ The principle of proportionality will not lose its utility, however. Civilian casualties and collateral damage are certain to remain an unfortunate consequence of war. When civilian casualties and collateral damage do occur, the evaluation of the legality of the attack will likely require the employment of a standard of “due care” to determine the appropriateness of the selected target and weapon chosen for the attack.³⁹⁶ Moreover, the principle of proportionality will remain useful in assessing secondary effects of an attack such as the impact on the civilian population of an attack on a dual use target or a State’s infrastructure.³⁹⁷

As the major powers of the world continue to acquire PGMs while the lesser powers lack the economic and technological capacity to do so, adversaries in twenty-first century warfare may be held to different standards.³⁹⁸ States that can afford PGMs may be required to use them to comply with the new principles of discrimination and proportionality whereas States that cannot afford them will not be required to do so. Although an identical legal standard of due care will be applied to all States, in practice,

³⁹³ The principle of discrimination is discussed in Chapter I, Part B1a, above.

³⁹⁴ See Chapter I, Part B2a(2), above.

³⁹⁵ “*Bellum Americanum*,” *supra* note 325 at 1080.

³⁹⁶ See *ibid.* at 1081.

³⁹⁷ See *e.g. ibid.* at 1082; “The Principle of Discrimination in 21st Century Warfare,” *supra* note 325 at 168.

³⁹⁸ See *e.g.* “*Bellum Americanum*,” *supra* note 325 at 1088; “The Principle of Discrimination in 21st Century Warfare,” *supra* note 325 at 170-171.

the States with PGM capability will be held to a higher standard requiring PGM use. This concept could be taken to the extreme of requiring States economically capable of doing so to arm themselves with PGMs.³⁹⁹

Although the law of armed conflict will arguably require the use of PGMs against targets located in populated areas, the use of unguided weapons, legal under the current laws of armed conflict, is likely to remain so into the foreseeable future. Unguided bombs capable of accuracy comparable to that of available PGMs will remain lawful against targets in populated areas and targets that are not in close proximity to the civilian population will certainly remain subject to lawful attack by unguided weapons. However, the use of cluster bombs has come under a great deal of scrutiny recently because of the risk to the civilian population from unexploded ordinance.⁴⁰⁰ While at least 95 percent of submunitions released explode, up to five percent are duds.⁴⁰¹ According to studies, 40 percent of the duds on the ground are hazardous and there is a 13 percent probability of detonation for each encounter with an unexploded submunition.⁴⁰² The potentially indiscriminate effects of cluster bombs have prompted some observers to call for a ban on their use.⁴⁰³

C. Weapons of Mass Destruction (Nuclear, Chemical and Biological Weapons)

1. Nuclear Weapons

Since their advent, nuclear weapons have been the most feared weapon of mass destruction because of their ability to cause enormous and instantaneous devastation and the subsequent effects of the radiation they emit.⁴⁰⁴ Today nuclear weapons are not

³⁹⁹ See "Bellum Americanum," *supra* note 325 at 1088.

⁴⁰⁰ See e.g. *A Report on United States War Crimes Against Iraq*, *supra* note 192; "The Gulf War: Not So Clean," *supra* note 192; "...And the Dirty Little Weapons," *supra* note 192; "Civilian Deaths in the NATO Air Campaign," *supra* note 237.

⁴⁰¹ See "Cluster Bombs," *supra* note 372.

⁴⁰² See *ibid.*

⁴⁰³ See e.g. C. Capati, "The Tragedy of Cluster Bombs in Laos: An Argument for Inclusion in the Proposed International Ban on Landmines" (1997) 16 Wis. Int'l L.J. 227; "Drop Today, Kill Tomorrow: Cluster Bombs as Inhumane and Indiscriminate Weapons," online: Mennonite Central Committee <<http://www.mcc.org/misc/drop-today.html>> (date accessed: 3 May 2000).

⁴⁰⁴ See "Bombs for Beginners: Introduction," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/nuke/intro.htm>> (last modified 21 October 1998). For a discussion on U.S. Nuclear Forces, see "Nuclear Forces Guide: United States Nuclear Forces," online: Federation of American Scientists <<http://www.fas.org/nuke/guide/usa/forces.htm>> (last modified 31 July 1999) [hereinafter "Nuclear Forces Guide"].

difficult to construct, the most formidable obstacle being the acquisition of sufficient weapon-grade material (uranium 235 or plutonium 239).⁴⁰⁵ Once the weapon itself has been constructed, nuclear warheads can be delivered to the target via numerous vehicles including unguided bombs, cruise missiles, ballistic missiles, theater ballistic missiles (TBMs) or intercontinental ballistic missiles (ICBMs).⁴⁰⁶

2. Chemical and Biological Weapons

Chemical weapons produce physical or physiological effects upon humans by using the toxic properties of chemical substances contained in these weapons.⁴⁰⁷

Biological weapons differ from chemical weapons in that living organisms or toxins are used to produce physical or physiological effects upon humans rather than chemicals.⁴⁰⁸

Chemical and biological agents are relatively simple to manufacture; any State capable of producing beer or household pesticides has the potential to produce chemical and biological weapons.⁴⁰⁹ Moreover, States with a developed military infrastructure can

⁴⁰⁵ See "Nuclear Forces Guide, *ibid.*

⁴⁰⁶ A cruise missile is "an unmanned self-propelled guided vehicle that sustains flight through aerodynamic lift for most of its flight path and whose primary mission is to place an ordnance or special payload on a target." "Bombs for Beginners: Cruise Missiles," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/cm/index.html>> (date accessed: 3 May 2000). For a detailed discussion on cruise missiles, see *ibid.* "Ballistic missiles have a prescribed course that cannot be altered after the missile has burned its fuel, unless a warhead maneuvers independently of the missile or some form of terminal guidance is provided." "Bombs for Beginner: Ballistic Missile Basics," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/missile/basics.htm>> (last modified 3 February 2000). For a detailed discussion on ballistic missiles, see *ibid.* TBMs are ballistic missiles with a range of less than 3,500 kilometers. For a detailed discussion on TBMs, see "Bombs for Beginners: Theater Ballistic Missiles," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/missile/tbm.htm>> (last modified: 25 October 1998). ICBMs have ranges greater than 5,500 kilometers. For a detailed discussion on ICBMs, see "Bombs for Beginners: Intercontinental Ballistic Missiles," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/missile/icbm.htm>> (last modified 25 October 1998).

⁴⁰⁷ There are various types of chemical agents. Choking agents irritate the eyes and respiratory tract; blood agents prevent transfer of oxygen to tissues; blister agents inflict painful burns and blisters; and nerve agents affect the central nervous system. See "Bombs for Beginners: Chemical Weapons – Introduction," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/cw/intro.htm>> (last modified: 21 October 1998). For a list of U.S. chemical weapons, see "Nuclear Forces Guide: Chemical Weapons," online: Federation of American Scientists <<http://www.fas.org/nuke/guide/usa/cbw/cw.htm>> (last modified: 19 October 1998).

⁴⁰⁸ Biological agents that may be used as weapons include bacteria, viruses, rickettsiae, fungi and toxins. All are living organisms with the exception of toxins. Although not living, toxins are poisonous substances produced and derived from living plants, animals or microorganisms. See "Bombs for Beginners: Biological Weapons," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/bw/intro.htm>> (last modified: 21 October 1998).

⁴⁰⁹ See P. Mann, "Bio-Warfare Called 'Weapon of Choice'" *Aviation Week & Space Technology* 150:15 (12 April 1999) 68 [hereinafter "Bio-Warfare Called 'Weapon of Choice'"] at 68.

readily adapt existing munitions for chemical and biological warfare. Chemical and biological weapon delivery vehicles include bombs, missiles, submunitions, projectiles, and even spray tanks.⁴¹⁰

3. Impact of Weapons of Mass Destruction on the Law Governing Aerospace Warfare

Although the use of nuclear weapons is legally permissible only under extreme circumstances, if at all, and the use of both chemical and biological weapons is unlawful under current international law, the proliferation of all three continues, making weapons of mass destruction an increasing threat to world security.⁴¹¹ Biological and chemical weapons are reportedly emerging as the weapons of choice to combat U.S. military superiority.⁴¹² When a lesser power faces a major power capable of military domination, it may well consider the use of weapons of mass destruction.⁴¹³ For example, although Iraq possessed a formidable military power, it was widely believed that Iraq would use chemical weapons in the Persian Gulf War. The challenge of the twenty-first century will be to ensure compliance with nuclear, chemical and biological weapons treaties. Moreover, as the proliferation of weapons of mass destruction continues, States are likely to develop weapon systems to defend against them. A Center for Strategic and International Studies report recommends the Pentagon establish a priority mission to develop, deploy and operate defensive measures to protect U.S. territory.⁴¹⁴ The U.S. is already researching and developing ballistic missile defense systems to defend against

⁴¹⁰ See e.g. "Bombs for Beginners: Chemical Weapon Delivery," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/cw/deliver.htm> (last modified: 21 October 1998); "Bombs for Beginners: Biological Weapon Delivery," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/bw/delivery.htm>> (last modified: 21 October 1998).

⁴¹¹ See P. Mann, "Multinational Warnings Issued on Weapons of Mass Destruction" *Aviation Week & Space Technology* 151:12 (20 September 1999) 60 [hereinafter "Multinational Warnings Issued on Weapons of Mass Destruction"]. The legality of nuclear weapons is discussed in Chapter I, Part B2c(3), above. The legality of chemical and bacteriological weapons is discussed in Chapter I, Parts B2a(1), B2c(2), above.

⁴¹² See "Bio-Warfare Called 'Weapon of Choice,'" *supra* note 409. See also, "Principle of Discrimination in 21st Century Warfare," *supra* note 325 at 155-156.

⁴¹³ See "Principle of Discrimination in 21st Century Warfare," *ibid.* at 155-156.

⁴¹⁴ See "Bio-Warfare Called 'Weapon of Choice,'" *supra* note 409 at 69.

ballistic missile delivery systems.⁴¹⁵

D. Aircraft

Vast numbers and types of aircraft both fixed wing and rotary are today employed by the world's armed forces.⁴¹⁶ Their functions are many and include attack, intelligence, surveillance, reconnaissance, command and control, electronic combat, aerial refueling, search and rescue and transport. Modern military aircraft are capable of delivering virtually any type of weapon (unguided, precision guided munition, nuclear, chemical or biological) to a target and with aerial refueling, bombers and other attack aircraft can attack targets located on the opposite side of the globe. Future airborne weapon systems may even be equipped with directed-energy weapons.⁴¹⁷

1. Stealth Aircraft

Stealth in the context of military technology essentially means the ability to avoid radar detection. Stealth technology employs special composite materials and the shape of an object to reduce its radar signature.⁴¹⁸ Stealth is relatively simple in principle, it involves designing an aircraft or other object so that incoming radar signals are deflected away from the aircraft or absorbed by special coatings on the aircraft.⁴¹⁹ Stealth aircraft

⁴¹⁵ Ballistic missile defense systems are discussed in Part F, below.

⁴¹⁶ For a detailed list and description of U.S. military aircraft, see "US Military Aircraft," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/index.html>> (date accessed: 3 May 2000). For a detailed list and description of military aircraft used by States other than the U.S., see "Rest of World Military Aircraft" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/row/index.html>> (date accessed: 3 May 2000). For detailed tables regarding all the world's military aircraft that include information such as weapons type, combat radius, maximum loads and maximum speeds, see e.g. "Fixed Wing Aircraft" online: Federation of American Scientists <http://www.fas.org/man/dod-101/sys/ac/row/fwair_frame.htm> (last modified: 31 August 1999); "Helicopters" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/row/helos.htm>> (last modified: 31 August 1999).

⁴¹⁷ See "B-2 Follow-on Design Revealed" *Aviation Week & Space Technology* 151:13 (27 September 1999) 57 [hereinafter "B-2 Follow-on Design Revealed"]. Directed-energy weapons are discussed at Part E, below.

⁴¹⁸ While stealth technology reduces the radar signature of an aircraft, stealth aircraft are not completely invisible to radar. For example, the new U.S. F-22 Raptor is expected to have the radar signature of a marble and the JSF the size of a golf ball. See e.g. D.A. Fulghum, "F-22, JSF Designed For Distinct Roles" *Aviation Week & Space Technology* 152:6 (7 February 2000) 52 [hereinafter "F-22, JSF Designed For Distinct Roles"]; D.A. Fulghum, "JSF Reflection Is Golf-Ball Sized" *Aviation Week & Space Technology* 150:7 (15 February 1999) 27.

⁴¹⁹ See D.A. Fulghum, "Small Stealth Designs Within China's Grasp" *Aviation Week & Space Technology* 150:23 (7 June 1999) 28 [hereinafter "Small Stealth Designs Within China's Grasp"] at 28.

are capable of flying through enemy air defense systems unnoticed. The world's first operational stealth aircraft was the U.S. F-117A Nighthawk and there are currently two known operational stealth aircraft, the F-117 and the U.S. B-2 Spirit.⁴²⁰ While the U.S. currently has the only operational stealth aircraft, Russia is reportedly designing a stealth bomber and the technology may be within China's grasp as well.⁴²¹

Military aircraft of the twenty-first century are likely to increasingly employ stealth technology. The U.S. currently has two stealth aircraft in development, the F-22 Raptor and the Joint Strike Fighter (JSF). The F-22 is the U.S. Air Force's next-generation air superiority fighter and will be capable of engaging multiple targets and carrying two precision-guided Joint Defense Attack Munitions for its air-to-ground role.⁴²² Initial operational capability of the F-22 is scheduled for December 2005.⁴²³ The JSF is a multi-role fighter designed primarily for an air-to-ground role and will be used by the U.S. Air Force, Navy and Marine Corps and U.S. allies (e.g. United Kingdom).⁴²⁴ Delivery of the first operational JSF is currently slated for fiscal year 2008.⁴²⁵ Although stealth may be the wave of the future, conventional military aircraft continue to be designed, developed and built.⁴²⁶

Aircraft are not the only aerial instrumentalities that can employ stealth technology. Cruise and ballistic missiles can be made stealthy as well and U.S. intelligence officials believe such weapons could be on the world market within a few

⁴²⁰ For detailed information on the F-117, see "USAF Fact Sheet 96-04: F-117A Nighthawk" online: United States Air Force <http://www.af.mil/news/factsheets/F_117A_Nighthawk.html> (last modified: March 1996). For detailed information on the B-2, see "USAF Fact Sheet: B-2 Spirit" online: United States Air Force <http://www.af.mil/news/factsheets/B_2_Spirit.html> (last modified: March 1999).

⁴²¹ See e.g. C. Covault & D.A. Fulghum, "Russian Stealth Bomber Design Work Underway" *Aviation Week & Space Technology* 152:15 (10 April 2000) 18; "Small Stealth Designs Within China's Grasp," *supra* note 419 at 28.

⁴²² See e.g. "F-22 Raptor" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/f-22.htm>> (last modified: 25 April 2000) [hereinafter "F-22 Raptor"]; D.A. Fulghum, "New F-22 Radar Unveils Future" *Aviation Week & Space Technology* 152:6 (7 February 2000) 50. See also "F-22, JSF Designed For Distinct Roles," *supra* note 418.

⁴²³ See "F-22 Raptor," *supra* note 422.

⁴²⁴ See "Joint Strike Fighter (JSF)" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/jsf.htm>> (last modified: 2 January 2000). See also "F-22, JSF Designed For Distinct Roles," *supra* note 418.

⁴²⁵ See "F-22, JSF Designed For Distinct Roles," *ibid.*

⁴²⁶ See M.A. Taverna, J. Fricker & H. Gethin, "New Fighters Star at Moscow" *Aviation Week & Space Technology* 151:10 (6 September 1999) 70.

years, increasing the difficulty in timely identification of the launching entity.⁴²⁷ To combat the coming proliferation of stealth technology, U.S. defense officials believe a new blend of technologies will soon allow them to detect stealth threats in the air, whether the threat consists of an aircraft, cruise missile or ballistic missile.⁴²⁸

2. *Unmanned Aerial Vehicles*

Unmanned aerial vehicles (UAVs) are remotely piloted or self-piloted miniature aircraft that can carry cameras, sensors, communication equipment or other payloads.⁴²⁹ Current UAVs are either tactical or endurance.⁴³⁰ Tactical UAVs have a range of approximately 200 kilometers, perform a wide variety of reconnaissance, surveillance, target acquisition and battle damage assessment missions and can provide tactical commanders with real-time images.⁴³¹ Endurance UAVs provide similar types of information but have a greater range (500 or more nautical miles), can fly at far greater altitudes (up to 65,000 feet) and can fly for longer periods of time (over 40 hours).⁴³² UAVs will likely garner an increasing intelligence, surveillance and reconnaissance role in the near future and are being considered for use in signals intelligence, electronic

⁴²⁷ See D.A. Fulghum, "New Radars Peel Veil from Hidden Targets" *Aviation Week & Space Technology* 150:3 (18 January 1999) 58.

⁴²⁸ See *ibid.*

⁴²⁹ See "UAVs," *supra* note 340. Several UAVs in flight test programs are as small as 6 inches. See M.A. Dornheim, "Several Micro Air Vehicles in Flight Test Programs" *Aviation Week & Space Technology* 151:2 (12 July 1999) 47.

⁴³⁰ For a detailed table regarding various types of UAVs including information on UAV mission, payload, weight, speed, endurance and maximum altitude, see "Worldwide UAV Systems" online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/row/uav-list.htm>> (date accessed: 3 May 2000).

⁴³¹ See *e.g. ibid.*; "Navy Fact File: RQ-2A Pioneer Unmanned Aerial Vehicle (UAV)," online: The United States Navy <<http://www.chinfo.navy.mil/navpalib/factfile/aircraft/air-uav/html>> (date accessed: 3 May 2000) [hereinafter "Pioneer UAV"]. Examples of tactical UAVs are the U.S. "Hunter" and the "Pioneer" UAVs. The Hunter provides ground and maritime forces with near-real-time imagery intelligence at ranges up to 200 kilometers and by using a second Hunter UAV as an airborne relay, the range can be extended to greater than 300 kilometers. The Hunter can fly as long as 12 hours at altitudes up to 15,000 feet. See "UAVs," *supra* note 340. The Pioneer has a range of over 100 nautical miles and can fly at an altitude of up to 12,000 feet for 5.5 hours. See *e.g. ibid.*; "Pioneer UAV," *supra* note 431. For a list a description of various UAVs, see "UAVs," *supra* note 340.

⁴³² Examples of endurance UAVs, are the U.S. "Predator" and "Global Hawk." The Predator (a medium altitude endurance UAV) has a range of approximately 500 nautical miles and can fly as long as 29 hours at altitudes exceeding 40,000 feet. The Global Hawk (a high altitude endurance UAV) has an endurance of 42 hours, can fly as high as 65,000 feet and can launch from the U.S. to perform ISR missions anywhere in the world. See "UAVs," *ibid.*

jamming and in counteracting chemical and biological warfare.⁴³³ In the twenty-first century, they will most likely take on a combat role as well.

UAVs are already capable of operating as laser designators for laser guided bombs in combat⁴³⁴ and a new unmanned combat aerial vehicle (UCAV) is being developed by Boeing for the U.S. Air Force. The first demonstrator UCAV is expected to be complete by September 2000. The UCAVs are expected to have a mission radius of 500 to 1,000 nautical miles and a weapons payload of 1,000 to 3,000 pounds.⁴³⁵ They will be capable of carrying Joint Defense Attack Munitions and other types of precision guided munitions. Furthermore, stealth will be a component of any production UCAV. While the UCAV's missions would initially be limited to air defense suppression and strikes against well defended targets, their missions could later be expanded to include electronic jamming and attacking mobile ballistic missile launchers.⁴³⁶ A single operator may be able to control three to five UCAVs from the ground and a little further into the future, manned aircraft will potentially control multiple UCAVs.⁴³⁷

3. Impact of Aircraft on the Law Governing Aerospace Warfare

Twenty-first century military aircraft and their associated weapon systems will work in concert with modern information systems and conventional weapons to reduce civilian casualties and collateral damage in accord with the laws of armed conflict as previously discussed. Care must be taken, however, to ensure that aircraft do not serve the unintended purpose of increasing the risk to protected people and objects. While stealth aircraft and UCAVs certainly provide a distinct military advantage and a measure of added protection for combatants, moving human beings too far from the heart of the battle could produce catastrophic results. Unlike humans, machines do not possess the capability to readily distinguish between legitimate military targets and protected objects

⁴³³ See e.g. R. Wall, "Army Eyes UAVs for Sigint, Jamming" *Aviation Week and Space Technology* 151:20 (15 November 1999) 97; "Multinational Warnings Issued on Weapons of Mass Destruction," *supra* note 411; "USAF Maps Out Future of Global Hawk UAV," *supra* note 343.

⁴³⁴ See "Kosovo Conflict Spurred New Airborne Technology Use," *supra* note 386 at 30.

⁴³⁵ See S.W. Kandebo, "Boeing UCAV Aims for September Rollout" *Aviation Week & Space Technology* 152:13 (27 March 2000) 32.

⁴³⁶ See D.A. Fulghum, "UCAV's Mission, Design Redefined" *Aviation Week & Space Technology* 151:12 (20 September 1999) 55 at 56.

⁴³⁷ See e.g. *ibid.*; "B-2 Follow-on Design Revealed," *supra* note 417.

nor can they distinguish between civilians and combatants. When UCAVs are employed in combat, the law of armed conflict may require they be used against targets where there is virtually no question as to the target's military character. Moreover, any weapon delivered by a UCAV should be of a type to ensure minimal risk of collateral damage and incidental injury without the need of human input.

E. Non-Lethal and Directed-Energy Weapons

Non-lethal and directed-energy weapons are likely to become a reality in twenty-first century warfare.⁴³⁸ For example, non-lethal acoustic weapons could be used to induce nausea in the combatant while microwaves could induce seizures or bring on discomfort by raising body their temperature.⁴³⁹ Directed-energy weapons such as electromagnetic pulse (EMP) could cause aircraft to fall out of the sky or disrupt large segments of a nation's infrastructure. One type of non-lethal weapon has already been used in armed conflict. As early as the Persian Gulf War in 1991, and again on a larger scale in Yugoslavia in 1999, the U.S. delivered munitions dispensers dispersing submunitions containing reels of flexible, specially treated wire that unwound in the air and draped over high voltage wires.⁴⁴⁰ These wires created electrical shorts tripping circuit breakers and shutting down electrical power without destroying power grids or causing any collateral damage. The U.S. reportedly has an operational weapon (delivered by a glide bomb or cruise missile) that when exploded produces a pulse of high power microwaves that can disable electronic circuitry in computers and communications equipment and may even erase computer software and memories.⁴⁴¹ High-energy lasers and microwave weapon, detection and communication systems could be operational in

⁴³⁸ For an in depth analysis of numerous types of non-lethal weapons, see J.B. Alexander, *Future War: Non-Lethal Weapons in Twenty-First-Century Warfare* (New York: St. Martin's Press, 1999) [hereinafter *Non-Lethal Weapons in Twenty-First-Century Warfare*].

⁴³⁹ See "Bellum Americanum," *supra* note 325 at 1066.

⁴⁴⁰ See e.g. "Russians Analyze U.S. Blackout Bomb," *supra* note 235; "Electronic Bombs Darken Belgrade," *supra* note 235.

⁴⁴¹ See "D.A. Fulghum, "Microwave Weapons Await a Future War" *Aviation Week & Space Technology* 150:23 (7 June 1999) 30 [hereinafter "Microwave Weapons Await a Future War"].

the next few years.⁴⁴² The only difference between a laser and microwave device is the electronic frequency with which it operates.⁴⁴³

Electromagnetic pulse (EMP) weapons basically operate by generating one or more very intense pulses of electromagnetic power that penetrate equipment to degrade or destroy electronic circuitry.⁴⁴⁴ A device is exploded over an intended target producing the EMP. EMP was first observed in high-altitude airburst nuclear weapons testing although non-nuclear explosions are also capable of generating EMP.⁴⁴⁵ One of the early problems with EMP was controlling the area covered ("footprint") of the EMP. However, the accuracy of precision-guided munitions has, for the most part, resolved that problem.⁴⁴⁶ The new U.S. EMP weapon reportedly covers an area the size of a football field on a good day, although its effective range can be far less.⁴⁴⁷ The U.S. is not the only State conducting EMP research and development; Germany, France, Russia and the United Kingdom are believed to have EMP programs as well.⁴⁴⁸

1. Impact of Non-Lethal and Directed-Energy Weapons on the Law Governing Aerospace Warfare⁴⁴⁹

Non-lethal and energy directed weapons such as EMP, although they are less deadly, also tend to be less discriminatory in that they do not distinguish between military and civilian systems.⁴⁵⁰ Massive or uncontrolled EMP strikes could completely destroy a nation's infrastructure, including telecommunications, financial, transportation and energy systems. While potentially less discriminatory, non-lethal and energy directed weapons appear to have the advantage of causing few if any civilian casualties and property destruction. For example, the explosion of an EMP weapon is not the cause of

⁴⁴² See W.B. Scott, "'Beam' Weapons Edging Into Arsenals" *Aviation Week & Space Technology* 151:1 (5 July 1999) 53 [hereinafter "'Beam' Weapons Edging Into Arsenals"].

⁴⁴³ See *ibid.* at 53.

⁴⁴⁴ See *Non-Lethal Weapons in Twenty-First-Century Warfare*, *supra* note 438 at 65.

⁴⁴⁵ See *ibid.*

⁴⁴⁶ See *ibid.* at 66.

⁴⁴⁷ See "Microwave Weapons Await a Future War," *supra* note 441 at 30.

⁴⁴⁸ See *Non-Lethal Weapons in Twenty-First-Century Warfare*, *supra* note 438 at 66.

⁴⁴⁹ For a detailed analysis on the legality of non-lethal weapons, see e.g. D.P. Fidler, "The International Legal Implications of 'Non-Lethal' Weapons" (1999) 21 *Mich. J. Int'l L.* 51; J.C. Duncan, "A Primer on the Employment of Non-Lethal Weapons" (1998) 45 *Naval L. Rev.* 1.

⁴⁵⁰ See e.g. *Non-Lethal Weapons in Twenty-First-Century Warfare*, *supra* note 438 at 66; "Bellum Americanum," *supra* note 325 at 1079-1080.

the actual damage, although the affected electrical components and computer systems are significantly damaged or destroyed.

Non-lethal weapons derive from a desire to further the principle of proportionality in warfare; less precise weapons are favored in lieu of less lethal ones.⁴⁵¹ Thus, according to one observer, “there will be significant support for relaxing the demands of discrimination when it conflicts with efforts to enhance proportionality by limiting the quantum of collateral damage and incidental injury.”⁴⁵² One must be careful, however, in assuming such weapons will enhance proportionality in every circumstance. Crippling a significant segment of a nation’s infrastructure to spare the lives of a few civilians or avoid the destruction of a building could instead have the undesirable effect of causing massive and widespread collateral damage and incidental injury such as shutting down transportation, financial and/or electrical systems. Moreover, where new weapons are capable of producing physiological effects in humans, such as inducing nausea or seizures, the legality of their use may be questioned by humanitarian considerations.⁴⁵³ The law of aerospace warfare in the twenty-first century is likely to require meticulous planning and precision before any such weapons could be employed on a large scale. One consequence of these new weapons could be demands for the conclusion of a multilateral agreement regulating or even banning their use.

F. Ballistic Missile Defense Systems

The troubles experienced by Coalition forces in locating and destroying Scud missiles in the Persian Gulf war, as well as Iraq’s indiscriminate use of the missiles, prompted the U.S. to accelerate research and development of ballistic missile defense systems.⁴⁵⁴ The U.S. is currently working on several “theater missile defense” (TMD) systems in addition to those already operational and on the controversial “national missile

⁴⁵¹ See “*Bellum Americanum*,” *ibid.* at 1080.

⁴⁵² *Ibid.*

⁴⁵³ See *ibid.* at 1085.

⁴⁵⁴ See D.E. Grogan, “Power Play: Theater Ballistic Missile Defense, National Ballistic Missile Defense and the ABM Treaty” (1999) 39 Va. J. Int’l L. 799 [hereinafter “Power Play”] at 825-826. While the U.S. is quite worried about the ballistic missile threat, in Europe there is far less concern and European States seem content to rely on U.S. technology and systems. See J.D. Morrocco, “Allies Pursue Few Indigenous Project” *Aviation Week & Space Technology* 151:7 (16 August 1999) 76.

defense” (NMD) system.⁴⁵⁵ TMD systems are designed to provide ballistic missile defense in the operating theater of an armed conflict whereas the NMD system would protect the continental U.S. from the threat of a limited ballistic missile attack from a “rogue” State.⁴⁵⁶

1. Theater Missile Defense

Current U.S. TMD systems include the surface-to-air HAWK Air Defense System and a version of the PATRIOT Advanced Capability System (PAC).⁴⁵⁷ Although both systems were initially designed as anti-aircraft systems, they are being continuously upgraded to enhance their capability against tactical ballistic missiles.⁴⁵⁸ They are radar guided missile systems that detonate their warheads near their targets by proximity fuses. The U.S. is also working on several new TMD systems including the Theater High Altitude Area Defense (THAAD) system and the Medium Extended Air Defense System (MEADS).⁴⁵⁹ MEADS is a joint venture of Germany, Italy and the U.S. and will be a highly mobile, low to medium air defense system used to protect maneuvering forces. MEADS is expected to replace current HAWK and PAC systems. THAAD, on the other hand, is a high altitude TMD system designed to engage incoming missiles at ranges of up to several hundred kilometers and to protect forward-deployed military forces, population centers and civilian assets. A long-range naval system (Navy Theater Wide

⁴⁵⁵ For a detailed description of U.S. missile defense systems, including Navy systems, see e.g. “Special Weapons Monitor” online: Federation of American Scientists <<http://www.fas.org/spp/starwars/program/index.html>> (date accessed 3 May 2000) [hereinafter “Special Weapons Monitor”]; United States, Office of the Director, Operational Test and Evaluation *Fiscal Year 1999 Report to Congress* (Washington, D.C., 2000) available online: Federation of American Scientists <<http://www.fas.org/spp/starwars/program/dote99.html>> (date accessed 3 May 2000) [hereinafter *DOT&E Report*].

⁴⁵⁶ See e.g. “NMD” online: Federation of American Scientists <<http://www.fas.org/spp/starwars/program/dote99.htm>> (date accessed: 3 May 2000) [hereinafter “NMD”]; *DOT&E Report*, *supra* note 455.

⁴⁵⁷ For detailed information on the HAWK, see “HAWK” online: Federation of American Scientists <<http://www.fas.org/spp/starwars/program/hawk.htm>> (last modified: 22 January 1999). For detailed information on PAC systems, see “Patriot TMD” online: Federation of American Scientists <<http://www.fas.org/spp/starwars/program/patriot.htm>> (date accessed: 3 May 2000) [hereinafter “Patriot TMD”]. The U.S. also operates the Navy Area Theater Ballistic Missile Defense system. See e.g. “Special Weapons Monitor,” *supra* note 455; *DOT&E Report*, *supra* note 455.

⁴⁵⁸ See e.g. “Patriot TMD,” *supra* note 457; *DOT&E Report*, *supra* note 455.

⁴⁵⁹ For detailed information on THAAD, see *DOT&E Report*, *supra* note 455. For detailed information on MEADS, see e.g. “Medium Extended Air Defense System (MEADS)” online: Federation of American Scientists <<http://www.fas.org/spp/starwars/program/meads.htm>> (last modified: 28 December 1997); *DOT&E Report*, *supra* note 455.

System (NTW)) is also under development.⁴⁶⁰ Both MEADS and THAAD should destroy incoming ballistic missiles by using hit-to-kill (actual impact) technology as opposed to the proximity detonation systems employed by HAWK and PAC systems. THAAD could become partially operational as early as 2007.⁴⁶¹ Another TMD system under development in the U.S. is the Airborne Laser (ABL). The ABL is intended to shoot down theater ballistic missiles by focusing a laser on the missile's booster skin, rupturing it or damaging it enough to cause the missile to lose thrust or flight control.⁴⁶² The laser will be carried on a modified Boeing 747-400F aircraft and the U.S. Air Force is proposing a fleet of seven aircraft.

2. National Missile Defense

In 1996, the U.S. began developing a NMD system which was to become ready for deployment by 2000, when the program would be reviewed and a decision made whether or not to deploy the system, depending on the severity of the ballistic missile threat to the U.S., the effectiveness of the technology, the cost and its impact on the ABM Treaty.⁴⁶³ The NMD system will consist of land-based, non-nuclear missiles with a space-based detection system.⁴⁶⁴ More specifically, it will be composed of three elements: an arsenal of ground based interceptor missiles; a battle management, command, control, and communications element; and four types of long-range sensors (the current Defense Support Program and future Space-Based Infrared System satellites, Upgraded Early Warning Radar, and Ground Based X Band Radar).⁴⁶⁵ All elements would work together to defend the U.S. against an incoming ballistic missile.⁴⁶⁶ If a decision is made to deploy the system, 20 interceptors could be ready for action as early as 2005, with full deployment of 100 interceptors occurring as soon as 2007.⁴⁶⁷

⁴⁶⁰ See *DOT&E Report, ibid.*

⁴⁶¹ See R. Wall, "Pentagon Considers Thaad for Fast-Track Development" *Aviation Week & Space Technology* 152:17 (24 April 2000) 80.

⁴⁶² See *DOT&E Report, supra* note 455.

⁴⁶³ See e.g. "NMD," *supra* note 456; *DOT&E Report, supra* note 455; E. Becker & E. Schmitt, "Delay Sought in Decision on Missile Defense" *The New York Times* (20 January 2000) A13 [hereinafter, "Delay Sought in Decision on Missile Defense"].

⁴⁶⁴ See e.g. "Delay Sought in Decision on Missile Defense," *ibid.*; "NMD," *supra* note 456.

⁴⁶⁵ See e.g. "NMD," *ibid.*; *DOT&E Report, supra* note 455.

⁴⁶⁶ For detailed descriptions of each segment, detailed analysis of how the system will function and a report on the status of the program, see e.g. *DOT&E Report, ibid.*; "NMD," *supra* note 456.

⁴⁶⁷ See "NMD," *ibid.*

3. *Impact of Missile Defense Systems on the Law Governing Aerospace Warfare*

Ballistic missile defense systems, particularly the U.S. NMD system, are highly controversial and have been the subject of intense debate recently as it is generally accepted that the U.S. NMD system would violate the ABM Treaty.⁴⁶⁸ Although the ABM Treaty only prohibits systems that counter strategic ballistic missiles and does not apply to systems that counter theater ballistic missiles, theater missile defense systems such as THAAD, which is capable of high altitude, long-range missile interception, could arguably violate the Treaty as well.⁴⁶⁹ A series of agreements signed by the U.S. and Russia in 1997, although not authorizing TMD systems in general, made systems such as the U.S. PAC-3, THAAD and Navy Area TMD lawful under the Treaty based on their technical specifications (e.g. the speed and range of the intercepting missiles).⁴⁷⁰

Russia currently opposes the U.S. NMD system and negotiations are underway between the U.S. and Russia, at American initiative, aimed at modifying the ABM Treaty to allow for the U.S. system. One option the U.S. is exploring would allow a single-site NMD system with interceptors based in Alaska and future negotiations would follow to expand that system to a second site.⁴⁷¹ Some U.S. Congressional supporters of NMD would prefer to negotiate the entire system at the outset⁴⁷² while others have even called for the termination of the ABM Treaty altogether.⁴⁷³ American President William J. Clinton and Russian President Vladimir V. Putin met in Moscow in early June 2000 to discuss, among other things, the U.S. NMD system. While President Putin continues to oppose the American system, he has proposed working with the U.S. and Europe to develop a joint missile defense program using short and medium range missiles to destroy ballistic missiles on their way up instead of intercepting the missiles on their way

⁴⁶⁸ The ABM Treaty is discussed in Chapter I, Part B3d, above. For a detailed analysis on the legality of both TMD and NMD systems, see e.g. "Power Play," *supra* note 454; K.M. Sorge, *Legal Implications of United States Ballistic Missile Defense Systems* (LL.M. Thesis) Institute of Air & Space Law, McGill University (1995) [unpublished].

⁴⁶⁹ Article 2, para. 1 of the ABM Treaty defines an ABM system as "a system to counter strategic ballistic missiles or their elements in flight trajectory ..." *ABM Treaty*, *supra* note 138. See also "Power Play," *supra* note 454 at 812-813.

⁴⁷⁰ See "Power Play," *ibid.* at 850-858.

⁴⁷¹ See R. Wall. "Debate Surrounding NMD Intensifies" *Aviation Week & Space Technology* 512:16 (17 April 2000) 41 at 41-43.

⁴⁷² See *ibid.* at 43.

⁴⁷³ See "Power Play," *supra* note 454 at 800.

down as the U.S. plan calls for.⁴⁷⁴ In theory, this plan would provide for ballistic missile defense from “rogue” States but would be of little use against the Russian nuclear force.⁴⁷⁵ The U.S. military do not believe the Russian approach will work and want to amend the ABM Treaty to allow for the U.S. system.⁴⁷⁶

Deploying a NMD system could have graver implications than the demise of the ABM Treaty. A review is currently taking place in the U.S. to determine the potential repercussions of fielding the U.S. NMD system.⁴⁷⁷ The review is to examine two scenarios, one where the U.S. makes a deployment decision after obtaining Russian concurrence and one where Russia continues to oppose NMD deployment.⁴⁷⁸ It is feared that a NMD deployment could trigger a new arms race, with significant increases in the number of ballistic missiles in the arsenals of States.⁴⁷⁹ Moreover, fielding such a system could cause countries like Russia and China to sell missile defense countermeasures to other countries, making it more difficult for the U.S. NMD system to intercept ICBMs.⁴⁸⁰

G. Chapter IV Summary

The ongoing revolution in military affairs, spawned by radical technological advances in information systems, weapons, aircraft and their associated weapon systems, is virtually certain to have an impact on the legal environment in which aerospace combat will be conducted in the twenty-first century. Working in concert, earth-based information systems, weapons, and weapon systems will significantly reduce targeting mistakes, civilian casualties and collateral damage. The resulting impact on the law of armed conflict will arguably be to narrow the interpretation and application of the basic principles of the law of armed conflict to the point where civilian casualties and collateral damage become the legal exception rather than the norm. Moreover, the law might permit fewer mistakes in determining and articulating the clear military objectives of

⁴⁷⁴ See A. Stanley, “Putin Travels to Rome to Promote Russian Arms Control Alternative” *The New York Times* (6 June 2000) A1.

⁴⁷⁵ See *ibid.*

⁴⁷⁶ See *ibid.*

⁴⁷⁷ See R. Wall, “Review of NMD Fallout Underway” *Aviation Week & Space Technology* 152:19 (8 May 2000) 31 [hereinafter “Review of NMD Fallout Underway”].

⁴⁷⁸ See *ibid.* at 31.

⁴⁷⁹ See *e.g. ibid.*; E. Eckholm, “Missile Defense would Set Off Arms Race, China Warns” *The New York Times* (25 November 1999) A11.

⁴⁸⁰ See “Review of NMD Fallout Underway,” *supra* note 477 at 31.

targets. While earth-based assets will work to ease compliance with the law of armed conflict in one context, increasingly intermingled military and civilian assets and other dual use targets could, paradoxically, make the practical application of and adherence to the law more difficult.

The evolving law of aerospace warfare will arguably require adversaries to use precision guided munitions against targets located in populated areas provided they have the means to do so. Unguided weapons may remain legal against targets in heavily populated areas only where their accuracy is comparable to that of available PGMs but they will certainly remain lawful against targets that are not located in close proximity to the civilian population. Moreover, the widening gap between States possessing advanced technology and those without might cause the law to be applied selectively, with States being held to standards to which they are capable of rising. Under such a scenario, States that are economically and technologically capable of acquiring and employing PGMs would be required to do so. States that are economically and technologically unable to acquire and employ PGMs would not be so required, the end result being a double standard. Furthermore, faced with the military dominance of the major powers, the lesser powers of the world may resort to the use of weapons of mass destruction to combat such dominance, exacerbating the proliferation of chemical and biological weapons despite their illegality and making compliance with existing nuclear, chemical and biological weapons treaties more difficult to monitor.

Non-lethal and directed-energy weapons such as electromagnetic pulse, while potentially indiscriminate, are arguably more in accord with the principle of proportionality in that they do not normally result in death or massive property destruction. As a result, discrimination concerns regarding non-lethal and directed-energy weapons might give way to fostering proportionality in twenty-first century warfare. Finally, the continued survival of the ABM Treaty in its original form is in question due to the possible, even probable, deployment of a national ballistic missile defense system by the U.S.

CHAPTER V

Role and Effect of Space-Based Assets

*We will engage terrestrial targets someday – ships,
airplanes, land targets – from space. We will engage
targets in space, from space ... [the missions are] already
assigned, and we've written the concepts of operations.
--General Joseph W. Ashy, USAF (1996)⁴⁸¹*

Perhaps in no other medium is the impact of the ongoing revolution in military affairs so profound as in outer space. The U.S. Air Force is shifting its advanced technology base toward space “to build a new technology foundation for more integrated air and space operations in the 21st century.”⁴⁸² Space-based assets have been used by the military virtually since the dawn of the space age but were used extensively for the first time in combat in the 1991 Persian Gulf War. Space-based systems are currently used by the major powers for communications, weather, information, remote sensing and mapping, surveillance, missile warning, signals intelligence, navigation and weapons guidance. Because of the integral role space-based assets play in modern warfare, anti-satellite (ASAT) weapons have been and are being developed to counter space-based systems and, at the same time, efforts to protect space-based assets from attack are under way.⁴⁸³ While there are currently no weapons based in outer space, at least some weapon systems could be readily adapted for delivery from space-based platforms. Although current international law requires outer space be used only for “peaceful purposes,” it is generally accepted that military uses of outer space are permissible.⁴⁸⁴ It seems only a matter of time before space-based assets are targeted and weapons are introduced in the space environment. A recent U.S. military study concluded that “[t]he Pentagon must develop the capability to neutralize or destroy commercial and military spacecraft to

⁴⁸¹ Former Commander, United States Space Command. Quoted in “USSC Prepares for Future Combat Missions in Space,” *supra* note 2 at 51.

⁴⁸² C. Covault, “USAF Space Technology Advances to Forefront” *Aviation Week & Space Technology* 150:14 (5 April 1999) 42.

⁴⁸³ See e.g. “Satellite Self-Protection Equipment Attracts USAF Interest, Investment” *Aviation Week & Space Technology* 151:7 (16 August 1999) 26; W.B. Scott, “New Satellite Sensors Will Detect RF, Laser Attacks” *Aviation Week & Space Technology* 151:5 (2 August 1999) 57.

⁴⁸⁴ See Chapter I, Part B3a, above.

prevent their use by U.S. adversaries in war.”⁴⁸⁵ As space is a relatively new medium for war, the volume of the law of armed conflict relating to space is quite limited and new legal norms will have to be established to deal with armed conflict in space.

A. Space-Based Assets Other than Weapons

1. *Communications Satellite Systems*

Satellite communications systems provide instantaneous communication capabilities, permitting military and civilian command authorities to stay in direct contact with military forces anywhere in the world.⁴⁸⁶ The U.S. military satellite communications architecture consists of four segments.⁴⁸⁷ The ultrahigh frequency (UHF) Fleet Satellite/Air Force Satellite (FLTSAT/AFSAT) system is used for tactical ground, sea and air forces. The superhigh frequency (SHF) Defense Satellite Communications System (DSCS) augments ground-based communications systems by providing medium and high-rate long-distance communications. The DSCS consists of ten satellites equipped with six super high frequency transponder channels to provide secure voice and high rate data communications.⁴⁸⁸ DSCS is used for high priority command and control communications such as communications between defense officials and battlefield commanders.⁴⁸⁹ The extremely high frequency (EHF) Military Strategic/Tactical Relay (MILSTAR) satellite system will provide worldwide, secure, jam-resistant communications capability for command and control of military forces when it becomes operational. The MILSTAR satellite constellation is designed to link command authorities with ships, submarines, aircraft, land vehicles and manned-portable systems.⁴⁹⁰ MILSTAR will consist of four satellites each serving as a smart switchboard

⁴⁸⁵ C. Clark & J. Singer, “Report Says U.S. Must Dominate Space in War” *Space News* 11:9 (6 March 2000) 4.

⁴⁸⁶ For a detailed discussion of all U.S. satellite communication systems, see “Space Communications: Overview” online: Federation of American Scientists <<http://www.fas.org/spp/military/com/overview.htm>> (last modified 13 April 2000) [hereinafter “Space Communications: Overview”].

⁴⁸⁷ See “Military Communications Satellites” online: Federation of American Scientists <<http://www.fas.org/spp/military/com/intro.htm>> (last modified 3 June 1997).

⁴⁸⁸ See “Defense Satellite Communications System” online: United States Air Force <http://www.af.mil/news/factsheets/Defense_Satellite_Communicati.html> (last modified: October 1999).

⁴⁸⁹ See *ibid.*

⁴⁹⁰ See “Milstar Satellite Communications System” online: United States Air Force <http://www.af.mil/news/factsheets/Milstar_Satellite_Communicati.html> (last modified: November 1999).

in space capable of directing traffic from terminal to terminal anywhere on earth.⁴⁹¹ It will significantly reduce ground control switching requirements as each satellite actually processes the communications signal and can link with other MILSTAR satellites.⁴⁹² Commercial communications satellites are used to support military satellite communications where jamming protection is not required. Laser communications systems capable of providing long-range, very high data rate satellite communication links are also currently under development.⁴⁹³

2. Weather Satellite Systems

Weather satellites provide vital information to military forces allowing military aircraft to avoid bad weather and enabling ground forces to take advantage of breaks in cloud cover.⁴⁹⁴ In the Persian Gulf War, weather satellites enabled Coalition forces to predict sandstorms and provided information to predict dispersal of chemical weapon clouds.⁴⁹⁵ The U.S. uses its constellation of two Defense Meteorological Support Program (DMSP) satellites for weather and integrates two similar satellites of the civilian National Oceanic and Atmospheric Administration into its military weather satellite system. DMSP sensors provide continuous visual and infrared imagery of cloud cover over an area 1,600 nautical miles wide.⁴⁹⁶ Additional DMSP sensors measure atmospheric vertical profiles of moisture and temperature.⁴⁹⁷

3. Remote Sensing, Surveillance and Early Warning Systems

Remote sensing from space can be as simple as taking photographs of the Earth from space using an optical camera and photographic film. More often, however, sensors on board a satellite perform remote sensing from space.⁴⁹⁸ The satellites are able to sense

⁴⁹¹ See *ibid.*

⁴⁹² See *ibid.*

⁴⁹³ See "Space Communications: Overview," *supra* note 486.

⁴⁹⁴ See "Weather" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/met/overview.htm>> (last modified 20 April 1997).

⁴⁹⁵ See *ibid.*

⁴⁹⁶ See "Defense Meteorological Satellite Program" online: United States Air Force
<<http://www.spacecom.af.mil/hqafspc/library/facts/dmsp.html>> (last modified: March 1999).

⁴⁹⁷ See *ibid.*

⁴⁹⁸ See D.H. Staelin & J. Kerekes, "Remote Sensing Capabilities" in D.G. Dallmeyer & K. Tsipis, eds., *Heaven and Earth: Civilian Uses of Near Earth Space* (The Hague: Kluwer Law International, 1997) at 163.

electromagnetic radiation from the objects they are viewing.⁴⁹⁹ Military remote sensing satellites can produce images of objects on the ground with resolutions of better than ten centimeters at ranges of up to 1,000 kilometers.⁵⁰⁰ Civilian remote sensing systems are capable of producing images with better than one-meter resolution.⁵⁰¹ Satellites equipped with radar sensors can see through clouds and synthetic aperture radars provide photographic quality images.⁵⁰² Remote sensing satellites are used for a myriad of purposes including mapping, collecting intelligence and locating targets in support of combat operations. In the Persian Gulf War, remote sensing satellites were used extensively to monitor Iraqi troop buildup and movement.⁵⁰³ Moreover, the U.S. Defense Mapping Agency produced more than 4,500 maps of the Persian Gulf operating theater using imagery produced by remote sensing satellite systems, including civilian systems.⁵⁰⁴ Remote sensing satellites are also a useful technical device for verification of arms control agreements.⁵⁰⁵

As space-based military systems have become essential to modern military operations, monitoring activities in and from space has become increasingly important. There are almost 10,000 known man-made space objects and debris in orbit around the earth.⁵⁰⁶ The U.S. uses various earth-based systems to track not only space objects and debris but also to monitor space launches worldwide and to provide early warning of ballistic missile attack.⁵⁰⁷ Satellite tracking systems are among the most sophisticated military technologies.⁵⁰⁸ Spacetrack radars have ranges and sensitivities a hundred times

⁴⁹⁹ See *ibid.* at 164.

⁵⁰⁰ See "IMINT Overview" online: Federation of American Scientists <<http://www.fas.org/spp/military/program/imint/overview.htm>> (last modified 7 April 1997) [hereinafter "IMINT Overview"]. For a detailed description of U.S. remote sensing satellites, see *ibid.*

⁵⁰¹ See J.C. Anselmo, "Commercial Spaces' Sharp New Image" *Aviation Week and Space Technology* 152:5 (31 January 2000) 52 at 52.

⁵⁰² See "IMINT Overview," *supra* note 500.

⁵⁰³ See *ibid.*

⁵⁰⁴ See "Mapping & Geodesy" online: Federation of American Scientists <<http://www.fas.org/spp/military/geodetic/overview.htm>> (last modified 9 March 1997).

⁵⁰⁵ See "IMINT Overview," *supra* note 500.

⁵⁰⁶ See "Ground-Based Electro-Optical Deep Space Surveillance" online: United States Air Force <<http://www.spacecom.af.mil/hqafspc/library/facts/geodss.html>> (last modified: March 1999).

⁵⁰⁷ See "Space Surveillance" online: Federation of American Scientists <<http://www.fas.org/spp/military/program/track/overview.htm>> (last modified 20 April 1997) [hereinafter "Space Surveillance"]. For a detailed description of U.S. surveillance and early warning systems, see *ibid.*

⁵⁰⁸ See "Space Surveillance," *supra* note 507. For a detailed description of space surveillance technology, see *ibid.*

greater than those used for tracking aircraft or surface targets and optical tracking systems rival all but the largest civilian astronomical observatories.⁵⁰⁹ Early warning detection radars are able to locate an object with an accuracy of approximately 1,000 meters while tracking radars have an accuracy of ten to 300 meters.⁵¹⁰

In addition to earth-based systems, space-based satellite systems perform ballistic missile warning functions as well. Ballistic missile warning satellites use infrared sensors to detect heat from a rocket's engine.⁵¹¹ The systems are used not only for early warning of missile attack but also to monitor missile launches to ensure compliance with arms control and weapon testing treaties.⁵¹² The U.S. Defense Support Program (DSP) satellites are capable of detecting missile launches, space launches and nuclear detonations.⁵¹³ The primary mission of the DSP is to provide tactical warning and limited assessment of ballistic missile attack. DSP satellites were successfully used to track Iraqi Scud missile launches in the Persian Gulf War.⁵¹⁴ The DSP system is slated to be replaced by the space-based infrared system (SBIRS) in the near future.⁵¹⁵ SBIRS will provide the U.S. with infrared space-based surveillance and ballistic missile warning. It will consist of four satellites in geosynchronous orbit (referred to as "SBIRS High") and approximately 24 low earth orbit satellites ("SBIRS Low").⁵¹⁶ SBIRS High will perform technical intelligence, missile warning and missile defense functions while SBIRS Low will provide missile tracking capabilities and discrimination data for missile defense.

⁵⁰⁹ See *ibid.*

⁵¹⁰ See *ibid.*

⁵¹¹ See "Warning" online: Federation of American Scientists

<<http://www.fas.org/spp/military/program/warning/overview.htm>> (last modified 20 April 1997) [hereinafter "Warning"]. For a detailed description of U.S. early warning satellite systems, see *ibid.*

⁵¹² See *ibid.*

⁵¹³ See "Defense Support Program Satellites" online: United States Air Force

<http://www.af.mil/news/factsheets/Defense_Support_Program_Satel.html> (last modified: June 1999).

The U.S. also uses the Nuclear Detonation Detection System to detect, locate and report nuclear detonations in the earth's atmosphere or near outer space in near-real-time. Detection is accomplished via sensors located on the 24 Navstar GPS satellites. See "Nuclear Detection System" online: Federation of American Scientists <<http://www.fas.org/spp/military/program/masint/nds.htm>> (last modified 20 April 1997).

⁵¹⁴ See "Warning," *supra* note 511.

⁵¹⁵ See e.g. "Space-Based Infrared System (SBIRS)" online: Federation of American Scientists <<http://www.fas.org/spp/starwars/program/dote99/99sbirs.htm>> (date accessed 3 May 2000) [hereinafter "SBIRS"]; DOT&E Report, *supra* note 455.

⁵¹⁶ See e.g. DOT&E Report, *ibid.*; "SBIRS," *supra* note 515.

4. *Signals Intelligence Systems*

Signals intelligence (SIGINT) satellite systems detect transmissions from communications systems, radars and other electronic systems.⁵¹⁷ The type and location of even low powered transmitters, such as hand held radios, can be determined by the interception of such signals.⁵¹⁸ However, they are not capable of intercepting communications carried over landlines or non-electronic communications such as the spoken word.⁵¹⁹ SIGINT is divided into several categories.⁵²⁰ The analysis of the source and content of message traffic is referred to as communications intelligence (COMINT) while electronic intelligence (ELINT) consists of the analysis of non-communications transmissions including radar transmitters (RADINT) and telemetry from missile tests (TELINT). The U.S. currently operates four constellations of signals intelligence satellites.⁵²¹

5. *Navigation and Weapons Guidance (Global Positioning Satellite Systems)*

First used in the Persian Gulf War, satellite systems such as the U.S. NAVSTAR Global Positioning System (GPS) provide navigation for aircraft, naval craft, land vehicles, weapons and even individual people. The NAVSTAR GPS satellite constellation consists of 24 satellites operating on six planes with a minimum of four satellites per plane.⁵²² Users receive signals from the satellites to calculate time, three-dimensional location information (latitude, longitude and altitude) and velocity. "The signals are so accurate, time can be figured to within a millionth of a second, velocity within a fraction of a mile per hour and location to within 100 feet."⁵²³ The system provides worldwide continuous real-time information and is capable of all-weather operations. Using the system, both aircraft and weapons can be directed to their targets with great accuracy.

⁵¹⁷ See "SIGINT Overview" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/sigint/overview.htm>> (last modified: 9 March 1997).

⁵¹⁸ See *ibid.*

⁵¹⁹ See *ibid.*

⁵²⁰ See *ibid.*

⁵²¹ See *ibid.*

⁵²² See "USAF Fact Sheet: NAVSTAR Global Positioning System" online: United States Air Force
<http://www.af.mil/news/factsheets/NAVSTAR_Global_Positioning_Sy.html> (last modified: October 1999).

⁵²³ *Ibid.*

6. *Spaceplanes*

Although currently experimental, spaceplanes (also referred to as transatmospheric vehicles, rocketplanes and aerospaceplanes) would be capable of horizontal or vertical takeoff, hypersonic speeds and able to operate both in the earth's atmosphere and outer space.⁵²⁴ Spaceplanes could perform air superiority functions and deliver weapons to, through and from space.⁵²⁵ According to certain reports, the U.S. has studied the possibility of using spaceplanes in armed conflict and an operational spaceplane squadron capable of performing orbital and sub-orbital military missions, "such as placing small satellites in low-Earth-orbit, conducting surveillance, disabling adversary space vehicles, releasing weapons (within the atmosphere) against terrestrial targets, serving as a time-critical communications platform or delivering cargo," could be operational by 2030.⁵²⁶

B. *Space Related Weapons*

Although there has yet to be a single reported case of force used in outer space,⁵²⁷ as the armed forces of the world become increasingly reliant on the space-based assets discussed above, it seems only a matter of time before such assets are targeted and attacked in armed conflict. According to Vice Admiral Thomas R. Wilson, the director of the U.S. Defense Intelligence Agency, countries are sure to develop capabilities to defeat space assets through denial and deception, signal jamming and ground segment attack; adding that satellite denial weapons are a future concern.⁵²⁸ Satellite denial weapons are commonly referred to as anti-satellite weapons or "ASATS." In addition to weapons designed attack to space-based assets, space-based weapons could also be used for ballistic missile defense and to attack earth-based targets. Various types of weapons can be used in, from and into space including conventional weapons, weapons of mass

⁵²⁴ See Y. Hashimoto, "The Spaceplane and International Space Law" *Proceedings of the Thirty-fifth Colloquium on the Law of Outer Space* (Washington, D.C.: AIAA, 1993) at 378.

⁵²⁵ See W.B. Scott, "U.S. Defines Missions for Military Spaceplane" *Aviation Week & Space Technology* (13 January 1997) 362.

⁵²⁶ *Ibid.*

⁵²⁷ See I.A. Vlasic, "Space Law and the Military Applications of Space Technology" in N. Jasentuliyana, ed., *Perspectives on International Law* (London: Kluwer Law International, 1995) at 397-398.

⁵²⁸ Quoted in R. Wall, "NRO's Mission Under Scrutiny" *Aviation Week & Space Technology* 152:6 (7 February 2000) 33.

destruction, kinetic energy weapons and directed-energy weapons.

1. Conventional Weapons and Weapons of Mass Destruction

Although currently nonexistent, platforms could be developed in the future capable of delivering conventional weapons and weapons of mass destruction from outer space to strike targets located on earth. These weapons could also be used to attack targets located in outer space. Since space is a virtual vacuum where little if any atmosphere or gravity exists (depending on altitude), conventional weapons and weapons of mass destruction would function differently in space than in the earth's atmosphere.⁵²⁹ Because no shock waves can form in space, conventional explosives and nuclear weapons must hit targets directly or detonate nearby to be effective.⁵³⁰ The physical characteristics of space make collateral damage and casualties resulting from both conventional and nuclear explosions fairly easy to control.⁵³¹ Whereas on earth weather and terrain often dictate the delivery and effectiveness of chemical and biological weapons, no such restrictions exist in outer space. Self-contained biospheres necessary to support life on spacecraft afford a superlative environment for chemical and biological warfare; once a chemical or biological agent enters the life support system of a manned space object it would incapacitate the crew.⁵³²

Initial radiation from nuclear explosions in space reacts uniquely when it contacts the boundary between the vacuum of space and the earth's atmosphere.⁵³³ One phenomenon is the disruption of radio and radar waves, temporarily halting or degrading radio and radar performance in the affected area.⁵³⁴ A second phenomenon is the generation of an electromagnetic pulse (EMP) that can have a debilitating effect on electronic circuitry.⁵³⁵ In the early 1960s, the U.S. conducted high altitude nuclear tests

⁵²⁹ See J.M. Collins, *Military Space Forces: The Next 50 Years* (Washington, D.C.: Pergamon-Brassey's, 1989) at 28-36 [hereinafter *Military Space Forces*].

⁵³⁰ See *ibid.* at 35.

⁵³¹ See *ibid.* at 29.

⁵³² See *ibid.*

⁵³³ See *ibid.*

⁵³⁴ See *ibid.*

⁵³⁵ See *ibid.*

aimed at producing an EMP for use as an anti-satellite weapon.⁵³⁶ As satellites contain highly sensitive electronic systems, they are particularly vulnerable to EMP. The use of EMP weapons in space proved to be problematic in that the EMP would carry for quite a distance, doing as much damage to friendly satellites as to their intended targets.⁵³⁷ The problems experienced with controlling the effects of these ASATS, coupled with the fact that they were originally intended to counter orbiting nuclear weapons (a threat that never materialized), lead to their dismantling.⁵³⁸ In addition to its effects on satellite electronic systems, EMP generated in space can also paralyze electronic systems on land, sea or in the air.⁵³⁹ A burst at an altitude of 300 miles would affect the entire continental U.S.⁵⁴⁰

2. Kinetic Energy Weapons

Kinetic energy weapons disable their targets by force of impact rather than through explosion. These weapons are as effective as explosives in space as they collide with satellites or other space objects at extremely high velocities.⁵⁴¹ For example, a half-ounce pellet propelled through space at 15,000 miles per hour can penetrate four inches of aluminum and electromagnetic railguns stationed on the moon could launch a one-ton lunar rock toward earth that would strike with the force equivalent to 500 tons of TNT.⁵⁴² The U.S. is currently developing a kinetic energy ASAT that will use a large Mylar "shroud" to attack hostile satellites.⁵⁴³ The shroud is intended to mitigate the amount of resulting space debris that would normally be associated with any kinetic energy weapon impact.

⁵³⁶ See "Space Defense" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/asat/overview.htm>> (last modified: 9 March 1997) [hereinafter "Space Defense"]. For a discussion on how EMP weapons work, see Chapter IV, Part E, above.

⁵³⁷ See "Space Defense," *ibid.*

⁵³⁸ See *ibid.*

⁵³⁹ See *Military Space Forces*, *supra* note 529 at 29.

⁵⁴⁰ See *ibid.* at 30.

⁵⁴¹ See *ibid.* at 36.

⁵⁴² See *ibid.*

⁵⁴³ See "Kinetic Energy Anti-Satellite" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/asat/herft.htm>> (last modified: 18 August 1997).

3. *Directed-Energy Weapons*

Directed-energy weapons include laser, high power radio frequency (including high power microwave) and particle beam technologies.⁵⁴⁴ Directed-energy weapons project energy at or near the speed of light and are designed to engage small, discrete targets without causing collateral damage.⁵⁴⁵ They have "soft kill" capability whereby sensors are blinded or electronics are disrupted by the energy these weapons emit.⁵⁴⁶ They also possess "hard kill" capabilities. Hard kills are accomplished when the directed-energy penetrates the surface of an object and then causes the object's fuel to ignite or munition to detonate. Although currently used only for testing, the U.S. military operates a high-powered earth-based laser (Mid-Infrared Advanced Chemical Laser)⁵⁴⁷ and a space-based laser intended to operate as both a theater and national missile defense system is under development.⁵⁴⁸

C. The Law of Armed Conflict In, From and Into Outer Space

1. *Applicability of Existing Laws of Armed Conflict in Outer Space*

While much has been written on the "militarization" and "weaponization" of space and international law relative to the military use of outer space exists,⁵⁴⁹ little has been written on the law of armed conflict in space nor is there any specific treaty dealing with the law of armed conflict in space. Moreover, since space-based assets have only recently been employed in armed conflict and actual force is yet to be used in, from or into outer space, customary international law of armed conflict specifically related to

⁵⁴⁴ See e.g. *Military Space Forces*, *supra* note 529 at 31-34; "High Energy Research and Technology Facility (HERTF)" online: Federation of American Scientists <http://www.fas.org/spp/military/program/asat/ke_asat.htm> (last modified: 21 November 1999) [hereinafter "HERTF"].

⁵⁴⁵ See *Military Space Forces*, *supra* note 529 at 31.

⁵⁴⁶ See e.g. *ibid.*; "HERTF," *supra* note 544.

⁵⁴⁷ See "Mid-Infrared Advanced Chemical Laser" online: Federation of American Scientists <<http://www.fas.org/spp/military/program/asat/miracl.htm>> (last modified: 21 March 1998). The U.S. Army is reportedly considering testing the laser against a satellite to learn more about the impact of directed energy weapons on spacecraft. See R. Wall, "Army Reconsiders Lasing Satellite" *Aviation Week & Space Technology* 151:25 (20/27 December 1999) 129.

⁵⁴⁸ See e.g. "Space Based Laser" online: Federation of American Scientists <<http://www.fas.org/spp/starwars/programs/sbl.htm>> (last modified: 9 February 1999); R. Wall, "Space-Based Missile Defense Program Crystallizing" *Aviation Week & Space Technology* 151:7 (16 August 1999) 73.

⁵⁴⁹ See Chapter I, Part B3, above.

space is yet to be developed. Given these circumstances, a preliminary issue that must be addressed is whether the existing laws of armed conflict are applicable in the space medium. Several factors indicate that they are.

Firstly, an analogy can be drawn with the law of the sea and the law of aerial warfare.⁵⁵⁰ The high seas, like outer space, are not subject to State sovereignty.⁵⁵¹ One observer has noted the "maritime antecedents" of the freedoms of outer space.⁵⁵² Since a jurisdictional parallel can be drawn between the sea and space mediums, it seems natural that a parallel can also be drawn between the two mediums regarding the law of armed conflict. As the law of armed conflict is applicable to the high seas, so too would it be applicable in space. Moreover, as is the case regarding space, no specific treaty dealing with the law of armed conflict in the air has ever come into force. As aerial instrumentalities became a factor in warfare, the law of aerial warfare evolved piecemeal; hence, it is not unreasonable to expect that the law of armed conflict in space will evolve in a similar fashion, making existing laws of armed conflict applicable in the space medium.⁵⁵³

Secondly, the "Martens, Clause," found in numerous treaties related to the law of armed conflict, makes existing principles of the international law of armed conflict applicable even where no specific treaty exists.⁵⁵⁴ The incorporation of the clause into law of armed conflict treaties suggests the concept has become an integral part of customary international law.⁵⁵⁵ Moreover, in its Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, the International Court of Justice (ICJ) stated that the

⁵⁵⁰ See R.A. Ramey, *Space Warfare and the Future Law of War* (LL.M. Thesis) Institute of Air & Space Law, McGill University (1999) [unpublished] [hereinafter *Space Warfare and the Future Law of War*] at 146-148.

⁵⁵¹ Under the U.N. Convention on the Law of the Sea, no State sovereignty or jurisdiction exists save for jurisdiction over registered vessels. *United Nations Convention on the Law of the Sea*, (1982) U.N. Doc. A/CONF 62/122, reprinted in (1982) 21 I.L.M. 1261 (entered into force 16 November 1994). Similarly, under the Outer Space Treaty and Registration Convention, no State sovereignty or jurisdiction exists save for jurisdiction and control over registered space objects. *Outer Space Treaty*, *supra* note 120 at Article 8.

⁵⁵² See H. DeSaussure, "The Freedoms of Outer Space and Their Maritime Antecedents" in N.

Jasentuliyana, *Space Law: Development and Scope* (Westport: Praeger, 1992) at 1.

⁵⁵³ The evolution of the law of aerial warfare is discussed in Chapter I, above.

⁵⁵⁴ See *supra* note 46. For a discussion on the relevance of the Martens Clause to the law of armed conflict in space, see M. Bourbonniere & L. Haeck, "Jus in Bello Spatiale" AIR & Space Law 25:1 (2000) 2 [hereinafter "Jus in Bello Spatiale"] at 5.

⁵⁵⁵ The proposition that the Martens Clause has become representative of customary international law is strengthened by the claim of the International Military Tribunal at Nuremburg in 1946 that the 1907 Hague Convention IV is declaratory of customary international law. See Roberts & Guelff, *supra* note 44 at 44.

humanitarian law of armed conflict “applies to all forms of warfare and to all kinds of weapons, those of the past, those of the present and those of the future.”⁵⁵⁶ Taken together, the Martens Clause and the ICJ advisory opinion indicate that existing laws of armed conflict apply to new areas of warfare, including space.

Finally, and perhaps most persuasively, the Outer Space Treaty provides guidance as to the applicability of existing laws of armed conflict in space. Article III states:

State Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.⁵⁵⁷

Thus, the Outer Space Treaty makes both the *jus ad bellum* and *jus in bello*, as bodies of international law, applicable to outer space and as a result, armed conflict conducted in, from or into outer space must be conducted in conformity with that law.

2. Impact of Space-Based Assets on the Law Governing Aerospace Warfare

Proceeding on the argument that existing laws of armed conflict are applicable to hostilities conducted in, from and into the space medium, attention can now be focused on the impact of space-based assets on that law. At the outset, a distinction must be made between the “militarization” of space, the “weaponization” of space and the “law of armed conflict” applicable to military space operations.⁵⁵⁸ Though there are no authoritative definitions for the terms “militarization” and “weaponization” of space, militarization can be referred to as “the use of outer space by a significant number of military spacecraft.”⁵⁵⁹ Weaponization “refers to the placing in outer space for any length of time any device designed to attack man-made targets in outer space and/or in the terrestrial environment.”⁵⁶⁰ The militarization of space thus encompasses the weaponization of space but the two terms are distinct and the militarization of space does

⁵⁵⁶ *Advisory Opinion on the Use of Nuclear Weapons*, *supra* note 118.

⁵⁵⁷ *Outer Space Treaty*, *supra* note 120.

⁵⁵⁸ This Thesis presupposes that armed conflict will eventually take place in, from and into outer space. Thus, the legality of the militarization and/or weaponization of space are not discussed in detail. Rather, emphasis is placed on outlining the probable future law of armed conflict as it applies to military space operations.

⁵⁵⁹ “Space Law and the Military Applications of Space Technology,” *supra* note 122 at 386, n.6.

⁵⁶⁰ *Ibid.*

not necessarily entail weaponization. The militarization of outer space has already taken place whereas weaponization is yet to occur. The distinction between the two terms is important as international law could conceivably evolve to permit the militarization of space but prohibit its weaponization. As discussed in Chapter I, it is generally accepted that non-aggressive military use of outer space is currently permissible under international law.⁵⁶¹ Moreover, while many States have called for a complete ban on weapons in space,⁵⁶² the placement of weapons in space is currently lawful, save for the prohibitions on nuclear weapons and weapons of mass destruction. The law of armed conflict applicable to military space operations, the focus here, governs the use of force and the way hostilities are conducted in, from and into outer space and thus assumes the militarization and weaponization of space have occurred.

Space-based assets do not operate independently of earth-based weapon systems and operational space-based assets are already an integral part of modern aerospace warfare. Integrated with earth-based weapon systems, information obtained from space-based assets and the use of global positioning satellite systems to guide precision guided munitions will work in conjunction with earth-based assets to ease compliance with the law of armed conflict as discussed in Chapter IV.⁵⁶³ Moreover, just as earth-based military assets have become intermingled with civilian systems, so too have space-based systems. As noted above, the armed forces of the world already rely heavily on civilian communications, weather and remote sensing satellite systems. Thus, while space-based assets will, in one context, make the law of armed conflict easier to comply with, the line between lawful space-based targets and protected objects could become blurred just as it might with earth-based systems, making the law more difficult to adhere to.

⁵⁶¹ See Chapter I, Part B3, above.

⁵⁶² For example, in 1981 the Soviet Union presented a "Draft Treaty on the Prohibition of the Stationing of Weapons of Any Kind in Outer Space" to the 36th Session of the U.N. General Assembly. The draft treaty would even have prohibited placing weapons on existing or future reusable manned space vehicles (spaceplanes) but would not have prevented earth-based ASATS. The draft treaty is reprinted in C.S. Gray, *American Military Space Policy: Information Systems, Weapon Systems and Arms Control* (Cambridge, MA: Abt Books, 1982) at 115. More recently, at the Millennium Air Power Conference, Air Vice Marshall Zeky Ambador, head of Indonesia's Air Force Command and Staff College, suggested that the use of any kind of weapon in space be completely banned, citing fears of a new global arms race associated with the weaponization of space. See R. Wall, "Space, New Technologies Shifting Air Force Strategies" *Aviation Week & Space Technology* 152:10 (6 March 2000) 51 at 51.

⁵⁶³ See "Jus in Bello Spatiale," *supra* note 554 at 6.

Article IV of the 1975 Convention on Registration of Objects Launched Into Outer Space (Registration Convention) requires that the Secretary General of the U.N. be furnished with information regarding the general function of every space object launched into outer space “as soon as practicable.”⁵⁶⁴ The U.N. maintains an international register of all thus registered space objects.⁵⁶⁵ Conceivably, warring parties could consult the international register to assist in distinguishing between legitimate military targets and protected civilian objects. Unfortunately, the problem is not so easily solved. The Registration Convention does not specifically require that military space objects be distinguished from civilian space objects. Rather, only the “general function” of the space object need be furnished to the U.N. As a result, many military satellites list “scientific” purposes as their general function. Moreover, as satellites need only be registered “as soon as practicable,”⁵⁶⁶ many military satellites may not be registered until after their missions are complete as States would not deem it “practicable” to do so any sooner, given the secrecy and national security concerns surrounding many military operations.⁵⁶⁷ Two observers have proffered “that the hiding of a military space object, used to commit an act of force in outer space, behind a civil registration may easily be interpreted as a severe violation of [the law of armed conflict] akin to an act of perfidy.”⁵⁶⁸ That is not to say that civilian space systems could not legally be used for military purposes, rather, only hiding behind a civilian registration for the purpose of committing an act of force would be unlawful.⁵⁶⁹

A potential solution would be to amend the Registration Convention to require registration of space objects with the U.N. immediately upon the launch of a space object, as opposed to as soon as practicable, and to require that military space objects be clearly distinguished from civilian space objects when registered. With such amendments, a clear distinction could be made between purely military and civilian space objects, making it easier to comply with the law of armed conflict. However, many space-based

⁵⁶⁴ *Convention on the Registration of Objects Launched into Outer Space*, 14 January 1975, 1023 U.N.T.S. 15, 28 U.S.T. 695, T.I.A.S. No. 8480 (entered Into Force 15 September 1979) [hereinafter *Registration Convention*] at Article 4.

⁵⁶⁵ *Ibid.* at Article 3.

⁵⁶⁶ *Ibid.* at Article 4.

⁵⁶⁷ See “Jus in Bello Spatiale,” *supra* note 554 at 7.

⁵⁶⁸ *Ibid.*

⁵⁶⁹ See *ibid.*

assets can be used both for military and civilian purposes and the problems posed by attacking these dual use assets would remain even with the amendments. As is the case with dual use earth-based assets, dual use space-based assets will likely be subject to lawful attack where they are of value to the enemy war effort, provided such an attack is otherwise in accord with the law of armed conflict.⁵⁷⁰

Serious problems could arise by attacking space-based assets, including the creation of space debris and the deleterious effect that weapons would have on the space environment. An attack against a lawful target in space could produce significant debris endangering protected satellites, not to mention the devastating effects of the resulting space debris to the useful earth's orbits. Moreover, the use of certain types of weapons in space could prove debilitating not only for the intended target and individual protected satellites, but also for entire satellite systems or even entire orbits. For example, according to Major-General Kenneth Hagemann, Director of the U.S. Nuclear Agency, a 50 kiloton nuclear explosion at an altitude of 62 miles "would pump the Van Allen belt with radiation to the extent that increased exposure would cause satellites to die in hours, days even weeks" effectively destroying communications satellites throughout the low earth orbit.⁵⁷¹ By Treaty, placing nuclear weapons in outer space is prohibited, as is their testing in space.⁵⁷²

States appear to be cognizant of these hazards. For example, the kinetic energy ASAT being developed by the U.S. is designed to limit any resulting debris.⁵⁷³ Problems associated with space debris and the effect of weapons on the space environment is likely to have an impact on the law of aerospace warfare in the twenty-first century. According to two commentators, "[t]he resulting debris from the use of force in outer space must be factored in the proportionality calculus of military operations."⁵⁷⁴ Twenty-first century law of armed conflict could conceivably evolve to be even more restrictive than merely factoring space debris into the proportionality equation. Weapons of the near future,

⁵⁷⁰ Article 2 of the 1907 Hague Convention IX stipulates that industrial targets of value to the war effort are lawful. See *supra* notes 72-75 and accompanying text.

⁵⁷¹ Quoted in "Jus in Bello Spatiale," *supra* note 554 at 3.

⁵⁷² The Outer Space Treaty prohibits the placement of nuclear weapons in space while the 1963 Partial Test Ban Treaty prohibits the testing of nuclear weapons in space. See Chapter I, Parts B3b, B3d, above.

⁵⁷³ See Part B2, above.

⁵⁷⁴ "Jus in Bello Spatiale," *supra* note 554 at 8.

kinetic and directed-energy weapons, are likely to have both soft kill and hard kill capabilities. Because of the devastating effects of space debris and other weapons effects in space, concepts of proportionality may call for the use of soft kill techniques as opposed to hard kill techniques when attacking space-based assets.

There may be additional guidance for the problems posed by space debris and weapons effects in space. Articles 35 and 55 of Protocol I to the Geneva Conventions prohibit means and methods of warfare intended or expected to cause widespread, long-term and severe damage to the natural environment and require States to take care to ensure said damage does not occur.⁵⁷⁵ Furthermore, parties to the 1976 Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques have undertaken not to engage in environmental modification techniques through the deliberate manipulation of natural processes that change the dynamics, composition or structure of outer space.⁵⁷⁶ While the applicability of these agreements to the protection of the earth's orbits from space debris and the effects of weapons in space is uncertain,⁵⁷⁷ an argument can certainly be made that the creation of vast amounts of space debris or severe damage to the utility of an orbit from the effects of a weapon are prohibited pursuant to these provisions. Some commentators have called for amendment to these agreements, making it clear that earth's orbits are a part of the global environment and thus applicable to the problems posed by space debris and weapons effects.⁵⁷⁸ Should these legal texts be interpreted as applicable to armed conflict involving outer space, they would have the effect of severely limiting the permissible means and methods of space warfare. Soft kill techniques would most likely be required when possible, significantly limiting the lawful use of other weapons in space. An alternative solution to amending current instruments may be the conclusion of a separate multilateral agreement specifically related to the problem of space debris and weapons effects in outer space.

The use of nuclear propulsion and power sources on board space-based assets creates another potential danger for the space environment. Attacking and destroying

⁵⁷⁵ *Geneva Protocol I*, *supra* note 98.

⁵⁷⁶ *Use of Environmental Modification Techniques Convention*, *supra* note 137 at Articles 1, 2.

⁵⁷⁷ See "Jus in Bello Spatiale," *supra* note 554 at 10.

⁵⁷⁸ See *ibid.*

such objects could disperse radioactive material throughout the earth's orbits. The U.N. Principles Relating to the Use of Nuclear Power Sources in Space is relevant to this issue although they do little to solve the problem. The Principles are not binding law and apply only to nuclear power sources on board spacecraft for non-propulsive purposes. Moreover, they do not prohibit, but merely regulate the use of nuclear power sources in space.⁵⁷⁹ Given the potential dangers posed by radioactive materials in space, the adoption of a more authoritative text on this issue which would either prohibit nuclear propulsion and power sources on military and dual use assets or prohibit the employment of hard kill techniques against such assets seems advisable.

3. Legal Status of Military Personnel Engaged in Hostilities in Space

The prospect of armed conflict in outer space raises issues regarding the legal status of military personnel engaged in hostilities in space. Under the Outer Space Treaty, astronauts are to be regarded as "envoys of mankind."⁵⁸⁰ The term "envoys of mankind" suggests that astronauts are afforded the legal status of quasi-diplomats.⁵⁸¹ As the Treaty does not distinguish between military and civilian astronauts, the term "astronaut" apparently applies to all humans in space. Since the use of military personnel under the Treaty is permissible in space for scientific and other "peaceful" purposes,⁵⁸² it logically follows that they too are to be regarded as envoys of mankind. Furthermore, both the Outer Space Treaty and The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Space Objects Launched Into Outer Space (Rescue and Return Agreement) require that in the event of accident, distress, or emergency or unintended landing on the territory of another State Party or on the high seas, astronauts be safely and promptly returned to the State of registry of their space vehicle or the

⁵⁷⁹ See *supra* notes 141-143 and accompanying text.

⁵⁸⁰ *Outer Space Treaty*, *supra* note 120 at Article 5.

⁵⁸¹ See e.g. "Jus in Bello Spatiale," *supra* note 554 at 8-9; *Space Warfare and the Future Law of War*, *supra* note 550 at 172. "The term 'envoy' has a precedent in diplomatic law, that of an envoy extraordinary. An envoy ranks just below an ambassador and always is an agent, a messenger. The reason for this unique concept lies in the fact that astronauts have been vested with the legal representation of all mankind in outer space and celestial bodies. No former representation has ever been as wide and political, it goes beyond the most audacious ambition. On the other hand, this investment was recognized in the General assembly by unanimity and acclamation." A.A. Cocca, "Prospective Space Law" (1998) 26:1 J. of Space L. 51 at 54.

⁵⁸² *Outer Space Treaty*, *supra* note 120 at Article 4.

launching authority.⁵⁸³ Two questions now arise. First, are military personnel engaged in armed conflict in space to be regarded as “envoys of mankind” and afforded the protection of such a status, including diplomatic immunity as prescribed in the Vienna Convention on Diplomatic Relations?⁵⁸⁴ Second, must military personnel engaged in armed conflict in space be promptly returned when captured by the enemy? The answer to both is most likely no.

Article IV of the Outer Space Treaty permits the use of military personnel on the moon only for scientific and other peaceful purposes. Therefore, one might assume that as a precondition to being considered an envoy of mankind under the Treaty, military personnel must be engaged in scientific or “peaceful” space operations. Personnel engaged in armed conflict clearly do not fall into either category. Once they depart from their non-aggressive role in space and engage in armed conflict, military personnel would lose their status as envoys of mankind. They would be regarded as “combatants” under the law of armed conflict just as they would if engaged in hostilities on land, at sea or in the air. To be regarded as a combatant, military personnel must be commanded by a person responsible for his subordinates; have a fixed distinctive emblem recognizable from a distance; carry arms openly; and conduct operations in accordance with the laws and customs of war.⁵⁸⁵ Combatants are afforded all of the protections of prisoners of war (POWs) contained in Geneva Convention III.⁵⁸⁶

If military personnel engaged in hostilities in outer space are regarded as combatants, it logically follows that the law would not require their prompt return upon capture. First and foremost, if military personnel engaged in hostilities in space are by definition considered combatants rather than envoys of mankind, the provisions of the Outer Space Treaty requiring their return would not be applicable. Furthermore, Article 31 of the Vienna Convention on the Law of Treaties requires that treaties be interpreted in good faith in accordance with the ordinary meaning to be given to the terms in their

⁵⁸³ *Ibid.*; *Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space*, 22 April 1968, 672 U.N.T.S. 119, 19 U.S.T. 7570, T.I.A.S. No. 6599 (entered into force 3 December 1968) at Article 4.

⁵⁸⁴ *Vienna Convention on Diplomatic Relations*, 18 April 1961, 500 U.N.T.S. 95, 95 A.J.I.L. 1064 (entered into force 24 June 1964).

⁵⁸⁵ *1907 Hague Convention IV*, *supra* note 52 at Article 1.

⁵⁸⁶ *Geneva Convention III*, *supra* note 85.

context and purpose.⁵⁸⁷ It can therefore be argued that the requirement to return astronauts found in the Outer Space Treaty and the Rescue and Return agreement were never intended to apply to military personnel engaged in hostilities in space nor were they intended to modify the law of armed conflict regarding the rules of capture and detention of combatants.⁵⁸⁸

The end result of the present analysis is that once military personnel engage in hostilities in space, they should acquire the legal status of a “combatant” under the law of armed conflict, provided they otherwise meet the legal definition of a combatant, with the status of astronauts as “envoys of mankind” being reserved for those engaged in non-aggressive space activities. As such, military personnel engaged in hostilities in space would be subject to lawful capture and detention and if so captured and detained, required to be afforded all of the protections a POW is entitled to under existing laws of armed conflict.⁵⁸⁹

D. Chapter V Summary

A number of principles and rules of the current law of armed conflict applicable to land, sea and air warfare are most likely applicable to the war-fighting medium of space as well. As is the case with earth-based military assets, space-based assets will assist in the reduction of targeting mistakes, civilian casualties and collateral damage; contributing to easing compliance with existing laws of armed conflict. Although placing nuclear weapons and other weapons of mass destruction in space is unlawful, the placement of other types of weapons in space is permissible under current international law and it may only be a matter of time before such weapons are stationed in earth’s orbit.

The problems posed by earth-based dual use targets also exist in space as the majority of space-based systems have dual use capabilities and the armed forces of various countries often rely on commercial systems. Thus, distinguishing between legitimate space-based military targets and protected objects as required by the law of

⁵⁸⁷ *Vienna Convention on the Law of Treaties*, 23 May 1969, 1155 U.N.T.S. 331, 8 I.L.M. 679, 63 A.J.I.L. 875 (entered into force 27 January 1980).

⁵⁸⁸ See “Jus in Bello Spatiale,” *supra* note 554 at 8.

⁵⁸⁹ See *ibid.*

armed conflict will pose a challenge in twenty-first century aerospace warfare. Attacking space-based assets using either space or earth-based weapon systems poses unique threats to the space environment. In an attempt to limit space debris and other damage to the space environment, it is conceivable that a multilateral agreement could be concluded, requiring “soft kill” techniques be employed against legitimate military targets in space, thus significantly limiting the lawful use of various environmentally unfriendly weapons in space.

Unique issues are also raised regarding the legal status of military personnel engaged in hostilities in space. Under current law, astronauts are regarded “envoys of mankind” affording them a quasi-diplomatic legal status. If astronauts through accident, distress or emergency landing end up in the custody of foreign officials, they must be safely and promptly returned to the State of registry of their space vehicle. The new law of armed conflict may require that military personnel engaged in hostilities in space be regarded “combatants” under the law of armed conflict as opposed to envoys of mankind. Under the new law of armed conflict, military personnel engaged in armed conflict in space could lawfully be captured and detained and would be afforded all of the protections due a prisoner of war.

CONCLUSION

Although no treaty dealing specifically with the law of armed conflict in the air has ever come into force, the law of aerial warfare has evolved piecemeal over the last 100 years by analogy to the established law of war on land and at sea. Current customary and conventional international law governs the means and methods of aerial warfare as well as humanitarian concerns relevant to that conflict. The nature of war in the twenty-first century, whether international in scope or limited to humanitarian intervention, may affect the manner in which the law is applied. Humanitarian intervention, of uncertain legality under current international law, could effectively limit lawful targets and collateral damage beyond the legal norms required in international conflicts due to the humanitarian nature of such conflicts.

The world is in the midst of a "Revolution in Military Affairs" and recent armed conflicts in Iraq in 1991 and Yugoslavia (Bosnia 1995; Kosovo 1999) have demonstrated an increasing reliance by the major powers on advanced information systems, precision guided munitions and space-based assets. While space-based assets were used extensively for the first time in combat in the Persian Gulf War, actual force is yet to be used in, from or into space. As a result, the law governing armed conflict involving the space medium is modest in scope at this time, although it is generally accepted that outer space may be used for non-aggressive military purposes. Moreover, save for the prohibitions against placing nuclear weapons and other weapons of mass destruction in space, the placement of other types of weapons in space is currently lawful as is their use.

Twenty-first century aerospace information systems, precision-guided munitions and their associated weapon systems will enable warring parties to significantly reduce targeting mistakes, civilian casualties and collateral damage. The resulting impact on the law will arguably be to ease compliance with the laws of armed conflict, ultimately narrowing the interpretation and application of the basic legal principles to the point where civilian casualties and collateral damage become the legal exception rather than the norm. Paradoxically, while these systems will ease compliance with the laws of armed conflict in one context, increasing reliance of the world's armed forces on civilian assets and attacking dual use earth and space-based assets could make compliance more

onerous as it becomes increasingly difficult to distinguish between legitimate military targets and protected objects. Moreover, adversaries in the twenty-first century may be required by the law to use precision-guided munitions against targets in heavily populated areas, provided they have the means to do so. This requirement could cause the law to be applied selectively, with States capable of employing precision-guided munitions being legally required to do so while States lacking the economic or technological capability to employ such munitions are not so required. Furthermore, faced with the military superiority of the major powers, lesser powers might resort to the use of weapons of mass destruction, making compliance with existing nuclear, chemical and biological weapons treaties more difficult to monitor and enforce.

Existing laws of armed conflict applicable to warfare on land, at sea and in the air are most likely applicable to the space medium as well. However, warfare in and into space poses unique problems related to the space environment and the legal status of military personnel engaged in hostilities in space. Attacking an adversary's space-based assets could potentially create vast amounts of space debris and the effects of using weapons in space, such as radiation, could further contaminate the space environment. The existing law of armed conflict may evolve, possibly through multilateral agreements, to require minimal contamination of the space environment, significantly limiting the lawful use of weapons in space. Finally, as astronauts are regarded as "envoys of mankind" and thus afforded a quasi-diplomatic legal status, the legal status of military personnel engaged in hostilities in space is somewhat uncertain at the present time. Nevertheless, military personnel engaged in hostilities in space are likely to be treated as "combatants" under the law of armed conflict rather than as "envoys of mankind." As such, they will be subject to lawful capture and afforded all of the protections of a prisoner of war.

The existing law of armed conflict is certainly capable of evolving to cope with ongoing revolution in military affairs and the legal problems posed by aerospace warfare in the twenty-first century. Historically, when the law has evolved in such a fashion it has done so reactively rather than proactively, with customary norms being established and multilateral agreements being concluded only after the problems have presented themselves on the battlefield. It is therefore recommended that a more proactive

approach be taken in the twenty-first century, particularly regarding the law of armed conflict involving outer space. Specifically, multilateral agreements should be concluded to regulate the use of new types of weapons (such as non-lethal and directed-energy weapons); to make existing laws of armed conflict applicable to the space medium; to deal with the problems posed by using certain types of weapons in space (those resulting in significant space debris and other contamination of the space environment); and to define the legal status of military personnel engaged in combat in space. While it is impossible to foresee all of the legal problems that will arise in aerospace warfare in the twenty-first century, the international community is certainly capable of proactively addressing the issues that have already presented themselves.

BIBLIOGRAPHY

A. Treaties and Other Official Documents (In Chronological Order)

Instructions for the Government of Armies of the United States in the Field, General Orders No. 100, 24 April 1863, reprinted in Schindler & Toman at 3.

Convention for the Amelioration of the Condition of the Wounded in Armies in the Field [Red Cross Convention], 22 August 1864, (1907 Supplement) 1 A.J.I.L. 90, reprinted in Schindler & Toman at 280.

Declaration of St. Petersburg Renouncing the Use, in Time of War, of Explosive Projectiles Under 400 Grammes Weight, 11 December 1868, (1907 Supplement) 1 A.J.I.L. 95, reprinted in Roberts & Guelff at 30, Schindler & Toman at 102.

Project of an International Declaration Concerning the Laws and Customs of War [Declaration of Brussels], 27 August 1874, reprinted in Schindler & Toman at 25.

Convention (I) for the Pacific Settlement of International Disputes, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 107, reprinted in Friedman vol. 1 at 204.

Convention (II) with Respect to the Laws and Customs of War on Land, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 129 (entered into force 4 September 1900) reprinted in Schindler & Toman at 63.

Convention (III) for the Adaptation to Maritime Warfare of the Principles of the Geneva Convention of 22 August 1864, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 159 (entered into force 4 September 1900, no longer in force) reprinted in Schindler & Toman at 289.

Declaration (IV 1) To Prohibit For the Term of Five Years the Launching of Projectiles and Explosives from Balloons, And Other Methods of a Similar Nature, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 153 (entered into force 4 September 1900), reprinted in Schindler & Toman at 202.

Declaration (IV 2) Concerning Asphyxiating Gases, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 157 (entered into force 4 September 1900), reprinted in Roberts & Guelff at 35, Schindler & Toman at 105.

Declaration (IV 3) Concerning Expanding Bullets, 29 July 1899, (1907 Supplement) 1 A.J.I.L. 155 (entered into force 4 September 1900), reprinted in Roberts & Guelff at 40, Schindler & Toman at 109.

- Convention (III) Relative to the Opening of Hostilities*, 18 October 1907, (1908 Supplement) 2 A.J.I.L. 85 (entered into force 26 January 1910), reprinted in Schindler & Toman at 6.
- Convention (IV) (and Regulations) Respecting the Laws and Customs of War on Land*, 18 October 1907, 205 Consol. T.S. 277 (entered into force 26 January 1910), reprinted in Roberts & Guelff at 43, Schindler & Toman at 63.
- Convention (IX) Concerning Bombardment by Naval Forces in Time of War*, 18 October 1907, (1908 Supplement) 2 A.J.I.L. 146 (entered into force 26 January 1910), reprinted in Roberts & Guelff at 93, Schindler & Toman at 811.
- Declaration (XIV) Prohibiting Discharge of Projectiles and Explosives From Balloons*, 18 October 1907, (1908 Supplement) 2 A.J.I.L. 216 (entered into force 27 November 1909), reprinted in Schindler & Toman at 202.
- Covenant of the League of Nations [Treaty of Versailles]*, 28 June 1919, 225 Consol. T.S. 188 (entered into force 10 January 1920).
- Hague Rules of Aerial Warfare*, 1923, (1923 Supplement) 17 A.J.L.L. 245 (not in force), reprinted in. (1938 Supplement) 32 A.J.I.L. 12, Roberts & Guelff at 123, Schindler & Toman at 208.
- (Geneva) Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare*, 17 June 1925, (1929) 94 L.N.T.S. 65, 26 U.S.T. 571, (1975) 14 I.L.M. 49, (1931 Supplement) 25 A.J.I.L. 94 (entered into force 8 February 1928), reprinted in Roberts & Guelff at 139, Schindler & Toman at 116.
- General Treaty for the Renunciation of War as an Instrument of National Policy*, 27 August 1928, 94 L.N.T.S. 59 (entered into force 24 July 1929).
- Convention for the Amelioration of the Condition of the Wounded and Sick in Armies in the Field*, 27 July 1929, (1933 Supplement) 27 A.J.I.L. 43 (entered into force 19 June 1931), reprinted in Schindler & Toman at 325.
- Convention Relative to the Treatment of Prisoners of War*, 27 July 1929, (1933 Supplement) 27 A.J.I.L. 59 (entered into force 19 June 1931), reprinted in Schindler & Toman at 339.
- Convention on International Civil Aviation*, 7 December 1944, 15 U.N.T.S. 295, 61 Stat. 1180, T.I.A.S. No. 1591 (entered into force 4 April 1947).
- Charter of the United Nations*, 26 June 1945, Can. T.S. No. 7 (entered into force 24 October 1945).

Geneva Convention (I) for the Amelioration of the Condition of Wounded and Sick in Armed Forces in the Field, 12 August 1949, 75 U.N.T.S. 31, 6 U.S.T. 3114, T.I.A.S. 3362 (entered into force 21 October 1950), reprinted in Roberts & Guelff at 171, Schindler & Toman at 375.

Geneva Convention (II) for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea, 12 August 1949, 75 U.N.T.S. 85, 6 U.S.T. 3217, T.I.A.S. 3363 (entered into force 21 October 1950), reprinted in Roberts & Guelff at 194, Schindler & Toman at 403.

Geneva Convention (III) Relative to the Treatment of Prisoners of War, 12 August 1949, 75 U.N.T.S. 135, 6 U.S.T. 3316, T.I.A.S. 3364 (entered into force 21 October 1950), (1953 Supplement) 47 A.J.I.L. 119, reprinted in Roberts & Guelff at 216, Schindler & Toman at 429.

Geneva Convention (IV) Relative to the Protection of Civilian Persons in Time of War, 12 August 1949, 75 U.N.T.S. 287, 6 U.S.T. 3516, T.I.A.S. 3365 (entered into force 21 October 1950), (1956) 50 A.J.I.L. 724, reprinted in Roberts & Guelff at 272, Schindler & Toman at 501.

Convention (and Regulations) for the Protection of Cultural Property in the Event of Armed Conflict, 14 May 1954, 249 U.N.T.S. 240 (entered into force 7 August 1956), reprinted in Roberts & Guelff at 340, Schindler & Toman at 747.

Protocol for the Protection of Cultural Property in the Event of Armed Conflict, 14 May 1954, 249 U.N.T.S. 358 (entered into force 7 August 1956), reprinted in Roberts & Guelff at 263, Schindler & Toman at 777.

Vienna Convention on Diplomatic Relations, 18 April 1961, 500 U.N.T.S. 95, 95 A.J.I.L. 1064 (entered into force 24 June 1964).

Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Underwater, United States, United Kingdom and Soviet Union, 5 August 1963, 480 U.N.T.S. 43, 14 U.S.T. 1313 (entered into Force 10 October 1963, later joined by numerous additional states), reprinted in (1963) 2 I.L.M. 889.

Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, 610 U.N.T.S. 205, 18 U.S.T. 2410, T.I.A.S. No. 6347 (entered into Force 10 October 1967), reprinted in (1967) 6 I.L.M. 386.

Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, 22 April 1968, 672 U.N.T.S. 119, 19 U.S.T. 7570, T.I.A.S. No. 6599 (entered into force 3 December 1968).

Treaty on the Nonproliferation of Nuclear Weapons, 1 July 1968, 729 U.N.T.S. 161, 21 U.S.T. 483 (entered into force 5 March 1970), reprinted in (1968) 7 I.L.M. 811.

Vienna Convention on the Law of Treaties, 23 May 1969, 1155 U.N.T.S. 331, 8 I.L.M. 679, 63 A.J.I.L. 875 (entered into force 27 January 1980).

Convention on International Liability for Damage Caused by Space Objects, 29 March 1972, 961 U.N.T.S. 187, 24 U.S.T. 2389, T.I.A.S. No. 7762 (entered into force 1 September 1972).

Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, 10 April 1972, 1015 U.N.T.S. 164, 26 U.S.T. 583, (1972) 11 I.L.M. 309, (1972) 66 A.J.I.L. 451 (entered into force 26 March 1975), reprinted in Schindler & Toman at 137.

Treaty on the Limitation of Anti-Ballistic Missile Systems, United States and Soviet Union, 26 May 1972, 23 U.S.T. 3435, T.I.A.S. 7503 (entered into force 3 October 1972; Protocol done 3 July 1974, entered into Force 24 May 1976).

Convention on the Registration of Objects Launched into Outer Space, 14 January 1975, 1023 U.N.T.S. 15, 28 U.S.T. 695, T.I.A.S. No. 8480 (entered Into Force 15 September 1979).

Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, 18 May 1977, 1108 U.N.T.S. 151, 31 U.S.T. 333, T.I.A.S. 9614 (entered into force 5 October 1978), (1977) 16 I.L.M. 88, reprinted in Roberts & Guelff at 379, Schindler & Toman at 164.

Protocol Additional to the Geneva Conventions of 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), 8 June 1977, 1125 U.N.T.S. 3 (entered into force 7 December 1978), (1977) 16 I.L.M. 1391, (1978) 72 A.J.I.L. 457, reprinted in. Roberts & Guelff at 389, Schindler & Toman at 627.

Protocol Additional to the Geneva Conventions of 1949, and Relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II), 8 June 1977, 1125 U.N.T.S. 609 (entered into force 7 December 1978), (1977) 16 I.L.M. 1442, (1978) 72 A.J.I.L. 457, reprinted in Roberts & Guelff at 449, Schindler & Toman at 691.

Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 18 December 1979, 1363 U.N.T.S. 3; U.N. Doc. A/RES 34/68 (1979) reprinted in. (1979) 18 I.L.M. 1434 (entered into force 11 July 1984).

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 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1523, reprinted in Roberts & Guelff at 473, Schindler & Toman at 179.

Protocol [to the Convention on Conventional Weapons] on Non-Detectable Fragments (Protocol I), 10 April 1981, 1342 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1523, reprinted in Roberts & Guelff at 479, Schindler & Toman at 185.

Protocol [to the Convention on Conventional Weapons] on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices (Protocol II), 10 April 1981, 1342 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1529, reprinted in Roberts & Guelff at 479, Schindler & Toman at 188, amended 3 May 1996, (1996) 35 I.L.M. 1209.

Protocol [to the Convention on Conventional Weapons] on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III), 10 April 1981, 1342 U.N.T.S. 7 (entered into force 2 December 1983), (1980) 19 I.L.M. 1529, reprinted in Roberts & Guelff at 484, Schindler & Toman at 190.

United Nations Convention on the Law of the Sea, (1982) U.N. Doc. A/CONF.62/122, reprinted in (1982) 21 I.L.M. 1261 (entered into force 16 November 1994).

Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, 13 January 1993, (1993) 32 I.L.M. 800 (entered into force April 1997).

Protocol [to the Convention on Conventional Weapons] on Blinding Laser Weapons (Protocol IV), 13 October 1995, (1996) 35 I.L.M. 1218.

Convention on the Prohibition of the Use, Stockpiling Production and Transfer of Anti-Personnel Mines and on their Destruction, 18 September 1997, (1997) 36 I.L.M. 1507 (entered into force 1 March 1999).

Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, The Government of Japan, the Government of the Russian Federation, And the Government of the United States of America Concerning the Cooperation on the Civil International Space Station, 29 January 1998, reprinted in S. Gorove, ed., *United States Space Law: National & International Regulation*, vol. IV (Dobbs Ferry, NY: Oceana, 1998) at 98-1 (not yet in force).

B. Judicial Decisions

Corfu Channel Case (Albania v. United Kingdom), [1949] I.C.J. Rep. 4.

Case Concerning Military and Paramilitary Activities in and against Nicaragua, Merits (Nicaragua v. United States) [1986] I.C.J. Rep. 14.

Legality of the Use By a State of Nuclear Weapons in Armed Conflict, Advisory Opinion [1996] I.C.J. Rep. 4.

C. United Nations Resolutions (In Chronological Order)

Universal Declaration of Human Rights, GA Res. 217 (III), UN GAOR, 3d Sess., Supp. No. 13, UN Doc. A/810 (1948) 71.

Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, 13 December 1963, G.A. Res. 1962 (XVIII), U.N. GAOR, 18th Sess. Supp. 15, U.N. Doc. A15515 (1964) 15.

Declaration on the Inadmissibility of Intervention in the Domestic Affairs of States and the Protection of their Independence and Sovereignty, GA Res. 2131, UN GAOR, 20th Sess., Supp. No. 14, UN Doc. A/6014 (1966) 11.

Respect for Human Rights in Armed Conflicts, 19 December 1968, G.A. Res. 2444 (XXIII), U.N. GAOR, 23rd Sess., Supp. No. 18, U.N. Doc. A17218 (1969) 50, reprinted in Schindler & Toman at 263.

Declaration on Principles of International Law Concerning Friendly Relations and Co-Operation Among States in Accordance with the Charter of the United Nations, 24 October 1970, G.A. Res. 2625 (XXV), U.N. GAOR, 25th Sess., Supp. No. 28, U.N. Doc. A/8028 (1971), reprinted in (1971) 65 A.J.I.L. 243.

Basic Principles for the Protection of Civilian Populations in Armed Conflicts, 9 December 1970, G.A. Res. 2675 (XXV), U.N. GAOR, 25th Sess., Supp. No. 28, U.N. Doc. A/8028 (1971) 76, reprinted in Schindler & Toman at 267.

Definition of Aggression, 14 December 1974, G.A. Res. 3314 (XXIX), U.N. GAOR, 29th Sess., Supp. No. 31, U.N. Doc. A/9631 (1975) 142, reprinted in (1975) 69 A.J.I.L. 480.

Principles Relating to Remote Sensing of the Earth From Outer Space, 3 December 1986, U.N. Doc. A/Res/41/65.

Protection of the Environment in Times of Armed Conflict, G.A. Res. 47/37, U.N. GAOR, 47th Sess., Supp. No. 49, U.N. Doc. A/47/49 (1992).

Principles Relating to the Use of Nuclear Power Sources in Outer Space, 14 December 1992, U.N. Doc. A/Res/47/68.

Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interests of All States, Taking Into Particular Account the Needs of Developing Countries, 13 December 1996, U.N. Doc. A/Res/51/122.

SC Res. 1160, UN SCOR, 53d Sess., U.N. Doc. S/Res/1160 (1998).

SC Res. 1199, UN SCOR, 53d Sess., U.N. Doc. S/Res/1199 (1998).

SC Res. 1203, UN SCOR, 53d Sess., U.N. Doc. S/Res/1203 (1998).

UN SCOR, 54th Sess., UN Press Release SC/6657 (1999).

UN SCOR, 54th Sess. UN Doc. S/PV 3989 (1999).

SC Res. 1244, UN SCOR, 54th Sess., U.N. Doc. S/Res/1244 (1999).

D. Government Documents (Listed Chronologically)

United States, Department of the Army, *The Law of Land Warfare*, Field Manual 27-10 (Washington D.C., July 1956).

United States, Department of the Air Force, *International Law – The Conduct of Armed Conflict and Air Operations*, Air Force Pamphlet 110-31 (Washington D.C., November 1976).

United States, Department of the Air Force, *Airpower in Operation Desert Storm* (USAF Fact Sheet 91-03) (Washington, D.C., 1991).

United States, Department of the Air Force, *Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf War* (Washington, D.C., September 1991).

United States, House of Representatives, *Interim Report of the Committee of Armed Services* (Washington, D.C., March 1992).

United States, Department of Defense, *Final Report to Congress: Conduct of the Persian Gulf War* (Washington, D.C., April 1992).

United States, Department of Defense, *Joint Vision 2020* (Washington, D.C.: US Government Printing Office, June 2000) at 22.

United States, General Accounting Office, *Report to Congressional Requesters: Operation Desert Storm - Evaluation of the Air War* (Washington, D.C., July 1996).

U.K., Ministry of Defence, *Kosovo: An Account After the Crisis*, by Lord Robertson of Port Ellen (London: Her Majesty's Stationary Office, 1999).

United States, Department of Defense, *Joint Statement on the Kosovo Action After Review* (Washington, D.C., 14 October 1999).

United States, Office of the Director, Operational Test and Evaluation *Fiscal Year 1999 Report to Congress* (Washington, D.C., 2000).

United States, Department of Defense, *Report to Congress: Kosovo/Operation Allied Force After Action Report* (Washington, D.C., 31 January 2000).

E. Books

Abiew, F.K., *The Evolution of the Doctrine and Practice of Humanitarian Intervention* (The Hague: Kluwer Law International, 1999).

Alexander, J.B., *Future War: Non-Lethal Weapons in Twenty-First-Century Warfare* (New York: St. Martin's Press, 1999).

Andem, M.N., *International Legal Problems in the Peaceful Exploration and Use of Outer Space* (Rovaniemi, Finland: University of Lapland, 1992).

Arend, A.C. & Beck, R.J., *International Law & the use of Force* (London: Routledge, 1993).

Barnett, J.R., *Future War: An Assessment of Aerospace Campaigns in 2010* (Montgomery, AL: Air University Press, 1996).

Brown, M.E., ed., *The International Dimensions of Internal Conflict* (Cambridge, Massachusetts: MIT Press, 1996).

Brownlie, I., *The Principles of Public International Law*, 4th ed. (Oxford: Clarendon Press, 1990).

_____, *International Law and the Use of Force by States* (Oxford: The Clarendon Press, 1963).

Carpenter, T.G., ed., *NATO's Empty Victory: A Postmortem on the Balkan War* (Washington, D.C.: Cato Institute, 2000).

Casse, A., ed., *The Current Legal Regulation of the Use of Force* (Dordrecht: Martinus Nijhoff, 1986).

Chadwick, E., *Self-Determination, Terrorism and the International Humanitarian Law of Armed Conflict* (The Hague: Martinus Nijhoff, 1996).

Chayes, H.A. & Chayes, A., *Planning for Intervention: International Cooperation in Conflict Management* (The Hague: Kluwer Law International, 1999).

Cheng, B., *Studies in International Space Law* (Oxford: Clarendon Press, 1997).

- Chomsky, N., *The New Military Humanism* (Monroe, Maine: Common Courage Press, 1999).
- Christol, C.Q., *Space Law: Past, Present, and Future* (Deventer, The Netherlands: Kluwer Law and Taxation, 1991).
- , *The Modern International Law of Outer Space* (New York: Pergamon Press 1982).
- Clark, P., ed., *Jane's Space Directory*, 13th ed., 1997-1998 (Surrey, England: Jane's Information Group, 1997).
- Clark, R. & Others, *War Crimes: A Report on United States War Crimes Against Iraq* (Washington, D.C.: Mainsonneuve Press, 1992).
- Clausewitz, C. von, *On War*, ed. & trans. by M. Howard & P. Paret (Princeton, New Jersey: Princeton University Press, 1976).
- Cohen, A.E., et al., eds., *Gulf War Air Power Survey*, 5 Vols. (Washington D.C.: U.S. Government Printing Office, 1993).
- Collins, J.M., *Military Space Forces: The Next 50 Years* (Washington, D.C.: Pergamon-Brassey's, 1989).
- Crocker, C., Hampson, F.O. & Aall, P., eds., *Managing Global Chaos: Sources of and Response to International Conflict* (Washington, D.C.: United States Institute of Peace Press, 1996).
- Dallmeyer, D.G. & Tsipis, K., eds., *Heaven and Earth: Civilian Uses of Near Earth Space* (The Hague: Kluwer Law International, 1997).
- Danchev, A. & Keohane, D., *International Perspectives on the Gulf Conflict, 1990-91* (New York: St. Martin's Press, 1994).
- Dinstein, Y., *War, Aggression and Self-Defense* (Cambridge: Grotius Publications Limited, 1988).
- Doyle, S.E., *Civil Space Systems: Implications for International Security* (Aldershot, UK: Dartmouth, 1994).
- Friedman, G. & Friedman, F., *The Future of War: Power, Technology and American World Dominance in the 21st Century* (New York: St. Martin's Press, 1998).
- Friedman, L., ed., *The Law of War: A Documentary History*, 2 Vol. (New York: Random House, 1972).

- Friedrich, O., ed., *Desert Storm: The War in the Persian Gulf* (Boston: Time Warner, 1991).
- Frostic, F., *Air Campaign Against the Iraqi Army in the Kuwait Theatre of Operations* (Santa Monica, California: Rand, 1994).
- Garrett, S.A., *Doing Good and Doing Well: An Examination of Humanitarian Intervention* (Westport, Connecticut: Praeger, 1999).
- Gibbs-Smith, C.H., *Aviation: An Historical Survey from its Origins to the end of World War II* (London: Her Majesty's Stationary Office, 1970).
- Gray, C.S., *American Military Space Policy: Information Systems, Weapon Systems and Arms Control* (Cambridge, Massachusetts: Abt Books, 1982).
- Green, L.C., *The Contemporary Law of Armed Conflict*, rev'd ed. (Manchester, UK: Manchester University Press, 1999).
- _____, *Essays on the Modern Law of war*, 2nd ed. (Dobbs Ferry, NY: Transnational, 1999).
- _____, *Essays on the Modern Law of War*, 1st ed. (New York: Transnational, 1985).
- Gurney, G., *A Chronology of World Aviation* (New York: Franklin Watts, Inc., 1965).
- Hall, W.E., *International Law* (Oxford: The Clarendon Press, 1880).
- Hallion, R.P., *Storm Over Iraq: Air Power and the Gulf War* (Washington, D.C.: Smithsonian Institution Press, 1992).
- Hoffman, S., et al., *The Politics and Ethics of Humanitarian Intervention* (Notre Dame: Notre Dame University Press, 1996).
- Hurwitz, B.A., *The Legality of Space Militarization* (Amsterdam: Elsevier Science, 1986).
- Jasani, B., ed., *Peaceful and non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race* (New York: Taylor & Francis, 1991).
- Jasentuliyana, N., *Space Law: Development and Scope* (Westport: Praeger, 1992).
- Johnson, D.J., Pace, S. & Gabbard, C.B., *Space: Emerging Options for National Power* (Washington DC: RAND National Defense Research Institute, 1998).
- Johnson, D.J. & Reynolds, K., *Spacepower for a New Millenium: Space and US National Security* (Colorado Springs: U.S. Air Force Academy, 1998).

- Joyner, C.C., ed., *The United Nations and International Law* (Cambridge: Cambridge University Press, 1997).
- Judah, T., *Kosovo: War and Revenge* (New Haven: Yale University Press, 2000).
- Khalilzad, Z.M. & White, J.P., eds., *Strategic Appraisal: The Changing Role of Information in Warfare* (Santa Monica, California: Rand, 1999).
- Lambeth, B.S., *The Winning of Air Supremacy in Operation Desert Storm* (Santa Monica, California: Rand, 1993).
- Mantz, M.R., *The New Sword: A Theory of Space Combat Power* (Maxwell AFB, AL: Air University Press, 1995).
- Mayall, J., ed., *The New Interventionism 1991-1994: United Nations Experience in Cambodia, Former Yugoslavia and Somalia* (Cambridge: Cambridge University Press, 1996).
- McDougal, M.S. & Feliciano, F.P., *The International Law of war: Transnational Coercion and World Public Order* (The Hague: Martinus Nijhoff, 1994).
- _____, *Law and Minimum World Public Order* (New Haven: Yale University Press, 1961).
- McDougal, M.S., Lasswell, H.D., & Vlasic, I.A., *Law and Public Order in Space*, (New Haven: Yale University Press, 1963).
- Mills, K. *Human Rights in the Emerging Global Order: A New Sovereignty?* (London: Macmillan Press, 1998).
- Molander, R.C. et al., *Strategic Information Warfare Rising* (Washington, DC: RAND National Defense Research Institute, 1998).
- Muolo, M.J., et al., eds., *Space Handbook: A War Fighter's Guide to Space*, vol. 1 (Maxwell AFB, AL: Air University Press, 1993).
- _____, *Space Handbook: An Analyst's Guide*, vol. 2 (Maxwell AFB, AL: Air University Press, 1993).
- Newberry, R.D., *Space Doctrine for the Twenty-First Century* (Maxwell AFB, AL: Air University Press, 1998).
- Oppenheim, L., *International Law, A Treatise*, 7th ed. by Lauterpacht, H. (London: Longmans, Green, 1948).
- Owen, R.C., ed., *Deliberate Force – A Case Study in Effective Air Campaigning: Final Report of the Air University Balkans Air Campaign Study* (Maxwell AFB, AL: Air University Press, 2000).

- Petersen, S.R., *Space Control and the Role of Antisatellite Weapons* (Maxwell AFB, AL: Air University Press, 1991).
- Preston, B., *Plowshares and Power: The Military Use of Civil Space* (Washington, DC: National Defense University Press, 1992).
- Prestwich, M., *Armies and Warfare in the Middle Ages: The English Experience* (New Haven: Yale University Press, 1996).
- Roberts, A. and Guelff, R., eds., *Documents on the Laws of War*, 2nd ed. (Oxford: Oxford University Press, 1989).
- Schindler D. & Toman J., eds., *The Laws of Armed Conflicts: A Collection of Conventions, Resolutions and Other Documents*, 2nd ed. (Dordrecht: Martinus Nijhoff, 1988).
- Schneider, B.R. & Grinter, L.E., *Battlefield of the Future: 21st Century Warfare Issues* (Maxwell AFB, AL: Air University Press, 1998).
- Shukman, D., *Tomorrow's War: The Threat of High-Technology Weapons* (New York: Harcourt Brace & Company, 1996).
- Strickland, M., *War and Chivalry: The Conduct and Perception of War in England and Normandy, 1666-1217* (Cambridge: Cambridge University Press, 1996).
- Teson, F.R., *Humanitarian Intervention: An Inquiry into Law and Morality*, 2d ed. (Irvington-on-Hudson, New York: Transnational, 1997).
- Vale, M., *War and Chivalry: Warfare and Aristocratic Culture in England, France and Burgundy at the End of the Middle Ages* (London: Gerald Duckworth, 1981).
- Weiss, T.G., ed., *Beyond UN Subcontracting: Task-Sharing with Regional Security Arrangements and Service-Providing NGOs* (London: Macmillan Press, 1998).
- Wilson, A., *Jane's Space Directory*, 14th ed. (London: Jane's Information Group, 1998).

F. Articles from Books and Journals

- Aldrich, R.W., "The International Legal Implications of Information Warfare" (1996) 10:3 *Airpower J.* 99.
- Anderson, D.S., "A Military Look Into Space: The Ultimate High Ground" 1995 *Army Law.* 19.

- Bilder, R.B., "Kosovo and the "New Interventionism": Promise or Peril?" (1999) 9 J. Transnat'l L. & Pol'y 153.
- Bourbonniere, M. & Haeck, L., "Jus in Bello Spatiale" AIR & Space Law 25:1 (2000) 2.
- Bruger, S.J., "Not Ready for the First Space War — What About the Second?" (1995) 48:1 Naval War College Review 73.
- Capati, C., "The Tragedy of Cluster Bombs in Laos: An Argument for Inclusion in the Proposed International Ban on Landmines" (1997) 16 Wis. Int'l L.J. 227.
- Charney, J.I. "Anticipatory Humanitarian Intervention in Kosovo" (1999) 32 Vand. J. Transnat'l L. 1231.
- Cocca, A.A., "Prospective Space Law" (1998) 26:1 J. of Space L. 51.
- Dennis, M.J., "The Fifty-Fifth Session of the UN Commission on Human Rights" (2000) 94 Am. J. Int'l L. 189.
- DeSaussure, A.L., "The Role of the Law of Armed Conflict During the Persian Gulf War: An Overview" (1994) 37 Air Force L. Rev. 41.
- DeSaussure, H., "The Freedoms of Outer Space and Their Maritime Antecedents" in Jasentuliyana, N., *Space Law: Development and Scope* (Westport: Praeger, 1992).
- Duncan, J.C., "A Primer on the Employment of Non-Lethal Weapons" (1998) 45 Naval L. Rev. 1.
- Fidler, D.P., "The International Legal Implications of 'Non-Lethal' Weapons" (1999) 21 Mich. J. Int'l L. 51.
- Godwin, J.D., "NATO's Role in Peace Operations: Reexamining the Treaty After Bosnia and Kosovo" (1999) 160 Mil. L. Rev. 1.
- Greenstock, J., "International Human Rights and Standards" (1999) 23 Fordham Int'l L.J. 398.
- Grogan, D.E., "Power Play: Theater Ballistic Missile Defense, National Ballistic Missile Defense and the ABM Treaty" (1999) 39 Va. J. Int'l L. 799.
- Hashimoto, Y., "The Spaceplane and International Space Law" *Proceedings of the Thirty-fifth Colloquium on the Law of Outer Space* (Washington, D.C.: AIAA, 1993).
- Henkin, L., "That "S" Word: Sovereignty, and Globalization, and Human Rights, Etcetera" (1999) 68 Fordham L. Rev. 1.

- Kastrup, D., "From Nuremburg to Rome and Beyond: The Fight Against Genocide, War Crimes, and Crimes Against Humanity" (1999) 23 Fordham Int'l L.J. 404.
- Kelley, E., *The Spaceplane: The Catalyst for Resolution of the Boundary and 'Space Object' Issues in the Law of Outer Space?* (LL.M. Thesis) Institute of Air & Space Law, McGill University (1998) [unpublished].
- Lavrov, S., "The Russian Approach: The Fight Against Genocide, War Crimes, and Crimes Against Humanity" (1999) 23 Fordham Int'l L.J. 415.
- Layne, C., "Collateral Damage in Yugoslavia," in T.G. Carpenter, ed., *NATO's Empty Victory: A Postmortem on the Balkan War* (Washington, D.C.: Cato Institute, 2000).
- Lillich, R.B., "Humanitarian Intervention," in J.N. Moore, ed., *Law and Civil War in the Modern World* (Baltimore: Johns Hopkins University Press, 1974).
- McDougal, M.S. & Reisman, W.M., "Response by Professors McDougal and Reisman" (1969) 3 Int'l Lawyer 438.
- Moorman, T.S., "The Explosion of Commercial Space and the Implications for National Security" (1999) 13:1 Airpower J. 1.
 _____, "Space: A New Strategic Frontier" (1992) 6:1 Airpower J. 14.
- Nanda, V.P., Muther Jr., T.F. & Eckert, A.E., "Tragedies in Somalia, Yugoslavia, Haiti, Rwanda and Liberia – Revisiting the Validity of Humanitarian Intervention Under International Law – Part II" (1998) 26 Den. J. Int'l L. & Pol'y 827.
- Ocran, T.M., "How Blessed Were the UN Peacekeepers in Former Yugoslavia? The Involvement of UNPROFOR and other UN Bodies in Humanitarian Activities and Human Rights Issues in Croatia, 1992-1996" (2000) 18 Wis. Int'l L.J. 193.
- Owen, R.C., "The Balkans Air Campaign Study: Part 1" (1997) 11:2 Airpower J. 4.
 _____, "The Balkans Air Campaign Study: Part 2" (1997) 11:3 Airpower J. 6.
- Parks, W.H., "Air War and the Law of War" (1990) 32 Air Force L. Rev. 1.
- Ramey, R.A., *Space Warfare and the Future Law of War* (LL.M. Thesis) Institute of Air & Space Law, McGill University (1999) [unpublished].
- Reisman, W.M., "Criteria for the Lawful Use of Force in International Law" (1985) 10 Yale J. Int'l L. 279.
- Riesch, E., *L'aeronautique Militaire au Service de L'espionnage en Temps de Guerre* (1932) 1 Revue Generale de Droit Aerien 813.

- Sand P.H., Freitas J.S. & Pratt G.N., "An Historical Survey of International Air Law Before the Second World War" (1960) 7 McGill L.J. 24.
- Schmitt, M.N. "The Principle of Discrimination in 21st Century Warfare" (1999) 2 Yale Human Rts. & Dev. L.J. 143.
- _____, "Bellum Americanum: The U.S. View of Twenty-First Century War and Its Possible Implications for the Law of Armed Conflict" (1998) 19 Mich. J. Int'l L. 1051.
- Schwabach, A., "Yugoslavia v. NATO, Security Council Resolution 1244, and the Law of Humanitarian Intervention" (2000) 27 Syracuse J. Int'l L. & Com. 77.
- _____, "The Legality of the NATO Bombing Operation in the Federal Republic of Yugoslavia" (1999) 11 Pace Int'l L. Rev. 405.
- Shulman, M.R., "Discrimination in the Laws of Information Warfare" (1999) 37 Colum. J. Transnat'l L. 939.
- Sorge, K.M., *Legal Implications of United States Ballistic Missile Defense Systems* (LL.M. Thesis) Institute of Air & Space Law, McGill University (1995) [unpublished].
- Staelin, D.H. & Kerekes, J., "Remote Sensing Capabilities" in D.G. Dallmeyer & K. Tsipis, eds., *Heaven and Earth: Civilian Uses of Near Earth Space* (The Hague: Kluwer Law International, 1997).
- Thomson, A., "Satellite Vulnerability: A Post-Cold War Issue?" (1995) 11:1 S. Pol. 19.
- Vlasic, I.A., "Space Law and the Military Applications of Space Technology" in N. Jasentuliyana, ed., *Perspectives on International Law* (London: Kluwer Law International, 1995).
- _____, "The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space" in Jasani, B., ed., *Peaceful and non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race* (New York: Taylor & Francis, 1991).
- Voute, C., "Boundaries in Space" in Jasani, B., ed., *Peaceful and non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race* (New York: Taylor & Francis, 1991).

G. Articles from Magazines and Newspapers

- Anselmo, J.C., "Commercial Spaces' Sharp New Image" *Aviation Week and Space Technology* 152:5 (31 January 2000) 52.
- Clark, C. & Singer, J., "Report Says U.S. Must Dominate Space in War" *Space News* 11:9 (6 March 2000) 4.

- Covault, C. & Fulghum, D.A. "Russian Stealth Bomber Design Work Underway" *Aviation Week & Space Technology* 152:15 (10 April 2000) 18.
- Covault, C., "USAF Space Technology Advances to Forefront" *Aviation Week & Space Technology* 150:14 (5 April 1999) 42.
- Dornheim, M.A. "Several Micro Air Vehicles in Flight Test Programs" *Aviation Week & Space Technology* 151:2 (12 July 1999) 47.
- Eckholm, E. "Missile Defense Would Set Off Arms Race, China Warns" *The New York Times* (25 November 1999) A11.
- Fulghum, D.A., "B-2 Follow-on Design Revealed" *Aviation Week & Space Technology* 151:13 (27 September 1999) 57.
- _____, "Compass Call to Dominate Electronic, Info Warfare" *Aviation Week & Space Technology* 151:16 (18 October 1999) 50.
- _____, "EC-130s Continue Upgrades for 21st Century Combat" *Aviation Week & Space Technology* 151:16 (18 October 1999) 54.
- _____, "Electronic Bombs Darken Belgrade" *Aviation Week & Space Technology* 150:19 (10 May 1999) 34.
- _____, "F-22, JSF Designed For Distinct Roles" *Aviation Week & Space Technology* 152:6 (7 February 2000) 52.
- _____, "Future UAV Sensors To Scan Vast Areas" *Aviation Week & Space Technology* 152:6 (7 February 2000) 58.
- _____, "Growing Intelligence Operation Focuses on New Types of Signals" *Aviation Week & Space Technology* 151:5 (2 August 1999) 50.
- _____, "JSF Reflection Is Golf-Ball Sized" *Aviation Week & Space Technology* 150:7 (15 February 1999) 27.
- _____, "Kosovo Conflict Spurred New Airborne Technology Use" *Aviation Week & Space Technology* 151:8 (23 August 1999).
- _____, "New F-22 Radar Unveils Future" *Aviation Week & Space Technology* 152:6 (7 February 2000) 50.
- _____, "Microwave Weapons Await a Future War" *Aviation Week & Space Technology* 150:23 (7 June 1999) 30.
- _____, "New Radars Peel Veil from Hidden Targets" *Aviation Week & Space Technology* 150:3 (18 January 1999) 58.
- _____, "Report Tallies Damage, Lists U.S. Weaknesses" *Aviation Week and Space Technology* 152:7 (14 February 2000) 34.
- _____, "Rights Groups Claim Many Bombs Strayed" *Aviation Week and Space Technology* 152:6 (7 February 2000) 36.
- _____, "Russians Analyze U.S. Blackout Bomb" *Aviation Week and Space Technology* 152:7 (14 February 2000) 59.
- _____, "Ryan Designs UAV Helicopter for Navy" *Aviation Week and Space Technology* 151:21 (22 November 1999) 33.
- _____, "Sensors Combine Data, Plumb Hidden Details" *Aviation Week & Space Technology* 152:6 (7 February 2000) 56.

- _____, "Small Deck UAV Flies" *Aviation Week and Space Technology* 152:5 (31 January 2000) 37.
- _____, "Small Stealth Designs Within China's Grasp" *Aviation Week & Space Technology* 150:23 (7 June 1999) 28.
- _____, "Telecom Links Provide Cyber-Attack Route" *Aviation Week & Space Technology* 151:19 (8 November 1999) 81.
- _____, "UAV to Carry U-2 Recce Unit" *Aviation week & Space Technology* 152:20 (15 May 2000) 28.
- _____, "UCAV's Mission, Design Redefined" *Aviation Week & Space Technology* 151:12 (20 September 1999) 55.
- _____, "USAF Eyes New Cruise Missile" *Aviation Week & Space Technology* 150:12 (22 March 1999) 84.
- _____, "USAF Sizes Up Next electronic Combat Aircraft" *Aviation Week & Space Technology* 151:12 (20 September 1999) 28.
- _____, "Yugoslavia Successfully Attacked by Computers" *Aviation Week & Space Technology* 151:8 (23 August 1999) 31.
- Kandebo, S.W., "Boeing UCAV Aims for September Rollout" *Aviation Week & Space Technology* 152:13 (27 March 2000) 32.
- Lopez, G.A., "The Gulf War: Not So Clean" *Bulletin of the Atomic Scientists* 47:7 (September 1991) 30.
- Mann, P. "Bio-Warfare Called 'Weapon of Choice'" *Aviation Week & Space Technology* 150:15 (12 April 1999) 68.
- _____, "Fathoming a Strategic World of 'No Bear, But Many Snakes'" *Aviation Week & Space Technology* 151:25 (6 December 1999) 61.
- _____, "Multinational Warnings Issued on Weapons of Mass Destruction" *Aviation Week & Space Technology* 151:12 (20 September 1999) 60.
- Morocco, J.D., "Allies Pursue Few Indigenous Project" *Aviation Week & Space Technology* 151:7 (16 August 1999) 76.
- North, D.M., "Venerable U-2 Forges on to Y2K and Beyond" *Aviation Week & Space Technology* 150:15 (12 April 1999) 60.
- Scott, W.B., "Bad Weather No Deterrent for Long-Range Weapons" *Aviation Week & Space Technology* 150:18 (3 May 1999) 66.
- _____, "New Satellite Sensors Will Detect RF, Laser Attacks" *Aviation Week & Space Technology* 151:5 (2 August 1999) 57.
- _____, "U.S. Defines Missions for Military Spaceplane" *Aviation Week & Space Technology* (13 January 1997) 362.
- _____, "USSC Prepares for Future Combat Missions in Space" *Aviation Week and Space Technology* 45:6 (5 August 1996) 51.

Taverna, M.A., Fricker, J. & Gethin, H., "New Fighters Star at Moscow" *Aviation Week & Space Technology* 151:10 (6 September 1999) 70.

Tirpak, J.A. "Deliberate Force" *Air Force Magazine* 80:10 (October 1997).

Walker, P.F. "...and the dirty little weapons" *Bulletin of the Atomic Scientists* 47:4 (May 1991).

Wall, R., "Army Eyes UAVs for Sigint, Jamming" *Aviation Week and Space Technology* 151:20 (15 November 1999) 97.

_____, "Army Reconsiders Lasing Satellite" *Aviation Week & Space Technology* 151:25 (20/27 December 1999) 129.

_____, "Debate Surrounding NMD intensifies" *Aviation Week & Space Technology* 152:16 41 (17 April 2000) 41.

_____, "Long-Range Calcm Proposed for Future B-52 Use" *Aviation Week & Space Technology* 151:13 (27 September 1999) 60.

_____, "NATO Expands Use of UAVs" *Aviation Week and Space Technology* 150:23 (7 June 1999) 55.

_____, "NRO's Mission Under Scrutiny" *Aviation Week & Space Technology* 152:6 (7 February 2000) 33.

_____, "Pentagon Considers Thaad for Fast-Track Development" *Aviation Week & Space Technology* 152:17 (24 April 2000) 80.

_____, "Pentagon Details Flaws in Kosovo Weapons" " *Aviation Week & Space Technology* 152:8 (21 February 2000) 43.

_____, "Review of NMD Fallout Underway" *Aviation Week & Space Technology* 152:19 (8 May 2000) 31.

_____, "Space-Based Missile Defense Program Crystallizing" *Aviation Week & Space Technology* 151:7 (16 August 1999) 73.

_____, "Space, New Technologies Shifting Air Force Strategies" *Aviation Week & Space Technology* 152:10 (6 March 2000) 51.

_____, "USAF Maps Out Future of Global Hawk UAV" *Aviation Week & Space Technology* 151:2 (12 July 1999).

_____, "U.S. Navy to Bolster Unmanned Aircraft Fleet" *Aviation Week & Space Technology* 152:4 (24 January 2000).

H. Magazine Articles Without Authors

"Global Hawk Relays Images" *Aviation Week & Space Technology* 150:7 (15 February 1999) 45.

"Satellite Self-Protection Equipment Attracts USAF Interest, Investment" *Aviation Week & Space Technology* 151:7 (16 August 1999) 26.

I. Internet Sources

"Air Force Link," online: United States Air Force <<http://www.af.mil/>> (date accessed: 10 May 2000).

"Bombs for Beginners," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/dumb/bombs.htm>> (last modified: 23 April 2000).

"Bombs for Beginner: Ballistic Missile Basics," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/missile/basics.htm>> (last modified 3 February 2000).

"Bombs for Beginners: Biological Weapons," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/bw/intro.htm>> (last modified: 21 October 1998).

"Bombs for Beginners: Biological Weapon Delivery," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/bw/delivery.htm>> (last modified: 21 October 1998).

"Bombs for Beginners: Chemical Weapons – Introduction," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/cw/intro.htm>> (last modified: 21 October 1998).

"Bombs for Beginners: Chemical Weapon Delivery," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/cw/deliver.htm>> (last modified: 21 October 1998).

"Bombs for Beginners: Cruise Missiles," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/cm/index.html>> (date accessed: 3 May 2000).

"Bombs for Beginners: Intercontinental Ballistic Missiles," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/missile/icbm.htm>> (last modified 25 October 1998).

"Bombs for Beginners: Introduction," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/nuke/intro.htm>> (last modified: 21 October 1998).

"Bombs for Beginners: Theater Ballistic Missiles," online: Federation of American Scientists <<http://www.fas.org/nuke/intro/missile/tbm.htm>> (last modified: 25 October 1998).

"DefenseLINK," online: United States Department of Defense <<http://www.defenselink.mil/>> (last modified 10 May 2000).

“Defense Meteorological Satellite Program” online: United States Air Force
<<http://www.spacecom.af.mil/hqafspc/library/facts/dmsp.html>> (last modified: March 1999).

“Defense Satellite Communications System” online: United States Air Force
<http://www.af.mil/news/factsheets/Defense_Satellite_Communicati.html> (last modified: October 1999).

“Defense Support Program Satellites” online: United States Air Force
<http://www.af.mil/news/factsheets/Defense_Support_Program_Satel.html> (last modified: June 1999).

“Drop Today, Kill Tomorrow: Cluster Bombs as Inhumane and Indiscriminate Weapons,” online: Mennonite Central Committee <<http://www.mcc.org/misc/drop-today.html>> (date accessed: 3 May 2000).

“Dumb Bombs,” online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/dumb/index.html>> (date accessed: 3 May 2000).

“Dumb Bombs: Aircraft Weapon Loads,” online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/dumb/carry.html>> (last modified: 4 March 2000).

“EA-6B Prowler” online: Federation of American Scientists
<http://www.fas.org/irp/program/collect/ea-6b_prowler.htm> (last modified: 23 April 2000).

“Electronic Combat Systems” online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/ac/equip/ec.htm>> (last modified: 9 January 1999).

“F-22 Raptor” online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/f-22.htm>> (last modified: 25 April 2000).

“Fixed Wing Aircraft” online: Federation of American Scientists
<http://www.fas.org/man/dod-101/sys/ac/row/fwair_frame.htm> (last modified: 31 August 1999).

“Fuel/Air Explosive (FAE)” online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/dumb/fae.htm>> (last modified 5 February 1998).

“General Purpose Bombs,” online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/dumb/gp.htm>> (last modified: 5 February 1998).

- “Ground-Based Electro-Optical Deep Space Surveillance” online: United States Air Force <<http://www.spacecom.af.mil/hqafspc/library/facts/geodss.html>> (last modified: March 1999).
- “Helicopters” online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/row/helos.htm>> (last modified: 31 August 1999).
- “High Energy Research and Technology Facility (HERTF)” online: Federation of American Scientists <<http://www.fas.org/spp/military/program/asat/herft.htm>> (last modified: 21 November 1999).
- “IMINT Overview” online: Federation of American Scientists <<http://www.fas.org/spp/military/program/imint/overview.htm>> (last modified 7 April 1997).
- “Joint Strike Fighter (JSF)” online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/ac/jsf.htm>> (last modified: 2 January 2000).
- “Kinetic Energy Anti-Satellite” online: Federation of American Scientists <<http://www.fas.org/spp/military/program/asat/herft.htm>> (last modified: 18 August 1997).
- “Kosovo Background” online: Federation of American Scientists <http://www.fas.org/man/dod-101/ops/kosovo_back.htm> (date accessed: 15 March 2000).
- “Laser Guided Bombs,” online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/smart/lgb.htm>> (last modified: 12 February 2000).
- “Mapping & Geodesy” online: Federation of American Scientists <<http://www.fas.org/spp/military/geodetic/overview.htm>> (last modified 9 March 1997).
- “Mid-Infrared Advanced Chemical Laser” online: Federation of American Scientists <<http://www.fas.org/spp/military/program/asat/miracl.htm>> (last modified: 21 March 1998).
- “Military Communications Satellites” online: Federation of American Scientists <<http://www.fas.org/spp/military/com/intro.htm>> (last modified 3 June 1997).
- “Military Space Programs: Overview” online: Federation of American Scientists <<http://www.fas.org/spp/military/program/overview.htm>> (last modified: 9 March 1997).

- "Milstar Satellite Communications System" online: United States Air Force
<http://www.af.mil/news/factsheets/Milstar_Satellite_Communicati.html> (last modified: November 1999).
- "Navy Fact File: RQ-2A Pioneer Unmanned Aerial Vehicle (UAV)," online: The United States Navy <<http://www.chinfo.navy.mil/navpalib/factfile/aircraft/air-uav/html>> (date accessed: 3 May 2000).
- "NMD" online: Federation of American Scientists
<<http://www.fas.org/spp/starwars/program/nmd.htm>> (last modified: 25 April 2000).
- "Nuclear Detection System" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/masint/nds.htm>> (last modified: 20 April 1997).
- "Nuclear Forces Guide: Chemical Weapons," online: Federation of American Scientists
<<http://www.fas.org/nuke/guide/usa/cbw/cw.htm>> (last modified: 19 October 1998).
- "Operation Allied Force" online: Federation of American Scientists
<http://www.fas.org/man/dod-101/ops/allied_force.htm> (date accessed: 15 March 2000).
- "Rest of World Military Aircraft" online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/ac/row/index.html>> (date accessed: 3 May 2000).
- "SB-WASS – Space Based Wide Area Surveillance System" online: Federation of American Scientists <<http://www.fas.org/spp/military/program/surveill/sbwass.htm>> (last modified: 12 May 1996).
- "SIGINT Overview" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/sigint/overview.htm>> (last modified: 9 March 1997).
- "Smart Weapons," online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/smart/index.html>> (date accessed: 3 May 2000).
- "Space Communications: Overview" online: Federation of American Scientists
<<http://www.fas.org/spp/military/com/overview.htm>> (last modified: 13 April 2000).
- "Space Defense" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/asat/overview.htm>> (last modified: 9 March 1997).

- "Space Surveillance" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/track/overview.htm>> (last modified: 20 April 1997).
- "Special Weapons Monitor" online: Federation of American Scientists
<<http://www.fas.org/spp/starwars/program/index.html>> (date accessed: 3 May 2000).
- "Specialized Forces: Military Aircraft" online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/ac/special.htm>> (last modified: 2 January 2000).
- "Unmanned Aerial Vehicles (UAVs)," online: Federation of American Scientists
<<http://www.fas.org/irp/program/collect/uav.htm>> (last modified: 4 May 2000).
- "US Military Aircraft," online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/ac/index.html>> (date accessed: 3 May 2000).
- "US Missiles," online: Federation of American Scientists <<http://www.fas.org/man/dod-101/sys/missile/index.html>> (date accessed: 3 May 2000).
- "USAF Fact Sheet: E-8C Joint Stars" online: United States Air Force
<http://www.af.mil/news/factsheets/E_8C_Joint_Stars.html> (last modified: June 1999).
- "USAF Fact Sheet: AGM-88 HARM" online: United States Air Force
<http://www.af.mil/news/factsheets/AGM_88_HARM.html> (last modified: March 1997).
- "USAF Fact Sheet: B-2 Spirit" online: United States Air Force
<http://www.af.mil/news/factsheets/B_2_Spirit.html> (last modified: March 1999).
- "USAF Fact Sheet 96-13: E-3 Sentry (AWACS)" online: United States Air Force
<http://www.af.mil/news/factsheet/E_3_Sentry_AWACS_.html> (last modified: March 1996).
- "USAF Fact Sheet 96-04: F-117A Nighthawk" online: United States Air Force
<http://www.af.mil/news/factsheets/F_117A_Nighthawk.html> (last modified: March 1996).
- "USAF Fact Sheet: NAVSTAR Global Positioning System" online: United States Air Force
<http://www.af.mil/news/factsheets/NAVSTAR_Global_Positioning_Sy.html> (last modified: October 1999).
- "USAF Fact Sheet 96-21: U-2R/U-2S," online: United States Air Force
<http://www.af.mil/news/factsheets/U_2R_U_2S.html> (last modified: June 1996).

"The United States Army Homepage Index," online: United States Army
<<http://www.army.mil/>> (date accessed: 10 May 2000).

"The United States Navy," online: United States Navy <<http://www.navy.mil/>> (last modified: 10 May 2000).

"Warning" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/warning/overview.htm>> (last modified 20 April 1997).

"Weather" online: Federation of American Scientists
<<http://www.fas.org/spp/military/program/met/overview.htm>> (last modified 20 April 1997).

"What's New With Smart Weapons," online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/smart/new.htm>> (last modified: 4 March 2000).

"Worldwide UAV Systems" online: Federation of American Scientists
<<http://www.fas.org/man/dod-101/sys/ac/row/uav-list.htm>> (date accessed: 3 May 2000).

J. Bibliographies

Security-Related Applications of Commercial Remote Sensing Satellites: A Bibliography 1955-1997 (Ottawa: Department of Foreign Affairs and International Trade, 1998).

Howard, S.L., *The Law of War and Neutrality: A Selective English Language Bibliography* (New York: Oceana, 1988).

Li, K.L., *World-Wide Space Law Bibliography* (Montreal: De Daro Publishing, vol. I-1978; vol. 11-1987; update-1998).

Rawnsley, L.S., *Selective Bibliography of Outer Space Law: A Bibliography of Materials in the English Language* (New York: Oceana, 1987).