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NON-LETHAL TECHNOLOGIES: IMPLICATIONS FOR MILITARY STRATEGY

by

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Historically, militaries have sought to increase lethality of weapons to better achieve military success and political objectives. This approach may not be the most effective means to achieve sustainable stability in current political environment. Political, societal, and operational factors have limited the effective use of traditional military response. Emerging non-lethal weapon technologies may offer the means to decisively confront today?s security dilemmas. The current interest in non-lethal weaponry is primarily centered on employment during close-in tactical engagements for peace-keeping and peace-enforcement missions. This assessment will continue the debate and examine the issue from a broader perspective. Specifically, are non-lethal weapons technologies an effective weapon to achieve military and political objectives across the spectrum of conflict. The paper will examine potentials of non-lethal doctrine by assessing the emerging characteristics of U.S. security policy, identify the unique competencies of nonlethal weapons, then evaluate the ?ponderables? of employment of non-lethal tools. Finally, military employment options for non-lethal weapons will be examined. Conclusions will identify ?high payoff? non-lethal technologies and its implications for Air Force doctrine and strategies.

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Abstract

Historically, militaries have sought to increase lethality of weapons to better achieve military success and political objectives. This approach may not be the most effective means to achieve sustainable stability in current political environment. Political, societal, and operational factors have limited the effective use of traditional military response. Emerging non-lethal weapon technologies may offer the means to decisively confront today's security dilemmas. The current interest in non-lethal weaponry is primarily centered on employment during close-in tactical engagements for peace-keeping and peace-enforcement missions. This assessment will continue the debate and examine the issue from a broader perspective. Specifically, are non-lethal weapons technologies an effective weapon to achieve military and political objectives across the spectrum of conflict. The paper will examine potentials of non-lethal doctrine by assessing the emerging characteristics of U.S. security policy, identify the unique competencies of non-lethal weapons, then evaluate the "ponderables" of employment of non-lethal tools. Finally, military employment options for non-lethal weapons will be examined. Conclusions will identify "high payoff" non-lethal technologies and its implications for Air Force doctrine and strategies.

Chapter 1

Introduction

Once in a while a door opens and lets the future in...

—Graham Greene

Historically, militaries have sought to increase the lethality of weapons to better achieve political objectives and military success. This approach may not be the most effective means to maintain stability in the current global environment. Political, societal, and operational factors have limited the effective use of a traditional military response. In spite of the tremendous military success during the Persian Gulf conflict, the United States struggles to develop the will and effective tools to respond to today's conflicts. The military operations in Bosnia, Somalia, Rwanda, and Haiti highlight the difficulties of adopting our existing military tools to the new strategic setting. Hence, there is a call for new strategy options and credible coercive tools. Non-lethal technologies, capabilities that can coerce or deter while limiting casualties and destructiveness, are being hailed as an answer.

Non-lethal weapons represent a shift from the increasingly lethal evolution of military arms. Overall, acceptance of non-lethal weapons by the defense community has been slow in spite of determined advocacy within Congress and the academic community.[1] Several advocates attempted to focus the debate on the military and moral advantages of non-

lethal weapons; however, the military services were reluctant to accept the supposed advantages. Recently, interest peaked when the US military struggled to forge effective employment doctrine and tactics for expanding commitments in operations-other-than-war during operations in Bosnia and Somalia. As a result of these experiences, the Department of Defense crafted a policy to consolidate procurement priorities and employment policies for the employment of non-lethal technologies. The policy concentrates on close-in, tactical applications in support of peace-keeping and humanitarian operations.[2] A review of proposed non-lethal funding indicates that over 70 percent of projected research and procurement funding is dedicated to tactical efforts.[3] While employment of non-lethal technologies is maturing for tactical applications; the evolution of non-lethal technologies for the more general warfighting applications is still being conceptionalized. It is here where advocates claim that non-lethal technologies may make the greatest contribution to future warfighting—enabling more effective political strategies and potentially changing the nature of war itself. The question of whether non-lethal technologies provide a compelling advantage that justifies advancement beyond tactical uses is a core issue facing policy makers.

This study will assess the expanded use of non-lethal technologies as a warfightng instrument and the potential implications to national and military strategy. The evaluation will look at what non-lethal weapons "bring to the fight," the emerging characteristics of our national strategy policy, and the "ponderable" issues that must be considered with the introduction of a new military technology. The objective is to determine if non-lethal strategies meet the emerging national security needs and if the non-lethal tools can be a

decisive tool for intervention. The synthesis of these security needs, technology promise, and policy constraints will provide the framework for this analysis.

Notes

[1] Greg Lynch, "The Role of Nonlethal Weapons in Special Wars," Navy Postgraduate School Thesis, ADA 297651, (Ft. Belvoir Va., Defense Technical Information Center, 1995), 19-23 and Charles Swett, "Strategic Assessment: Non-lethal Weapons, Office of the Assistant Secretary of Defense for Special Operations and Low-intensity Conflict Staff Paper, November 1993, 1-3.

[2] Charles Swett, Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, telephone interview on 12 December 1996 and "Policy for Non-Lethal Weapons," Department of Defense Directive, 9 July 1996, 1-4.

[3] Nonlethal Weapons FY98-03 Augmentation POM, Commandant of the Marine Corps (Executive Agent), 3 October 1996.

Chapter 2

Non-lethality—A Technology Assessment

The endless number of military inventions is limited only by the imagination of the soldier and the scientist.

—Michael Handel

Non-lethal technologies cover a broad, diverse range of capabilities that, in general, disrupt or destroy specific targets with minimum lethal effects. The technology ranges from biological, chemical, information warfare, crowd control measures, to the latest offerings of exotic weapons. This section will conduct a review of the promise of non-lethal technologies to assess their strategic value.

Serious interest in "non-lethality" as a technology and as a distinct class of weapons is recent. Joseph Coates authored the study "Nonlethal and Nondestructive Combat in Cities Overseas" in 1970 which proved to be a seminal assessment of potential non-lethal concepts. The study assessed numerous potential applications and non-lethal technologies for operations in urban areas. This early evaluation became the template for current technology research and development.[1] Today's assortment of emerging non-lethal technologies grew from these concepts following the termination of the Cold War. In a search for relevance, the national labs turned from nuclear warfare technology to less conventional research areas as "non-lethality." As a result, non-lethal concepts are a

product of a "technology-push" and; therefore, lacked traditional, well-defined war fighting requirements, established doctrine, and initial support.[2]

Non-lethal Technology—A Definition

The original phrase "non-lethal" caused considerable confusion in identifying the realistic capabilities and the intent of these weapons. The perceptions drawn from the definition tend to overstate the capability of the various technologies. The visions, by some advocates, that future wars may be transformed to short, "bloodless conflicts" drew an expected cautionary reaction from the defense community.[3] As a result, the debate did not focus on identifying realistic expectations and employment of these technologies. Therefore, a clear, precise definition is essential to correctly characterize what capabilities non-lethal technologies "bring to a future fight."

The recent DOD Directive provides a workable definition of non-lethal weapons.

> Weapons that are explicitly designed and primarily employed so as to incapacitate personnel or material, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment. Unlike conventional lethal weapons that destroy their targets principally through blast, penetration and fragmentation, non-lethal weapons employ means other than gross physical destruction to prevent the target from functioning. Non-lethal weapons are intended to have one or both of the following characteristics: 1) they have relatively reversible effects on personnel or material, 2) they affect objects differently within their area of influence.[4]

The Army's "Concept for Non-lethal Capabilities in Army Operations" more simply states this definition: "Nonlethal capabilities are employed with the intent to compel or deter adversaries by acting on human capabilities or material while minimizing fatalities and damage to equipment or facilities."[5]

Implicit in these definitions are several important points that are relevant to the discussion. The first is the concept of non-lethal intent. Non-lethal weapons, when properly employed, should significantly reduce lethal effects—however, there is no guarantee of "zero" fatalities or permanent injuries.[6] Certainly, even the most benign weapons technologies may create lethal effects under some conditions. It is the intent that separates this class of weapons from conventional munitions. Unintended lethal effects must be considered and may modify employment strategies and tactics. Second, non-lethal weapon employment is not limited to the lower spectrum of conflict—peace-keeping, peace-enforcement, and humanitarian missions. Rather, they can apply across the range of military operations where they will enhance the "effectiveness and efficiency of military operations."[7] The DOD Policy leaves the door open for warfighting applications of these weapons—but the rationale for expanded employment is not convincingly developed. The third point is the exclusion of information warfare in the definition of non-lethal technologies. Information warfare is a form of non-lethal warfare when it seeks to deny or disrupt indirectly without actual destruction of personnel or material. However, the means of application are distinctly different from other forms of non-lethal weapons and, therefore, should be addressed separately.

State of the Technology

From this definition, the "promise" of non-lethal technology will be assessed. Considering the evolution of conventional munitions occurred over the last several centuries, the evolution of non-lethal technology is in its infancy. The advancement of these technologies has been recent and largely unfocused. The recent Department of

Defense (DOD) "Policy for Non-Lethal Weapons" goes a long way to correct this deficiency by establishing specific responsibilities for the development and employment of non-lethal weapons. This policy identifies the Commandant of the Marine Corps as the DOD executive agent and assigns oversight for development and employment to the Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict.[8] This welcome initiative will go a long way to focus future development and employment policy.

The current state of the art must be considered a starting point for continued advancement. Expectations for future non-lethal employment must consider greatly expanded range, precision, and effectiveness but at the same time must remain technically and operationally realistic. In an effort to establish a common point of reference, a brief review of the on-going research is necessary to establish an appreciation for the potential of non-lethal capabilities and the limits of the technology. It is necessary to identify "the possible" in order to assess future employment, needed characteristics, and limitations of non-lethality.

Non-lethal weapons can be classified by either function or technology. Since the intent of this study is to build a road map for future missions, it is more useful to describe emerging capabilities by function—either by non-lethal anti-material or anti-personnel effects. In these categories there are no absolutes. While some technologies may be used for either purpose depending on the needs of the military strategy, only applications that may have some implications to a warfighting role will be detailed in this assessment. An additional summary of current non-lethal capabilities is at Figure 1.

Anti-Personnel

Anti-personnel, non-lethal capabilities target people by nondestructive means to include paralyzing or disabling effects. The nature of the anti-personnel effects are generally temporary in nature or reversible with minimum lasting effects.

Chemical Agents. Non-lethal chemical capabilities generally include agents that induce sleep or agents that produce irritation (calmative, neural inhibitors, irritants, and odor producing chemicals). Chemical agents are not new, and have been used for combat in more lethal forms or in law enforcement to disrupt riots or crowds. As a result, there is considerable experience in the employment and delivery of chemical munitions as well as extensive experience in the protective measures. Many types of chemical agents, such as pepper spray, currently exist and are used for crowd and riot control.

The effective, quick-acting effects of this these chemical can be used to disrupt military operations or as a means to achieve temporary military advantage. Targets may include disablement of individuals, a large grouping of people or an assembly of troops, or precision targets such as ventilation intakes in critical leadership facilities. The military employment of chemical agents is limited by several factors. First, protective equipment is readily available and tactics are routinely practiced by most modern militaries. Second, the effects and effective radius of these agents may be subject to environmental conditions such as precipitation and air currents. Third, the unpredictable reaction of some individuals to the agents, even at low dosages, may result in greater lethality than desired. Finally, various international conventions may limit the offensive use of chemical and biological agents. The legal implications will be discussed in detail in a subsequent chapter. In view of the limitations, chemical agents may be best employed for crowd or

riot control. The effectiveness of chemical agents in other military operations will depend on the assessed vulnerabilities of the target to this type of attack and established legal agreements.[9]

Optical Weapons. Low energy lasers radiate directionally disrupting human vision or optical sensors such as night vision devices, target acquisition devices, or range finding equipment. The low powered lasers can temporarily, or permanently, damage optic nerves in humans rendering the individual "temporarily" blind. The intensity of the effects is dependent on the laser power, range to the target, and the stability of the target (it is more difficult to precisely target a moving object for a long enough period to achieve the desired effect). A similar capability are isotonic radiators or optical bombs. These devices produce an extremely intense flash by an explosive burst that superheats a gaseous plasma. This flash can radiate a directional or omni-directional burst that has an intensity equivalent to a laser. The effects are similar to the low energy laser and include disorientation, temporary or permanent optic nerve damage to humans, or blinding of optical sensors.

This capability can be used to achieve temporary military advantage within the limited range of the weapon. These weapons currently exist and are small enough to be mounted on an air vehicle or can be man-portable. The proliferation of the advanced optical sensors that support precision weaponry may create a vulnerability that can be attacked. The use of a laser to "sweep" an area to degrade the optical sensors tied to precision weapons may be significant. However, the destruction of the optics rarely disables the weapons since back-up modes are usually available that can provide a less effective, but still capable, means to employ the targeted weapon. The Army investigated the use of

lasers to blind optical sensors used for targeting or acquisition. One of these systems was deployed to the Persian Gulf conflict; however, was not used due to insufficient training and tactics. In addition, illumination lasers for individual weapons were deployed to Somalia during peacekeeping operations; however, the use was again limited.[10] The use of lasers to disorient combatants could prove effective but has generated significant opposition and is subject to various restrictions. The question of the "humane-nature" of a weapon that causes indiscriminate blinding of combatants and non-combatants will restrict the future use of this technology in combat.

Acoustics. There has been considerable interest in using acoustics as a potential non-lethal weapon. The acoustical weapons generate a low frequency sound (below 50Hz) that can disorient or cause nausea in personnel. The distress is reported as temporary and stops when the acoustic source is stopped. At high power settings, these weapons may have an anti-material capability if "tuned" to the appropriate frequencies. Several limitations are notable. First, this capability requires large amplifiers and large volume speakers (or a phased array of speakers) that may limit the mobility of the weapon. In addition, the range of the weapon is limited as the sound energy dissipates at greater ranges. This creates a challenge to deliver the effects at extended range—delivery from an air vehicle will require significant engineering advances. "Acoustic bullets" is another concept that is being explored. This capability employs a high-powered, low frequency blast to generate an impact wave that can incapacitate people.

The acoustic technology is immature. The current capabilities may limit future acoustic weapons to close-in engagements due to range and size of the required

equipment. If the technical difficulties can be solved, this technology may offer the potential for meeting other military requirements.

Directed Energy—High Power Microwave (HPM). High powered microwaves are normally considered an anti-material weapon, but this technology may have a significant anti-personnel capability as well. Some directed energy weapons, such as microwaves, are able to produce a variety of effects on humans to include increasing levels of pain, incapacitation, and disorientation. Research is still under development. The range and power of these effects are not yet known but is assumed to be sufficient for use as a strategic weapon. A high-powered microwave weapon can be used for area denial or as a force protection capability.

Restraining Mechanisms. A variety of devices are being developed to restrain personnel. These include polymer adhesives or "sticky foams," ensnaring nets, and ultra-slick liquids that can impede personnel movement. Most of the restraining technologies are being developed for tactical applications, but they may have some future use in a strategic role to disrupt personnel movement or denial of an area or facility.

Anti-Material

Anti-material applications produce the disruption or the limited destruction of equipment, vehicles, facilities, weapons, or supplies. The advantage of these weapons is the ability to achieve desired effects with minimal lethal risk. This grouping may have the greatest application for warfighting employment.[11]

Chemical and Biological Agents. Research is underway to create chemical or biological agents that have a variety of anti-material effects. Supercaustic agents, derived from chemical, biological, or biological enzymes, can rapidly deteriorate rubber, plastics,

or spoil petroleum supplies. These are claimed to be "millions of times more caustic than hydrofluoric acid" and can be delivered as a liquid or aerosol. Liquid metal embrittlement agents are able to alter the molecular structure of metals making them weak and susceptible to structural failure. The embrittlement agents are normally formulated for a specific metal or alloy which may complicate the flexibility for combat employment. Polymer agents are extremely strong adhesives. Polymers, called "stick-ems," can be applied as a liquid or foam to deny the mobility of equipment and personnel. Alternatively, super-lubricants ("slick-ems") are being developed as an anti-traction capability that could disrupt the movement of vehicles. Finally, combustion inhibiting substances are being developed that will shut down engines of ground and small maritime vehicles. Many of these agents have proven to be effective in a laboratory setting, but have not been fully tested in the range of environmental conditions that will be experienced in a combat setting.

Anti-material chemical agents can be used to disrupt enemy supply lines by attacking critical transportation nodes, denying the use of critical supplies and equipment, or disabling critical infrastructure. The capability against these targets offers significant options to military commanders; however, this type of weapon does suffer from several limitations. The effective reaction time and difficulty of precision delivery may limit the use of these agents for combat. Application over a broad area may require a significant amount of agent; and therefore, complicates effective targeting. Therefore, anti-material chemical agents may be best employed against smaller "choke" points such as airfield taxiways, critical intersections, or inclines on railroads. In most cases, the effects will be short lived until the substance can be removed or countered and are best employed in

close battle situations where small delays in maneuver or supply can be critical. For some proposed weapon concepts, it is hard to discriminate between the effects of a lethal munitions and a "non-lethal" capability such as metal embrittlement or super caustic agents. The destruction of a bridge by non-lethal chemicals or by kinetic munitions achieves the same results. Hence, "non-lethal" advantages, if any, must be weighed against the commander's confidence in the weapon.

Electromagnetic Pulse (EMP) and High Powered Microwave (HMP) Weapons. This technology offers a significant capability against modern electronic equipment that is susceptible to damage by transient power surges. This weapon produces a very short but intense energy pulse that can produce a transient surge of thousands of volts that is deadly to semiconductor devices. The conventional EMP and HMP weapons can disable non-shielded electronic devices such as command, control and communications, aircraft flight controls, computer equipment, and practically any modern electronic device within the effective radius of the weapon. The effect of an EMP device is determined by the level of power generated and the characteristic of the pulse. The shorter pulse wave forms, such as microwaves, are far more effective against electronic equipment and more difficult to protect with hardening countermeasures. Current efforts are focused on converting the energy from an explosive munitions to supply the electromagnetic pulse. This method produces significant levels of electromagnetic energy that can be directionally focused. Future advances may provide the compactness needed to weaponize the capability in a bomb or missile warhead. The radius of the weapon is not as great as nuclear EMP effects but can be significant. Open literature sources indicate that an effective radius of "hundreds of meters or more" are possible using this technology. EMP and HPM devices

can effectively disable a large variety of military or infrastructure equipment located in a relatively broad area. This can be useful for targets where components are spread over a large area or that are dispersed for protection. A difficulty is determining the appropriate level of energy to achieve the desired effects. This will require an in depth knowledge of the targeted equipment and the environment (walls, buildings) to provide confidence of success. The obvious counter-measure is the shielding or "hardening" of electronic equipment. Currently, the only critical military equipment is "hardened" such as strategic command and control systems. The hardening of existing equipment is difficult and can add significant weight and expense. As a result, a large variety of commercial and military equipment will be susceptible to this type of attack. It does appear that EMP and HPM weapons are emerging as the leading contender among the large and diverse assortment of non-lethal technologies.[12]

Table 1. Non-Lethal Technologies

TECHNOLOGY	CATEGORY	APPLICATION
Conductive Particles	M	Any variety of particles that can induce short circuits in electrical or electronic equipment
Depolymerizing Agents	M	Chemicals that cause polymers to dissolve or decompose. Could clog air breathing engines. Adhesives could "glue" equipment in place
Liquid Metal Embrittlement Agents	M	Agents that change the molecular structure of base metals or alloys, significantly reducing their strength. Could be used to attack critical metal structures—aircraft, ships, trucks, metal treads
Non-Nuclear Electromagnetic Pulse	M	Pulse generators producing gigawatts of power could be used to explode ammunition dumps or paralyze electronic systems. Vulnerable systems include electronic ignition systems, radars, communications, data processing, navigation, electronic triggers of explosive devices
High Powered Microwave	M, P	Microwave pulse generators are similar to electromagnetic pulse. Applications are also similar; however, microwave frequencies may have anti-personnel applications that can cause pain or incapacitation. May also be used for force protection applications

Table 1—continued

TECHNOLOGY	CATEGORY	APPLICATION
POL Contaminators	M	Additives that cause fuel to gel or solidify making it unusable
Supercaustics	M	Acids that corrode or degrade structural materials
Super Lubricants	M	Substances that cause lack of traction. Delivered by aircraft, can render railroads, ramps, or runways unusable for limited time frames
Acoustics	M, P	Very low frequency sound generators that could be tuned to incapacitate personnel. At high power may have anti-material applications
Foam	M, P	Sticky or space-filling material that can impede mobility or deny access to equipment
Isotropic Radiators	M, P	Conventional weapons that produce an omni-directional laser-bright flash that can dazzle personnel or optical sensors
Lasers	M, P	Low energy lasers could flash blind personnel or disable optical or infrared systems used for target acquisition, tracking, night vision, and range finding
Calmative Agents	P	Chemical substances that are designed to temporary incapacitate personnel

Source: Timothy Hannigan, Lori Raff, and Rod Paschall, "Mission Applications of Non-Lethal Weapons," JAYCOR Technical Study for the Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, August 1996, Appendix D and Col John Barry, LTC Michael Everett, and Lt Col Allen Peck, :Nonlethal Military Means: New Leverage for a New Era," National Security Program Policy Analysis Paper 94-01, John F. Kennedy School of Government, Harvard University, 6.

Categories: P = Anti-Personnel, M = Anti-Material

Weapon Characteristics

An assessment of the relevance of non-lethal technologies to national and military strategies cannot be accomplished without identifying the unique competencies of non-lethality. This is a dangerous proposition given the diverse technologies and capabilities that are included in non-lethal initiatives. However, there are several common elements that establish the unique features of non-lethal weapons. These competencies will define future non-lethal technologies as credible weapons. The extent to which non-lethal technologies represent an evolution in national and military strategies depends on the advances to technology that support these unique weapon competencies.

Precision Effects

There is no clear line between precision guided lethal and non-lethal capabilities. Rather, it is a continuum of capabilities that strive to increase the effectiveness of the attack while limiting lethal and collateral destruction. The difference is that the precision guided lethal weapons control the destructiveness by highly accurate delivery means. Non-lethal weapons, on the other hand, are able to control the effect of the weapons. In other words, conventional munitions destroy everything within the effective radius of the weapon, whereas a non-lethal weapon is able to precisely attack specific components of the enemy's infrastructure or military force. As an example, an EMP attack will defeat electronic equipment within a large radius area while having minimal impact on other infrastructure or people. The precision effect of non-lethal weapons allow increased radius of effects and the ability to target areas where risk of lethal effects or collateral damage is too great for conventional munitions.

Radius of Effects

Non-lethal weapons differ from precision munitions by having a considerable greater radius of effects. Chemical, acoustic, or directed energy weapons (EMP or HPM) can have an effective range measured in the hundreds of meters. Since lethal effects are minimized, the effective radius of future weapons can be expanded, perhaps to have country-wide effects. This fills an important niche that precision weapons cannot fill. This capability enables the destruction of dispersed equipment, denial/disruption of a large area or facility, or disabling of infrastructure targets such as a manufacturing facility where critical nodes can not be determined or targeted. The flexibility to attack diverse target sets will require future non-lethal weapons to control the radius of effects. The ability to

match the weapon radius to the desired target allows greater discrimination and precision of effects (minimal collateral effects). This permits the ability to better match the weapon with the objective.

Repeatable Effects

Non-lethal weapons must produce reliable and repeatable effects. Political decision-makers and military commanders must have confidence in the weapon's ability to achieve the non-lethal effects required by the strategy. Without confidence in the weapon system, military commanders will be reluctant to risk lives and equipment to use non-lethal force. Further, subsequent military actions may depend on the effectiveness of a non-lethal attack. Confidence in the ability of the weapon to reliability deliver the intended effects is imperative if these weapons are to enable new military strategies. Many of the capabilities depend on a singular, non-lethal mechanism of effect, which in turn aids in the development of effective counter-measures. As examples, anti-material chemical agents depend on a single effect that may be defeated with the proper chemical "anti-dote," EMP weapons may be defeated by the "hardening" of electronic equipment and anti-traction agents may be countered by applying sand to add traction. If non-lethal weapons are to become a dominant capability, national leaders and military commander must be confident that the effects will be repeatable under a variety of combat environments.

Selectivity of Effects

The "non-lethal intent" is the true enabling aspect of these weapons. The "intent of non-lethality" may enable political and military strategies that are not possible with conventional munitions. This feature of non-lethal weapons will enable many advantages

to include: a greater flexibility to attack politically sensitive targets and attack broad area targets without risking extensive civilian fatalities or collateral damage; a "reversibility" of material damage to permit a rapid reconstruction of economic infrastructure; and an answer to moral imperatives to minimize combat casualties. The "non-lethality"; however, must be verifiable because decision-makers will be reluctant to engage a threat with unconventional weaponry unless there is confidence in the effects.

Weaponized Capability

Future non-lethal weapons must be capable of being weaponized to be an effective strategic tool. The emphasis on stand-off engagements will require these weapons to be delivered by standoff means such as cruise missiles or unattended air vehicles (UAVs). The stand off capability allows reduced risk to friendly forces and equipment as well as the ability to strike the strategic targets that support the enemy's war-making capabilities. This element is critical for the eventual use of non-lethal weapons in a strategic role.

Summary

The non-lethal debate that has continued within the US defense community during the last several years is marked by considerable misunderstanding and exaggeration concerning the utility and effectiveness of non-lethal technologies. A review of these technologies reveals that:

- Non-lethal technologies act on human capabilities or material and, when properly employed, have the intent of minimizing fatalities and undesired damage. Non-lethal weapons may be employed across the spectrum of conflict.
- Current technologies represent a first generation effort. A wide variety of non-lethal weapons are under research or development. It can be expected that future capabilities will possess significantly greater capabilities.

- In concept, non-lethal technologies represent a continuation in the evolution of precision weaponry. Precision weapons deliver kinetic effects to a precise target. The next generation of weapons will be able to deliver precision effects to precise targets.
- There are credible anti-personnel and anti-material non-lethal weapons in development. Directed energy (EMP and HPM) and acoustic technologies offer the greatest near-term promise for a credible warfighting capability. Some chemical non-lethal agents (anti-traction or adhesive foam) and optical weapons may provide a useful capability in some situations.
- Although individual effects may vary, there are several unique characteristics that will define future non-lethal technologies as credible weapons: precision effects; expanded radius of effects; repeatable effects; selectivity; and a weaponized capability. The ability to control the effects to achieve precise, non-lethal results over a controllable radius will continue the evolution of precision engagement.

Notes

[1] Joseph Coates, "Nonlethal and Nondestructive Combat in Cities Overseas," Study Paper for Institute for Defense Analysis, Science and Technology Division, May 1970 and Lynch, Greg, "The Role of Nonlethal Weapons in Special Wars," Navy Postgraduate School Thesis, ADA 297651, (Ft. Belvoir Va., Defense Technical Information Center, 1995), 19.

[2] Charles Swett, "Strategic Assessment: Non-lethal Weapons, Office of the Assistant Secretary of Defense for Special Operations and Low-intensity Conflict Staff Paper, November 1993, 4-6 and Col John Barry; LTC Michael Everett; and, Lt Col Allen Peck, "Nonlethal Military Means: New Leverage for a New Era, National Security Program Policy Analysis Paper 94-01, John F. Kennedy School of Government, Harvard University, 1994, 9.

[3] Alvin and Heidi Toffler, *War and Anti-War*, (Boston, MA: Little, Brown and Company, 1993), 128.

[4] "Policy for Non-Lethal Weapons," Department of Defense Directive, 9 July 1996, 1-2.

[5] TRADOC Pamphlet 525-73, "Concept for Nonlethal Capabilities in Army Operations," 1 September 1996, 6.

[6] "Policy for Non-Lethal Weapons," Department of Defense Directive, 9 July 1996, 2.

[7] "Policy for Non-Lethal Weapons," Department of Defense Directive, 9 July 1996, 2.

[8] "Policy for Non-Lethal Weapons," Department of Defense Directive, 9 July 1996, 3.

[9] General information on anti-personnel capabilities is derived from multiple sources to include: Steve Aftergood, "The Soft Kill Fallacy," *Bulletin of Atomic Scientists,* September-October 1994: 43-45; John Collins, *Report to Congress: Nonlethal Weapons and Operations: Potential Applications and Practical Limitations*, (Washington DC, Congressional Research Service), 1-2; Paul Evancoe, "Nonlethal Technologies Enhance Warriors Punch," *National Defense*, December 1993, 27-28; Dennis Evans, and William Howard, "Nonlethal Arms," Secretary of the Army staff study, February 1993; Timothy Hannigan, Lori Raff; and Rod Paschall, "Mission Applications of Non-Lethal Weapons,"

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Chapter 3

Images of the Future—A Mandate for Change?

A new season of war is upon us…

—Luttwak

Appropriate military strategy is directly linked to the strategic setting, the state's technological capabilities, the state's national interests, and fiscal constraints. Revolutionary advances in military innovation and technology are of no consequence unless they enable more effective or efficient application of military force in the context of the international strategic environment and national interests. Non-lethal weapons, or any military technology, are not relevant unless they serve these demands. Therefore, if the "strategic setting" is fundamentally different, fresh approaches in the application of military and political tools may be needed. From this perspective, an assessment of non-lethality's role as a strategic weapon must be viewed through the lens of our future strategic setting.

The nature of the future international landscape is hotly debated among political scientists and futurists. Revolutionary changes are being predicted by futurists such as Alvin and Heidi the Toffler and Martin Van Creveld. These future visions include the rise in dominance of non-state actors, the demise in relevance of the nation-state, and a change in the nature of conflict to emphasize economic and information dominance.[1] While there

is no consensus on the details of the future course of history, it is clear that the failure of communist ideology and the systemic influences of societal change are significantly transforming the character of the international stage and the nature of conflict. Conflict will continue and perhaps become more frequent. The US, as the world's sole superpower, must adapt its military strategy and doctrine to maintain effective tools that serve our new national interests.

Strategic Features

What is important is to distill the features of the new landscape that will define our future national interests and strategy and determine the applicability of non-lethal weapons as an element of an emerging military strategy. The following discussion highlights several of the major elements of this emerging "strategic setting."

Focus on Global Management. The global scene may appear more chaotic but there is a single characteristic that distinguishes today's era. The major economic and military powers for the next several decades, United States, Europe, Japan, China, and Russia, are driven by common economic and political purposes, which has several obvious implications. First is the primacy of economic growth. Economic growth within a free market environment is the core feature that binds the great powers together. The rise of the market as the principal interface for economic growth promotes interdependence among participating states that will extend our strategic interests well beyond the territorial borders. Further, the majority of great powers share democratic principles. Although not all the major states are mature democracies, most share a commitment to democratic values. The lack of competing ideologies among the major powers removes a

primary strategic threat to global security.[2] The result is the desire of the major powers to favor a continuation of the military and political status quo. These goals are reflected in the US *National Security Strategy of Engagement and Enlargement* and the *National Military Objectives*, both of which stress the promotion of stability and thwarting of aggression.[3] The threat to stability comes from the peripheral states that may be driven to increased conflict and turbulent relations given the impacts of societal change and the collapse of bipolar competition. The major powers will be driven to intervene, possibly at a greater frequency, when the status quo is threatened or in response to moral imperatives.

Therefore, a common strategy emerges for the major powers—global management to maintain an environment favorable (or improve) to key national interests. This environment will likely reflect the military and political status quo. The scope of this strategy requires a broad international perspective as indicated in the US National Security Strategy policy statement; "Never has American leadership been more essential…exerting our leadership abroad, we make America safer and more prosperous—by deterring aggression, by fostering the peaceful resolution of dangerous conflicts, by opening foreign markets, by helping democratic regimes, and by tackling global problems."[4]

Most experts agree that a peer competitor to the US is not likely to emerge within the next 20 years. Therefore, the US will continue as the reluctant world leader—taking the initiative in conflict management issues. Intervention may no longer be desired but may now be a necessity. Cultivating the national will to implement this strategy become increasingly difficult as primary threat becomes more indirect but still real. In spite of these obstacles, the US must retain the national will and maintain the tools to be decisive in this role.

Intervention at a lower level of conflict. It is in our interest to intervene where our national interests are threatened. For effective "global management," early intervention should be considered before a major conflict emerges that may threaten economic or political interests. The US should focus on coercive measures early in the conflict rather than large-scale intervention after the conflict matures. Delayed intervention creates pressures on political and economic stability and is more costly in terms of resources. The *US National Security Strategy* echoes this objective: "Our leadership must stress preventative diplomacy—in order to help resolve problems, reduce tensions, and defuse conflicts before they become crisis. These measures are a wise investment in our national security because they offer the prospect of resolving problems with the lest human and material cost."[5] This leaves lethal force as the means of last resort. The escalation thresholds must give way to a continuum if military force is to be effective in the gray area between crisis and war. The Tofflers refer to this type of intervention as a "new peace-form" and advocate new strategies and innovation in the political and military tools.[6] Given the correct diplomatic and military strategy, it could be argued that early US (or coalition) intervention in Bosnia or the Persian Gulf could have resolved the conflict before a major commitment of ground forces was required.[7]

Rise of non-State Actors. Most political scientists note that the rise of non-state actors will dominate the future global scene. These terrorists and sub-state actors will be motivated by a number of causes, including emerging nationalism, ethnic rivalries, religious motivations, and narco-interests. The threat is compounded by the end of the Cold War's disciplined confrontation. Without the "lid" of the Cold War, many of the regional religious and cultural rivalries are now unrestrained creating increased tensions

and conflict.[8] This feature of the "strategic setting" adds another complication to military intervention. Conflict involving non-state actors is likely to be conducted in the midst of the civilian population. The mingling of civilians and combatants will force the military to adopt more restrictive rules of engagement or new strategies to reduce the risk of civilian casualties while at the same time maintain effectiveness against the threat. The US military is currently restricted in the tools it can employ; hence, intervention is constrained.

Disengaged Combat. Future militaries will be forced to conduct operations at an increasingly greater distance from the conflict to remain out of harm's way for two fundamental reasons. The first is the increasing lethality and accuracy of available conventional arms. The proliferation of weapons of mass destruction and the increasingly lethal range of conventional ballistic and cruise missiles may significantly increase the risk to engaged forces. Michael Mazzarr forecasts that in the future, "movement of large-scale forces on the battlefield may be tantamount to suicide."[9] While Mazzarr's point may be an extreme view, this environment does encourage engagement distances beyond the range of lethal threats to minimize casualties and destruction of friendly forces. Second, the increased accuracy of our delivery methods makes proximity operations unnecessary. Admiral Owens argues "With greater range, greater precision, and horizontal integration of real-time intelligence and targeting…it may not be necessary in every case to "close with" the enemy in order to destroy him."[10] Attrition warfare is giving way to control warfare by redefining the meaning of concentration of mass. In the future, effective military forces will fight from a distance.

Civilization of conflict. In situations where US security is not directly threatened, there is an increasing demand to minimize casualties and collateral damage. This element

is based on many factors which include the intrusiveness of the media, low tolerance of risk for overseas intervention, and high regard for life in modern democracies.[11] Recent conflicts validate the importance of this factor in modern conflict. The consideration to minimize casualties was a major feature in the planning for Operation DESERT STORM and was highlighted during the Congressional debate to approve military intervention in Bosnia. This Congressional debate focused on the risk to deployed US military troops; "We should have exhausted all other means and all other possibilities before we resorted to deploying ground troops."[12] The issue was echoed at the highest levels of decision making. President Clinton approved the Bosnia deployment based on the Chairman's projection for a minimal number of civilian casualties.[13] During execution, the target selection and approval process for military operations in Bosnia required extensive, direct involvement from the senior military commanders in an effort to minimize unintended casualties and damage. It is clear that the concern to minimize friendly, civilian, and enemy forces permeates the US decision process.

The perceptions of excessive destruction directly impacts the sustainment of US policy and actions. Recent history is filled with examples: Marine casualties during peace keeping operations in Beirut, the dead Ranger being dragged through the streets of Somalia, the infamous destruction along the "highway of death" in DESERT STORM, and the casualties resulting from the Al Firdos bunker destruction in Baghdad. In each of these cases, US will was held hostage by the unfortunate events resulting in significant US policy reversals.[14] The amazing success during the Gulf war has reinforced the mandate for minimum casualties. As noted by Eliot Cohen, "the most dangerous legacy of the Persian Gulf war is the fantasy of near bloodless uses of force."[15] This reality, combined

with the increasing lethality of a modern conventional military force, makes it more difficult to engage in actions, in which, US security is not directly threatened.

Another element is the reversibility of damage. It is in our interest to re-establish stability and limit human suffering following a conflict. The rapid reconstruction of infrastructure and return of economic viability is necessary to restore regional stability, satisfy moral obligations, and protect US global economic interests. Historically, the US makes substantial investments in re-building the infrastructure following a conflict. In effect, the US pays twice for an intervention. Once to intervene and then to restore infrastructure. Creating the means to reverse anti-material or anti-personnel effects could decrease the time and investment necessary to return a region to stability.

Strategic Dilemma

From Bosnia, Somalia, Haiti, to Iraq, the threats of the "new world order" call for a US willingness to act. Unfortunately, the US is caught in a dilemma. The current military tools are not well suited to meet the political needs. When combined with the strong national pressures to avoid combatant and civilian casualties, this condition undermines the national will to engage and restricts the means of engagement. It is ironic that these same factors which drive US involvement often restrict the means and will to intervene.[16]

Current diplomatic, economic, and military tools have not been successful in managing the post-Cold war conflicts. Conventional warfighting methods are largely unresponsive to these situations. In spite of seemingly overwhelming power, the US military grapples for options that are only marginally effective in managing conflicts in vital areas.[17] Operations in Bosnia, Somalia, and Haiti are clear examples that

demonstrate the difficulties in applying traditional military force. To a degree, the US "will to engage" is stymied by the inability to apply appropriate and credible coercive force.[18]

Summary

This chapter identifies the emerging global environment that will define the future military requirements. The future appears to call for a willingness to act but with new military tools and strategies to remain relevant and credible.

1. Political and societal factors are fundamentally changing the "strategic landscape."
2. These changes will necessitate appropriate changes to military capabilities and strategy to give our policy makers effective options and credible leverage. The current military tools are becoming less relevant in some situations.
3. The key features of the new strategic landscape are: 1) A greater calling to intervene in support of global national interests (global management); 2) An incentive to resolve crisis at a lower threshold of conflict; 3) The domination of non-state actors as a source of conflict; 4) Characteristics of conflict that demands minimal combatant and noncombatant casualties, minimal collateral destruction, and need to economically restore the enemy following conflict to restore regional stability; 5) An incentive to conduct military operations from greater distances from the conflict to reduce the risk to U.S. military forces.
4. The combination of the above factors results in a strategic dilemma. The US faces increasing demands to intervene, but does not have the appropriate military tools to be effective.
5. Future military intervention must limit casualties and damage to sustain the will to intervene and maintain the effectiveness of political negotiations. The future calls for a willingness to act but with means that are calibrated and proportional to the political objective. The new military force must become relevant in these tasks giving national leaders the ability; and hence the will, to take action.

Thus there is a mandate for non-lethal weapons to be a tool for the new 'strategic setting." Accordingly, the assessment of non-lethal technologies will continue by an examination of the technology constraints and an evaluation of how well the competencies of non-lethal technologies support these strategic needs.

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Chapter 4

The Ponderables—Elements of the Debate

In affairs so dangerous as war, false ideas proceeding from kindness of heart are precisely the worst.

—Clausewitz

The application of non-lethal technologies as a strategic military tool conceptually appears to be an ideal match to future strategy mandates and a "heaven sent" answer to many of today's difficult foreign policy dilemmas. However, the promise of non-lethal technologies comes with considerable "baggage." The transition from the lofty promises by non-lethal advocates to warfighting reality is clouded by several contentious issues. This debate complicates the integration of non-lethal technology development, adoption of a non-lethal doctrine, and acceptance within the defense community.

Unrealistic Expectations

The debate on non-lethal technology employment suffers from the need to characterize strategic non-lethal technologies in the abstract. Many of the proposed technologies remain in the research and development environment. As a result, there is a lack of objective data to test the effectiveness of non-lethal applications. The lack of combat testing, exercising, and military experience in this category of weapon leaves the military services unconvinced. The question "Can non-lethal weapons be decisive?" is still

difficult to answer. In principal, the concept of non-lethal employment is compelling. The ability to use technology to defeat an enemy without causalities appeals to our sense of morality. This vision is inspiring but, unfortunately, not realistic. While the thoughts of a "near bloodless battlefield" is no longer advanced by most advocates, the visionary promise of non-lethality leads to widespread misconceptions that that "are likely to prove counterproductive and potentially dangerous."[1]

The first caution stems from accepting "non-lethal" characteristics too literally. Non-lethal weapons consist of a large array of technologies with differing characteristics and effects. Application of these weapons, while intending to minimize material and personnel damage, may well be destructive in some situations; as with most technologies they may produce unintended consequences. An anti-personnel attack by chemical or directed energy weapons may be fatal to a percentage of the population with a low tolerance for particular weapons effects, or an anti-material attack on an electrical grid may prove fatal to vulnerable civilians requiring life-sustaining electrical equipment in a hospital. Further, the incomplete testing of non-lethal technologies leaves doubt on the significance of the long term effects to humans and the environment. The political and moral advantages of non-lethality are of little value if the non-lethal weapons effects pose a significant, unintended health risk or unacceptable environmental impact to the region. To be effective, the use of these weapons must objectively consider the target, timing, and mechanism of the desired effects with full consideration for the potential of unintended destructive consequences.

Second, the perception that non-lethal technologies offer a "revolution in warfare" based on the "tremendous potential" of capabilities is premature. Scenarios are being

hypothesized where the application of a non-lethal strategy during the Persian Gulf war subdues the enemy without a shot being fired.[2] This perception, if adopted by senior leaders, may lead to misapplication of non-lethal force, unrealistic expectations, and disappointing results. Separating the promise from reality is critical for both military and political decision makers if we are to avoid operational failures and the subsequent rejection of non-lethal means. While future non-lethal technologies may well achieve the promises articulated by today's visionaries the tendency to oversell current capabilities may prove disastrous.

Legalities

The employment of non-lethal technologies invites considerable legal discussion that may impact the development of specific technologies and limit the use of selected non-lethal weapons. Historically, the introduction of any new class of weapons introduces legal debate—and non-lethal weapons are no exception.[3] The primary concern centers on Just War Doctrine and compliance with established biological and chemical weapons conventions.

The Just War Doctrine attempts to limit or restrain the ways which states engage in war. The concept of "jus in bello" (conduct of war) requires restraint in using unnecessary force and to conduct hostilities with regard to "humanity" and "chivalry." The key tests to determine compliance are military necessity (military targets), humanity (minimize suffering), and proportionality (level of damage is consistent with military significance).[4] In general, the objective of non-lethal weapons is to "humanize" military conflict and is consistent with the goals of Just War Doctrine. However, a problem occurs with the

relatively indiscriminate nature of some non-lethal technologies. The greater number noncombatants that may be affected by a non-lethal weapon increases the risk for unintended consequences. These effects must be minimized, to maintain the moral "high ground" of non-lethal employment. It can be expected that anti-personnel non-lethal weapons, such as chemical and biological technologies, will attract the most opposition due to the historic suspicions of this category of weapons.

Assuring compliance with several international treaties and conventions further complicates the debate. Several nations and organizations oppose the use of anti-personnel lasers (blinding) and are initiating efforts to prohibit the use. The issue is highlighted during the debates rising from the Convention on Certain Conventional Weapons. The US previously maintained that the employment of non-lethal blinding lasers was consistent with the laws of armed conflict. However, under pressure from several international agencies, the current administration adopted a ban on "…laser weapons specifically designed, as their sole combat function or as one of their combat functions, to cause permanent blindness to unenhanced vision…"[5] It is expected that other "dubious" technologies such as directed energy weapons and acoustic devices will be subject to a similar international legal review and debate.

A more serious concern is compliance with Chemical and Biological Weapons Conventions. Future employment of several non-lethal concepts must be carefully weighted in the context of these agreements. The 1972 Biological Weapons Convention prohibits the development and use of certain biological agents. Specifically, the terms prohibit development or production of biological agents of "types and quantities that have no justification for prophylactic, protective, or other peaceful purposes."[6] Current US

policy maintains a strict interpretation of this convention by prohibiting any substance causing deterioration of food, water, equipment, or supplies.[7] Further, the Chemical Weapons Convention, awaiting ratification, prohibits the use of chemical weapons as a method of warfare. The prohibition restricts use of chemicals that affect "life processes" but, interestingly, does not restrict these same chemical agents in peace-keeping or humanitarian operations. Chemical agents used for anti-material purposes are not addressed in this agreement and are considered legal. Irrespective of the obvious inconsistency, chemical agents targeted for anti-personnel purposes are prohibited by existing international convention and US policy.

As noted above, there are significant issues concerning compliance with international convention. The US future position on these issues must be carefully considered. Modification or denouncement of the existing agreements to accommodate non-lethal technologies may open a "Pandora's Box" of lethal biological and chemical weapons proliferation and potential escalation of the "horrors of war." A chemical agent used by a one nation may serve to limit the human cost of warfare, but can also be an ideal tool for mass destruction by a terrorist organization. Future US policy must strive to achieve a careful balance between the promotion of future weapons of mass destruction and legitimate uses of non-lethal technologies. Paradoxically, only a few non-lethal technologies are free from potential legal restraints. Anti-personnel uses of chemical weapons and low power lasers are already restricted and it can be expected the other anti-personnel non-lethal technologies will face a continuing critical review. As noted by the Independent Task Force Study on non-lethal weapons: "It would, of course, be a tragic

irony if nations used lethal means against noncombatants because non-lethal means were banned by international convention."[8]

Proliferation Risks

Adoption of non-lethal technologies may create a risk from the proliferation of non-lethal weapons to hostile states and terrorist organizations. Reliance on non-lethal technologies for strategic attack will generate continuing research and refinement of existing concepts. As second and third generation weapons are fielded, current generation non-lethal capabilities will diffuse throughout the world and be targeted against US personnel and interests. Nonproliferation measures will be difficult to implement since the technologies and equipment are not unique to non-lethal technologies. The real danger may be that the US may be highly vulnerable. The US reliance on advanced technology and sophisticated electronics makes us more susceptible to a non-lethal attack by a variety of hostile actors. For example, EMP attack against critical data processing computers, or contamination of petroleum reserves by biological or chemical agents, will pose a significant threat to the US. Protection of resources and interests will require the development of effective countermeasures or the adoption of appropriate protective methods. The development of these protective means must be concurrent with the acquisition of the corresponding non-lethal weapon.

Means to Adventurism or Deterrence

The assessment of the strategic setting predicts that non-lethal technologies will enable intervention at earlier stages of a crisis. A critical element of the debate is whether this represents a more effective means to manage crises or represents a "slippery slope" to

more frequent intervention in areas of marginal national interests or a mechanism that results in escalation of conflicts. The attractiveness of non-lethal weapons may drive decision makers to get involved because "we need to do something." The appeal of a low risk, easy response may become addictive and thus cause inappropriate interventions and eventual military quagmires. There is no doubt that the availability of effective non-lethal weapons may provide an incentive for "adventurism." However, it must be remembered that military operations remain a slave to national policy and will. The nation should not defer development of a more effective and humane military capability because we do not trust the judgment of the decision makers; rather, we must educate decision makers on the dangers of inappropriate use and expect them to take their obligations seriously.[9] Non-lethal policy and doctrine must be crafted to address these concerns.

The second risk with using non-lethal technology for crisis de-escalation is the risk of retaliation. The leaders of a state targeted by non-lethal weapons may not be able to respond in kind. In response to a non-lethal attack, the targeted leaders may feel justified in responding with lethal force, terrorism, or even weapons of mass destruction. If a state is denied critical electrical production capability it may not be relevant to the leader how the effect was produced; only that the electrical power was denied. Therefore, it appears that escalation remains a risk with the intervention of non-lethal weapons but it is probably reduced when compared to use of lethal means. This underscores the need for careful decision making—to insure that strategies permit intervention at a lower threshold of conflict and not a decrease in the threshold for intervention. Non-lethal intervention should not lead to frequent adventurism, but it should be retained for situations in which U.S. national interests are at risk.

Strategic applications of non-lethal weapons will lead to an effective means for coercion if the US maintains the credible capability and will to apply lethal force if required. Robert Pape's study of military coercion concludes that conventional coercion is most effective when the military forces or war-making capabilities of a state are threatened.[10] Therefore, strategic non-lethal means will be most effective when they increase the vulnerability of the war-making capabilities and forces. Non-lethal means can effectively increase a threat's vulnerability to lethal attack by the destruction of early warning, denying communications, disrupting supply lines, or immobilizing equipment. Non-lethal means, applied to strip the enemy of military capability, backed by a credible lethal threat can be an effective coercive tool.

A positive outcome to intervention assumes the threat is a rational actor. Intense religious and political issues mark many of today's struggles. In these situations, rational thought may give way to the passions of war. In these circumstances, non-lethal weapons may not succeed as an effective coercive tool—non-rational factors may drive the decision. This should not imply that non-lethal intervention should not be attempted. Non-lethal application of force can be an effective deterrent or coercive tool in many circumstances provided the US retains a credible threat of lethal force.

Operational Considerations

There are several operational considerations that enter into the debate on the employment of non-lethal technology for warfighting purposes. Many of the notional military scenarios that are used to demonstrate the effectiveness of non-lethal weapons do not consider the evolution of counter-measures. As the non-lethal arsenal expands,

threatened states will be driven to acquire protective or counter measures to strategic non-lethal technologies. Many of these counter measures may be technically or financially out of reach for may states. For example, hardening of existing electronic equipment against EMP damage may be difficult due the vulnerability of power lines and antennas. However, other protective measures such as protective goggles for lasers or protective covers to limit the effectiveness of anti-traction substances for runways or bridges may be relatively low-cost and effective options. Failure to consider the evolution of air defense weapons led to excessive aircraft losses in the strategic bombing campaigns over Germany during World War II. Failure to plan for the development of non-lethal counter-measures could be as dramatic.[11]

The difficulty in assessing the effectiveness of non-lethal attack further complicates the employment of these weapons. The nature of non-lethal "target damage" significantly complicates the assessment process. External indicators of success are not as obvious as destruction by lethal munitions. The assessment of an embrittled bridge, acoustic incapacitating effects on personnel, or an EMP attack on air defense systems is not obvious from the traditional imagery-based assessment process of military intelligence. The confidence in the successful attack on a target may not be confirmed until the enemy uses, or attempts to use, the particular equipment. In the case of air defense or offensive military equipment, waiting until friendly forces are engaged is a little too late to confirm disablement. Inaccurate assessments increase the risk to ground forces and air crews. Thus non-lethal solutions may appear technically elegant but may not be a credible capability unless the results can be confirmed.

The intelligence process must turn to new methods of assessment that consider the means and timing of effects for non-lethal technologies. This will involve interdisciplinary skills, new multi-sensor reconnaissance methods, and detailed analysis of the disabling effects of non-lethal weapons.[12] The development of a process is critical to the future use of non-lethal means in a warfighting role. An accurate assessment is essential to determine the level of damage, sequence subsequent military or political actions, or task a re-attack of the objective. The process must not only be accurate but must also be quick. The high intensity of the modern battlefield demands that we operate within an enemy's decision cycle. It will be difficult to collect, fuse, and analyze the unique data necessary to assess non-lethal effectiveness. New technological means and innovative methods must be sought to condense intelligence methods into a rapid process. The Gulf War highlighted difficulties in assessing bomb damage resulting in considerable debate on the appropriate "signatures of success." If it is difficult to confidently assess the effectiveness of a 2,000 pound bomb; then, the assessment of non-lethal weapons will represent a considerable challenge driving fundamental changes to our intelligence methods. A strategic weapons is not effective unless it can deliver the desired and verifiable results. Indeed, in some situations lethal means may be the weapon of choice, even if equally effective non-lethal weapons are available. The future integration and employment of strategic non-lethal means will depend on the success of intelligence organizations to build the effective supporting processes for verification.

Summary

The integration of new technology affects all aspects of national and military strategy and doctrine, and the introduction of non-lethal technologies is no different. The discussion of "ponderables" highlights the obstacles confronting national and military leaders as these technologies are employed.

- Unrealistic expectations of non-lethal weapon effectiveness and capabilities can drive inappropriate strategies and employment of these technologies. Misuse of non-lethal weapons will likely end with disappointing results and could expose US forces to unnecessary danger.
- Non-lethal technologies may be constrained by international convention and US policy. Although the concept of non-lethality meets the intent of Just War Doctrine, broadly crafted international conventions may prohibit the use of some technologies. Clearly, anti-personnel use of chemical and biological agents are prohibited by international and US law. The legal implications of other technologies will come under similar debate. The US position during the future debates should be to balance the non-lethal weapon benefits with the risk of misuse by risk adverse actors.
- Proliferation of non-lethal technologies may present a significant risk to the US especially if employed by terrorists or the leadership of a rogue state. Therefore, countermeasures (equipment and tactics) should be developed concurrent with the development of non-lethal weapons.
- Operational employment must consider the development of countermeasures by potential threats and the limitations of intelligence assessments. The capability to accurately determine non-lethal damage assessments may drive new intelligence processes and methods.
- The seductive nature of non-lethal intervention may provide a "slippery slope" to more frequent intervention in areas of marginal national interests. Weapon limitations and strategic implications must be understood and carefully assessed by decision makers at all levels.

These obstacles are significant but they are not "show stoppers" given the national will to pursue integration of non-lethal weaponry. However, it does underscore the pervasive implications of technology and the need for a continuing, objective assessment of all the second and third order implications of a future strategy, and thus we turn to the strategic implications.

Notes

[1]Lexi Alexander and Julia Klare, "Nonlethal Weapons: New Tools for Peace," *Issues in Science and Technology*, Winter 1995-1996: 67-74 and Report of an Independent Task Force, "Nonlethal Technologies: Military Options and Implications," (New York, N.Y., Council on Foreign Relations, 1995).

[2] Col John Barry, LTC Michael Everett, Lt Col Allen Peck, "Nonlethal Military Means: New Leverage for a New Era, National Security Program Policy Analysis Paper 94-01, John F. Kennedy School of Government, Harvard University, 1994.

[3] Col John Barry, LTC Michael Everett, Lt Col Allen Peck, "Nonlethal Military Means: New Leverage for a New Era, National Security Program Policy Analysis Paper 94-01, John F. Kennedy School of Government, Harvard University, 1994.

[4] Mr. Miguel Walsh, "New Technology, War, and International Law,". Office of the Secretary of Defense, Policy and Planning staff study, 1993, Maj Joseph Cook, et all, "Nonlethal Weapons: Technologies, Legalities, and Potential Policies," *AirPower Journal*, Volume IX, 1995, 79-81, and Timothy Hannigan, Lori Raff, and Rod Paschall, "Mission Applications of Non-Lethal Weapons," JAYCOR Technical Report for the Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, August 1996, 13-18.

[5] Lt Col Greg Schneider, "Nonlethal Weapons: Considerations for Decision-Makers," National Defense Fellow Research Paper (unpublished), Program in Arims Control, Disarmament, and International Security, University of Illinois, June 1996.

[6] Timothy Hannigan, Lori Raff, and Rod Paschall, "Mission Applications of Non-Lethal Weapons," JAYCOR Technical Study for The Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, August 1996.

[7] Timothy Hannigan, Lori Raff, and Rod Paschall, "Mission Applications of Non-Lethal Weapons," JAYCOR Technical Study for The Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, August 1996.

[8] Report of an Independent Task Force, "Nonlethal Technologies: Military Options and Implications," (New York, N.Y., Council on Foreign Relations, 1995).

[9] Maj Roger Hunter, "Disabling Systems and the Air Force," *AirPower Journal*, Fall 1994, 43-47 and Report of an Independent Task Force, "Nonlethal Technologies: Military Options and Implications," (New York, N.Y., Council on Foreign Relations, 1995).

[10] Robert Pape, *Bombing to Win*, (Ithaca NY, Cornell University Press, 1996).314-330.

[11] Lexi Alexander, and Julia Klare, "Nonlethal Weapons: New Tools for Peace," *Issues in Science and Technology*, Winter 1995-1996: 72 and Report of an Independent Task Force, "Nonlethal Technologies: Military Options and Implications," (New York, N.Y., Council on Foreign Relations, 1995), 9.

[12] Capt Edward O'Connell and 1st Lt John Dillaplain, "Nonlethal Concepts: Implications for Air Force Intelligence," *Airpower Journal*, Winter 1994: 26-33.

Chapter 5

Non-Lethality—Emerging Strategies and Missions

Those skilled in war subdue the enemy's army without battle. They capture his cities without assaulting them and overthrow his state without protracted operations.

—Sun Tsu

To date, there has not been any serious effort to incorporate the implications of non-lethal concepts in strategy or policy planning.[1] Although there appears to be an acceptance of non-lethal employment for tactical operations during peacetime engagements, expansion of non-lethal horizons is not yet accepted within the Department of Defense or the foreign policy community. This section will attempt to expand these horizons by examining the role of non-lethal technologies in military strategies and missions involving the range of conflict beyond peace-enforcement.

Strategy and Technology

The thesis is that non-lethal technologies provide an effective solution to the political and military security needs of our emerging strategic setting. Do the particular competencies of non-lethal technologies offer national decision-makers a credible military option that minimizes risk and maximizes success? A comparison of the strategic mandates with the unique competencies of non-lethal technologies suggests they may

provide a much needed capability that fills the gap between political coercion and the employment of lethal force.

Emerging Conflict

The attributes of non-lethal tools enable a visible demonstration of intent or disruption of warfighting preparations without significant casualties and material damage to the enemy. This offers a potentially powerful and flexible coercive tool that can be applied across the range of military options. On the lower end of the spectrum, non-lethal technologies could substantially increase the effectiveness of traditional sanctions and economic measures without resorting to lethal means. A greater ability to enforce compliance of sanctions by other states, allowing a non-lethal means to stop or inspect suspect shipping, and an ability to selectively disrupt transportation within the target state adds significant strength to this option. Non-lethal "technical sanctions" may achieve more immediate results, selective effects against the specific vulnerabilities, and an ability to vary the level of effects to complement political initiatives.[2] In crisis involving non-state actors, the non-lethal nature of developing technologies may offer the means to intervene in close proximity to non-combatants without undue risk to the civilian population. The combination of effects provides a more powerful incentive to compel a change in behavior and may preclude intervention by lethal military force.

Non-lethal technologies enable intervention at a lower threshold of conflict. The precision of effects and the ability to employ as a standoff weapon (via cruise missile, UAV, or aircraft) will decrease the political and military risks that presently constrain our decision to intervene. While military intervention may not be able to resolve the core issue driving the confrontation, the appropriate non-lethal application may provide the time and

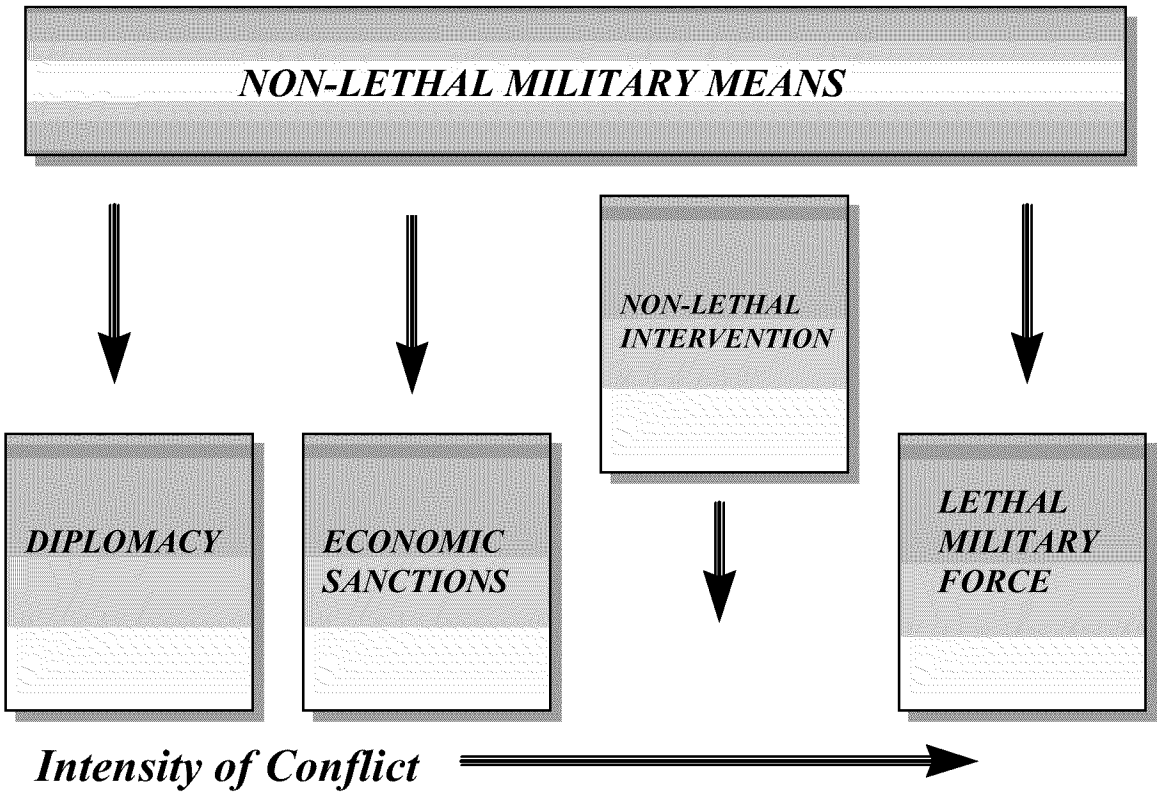
distance necessary to de-escalate a crisis or signal the intent to ward off a potential conflict. The "apparent neutrality" of non-lethal technology can maintain political options if it does not harden a population against future diplomatic efforts or arrangements.[3] National decisions makers no longer have to contend with the paradox of engaging in peace-keeping operations with overwhelmingly lethal military tools.

Non-lethal weapons enable a lower risk option for intervention. Non-lethal means, with large radius effects, can have significant visibility and impact without the use of ground troops. Our enemies are well aware of our aversion to casualties and the implications to continued US support to an operation. As was demonstrated by many unfortunate incidents, deployed US forces become a target when our adversaries wish to initiate a re-consideration of US involvement. The combination of fewer engaged forces and the less destructive nature of a non-lethal technologies reduces the overall "cost" of intervention in terms of physical damage and political risk. The reduced risk of noncombatant casualties is also significant. In the 1950s, noncombatants accounted for about one half of all casualties; in the 1980s the rate rose to about 80 percent. Efforts to curb this trend are morally needed and worthy of our best efforts.[4] Further, non-lethal engagements reduce the necessity of escalation by the targeted state or group. Arguably, there may be a less emotional response to an EMP attack on a state's communications equipment than a visible, lethal attack on the communications facility. This maintains a more open environment for negotiations and adds to the synergy of political and economic tools.

Non-lethal weapons enable effective conflict termination. The reversibility of most non-lethal effects limits the duration of the "damage." Assuming the political objective is

to re-establish stability, it becomes necessary to assist the failed state to restore economic and political processes; and a non-lethal strategy provides one option. The "reversibility" of effects is dependent on the particular non-lethal methods used and the selected targets being attacked. However, several non-lethal technologies could provide this capability. As airpower doctrine continues to emphasize the destruction of national leadership, infrastructure, and economic capabilities to achieve 'strategic paralysis," the element of "reversibility" becomes more critical. The ability to rapidly re-build the infrastructure avoids the creation of an economically and politically failed state which may lead to continuing regional instability.

Table 2. Spectrum of Coercion Options



Source: Col John Barry, LTC Michael Everett, Lt Col Peck, "Nonlethal Military Means: New Leverage for a New Era," National Security Program Policy Analysis Paper 94-01, John F. Kennedy School of Government, Harvard University, 1994, 1.

Major Conflict

On the other end of the spectrum, non-lethal technologies provide a significant complement to lethal force during a major conflict, particularly as the effectiveness of non-lethal technologies develop. As previously noted, an analysis of the implications for warfighting is elusive due to the unknowns of an immature technology, but the impacts should expand as the technology evolves. The vision of airpower is to attack the fundamental centers of gravity in the state's leadership, infrastructure, and war-making capabilities as was demonstrated by the execution of the air campaign in Operation DESERT STORM. Non-lethal weapons provide a natural complement to this military strategy. The precise effects and selective nature of engagement supports an efficient, high tempo strategic attack of the vulnerable and vital targets while limiting the level of violence. The larger radius of effects for future weapons may enable devastating, simultaneous effects on a country-wide scale. Although it may not be politically feasible, a sea launched ballistic missile armed with EMP munitions could achieve substantial disruption to a nation's vital centers of gravity with a single strike. This type of attack required scores of sorties and days to achieve during Operation DESERT STORM. Conversely, the employment of non-lethal technologies allows a modest sized force to apply overwhelming pressure to the leadership and war-making capabilities during the initial stages of a campaign.

The ability of non-lethal weapons to delay, disrupt, and disorient can make the enemy forces open and more vulnerable to lethal attack. The destruction of electronic devices in military equipment and vehicles, disruption of vital transportation, and denying critical communications places the enemy leadership in a position to re-consider continuing

military action or suffer the consequences of a lethal attack. For example, a non-lethal attack can disrupt air defenses, degrade sophisticated electronics in fielded military forces and aircraft, and render many vehicles unusable. The attack could render a significant portion of the military forces either undefended or non-operational; and thus highly vulnerable. A subsequent attack on the disabled forces with conventional munitions can be conducted at the discretion of national decision makers and military commanders.

In several mission areas, non-lethal weapons may be more effective than traditional lethal means. The greater radius of EMP or HPM effects offer a better capability for electronic attack or suppression of enemy air defenses. The greater radius of effects provides an ability to disable dispersed air defense equipment more efficiently than precision munitions. An EMP or HPM attack on air defense can achieve a hard electronic kill of all radar and support equipment associated with an air defense site. This attack is equivalent to multiple missions with conventional munitions and provides more sustained results than electronic jamming. Non-lethal technologies, also, offer a greater flexibility for targeting. Since the risk of collateral damage is reduced, non-lethal weapons can attack the "higher risk" targets. The location of command and control facilities or infrastructure targets in highly populated areas posed significant problems to targeting. In these situations, the availability of non-lethal weapons may provide a more acceptable alternative than lethal munitions.

The strategic implications for a major conflict are significant—non-lethal weapons present more than an adjunct to lethal force. Non-lethal weapons provide the ability to strike early in a conflict, significantly disrupt military actions, and increase the vulnerability of the aggressor's military force. The combination of these outcomes will enable decisive

intervention with a smaller deployed military force. In essence, the attributes of non-lethal weapons may allow technology to substitute for mass. The future military requirements to intervene in a major conflict may shift from a DESERT STORM sized force to a much smaller DESERT SHIELD force requirement. The enhanced ability to intervene may help solve the dilemmas of insufficient resources to meet the standing security requirements.

Table 3. Strategy-Technology Mix

Strategic Elements	**Strategy Objectives**	**Non-Lethal Competencies**
Global Management	• Maintain and Sustain "Will" to Intervene • Visible, Decisive, and Controlled Intervention • Establish Political and Economic Stability Post-Conflict	• Selectivity • Precision Effects • Radius of Effects • Weaponized
"Civilization" of Conflict	• Minimize Combatant and Civilian Casualties • Minimize Human Suffering Post-Conflict	• Precision Effects • Selectivity
Rise of Non-State Actors	• Minimize Casualties of Non-Combatants	• Selectivity
Dis-Engaged Combat	• Reduce Threat to Friendly Forces	• Weaponized
Low-Intensity Intervention	• Preserve and Support Political Options for Conflict De-Escalation • Establish Low-Risk Means for Intervention • Minimize Fatalities and Material Damage	• Precise Effects • Selectivity • Radius of Effects

The synthesis of strategic policy needs and characteristics of non-lethal weaponry provides a strong case for the development and employment of non-lethal arms. The employment of non-lethal technologies allows military force to better meet the future challenges. They reduce the risk of intervention, permit intervention at a lower level of

conflict, protect the will to intervene, allow more rapid reconstitution of attacked infrastructure, and permit greater synergy of political and economic tools. Restraints to intervention are weakened permitting a bolder, preemptive intervention strategy at a reduced risk and cost. Further, non-lethal technologies add strength to US forces engaged in a major conflict. The enabling features of non-lethal technologies allows a smaller force to be decisive.

Before non-lethal technologies are hailed as a panacea, two cautions are in order. The non-lethal employment assumes the appropriate use of the technology. The limitations of non-lethal technologies that were previously discussed will constrain the situations and missions where non-lethal employment is appropriate. The misuse of the capability may lead to dangerous political and military risks. Second, the assessment assumed unique capabilities common to all non-lethal technologies. The current selection of technologies have individual strengths, weaknesses, and effects. These individual characteristics must be considered for the employment of these weapons. It is expected that continued technology development will strengthen the unique competencies of these weapons and result in more effective tools for the future.

Non-Lethal Employment

This section will examine the non-lethal employment in greater detail to highlight specific applications and strategies. This will be examined in the context of two scenarios—emerging crisis (enforcement of sanctions), and a major conflict. These areas are not meant to be inclusive but are intended to highlight the spectrum of scenarios where

non-lethal technologies may be applied to enhance strategy options and military effectiveness.

Emerging Crisis—Technological Sanctions

Sanctions are traditionally a "first choice" option to coerce or weaken a potential threat when the immediacy of the crisis or the risk to U.S. interests do not justify the immediate use of military force. The goal of sanctions is to inflict sufficient economic hardship to persuade the adversary to modify its behavior by prohibiting the flow of goods, or of selected goods, into the target state. Traditionally, economic sanctions are only marginally effective due to the difficulty of enforcement and the lack of credible means to escalate the sanctions. The effectiveness of sanctions can be significantly enhanced by concurrent employment of non-lethal weapons. The precision of effects and non-lethal nature of these weapons complement economic sanctions by providing greater freedom of action, increasing the immediacy of the effects, and maintaining a low lethal risk to civilians and military forces.

The effectiveness of traditional sanctions can be complicated by the difficulty to enforce compliance across large geographic area and neutral states that choose not to cooperate by resisting shipping inspections. These obstacles tend to dilute the effectiveness of sanctions and prolong the commitment needed to achieve the intended results. Currently, the U.S. has little, except use of military force, to police violations and lethal force is not a usable threat against neutral shipping. Non-lethal technologies are able to add a new dimension to sanctions by denying or disrupting the movement of critical goods and technologies to, and within, the targeted nation. The ability to safely shut down suspect shipping by use of EMP or HPM weapons, possibly as mines, within a

restricted region gives a new level of effectiveness to sanction enforcement. Further, the ability of non-lethal technologies to selectively disrupt port facilities, equipment, and transportation nodes restricts shipping at a vulnerable "choke points." The disruption of off-loading or transporting the goods increases the effectiveness and the immediacy of sanctions.

The ability of a commander to adjust the radius of the non-lethal effects to incorporate greater geographic areas or to expand the categories of targets adds the flexibility for escalation. This allows the commander to selectively apply or relax expanded sanctions allowing a graduated response to the crisis. The application of non-lethal technologies to augment sanctions achieves a greater immediacy of effects and limits military risk to friendly forces, civilians, and neutral non-combatants. Minimizing permanent collateral damage maintains an environment more favorable for diplomatic resolution of the crisis and protects favorable world opinion.

Non-lethal disruption of electrical power, communications, or transportation systems of selected regions of a nation, or the entire nation, may provide a new category of sanctions. These "technological sanctions" acting alone, or in combination with economic sanctions, can be decisive. Denying critical infrastructure can produce the same impacts to the political leadership or military forces as sanctions but with greater speed and focus. As an example, the disruption of television, radio, and commercial communications can isolate a state's leadership or denying electrical production can grind an economy to a halt. This category of sanctions increases the economic cost of noncompliance and increases the vulnerability of the targeted military forces. These options do come at the increased

risk of being inherently more intrusive and offensive in nature and, as a result, may invite retaliation.

The following are notional examples of non-lethal technologies employed to augment sanctions:

- Enforcement of Sanctions. EMP munitions, delivered via cruise or air launched missiles, to disable suspect shipping within a designated restricted area. EMP sea mines may be employed in the restricted area to deter any maritime traffic. The port activities can be disrupted via air-launched EMP weapons to disable electronic components of infrastructure equipment and the electronic ignition of transportation vehicles at selected port areas. Consistent with the military risk, transportation nodes can be further disrupted by application of anti-traction material or super-adhesives to selected roadways and rail routes. Escalation of sanctions, if necessary, can be accomplished by expanding the radius of these effects. Denying electrical power, disrupting transportation, or disabling communications in selected regions of the targeted nation, particularly if the region is linked to the political mandates, can signal more determined intent.

Major Regional Conflict.

Non-lethal weapons are well suited to blunt an imminent military invasion primarily through stand-off delivery means. Non-lethal weapons can engage in a strategic attack on the enemy's strategic centers of gravity—leadership, warfighting essentials, and infrastructure—to paralyze the aggressor state and increase the vulnerabilities of the aggressor's military forces to lethal attack. A current strategy would rely heavily on EMP or HPM munitions to disable the enemy's communications, logistics, and transportation

infrastructure. Anti-material chemical agents, properly positioned, may disrupt transportation sufficiently to delay the movement of essential warfighting equipment and forces. The combined effects will effectively disrupt the deployment and re-supply efforts that are essential to a military force on the move. Disabling the air defense sites, primarily via standoff weapons, significantly increases the vulnerability of the enemy's military forces to a lethal attack. Further, EMP or HPM attack on invading forces will disable sophisticated military electronics decreasing the effectiveness the enemy's military force. The overall effect is a temporary "paralysis" of the leadership and the military that will coerce the enemy or, as a minimum, increase the enemy's vulnerability to a follow-on lethal attack. It is important to note that this effort can be accomplished by non-lethal, stand-off means which will reduce the risk of the intervention and will promote the continuation of diplomatic efforts to resolve the crisis.

One of the more critical current and future threats is the proliferation of weapons of mass destruction (WMD). Neutralizing a potential WMD production or storage facility will remain a critical target in future conflicts. The use of non-lethal technologies may provide a means to counter this threat without risking contamination that may result from a lethal attack. EMP or HPM technologies can destroy navigation, guidance, and detonation circuits in the WMD munitions or delivery systems thus neutralizing the WMD. In coordination with this attack, a variety of non-lethal technologies can be employed to deny access to the storage facilities. Anti-material chemical agents can disrupt vehicle access to a facility or the use of polymer foams may offer a means to contain the weapon in the storage facilities. The denial of WMD is temporary but sufficient to deter an immediate strike.

The following are examples of non-lethal technologies that can be employed, in conjunction with lethal force, to prosecute a major conflict.

- Strategic Attack. Non-lethal strategic attack includes simultaneous disruption of the enemy's key leadership, organic essentials, and infrastructure. Air-delivered EMP and conductive particle munitions can shut down electric power grids that support military facilities and logistics. Stand-off delivery of EMP munitions will target commercial communications (radio and television) and military command and control to degrade leadership control of the population and leadership coordination of the military deployment actions. In addition, EMP can disable electronic equipment on aircraft, neutralize computer systems, and disable sophisticated electronic equipment and vehicles.
- Weapons of Mass Destruction (WMD) Sterilization. A UAV-delivered HPM weapon will be targeted at assembly and storage areas to destroy the guidance, navigation, and detonation systems of the WMD and the respective delivery systems. To deny access to WMD storage areas, multiple UAVs will air-deliver sufficient polymer foam agent to render the facility temporarily inaccessible.
- Suppression of Enemy Air Defense (SEAD). A combination of lethal and non-lethal SEAD will be employed to disable key air defense sites. Air-delivered EMP munitions will disable radar, fire control, and associated electronic systems. The EMP attacks will concentrate in urban areas, mobile systems, and suspected areas with dispersed systems. The effective radius of the EMP weapons varied to match the target requirements and minimize collateral effects.

- Attack on Enemy Logistics. The enemy's logistic and transportation infrastructure will be impaired by air-delivered EMP munitions. The EMP burst will disable electronic controls and ignition systems of supporting equipment and vehicles. Odor producing chemical munitions can be delivered to assembly areas and logistics facilities to disrupt deployment preparations. Air-delivered HPM munitions will attack munitions assembly and storage areas to disable vehicles and detonate fuses in exposed munitions. UAVs can deposit super-lubricant to inclined sections of railroad and key transportation nodes to deny movement of equipment and supplies.

Table 4. Non-Lethal Missions

Mission	Target	NLW	Advantages
Electronic Attack	• Disable Radar and Targeting Systems • Disable C3	• HPM or EMP	• Reduced Casualties • Greater Radius of Effects • More Effective than Jamming • Flexible Targeting
Airborne Personnel Recovery	• Disable C3 • Disable Pursuers	• HPM or EMP • Anti-Personnel HPM; Optical Munitions; Acoustic Projection	• Disrupt Electronics more Effective than Jamming • Limit Vulnerability of Friendly Forces
Ground Attack	• Disable Vehicles • Disable C3 and Radar • Temporarily Disable of Disperse Personnel	• EMP or HPM; Adhesives; Lubricants; Combustion Modifiers • EMP or HPM • Anti-personnel Microwave; Acoustic Projection; Adhesives	• Reduce Casualties • Flexible Targeting

Table 4—continued

Mission	Target	NLW	Advantages
Offensive Counter Air	• Disable Aircraft on the Ground • Disable Aircraft Systems • Disrupt C3	• Anti-Material Chemical Agents • EMP or HPM • EMP or HPM	• Reduce Damage to Infrastructure • Reduce Casualties • Disruption of C3 More Effective than Traditional Means
Offensive Counter Space	• Disable Space Based Systems	• Lasers; HPM; EMP	• Disruption More Effective than Traditional Means
Strategic Attack	• Disable Transportation Infrastructure • Disable Industrial Infrastructure • Electrical Power	• Anti-Material Chemical Agents (Lubricants; Adhesives, Corrosive); EMP Mines or Munitions; Combustion Modifers • See Above • EMP or HPM munitions or conductive Devices	• Reduce Damage to Infrastructure • Reduce Casualties • Greater Radius of Effects • Flexibility in Targeting
Suppression of Enemy Air Defense	• Disable Sensors	• Lasers (optical sensors); HPM or EMP (electronics)	• Disruption More Effective than Traditional Means • Flexibility in Targeting • Reduce Casualties
Air Defense	• Disable Sensors, Navigational Systems, Guidance Systems	• HPM, EMP • Lasers (optical)	• More Effective than Jamming • Limit Vulnerability of Friendly Forces (to detection)
Advance Force Operations	• Disable C3 Systems	• HPM or EMP	• Limit Vulnerability of Friendly Force
Force Protection	• Deny Access	• Anti-Personnel HPM; Acoustic Weapons; Optical Weapons; Entanglement; Adhesives (foam)	• Reduce Casualties
Interdiction	• Disable Shipping and Transportation	• Anti-Material Chemical Agents; Combustion Modifiers; EMP; Lubricants	• Reduce Damage to Infrastructure • Reduce Casualties • Flexible Targeting

Beginnings of a Doctrine

> *At the very heart of war lies doctrine. It represents the central beliefs for waging war in order to achieve victory. Doctrine is of the mind, a network of faith and knowledge reinforced by experience which lays the pattern for the utilization of men, equipment, and tactics. It is fundamental to sound judgment.*
>
> —General Curtis LeMay

Non-lethal technologies, properly employed, can provide flexibility and credibility to military commanders, diplomats, and national decision makers. However to be effective, the employment of non-lethal weapons must be appropriate to the political, economic, and military strategies, the technology, and the intended target. An effective non-lethal strategy requires close integration with diplomatic efforts, solid understanding of the technology characteristics, and an evaluation of the mechanisms of non-lethal effects. A strong doctrinal framework is needed to assist decision makers and commanders to craft coordinated strategies, develop plans that optimizes non-lethal strengths, and execute the campaign within the limitations and constraints of non-lethal technologies. Further, inclusion in doctrine begins to break down the institutional barriers making these nontraditional means acceptable to the military culture. This doctrine should not stand alone; it must be integrated into existing military doctrine to promote the continuum of military capabilities. The following overarching principles of doctrine, proposed to serve as the foundation of a future non-lethal doctrine, are distilled from the previous arguments in this study.

- ***Non-lethal weapons have inherent characteristics of precision effects, selectivity of engagement, and versatility.*** The ability to control the weapon

effects and minimize violence creates a flexible military capability that can respond across the spectrum of conflict.

- ***Non-lethal weapons provide options between diplomacy and lethal force.*** Non-lethal weapons provide flexible options to avert an emerging crisis by creating time and space, controls level of violence, and fill the options gap between diplomatic and lethal force. Non-lethal force adds strength to sanctions and protects diplomatic efforts.
- ***Non-lethal options enable intervention at a lower threshold of conflict.*** Early intervention may reduce the cost of intervention and the risk of escalation. Non-lethal means permit an early, preemptive intervention by reducing the risk of escalation and lethal destruction.
- ***Non-lethal weapons can be effective in wartime.*** In combat, weapon employment requires the most effective combination of lethal and non-lethal means. In situations where non-lethal weapons provide an equivalent or more effective capability, non-lethal options should be employed to take advantage of non-lethal benefits.
- ***Employment of non-lethal weapons is most effective as part of a synergistic plan.*** The non-lethal strategy must be closely coordinated and executed in conjunction with the respective political and economic efforts. The combined effects produce a powerful, coercive tool to achieve national policy goals without incurring the risks of traditional military actions.
- ***Non-lethal weapons are not a replacement for lethal force.*** Commanders with forces at risk must retain the means and authority to respond with lethal force.

Adherence to a non-lethal strategy must give way U.S. resources and lives are at risk.

- ***Non-lethal technologies are not usable in all situations***. The success of non-lethal technologies is dependent on the specific situation, political goals, and the identified vulnerabilities of the threat. Skillful employment must consider vulnerabilities of the enemy, the political objectives, implications of potential unintended consequences, and compliance with international convention. Any of these factors can render the application of non-lethal technologies ineffective.

This represents a beginning for the doctrinal development for the employment of non-lethal technology. The refinement of specific non-lethal capabilities, experienced gained through employment, exercise and simulation, and the expansion of future non-lethal technologies will certainly add to these principles and contribute to an effective vision for non-lethal employment.

Notes

[1] Report of an Independent Task Force, "Nonlethal Technologies: Military Options and Implications," (New York, N.Y., Council on Foreign Relations, 1995), 3.

[2] John Alexander, "Non-Lethal Weapons and the Future of War," Los Alamos staff paper for Harvard-MIT Seminar on the Future of War, 9 March 1995, 5.

[3] Col John Barry, LTC Michael Everett, Lt Col Allen Peck, "Nonlethal Military Means: New Leverage for a New Era, National Security Program Policy Analysis Paper 94-01, John F. Kennedy School of Government, Harvard University, 1994.

[4] Timothy Hannigan, Lori Raff, and Rod Paschall, "Mission Applications of Non-Lethal Weapons," JAYCOR Technical Study for The Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, August 1996.

Chapter 6

Conclusions and Recommendations

> *There is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things…{because of} the incredulity of mankind, who do not truly believe*
>
> —Machiavelli

Efforts to defeat the enemy without the use of lethal force is as ancient as warfare itself as evidenced by Sun Tsu's axiom. According to non-lethal advocates, "victory without battle" may no longer be confined to political and economic tools. Technological advancements in non-lethal concepts may better equip the military forces to achieve this vision. This study examined this contention to determine the decisiveness of non-lethal technologies as an element of military strategy.

The relationship of non-lethal capabilities and the emerging strategic environment suggests that future non-lethal technologies can be decisive. The elements of the new "strategic setting" is significantly different to demand new tools that operate between diplomacy and war. Strategic uses of non-lethal technologies can meet these new challenges. Non-lethal technologies, properly employed, can enable significant advantages across the spectrum of conflict by invigorating diplomatic actions, creating flexibility for military commanders, and adding strategic options to national decision makers. Non-lethal technologies not only provide flexible political options but in some cases can offer a

more effective means of combat. The employment of non-lethal arms for electronic attack appears to be more efficient that traditional electronic warfare options. Further, non-lethal technologies may represent a capable force multiplier because a non-lethal attack may significantly increase the vulnerabilities of the enemy's military force while creating the means for effective coercion or destruction of the enemy's military capability by a smaller conventional force.

The degree to which non-lethal means are able to affect strategy depends on the evolution of technology. With the exception of some non-lethal tools for tactical applications, the current state of the art is too immature to be a reliable or effective component to military force. Non-lethality is not yet a compelling technology. The lack of any existing capability limits an objective evaluation and promotion of a near term strategy, largely because analysis are based on highly speculative data. Many of the capabilities that have strategic applications can be demonstrated in the laboratory, but we need to expand the range of effects and engineering advances to weaponize the technology. The acceptance and advocacy of future non-lethal strategies is, therefore, constrained by the lack of confidence and experience with this non-traditional form of warfighting. Although the near term non-lethal revolution is limited, the future is promising. The demands of future national strategy begs for the capabilities that non-lethal technologies promise to offer. In order to better serve the strategy needs, future technological development must concentrate on advancing the non-lethal characteristics of precision effects and selective engagement. Non-lethal weapons must expand the scope of the effects to increase the impact to the enemy and the enemy's systems. The expansion of the scope means increasing the radius of effects as well as expanding the types of

vulnerabilities that these weapons can exploit. Expanding the non-lethal scope will allow commanders to better focus the attack on critical, strategic vulnerabilities that are specific to the enemy and tailor these effects to the particular target. Further, the larger radius of effects can enable a near instantaneous attack on critical strategic centers of gravity. Currently, the EMP, HPM, and acoustic weapons appear to best fit the desired characteristics of non-lethal weapons. Continued investment in these weapons, and other technologies that match the desired non-lethal competencies, will have the greatest near-future effect on our operational capabilities.

The creation of the technology and the employment doctrine requires a revolutionary perspective and innovative approaches to executing war. A non-lethal strategy will require innovations in technology to create effective weapons, re-think force structure, new analytic processes for determining of centers of gravity vulnerable to non-lethal technologies, re-engineering of intelligence collection and assessment processes to support new planning and assessment needs, and close interaction with the respective economic and diplomatic strategies. The challenge is much more complex than simply fielding a weapon system and will require considerable investment and commitment by the Air Force and the defense community. Non-lethal technologies can make a revolutionary impact in the conduct of war. The success of implementing non-lethal technologies will depend on our will to overcome the difficult but solvable obstacles inherent in applying a new technology to warfare.

Recommendations

The following recommendations are provided for consideration:

- The development and employment of non-lethal weapons for warfighting strategies is warranted. The Air Force should take a proactive role in the long range planning and advocacy for future non-lethal capabilities that contribute to warfighting strategies. The specific mission needs of future non-lethal weaponry should be assessed by Air Force's long range planning staffs.
- Invest in research and development of non-lethal systems. Although the current array of non-lethal technologies may not be convincing from the warfighter's perspective, the unique competencies of future non-lethal technologies is compelling for addressing the needs of our future strategic setting. Since investment yields innovation, appropriate funding levels for the research and support of warfighting non-lethal technologies must be established. The impact of future non-lethal concepts can be significant provided continued innovation and development of the technology. The current priority for funding emphasizes development of technologies for tactical applications.[1] Tactical applications are important, but strategic non-lethal technologies can best maximize our ability to defeat an enemy and are best matched to the strategic environment. The research emphasis must place appropriate emphasis on expanding the scope of promising non-lethal technologies, such as directed energy research, by expanding the effective radius of the weapons and the types of vulnerabilities that can be exploited. Consideration should be given to make the program transition to reflect a broader mission and impact of non-lethal technologies. As a minimum, the executive agent should insure that the core research areas maintain appropriate priority and sufficient funding to accelerate development efforts.

- Establish confidence in non-lethal technologies. The future integration of non-lethal weapons in a warfighting role depends on building confidence in the reliability and repeatability of effects in a combat environment. The level of confidence can only be achieved through extensive operational testing, exercise, and simulation of non-lethal concepts to build an objective knowledge base for this mission area. Further, the long term effects of these weapons must be identified and understood prior to employment. The current non-lethal program funds these studies efforts—these research programs must continue.
- Get on with doctrine and training. History has shown that it takes 20 years to incorporate new warfighting doctrine after the introduction of a technology.[2] Without a deliberate effort, the evolution of non-lethal technologies may suffer the same fate. The evolutionary changes to national and military strategy, planning and targeting, and the intelligence process requires considerable re-thinking in the way we approach conflict. The recent DOD Policy for Non-Lethal Weapons provides a beginning, but this effort needs to be expanded by the Joint and Service Staffs. The future implications to national and military strategies is sufficient to begin this effort. The doctrinal discussions should extend beyond the military services to include the foreign policy and national intelligence communities of the U.S. in order to promote a considered and coordinated approach to the future employment of these technologies.

Epilogue

The cornerstone of the debate is whether non-lethal technologies represent a true revolution in strategic options, or in the words of Steve Aftergood, a senior analyst for the Federation of American Scientists, the non-lethal initiatives are at best simply an "adjunct to deadly force." [3] The answer will depend on the emphasis placed on technological advancement and the corporate will to make it a reality.

Notes

[1] Nonlethal Weapons FY98-03 Augmentation POM, Commandant of the Marine Corps (Executive Agent), 3 October 1996.

[2] Report of an Independent Task Force, "Nonlethal Technologies: Military Options and Implications," (New York, N.Y., Council on Foreign Relations, 1995), 15.

[3] Steve Aftergood, "The Soft Kill Fallacy," *Bulletin of Atomic Scientists,* September-October 1994: 40-45.

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