

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YYYY) 17-05-2004	2. REPORT TYPE FINAL	3. DATES COVERED (From - To)
--	--------------------------------	-------------------------------------

4. TITLE AND SUBTITLE Transforming How We Fight Through Effects-Based Operations & Non-Lethal Weapons	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S) LtCol David B. Hall Paper Advisor (if Any): Professor Richard Martin	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Joint Military Operations Department Naval War College 686 Cushing Road Newport, RI 02841-1207	8. PERFORMING ORGANIZATION REPORT NUMBER
--	---

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Distribution Statement A: Approved for public release; Distribution is unlimited.

13. SUPPLEMENTARY NOTES A paper submitted to the faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.

14. ABSTRACT
Secretary of Defense Donald Rumsfeld has directed that the defense establishment transform the way it thinks about and conducts warfare. This means analyzing the new security environment and building capability sets to meet emerging threats and challenges. The fact of the matter is, there are no more symmetrical threats at which the U.S. can aim its highly lethal military. Instead, emerging threats are amorphous, ubiquitous, and asymmetric. The U.S. and its military must be prepared to respond to these threats in a forceful way that demonstrates their determination and resolve. The catch is that they must also take into consideration America's growing aversion to the casualties and physical destruction inherent in conventional warfare. U.S. leaders and planners must be prepared to think and act asymmetrically – just like their adversaries. Effects-based operations, with its focus on strategic effects vice physical destruction, combined with current and emerging non-lethal technologies with their temporary and reversible effects, provide an effective operational construct for meeting emerging threats head-on while also coinciding with American demands for quick victory and minimal collateral damage.

15. SUBJECT TERMS
Transformation, effects-based operations, non-lethal weapons

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 65	19a. NAME OF RESPONSIBLE PERSON Chairman, JMO Dept
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED			19b. TELEPHONE NUMBER (include area code) 401-841-3556

**NAVAL WAR COLLEGE
Newport, RI**

**TRANSFORMING HOW WE FIGHT THROUGH
EFFECTS BASED OPERATIONS
&
NON-LETHAL CAPABILITIES**

By

**David B. Hall
Lieutenant Colonel
U.S. Marine Corps**

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy

Signature: _____

17 May 2004

**Professor Richard Martin
Faculty Advisor**

ABSTRACT

Secretary of Defense Donald Rumsfeld has directed that the defense establishment transform the way it thinks about and conducts warfare. This means analyzing the new security environment and building capability sets to meet emerging threats and challenges. The fact of the matter is, there are no more symmetrical threats at which the U.S. can aim its highly lethal military. Instead, emerging threats are amorphous, ubiquitous, and asymmetric. The U.S. and its military must be prepared to respond to these threats in a forceful way that demonstrates their determination and resolve. The catch is that they must also take into consideration America's growing aversion to the casualties and physical destruction inherent in conventional warfare. U.S. leaders and planners must be prepared to think and act asymmetrically – just like their adversaries. Effects-based operations, with its focus on strategic effects vice physical destruction, combined with current and emerging non-lethal technologies with their temporary and reversible effects, provide an effective operational construct for meeting emerging threats head-on while also coinciding with American demands for quick victory and minimal collateral damage.

Table of Contents

Introduction	1
Effects-Based Operations (EBO)	3
A Review of Non-Lethal Weapons (NLW)	5
New Developments in Non-Lethal Weapons	6
Effects-Based Operations and Non-Lethal Capabilities Beyond the Tactical Level	9
Impediments to Implementation	14
Recommendations	17
Conclusion	18
Appendix A – Tables	
Table 1: Existing and Emerging Non-Lethal Technologies	19
Table 2: Master Technologies List	20
Table 3: Evolving Technologies	22
Appendix B - Universal Joint and Service Task List	25
Tasks with Non-Lethal Applicability	
*The tables included in hard copy could not be reproduced electronically	
Endnotes	26
Bibliography	29

“As we prepare for the future, we must think differently and develop the kinds of forces and capabilities that can adapt quickly to new challenges and unexpected circumstances. We must transform not only the capabilities at our disposal, but also the way we think, the way we train, the way we exercise, and the way we fight.”ⁱ

Secretary of Defense, Donald Rumsfeld

Introduction. Secretary Rumsfeld is correct in his premise that the U.S. defense establishment must change and adapt to face the approaching challenges of the new security environment. The question, however, is “Transform into what, to meet what challenges?” If one takes a practical look at the world today, it is easy to conclude that the U.S. has no military peer. Not even an industrializing China or a resurgent Russia shows the potential of emerging as a peer competitor in the near or mid-terms.ⁱⁱ Therefore, it appears that the U.S. need not overly concern itself with preparing for the symmetrical conflict that those terms imply. Instead, a dramatic increase in asymmetric threats to the U.S., its citizens and interests abroad, and its military appear to be the new order of business. The most significant threat of this nature is a rogue state or non-state actor with ties to global terrorism and weapons of mass destruction (WMD). While the preemptive actions employed in Afghanistan and Iraq curtailed attacks in the U.S., they fell well short of ending the terrorist pansurgency that continues to plague other nations like Spain, Saudi Arabia, and even Syria. As a result, the Global War on Terrorism (GWOT) promises to be a protracted conflict involving both military and law enforcement agencies around the world.

Beyond that, U.S. successes in Iraq (I & II) and Afghanistan clearly demonstrated to potential adversaries that it is foolhardy to attempt to match conventional U.S. might on the modern battlefield. Consequently, it is unlikely that future adversaries will cede the initiative to the U.S. by allowing the assembly of an extensive U.S.-led coalition and the build-up of overwhelming firepower. Rather, the smart adversary is going to take action to frustrate coalition building and interrupt war preparations. He is also going to co-mingle with like-minded or disinterested non-combatants and fight in, around, and from cultural, religious, and

historical icons throughout all stages of the conflict to make it more difficult for the U.S. to apply its massive firepower.ⁱⁱⁱ

Finally, when considering new challenges, one must consider the Nation's current National Security Strategy (NSS). The Bush NSS clearly holds that "nations need not suffer an attack before they can lawfully take action to defend themselves against forces that present imminent danger of attack."^{iv} This position, supported by recent actions in Afghanistan and Iraq, leads one to suspect that the U.S. is in the regime changing business. In this realm, America's dispute is not with the people of a given nation; rather it is with the tyrant at its helm. Removal of the despot requires defeating the authoritarian regime without alienating the population to facilitate postwar reconstruction and stability operations. Key to achieving this monumental task is limiting noncombatant casualties and damage to the target state's infrastructure.^v This is no easy task for a warfighting establishment whose research and development focus has historically been on increased lethality.

This cursory review of the challenges inherent in the new security environment brings us back to Secretary Rumsfeld and the question of "transform into what?" Vice Admiral (VADM) Arthur Cebrowski, UNS (Ret), Director, Office of Force Transformation, suggests that transformation means that the defense establishment must restructure its forces and develop new and different sets of capabilities.^{vi} It is in that vein that this paper intends to propose that effects-based operations (EBO), coupled with the synergistic effects gained through the integration of non-lethal and lethal capabilities, provides the new ways of thinking and fighting called for by Secretary Rumsfeld and at least one new set of capabilities called for by VADM Cebrowski. This paper will also contend that this new construct provides alternate means for facing the emerging threats and challenges described above. This requires a brief look at the history of

EBO and non-lethal capabilities and then a discussion on the potential operational and strategic benefits gained through their employment. A short discourse on potential obstacles and recommendations to help mitigate them concludes the paper.

Effects-Based Operations (EBO). Conceptually, EBO is nothing new; old wine in new bottles with a “sexy” new name. One could argue that anyone that has conducted a “wargaming” analysis using an action – reaction – counteraction model to validate a course of action and determine the viability of selected objectives has practiced EBO. However, while the principles are not new, application is ad hoc at best. Therefore, a key component of the current debate on EBO is an effort to formalize the process and pull into it all the elements of national power. It is this aspect of the process that, nurtured fully, holds out the possibility of transforming how the U.S. conducts war. Consequently, perhaps the best place to begin a discussion of this broader application is with a common understanding of the concept.

Most EBO advocates credit Colonel John A. Warden, USAF (Ret) with breathing new life into the concept. Warden, an airpower advocate, depicted the enemy as a complex, adaptive system viewed holistically and attacked simultaneously throughout its breadth and depth (parallel warfare) in order to achieve a desired strategic effect.^{vii} He believed that the advent of airpower and precision munitions made it possible to *destroy the physical aspects* of this system, thereby creating strategic paralysis and collapse without having to risk ground forces.^{viii} The current EBO construct retains elements of Warden’s 1991 air-centric concept, but it has also continued to evolve into a much more comprehensive process.

While there is a plethora of definitions for “effects-based operations,” LtCol Allen W. Batschelet, U.S. Army, best captures the essence of the concept without selling any particular capability or technology. Batschelet defines EBO as “a process for obtaining a desired strategic

outcome or effect on the enemy through the synergistic and cumulative application of the full range of military and non-military capabilities at all levels of conflict.” He goes on to say that the “effect” of effects-based operations is “. . . the physical, functional, or psychological outcome, event or consequence that results from specific military or non-military actions.”^{ix}

This definition illuminates several dimensions of the new debate on EBO. First is the notion that non-military actions (diplomatic, economic, and information) can interact synergistically with military actions to play a key role in achieving desired strategic effects. The second incorporates Warden’s concept of the enemy as a complex, adaptive system attacked, *but not necessarily destroyed*, at multiple levels simultaneously to achieve strategic effect. The third aspect of the new framework is that unlike an attrition-based strategy, an effects-based strategy is conceived and executed as a direct assault on an opponent’s will and focused on generating desired effects rather than on the physical destruction of target sets. In other words, it seeks to shape the behavior of the foe so that he no longer wishes to, or is so disoriented that he no longer can, continue the struggle or react coherently.^x While physical destruction remains an effective tool in EBO, it is used primarily because it contributes to breaking the enemy’s will or creates the desired strategic paralysis by denying him use of the tools necessary to respond to the threat. The key is tying every action, regardless of the element of national power enacting it, to the desired strategic effect. This approach ensures ends and means are linked. For the military, it means establishing a direct link between military activities on the tactical and operational levels to the overall strategic objective and foregoing it if that relationship cannot be established.^{xi}

With this as a foundation, the next step is to view EBO as a process based on a comprehensive understanding of the adversary – his political, cultural, technological, military, and economic makeup. This process requires constant analyzing and understanding, planning,

executing, assessing, and adapting to identify key nodes and links that, if attacked simultaneously, may result in achieving the desired effects.^{xii} It places a premium on the situational awareness of decision makers at all levels, makes monumental demands on the Nation's intelligence capabilities, and requires seamless interagency coordination to be effective.^{xiii} While a daunting proposition, this attempt to formalize the EBO process recognizes and seeks to leverage U.S. military and technical superiority with its vast lead in computation and information collection to give it a decisive warfighting advantage.^{xiv}

A Review of Non-Lethal Weapons (NLW). One could argue that NLW, like EBO, are not new. Throughout the history of warfare, belligerents used “non-lethal” tools to gain relative advantage or to deny it to their opponents. Examples include the use of smoke to impede observation, entanglements and caltrops to stop or slow cavalry, and manmade barriers to canalize, stop, or redirect forces.^{xv} All of these were just tools in the tool kit. The current issue with NLW is that the Department of Defense (DoD) chose to define them as something special, something other than just another tool in the tool kit. Exploring DoD's definition helps to explain why expectations and scrutiny are so high.

Non-lethal weapons are defined as weapons “. . . 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.”^{xvi} In our bid to understand NLW better, it is also instructive to note where they diverge from other “weapons.” First, conventional lethal weapons are “. . . designed to destroy targets primarily through blast, penetration, and fragmentation, non-lethal weapons employ means other than gross physical destruction to prevent the target from functioning.”^{xvii} Second, “non-lethality” is a goal based on intention. The goal – not the guarantee – is that use of these capabilities will not lead to

unintentional loss of life or physical destruction.^{xviii} In fact, the DoD policy explicitly states that “while complete avoidance of these effects is not guaranteed or expected, when properly employed, non-lethal weapons should significantly reduce them as compared with physically destroying the same target.”^{xix} Finally, unlike lethal weapons, whose intent is to cause death, permanent injury, or irreversible destruction of a system, temporary and reversible effects on targeted personnel and materiel is an important aspect of most non-lethal technologies.^{xx}

With this basic understanding of NLW, we can now explore their application and development. Since 1995, the Army and Marine Corps have successfully employed non-lethal capabilities in places like Somalia, Bosnia, Kosovo, and Haiti. Demonstrating restraint and value for human life by using NLW, the U.S. maintained legitimacy and the moral high ground throughout these Military Operations Other Than War (MOOTW). Despite this, the defense industry’s focus remained on increased lethality, precision, and speed in hopes that these capabilities would meet the American demand for rapid victory with minimal casualties and collateral damage. Also contributing to the lack of interest by defense contractors was the release of a Joint Concept for NLW in 1998 that stated “. . . the Department of Defense non-lethal weapons programs will *focus* efforts on those weapons and systems designed primarily for employment at the *tactical* level”^{xxi} This focus at the lower end of the warfighting spectrum tended to relegate non-lethal capabilities to the category of sub-programs where they competed poorly with other programs for limited resources.^{xxii} Illustrating this is a Joint Non-Lethal Weapons Directorate (JNLWD) annual core budget of roughly \$45 million through FY09.^{xxiii}

New Developments in Non-Lethal Weapons. As seen above, the JNLWP got off to a rocky start. However, a significant milestone reorienting the program occurred recently with the completion and publication of the JNLWP’s Joint Mission Area Analysis and Joint Mission

Need Analysis (JMAA/JMNA) in December 2000. This exacting seven-month study, conducted in accordance with CJCSI 3170.1A, Requirements Generation System, included participants from all the Services, some military departments, Combatant Commander's staffs, and the U.S. Coast Guard.^{xxiv} In December 2002, the Vice Chairman of the Joint Chiefs of Staff, as the Head of the Joint Requirements Oversight Council (JROC), approved the Joint Mission Need Statement generated by the JMAA/JMNA.^{xxv} JROC approval recognized the future benefits of non-lethal capabilities applied across the spectrum of conflict, as well as the importance of continued research and development. An immediate visible impact was the establishment of a science and technology funding line that adds from \$8.2 to \$16.8 million through FY09.

Length restrictions prevent giving a full accounting of the 376 page JMAA/JMNA report, therefore this paper will address only a few of the highlights to show non-lethal progression and potential. One of the first items of business for the study group was to validate the two existing non-lethal core capabilities and their associated six functional areas. As the study group worked through this process, the Combatant Commander and Service representatives determined that the current security environment dictated an additional core capability that is included in the third position below:^{xxvi}

- Counter-Personnel
 - Incapacitation of Personnel
 - Crowd Control
 - Area Denial to Personnel
 - Clearing Facilities/Structures of Personnel
- Counter-Material
 - Area Denial to Vehicles, Vessels, and Aircraft
 - Disabling or Neutralizing Vehicles, Vessels, Aircraft & Equipment
- Counter Capability
 - Disable or Neutralize Facilities and Systems
 - Deny the Use of WMDs

With an agreement on core capabilities, the study group acknowledged that while non-lethal capabilities have widespread applicability, DoD's shortsighted focus at the tactical level had handicapped the program's exposure and advancement. Therefore, they set about to demonstrate that non-lethals had applicability at the operational and strategic levels of war as well.

To accomplish this task, and to tie it into current doctrine, they undertook the monumental chore of translating missions included in the Universal Joint and Service Task Lists into common language tasks. The study group catalogued these 1,712 tasks into one of four categories: strategic-national (SN), strategic theater (ST), operational (OP), and tactical (TA).^{xxvii} Before analyzing these tasks to determine potential non-lethal applicability, a comprehensive list of existing and emerging non-lethal technologies representing viable methods for aiding in task accomplishment was required.^{xxviii} The list generated by the study group is included in Table 1.

For each of the 1,712 tasks derived, the study group analyzed and assessed whether any of the non-lethal technologies listed in Table 1 supported task accomplishment and if the task description specified non-lethal use. In all, this painstaking work identified 398 Joint and Service tasks where non-lethal technologies had application.^{xxix} Of significance, there are 31 tasks (17 specified and 14 implied) at the SN level; 66 tasks (44 specified and 22 implied) at the ST level; and 89 tasks (71 specified and 18 implied) at the OP level that have non-lethal applicability.^{xxx} From this list, the study group then derived a master list of candidate technologies for potential development. Inclusion on the master list was determined by the number of times a given technology was identified as contributing to task accomplishment and the number of feasible delivery modes to bring the capability to bear.^{xxxi} This list is included in Table 2. Additionally, the derived list of SN through OP-level tasks is included at Appendix B. In addition to the capabilities listed in Table 2, there are a number of other important

technologies embedded firmly in the acquisition pipeline that also show potential. These are in Table 3.^{xxxii,xxxiii} The take away is that there are new non-lethal capabilities being developed and fielded that reflect the requirements of the Universal Joint and Service Task Lists and represent the new set of capabilities called for by VADM Cebrowski.

Effects-Based Operations and Non-Lethal Capabilities Beyond the Tactical Level.

With the background provided thus far, we can now turn our attention to the potential benefits derived from the implementation of EBO and employment of NLW. Effects-based operations and non-lethal capabilities form a uniquely compatible operational construct that is appealing because it not only offers the prospect of being highly effective, it also coincides with the value Americans place on human life and their increasing aversion to the physical destruction and human suffering caused by conventional military operations.^{xxxiv,xxxv,xxxvi} It may be easier to see this by exploring the possibilities using the same three threat areas outlined in the introduction: terrorists and WMD; and adaptive adversary; and not alienating the local populace.

Title 22 of the United States Code defines terrorism as “premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents, usually intended to influence an audience.”^{xxxvii} The intent behind the act is usually to exact extreme retribution from the intended audience, thereby gaining legitimacy for their cause. Utilizing a comprehensive interagency approach to attack all aspects of their organization, as well as a military response that demonstrates restraint using non-lethals, denies these extremists their legitimacy. This lack of legitimacy may hinder the recruiting efforts that keep their ranks filled. Additionally, the idea of capturing and bringing these criminals to justice vice simple “elimination” appeals to America’s sense of fair play. It also allows the U.S. to maintain the moral high ground. Assassinations tend to make other nations leery of multilateral

activity. By maintaining the moral high ground, the U.S. assures its continued access to, and cooperation from, those nations necessary to prosecute the GWOT. Finally, the tremendous advantages gained in the WMD counter-proliferation fight through the development of nanoparticle technology is undeniable (Table 2). These technologies provide viable flexible deterrent options (FDO) suitable to convince a rogue or non-compliant state to cease its WMD operations. Options include sealing a facility with rigid foam to prevent outside interference and then release of the nanoparticles inside the facility to destroy the chemicals. Another option is the now very real threat of lethal destruction of production or storage facilities. Nanoparticles eliminate the fear of collateral damage that currently serves as a key deterrent against such preemptive or deterrent action. Both options, coupled with intense diplomatic and economic actions have the potential to stop the WMD activity, thus achieving the desired strategic effect.

Our next challenge dealt with an adaptive adversary that learned not to challenge the U.S. conventionally. This threat exists for U.S. service members in both MOOTW and major theater war (MTW) scenarios. The challenge is separating a belligerent from a superficial veil of anonymity and security provided by the non-combatants or religious, cultural, or historical icons where he has chosen to hide. Non-lethal capabilities are designed to be discriminating. They possess the potential to strip away any advantage an adversary may perceive from operating in this type of environment. For instance, the use of millimeter wave and malodorant technologies is effective in dispersing a crowd that may not respond to verbal threats and warnings. Also, laser technologies (Tables 2 & 3), which have application in both counter personnel and material scenarios, can be extremely precise over long ranges (500 – 15,000 meters). They allow for the neutralization or destruction of legitimate military targets located in close proximity with structures normally precluded from target lists. Finally, if these means fail, there are calmativ

agents. Calmative agents render both combatants and non-combatants incapable of continuing their actions for various periods. This permits U.S. forces to move amongst them to remove the belligerent individual or group. All of these technologies have the *effect* of de-escalating a situation that may have operational impact by depriving the adversary of the veil of anonymity that he identifies as security and strength. As discussed in the terrorism section above, it also takes away the perception of legitimacy afforded the belligerent by U.S. induced noncombatant deaths and the physical destruction. One need only consider recent operations in Fallujah and Najaf, Iraq now to see how collateral damage, both human and material, give the insurgents strength and legitimacy in their fellow citizen's eyes. From 28-30 April 2004, warplanes dropped three dozen 500-pound laser-guided bombs destroying more than ten buildings and two sniper nests in Fallujah as opposed to non-lethal technologies to take out just the belligerent. Fallujah holds incalculable symbolic power as a bastion against American occupation. While destruction of the city to eliminate a hundred or so insurgents may return the city to American control, it will undoubtedly galvanize resistance around the country and prolong achieving the stability and security required to move forward in Iraq.^{xxxviii} Tactical application of non-lethal capabilities in this instance could have dramatic operational and strategic impact.

Our next area of discussion takes into consideration major theater war (MTW) without alienating the local populace. At issue is the expectation that the most technologically advanced nation in the world ought to be able to limit destruction of key infrastructure and collateral damage in the execution of regime change. This was not the case in Operation IRAQI FREEDOM (OIF). The U.S. lost a great deal of support in the early months of the reconstruction and stabilization effort by not restoring water and electricity rapidly. Of further concern is the fact that the financial burden of rebuilding these nations is borne predominantly by the U.S. and

passed on to its citizens. Mr. Wolfowitz recently stated that the cost of rebuilding Iraq would require an additional \$50 billion next year. That brings the total to over \$137 billion so far. So how can the EBO/NLW construct help?

Utilizing a hypothetical situation in North Korea may help illustrate the possibilities. The operation opens with an effort to take out key power grids. The same opening moves occurred in 1991 (Iraq) and 1999 (former Yugoslavia) when the U.S. dropped bombs that dispersed a specially treated carbon-graphite wire that shorted out transformers, caused flash fires, and shut off power in Baghdad and 70% of the former Yugoslavia. The problem was that within a couple of hours the Iraqis and Serbs restored most of the power simply by entering the facility and sweeping away the fibers.^{xxxix} They were able to do so because the U.S. employed the non-lethal capability in isolation - i.e. without supporting non-lethal or lethal capabilities. To achieve the desired effect required re-attacks, with all their inherent risks, either to reapply the non-lethal or to destroy the power plant. In essence, the planners in these cases violated the DoD's Policy for Non-Lethal Weapons which states that “. . . non-lethal weapons will be used in conjunction with lethal systems to enhance the latter's effectiveness and efficiency in military operations.”^{xl}

Therefore, in our scenario, we are going to shut down the nuclear power plant at Yongbyon with the carbon-graphite bombs, but we are also going to apply anti-traction material on all the roads around it. Then taking advantage of the temporary lapse in the integrated air defense, and since Yongbyon is relatively isolated, the Air Force will sow a low density, limited duration minefield using FASCAM (FAMILY of SCATTERABLE Minefields). Between the anti-traction material and the minefield, we have virtually eliminated the ability to get into the power plant. This prolongs the power outage without the need for physical destruction. We also apply anti-traction material across key air force runways with complimenting FASCAM to keep repair

crews at bay. Then we execute an event-driven electromagnetic pulse to kill the engines of his armored vehicles and complete the incapacitation of his target acquisition systems.^{xii} The coup de grace is a special operations (SOF) raid at the Musudan-ni Missile Facility. SOF forces apply rigid foam to all facility entry points and render inoperable the long-range missile silos by applying super caustic acids to the outer hatches.^{xiii} The reversibility of these non-lethal effects, as well as minefields that deactivate after a designated period, limits the duration and extent of “damage” incurred and virtually eliminates non-combatant casualties. As a result, we have achieved strategic paralysis without alienating the North Korean people. Additionally, while the above scenario implied a preventative action, it just as easily could be the opening moves of an offensive campaign designed to topple the government. This time the integrated non-lethal and lethal operational fires are used to shape the battlespace by setting up the enemy’s forces for a devastating lethal attack. The same effects that de-escalated the previous situation now render the government virtually unable to respond to the threat and risk its very survival.

Finally, as touched on briefly earlier, the EBO/NLW construct holds a great deal of strategic promise as additional FDOs available to Combatant Commanders (COCOM). This construct adds “delay,” “deny,” and “defuse” to the range of viable options available to the COCOM before he is forced to “defeat” a potential adversary. The tenets of EBO (extensive inner agency cooperation & intelligence sharing) allows the COCOM to demonstrate a comprehensive understanding of the issues that, when combined with the inherent restraint of NLW, contributes to an environment more conducive to diplomatic resolution. Additionally, the potential of non-lethal action as an FDO represents a visible demonstration of intent, thereby adding teeth to the diplomatic process while courting favorable world opinion through efforts to demonstrate restraint while resolving potential crises. For example, perhaps the threat or use of

non-lethal action against Libya and Muammar Qadhafi would have expedited extradition of the Pan Am 103 bombers vice taking nearly eight years and three UN Resolutions.^{xliii} Finally, the understanding that employment of NLW will likely leave a future adversary more vulnerable to lethal attack serves as powerful incentive to cease provocative activity.^{xliv}

Impediments to Implementation. As described above, the EBO/NLW construct offers the potential to significantly enhance U.S. capabilities for bringing about a desired strategic effect. That said, there are numerous impediments to implementation that need attention before realizing that potential. Fundamental to making the EBO construct work is the smooth flow of information, both horizontally and vertically, between multiple government agencies and the military. The EBO construct mandates that the planning and analysis cells are performing their duties before a crisis erupts in order to develop and sustain the requisite situational awareness. Unfortunately, most of the government agencies needed to support those cells do not have the staffing to provide personnel on a full time basis. Additionally, interagency personalities and cultural resistance to surrendering flexibility and ambiguity creates opposition to locking people into an unfamiliar, formalized architecture managed primarily by the military.^{xlv} While it may be possible to overcome this shortfall through increased staffing, there is still some concern whether or not the U.S. intelligence community can provide the support required of it. Andrew Krepinevich, Center for Strategic and Budgetary Assessments, argues that the U.S. certainly did not have the level of intelligence support required in OIF to support the notion that shock and awe could yield prompt, decisive, strategic results. He goes on to say that “victory in the Second Gulf War was achieved the ‘old-fashioned’ way: the enemy’s army was defeated and his capital occupied.”^{xlvi} While Clausewitz undoubtedly would have been proud, the fact of the matter is, the Clausewitzian way is becoming the least desired way to win a war. Steven Metz of the

Strategic Studies Institute, in writing about NLW and not EBO, suggests that in the future, miniaturized robotic sensors and human intelligence will be more important than overhead or orbital sensors. He also acknowledges, more importantly, that the information will be less concerned with the location of physical assets than with psychological factors that are beyond satellite imagery.^{xlvii} The point here is that the U.S.'s industrial age intelligence architecture is lagging behind its information age concept of warfighting. It must be overhauled to resemble VADM Cebrowski's concept of netcentric intelligence capabilities that provides for a seamless flow of information to and from the lowest levels before EBO can be effective.

While the impediments to EBO are potentially surmountable through improved technology, increased human intelligence assets, and some organizational changes, the obstacles to non-lethal capabilities present a more significant problem. The resistance here is more philosophical than practical and is based on the western Christian principle of just conduct in war (*jus in bello*). There is a strong lobby, including the likes of the International Committee of the Red Cross (ICRC), that exploits the ambiguity of current international laws, treaties, and conventions to make a case against non-lethal "weapons." As a result, and quite ironically, we find organizations like the ICRC advocating the use of lethal force over the proposed, more humane, non-lethal capabilities.^{xlviii} Well over a dozen such documents are cited in this debate; however, this paper touches briefly on only five of them to illustrate the point.^{xlix} The Chemical Weapons Convention affects any attempt to use riot control agents in warfare, as well as a number of the chemically based non-lethals such as anti-traction, and super caustics. The Geneva Convention, Additional Protocol I of 1977 prohibits "indiscriminate attacks." It has the potential to affect aurally dispersed chemically based technologies that have the potential to drift. The Biological Weapons Convention jeopardizes research into proposed bio-deterioration

agents such as fuel gelling and fuel/air filter damaging microbes. The Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD) has the potential to impact super caustics or area denial technologies. Finally, the Convention on Prohibition or Restrictions on the Use of Certain Conventional Weapons (CCWC) specifically addresses using lasers to blind combatants. While the non-lethal laser suites are not intended to cause permanent blindness, this convention has the potential to impact other non-lethal technologies such as microwave, and directed energy weapons.^{1,li}

In Nick Lewer's book, The Future of Non-Lethal Weapons, David Fidler explores three perspectives for dealing with the obstacles presented by international law. His first, the compliance perspective, insists that non-lethal capabilities comply with current international law. His second, the selective change perspective, advocates pursuit of select changes in international law to allow a more robust use of non-lethal capabilities for military and humanitarian reasons. His final perspective, the radical change perspective, sees in non-lethals the chance to challenge and alter the international status quo on armed conflict and the use of force.^{lii} This debate is not currently an issue in the international community because the U.S. and its western allies, i.e. NATO, assert that “. . . Non-Lethal Weapons shall always remain consistent with applicable treaties, conventions, and international law, particularly the Law of Armed Conflict.”^{liiii}

There are a number of other concerns as well. Some opponents argue that NLW demonstrate a lack of will on the part of the U.S. and allow the bad guys to live to fight another day. What these folks seem to miss is the *substance* NLW add to diplomacy. This substance allows the U.S. to do more than just talk at an issue while demonstrating just the opposite of a lack of will. It shows great determination to resolve the issue at hand by the most efficient means available. As to allowing the bad guys to live to fight another day, it is difficult to carry

on a terror crusade serving a 240-year sentence in an eight-by-eight maximum-security cell – just ask Ramzi Yousef.^{liv} The visible arrest, trial, and sentencing of known war criminals and terrorists may also serve as enough of a deterrent to thwart other similar activities.

Recommendations. 1) That the U.S. defense and intelligence establishment accept VADM Cebrowski's requirement for an enhanced, networked intelligence architecture that provides for rapid dissemination of information to enhance the situational awareness of commanders at every level in order for them to contribute to achieving the desired strategic effect. This increase in situational awareness has the added benefit of increasing the number of independent entities operating and reporting on enemy activity.^{lv} This system could resemble that which the Department of Homeland Security is building with state and local agencies to pass terrorist or threat information rapidly. A similar system will assist analysts in building a clearer, actionable intelligence picture that will have greater strategic effect on our adversary.

2) That U.S. policymakers accept the selective change perspective and propose an international forum for discussion and action. The potential benefits gained through non-lethal capabilities are too great to allow ambiguous laws to prohibit their employment in both MOOTW and MTW.

3) That the Department of Defense takes the lead in advocating and formalizing interagency planning cells down to the operational level. The Counterterrorism Security Group,^{lvi} at the strategic level, and the Joint Inter-Agency Coordination Group (JIACG) at U.S. Pacific Command, provide great precedence in demonstrating the viability of this type of organization. The JIACG provides regular reachback capability to key agencies and regional planners in Washington that makes crisis planning more efficient. This effort will meet organizational/agency resistance, but it is a crucial first step to building the planning cells and cooperation necessary to make EBO a reality vice just a concept kicked around in academic circles.

Conclusions. Neither EBO, nor NLW are a panacea for the bloodshed and destruction inherent in armed conflict. That said, this paper suggests that if U.S. policymakers and military leaders make a concerted effort to overcome the impediments discussed herein, the EBO/NLW construct offers a new way of thinking and fighting, as well as a new set of capabilities that better positions the U.S. and its military to face emerging asymmetric threats. Formalizing the EBO process brings all elements of national power to bear at the strategic and operational levels while leveraging current U.S. technological advantages to foment strategic paralysis amongst its adversaries. This process, when combined with the synergistic effects gained through the integration of non-lethal and lethal operational fires, can also reduce the number of casualties (combatant and non-combatant) and limit physical destruction. This helps establish the conditions for success in the post-conflict stages where these capabilities can have operational and strategic impact even when applied at the tactical level. Additionally, the EBO/NLW construct may provide COCOMs a wider array of FDOs at the operational and theater strategic levels that put teeth into U.S. diplomacy and facilitate de-escalation of future crises before forces have to be committed. Finally, the nanoparticle technology is a truly exciting possibility in our fight against our biggest threat today, rogue states and non-state actors with WMD. The ability to destroy biological and chemical weapons without concern for collateral damage will provide a great deal of flexibility to the U.S. in dealing with this global threat. Lest the reader think this work advocates a kinder, gentler approach to warfare the following Clausewitzian edict, which is as true today as it was some two centuries ago, is provided as a stark reminder of the realities of war.

“Kindhearted people might of course think there was some ingenious way to disarm or defeat an enemy without too much bloodshed, and might imagine this is the true goal of the art of war. Pleasant as it sounds, it is a fallacy that must be exposed: war is such a dangerous business that the mistakes which come from kindness are the very worst.”^{lvii}

APPENDIX A: TABLES

Table 1. Existing & Emerging Non-Lethal Technologies
(Green bold text = existing technologies & red italicized text = emerging technologies)

Electromagnetic	Chemical	Acoustic	Mechanical & Kinetic
ELECTRICALS Pulsed Current <i>Sticky Shocker</i> <i>Taser Mine</i> Stun Guns Direct Current RADIO FREQUENCY <i>Non-nuclear EMP</i> MICROWAVE <i>High power microwave</i> MILLIMETER WAVE <i>Millimeter Wave Projector</i>	OBSCURANTS Smokes REACTANTS <i>Supercorrosives</i> <i>Combustion Alteration - Air/Fuel</i> <i>Combustion Alteration-Fuel</i> <i>Viscosity</i> <i>Lubricant Contaminants</i> <i>Depolymerizers</i> <i>Embrittlers</i> <i>Emulsifiers</i> MALODORANTS Skatole Mercaptan	AUDIBLE Infrasonic Ultrasonic	BARRIERS Caltrops Tire Spikes & Strips <i>Air Bag Mines</i> ENTANGLEMENTS Portable Vehicle Arresting Barrier Running Gear Entanglement System <i>Net Mines</i> CLOGGERS <i>Vessel Exhaust Stack</i> <i>Blocker</i>
LASERS Infrared <i>Chemical Oxygen Iodine</i> <i>Laser</i> <i>CO2 Lasers</i> <i>HF/DF Lasers</i> <i>Solid State Lasers</i> Visible <i>Laser Scattering</i> <i>Obscurants</i> <i>Holograms</i> <i>Laser Light Bullets</i> <i>Isotropic Radiators</i> Laser Illuminators Flashes & Flares Strobes Ultra violet <i>Laser Ionizer</i>	CALMATIVES RIOT CONTROL AGENTS OC (pepper spray) CS CN (mace) ANTI-TRACTION FOAMS <i>Sticky Foam</i> <i>Rigid Foam</i> THERMOBARRIC COMPOUNDS NANOPARTICLES <i>Magnesium Oxide</i>		BLUNT IMPACT DEVICES Projectile Rubber Balls Modular Crowd Control Munition 40mm Crowd Dispersal Cartridge 66mm Vehicle Launched NL Grenade Liquid Filled Bean Bag Baton Velocity Adjusting Water Stream Cannon
Combined Technologies		Ancillary Technologies	
Flash Bangs <i>Multi-Sensory Distraction Device</i> <i>66mm Vehicle Launched Grenade</i>		MARKERS Dyes Liquid Dyes Foam Dyes Smokes Dyes Fluorescent Invisible – UV Light Visible Paint Ball Guns	NON-LETHAL CASINGS <i>Frangible casings</i> <i>Combustible casings</i> ENCAPSULANTS <i>Microencapsulation</i> <i>Temperature Released</i> <i>Pressure Released</i> TAGGERS - Active

Table 2. Master Technologies List

TECHNOLOGY	RATIONALE
1. Millimeter Wave Electro-magnetic Radiation	Previously classified. Now labeled as the Active Denial System and part of the Advanced Concept Technology Demonstration. The current capability is a HMMWV integrated counter-personnel directed energy NLW that creates an intolerable skin heating sensation, repelling human targets w/o damage.
2. Chemical Oxygen Iodine Lasers	COIL technology offers unique contributions to the non-lethal counter-materiel and counter-capability areas by providing the capability to strike targets with ultra-precision, controllable effects from long standoff ranges while minimizing collateral damage. A derivative of the technology being used on the Air Force Airborne Laser program, COIL has the highest technical maturity and offers the greatest potential for implementation in the near to mid term. It is the central element of the Advanced Technology Laser ACTD proposed for FYO 1 start. Technical challenges include scaling down of the laser gain module, beam conditioning and control in a dynamic motion environment, and management of the chemical process effluents. Technical risk is considered medium.
3. Anti-Traction	Anti-traction or slippery substances can provide the capability to inhibit the free movement of vehicles or individuals through treated areas. This would provide a capability to deny access to or through an area in a number of operationally useful situations. Although some development has taken place and the concept has been successfully demonstrated, additional work is necessary to improve the persistence and concentration of these materials in operational environments. Anti-traction material payloads can be readily integrated into a number of existing ground and air delivery systems and platforms, and can be made operational in the near term.
4. Non-Lethal Delivery / Deployment	Non-lethal munitions must be capable of deploying and dispersing their payloads in a non-lethal and controlled manner. Technologies that reduce the kinetics of the delivery process such as frangible and combustible materials enable the development of munition casings that break up into many low mass, low-velocity fragments. Other options include use of materials that are combusted during payload deployment and drogue parachute applications. The development of encapsulation materials that will activate/release their contents when subjected to specific stimuli such as a mechanical pressure, a specific temperature, light of a specific wavelength, etc., would be very useful operationally. This, coupled with the ability to produce capsules of various diameters down to 100 microns, could considerably broaden the range of options for delivery and deployment of numerous non-lethal payloads. The existence of such materials will enable the development of common munitions capable of carrying several types of non-lethal payloads fired from a large number of existing weapons such as grenade launchers, mortars, field artillery, and aircraft ordnance.
5. Malodorants	Malodorous substances can be very useful operationally in counter-personnel applications. Where the minimum level of force is appropriate or as a first measure to prevent escalation. By themselves, these extremely foul, putrid smelling substances can be very effective first-level discriminators of motivation and intent. In combination with other non-lethal technologies, such as bright light flashes and loud explosive bangs, malodorants can effectively produce multi-sensory overload of individuals and groups to incapacitate/distract them temporarily. The technology of malodorous substances is mature.
6. Calmatives	This technology was selected because of its very broad applicability and utility. Sleep agents or calmatives that could render individuals incapable of continuing their actions for various periods in a controllable fashion would be extremely useful in a very large number of operational scenarios. To make them most useful, calmative agents should be capable of being used in situations involving a mix of people of varying ages and physical characteristics. Consequently, the primary technical challenge will be in developing agents that produce consistent, safe effects over broad ranges of the human population, and be made relatively insensitive to dosage. Additionally, mechanisms must be found to enable absorption into the body in a variety of ways such as inhalation or through skin. Research is also needed to accelerate the onset of the effects of these agents. This would enable the safe and quick incapacitation of individuals in certain critical situations. The technical challenge associated with this effort is deemed to be significant.
7. High Power Microwave	Classified.

Table 2. Master Technologies List - continued

TECHNOLOGY	RATIONALE
8. Rigid Foam	Rigid foams provide significant utility for creating temporary barriers, particularly in entryways, and for disabling the support functions of facility existence (i.e., power distribution, communications, etc.). Additionally, they can be used to disable vehicles and other equipment by jamming moving parts. This capability has potentially broad application in the counter-materiel and counter-capability areas. Technical challenges still exist to reduce the hardening/curing time and to increase structural strength. Additionally, other alternatives to deliver and deploy the foam payloads, such as binary configurations, are needed to enable standoff and long-range delivery when applicable.
9. Tagging, Tracking and Locating	The technology associated with luminous or covert dyes and paints is mature with the majority of the effort required in developing delivery/deployment means (range and non-disclosure) and integration into the necessary platforms. Significant work is required to develop minute tagging devices capable of being tracked and located, as well as their delivery/deployment means.
10. Nanoparticles	Nanotechnology was chosen because of its significant potential contribution in reducing the harmful effects of releases of chemical and biological agents. Although early in development, the concept using reactive nanoparticles to decompose chemical agents or destructively absorb biological agents shows considerable promise, and results of experimentation are very encouraging. Nanotechnology also has significant potential for advancing materials development by enabling the production of very high shear and tensile strength fibers that are extremely lightweight. Such material could enable the development of new, highly effective entanglement systems that can be used for both non-lethal counter-personnel and counter-material applications. Technical challenges include the development and testing of agents to counter the various threats, and developing the capability to produce these substances in sufficient volume.
11. Low Energy Laser Scattering and Dazzling	The capability to obscure temporarily an adversary's vision can provide significant military advantage in a number of situations. The use of low power, eye-safe lasers against individuals for this purpose has been proven effective in evaluations conducted during military operations. However, low-power laser technology also has the potential to provide this capability against large groups, yielding similar non-lethal operational utility at a larger scale. This can be done by either directly illuminating the adversary group with an eye-safe, broader laser beam or by illuminating an external medium, such as an airborne aerosol cloud, resulting in the scattering of the laser light and creating a "wall of light." Challenges exist in the accurate characterization of effects on the human eye and in overcoming issues of public perception associated with laser technology.
12. DFIHF Lasers	Applications of pulsed Deuterium-Fluoride (DF) and Hydrogen-Fluoride (HF) laser technology have direct applicability in the non-lethal counter-personnel area by providing the unique capability to incapacitate individuals from standoff ranges of up to 500 m. Mounted on a vehicle or eventually man-portable, these devices produce pulsed energy projectiles that travel instantaneously and produce controllable effects. Technical challenges include the development of a robust, practical field device, successfully developing the capability to control the effects and characterizing the human effects.

Table 3. Evolving Technologies

Current Production Program	Currently in production to be fielded in the near future.
<i>Modular Crowd Control Munition</i>	A non-lethal variant of the current claymore mine which propels hundreds of small rubber balls
<i>66mm Vehicle Launched NL Grenade</i>	A short-range, indirect fire, crowd control and area denial non-lethal capability that employs either a flash-bang device or 32-caliber rubber balls. This system can be employed from a light vehicle.
<i>Portable Vehicle Arresting Barrier</i>	Designed to stop a 7,500lb vehicle traveling at speeds up to 45 mph without causing permanent injury to the occupants.
<i>40mm Non-Lethal Crowd Dispersal Cartridge</i>	Intended to disperse a crowd with rubber balls. It has a range up to 30 meters.
<i>Mobility Denial System</i>	A non-hazardous chemical spray system that spreads highly slippery, viscous gel to inhibit the movement of individuals or vehicles on treated surfaces such as asphalt, concrete, grass, and wood.
Concept Exploration Programs	Designed to refine proposed non-lethal concepts that have been proposed but the viability of which is not always obvious. This program assists not only in refining the concept but reducing the technical uncertainties.
<i>Clear Facilities Program</i>	A USMC program that seeks to develop alternatives to assist in the clearing of buildings or structures, including naval vessels, without harming personnel, equipment, or structure.
<i>Non-Lethal Slippery Foam</i>	A joint USA & USMC program analyzing slippery foams to determine the degree and longevity of anti-traction capability on various surfaces for use as an area denial system for personnel and vehicles.
<i>Area Denial to Vehicles</i>	A USA project exploring stopping, denying, or canalizing vehicles in an urban or open environment.
<i>Area Denial to Personnel</i>	A USA project exploring alternatives to land mines.
<i>Disable Displacement Vessels</i>	A program exploring technologies to disable large displacement, diesel ships ranging from 150-600 feet. The program explores methods of affecting a shipboard system or subsystem to cause the vessel to stop and yet be capable of quick reconstitution.
<i>Crowd Control Device</i>	A USA project that explores means for containing or stopping a crowd from advancing, directing its movement, or dispersing it at ranges up to 1,000 meters. It also explores ways to separate belligerents and isolating specific individuals within a crowd.
<i>Incapacitate Personnel Program</i>	A USMC program that seeks to develop capabilities to incapacitate individuals in order to distract an individual or group, seize and individual or group, render an individual or group unconscious, render an individual or group incapable of performing tasks, disorient an individual or group, facilitate deceptions and demonstrations, and facilitate the release of hostages.
Component Advanced Development Efforts	A project in which a project leader has a concept for the required capability but does not yet know the system architecture to support it.
<i>Anti-Traction Material</i>	A USMC project aimed at developing a water cannon-like weapon that distributes slippery liquids or foams that preclude vehicle or personnel use of an area.
<i>Clear Space Device</i>	A USMC project designed to produce a grenade-like round that enables troops to shoot a number of different non-lethal substances into a building to clear it of its occupants.
Pre-Milestone A Programs	Facilitates concept exploration or advanced component development on systems that may require more work on key sub-systems or components before demonstrating the technology in a relative environment.
<i>Running Gear Entanglement System</i>	A rope device designed to stop fast-moving boats by entangling the propeller or rudder.
<i>Pulsed Energy Projectile</i>	A counter personnel laser of which studied bio-effects include a disorienting flash-bang, a sensation of pain, or incapacitation.

Table 3. Evolving Technologies - continued

<i>Non-lethal round for the Objective Individual Combat Weapon (OICW)</i>	A lightweight portable weapon capable of firing kinetic energy projectiles and an air-bursting fragmentation munition up to 1000 meters. This weapon is also an advanced technology demonstrator currently under development with a fielding planned for 2005.
<i>Non-Lethal Mortar Munition</i>	An 81mm round designed to deliver and dispense non-lethal payloads up to 1.5 km.
<i>Non-Lethal Munition for the 40mm Mk 19 Grenade Launcher</i>	Capitalizing on current 40mm non-lethal technologies, this expands the range of this capability up to 1000m. Munition includes a “flash-bang” capability and a round packed with 48 .48 caliber rubber balls that have a 15 – 50 meter effective range on impact.
Advanced Concept Technology Demonstrations	Facilitates construction of prototype equipment to meet a critical military need for new but mature technologies.
<i>Advanced Tactical Laser</i>	This system includes a laser, optics, and fire control system that enables fixed and rotary wing aircraft to precisely direct laser fire on targets to disable them from 15 kilometers away.
<i>Active Denial System</i>	A breakthrough in non-lethal technology that uses millimeter-wave electromagnetic energy to stop, deter and turn back an adversary from a relatively long range. The system creates a burning/hot sensation on the skin. The current system is mounted on a HMMWV but other applications are envisioned.
Technology Investment Projects	New ideas receiving up to 2 years of funding for concept development to determine potential value for continued development.
<i>Laser Guided Energy (LGE)</i>	Investigating the feasibility of using a laser to guide various forms of energy for a variety of non-lethal effects.
<i>Pulsed Energy Projectile (PEP)</i>	Investigating the feasibility of using laser induced plasma with multiple tunable non-lethal effects (deny, deter, disable) for counter-personnel application.
<i>Personnel Halting and Stimulation Response (PhaSR)</i>	Demonstrating the feasibility of building a self-contained, lightweight, hand-held non-lethal laser system for counter-personnel application.
<i>Front-End Analysis of Riot Control Agents</i>	Seeks to identify feasible non-lethal chemical materials with minimal side effects for immobilizing adversaries in military and law enforcement scenarios.
<i>Thermobaric Technologies</i>	Determines the feasibility of using thermobaric technology, which produces light, overpressure, and heat, to incapacitate humans.
<i>Veiling Glare Effects of Violet Laser Exposures in Humans</i>	An initial effort to evaluate the ability of a violet laser to create a veiling glare on isolated human lenses.
<i>Odorous Substances</i>	Investigates odorants and their effects on behavior as a riot control means, as well as to clear facilities, deny an area, or as a tagging agent.
<i>Microencapsulation</i>	Identifies encapsulation techniques for anti-material and anti-personnel non-lethal technologies related to area denial and stopping vessels. Pursued techniques are those that will release and spread a variety of chemical payloads upon pressure contact with water, or at a specific temperature.
<i>Bio-Materials Survey</i>	A project of the University of New Hampshire that is gathering information on the physical properties of certain biomaterials applicable to non-lethal weapons.
<i>Overhead Liquid Dispersal System</i>	Studies the ability to disperse rapidly, non-lethal chemical agents over large areas.
<i>Taser Landmine</i>	explores an alternative to personnel land mines – a device that fires small darts attached to wires that deliver an incapacitating electrical current.
<i>Non-Lethal Weapon Guided Projectile</i>	explores the feasibility of employing Raytheon’s Extended Range Guided Munition (ERGM) and other long-range delivery vehicles to deliver non-lethal payloads for area denial and clearing facilities missions.

Table 3. Evolving Technologies - continued

Rejected technologies	
<i>Non-Lethal Loitering Submunition</i>	Studies non-lethal payloads and a concept of operations for a loitering submunition.
<i>Sticky Foam</i>	At first thought to be a candidate for counter-personnel and counter-material uses; however, concerns about the potential for accidental lethal effects (i.e. suffocating) and difficulty in removing the substance resulted in dismissal of the project.
<i>Infrasound</i>	Designed to create disabling physical responses such as nausea and incapacitating pain through the use of inaudible, very low frequency (below 20 Hz) noise. JLWND sponsored extensive research in this area but halted it in 1999 after the program failed to identify the frequencies that produced reliable, repeatable bio-effects.

Appendix B (Universal Joint and Service Task List Tasks with Non-Lethal Applicability)

NLW Functional Assessment of Joint and Service Tasks

The following tables represent the finished product resulting from the JMAA/JMNA assessment to determine non-lethal applicability in 1,712 Universal Joint and Service Tasks. Recall that the list of current and emerging non-lethal capabilities from Table 1 were assessed for both potential utility and application in the accomplishment or supported accomplishment of the task (mission requirements). The three core capabilities identified in the study, and their respective functional areas are listed again below. The number to the left of the functional area corresponds to how the functional area applies to each specific Joint or Service Task. The number one (1) is used for the functional area of crowd control, with the number two (2) is used for Incapacitate Individuals and groups. The sequence continues through all eight functional areas. The number nine (9) was used to indicate that all non-lethal functional areas were found to accomplish, or support the accomplishment of the task.

Counter-Personnel

- 1 Incapacitation of Personnel
- 2 Crowd Control
- 3 Area Denial to Personnel
- 4 Clearing Facilities/Structures of Personnel

Counter-Material

- 5 Area Denial to Vehicles, Vessels, and Aircraft
- 6 Disabling or Neutralizing Vehicles, Vessels, Aircraft & Equipment

Counter Capability

- 7 Disable or Neutralize Facilities and Systems
- 8 Deny the Use of WMDs

9 All of the above functional areas apply to the task identified

Additionally, the JMAA/JMNA study group used the terms “specified” or “implied” to indicate the association of the functional area to the task. Specified was defined as directly connected, stated explicitly or in detail to the functional area. Implied was defined as involving or indicating by inference, association or necessary consequence rather than by direct relation to the functional area. The letters “S” or “I” were used to represent specified or implied respectively. The following example provides guidance for reading the table.¹

- SN 3 = Strategic National task number 3
9 (S) = Indicates the task can be accomplished or supported by all the functional areas and specified uses have been identified

ENDNOTES

-
- ⁱ Donald H. Rumsfeld, "Transformation Planning Guidance." Department of Defense, The Pentagon, April 2003, 1.
- ⁱⁱ "China's Commercial Technology – Implications for Future Military Capabilities," RAND Publications, 2001. RAND Research Brief no.67, <http://www.rand.org/publications/RB/RB67/index.html> [28 September 2003]. In fact, while China's economy continues to grow at impressive rates, and it has gone through several modernization efforts in its military, the technological capabilities of its defense industry still lag significantly behind the U.S. It is estimated that by 2020, with significant emphasis on its technological capabilities, China's capabilities will be on par with those *currently* possessed by Japan and South Korea and no threat to the U.S. Russia is in even worse shape as she continues to progress through the turbulent transition to a free market economy and a democratic system of government. Until Russia can stabilize its economy, recapitalize its military, stop its negative population growth, and address its endemic health, crime, and corruption issues, it will not be a threat to the U.S. in any conventional means.
- ⁱⁱⁱ Nick Lewer, The Future of Non-Lethal Weapons: Technologies, Operations, Ethics, and Law, London, UK : Frank Cass Publishers, 2002, 15.
- ^{iv} Ibid, 52.
- ^v Andrew F. Krepinevich, Operation Iraqi Freedom: A First-Blush Assessment, Washington, DC : Center for Strategic and Budgetary Assessments, 2003, 13.
- ^{vi} Arthur Cebrowski, "Transforming Transformation," Transformation Trends, Arlington VA : Office of Force Transformation, 19 April 2004, 4.
- ^{vii} Colonel John A. Warden III, USAF. "The Enemy As A System." Airpower Journal, Spring 1995, 42.
- ^{viii} Ibid, 43. Warden actually portrays the enemy system as five concentric rings with the most important ring being in the center and essentially protected by the outer rings. From the inside out the rings are labeled as follows: 1) Strategic leadership, 2) Organic essentials, i.e., electricity & petroleum, 3) Infrastructure: rail lines, airlines, highways, bridges, airfields, and etc 4) The population, and 5) Fielded military forces
- ^{ix} Williamson Murray, ed. Transformation Concepts for National Security in the 21st Century. Carlisle, PA : Strategic Studies Institute, 2002, 103.
- ^x Smith, Edward A. Effects Based Operations – Applying Network Centric Warfare in Peace, Crisis, and War. Washington, DC : DoD Command and Control Research Program, 2002, 45.
- ^{xi} Saunders-Newton, Desmond and Aaron B. Frank. "Effects-based Operations: Building the Analytic Tools." Defense Horizons, no. 19, October 2002. Available online at http://www.ndu.edu/inss/DefHor/DH19/DH_19.htm [22 April 04].
- ^{xii} Gene Myers, "Effects-Based Operations," Armed Forces Journal, June 2003, 48.
- ^{xiii} Murray, 106.
- ^{xiv} Saunders-Newton.
- ^{xv} American Systems Corporation (ASC). Joint Vision for Non-Lethals: Meeting the Demand of Future Military Operations. A Study for the Joint Non-Lethal Weapons Program done in conjunction with the Center for Naval Analysis. Dumfries, VA : ASC, December 1999, 1.
- ^{xvi} U.S. Department of Defense, Policy for Non-Lethal Weapons, Department of Defense Directive (DoDD) 3000.3, Washington, D.C. : U.S. Department of Defense, 9 July 1996, 3.1.
- ^{xvii} Ibid.
- ^{xviii} Lewer, 13.
- ^{xix} Ibid.
- ^{xx} Ibid, 3.2.
- ^{xxi} U.S. Marine Corps, Joint Concept for Non-Lethal Weapons, Washington, DC : Headquarters, U.S. Marine Corps, 5 January 1998. Available online at <http://www.fas.org/man/dod-01/sys/land/docs/NONLETH.HTM> [25 April 2004]
- ^{xxii} Lexi R. Alexander & Julia L. Klare, "Nonlethal Weapons: New Tools for Peace," Issues in Science and Technology, Winter 1995-96, 72.
- ^{xxiii} Colonel Dave Karcher, Director, Joint Non-Lethal Weapons Directorate, "Joint Non-Lethal Weapons Program Brief to the Force Protection, Force Capability Board (JROC)." A powerpoint presentation given to Radm Mathis, J-8, on 6 Apr 2004, 13. The JNLWD was established in January 1997 as the JNLWP day-to-day manager.

^{xxiv} Joint Non-Lethal Weapons Directorate, Non-Lethal Weapons Joint Mission Area Analysis/Joint Mission Need Analysis (JMAA/JMNA) Final Report, Dumfries, VA : American Systems Corporation, December 2000, 4.

^{xxv} Karcher, 18.

^{xxvi} JMAA/JMNA, iii – iv.

^{xxvii} Ibid, 8-10.

^{xxviii} Ibid, 14.

^{xxix} Ibid, 11.

^{xxx} Ibid, A-4-3 to A-4-5. A complete listing of all tasks is available on pages A-4-13 through A-4-41.

^{xxxi} Ibid, 14 -18. Due to length restrictions on this paper, the processes used to generate the lists in Tables 1 & 2 were over-simplified. For more detail and a full appreciation of the monumental amount of work and depth of analysis involved in this study, I emphatically recommend the full report.

^{xxxii} Karcher, 26-35.

^{xxxiii} Eric L. Nutley, LtCol, USAF, “Non-Lethal Weapons: Setting our Phasers on Stun? Potential Strategic Blessings and Curses of Non-Lethal Weapons on the Battlefield,” Occasional Paper no. 34, Center for Strategy and Technology, Air War College, Maxwell Air Force Base, AL, August 2003, 21-24.

^{xxxiv} Coppennoll, Margaret-Anne, LTC, Army National Guard, “The Nonlethal Weapons Debate,” Naval War College Review, Spring 1999, Vol. LII, No.2, 122. The just conduct of war (*jus in bello*) rests on the principles of proportionality and discrimination. These principles have become increasingly important to the American public.

^{xxxv} Ruth Leger Sivard, World Military & Social Expenditures, 1989, 13th ed., (Washington DC: World Priorities, 1989), cited in Coppennoll, 121-123. Of concern is the seeming increasing imbalance between combatant and non-combatant deaths as lethality and technology have increased. For instance, during the American Revolution, British and American forces suffered thirty-four thousand military casualties; civilian deaths were virtually negligible. By the e1950s, however, noncombatant accounted for about half of all war casualties; by the 1980s noncombatant casualties had increased to 80 percent.

^{xxxvi} From an interview the author conducted with Lieutenant General Robert Johnston, USMC (Ret) in 1997 for a research paper that included sections about Operation RESTORE HOPE. Johnston was the JTF Commander for that phase of operations in Somalia and he advised the author that Somali civilian deaths exceeded 7,000 during the period 1992-1995. U.S. military deaths were less than two dozen.

^{xxxvii} Cited in Nutley, 47.

^{xxxviii} Eric Schmitt and Thom Shanker, “A Full Range of Technology Is Applied to Bomb Fallujah,” New York Times, April 30, 2004. Available on line at <http://ebird.afis.osd.mil/ebfiles/e20040430280873.html> [30 April 2004].

^{xxxix} David A. Fulghum, “Electronic Bombs Darken Belgrade,” Aviation Week and Space Technology, 10 May 1999, 34-35.

^{xl} DoDD 3000.3,3.

^{xli} Colonel John B. Alexander, U.S. Army (Retired), Future War, Non-Lethal Weapons in Twenty First-Century Warfare, New York : St. Martin’s Press, 1999, 65. While the EMP is not a field capability yet, Colonel Alexander refers to it as the holy grail of non-lethal direct energy weapons. According to Alexander, the U.S. military has poured hundreds of millions of dollars into research and development of pulse-power weapons, and foreign countries have done likewise. The basic concept of EMP weapons is to generate one or more very intense pulses of electromagnetic power that penetrates equipment to degrade or destroy sensitive electronic circuitry. The concept is feasible and comparable to when a lightning bolt strikes in the immediate vicinity of computers, televisions, or other electronic equipment. There have been some successes with non-nuclear EMP but they have been inconsistent which is why the technology is not considered mature. This electromagnetic attack leaves equipment burned out or otherwise damaged as an electrical surge travels through the power cables & overloads computer terminals. Gets in via coupling. Front door – through an antenna or other path that is open to the outside and leads directly to the electronic device. Back door – through unprotected cables, poorly shielded interfaces or even holes in the walls of the system.

^{xlii} Jane’s Sentinel Security Assessment. Available on line at <http://80-www4.janes.com.exlib.nwc.navy.mil/K2/doc.jsp?> [21 April 2004].

^{xliii} Paul R. Pillar, Terrorism and U.S. Foreign Policy, (Washington, D.C. : Brookings Institution Press, 2001, 77.

^{xliv} Harmon A. Stockwell, Colonel, USMC, “Beyond Sticky Foam: The Operational Use of Non-Lethal Technologies,” Unpublished Thesis, Naval War College, 16 May 2001, 9.

^{xlv} George T. Raach and Ilana Kass, “National Power and the Interagency Process,” Joint Forces Quarterly, Summer 1995, Number 8, Washington, D.C. : National Defense University, 1995, 11.

^{xlvi} Krepinevich, 22.

^{xlvii} Steven Metz, “Non-lethal Weapons—A Progress Report,” Joint Force Quarterly, Spring/Summer 2001, 21.

^{xlviii} Benjamin K. Barrett, LCDR, USN, “The Utility of Non-Lethal Weapons in Large Scale Conflict,” Unpublished Thesis, Naval War College, 8 Feb 00, 6.

^{xlix} Nutley, 39-40.

¹ Barrett, 5-6. This section on international treaties and conventions was cited in both LCDR Barrett’s and LtCol Callihan’s papers and pieces and parts were taken from both of them to create this section. The *Chemical Weapons Convention (CWC)* was ratified by the U.S. Senate in 1993 after a great deal of debate and inclusion of specific exceptions for American armed forces. It prohibits the employment of munitions and devices specifically designed to cause death or other harm through the toxic properties of chemical weapons. The convention expressly prohibits the use of toxic chemicals for any purpose. *The Geneva Convention, Additional Protocol I of 1977* defines indiscriminant attacks as “those which employ a method or means of combat the effects of which cannot be limited [to a specific military objective] . . . and are of a nature to strike military objectives and civilians or civilian objects without distinction. *The Biological Weapons Convention* was ratified in 1975 and it bans development and production of biological agents “that have no justification for prophylactic, protective, or other peaceful purposes. *The Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD)* was ratified in 1980 and it prohibits any technique for changing the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere, and atmosphere, or of outer space. *The Convention on Prohibition or Restrictions on the Use of Certain Conventional Weapons (CCWC)* which was approved by the President and forwarded to the Senate in 1997. One of its protocols bans the use of laser weapons specifically designed, as their sole combat function, to cause permanent blindness to unenhanced vision.

^{li} W.M. Callihan, LtCol, USMC Non-lethal Weapons in Conventional Combat Operations: Leveraging Capabilities or Violating the Rules of War? Naval War College, 17 May 1999, 8-9.

^{lii} Lewer, 30-34.

^{liii} Ibid, 30.

^{liv} Pillar, 81.

^{lv} Cebrowski, 8.

^{lvi} Pillar, 124. Pillar asserts that the CSG is a model of interagency cooperation at the highest level. This stems from the fact that the same key players meet on a regular basis and have established both formal and informal working relationships. Pillar claims that the informal relationships are at least as important as the formal machinery, and are critical to each agency understanding the business and equities of other agencies.

^{lvii} Carl von Clausewitz, Michael Howard and Peter Paret, ed., On War, Princeton, NJ : Princeton University Press, 1985, 75.

BIBLIOGRAPHY

- Alexander, Colonel John B., U.S. Army (Retired). Future War, Non-Lethal Weapons in Twenty First-Century Warfare. New York : St. Martin's Press, 1999.
- _____. "Non-Lethal Weapons to Gain Relevancy in Future Conflicts," National Defense, March 2002, 30-31.
- _____, "Shoot, But Not to Kill" Janes International Defense Review, June 1996. 77-78.
- Alexander, Lexi R. & Julia L. Klare. "Nonlethal Weapons: New Tools for Peace." Issues in Science and Technology, Winter 1995-96, 67-74.
- American Systems Corporation (ASC). Joint Vision for Non-Lethals: Meeting the Demand of Future Military Operations. A Study for the Joint Non-Lethal Weapons Program done in conjunction with the Center for Naval Analysis. Dumfries, VA : ASC, December 1999.
- Barnett, Roger W. Review of Effects Based Operations: Applying Network-Centric Warfare in Peace, Crisis, and War by Edward A. Smith Jr. Available online at <http://www.nwc.navy.mil/press/Review/2004/Spring/br6-sp04.htm> [22Apr 04].
- Barrett, Benjamin K., LCDR, USN. "The Utility of Non-Lethal Weapons in Large Scale Conflict." Unpublished Thesis, Naval War College, 8 Feb 00.
- Beal, Clifford. "Non-lethals' Next Step." Jane's International Defense Review, December 1997, page 1.
- Boock, Michael, Captain, USN. Navy Judge Advocate General. Comments from a class on International Law given to Seminar #2 at the Navy War College on 4 March 2004.
- Callihan, William M., LtCol, USMC. "Non-lethal Weapons in Conventional Combat Operations: Leveraging Capabilities or Violating the Rules of War?" Unpublished Thesis, Naval War College, 17 May 1999.
- Capstick, Paul R. "Non-Lethal Weapons and Strategic Policy Implications for 21st Century Peace Operations." Unpublished Research Paper, U.S. Army War College, Carlisle, PA.
- Cebrowski, Arthur. "Transforming Transformation," Transformation Trends, Arlington VA : Office of Force Transformation, 19 April 2004.
- "China's Commercial Technology – Implications for Future Military Capabilities," RAND Publications, 2001. RAND Research Brief no.67,<http://www.rand.org/publications/RB/RB67/index.html> [28 September2003].

-
- Clausewitz, Carl von. Michael Howard and Peter Paret, ed. On War. Princeton, NJ : Princeton University Press, 1985.
- Cook Joseph W. III, David P. Fiely, and Maura T. McGowan. “Nonlethal Weapons Technologies, Legalities, and Potential Policies.” <http://www.airpower.maxwell.af.mil/airchronicles/apj/mcgowan.html>
- Coppernoll, Margaret-Anne, LTC, Army National Guard. “The Nonlethal Weapons Debate.” Naval War College Review, Spring 1999, Vol. LII, No.2, 112-131.
- Dando, Malcolm. A New Form of Warfare – The Rise of Non-Lethal Weapons. UK : Brassey's Ltd, 1996.
- Davison, Edwin A. “A Case for More Effective Non-Lethals,” Marine Corps Gazette, June 2000, 27.
- Fulghum, David A. “Electronic Bombs Darken Belgrade.” Aviation Week and Space Technology, 10 May 1999, 34-35.
- Fulghum, David A. “Secret Carbon-Fiber Warheads Blinded Iraqi Air Defenses.” Aviation Week and Space Technology, 27 Apr 1992, 18-20.
- Gaddis, John Lewis. ”A Grand Strategy of Transformation.” Foreign Policy, Nov/Dec 2002, 50-57.
- Garwin, Richard L. and W. Montague Winfield. “Nonlethal Technologies: Progress and Prospects.” Council on Foreign Relations. July 1999. <https://www.columbia.edu/sec/dlc/ciao/conf/gar01>
- Gourley, Scott. “Non-Lethal Weapons, Measure for Measure.” Jane’s Defense Weekly, 24 June 1998, 23-25.
- Hutton III, Paul Churchill. “Weapons of Restraint.” Armed Forces Journal International, May 2000, 52-55.
- Jane’s Sentinel Security Assessment. Available on line at <http://80-www4.janes.com.exlib.nwc.navy.mil/K2/doc.jsp?> [21 April 2004].
- Joint Non-Lethal Weapons Directorate. Non-Lethal Weapons Joint Mission Area Analysis/ Joint Mission Need Analysis (JMAA/JMNA) Final Report. Dumfries, VA : American Systems Corporation, December 2000.
- Joint Non-Lethal Weapons Directorate. “Joint Non-Lethal Weapons Program Brief to the Force

-
- Protection Functional Capability Board (JROC).” Powerpoint presentation given by Colonel Dave Karcher, Director, Joint Non-Lethal Weapons Directorate at the Pentagon on 6 Apr 2004.
- Kenny, John M. “What’s so Special About Non-Lethal Weapons’ Human Effects – Everything.” Marine Corps Gazette, June 2000, 28-29.
- Krepinevich, Andrew F. Operation Iraqi Freedom: A First-Blush Assessment. Washington, DC : Center for Strategic and Budgetary Assessments, 2003.
- Lamb, Timothy J. “Emerging Nonlethal Weapons Technology and Strategic Policy Implications for 21st Century Warfare.” Unpublished Research Paper, U.S. Army War College, Carlisle, PA.
- Levine, Susan D. and Maj Noel Montgomery, USAF. “Non-Lethal Weapon Human Effects, Establishing a Process for DoD Program Managers.” Program Manager, July-August 2002, 50-54.
- Lewer, Nick, ed. The Future of Non-Lethal Weapons: Technologies, Operations, Ethics, and Law. London, UK : Frank Cass Publishers, 2002.
- Lovelace, Jr., Douglas C and Steven Metz. Nonlethality and American Land Power: Strategic Context and Operational Concepts. Carlisle, PA : Strategic Studies Institute, 1998.
- Metz, Steven. “Non-lethal Weapons – A Progress Report.” Joint Force Quarterly, Spring/Summer 2001, 18-22.
- Murray, Williamson, ed. Transformation Concepts for National Security in the 21st Century. Carlisle, PA : Strategic Studies Institute, 2002.
- Myers, Gene. “Effects-Based Operations.” Armed Forces Journal, June 2003, 47-49.
- Nutley, Eric L. LtCol, USAF. “Non-Lethal Weapons: Setting our Phasers on Stun? Potential Strategic Blessings and Curses of Non-Lethal Weapons on the Battlefield,” Occasional Paper no. 34. Air War College, Maxwell Air Force Base, AL : Center for Strategy and Technology, August 2003
- Page, Clyde A. “The Strategic Implications of the Use of Nonlethal Force.” Unpublished Research Paper, U.S. Army War College, Carlisle, PA.
- Pillar, Paul R. Terrorism and U.S. Foreign Policy. Washington, D.C. : Brookings Institution Press, 2001.
- Perry, Joseph M. “Joint Doctrine for Nonlethal Weapons.” Unpublished Master’s Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS.

-
- Raach, George T. and Ilana Kass. "National Power and the Interagency Process." Joint Forces Quarterly, Summer 1995, Number 8. Washington, D.C. : National Defense University, 1995.
- Rumsfeld, Donald H. "Transformation Planning Guidance." Department of Defense, The Pentagon, April 2003.
- Saunders-Newton, Desmond and Aaron B. Frank. "Effects-based Operations: Building the Analytic Tools." Defense Horizons, no. 19, October 2002. Available online at http://www.ndu.edu/inss/DefHor/DH19/DH_19.htm [22 April 04].
- Schmitt, Eric and Thom Shanker. "A Full Range of Technology Is Applied to Bomb Fallujah." New York Times. April 30, 2004. Available on line at <http://ebird.afis.osd.mil/ebfiles/e20040430280873.html> [30 April 2004].
- Sheldon, Rex D. "Nonlethal Policy, Nonlethal Weapons, and Complex Contingencies." Unpublished Thesis, Naval War College, 5 February 1999.
- Smith, Edward A. Effects Based Operations – Applying Network Centric Warfare in Peace, Crisis, and War. Washington, DC : DoD Command and Control Research Program, 2002.
- Stanton, Martin T. LTC, USA. "The Impact of Non-Lethal Weapons Acquisitions, or 'There's One Born Every Minute,'" Marine Corps Gazette, June 2000, 30-33.
- Stockwell, Harmon A., Colonel, USMC. "Beyond Sticky Foam: The Operational Use of Non-Lethal Technologies." Unpublished Thesis, Naval War College, 16 May 2001.
- Toffler, Alvin and Heidi. War and Anti-War. New York : Warner Books, Inc. 1993.
- United Nations. Charter of the United Nations, Chapter VII, Article 51. Available online at <http://www.un.org/aboutun/charter/> [1 May 2004].
- U.S. Department of Defense, Policy for Non-Lethal Weapons, Department of Defense Directive 3000.3, Washington, D.C. : U.S. Department of Defense, 9 July 1996.
- U.S. Marine Corps. Joint Concept for Non-Lethal Weapons. Washington, DC : Headquarters, U.S. Marine Corps. 5 January 1998. Available online at <http://www.fas.org/man/dod-101/sys/land/docs/NONLETH.HTM> [25 April 2004]
- Utley, Peter D., LTC, USA. "Non-Lethal Weapons: A Capability for the Full Range of Military Operations." Unpublished Thesis, Naval War College, 13 May 2000.
- Warden, Colonel John A. III USAF. "The Enemy As A System." Airpower Journal, Spring 1995, 41-55.

Ware, Dr. Lewis. "Some Observations of the Enemy as a System." Airpower Journal, Winter 1995, 87-93.

Wehrle, Robert A. "Non-Lethal Weapons Design Criteria: A Proposal," Marine Corps Gazette, April 2001, 33-34.
