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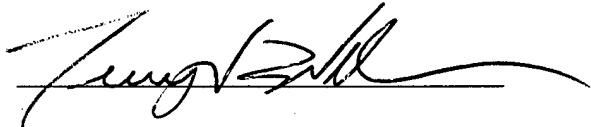
"FILLING AN OPERATIONAL REQUIREMENT: THE NONLETHAL APPROACH"

by

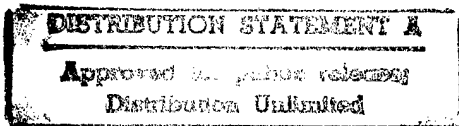
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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

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.

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ABSTRACT OF

"FILLING AN OPERATIONAL REQUIREMENT: THE NONLETHAL APPROACH"

Pressures generated as a result of the growing worldwide concern over the use of conventional landmines forced the United States to severely limit their use. At the same time, the operational commander continues to have a need to shape the battlefield and protect his forces, a need currently filled by the conventional landmine. This paper examines the roll that nonlethal technologies can play in filling the battlefield shaping and force protection requirements. It will show that not only can nonlethal weapons replace the conventional landmine, but that they will give the operational commander options never before possible, so revolutionary that they will change the entire mine warfare paradigm.

This paper looks at emerging nonlethal technologies and how they can meet the old requirements and the newly generated battlefield shaping and force protection requirements. It looks at their employment options, highlighting the new options and what they do for the operational commander. The paper then looks to the future to see where and how these assets fit in Joint Vision 2010. Finally, it looks at the key legal and ethical concerns associated with the employment of these new assets.

"FILLING AN OPERATIONAL REQUIREMENT: THE NONLETHAL APPROACH"

"Like a bad dream, the enemy's forces were everywhere, striking at will with diabolical freedom, while our feet remained rooted to the ground and we seemed constrained by a thousand invisible bands which slowed down our movements."

-General Andre Beaufre, World War II

INTRODUCTION

The operational commander can expect to lose an essential capability without which will put his operating forces at great risk. Pressures generated by worldwide humanitarian concerns are forcing the United States to severely restrict the use of all non-self-neutralizing antipersonnel landmines (APLs). Furthermore, a growing intolerance for collateral damage and injuries caused as a result of military operations is steadily making the use of all landmines (APLs and antitank landmines(ATLs)) questionable, especially at the lower end of the spectrum of military operations. Yet, the landmine is the operational commander's primary battlefield shaping and force protection asset. The eventual loss of the APL and the anticipated tightening of restrictions on the use of the ATL will severely degrade the operational commander's ability to shape the battlefield and protect his forces. An alternative is needed to replace the conventional landmine, and it must be fielded as quickly as possible.

The purpose of this paper is to show that nonlethal technology-based weapons, once fully developed and appropriately packaged, will produce the best replacement for the conventional landmine. In fact, these technologies will revolutionize landmine warfare--so much so that it will create a paradigm shift that will redefine and change the term

"landmine warfare." These nonlethal technologies, married with other emerging technologies, will not only fill the operational commander's requirements for battlefield shaping and force protection, but will open up options that were never before available.

This paper will show this by first discussing the relevance of the landmine. It will then analyze the effects that these landmine alternatives can produce, and will examine employment options, highlighting the new options and what they do for the operational commander. The paper then looks to the future to see where and how these alternatives fit in Joint Vision 2010. It looks at legal and ethical issues critical to the operational commander when employing these alternatives. Finally, it sums up the salient points, looks at what they mean to the operational commander, and formulates recommendations based on those points.

In the end, the operational commander will understand the awesome potential that these alternatives hold. He will understand the advantages that they offer in shaping the battlefield and protecting his forces, as well as their revolutionary potential. This should ultimately compel the operational commander to take action to speed up the acquisition process, which will thereby speed up the fielding of these necessary assets.

RELEVANCE TO THE OPERATIONAL COMMANDER

The landmine plays a critical role in filling the operational requirement to shape the battlefield and protect the force. However, landmines have recently come under massive public scrutiny for two reasons. First, the indiscriminate use of APLs kills or maims over 30,000 people each year, most of whom are innocent women and children.¹

This has generated a worldwide effort to ban the use of APLs. In early December 1997, approximately 122 nations signed the Ottawa Treaty which was directed towards banning the use, stockpiling, production, and transfer of APLs.² Although not a signatory of the treaty, the United States has announced that it would attempt to end the use of non-self-neutralizing APLs everywhere except Korea by the year 2003.³

Second, any collateral damage or casualties caused as a result of military operations, especially on the lower end of the spectrum, are becoming increasingly unacceptable. The idea of using the "appropriate" military force for a given military mission challenges the military's use of conventional, explosive-based, "dumb" landmines in situations where they may put innocent civilians and their property at risk.⁴ General Zinni, Commander-in-Chief, U.S. Central Command, in an article written for Proceedings, makes the point that it is necessary for operational commanders to operate appropriately at any point along what he calls the "force continuum."⁵ Joint Vision 2010, the conceptual template for how the United States envisions operating in the future, specifically states that in future conflicts U.S. military forces **will** reduce the potential for adverse effects and collateral damage caused from the use of force.⁶ Sensitivity to this is rapidly growing. Consequently, it is questionable whether the use of conventional "dumb" landmines--both APLs and antitank landmines (ATL)--in military operations other than war (MOOTW) will be politically acceptable. Legitimacy has a direct impact on the success of these operations. Injuring civilians or damaging private property as a direct result of conventional landmine use would damage the legitimacy of the operation, jeopardizing its success.

On November 27, 1997, the Joint Requirements Oversight Counsel (JROC) validated a Mission Needs Statement for Battlefield Shaping and Forces Protection Against Personnel Threats.⁷ This Mission Needs Statement (MNS) was generated as a direct result of the humanitarian concern and increased intolerance for collateral damage and casualties. The MNS encapsulates the critical importance that the Joint Chiefs and the Unified Combatant Commanders put on the role of landmines in shaping the battlefield and protecting their forces.⁸ However, the MNS also points out that the conventional landmine can no longer fill the requirement.⁹

Given these facts, the operational commander needs something to replace the conventional landmine while fulfilling the additional requirements generated as a result of the humanitarian concerns and the growing intolerance for collateral damage and injury. Although this problem could be offset with manpower increases, the realities of the current military draw down make this option unrealistic.

Another option, the most promising, can be found among the nonlethal technologies. Once developed and appropriately packaged, they will make outstanding replacements for the conventional landmine, and will give the operational commander entirely new options. These nonlethal alternatives will meet the newly generated requirements of the MNS: to detect targets, alert friendly forces, classify targets, and warn friendly forces; to produce desired nonlethal effects; and to reduce risk, injury and collateral damage.¹⁰ These alternatives show great promise when employed against varied threats and can be employed across the entire spectrum of military operations.

THE NONLETHAL ALTERNATIVE

The Department of Defense (DoD) defines nonlethal weapons as *"weapons that are explicitly designed and primarily employed so as to incapacitate personnel or materiel, while minimizing fatalities, permanent injury to personnel, and undesirable damage to property and the environment."*¹¹ Lethal weapons employ means that physically destroy their intended targets. They employ blast, penetration, and fragmentation effects that are intended to be irreversible. Conventional landmines employ these means. Nonlethal weapons produce effects that are reversible, discriminate, or both.

The nonlethal alternatives should not be packaged as "landmines." Clearly there is merit in packaging them as landmines (e.g. landmine doctrine, tactics, policies and procedures already exists), however, viewing these new technologies through the prism of the existing paradigm might cause us to limit or neglect new possibilities. Furthermore, because landmines are limited and restricted by various conventions, treaties, and international custom, labeling these alternatives as "landmines" restricts and limits them by definition.¹² This will make it difficult to explore new options. These nonlethal alternatives should be classified as "battlespace affectors," which includes *any device explicitly designed to be placed in a specific location, activated by the presence or contact of personnel or vehicles (air, land, or sea), to incapacitate personnel or vehicles, while minimizing fatalities, permanent injury or undesirable damage.* Some nonlethal technologies (and therefore battlespace affectors) can produce effects that are irreversible and lethal as well as reversible and nonlethal. They are, however, discriminate in their targeting, and are

therefore, in full accordance with the DoD policies on nonlethal weapons.¹³ Depending on their target, these types of effectors can incapacitate, injure, or kill personnel; or they can stop, damage, or destroy vehicles.

Battlespace effectors can be put into two categories: antipersonnel (AP) or antivehicle (AV). Unlike the "dumb" conventional, explosive-based landmine, effectors incapacitate their targets through acoustic, chemical, electric, electromagnetic, mechanical, or optical means.¹⁴ Appendix A lists those nonlethal technologies that demonstrate the greatest potential as battlespace effectors and in filling the newly generated battlefield shaping and force protection requirements.¹⁵

EMPLOYMENT

Battlefield effectors can be employed like conventional landmines. Used to produce their same operational effects. As an example, the battlespace effector could be used to help gain essential air superiority. By dropping a mix of electric projector, slickums, and electromagnetic pulse (EMP) effectors on an enemy airfield as a disabling measure (either by themselves, subsequent to, or in conjunction with conventional munitions), the operational commander could deny the enemy access to targeted areas of the airfield. This would degrade the enemy's ability to launch and recover aircraft.

As a key element in operational countermobility, a mix of High Power Radio Frequency (HPRF), acoustic projectile, and entangler effectors could be dropped in an enemy's assembly area, delaying or disrupting his operational maneuver. The target could be the enemy's command and control, or his forces. These same effectors could be laid

or dropped on key transportation junctions or key nodes, thereby disrupting the enemy's command and control or logistics efforts.

Finally, battlespace affectors could be laid on an exposed friendly flank to provide operational protection and to support economy of force operations. The use of an "affectorfieid" is especially critical to the operational commander planning to mass his forces or having numerically inferior forces. Affectorfieids could also be used to protect the forces operating out of static positions.

Battlespace affectors can provide the operational commander new employment options. Affectors can be effectively employed across the entire spectrum of military operations. If the operational commander is in a situation where nonlethal effects are desired, or required, affectors can be employed to incapacitate targets with relatively low risk of unnecessary injury or damage. If the operational commander is in a situation that requires lethal effects, affectors in the "lethal mode" can be used to kill, injure, damage, or destroy the target. If the available affector only has a nonlethal mode, it can be employed in conjunction with conventional munitions to increase the overall efficiency and effectiveness of the conventional munitions. Affectors would incapacitate the target leaving it exposed and helpless. Artillery, missiles, or aircraft could then strike the target with conventional munitions. The synergistic effects would create a more lethal "kill." The ability to vary the effects of one weapon to this degree was not available before.

Battlespace affectors will make it possible for the operational commander to use the same system regardless of the situation, even in areas where the use of conventional landmines pose an unacceptably high

risk of collateral damage and injuries. A mix of electromagnetic pulse (EMP) and infrasound effectors could be employed in a preemptive strike to stop belligerent faction assembled in an urban area, prepared to launch a raid on the opposition. Using the EMP effectors to interrupt or destroy engine electrical systems would stop the vehicles. The personnel would be disoriented or confused by low frequency soundwaves generated by the acoustic effectors. This would give diplomats more time to solve the problem while limiting the potential for escalation.¹⁶

In another scenario, two types of EM effectors could be used in MOOTW for operational protection of forces in static positions. In this scenario, the effectors could be integrated with wire and other obstacles to keep unauthorized personnel out of a basecamp or key facility. The high power microwave (HPM) effectors could be set up to act like a fence. Warning signs would be posted and anyone who successfully breached the perimeter wire would enter the HPM "fenced" area. There the trespasser would be incapacitated in the effectorfield. Electronic vehicle stoppers could be used to stop threat vehicles that approached restricted areas or ran checkpoints. In both scenarios the risks to civilians and their property are minimal. Because of the destructive and indiscriminate nature of the conventional landmine, their use in these scenarios would be impossible.

The potential of the battlespace effectors goes far beyond the options just examined. The concept of the "mobile obstacle" --the idea of moving obstacles rapidly from one part of the battlefield to another in order to shape and protect--has never been possible at the operational level of war. The limitations of the conventional landmine (a major component of the mobile obstacle system) prevented this from

being realized.¹⁷ The scatterable mines were developed to give the operational commander a capability along the lines of the "mobile obstacle." Deliverable by artillery or aircraft, these self-activating and self-destructing, explosive-based landmines can be quickly employed to achieve operational effects.¹⁸ However, because they are explosive-based they pose an increased risk to civilians and their property. Additionally, most air delivered scatterable mines, although self-neutralizing, are not reusable.

Given the demonstrated and theoretical effective ranges of some of the nonlethal technologies, and with appropriate packaging, the mobile obstacle concept invokes revolutionary possibilities. Imagine putting HPM effectors in the back of APCs or HMMWVs, helicopters or UAVs. The operational commander would enjoy a responsiveness and flexibility never before available. Because the effective ranges of some nonlethal technologies are much greater than those of conventional landmines, it will take far less effectors as compared to conventional landmines to affect a designated area.¹⁹ This would reduce the operational commander's logistics and manpower requirements. The time saved from this, and the time gained from greater mobility, drastically increases the operational commander's reaction time.

The options are even more revolutionary than this. Battlespace effectors could be deployed on UAVs that loiter at a designated height over the battlefield influencing the battlespace around it. This gives the operational commander the ability to target troops on the ground, UAVs, helicopters, and possibly fast moving fixed wing aircraft. Further, these UAV/effector units could patrol a designated sector, engaging targets either in an autonomous mode or a command directed

mode. If the operational commander needs to quickly cover another location in his area of operations, these same effectors could be moved rapidly to that location.

LOOKING TO THE FUTURE

Joint Vision 2010 predicts U.S. military forces will operate in smaller, disparate units, with a smaller footprint, but greater lethality. Additionally, it is clear that there will be a need for "boots on the ground" in most of the operations in which the U.S. military will be involved.²⁰ It can therefore be assumed that the newly generated requirements for battlefield shaping and force protection will be valid up to the year 2010. Battlespace effectors can fill those requirements.

Battlespace effectors will leverage nonlethal technologies with emerging technologies in camouflage, sensing, networking, and autonomous functioning, to provide future warriors with tools that will bring U.S. military forces closer to realizing dominant maneuver and full-dimensional protection. Because of their speed of employment, small logistic support and manpower requirements, wide range of effects, and adaptability for greater mobility, effectors will enhance the operational commander's ability to achieve positional advantage and increase the speed and tempo at which he is operating. This, in turn, will facilitate the operational commander's ability get inside the enemy's decision loop and apply overwhelming force to the enemy, capitalizing on dominant maneuver to force the enemy to react from a disadvantage, or quit.²¹

Battlespace effectors will contribute to full dimensional protection by giving the operational commander a set of tools that

facilitate an increased ability to control and shape the battlespace. The effectors, which have the ability to sense, identify, and warn, not only act as a detection system, but because of their ability to effect a target, can also physically stop the threat from attacking friendly forces. With the ability of some of the effectors to operate in the air and on the land (as well as on and under the sea) battlespace effectors truly protect the operational commanders entire battlespace, all three dimensions. This will ensure his forces maintain freedom of action while providing multi-layered defenses for his forces and facilities.²²

DISADVANTAGES

There are some disadvantages associated with battlespace effectors. Many are still in the research and development stage which means meaningful data on short and long term effects have not been compiled. For many of the technologies, demonstrated effective ranges have not been established (although they can be predicted through modeling). Likewise, many are not being developed as battlespace effectors; the focus might not be on finding the appropriate size to power ratio, an important consideration for military application. Specific performance requirements from the field will address part of this problem, however, only time and money will ultimately fix it. Additionally, it is very likely that those effectors that employ chemical or biological means, and are indiscriminate or cause unnecessary suffering, will be deemed illegal weapons.²³ This is not a major problem because there are other available means that show great potential (acoustic, electrical, electromagnetic, and mechanical optical), but they must nonetheless be pursued.

Many believe the temporary effects that nonlethal weapons (and therefore, battlespace affectors) produce, necessitate drastic increases in surveillance requirements. This is not inherently true. Field Manual 20-32, Mine/Countermining Operations, prescribes that conventional minefields be covered by observation and/or fire. This surveillance requirement is not new. Battlespace affectorfields must also be covered by observation and/or fire. Affectorfields could employ the same assets and methods used to cover conventional minefields. This might require adapting assets, or changing methods, to account for the affector's revolutionary employment options, but it does not demand a drastic increase in surveillance requirements. Additionally, stipulations delineated in the MNS require the new battlefield shaping and force protection assets be able to detect and classify targets, as well as warn friendly forces of enemy movements in a targeted area. Consequently, the affector's ability to detect and classify targets, and relay it to the operational commander as a warning, actually reduces the surveillance requirements. The effectors themselves are the surveillance means. Given these facts, the use of battlespace effectors does not necessitate an increased surveillance requirement.

Using nonlethal technologies may give an enemy, and even some allies, an impression of weakness or lack of commitment. This could embolden the enemy or keep a potential ally neutral. Furthermore, there are those that argue nonlethal weapon--and therefore battlespace effectors--have no place on the battlefield. They believe that by adopting nonlethal weapons the U.S. military is "gradually blunting its swords," but as this paper has shown, this is not the case. Battlespace effectors give the operational commander more lethal force.

Finally, those enemy or their equipment targeted by an affector (in the nonlethal mode) could return to fight another day. This is a valid concern. Decisive action, however, directed at a quick end to the crisis, could preclude enemy personnel or equipment from re-entering the crisis. The targeted personnel or equipment could be detained until the crisis is resolved. The nature of the crisis would no doubt dictate the solution to the problem. In any case, the operational commander might have to accept some risk.

LEGAL AND ETHICAL ISSUES

The advantages and disadvantages of battlespace effectors should be clear to the operational commander. There are, however, important legal and ethical issues tied to the employment of these assets.

DoD requires that all conventional weapons and nonlethal weapons go through a legal review before they are fielded.²⁴ DoD directives state that the legal review process should be conducted in conjunction with the acquisition process in order to preclude U.S. military forces from using illegal weapons, and from wasting U.S. tax dollars by purchasing weapons systems that cannot be used.²⁵ Technically, once a nonlethal weapon system is fielded (and therefore, has passed a legal review), it is a "legal" weapon. However, weapons that are legal can still be illegally employed. During the Iran-Iraq Wars, Iran set adrift armed contact naval mines, thereby endangering innocent ships as well as enemy ships. This indiscriminate use of naval mines is a clear example of the illegal use of a legal weapon. The legal employment of battlespace effectors is the critical issue.

Treaties, customary international law, and U.S. policy lay down the terms for legal employment. The Staff Judge Advocate sorts through

the pertinent sources, interprets employment legalities, and advises the operational commander as to his findings. When making the decision to employ effectors the operational commander considers the SJA's advice, and must understand that: (1) their use must be proportional and necessary, (2) not directed against civilians, (3) must not cause unnecessary suffering, and (4) every effort must be taken to protect civilians.²⁶ These considerations are not new, and therefore, no new legal dilemmas should arise.

No new legal dilemmas should arise from the use of battlespace effectors, although many believe their use will exacerbate civil-military relations thereby creating a dilemma for the operational commander. Nonlethal technologies have created the expectation of a "bloodless conflict." As a consequence, a political desire for a "bloodless conflict" might result in extreme pressure being put on the operational commander to use nonlethal weapons. If, in the operational commander's judgment, conventional weapons are more appropriate, how should he resolve this dilemma? What should he do if directed to use nonlethal weapons anyway? Although very problematic, the dilemma only exists if the operational commander has a choice between the use of a nonlethal weapon or a conventional weapon. Without a choice, the problem is moot. There will be no choice between conventional landmines or battlespace effector. Conventional landmines are effectively gone. In their place, effectors will be used. The use of effectors, therefore, will not create any new civil-military dilemmas.

The operational commander should also understand that public opinion can have a great impact on how he employs battlespace effectors. Although he does not take his direction directly from the American

public, it is extremely important that he consider them. The effects of effectors must be acceptable to society lest the military find itself at odds with the American public. In the same vein, if for cultural or religious reasons, the effects caused from the use of effectors offends allies or key neutrals, the operational commander may need to restrict the use of the offending effector as its use could become counterproductive.²⁷

CONCLUSIONS

Battlespace effectors, once developed, will provide a viable solution to the inevitable loss of the conventional landmine. This is critical because the operational commander's need to shape the battlefield and protect his forces remains essential. Although conventional landmines were once appropriate for filling this need, new requirements generated from humanitarian concerns and the growing intolerance for any collateral damage or injury have made them inappropriate. Not only will the effectors cover these requirements, but also they will open up new options to the operational commander revolutionizing landmine warfare.

Nonlethal technologies are the basis for battlespace effectors. Designed to reduce risk of injury and collateral damage, they will detect, alert, classify, warn, and produce a wide range of effects from nausea to death, or from disabled to destroyed. They will facilitate quick employment, and have a small logistic support and manpower requirement.

The use of battlespace effectors will drive a major reassessment of operational concepts and doctrine. Although they can be employed in the same manner as conventional landmines, the revolutionary options

will compel a major reassessment. This is because these alternatives can be employed in ways never before possible. They will permit the operational commander to create operational effects by moving effectors rapidly from one point to another, at speeds never before possible. They will give the operational commander the ability to shape and protect in three dimensions--setting up point effectors or vertical effectorfields.

Battlespace effectors lend themselves to the achievement of the new operational concepts submitted in Joint Vision 2010. By leveraging nonlethal technologies, effectors will play a key role in two of the four new operational concepts: dominant maneuver and full dimensional protection. As a supporting element of dominant maneuver, effectors will shape the battlespace in order to make the conditions favorable for dominant maneuver. As a key element of full dimensional protection, the effector's ability to sense, detect, identify, and warn; and to operate in three dimensions will ensure the operational commander's forces maintain freedom of action. Effectors will bring the military closer to realizing the vision--"Full Spectrum Dominance."

Given this, U.S. CINCs and their subordinates should evaluate these battlespace effectors by using them as a governing factor while gaming their respective OPLANS, CONPLANS, current crises, and predicted future military operations. The results should be compared to the results attained from gaming the same scenarios using conventional landmines. Favorable results would provide justification for giving effectors a higher priority on the CINCs integrated priority list. In addition, the CINCs service component commanders should work along

service lines to affect their service POMs. This should focus more attention on the issue and help speed up fielding.

Because the technologies are not fully developed and the need for a battlefield shaping and force protection capability is critical to military operations, every effort must be made to ensure U.S. military forces do not lose conventional landmines until suitable battlefield effectors can be fielded. The focus should be on those technologies that will still be effective well past the year 2010. Size, effective ranges, and desired effects should be defined by the operating forces and forwarded to the appropriate agency or researchers. In addition, the operating forces must begin developing operational concepts. Not only will this help keep researchers in tune with military needs, and keep the military informed of any technological shortfalls, but it will help ensure that training, tactics, and techniques are in place prior to the fielding of these assts.

The world is on the verge of a Revolution in Military Affairs. Will the operational commander emerge from the next major military operation repeating the words of General Beaufre, or will he take advantage of the opportunity that is at his finger tips? There is no question that the battlespace effector has a place on the modern battlefield. The real question is "how fast can the he get them?"

APPENDIX A

BATTLESPACE EFFECTORS

MEANS	DEVICE(s)	TARGET(s)	EFFECT	DEVELOPMENTAL STATUS	GENERAL INFORMATION
ACOUSTIC	Infrasound Generator	Personnel	Low-frequency high-energy sound (in-band) couples w/the body causing resonance of bones, muscles, or organs, resulting in nausea, loss of bowels, internal organ damage, or death.	In advanced test & eval stages. Technical hurdle: producing appropriate size unit for use as an "effector."	Can produce Nonlethal & lethal Effects. Effects cease when system is turned off. Demonstrated effective range of hundreds of yards. Can penetrate most bldgs & vehicles w/little dissipation of effects. Has no known countermeasures.
"	Blast Wave or Acoustic Bullets	Personnel or Vehicles (Air & Ground)	Low-frequency high-energy sound generates high pressure plasma waves that are emitted in front of the target & act as sonic "bullets" or blast waves that result in blunt object trauma.	In advanced test & eval stages. Technical hurdle: producing appropriate size unit for use as an "effector."	Can produce Nonlethal & lethal Effects. Demonstrated effective range of hundreds of yards.
"	Ultrasound Generator	Personnel	[Same as Infrasound]	[Same as Infrasound]	Same as Infrasound except the wavelength is out-of-band making it less effective than infrasound. This is because ultrasound's effectiveness is degraded when it changes mediums; infrasound travels thru armor skin w/o degrading, ultrasound would degrade.
"	Acoustic Squawk Box	Personnel	Two ultrasound frequencies which when mixed in the human ear become intolerable. It produces giddiness, nausea or fainting.	In early test & eval stages. Technical hurdle: producing appropriate size unit for use as an "effector."	Can produce variable effects but not lethal. Beam is so small pinpoint targeting is possible. No source on effective range found.
ELECTRO-MAGNETIC	Electronic Vehicle Stopper	Vehicles (Ground)	Vehicle drives over oval-shaped disk device which uses strong electromagnetic pulse to couple w/frame disrupting or damaging electronic engine control components.	In the proof of technology stage.	Effects are not adjustable. Effective range: Feet. Deep snow, mud, or heavy rains can degrade capability. DC-powered or AC-hardwired. Can be defeated by protecting/hardening electrical systems.

Note: Compiled from several sources. Timothy J. Hamnigan and others, *Mission Applications of Non-Lethal Weapons*. (JAYCOR. McLean, Va. August 1996) pp. D-1 to D-4, Robert J. Bunker, ed., *Nonlethal Weapons: Terms and References*. (U.S. Air Force Institute for National Security Studies: U.S. Military Air Force Academy, Co. 1997), Greg R. Schneider, "Nonlethal Weapons: Considerations for Decision Makers" Program in Arms Control, Disarmament, and International Security, University of Illinois, Champaign, Il, January 1997), pp. 9-22, and George R. Lynch, "The Role of Non-Lethal Weapons in Special Operations." (Naval Post graduate School Monterey, Ca March 1995), pp. 153 to 160.

APPENDIX A (Continued)

MEANS	DEVICE	TARGET	EFFECT	DEVELOPMENTAL STATUS	GENERAL INFORMATION
ELECTRO-MAGNETIC (EM)	High-Power Microwave(MW) or High-Power Radio Frequency (RF)	Vehicles (Air & Ground) or Personnel	Energy generated by conventional EM source & converted into MW or RF which couples w/vehicle disrupting electrical engine components, guidance systems, or control systems. Can cause unconsciousness w/o perm damage, or death by upsetting the neural pathway.	In advanced test and eval stages. Technical hurdle: producing appropriate size unit for use as an "effector."	Can produce Nonlethal & lethal Effects in both personnel and vehicles. Heavy rains can absorb MW. Effective range varies w/size & power of unit, can reach 50-100 yards. Most info on this is classified.
"	Electro-magnetic Pulse (conventional)	Vehicles (Air & Ground)	Non-nuclear electromagnetic pulse (broad band) couples w/frame disrupting or damaging electronic engine control components, guidance systems, or control systems.	[Same as MW/RF]	Can produce Nonlethal & lethal Effects
ELECTRIC	Electric Projector	Personnel	Unit acts like a wireless stun gun. After triggering, charges are delivered thru the air via pre-ionized air channels or by charging low energy projectiles which release the charge on impact. Peak currents temporarily incapacitate by overriding voluntary nervous system.	Systems fielded but not packaged as an "effector."	Effective range: Feet. Can be defeated by wearing protective clothing.
"	Electrical Stun Mine	Personnel	[Same as electric projector except w/wires]	[Same as electric projector except w/wires]	[Same as electric projector except w/wires]
MECHANICAL	Caltrop Anti-tire	Vehicles (Wheeled)	Device designed with four metal points so arranged that when any three are on the ground, the fourth spike points up to puncher tires disabling the vehicle.	Available now.	Deep snow or mud may degrade the performance of the unit. Enhancement: Add a built-in anti-handling device that discharges an electrical charge stunning anyone tampering with the mine.
"	Entangler (Net-electrified)	Personnel	Once triggered, the unit fires a net into the air which lands on its target. If the target tries to struggle, the net releases an electric shock which temporarily incapacitates the target.	[Status not found]	[No Informations found]

APPENDIX A (Continued)

MEANS	DEVICE	TARGET	EFFECT	DEVELOPMENTAL STATUS	GENERAL INFORMATION
CHEMICAL	Calmaive Dispenser	Personnel	Sedatives, tranquilizers, hypnotics (sleep inducing drugs) are inhaled, injected into the skin by tiny darts, or absorbed through the skin, to produce drowsiness or unconsciousness.	Conceptual Only.	Use of these "effectors" will most likely be a violation of the Chemical Weapons Convention of which the U.S. is a signatory.
" "	Reactant Liquid Embrittlement	Vehicles (Air & Ground)	Agents alter the molecular structure of target's metal or alloy components making them weak and susceptible to fracture and structure failure.	[Status not found]	[No information found]
" "	"Slickums"	Personnel or Vehicles (Ground)	After being triggered Teflon-type lubricants which create a slippery surface because the chemical properties, inhibit freedom to move on hard surfaces.	In the advanced stages of test & eval stage. Technical Hurdle: Not yet packaged as an autonomous "effector."	A dry chemical that requires water to give it its ice slick characteristics. It is non-toxic, non-corrosive, and relatively inexpensive.
OPTICAL	Laser Infrared CO ₂	Personnel	Once triggered, can heat the skin of the target causing pain without burning the skin.	[Status not found]	[No information found]
" "	Mobile Test Unit	Vehicles (Air & Ground)	Medium powered laser that fires a beam that destroys its target	[Status not found]	[No information found]
" "	Stroboscopic Device	Personnel	Once triggered, generates a 5-15 Hertz beam that can cause various physical systems in its target. In some cases can trigger epileptic seizures.	[Status not found]	[No information found]

ENDNOTES

¹ United Nations. "Fighting Landmines: The Ottawa Process and the United Nations Role. (New York: United Nations Department of Public Information, 10 November 1997) p. 1.

² Anthony Depalma, "As U.S. Looks on, 122 Nations Agree to Landmine Ban," New York Times, 4 December 1997, pp. 1-2.

³ Department of Defense. "Mission Need Statement for Battlefield Shaping and Force Protection Against Personnel Threats." (Washington D.C.: 27 November 1997), p. 1.

⁴ The term "dumb" landmine refers to landmines that do not self-destruct or self-neutralize, or cannot discriminate between noncombatants and combatants or their equipment/property.

⁵ Anthony Zinni, LtGen and Gary Ohls, Col. "No Premium on Killing." U.S. Naval Institute Proceedings. December 1996, p. 27.

⁶ Joint Chiefs of Staff. Joint Vision 2010: Americas Military, Preparing for Tomorrow. (Washington D.C.: July 1996), p. 8.

⁷ The MNS was drafted with the participation of DOD, the Service Chiefs, and the CINCs, p.1.

⁸ MNS p. 3.

⁹ The conventional landmine was adequate for battlefield shaping and force protection until the growing humanitarian concern and sensitivity to the unacceptability of collateral damage and casualties generated new criteria. The MNS was a direct result of these facts and lists the limitations and shortfalls of the conventional landmine in filling that new requirement, pp. 2-3.

¹⁰ MNS p. 2.

¹¹ Department of Defense. "Policy for Non-Lethal Weapons." (Department of Defense Directive 3000.3) (Washington: 9 July 1996), p. 1.3.

¹² The Conventional Weapons Convention, Protocol II to the Conventional Weapons Convention, the four Geneva Conventions of 1949, and the 1977 Additional Protocol I to the four Geneva Conventions all restrict and limit the landmine. Moreover, if a battlespace affector meets the definition of a landmine as defined in Protocol II of the Conventional Weapons Convention, it will be governed by those rules.

¹³ DoDD 3000.3.

¹⁴ Chemical landmines have been around for years. The difference here is that the type of chemical used and their intended effects. The affector could be an old chemical mine casing filled with one of these new nonlethal chemicals. Examples of nonlethal chemical mines are

calmatives (agents that calm or sedate) such as benodiazepine or barbiturates encased in a canister that once triggered releases as a gas to produce drowsiness or unconsciousness in personnel, sticky foam encased in a canister that once triggered releases the foam slowing or disrupting personnel movement, or embrittling agents encased in a canister that once triggered releases chemical agents in mist or gas form that alters the molecular structure of metal and alloy components making those components weak and more susceptible to fracture.

15 The operational utility of some of the alternatives are questionable because of treaties and conventions. The Chemical Weapons and the Biological Weapons Conventions are two such conventions that make the use of relaxants and calmatives to incapacitate personnel or microbes to jellyfy gas or eat tires, potentially illegal. And although their use may be determined legal, their use could justify chemical retaliation by an adversary. Because the concept of the battlespace affector is relatively new, many of the nonlethal technologies have not been directed towards. In such cases, this paper adapts those technologies and applies them.

16 Various sources theorize that the use of nonlethal force in this manner will limit the potential for escalation because fewer political objections result from nonbloody intervention than bloody destructive intervention. Robert Bunker and Lindsay Moore. Nonlethal Technology and Fourth Epoch War: A New Paradigm of Politico-Military Force. (Arlington Va., February 1996), p. 2.

17 The explosive nature of the landmine and the sheer number required to create operational effects make the handling and deployment of the conventional landmine slow and time consuming. Incapacitation probability or kill probability = vehicle mine encounter probability x probability that mine produces incapacitation effect, FM 20-32, pp. 2-6 to 2-7 and 2-12. The same concept is true for personnel. Calculations for mine resources found on p. 4-13. See also Joint Pub 3-15, p. I-2 for operational effects.

18 FM 20-32 Chapter pp. 6-1 to 6-8.

19 Based on minefield densities and the theoretical and demonstrated effective ranges of some nonlethal alternatives, it can be shown that it would require substantially fewer battlespace effectors to cover a given area as compared to conventional landmines. For example, it would take a 12-man squad 10 to 15 minutes to set up a 500 meter by 320 meter effectorfield made up of three to four EMP or HFM effectors. In contrast, it would take a 39-man engineer platoon approximately five hours and a mix of approximately 1,046 conventional APLs and ATLs to cover a 500 meter by 320 meter area with an incapacitation probability of 60 to 80 percent. Also Bunker, p. 6.

20 Joint Chiefs of Staff, Concepts for Future Joint Operations: Expanding Joint Vision 2010. (Washington D.C.: May 1997), pp.7-10.

21 Joint Vision 2010, p. 21.

22 Ibid, p. 22.

23 John Collins. "Nonlethal Weapons and Operations: Potential Applications and Practical Limitations." Congressional Research Service. Library of Congress, (Washington D.C.: 14 September 1995), p. 5 and Cook, pp. 29-31.

24 DoDD 3000.3, p.3 and DoDD 5000.1, p. 7.

25 Ibid., p.3 and p. 7.

26 Adam Roberts and Richard Guelff, eds. Documents on the Laws of War. (Clarendon Press, Oxford:1982), p. 476, and Joseph W. Cook and others, "Non-Lethal Weapons, Technologies, Legalities and Potential Policies," Journal of Legal Studies. 1944-1995, p. 27.

27 U.S. Marine Corps. "Joint Concept for Nonlethal Weapons" Quantico, VA, 1997.p. 9.

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