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NON-LETHAL WEAPONRY:
APPLICATIONS TO AC-130 GUNSHIPS

by

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Abstract

The theory and application of non-lethal weapons is not new and has been in use by ground combat troops and civil authorities for some time, in situations requiring the application of less than lethal force. With the increasing involvement of US military in operations other than war, the AC-130 Gunship has been the weapon of choice to provide air support. This paper analyzes the viability of integrating existing non-lethal technologies with current AC-130 Gunships' weapons and equipment for use in supporting combat operations or Military Operations Other Than War.

The research begins with an overview of the gunship's current capabilities, roles and missions followed by a summarization of current and future non-lethal weapons. There appears to be current and emerging weapons technology which shows great potential in fulfilling the non-lethal requirement for Air Force Special Operations Command's AC-130 Gunships. Many issues, however, must be addressed before these weapons are fully integrated into the AC-130's arsenal. Technical and engineering evaluation, funding, training, doctrine reviews, safety, and legal concerns are some issues requiring further assessment.

Given the capabilities and flexibility of the gunship and mission suitability, non-lethal weapons integration will enhance US military mission accomplishment by providing commanders a full range of weaponry from an airborne platform which was not previously available to them.

Chapter 1

The Research

Real exploitation of air power's potential can only come through making assumptions that it can do something we thought it couldn't do...We must start our thinking by assuming we can do everything with airpower, not by assuming that it can only do what it did in the past.

—Col John Warden

Background

With the increasing need for US military involvement in operations other than war, AC-130 Gunships have been the air-weapon of choice to provide close air support. However, being armed with only lethal weapons has restricted its ability to more effectively carry out those types of missions or support friendly ground troops in certain environments. Guideline documents of the US Department of Defense (DOD) define non-lethal weapons as “Weapons that are explicitly designed and primarily employed so as to incapacitate personnel or material, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment. Unlike conventional lethal weapons that destroys their targets principally through blast, penetration and fragmentation, non-lethal weapons employ means other than gross physical destruction to prevent the target from functioning. Non-lethal weapons are intended to have one or both of the following characteristics: 1) they have relatively reversible effects on personnel or material, 2) they affect objects in subjective ways within their area of influence.”¹

Problem Significance

The effects of precision application of non-lethal weapons, coupled with the standoff capability and significant time on station that the AC-130 Gunship can provide, may have the potential for providing new strength for diplomacy, new creditability for deterrence, new flexibility for the military, and new strategic options for policy makers. Air Force Special Operations Command (AFSOC) requested this study and if found feasible, new doctrine and tactics may be developed for employment and application.

Research Question

Is the integration of current non-lethal weapons on existing AC-130 Gunships, for use across the full spectrum of military operations and particularly during Military Operations Other Than War, feasible?

Scope

The research performed and recommendations presented in this report are reasonably broad based but limited in magnitude due to two primary reasons. First, this paper will primarily focus on immediate and short term solutions which may be compatible with current AC-130 Gunships' onboard weapons and equipment. AFSOC is presently exploring the more advanced technologies which will be incorporated into the futuristic AC-XXX gunship or during modernization upgrades of existing AC-130 Gunships. Second, this research was intentionally limited to the examination of open sources. Several areas and associated technologies are classified or still of a sensitive nature due to political or contractual agreements.

Research Methodology

The research method utilized for this paper involves the review and analysis of a collection of numerous books, documents, periodicals, DOD, Joint Staff, United States Air Force and United States Marines directives, publications, instructions, and reports.

Overview

Chapter 1 is the introduction which outlines key issues such as the background, significance, scope, methodology, and research question. An introduction to AC-130 Gunship's capabilities and roles, to include examples of various missions is provided in Chapter 2. Chapter 3 reviews a broad-spectrum of current non-lethal technologies. An assessment of non-lethal weaponry which may complement existing gunship's weapons, equipment and capabilities is presented in Chapter 4. Conclusions are summarized and recommendations are proposed in Chapter 5.

Notes

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

Chapter 2

The AC-130 Gunship

There have existed in all times fundamental principles, on which depend good results in warfare...These principles are unchanging, independent of the kind of weapons, of historical time and of place.

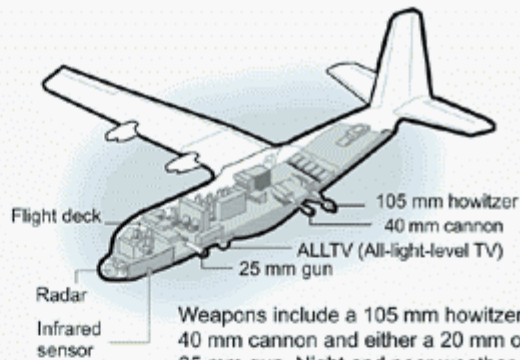
—Antoine Henri Jomini

Capabilities, Roles, and Missions

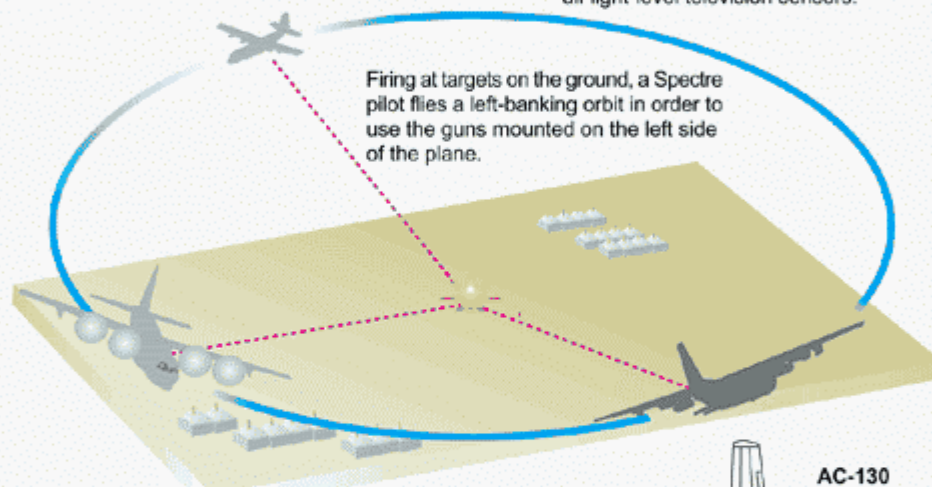
The Air Force Special Operations Command (AFSOC) maintains a fleet of AC-130H and AC-130U model gunships to provide airborne precision fire support to ground-based special operations forces, and other U.S. and multinational ground forces as required. The H models were built during the Vietnam era, while the newer U models were built in the 1990s. These heavily armed aircraft incorporate side-firing weapons integrated with sophisticated sensors, navigation and fire control systems to provide surgical firepower or area saturation during extended periods, at night or in adverse weather conditions.

AC-130 GUNSHIP

The AC-130 is a side-firing, modified C-130 transport plane armed to perform sustained and precision attack missions. The Spectre is used to support forces on the ground, attack enemy troops and facilities, or escort and provide security for helicopter operations at night or in poor weather.

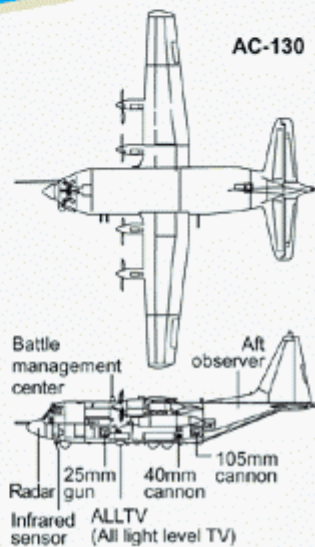


Weapons include a 105 mm howitzer, a 40 mm cannon and either a 20 mm or 25 mm gun. Night and poor weather capabilities are provided by infrared and all-light-level television sensors.



The AC-130 is used mostly at night because its slow speed makes it more vulnerable during daylight.

- Primary function:** Gunship, close air support
- Crew:** Five officers and eight enlisted
- Length:** 97 ft., 9 in.
- Height:** 38 ft., 6 in.
- Wingspan:** 132 ft., 7 in.
- Max. speed:** 374 mph
- Ceiling:** Over 33,000 ft.
- Range:** With max payload; 2,356 miles
- Armament:** 40mm and 105mm cannons; 25mm gun



SOURCES: Jane's; U.S. Air Force

AP

Figure 1 AC-130 Gunship¹

Gunships in Action

In past conflicts, the AC-130 Gunship has been an essential asset to commanders and contributed significantly to the success of many operations. During Vietnam, gunships destroyed more than 10,000 trucks and were credited with many life-saving close air support missions. AC-130s suppressed enemy air defense systems and attacked ground forces during Operation Urgent Fury in Grenada. This enabled the successful assault of Point Salines Airfield. The gunships had a primary role during Operation Just Cause in Panama of destroying Panamanian Defense Force Headquarters and numerous command and control facilities through surgical employment of ordnance in an urban environment. When Saddam Hussein invaded Kuwait in early August 1990, both the AC-130A and AC-130H Gunships were part of the international force assembled in the Persian Gulf to help drive the Iraqi forces out of the region. During Operation Desert Storm, gunships provided air base defense and close air support for ground forces. AC-130s were also used during Operations Continue Hope and United Shield in Somalia, providing close air support for United Nations ground forces. The gunships played a pivotal role during operations in support of the NATO mission in Bosnia-Herzegovina and in Kosovo, providing air interdiction against key targets. Operation Enduring Freedom saw the greatest use of gunships since the Vietnam days. The full range of combat mission capabilities was employed, from Close Air Support (CAS) and interdiction to armed reconnaissance and Forward Air Controlling. As new conflicts surface the gunship will continue to be an essential and highly sought after weapon system.

Doctrine

Joint Pub 3-05, Doctrine for Joint Special Operations, describes key elements of special operations as follows:

Operations conducted by specially organized, trained and equipped military and paramilitary forces to achieve military, political, economic or psychological objectives by unconventional military means in hostile, denied, or politically sensitive areas. These operations are conducted during peacetime competition, conflict, and war... Political-military considerations frequently shape special operations, requiring clandestine, covert or low visibility²

The USSOCOM mission has expanded to include counterproliferation (CP) described as “actions taken to locate, identify, seize, destroy, render safe, transport, capture, or recover weapons of mass destruction.”³ Additionally, to be most effective, USSOCOM’s other primary missions which fall under the umbrella of Military Operations Other Than War (MOOTW) may at times require the application of non-lethal weapons. Other primary roles of SOF in MOOTW consist of combat operations and non-combat operations. The combat operations group involves the aggressive use of force and enforcement of sanctions (quarantines), enforcement exclusion zones, protection of shipping lanes, strikes, and raids.⁴ Non-combat operations include arms control, domestic support operations, foreign humanitarian assistance, nation assistance, show of force, and support of insurgency.⁵

Operation Analysis

Many advocates of non-lethal weapons point to the growth of peacekeeping and peace enforcement operations where military force structures are evidently needed but where effective alternative non-lethal weapon systems are not available. In Somalia, for example, Operation Restore Hope quickly escalated from self-defense against snipers and

rioters to offensive operations using helicopter gunships and Special Forces assault troops. That operation resulted in the death of many including U.S. soldiers. Somalia highlighted internal US political issues about the level of casualties, both to combatants and non-combatants, and also the role of the news media in potentially undermining support for military peace enforcement and peacekeeping operations.⁶

Non-Lethal Application

A major impact of AC-130 Gunships in both the Panama and Somalia area of responsibility was the psychological effect. This combined with the judicious use of the weapons system under the rules of engagement combined to make the aircraft an enormously valuable combat force multiplier for the commander. On several occasions, the mere presence of the gunships, by its acoustic signature and the judicious use of its 2KW high intensity flood lights, served as a deterrent and caused crowds and vehicles to disperse. These lessons from Panama and Somalia are clear. Future military operations, in particular Military Operations Other Than War, need air support from weapon systems capable of delivering both lethal and non-lethal weapons on to the target. Builder argues that in the future, when effective airpower and space power combine with non-lethal weapons, “we might be able to find the tools to exploit our control of the air and space for controlling the use of the ground. If the air and space power can be forged into means that can effectively deny people the use of the streets for looting property or mobbing human victims, the dark shadow of one of the most vexing problems of the future will have been drawn back.”⁷

O’Connell and Dillapain point to the utility of non-lethal weapons in US Air Force operations where non-lethal air force applications do not appear to be a departure from

the normal evolution of air power.⁸ They give an example in the Gulf War when Iraqi MiG aircraft were parked provocatively, as a baiting tactic, in front of an ancient mosque. To attack such a target with conventional high-explosive weapons was “out of the question” because of collateral damage to the temple. There also existed a broad range of targets in close vicinity to temples monuments and buildings, particularly those of cultural and religious symbolic importance, which could have been targeted with non-lethal weapons.⁹ That alternative gives command decision makers more flexibility in the force-application stage, enabling them to service targets that would otherwise not be attacked.

Notes

¹http://web.knoxnews.com/web/kns/news/breaking/attack/graphics/1016_ac130spectre.html

² Joint Pub 3-05, *Doctrine for Joint Special Operation*, 17 April 1998, GL-10

³ USSOCOM Pub 1, 3-3.

⁴ Maj Aryea Gottlieb and Maj Steve Black, *The Role of SOF In Military Operations Other Than War: A Primer*, Hurlburt Field, FL, March 1996, 10.

⁵ *Ibid.*

⁶ Lewer, Nick, and Steven Schofield. *Non-Lethal Weapons—A Fatal Attraction? Military strategies and Technologies for the 21st Century Conflict*. (London, UK: Zes Books, 1997): 129

⁷ Carl Builder, “Doctrinal Frontiers,” *Airpower Journal* 9, no. 4 (Winter 1995): 12.

⁸ Edward O’Connell and John Dillapain, “Non Lethal Concepts: Implication for Air Force Intelligence”, *Airpower Journal*, Vol. 8, Part 4, pp. 26-33.

⁹ *Ibid.*

Chapter 3

THE TECHNOLOGY

Today, a new arms race may be about to dawn on the planet--a push for weapons that minimize, rather than maximize, lethality.

—Alvin and Heidi Toffler

The theory and application of non-lethal weapons is not new; weapons such as incapacitant gases and plastic and rubber bullets have been around for many years.¹ Rapid advances in technology are multiplying the types and numbers of non-lethal weapons. The governing DOD policy states that, “Non-lethal weapons should enhance the capability of US forces to accomplish the following objectives: Discourage, delay, or prevent hostile actions; limit escalation; take military action in situations where use of lethal force is not the preferred option; better protect our forces; [and] temporarily disable equipment, facilities, and personnel.”²

Weapons Inventory

Non-lethal weapons are traditionally placed into two categories, anti-personnel and anti-material, in order to optimize some of their intrinsic potential. Anti-personnel non-lethal technologies target humans by nondestructive means and have the capabilities to temporary disorientation, calm or stun personnel, immobilize personnel, and sensory impairment.

Anti-Personnel Technologies³

Acoustics – The objective of anti-personnel acoustic weapons is not predominantly to create untenable sound, but rather, to pulsate the targeted people physically. There are three levels of acoustic frequencies that might be applied as weapons: infrasonic, audible sound, and ultrasound. Infrasonic is at the low end of the spectrum (below 50 Hz) that can disorient or cause nausea in personnel. The distress is reported to be temporary and stops when the acoustic source is stopped. Due to the low frequency, it is very difficult to screen out and can penetrate inside buildings and objects. Audible sound, in the frequencies from 20 to 20,000 hertz, can be applied to influence behavior as most people are sensitive to very loud noise. Ultrasound, frequencies above 20 kilohertz, is well known to the medical community. Although no hazard has been identified with diagnostic ultrasound, people exposed to moderate dosages reported noticeable heating effects that could lead to injury.⁴ There are many military and law enforcement applications for acoustic weapons. In civil disturbances and peace support operations, there is a need to gain control of violent situations with minimal force. These weapons can be used to drive people away from a selected area or to enforce a safety zone between troops or police and potential attackers. The disadvantages associated with acoustic weapons are injury, seizures and possible fratricide. While most acoustic work has focused on anti-personnel applications, some work has been done on anti-material weapons.

Chemicals – Non-lethal chemical technology generally includes agents that induce sleep or produce irritation. The military and law enforcement uses for chemical agents include disabling individuals, large groupings of individuals or assembled troops. The

most common of these agents are riot control agents which are used around the world. Although civilians tend to think of them collectively as tear gas, these can affect many human functions, causing tearing, nausea, vomiting, and sometimes pain in the form of a burning sensation. The effective, quick-acting effects of these chemicals can be used to disrupt military operations or as a means to achieve temporary military advantages.

Optical – A family of low energy lasers which disrupt human vision or optical sensors such as night vision devices, target acquisition devices, or range finding equipment. These low powered lasers can temporarily or permanently damage optic nerves in humans rendering the individual “temporarily” blind. The intensity of the effect is dependent on the laser power, range to the threat, environmental conditions, and the stability of the target. The current weapons are small enough to be portable or mounted on air platforms. Lasers that can do damage to the eye are widely available and can be bought on the open market. The Army deployed optical weapons during the Persian Gulf war but it was not used due to insufficient training and tactics. Illumination lasers for individual weapons were deployed to Somalia during peacekeeping operations, however the use was again limited.⁵

Physical Restraints – A variety of devices developed to immobilize personnel. These include super adhesives, binding coatings, anti-traction compounds, containment devices, and foams. This includes families of substances that impede mobility, create barriers, ensnare, and cause lack of traction for personnel. Some examples of physical restraint devices include weapons with names such as Birdcatcher, Speedbump, Silver Shroud, and Spiderman.

Low Kinetic Impact – A family of projectiles and weapons that stunts upon contact with personnel without penetrating. Low Kinetic Energy (KE) munitions injuries have been compared to baseball impact. It offers troops in peace support operations and law enforcement officers attractive options between shooting and not shooting. All low-KE weapons and munitions come with a warning about proper use and acknowledge the possibility of serious injury or death. Weapons developers in the United States have been busily making a variety on non-lethal low-KE munitions. By one count, fifty-nine different rounds and grenades are currently available, with new versions quickly following them to market.⁶ Examples of low-KE weapons are rubber bullets, sting balls, SPLLAT (Special Purpose Low Lethality Anti-Terrorist shell) and low-KE rounds.

Directed Energy-High Power Microwave (HPM) – Systems that produce microwave radiation. They are considered anti-material weapons but have significant anti-personnel capabilities as well. Some of these HPMs are able to produce a variety of effects on humans to include increasing levels of pain, incapacitation, and disorientation. This is a fast growth area with research on-going. Tactical directed energy systems, such as high powered microwave weapons that shoot photons rather than bullets, will change the battle field forever.

Anti-material Technologies⁷

Anti-material non-lethal technologies produce the disruption or the limited destruction of material systems and equipment. These weapons are capable of blinding optical sensors and targeting devices, disabling electronics in equipment, preventing the movement of vehicles including aircraft, and causing computer driven systems failure or inducing operating error malfunctions.

Chemical – While almost every material can be attacked with an aggressive chemical or biological agent there is no single solvent or organism. Super-acids, super-caustics, or super-aggressive agents derived from chemical or biological enzymes can be found that can degrade or destroy any target. These agents are so powerful that only a small amount is necessary to destroy the designated target. While total area coverage would unlikely be authorized, precision delivery methods that can ensure no contact with humans is feasible. An anti-material approach that offers great potential is to degrade chemical bonds of component parts rather than the entire targets. Vulnerabilities include adhesives, rubbers (natural or synthetic), resins, coverings, joints, metal pins, or insulation. The most viable places to attack and degrade are the critical subcomponents. A small amount of damage at key points can prevent an entire weapon system from functioning properly. Biochemists all over the world are working on developing new and improved organisms and compounds. The very bad news is that these agents are becoming relatively easy to acquire and could easily be in the hands of an adversary.

Electromagnetic Pulse (EMP) and High Power Microwave (HPM) – These weapons deliver high energy pulses which are capable of damaging or destroying electronic weapons or equipment which are susceptible to damage by power surges. The basic concept of these weapons is to generate one or more very intense pulses of electromagnetic power that penetrate non-shielded equipment to degrade or destroy sensitive electronic circuitry. A report indicates that effective radii of “hundreds of meters or more” are possible.⁸ A massive EMP strike could cripple a nation temporarily and make recovery efforts very expensive. EMP and HPM appear to be at the forefront of

NLW technology research, and advances are leading increasing to compactness which will enable delivery via bombs, missiles or artillery shells.

Notes

¹ J.F. Coats, *Non-Lethal and Nondestructive Combat in Cities Overseas* (Arlington, VA: Institute for Defense Analysis, Science and Technology Division, May 1970).

² DOD Directive 3000.3, *Policy for Non-Lethal Weapons*, 9 July 1996, 2.

³ Summaries mainly compiled from five sources: Nick Lewer and Steven Schofield, *Non-Lethal Weapons—A Fatal Attraction? Military Strategies and Technology for 21st Century Conflict* (London, UK: Zed Books, 1997), 8-9; Col John B. Alexander. *Future War: Non-Lethal Weapons in Twenty-First-Century Warfare*. New York, NY: St Martin's, 1999, 57-123; Col Joseph Siniscalchi, *Non-Lethal Technologies: Implication For Military Strategy*, Occasional Paper No 3, Maxwell AFB, AL: Air War College, March 1998; Lt. Col. Allan Poland-Price, "Non-Lethal Weapons; A Synopsis," Policy and Doctrine Paper for the Ministry of Defense, United Kingdom, 1995, 120-121; and V.S. Frolov, "Nonlethal Weapons – United States; WAR casualties – United States." *Military Thought*, Vol 10, Issue 3, 2001, 57.

⁴ Dr Gonzalo M Diaz, "Safety in Training and Research," an official statement of the American Institute of Ultrasound in Medicine, March 1993.

⁵ Neil Munro, "Peacekeeping Requires Special Tools," *Defense News*, 4 April 1994, 14.

⁶ "Survey of Limited Effects Weapons, Munitions, and Devices," US Special Operations Command and ARPA, 2nd edition, 29 December 1995.

⁷ Summaries mainly compiled from five sources: Nick Lewer and Steven Schofield, *Non-Lethal Weapons—A Fatal Attraction? Military Strategies and Technology for 21st Century Conflict* (London, UK: Zed Books, 1997), 8-9; Col John B. Alexander. *Future War: Non-Lethal Weapons in Twenty-First-Century Warfare*. New York, NY: St Martin's, 1999, 57-123; Col Joseph Siniscalchi, *Non-Lethal Technologies: Implication For Military Strategy*, Occasional Paper No 3, Maxwell AFB, AL: Air War College, March 1998; Lt. Col. Allan Poland-Price, "Non-Lethal Weapons; A Synopsis," Policy and Doctrine Paper for the Ministry of Defense, United Kingdom, 1995, 120-121; and V.S. Frolov, "Nonlethal Weapons – United States; WAR casualties – United States." *Military Thought*, Vol 10, Issue 3, 2001, 57.

⁸ Carlo Kopp, "A Doctrine for the Use of Electromagnetic Pulse Bombs," Royal Australian Air Force Staff Paper, July 1993, 7.

Chapter 4

The Connection

To win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill...

—Sun Tzu

The options provided to military leadership remain highly lethal for the most part. Troops are sent into peace-enforcement and peacekeeping missions armed and supported only with lethal options. If peaceful intervention fails, they have but one option and that's the use of lethal weapons. Non-lethal weapons have applications across the whole force spectrum, including close arrest situations, counter-terrorism, anti-drug operations, military operations in urban terrain, peace-enforcement/peacekeeping activities, and conventional war. Non-lethal weapons coupled with a gunship platform may provide military commanders with more options to resolve situations without resorting to lethal methods, so that force is applied proportional to the threat.

Chapter two addressed the AC-130 Gunship's involvement in past conflicts and its missions, weapons, and capabilities. Given the scope of this research, this chapter will primarily address currently available NLW which can be adapted to the gunship's current weapons and electromagnetic equipment. AFSOC will very likely integrate current and/or more advanced NLW into their future gunship platform. Certain inherent limitations of an airborne platform such as weight, available space, power availability,

minimum standoff altitude, and difficulty of integration, may restrict non-lethal weapons options. The AC-130 Gunship is a unique platform, and although many limitations still exist, its accurate weapon systems, size, loiter time, roles and missions contributes favorably to making it an ideal candidate for non-lethal weapons application. In addition, its weapons' accuracy rivals those of smart bombs launched from fighter aircraft. Non-lethal weapons on a gunship type platform could provide commanders a full range of weaponry that can prevent the escalation of conditions requiring more lethal force.

AC-130 Weapons and NLW Technology Compatibility¹

The key weapons systems and equipment on existing gunships which could probably accommodate current NLW technologies, with comparatively little modification to the non-lethal technology or the gunship, are its 25-mm, 40-mm, and 105-mm guns, and the Laser Target Designator Range-finder.

25-mm, 40-mm, and 105-mm Guns

These existing NLW technologies appear to be the most compatible with the AC-130 guns. Some modifications to the technology may be needed, such as resizing the non-lethal munitions to be compatible with the gunship's 25, 40 or 105-mm guns.

Shroud Round: Tank, artillery, or aircraft-delivered munitions that explodes milliseconds before impacting their intended target then forming a polymer sheet that is reinforced with a fine aluminum wire mesh. The effect is a weapon that envelopes its target much like an octopus, wrapping it in the polymer sheet and thus shorting out its communication and optics and choking its engines. The maximum ground to ground range is currently about ten kilometers.

Optical Flash munitions: 40-mm shells filled with plastic dye laser rods. Used to blind electro-optics sensors and enemy personnel.

40-mm (M203): A shell containing multiple rubber, sponge, or foam balls.

Chemical and Biological munitions: Various caliber shells filled with a variety of non-lethal chemical agents or biological organisms such as; super-corrosive and super-caustic agents, liquid metal embrittlements, combustion alteration technology, anti-traction technology, and calmativ or foul-smelling agents.

66-mm non-lethal area munitions: Provides indirect fire for area denial and crowd control. Two types of munitions exist: (a) Blunt Trauma with 450 32-caliber rubber balls inside a rubber housing attached to a metal base, and (b) Distraction (flash-bang) device made of a polyurethane material which produces audible and visual distractions.

81-mm and 120-mm: Rounds which are capable of delivering long range non-lethal payloads. The effect is to cause disorientation and distraction among a crowd in a targeted area. These non-lethal rounds flight performances will closely match the aerodynamics, ballistics, firing tables and propellant loads of the rounds in inventory.

105-mm EMP munitions: Once technical production challenges are overcome, an explosive-driven EMP will be packed into weapons-delivery systems possible as small as a 105-mm Howitzer round.

Laser Target Designator Range-finder (LTDR)

Some NLW technology, such as directed energy, may be applicable to gunships with slight modifications to the gunship's LTDR.

Directed-Energy (DE): Any coherent or concentrated energy source. The effect is the burning, cracking, distortion, or impairment of conventional or unconventional

weapons and equipment. In people, these technologies can be attenuated to invoke stammer, confusion, and coma or cause temporary or permanent blindness.

Future Weapons

As the use of non-lethal weapons increases and it becomes valid and acceptable, more options will become available. These are some potential non-lethal devices which could be incorporated onto the AC-130 Gunship platform of the future, or after significant improvements/modifications to the current platform.

Airborne Tactical Laser (ATL): A counter material system with a welding torch effect. Its application is to disable/neutralize facilities, equipment, vehicles or vessels. It also has the capability of being used as a missile defense systems.

High-power Microwave (HPM): Designed to disrupt brainwave patterns, communications, or any electronic component of a machine. The effect is confusion, stupor, or coma in people or animals, and the disruption, scrambling, or jamming of electronics.

Active Denial System (ADS): A special transmitter that fires a two-second burst of focused microwave energy causing burning sensations on the skin. The beam penetrates just beneath the skin's surface at a depth of about 1/64th of an inch.

High-Power Radio Frequency (RF): Electromagnetic energy employment of sound waves in a coherent or concentrated form against various targets. The effect is the shattering of metal or composite materials on war equipment and buildings.

Infra-sound Acoustics: Very low frequency sound generators that might be tuned to incapacitate personnel. These devices could be very effective against personnel in buildings, caves, or underground facilities.

Notes

¹ Summaries primarily compiled from these seven sources: Nick Lewer and Steven Schofield, *Non-Lethal Weapons—A Fatal Attraction? Military Strategies and Technology for 21st Century Conflict* (London, UK: Zed Books, 1997), 8-20; Col John B. Alexander. *Future War: Non-Lethal Weapons in Twenty-First-Century Warfare*. New York, NY: St Martin's, 1999, 57-123; Col Joseph Siniscalchi, *Non-Lethal Technologies: Implication For Military Strategy*, Occasional Paper No 3, Maxwell AFB, AL: Air War College, March 1998; John B. Alexander, "Shoot, But Not to Kill: Non-Lethal Weapons Have Yet To Establish a Military Niche." *Jane's International Defense Review*, Vol. 29, No. 6 (June 1996): 77-78. Sam Dunne, "New Munitions Less Lethal—And Smarter." *Navy Times*, Vol. 46, No. 36 (9 June 1997): 70; Bill Harris, "Less-Than-Lethal Munitions to Give Army Greater Flexibility." *Ordnance*, Vol. 9, No. 2 (May 1993): 22-23; and Julie Merchant, "Threat Weapons and Weapons Technologies: Implications for Army SOF" *Special Warfare*, Vol. 7, No. 3 (July 1994): 32-39.

Chapter 5

Conclusions and Recommendations

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

—Sun Tzu

Summary of Findings

Non-lethal weapons have the potential to fill the void in situations where traditional weapons of minimum force are ineffective, and deadly force is inappropriate. These weapons, when properly employed, should significantly reduce lethal effects. However, there is no guarantee of “zero” fatalities or permanent injuries.¹ Certainly, even the most benign weapons may be lethal under certain conditions.

The closer incidents appear to be normal police action, such as Military Operations Other Than War, the more likely the need for the use of non-lethal technologies. Peace-enforcement and peacekeeping operations are not likely to provide a high threat environment for military aircraft. The need to contain the cost of peace-enforcement and peacekeeping operations will probably dictate the employment of multi-purpose platforms. These platforms will need to be capable of providing timely reconnaissance and surveillance of an operation and at the same time, have the ability to service target with both lethal and non-lethal weapons at a moments notice. Low density high demand

equipment such as Airborne Warning and Control Systems (AWACS) and Joint Surveillance and Target Attack Radar Systems (JSTARS) aircraft can support some of these mission requirements but they will remain necessary for conventional war operations. At this moment, only one aircraft appears to have the potential of fulfilling these functions, and that's the AC-130 Gunship.

The Lethal/Non-Lethal Combination

The obvious preference of soldiers is to permanently eliminate the battlefield threats they face. Non-lethal weapons can be used as an enhancement for lethal weapons rather than a substitute. The combination of combined lethal and non-lethal weapons are perfectly aligned with the AC-130 Gunship's potential weapons capacity and mission capabilities. An example is the use of noxious substances which can be delivered via a 40 or 105 millimeter round at the mouth of a cave or re-enforced shelter to flush out enemy troops from their hidden or protected positions. Upon exiting they would be subjected to lethal attack from that same gunship or another asset, or captured by friendly forces. According to DOD Directive 3000.3, "non-lethal weapons may be used in conjunction with lethal weapon systems to enhance the latter's effectiveness and efficiency in military operations. This shall apply across the range of military operations to include those situations where overwhelming force is employed."²

The application of non-lethal technologies to expand options achieves a greater immediacy of effects and limits military risk to friendly forces, civilians, and neutral non-combatants. Minimizing permanent collateral damage maintains an environment more favorable for diplomatic resolution of the crisis and protects favorable world opinion.

Precision and Repeatable Effects

Precision guided lethal weapons moderates destructiveness by highly accurate delivery means. Non-lethal weapons attempt to increase the effectiveness of the attack while limiting lethal and collateral damage and must also produce reliable and repeatable effects. Confidence in the ability of the weapon to deliver the intended effects is imperative if these weapons are to enable new military strategies. The AC-130 Gunship controls the destructiveness of its lethal weapons by highly accurate delivery means. Vast confidence in the precision, repeatable effectiveness, minimization of collateral damage and flexibility of gunships has been established over the years. These gunship traits coupled with the highly desirable features of non-lethal weapons will enable many advantages. This will allow greater flexibility to attack politically sensitive and broad area targets without risking extensive collateral damage. Furthermore, there is the “reversibility” of material damage for rapid reconstruction of economic infrastructure and finally, an answer to moral imperatives to minimize casualties.³

Principal Conclusions

Several non-lethal weapons currently exist that have the potential to be compatible with the weapon systems and electromagnetic equipment on AFSOC’s AC-130 Gunships. With slight modifications to the NLW technology, such as resizing the caliber of the munitions to fit the gunship’s weapons, it’s feasible to incorporate NLW onto gunships.

NLW are ideal for both traditional and emerging military missions. DOD, and in particular the Marine Corps, have defined NLW as an essential tool that will have a major impact on future conflicts. The Joint Non-lethal Weapons Directorate (JNLWD) stands as

an important organization in this groundbreaking venture. Non-lethal weapons, doctrine, and concept of operations shall be designed to reinforce deterrence and expand the range of options available to commanders.⁴ Incorporating non-lethal weapons and technology onto AC-130 Gunships may usher in revolutionary means for better supporting both combat operations, Military Operations Other Than War and non-military sponsored operations. A few months after the Waco disaster, Attorney General Janet Reno asked the SECDEF for help in developing military non-lethal technologies for law enforcement application by the DOJ.⁵ Attorney General Reno stated that the DOJ wanted information on dual-use NLWs already available and those still under development. In particular, Attorney General Reno was interested in: “A weapon with selectable lethal or non-lethal capabilities which would provide an array of technologies that can readily be brought to bear in less-than-lethal scenarios.”⁶

It is no surprise that DOJ wanted access to and will continue to rely on the military for guidance, direction and use of NLW to resolve domestic disturbances. NLW provide political leaders and military commanders the needed flexibility for resolving conflicts.

With America being casualty conscious, advocates of NLW may seem as a way to avoid taking and inflicting fatalities. Military forces must guard against the tendency to rely on NLW when lethal weapons are clearly appropriate and their capabilities must not be exaggerated nor their limitations overlooked. The AC-130 Gunship, with its unique ability to quickly select various types of weapons and munitions, would be the ideal platform to facilitate the ground party’s need to more appropriately service the targets in question.

Airpower can bring quick and dramatic results, and for that reason, is popular with the American public and political leadership. However, problems and tensions that generate implosion of whole countries and civil wars such as those in Haiti, Rwanda, Yugoslavia and Liberia require resources that allow forces to respond quickly and provide air cover with sufficient flexibility to bring to bear non-lethal weapons or devastating lethal firepower. The AC-130 Gunship is a superb CAS platform in combat. It is also undisputedly the best airborne weapon system for providing close air support during Military Operations Other Than War. Incorporating non-lethal weapons on that platform to compliment its outstanding lethal weapons capability appears to be feasible and highly desirable. Having the right tools to execute missions in volatile and dangerous situations, enhances the probability for success; non-lethal weapons provide that enhanced capability.⁷

Recommendations

There are several gaps that must be filled if non-lethal weapons are going to be a permanent part of AFSOC's AC-130 Gunships' arsenal.

The NLW weapons and technology which currently exist and appear to be relatively adaptable to the gunship's existing weapons systems, need to be analyzed in greater depth and then tested extensively to answer questions of altitude and range effects, environmental concerns, accuracy, and handling and storage issues. The benefit to this cross-utilization approach is reduced cost for pre-existing technology which are being developed and used by other organizations in both the military and civilian sector.

Given the competition for funding and resource scarcity within the military, AFSOC and USSOCOM need to team up with the JNLWD to leverage their efforts and pursue

opportunities to acquire and test NLW. Modification of existing gunship weaponry should be a focus of a longer-term effort. Modeling and simulation can provide an idea of the benefits or tradeoffs of integrating specific NLW onto the gunship platform.

For longer-term efforts, RDT&E and procurement program elements (PEs) can be established for gunship unique NLW technology. AFSOC needs to exploit the development and use of NLW tailored specifically for the gunship and compatible with the numerous missions which it's capable of performing. This not only benefits the current airframe, but the results can also be applied to the advance concept platform, the AC-XXX Gunship.

Technical feasibility, operational utility, policy acceptability, training, and safety all require further careful evaluation prior to developing and integrating NLW on AC-130 Gunships for employment.

Doctrine and training need to be initiated and this effort will need to expand and address issues beyond the military services to include foreign and civil initiatives. History has shown that it normally takes twenty years to develop a new operational doctrine after the introduction of a new technology.⁸

Finally, the need for non-lethal weapons in AFSOC must be clearly substantiated. Other agencies with similar desires and abilities may not be fully aware of the capabilities of the gunship, and the desires of AFSOC to be involved in the NLW business. An active advocacy for possible future non-lethal gunship capabilities and its contribution to warfighting strategies needs to be publicized.

This non-lethal effort is principally relevant in peace-enforcement and peacekeeping, where even the most judicious application of lethal force may be damaging. As General

Wayne Downing candidly stated “it’s kind of incongruous to be someplace on a peace-keeping mission and kill people.”⁹

Notes

¹ “Policy for Non-Lethal Weapons,” Department of Defense Directive, 9 July 1996, 2

² DOD Directive 3000.3, *Policy for Non-Lethal Weapons*, 9 July 1996, 2.

³ Mark R Thomas, *Non-Lethal Weaponry: A Framework For Future Integration*. Research report, Maxwell AFB, AL: ACSC, April 1998.

⁴ DOD Directive 3000.3, *Policy for Non-Lethal Weapons*, 9 July 1996, 2.

⁵ Mark Tapscott, “Reno Asks Aspin for Non-Lethal, Other DOD Weapons to Fight Crime.” *Defense Electronic*, December 1993, 8.

⁶ Ibid.

⁷ Frank Morales, “Civil Disturbance; Incorporating Non-Lethal TTPs.” Center for Army Lessons Learned, Newsletter 00-7, June 2000.

⁸ Report of an Independent Task Force, “Nonlethal Technologies: Military Options and Implications,” (New York, N.Y., Council on Foreign Relations, 1995), 15.

⁹ “One On One,” *Defense news* 9, no. 14 (11-17 April 1994): 30. General Downing was Commander-in-Chief United States Special Operations Command in April 1994.

Glossary

ADS	Active Denial System
AFSOC	Air Force Special Operations Command
ATL	Airborne Tactical Laser
AWACS	Airborne Warning and Control System
CAS	Close Air Support
CINC	Commander-in-Chief
CJCS	Chairman of the Joint Chiefs of Staff
DE	Directed Energy
DOD	Department of Defense
DOJ	Department of Justice
EMP	Electromagnetic Pulse
JNLWD	Joint Non-Lethal Weapons Directorate
JSTARS	Joint Surveillance, Target, Attack Radar System
LCDM	Low Collateral Damage Munitions
LTDR	Laser Target Designator Range-finder
MOOTW	Military Operations Other Than War
NLW	Non-Lethal Weapons
RDT&E	Research, Development, Test and Evaluation
SECDEF	Secretary of Defense
US	United States
USA	United States of Army
USAF	United States Air Force
USMC	United States Marine Corps
USN	United States Navy
USSOCOM	United States Special Operations Command
WMD	Weapons of Mass Destruction

Bibliography

- Alexander, John B. "Shoot, But Not to Kill: Non-Lethal Weapons Have Yet To Establish a Military Niche." *Jane's International Defense Review*, Vol. 29, No. 6 (June 1996): 70-78
- Alexander, John B. *Future War: Non-Lethal Weapons in Twenty-First-Century Warfare*. New York, NY: St Martin's, 1999.
- Builder, Carl. "Doctrinal Frontiers," *Airpower Journal* 9, no. 4 (Winter 1995): 12.
- Coats, J. F. *Non-Lethal and Nondestructive Combat in Cities Overseas*. Arlington, VA: Institute for Defense Analysis, Science and Technology Division, May 1970.
- Diaz, Gonzalo M. "Safety in Training and Research," an official statement of the American Institute of Ultrasound in Medicine, March 1993.
- Dando, Malcolm. *A New Form of Warfare: The Rise of Non-Lethal Weapons*. London, UK: Brassey's, 1996.
- Dunne, Sam, "New Munitions Less Lethal—And Smarter." *Navy Times*, Vol. 46, No. 36 (9 June 1997): 70;
- Frolov, V.S. "Nonlethal Weapons -- United States; WAR Casualties -- United States." *Military Thought*, Vol. 10, Issue 3, 2001: 57.
- From
http://web.knoxnews.com/web/kns/news/breaking/attack/graphics/1016_ac130spectre.html
- Gottlieb, Aryea and Steve Black, *The Role of SOF In Military Operations Other Than War: A Primer*, Hurlburt Field, FL, March 1996.
- Harris, Bill. "Less-Than-Lethal Munitions to Give Army Greater Flexibility." *Ordnance*, Vol. 9, No. 2 (May 1993): 22-23.
- Kirkwood, David B. *Non-Lethal Weapons In Military Operations Other Than War*. Newport, RI: Naval War College, June 1996.
- Kopp, Carlo. "A Doctrine for the Use of Electromagnetic Pulse Bombs," Royal Australian Air Force Staff Paper, July 1993.
- Lewer, Nick, and Steven Schofield, *Non-Lethal Weapons—A Fatal Attraction? Military strategies and Technologies for the 21st Century Conflict*. London, UK: Zes Books, 1997.
- Merchant, Julie, "Threat Weapons and Weapons Technologies: Implications for Army SOF" *Special Warfare*, Vol. 7, No. 3 (July 1994): 32-39.
- Morales, Frank. "Civil Disturbance; Incorporating Non-Lethal TTPs." Center for Army Lessons Learned, Newsletter 00-7, June 2000.
- Jomini, Henri A. *Makers of modern Strategy: From Machiavelli to the Nuclear Age*, edited by Peter Paret and others. Princeton NJ, Princeton University Press, 1986.
- Munro, Neil "Peacekeeping Requires Special Tools," *Defense News*, 4 April 1994: 14.
- O'Connell, Edward P. and John Dillapain, "Non Lethal Concepts: Implication for Air Force Intelligence", *Airpower Journal*, Vol. 8, Part 4, (Winter 1994): 26-33.

- “One On One,” *Defense news* 9, no. 14 (11-17 April 1994): 30.
- Poland-Price, Allan. “Non-Lethal Weapons; A Synopsis,” Policy and Doctrine Paper for the Ministry of Defense, United Kingdom, 1995.
- Report of an Independent Task Force, “Nonlethal Technologies: Military Options and Implications,” (New York, N.Y., Council on Foreign Relations, 1995).
- Siniscalchi, Joseph. *Non-Lethal Technologies: Implication For Military Strategy*, Occasional Paper No 3, Maxwell AFB, AL: Air War College, March 1998.
- Tapscott, Mark. “Reno Asks Aspin for Non-Lethal, Other DOD Weapons to Fight Crime.” *Defense Electronic*, December 1993: 8.
- Thomas, Mark R. *Non-Lethal Weaponry: A Framework For Future Integration*. Research report, Maxwell AFB, AL: ACSC, April 1998.
- “Survey of Limited Effects Weapons, Munitions, and Devices,” US Special Operations Command and ARPA, 2nd edition, 29 December 1995.
- US Department of Defense Directive 3000.3, *Policy for Non-Lethal Weapons*. Washington, DC: Office of the Assistance Secretary of Defense (Special Operations and Low Intensity Conflict), 9 July 1996.
- US. Joint Publication 3-05, *Doctrine for Joint Special Operation*, Washington DC: Office of the Chairman Joint Chiefs of Staff, 17 April 1998.
- US Special Operations Command Publication 1, *Special Operations in Peace and War*, January 1996.
- Sun Tzu. *The Art of War*. Translated and with an introduction by Samuel B. Griffith. Oxford, Clarendon Press, 1963.
- Toffler, Alvin, and Heidi Toffler. *War and Anti-War: Survival at the Dawn of the Twenty-First Century*. Boston, MA: Little, Brown & Company, 1993.
- Warden, John A. III. “Air Theory for the Twenty-first Century.” *In Challenge and Response: Anticipating US Military Security Concerns*. Edited by Dr. Karl P. Magyar, et al. Maxwell AFB, AL: Air University Press, 1994.