

# **Directed Energy Weapons: Do We Have a Game Plan?**

**A Monograph  
by  
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**Warfare is an evolving process where innovations in technology and the application of that technology to military operations combined to provide an opportunity to gain military advantage. Today's military performs missions across the spectrum of warfare. In these roles, operators and planners must leverage technology in order to gain an advantage over their enemy and protect their forces. Directed Energy (DE) weapons (DEW) are at the forefront of the next revolution in military weaponry. These weapons seemingly promise the military planner and operator a wide variety of lethal and non-lethal capabilities to meet the challenges across the spectrum of warfare. The purpose of this monograph is to explore whether current U.S. policy and doctrine are adequate to employ emerging DEW technology. Second, it will recommend possible areas where doctrine and policy should focus in order to provide the best framework for implementing DEWs into joint operations. This study will address why DEWs are important to our national defense; what policy and doctrine are; current policy/doctrine concerning DEWs; provide an assessment of the current doctrine and policy; and finally provide a conclusion followed by a set of recommendations for future development of directed energy weapon policy and doctrine. Technology may allow us to gain a decisive advantage on the battlefield however, the proper integration, development, and employment strategies are critical to exploiting any new weapon system. Military forces must be organized, equipped, and trained properly. Doctrine and policy provide this framework to ensure our systems provide the required capabilities and necessary effects on the battlefield. Without well-defined doctrine and policy, weapon system acquisition, deployment, employment, and integration are done in an ad hoc fashion, resulting in a piecemeal of systems that are unable to provide the necessary synergistic effects in the joint warfighting arena.**

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## Abstract

Directed Energy Weapons: Do We Have a Game Plan? By Major Timothy J. Lincoln, United States Air Force, 63 pages.

Warfare is an evolving process where innovations in technology and the application of that technology to military operations combined to provide an opportunity to gain military advantage. Today's military performs missions across the spectrum of warfare. In these roles, operators and planners must leverage technology in order to gain an advantage over their enemy and protect their forces.

Directed Energy (DE) weapons (DEW) are at the forefront of the next revolution in military weaponry. These weapons seemingly promise the military planner and operator a wide variety of lethal and non-lethal capabilities to meet the challenges across the spectrum of warfare. The progress the U.S. is making in the development of these weapons holds the prospect of significant new capabilities in both offensive and defensive operations.

Important questions remain regarding the use of DEWs on the future battlefield. One of the most important is does current U.S. policy and doctrine adequately address the employment of emerging directed energy weapons?

The purpose of this monograph is to explore whether current U.S. policy and doctrine are adequate to employ emerging DEW technology. Second, it will recommend possible areas where doctrine and policy should focus in order to provide the best framework for implementing DEWs into joint operations.

This study will address why DEWs are important to our national defense; what policy and doctrine are; current policy/doctrine concerning DEWs; provide an assessment of the current doctrine and policy; and finally provide a conclusion followed by a set of recommendations for future development of directed energy weapon policy and doctrine.

The joint publications and policy cited in this paper effectively address the general organization, training, execution, and support of the forces and DE weapon systems necessary to ensure effective execution of joint operations. Further, current doctrine provides general planning methodology, fundamentals, coordination, and integration/deconfliction guidelines and common understanding of conducting these operations while providing a common language for discussion. However, current doctrine and policy falls short in two areas. First, future DEWs may be capable of creating effects across the strategic, operational, and tactical levels of war and therefore more specific guidance must be developed in order to properly organize, plan, coordinate, and utilize these weapons. Second, although current policy and doctrine do account for current and near-term anticipated realities in terms of developing capabilities to meet emerging threats, they fail to articulate the U.S. position on the use of DEWs in light of current international treaties and conventions. Additionally, the U.S. has failed to articulate its policy on placing weapons in space. Therefore, more research, analysis, and specific guidance is required in these two areas before we can employ more advanced DEW systems.

Technology may allow us to gain a decisive advantage on the battlefield however, the proper integration, development, and employment strategies are critical to exploiting any new weapon system. Military forces must be organized, equipped, and trained properly. Doctrine and policy provide this framework to ensure our systems provide the required capabilities and necessary effects on the battlefield. Without well-defined doctrine and policy, weapon system acquisition, deployment, employment, and integration are done in an ad hoc fashion, resulting in a piecemeal of systems that are unable to provide the necessary synergistic effects in the joint warfighting arena.

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## CHAPTER ONE: INTRODUCTION

“The gravest danger to freedom lies at the crossroads of radicalism and technology. When the spread of chemical and biological and nuclear weapons, along with ballistic missile technology—when that occurs, even weak states and small groups could attain a catastrophic power to strike great nations. Our enemies have declared this very intention, and have been caught seeking these terrible weapons. They want the capability to blackmail us, or to harm us, or to harm our friends—and we will oppose them with all our power.”<sup>1</sup>

President Bush  
West Point, New York  
June 1, 2002

The nature of warfare can be characterized as a continual process of evolution where innovations in technology and innovations in the application of technology to military operations have combined to provide the opportunity for military advantage.<sup>2</sup> In today’s world, military personnel are deployed in a variety of roles including, peacekeeping, and peace enforcement, as well as in conventional combat. In these roles, operators and planners must be able to leverage technology in order to gain an advantage over their enemy and protect their forces at the same time.

The emerging technology of Directed Energy (DE) weapons (DEW) is at the forefront of the next revolution in military weaponry. These weapons seemingly promise the military planner and operator a wide variety of lethal and non-lethal capabilities to meet the challenges of the diverse spectrum of military operations. The progress the U.S. is making in the development of very-high power generators and projectors of electromagnetic wave energy, both radio frequency and optical, holds the prospect of significant new capabilities in both offensive and defensive operations. DEWs can provide any commander with the particular benefit of an effective, but

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<sup>1</sup> George W. Bush, Graduation Address, United States Military Academy, West Point, NY, 2002

<sup>2</sup> Michael J. Moran, *An Evolving Doctrine: Force Application from Space*. (Maxwell AFB, AL: Air University Press), 22 March 2000, Pg. 1.

non-lethal, option. The option of defeating command and control systems or air defense systems without lethal force has merit. DEWs may also be applied to provide precise target engagement where damage is achieved without unnecessary collateral damage. The use of DEWs will become as important to warfighting in the future as precision-guided munitions are to warfighting today.

Important questions remain regarding the use of DEWs on the future battlefield. One of the most important is does current U.S. policy and doctrine adequately address the employment of emerging directed energy weapons? The purpose of this monograph is to explore whether current U.S. policy and doctrine are adequate to employ emerging DEW technology and recommend possible areas where doctrine and policy should focus in order to provide the best framework for DEW development, acquisition, deployment, and employment.

## **BACKGROUND**

### **CURRENT THREAT ENVIRONMENT**

“The nature of the Cold War threat required the United States—with our allies and friends—to emphasize deterrence of the enemy’s use of force, producing a grim strategy of mutually assured destruction. With the collapse of the Soviet Union and the end of the Cold War, our security environment has undergone profound transformation.”<sup>3</sup> The challenges we face in terms of terrorism, rogue nations, peacekeeping, peace enforcement, and humanitarian operations will continue to require the transformation of “our military forces to ensure our ability to conduct rapid and precise operations to achieve decisive results.”<sup>4</sup> DEWs are just one set of enabling factors to ensure we can meet the intent of the National Security Strategy as laid out by the President of the United States.

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<sup>3</sup> The White House, National Security Strategy of the United States of America (hereafter known as NSS), 17 September 2002, Pg. 13; available from <http://www.whitehouse.gov/nsc/nss.html>; internet; accessed 8 September 2003.

<sup>4</sup> NSS, Pg. 16.

## TRADITIONAL GLOBAL STRIKE SYSTEM LIMITATIONS/CAPABILITIES

Global Strike, as defined by Air Force Chief of Staff General John P. Jumper, is leveraging the U.S. asymmetric advantages of stealth, precision and standoff capabilities, information, and space to overcome the enemy's ability to deny access to U.S. forces. It will rapidly establish air dominance and subsequently guarantee that joint aerospace, land and sea forces will enjoy both freedom from attack and freedom to attack.<sup>5</sup> Traditionally the conventional global strike mission has been assigned to the USAF's bomber force, while the nuclear global strike missions have been assigned to the Intercontinental Ballistic Missile (ICBM) and Sub-Launched Ballistic Missile (SLBM) forces. Each of these components offers the national leadership the capability to strike at great distances on relatively short response. However, each of these components has limitations, which DEWs may be able to overcome in the future.

### **BOMBERS**

The U.S. bomber force has been a mainstay for global strike since World War II. In every conflict, the bomber force has been utilized to strike deep into the enemy's rear area to conduct strategic attack and interdiction with the objective of destroying or degrading the enemy's ability to wage war. Today the bomber force employs the use of precision guided munitions (PGM) and stealth technology in order to mass effects at the time and place of our choosing, while at the same time reducing collateral damage. Still these weapon systems are limited in many ways. For instance, B-2 bombers flew long-range missions from Whiteman AFB, Missouri to Afghanistan during Operation Enduring Freedom. Although the missions were effective, they took over 40 hours to complete. The missions were also limited to nighttime employment even though the B-2 is a stealth aircraft. Finally, The U.S. had to gain diplomatic clearances for the ingress and egress routes of the B-2 before the mission. Although this is an extreme case, conventional bombers are usually limited to missions where we have air

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<sup>5</sup> John P. Jumper, *Global Strike Task Force- A Transforming Concept, Forged by Experience*, (Aerospace Power Journal – spring 2001); NP, available from <http://www.globalsecurity.org/military/agency/usaf/gstf.htm>; internet, accessed 28 Nov 03.

superiority, close proximity air-basing, diplomatic clearances, and the 72-hour Air Tasking Order (ATO) planning cycle. Recent conflicts have been characterized by early attainment of air superiority and relatively positive international support. This may not be the case in the future and the U.S. must look at other methods of performing global strike in shorter response and planning cycles in less permissible environments, while still maintaining our capability to attain desired effects and limit collateral damage.

### **ICBMS/SLBMS**

Since August 6, 1945, nuclear weapons have been the ultimate weapon of mass destruction. On August 29, 1949, the Soviet Union conducted their first nuclear test and so began the nuclear arms race and the cold war that would last until 25 Dec 1991, when the Soviet Union ceased to exist. Nuclear weapons, more precisely ICBMs and SLBMs have given the U.S. leadership an inherent deterrent capability as well as a nuclear global strike capability, should it be needed. The ICBMs/SLBMs fleets have maintained an impressive readiness rate, responsive retargeting capability, and a delivery time of ~30 minutes. Hence, the slogan, “guaranteed 30 minute delivery or your next one is free.”

However, ICBMs/SLBMs are limited in their usefulness in military operations other than war (MOOTW) or even in convention war. ICBMs/SLBMs do not provide a wide range of capabilities or effects. Even current proposals to equip the ICBM boosters with a conventional warhead are limited due to over flight restrictions, and international concern. Therefore, main effort of the ICBM and SLBM systems will continue to be “detering the use of weapons of mass destruction against U.S. or allied forces and seeks to integrate conventional and nuclear capabilities, providing commanders a full spectrum of responses to counter aggression.”<sup>6</sup> The battlefield of tomorrow requires that we develop weapon systems capable of deterring our enemies, but at the same time, maintain a capability of graduated response and effect. Allowing

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<sup>6</sup> Global Security.org website, Task Force Concepts of Operations (CONOPS), NP; available from <http://www.globalsecurity.org/military/agency/usaf/nrtf.htm>; internet; accessed 28 Nov 03.

leaders to strike global targets with either lethal or non-lethal force dependent on the situation and desired end state. DEWs technology may offer the U.S. such a capability. However, to ensure this capability is developed and employed properly the U.S. must implement the proper doctrine and policy.

## **SCOPE AND LIMITATIONS**

This study is an analysis of whether of not current U.S. policy and doctrine is adequate for the employment of emerging DE weapon systems. There are two main limitations. First, this study is not intended to compare, contrast, or to otherwise analyze other global strike or response capabilities. These systems include but are not limited to Intercontinental Ballistic Missiles (ICBM), Sub Launched Ballistic Missiles (SLBM), and the strategic bomber force. However, these traditional systems and their limitations will be briefly described. It is important to note, these systems were meant to provide military commanders the ability to apply large-scale lethal force. Unlike many DEWs, they do not possess the ability to provide non-lethal effects. The capabilities identified in this paper should be used to augment existing capabilities, such as those above. This will enable military planners the necessary tools to solve problems in the complex military operating environment.

Secondly, this monograph does not necessarily recommend new doctrine. Its focus is on providing an assessment of current U.S. policy and doctrine. This assessment will be used to provide recommendations where current doctrine could be augmented, revised, or if necessary rescinded.

## **IMPORTANCE OF THE STUDY**

Changes in technology enable us to gain a decisive advantage on the battlefield yet proper integration, development, and employment strategies are critical to exploiting any new weapon system to gain that advantage. “The creation of an effective military force depends upon more than the provision of adequate resources, the building of advanced weapons, or the



availability manpower. Military forces must be organized, equipped, and trained properly. Doctrine is the substance that binds them together and makes them effective.”<sup>7</sup> Doctrine and policy provide the necessary framework to ensure our systems provide the required capabilities and necessary effects on the battlefield. If doctrine and policy are non-existent or lack proper clarity, it may prove impossible to balance the force mix, integrate missions across the services, or prioritize the acquisition of new systems.<sup>8</sup> Instead, weapon system employment, integration, deployment, and acquisition is done in an ad hoc fashion, resulting in a piecemeal of systems that are unable to provide the necessary synergistic effects in the joint warfighting arena.

## **METHODOLOGY**

This monograph provides the results of research on whether or not current U.S. doctrine and policy are adequate for employment of emerging DEWs. This study will address why DEWs are important to our national defense; what policy/doctrine is; current policy/doctrine concerning DEWs; an assessment of the doctrine/policy for future employment of these systems; and finally a conclusion, followed by a set of recommendations for future development of directed energy weapon policy, doctrine and weapon systems.

To answer the research question, the monograph must answer or address the following sub-questions:

1. What are DEWs and why are they an important potential component of joint warfare operations?
2. What is the purpose of policy and doctrine?
3. What is the existing policy/doctrine concerning DEWs?
4. Does current policy/doctrine meet the criteria for effective doctrinal/policy guidance?
5. What modifications should be made to current DEW policy and doctrine?

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<sup>7</sup> Robert Allen Doughty, *The Seeds of Disaster- The Development of the French Army Doctrine 1919 – 1939*, (Hamden, Connecticut: archon Books, 1985), Pg. xi.

<sup>8</sup> Robert D. Newberry, *Space Doctrine for the 21st Century*, (Maxwell AFB, AL: Air University Press, March 1997), Pg. 2.

In order to answer the primary research question, current doctrine and policy is compared against a well-defined set of criteria. That criteria is derived from TRADOC Regulation 25-36 (Doctrinal Literature Program (DLP)) The characteristics of sound doctrine: How the military intends to conduct operations in the future and the capabilities required to execute those operations set the azimuth for doctrine development. The developer's objective is to produce sound doctrine that will enhance the military's ability to accomplish missions across the range of military operations. It must be effective, acceptable, well researched, enduring, flexible, comprehensive, consistent, and concise.<sup>9</sup>

1. Does current doctrine effectively describe how we organize, train, fight, and support these weapons, thereby contributing directly to the successful execution of operations?
2. Does current doctrine incorporate lessons learned from relevant history, exercises, and recent operations, reflecting a solid understanding of the art and science of military operations?
3. Does current doctrine account for current and near-term anticipated realities and for force modernization and organizational evolution?
4. Does current doctrine/policy convey a common understanding of how to think about conduction operations and provide a common language for discussion? Does it use clear, well-defined terms and concepts and is written to the level of the target audience?

This study of U.S. DEW policy and doctrine is presented in five chapters. This first chapter serves as an introduction. Chapter defines DEWs and identifies current systems being developed, identifies the unique capabilities/characteristics of DEWs, identifies roles of DEWs in joint operations, and analyzes historical examples where DEWs have proven effective. Chapter three defines purpose of policy and doctrine, discusses how doctrine is developed, and defines current policy and doctrine relating to DEWs. Chapter four provides the assessment of current U.S. policy and doctrine using four criteria identified in TRADOC Regulation 25-36 for

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<sup>9</sup> TRADOC Regulation 25-36, The TRADOC Doctrinal Literature Program (DLP), 5 April 2000, Chapter 3-3; available from <http://www-tradoc.army.mil/tpubs/regs/r25-36fram.htm>; internet, accessed 28 Nov 03.

characterizing sound doctrine. Finally, chapter five will provide a conclusion and recommendations on the topic.

## CHAPTER TWO: DEW SYSTEMS, APPLICATION, AND HISTORY

“Thirty years ago the vision of directed energy weapons, using high energy lasers (HEL) and high power microwaves (HPM), was first seriously engaged by the military. Within a decade the capability of these weapons to destroy or disable targets had been proven, and numerous demonstrations of lethal effect, on increasingly difficult targets, have been carried out since then.”<sup>10</sup>

### WHAT ARE DEWS?

Joint Publication 1-02 defines directed energy (DE) as “an umbrella term covering technologies that relate to the production of a beam of concentrated electromagnetic energy or atomic or subatomic particles.”<sup>11</sup> Directed energy weapons (DEW) are defined by Joint Publication 1-02 as, “a system using directed energy primarily as a direct means to damage or destroy enemy equipment, facilities, and personnel.”<sup>12</sup> Joint Publication 1-02 further defines Directed Energy Warfare as “military action including the use of directed energy weapons, devices, and countermeasures to either cause direct damage or destruction of enemy equipment, facilities, and personnel, or to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum through damage, destruction, and disruption.”<sup>13</sup>

### DIRECTED ENERGY WEAPON SYSTEMS

There are three primary types of DE weapon systems this study is concerned with, High Power Microwaves (HPM), Radio Frequency Munitions (RFM), and Laser directed energy (LDE).<sup>14</sup>

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<sup>10</sup> New World Vistas: Air and Space Power for the 21st Century, Directed Energy Volume (hereafter known as New World Vistas), 18 June 1996, Pg. V.

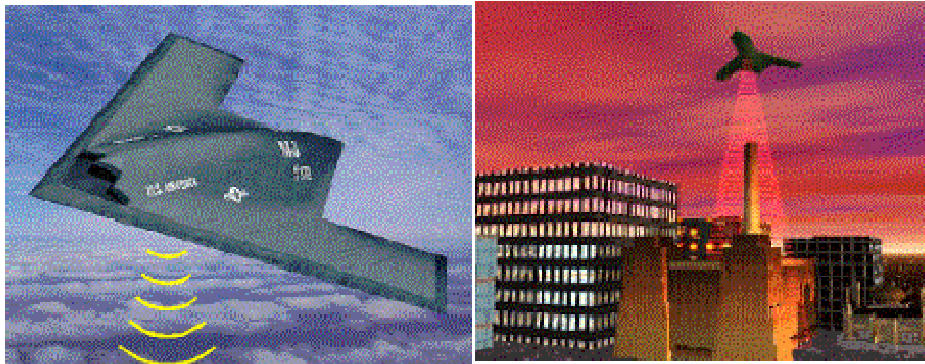
<sup>11</sup> Joint Chiefs of Staff, Joint Publication 1-02 (hereafter known as JP 1-02), Department of Defense Dictionary of Military and Associated Terms, Washington D.C., 12 April 2001 (as amended through 5 September 2003), Pg. 158.

<sup>12</sup> Ibid., Pg. 159.

<sup>13</sup> Ibid.

<sup>14</sup> Advisory Group for Aerospace Research and Development (hereafter known as AGARD) Advisory Report 360, Aerospace 2020, Volume II- Main Report, September 1997, Pg. 51.

HPMs are used in a variety of ways to include disrupting electronic components and as direct engagement of combatants. Their effectiveness against our adversary's weapon systems is based on the premise that as weapons systems become more technology advanced their susceptibility threshold decreases and lower power HPM devices can be utilized to disable or destroy them. HPMs can be operated at varying levels depending on the effect desired. At low power density, sensors can be confused while burn up of electronic components can be achieved at higher powers.<sup>15</sup> The HPM Airborne Electronic Attack (AEA) concept provides a revolutionary method for future tactical force employment (Fig. 2.1.). In the future HPM AEA payloads may be carried on a variety of platforms to include unmanned air vehicles (UAVs). HPM AEA packages will be used to directly, remotely, and potentially autonomously attack an adversary's electronic-dependent systems.<sup>16</sup>



**Figure 2.1. HPM AEA Concept**

HPMs may also be used to directly attack adversarial combat forces in a non-lethal means through technology known as Active Denial Systems (ADS). Two potential weapon systems include the Airborne ADS and the Vehicle Mounted Active Denial System (VMADS).

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<sup>15</sup> Ibid., Pg. 52.

<sup>16</sup> 2003 United States Air Force Directed Energy Master Plan Volume II (hereafter known as DEMP Vol II), - Programs and Science and Technology Investments, HQ USAF/XPXC (Washington D.C., January 2003), Pg. 26.

The Airborne ADS program (Fig. 2.2.) utilizes active denial technology (ADT), a DE non-lethal weapon (NLW) that uses microwave energy to “rapidly stop, deter, and turn back advancing adversaries from a relatively long range”<sup>17</sup>



**Figure 2.2. Airborne ADS Concept**

ADT is expected to limit enemy casualties because of its non-lethal effects. Therefore, ADT can be used across the spectrum of conflict from force protection to peace enforcement to humanitarian assistance where the use of lethal force can have monumental diplomatic implications.<sup>18</sup>

ADT works by sending out a beam of energy that causes a very rapid heating of the skin surface layers, resulting in an intense burning sensation. Despite the intensity of this burning sensation (very similar to touching a very hot light bulb), ADT does not injure targeted individuals because the beam's penetration is very shallow and the beam energy levels are too low to induce damage.<sup>19</sup>

The VMADS (Fig. 2.3.) utilizes ADT in order to “provide land combat and combat support forces with non-lethal defensive and offensive capabilities against a wide array of threat forces. This weapon will provide Air Force Security and ground forces, Special Operations Forces, and other U.S. ground combatants with a NLWs capability suitable for use in a wide

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<sup>17</sup> Ibid., Pg. 20.

<sup>18</sup> Ibid.

<sup>19</sup> Ibid., Pg. 21.

variety of environments from MOOTW and military operations in urban terrains (MOUT) to major theater wars (MTWs).”<sup>20</sup>



**Figure 2.3. VMADS**

The RFM (Fig. 2.4.) concept involves “replacing a warhead on a missile, artillery shell, or air-dropped munitions with a high peak-power RF radiating device that would be used to engage various (including high-value) targets, whose electronic circuits might be highly vulnerable if they are engaged at short distance.”<sup>21</sup> RFMs operate on the premise of with Electromagnetic pulse (EMP) or Ultra wideband Pulse (UWBP). EMP & UWBP devices produce a high-power pulse covering the high frequency (HF) to the ultra high frequency band; an effect quite similar to an exoatmospheric nuclear blast is created although by a non-nuclear means.<sup>22</sup> UWBP devices produce a continuous spectrum of pulsed energy over a range of 100 MHz to 5 GHz allowing the device to affect all frequencies simultaneously and thus affect a greater range of enemy targets. Accurate control of UWBP system would allow friendly forces to selectively attack particular enemy systems based of the frequencies of the pulse generated.<sup>23</sup> RFMs offer distinct advantages over conventional munitions in that they are non-lethal, can

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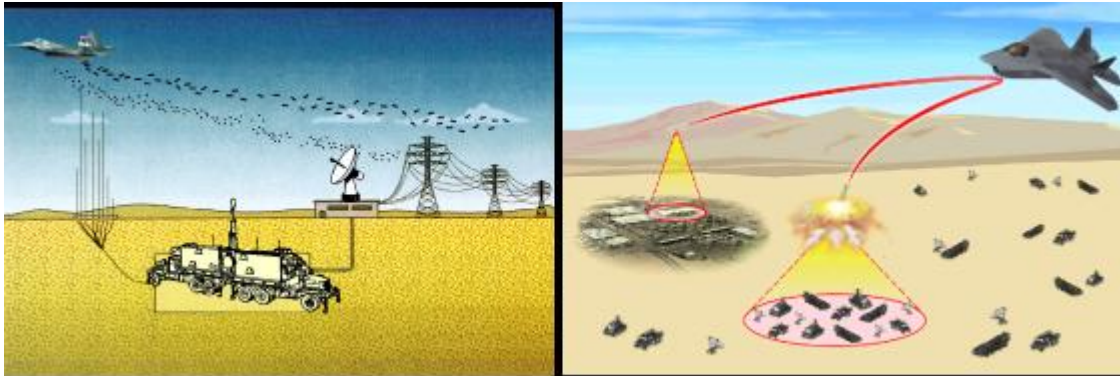
<sup>20</sup> Ibid., Pg 80.

<sup>21</sup> AGARD, Pg. 53.

<sup>22</sup> Ibid.

<sup>23</sup> Ibid.

disrupt or destroy many physically separated targets simultaneously, and their effects are persistent over a large area.<sup>24</sup>



**Figure 2.4. RFM Concepts**

This new capability will provide the user with increased mission effectiveness while minimizing collateral damage near the intended target. Current precision-guided munitions rely on highly accurate targeting systems with explosive yields that are small enough to destroy the target while attempting to leave the surrounding structures relatively intact. RFMs generate pulses that couple through landlines, antennas, and even wires outside of buildings into the electronic components of the targeted systems. This results in upset, disruption, or burnout of the electronic components within the targeted systems

LDE is probably the most widely known and publicized of the DE weapon systems. The characteristics of almost instantaneous flight times combined with a directional beam make LDEs very attractive in both the offensive and defensive realms of warfare. There are two primary classifications of LDE, high-energy lasers (HEL) and low-power lasers (LPL).<sup>25</sup>

HELs generate visions of Star Trek™ and Star Wars™ and it's no surprise that the concept of using HELs as a DE weapon system is at least a quarter century old. HELs have been limited in development due to problems with size and weight, however technological advances seem to indicate there will be technological breakthroughs in the next 20 years.<sup>26</sup> For instance, initial

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<sup>24</sup> DEMP Vol II, Pg. 25.

<sup>25</sup> AGARD, Pg. 53.

<sup>26</sup> Ibid.



HEL research centered on the development and testing of the gas-dynamic carbon dioxide (CO<sub>2</sub>) laser. Although the Airborne Laser Laboratory (ALL) successfully developed and tested the CO<sub>2</sub> laser, the CO<sub>2</sub> laser's radiation is strongly absorbed by the atmosphere, and thus its application was severely limited.<sup>27</sup> In order to meet the need for high power long-range systems the United States Air Force (USAF) has led the development of the Chemical Oxygen Iodine Laser (COIL) and the hydrogen fluoride (HF) chemical laser systems. Additionally, research has been conducted on solid-state lasers (SSLs), free-electron lasers, and excimer lasers, but significant research is necessary before the output level of these lasers are sufficient for high-power military applications.<sup>28</sup> Three of the most highly known HEL systems are the Airborne Laser (ABL), the Space based Laser (SBL), and the Advanced Tactical Laser (ATL).

The ABL (Fig. 2.5) is a Boeing 747-based multi-megawatt (MW) laser platform that will engage and destroy ballistic missiles (BM) during their boost phase at hundreds of kilometers standoff range. Although the ABL's primary mission is missile defense, it could support other missions including: force protection, by providing enhanced BM post-boost phase tracking cues to other MD systems, and strike operations, since it can accurately determine BM launch-points to enable precision strikes against BM transporter erector-launchers.<sup>29</sup> The weapon system consists of a 1.5-meter diameter primary mirror, six onboard infrared sensors that provide 360 degrees of coverage to autonomously detect boosting missiles in a 700-mile radius, and a megawatt-class COIL used to heat missile structures to their failing point, resulting in destructive kills of the missiles. The ABL will cruise at over 40,000 feet and be capable of destroying a minimum of twenty enemy missiles. Greater potential may exist, but is dependent on engagement geometry, atmospheric conditions, and missile type. Since the ABL aircraft will be in-flight refuelable, only a few ABLs will be required to provide continuous MD/Force Protection of U.S. and

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<sup>27</sup> 2003 United States Air Force Directed Energy Master Plan Volume I (hereafter known as DEMP Vol I), - Foundation & Investment Strategy, HQ USAF/XPXC (Washington D.C., January 2003), Pg. 9.

<sup>28</sup> Ibid.

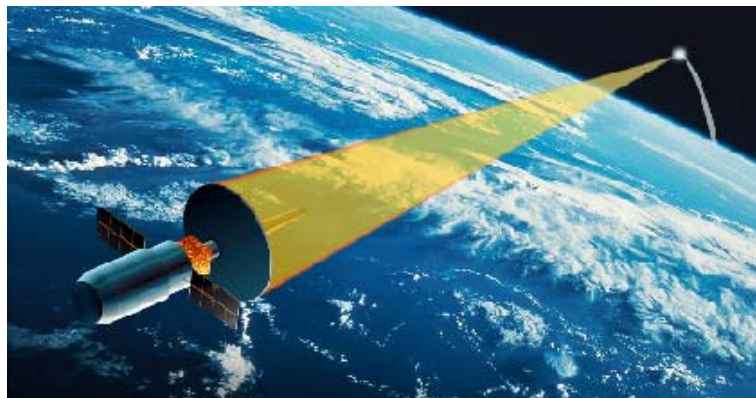
<sup>29</sup> DEMP Vol II, Pg. 3.



**Figure 2.5. Airborne Laser**

coalition forces throughout an area of operations (AO) from the earliest phase of the operation. The ABL will provide flexible and rapidly deployable MD capability for expeditionary operations.<sup>30</sup>

The SBL Program (Fig. 2.6) remains a long-term element of the United States MD strategy to achieve a global, ballistic missile defense capability. The SBL concept consists of a constellation of orbiting laser weapons (cylindrical hydrogen fluoride (HF) MW-class lasers with



**Figure 2.6. SBL Concept**

a 4 m primary beam director and an integrated beam-control system). These systems will be capable of detecting and negating a plethora of BM systems at anytime and anywhere in the world. The global characteristics of the SBL program coupled with other Missile Defense Agency (MDA)

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<sup>30</sup> Ibid., Pg. 4.

MD systems currently being developed by the United States Army and the USAF will provide mutual enhancement and a layered umbrella approach to MD.<sup>31</sup>

The SBL is not expected to deploy until after 2017. This long-range projection coupled with the continued development of better laser technology has led senior military advisors to recommend the SBL concept remain flexible. Still, SBL will need to be tested on-orbit in order to validate its MD capabilities as well as several ancillary missions to include; “ground surveillance and reconnaissance, tactical warning, target designation for precision strikes by conventional systems/assets, space object tracking and identification, and counter space, counter air, and strategic interdiction of soft ground targets.”<sup>32</sup>

“The ATL (Fig. 2.7) is an Advanced Concept Technology Demonstration (ACTD) program to demonstrate a tactical HEL weapon system on an airborne platform. This jointly sponsored effort will demonstrate technology concepts to satisfy mission needs for an ultra-precision strike capability.”<sup>33</sup> The specific ATL objectives include ultra-precision strike missions for the warfighter using a modularized sealed exhaust COIL system, capable of deployment on a C-130, and demonstrated ability to track and engage tactical targets in an air-to-ground situation. Potential target sets include vehicles, aircraft, munitions, rockets/mortars, optical and radar surveillance systems, communication infrastructure, and other military targets.<sup>34</sup>



**Figure 2.7. ATL Concept**

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<sup>31</sup> Ibid., Pg. 12.

<sup>32</sup> Ibid., Pg. 13.

<sup>33</sup> Ibid., Pg. 16.

<sup>34</sup> Ibid., Pg. 17.

The ATL concept includes the ability to covertly conduct precise engagements at tactically significant standoff distances with little or no collateral damage. Although the ACTD will demonstrate ATL on a C-130, the ATL weapon will be designed to be platform-independent, modular system that could be rolled on/rolled off any number of airborne tactical platforms including the AC-130, the CV-22, and several larger helicopters.<sup>35</sup>

ATL brings new capabilities to joint operational arena such as Urban Close Air Support (CAS), employed from platforms such as the AC-130 in the near term, followed by other “fast-movers” in the mid and far term. The ATL will also be able to conduct Air-to-Surface Strike with an emphasis on suppression of enemy air defense (SEAD) targets. There are also plans to develop a “Combined Arms Gun Ship” by employing the ATL on a United States Marine Corps (USMC) MV-22 Osprey in order to protect and support Marine Air-Ground Task Forces (MAGTFs) deployed in expeditionary operations from peace keeping to force projection missions. The ATL will provide airborne tactical anti-air warfare (AAW), Direct Fire and Maneuver, and operations-other-than-war (OOTW) non-lethal weapons (NLWs) support to the MAGTF.<sup>36</sup>

Unlike HELs, LPLs offer a large number of capabilities and effects in the relatively near term. LPLs technology is being utilized in a wide range of systems including (not an exhaustive list) laser communications, battlefield laser wound cauterizers, improved laser designating systems, and automated optical defeat systems such as the Electro-Optical Day/Night Multifunction/Multithreat Countermeasures.

One such LPL application is the Hindering Adversaries with Less-than-lethal Technology (HALT) system (Fig. 2.8). HALT was developed at the Air Force Research Laboratory (AFRL). HALT utilizes an eye-safe laser that fits in an M-16 grenade launcher to target adversaries (i.e.,

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<sup>35</sup> Ibid.

<sup>36</sup> Ibid. Pg. 18.

place a small bright laser spot on) and thus hinder them from taking hostile actions since they know they have been detected and are targeted. <sup>37</sup>



**Figure 2.8. HALT Laser Device**

All of the weapon systems described above provide unique capabilities to the warfighter across the full spectrum of operations. Before a discussion of policy/doctrine can take place, we must understand the roles, enduring concepts and enablers of joint operations, and the elements of joint operational art and how DEW capabilities and characteristics compliment these important facets of our current/future military posture.

## **IMPORTANCE OF DEWS IN JOINT WARFARE OPERATIONS**

“There is still a tendency in each separate unit . . .to be a one-handed puncher. By that, I mean that the rifleman wants to shoot, the tankier to charge, the artilleryman to fire . . .To get harmony in battle, each weapon must support each other. Team play wins.”

GEN George S. Patton, Jr., USA<sup>38</sup>

In this section, we will answer the second part of sub-question #1, why are DEWs an important potential component of joint warfare operations?” Specifically, we will look at two components of joint operations, joint enduring concepts and the elements of joint operational art.

## **JOINT ENDURING CONCEPTS**

The ability to commit U.S. military power depends on the posture and readiness of the forces. The Armed Forces of the U.S. apply a set of enduring concepts for conducting key types

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<sup>37</sup> Ibid., Pg. 84.

<sup>38</sup> Joint Publication 1 (hereafter known as JP-1), Joint Warfare of the Armed Forces of the United States, Washington D.C., 14 November 2000, Pg. V-1.

of military operations. These concepts provide guidelines to define and establish the posture needed to accomplish contemporary missions. In view of the current international security environment, these concepts enable the U.S. military to react quickly and effectively to the direction of the national leadership. There are seven enduring concepts of joint operations: strategic agility, overseas presence, power/force projection, decisive force, forcible entry, timeliness, and survivability.<sup>39</sup> Although DEWs support all seven concepts, their application is particularly evident in terms of strategic agility, force projection, and timeliness.

### **STRATEGIC AGILITY**

“Strategic agility is the ability to adapt, conceptually and physically, to changes in the international security environment in order to prevent an adversary from successfully exploiting surprise and to ensure the protection of U.S. interests at risk.”<sup>40</sup> DEWs lend themselves to being strategically agile because they are inherently flexible depending on the mission assigned and the threat within the operating environment. DEW employment may prove just as decisive in a MTW by destroying or disabling enemy tanks and aircraft as they do in a peace enforcement or peacekeeping mission by deterring aggressive action by belligerent parties.

### **FORCE PROJECTION**

Force projection is the ability to project the military instrument of national power from the continental United States (CONUS) or another theater, in response to requirements for military operations....<sup>41</sup> One key component of space-based DEWs is the concept of global presence. Traditionally, military force projection has consisted of overseas forward basing or the presence of an U.S. Navy Carrier Battle Group in the littoral waters near a conflict. Deployment and staging of these power projection capabilities takes time. Space based DEWs however, possess all the means of presence such as strategic agility, situational awareness, and lethality but

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<sup>39</sup> Ibid., Pg. IV-6

<sup>40</sup> Ibid.

<sup>41</sup> Ibid.

have the advantage of being propositioned in orbit above the earth's surface, ready to be employed at a moments notice, and the ability to engage at the speed of light.<sup>42</sup>

## **TIMELINESS**

“U.S. military campaigns should be designed to achieve their objectives in the most rapid, effective manner possible and at the lowest cost feasible in terms of loss of life and unwanted destruction.”<sup>43</sup> Global presence, flexible engagement protocols, and speed of light transmission make DEWS decisive on a global scale. DEWs may achieve the same rapid defeat of the enemy as traditional weapon systems without physical destruction utilizing AEA, RFMs, and Airborne and Vehicle mounted ADS. If developed and employed properly, DEWs will be able to surgically defeat the enemy's ability to resist without immediate threat of loss of life or collateral damage. Using flexible engagement protocols, damage levels will vary from functional disablement to lethal destruction.<sup>44</sup> However, they should not become the “catch-all” in terms of force application because of the potential long-term effects they can have. Although DEWs may minimize the risk of immediate loss of life and collateral damage, careful examination of the consequences of individual actions, sequences of actions, and the possible consequences of those actions must be accomplished in order to prevent unwanted collateral effects.<sup>45</sup>

## **ELEMENTS OF JOINT OPERATIONAL ART**

Joint operational art translates strategy into operational design for the joint employment of forces at all levels of war. Joint operational art integrates force capabilities, unifies them toward the command's major objectives, and guides the development, organization, integration, and execution of strategies, campaigns, major operations, and battles.<sup>46</sup> There are fourteen elements of joint operation art: synergy, simultaneity and depth, anticipation, balance, leverage,

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<sup>42</sup> New World Vistas, Pg. 29.

<sup>43</sup> JP-1, Pg. IV-8.

<sup>44</sup> New World Vistas, Pg. viii.

<sup>45</sup> Dietrich Dörner, *The Logic of Failure: Why Things Go Wrong and What We Can Do to Make Them Right*. Translated by Rita and Robert Kimber, (New York: Henry Holt and Company, 1996), Pg. 154.

timing and tempo, operational reach and approach, forces and functions, arranging operations, centers of gravity, direct versus indirect, decisive points, culmination, and termination. Although DEWs are equally adept at supporting all fourteen elements, we will focus on their support of synergy, simultaneity and depth, and operational reach.

## **SYNERGY**

Synergy is the application of operational art to achieve the greatest effect from the combination of all relevant and available force capabilities. The synergy that results from the integration and synchronization of the actions of air, land, sea, space, and special operations forces over time and space assists the Joint Force Commander (JFC) to assail important adversary vulnerabilities while presenting no friendly seams or vulnerabilities for the adversary to exploit.”<sup>47</sup> DEWs are not ultimate weapons, which will end the need to put soldiers and marines on the ground or aviators in the air during a conflict. DEWs provide a new assortment of tools which provide the commander flexible capabilities for detecting and engaging the enemy and protecting his forces. DEWs if employed properly will combine with the latent lethal capabilities of each service in order to provide the synergistic effects needed to obtain victory and end the conflict on terms favorable to the U.S..

## **SIMULTANEITY AND DEPTH**

An important challenge in applying the operational art is to achieve the greatest effect. Another fundamental aim in applying the operational art is to bring the appropriate elements of the force to bear simultaneously against the opponent’s entire structure to the depth of the theater in order to multiply the combined effects and increase synergy. When the friendly forces have an accurate and shared awareness of the situation, understand the opponent, and operate more rapidly than the opponent can react, they can anticipate events, achieve surprise, and seize

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<sup>46</sup> JP-1, Pg. V-1.

<sup>47</sup> Joint Chiefs of Staff, Joint Publication 3.0 (hereafter known as JP-3.0), Doctrine for Joint Operations, Washington D.C., 10 September 2001, Pg. III-9.



opportunities.<sup>48</sup> DEW technology provides the ability to amplify battlespace awareness allowing commanders to better leverage ISR platforms in order to confirm anticipated enemy locations, and quickly provides decision-quality information to the targeting process. DEW initiatives support the Air Force's current Global Strike Task Force (GSTF) concept by supporting the exploitation of predictive battlespace awareness, enhancing ISR technologies and processes, and a decreasing the response time to prosecute time-sensitive targets.<sup>49</sup>

## **OPERATIONAL REACH**

The ability to understand the operational reach of friendly capabilities, including those that may be in support from locations outside the immediate theater of operations is critical to operational planning and execution of combat operations. This understanding will facilitate establishing the operational approach, proper lines of operations, and sequencing operations.<sup>50</sup> Similar to space platforms and global strike forces (B2 bombers and ICBM/SLBMs) that operate from or are controlled from the CONUS today, DEW systems such as the SBL, GBL, and even CONUS-based ABLs will provide strategic-level capabilities to the combatant commander. These systems will provide immediate operational reach in a crisis through lethal and non-lethal precision strike capabilities, space control, and missile defense. It will remain important to educate commanders on these capabilities, employment characteristics, and establish proper supporting doctrine and policy in order to provide synergistic effects and full spectrum dominance against a determined and resourceful enemy.

## **HISTORICAL APPLICATION**

As we have seen, DEWs have potential application across the full spectrum of operations due to their inherent flexibility and support of the joint enduring concepts and elements of joint operational art. The beginning of this chapter highlighted some of the potential capability future

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<sup>48</sup> JP-3.0, Pg. III-11.

<sup>49</sup> Jumper, Pg. 2.

<sup>50</sup> JP-3.0, Pg. III-16.

DEWs might possess. However, DEWs have been used and are being used in where technology is mature enough. The following is a historical example of how DEWs were used to provide required effects while limiting or eliminating unwanted collateral damage. This example provides a glimpse into the possibilities that may exist with DEWs in the future.

## MOGADISHU

In 1993, U.S. Marines returned to Mogadishu Somalia on a mission to cover the extraction of all remaining United Nations troops in Somalia. Operation United Shield was to be precise and short. It also marked the first time the Marines had publicly declared they would be carrying non-lethal weapons for the purpose of riot control. The Marines did not want a repeat of the ill-fated Ranger raid of 1991; therefore, security and force protection levels were high. One evening while the Marines were performing anti-sniper surveillance, the Marines were using a non-blinding laser to enhance the capability of their third generation night vision goggles. This particular laser emitted a green light at 532 nanometers wavelength, which is visible to the naked eye. While scanning the vicinity, the team noticed suspicious activity in a building approximately a mile away. Inside the building, a small team was setting up a mortar position. Once the threat was confirmed, the team leader requested a hellfire strike from an on station helicopter gunship. However, as the team continued to observe the mortar crew, it became apparent that the mortar crew became aware that they were being immersed in an eerie green light. One of the team members came to the window and raised his hands in surrender. The rest of the crew responded in the same way. The air strike was called off; there was no need to destroy the building and risk collateral damage.<sup>51</sup> This was not an isolated event.

Another anti-sniper team in Mogadishu was utilizing a prototype red diode laser one evening when they observed a 4-man team moving through the dark streets. Using their NVGs

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<sup>51</sup> John B. Alexander, *Future War: Non-Lethal Weapons in Twenty-first Century Warfare*, (New York: St. Martin's Press, 1999), Pg. 60.

they determined only one individual appeared to be armed with a sniper rifle. The team placed a small red dot on the individual's chest. Surprised, the individual stopped moving, put down his rifle, and raised his hands. Although only the rifleman was illuminated, all of the individuals with him raised their hands in surrender.<sup>52</sup>

These two examples show how DEWs, even low powered lasers, can have immediate and decisive impact on the battlefield of today. In the end, there were no casualties in Operation United Shield. Although these examples are promising, they are limited in scope, application, and ultimately strategic impact.

DEWs may eventually have the capability to inflict long-term lethal and non-lethal effects on the battlefield and national infrastructure of our adversaries. They require as serious look at current policy and doctrine to ensure we apply them properly, maximize synergy and effects, and manage undesired world impact. In order to do this we must analyze our current doctrine and policy. However, first we must define doctrine and policy, as well as identify the applicable U.S. policy and doctrine we must analyze. Chapter three will provide an answer to sub-questions # 2 & 3: What is the purpose of policy and doctrine? Moreover, What is the existing policy/doctrine concerning DEWs?

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<sup>52</sup> Alexander, Pg. 61.

## CHAPTER THREE: DEW POLICY AND DOCTRINE

“Military doctrine cannot be allowed to stagnate, especially an adaptive doctrine like maneuver warfare. Doctrine must continue to evolve based on growing experience, advancements in theory, and the changing face of war itself.”

**Gen Charles Krulak, USMC<sup>53</sup>**

### PURPOSE OF U.S. POLICY AND DOCTRINE

#### POLICY

The definition of policy is multi-faceted. First, “Policy is the course or general plan of action adopted by a government or party or person.”<sup>54</sup> It provides the answer to the strategic question: “What does the U.S. want to do?” Policy decisions establish the ground rules that will determine a nation’s action or inaction in a particular situation. National policy [is] a broad course of action or statements of guidance adopted by a government at the national level in pursuit of national objectives.<sup>55</sup> Broadly, it defines our national interests and how we will respond to crisis using our instruments of power from economic sanctions to nuclear war. In addition, it answers such questions as “Does the use of chemical weapons equal a nuclear attack?” “Do we consider an attack on our space satellites or information systems the same as an attack on our homeland?” Policy also focuses the national instruments of power by communicating the priorities, vision, strategy, and strategic perceptions of the governing body that produces it. In the United States, our civilian leadership sets policy that guides military operations, and this policy changes over time depending on the political administration and strategic environment.<sup>56</sup>

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<sup>53</sup> JP 1. I-9.

<sup>54</sup> Steven Schofield and Nick Lewer. *Non-Lethal Weapons, a Fatal Attraction?* (London: Zed Books Ltd., 1997), Pg. 50.

<sup>55</sup> JP 1-02, Pg. 295.

<sup>56</sup> Commander, Air Force Doctrine Center, *Doctrine Watch #6* (hereafter known as *Doctrine Watch #6*): *Policy-Doctrine-Strategy*, (Air Force Doctrine Center, 11 February 2000), NP.

## DOCTRINE

According to Joint Publication 1, “military doctrine presents fundamental principles that guide the employment of forces. It provides the distilled insights and wisdom gained from experience in warfare and other operations requiring the use of the military instrument of national power. The importance of joint doctrine is the common perspective it promotes in which to plan, train, and conduct military operations in combat and non-combat situations. Doctrine also fundamentally shapes the way the armed forces think about the use of the military instrument of national power.”<sup>57</sup>

“Although joint doctrine is neither policy nor strategy, it serves to make U.S. policy and strategy effective in the application of U.S. military power.”<sup>58</sup> Joint doctrine is authoritative guidance that must be followed except when, in the judgment of the commander, exceptional circumstances dictate otherwise. Service doctrine possesses all the same characteristics and requirements as joint doctrine except that it must be consistent with joint doctrine and joint doctrine always takes precedence over individual Service doctrines. Unlike policy, doctrine changes only when experience or advances in technology require a change.<sup>59</sup>

## HOW ARE POLICY AND DOCTRINE DEVELOPED?

### POLICY DEVELOPMENT

The primary policy maker in the U.S. government is the Executive Branch, led by the President of the United States. As stated before, policy guides the way our nation approaches issues/crises in every conceivable area from foreign policy to economic policy to defense policy. Each administration attempts to clearly state their policy in a particular area in order to focus the activities of the affected areas of government. For instance, the National Security Strategy (NSS) is normally published at the beginning of a President’s term in office. The NSS serves to focus

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<sup>57</sup> Ibid., Pg I-8.

<sup>58</sup> Ibid.

<sup>59</sup> Doctrine Watch #6.

the economic, military, and diplomatic initiatives during the president's term. In most cases, the NSS is further clarified and refined by the affected government agencies. In the case of the military, the Department of Defense (DoD) produces the National Military Strategy (NMS) and DoD directives to further focus the actions of the services in order to meet the national objectives set forth by the President in the NSS.

## **DOCTRINE DEVELOPMENT**

The Chairman of the Joint Chiefs of Staff has the statutory responsibility to develop and disseminate joint doctrine, and does so in coordination with the Services and combatant commands. The joint doctrine development process provides the conceptual basis by which Armed Forces assess, review, and revise doctrine and concepts for the future. The continuous application of joint doctrine in training and leader development also encourages development of new and innovative capabilities — including joint tactics, techniques, and procedures — that improve upon extant capabilities. Feedback to the doctrine process from joint exercises and operations validates time-tested principles for successful military action as well as incorporates contemporary lessons that together guide aggressive exploitation of U.S. advantages against adversary vulnerabilities. This process is essential for the continuing vitality and improvement of joint doctrine and the consistency of Service doctrine and procedures. This process of deliberate and experience-based doctrinal change is crucial for the present and future effectiveness of the armed forces of the United States.

## **CURRENT DOCTRINE RELATING TO DE WEAPONS.**

Now that we understand the intent and purpose of U.S. policy and doctrine, we can look closer at the current policy and doctrine that either directly or indirectly affects the acquisition, development, and ultimately employment of DEWs. This portion of the chapter will answer sub-question #3: What is the existing policy/doctrine concerning DEWs? We will look at national level policy, joint policy, and joint doctrine.

## NATIONAL POLICY FOR DE WEAPONS

### ***NATIONAL SECURITY STRATEGY (NSS)***

The NSS states the unparalleled strength and forward presence of the U.S. armed forces is what maintains strategic balance and peace in support of U.S. national objectives. It also states the threats and enemies to our nation have changed. In order to meet and defeat these new threats and enemies our military must transform. No longer can the U.S. rely on a military posed to take on a Cold War era enemy. Our military must be flexible, responsive, and lethal.<sup>60</sup>

The transformation of our military to meet the challenges of a new strategic environment will require the acquisition of new weapon systems with the capability to meet current and emerging threats. Specifically, “We must prepare by developing assets such as advanced remote sensing, long-range precision strike capabilities, and transformed maneuver and expeditionary forces. This broad portfolio of military capabilities must also include the ability to defend the homeland, conduct information operations, ensure U.S. access to distant theaters, and protect critical U.S. infrastructure and assets in outer space.”<sup>61</sup>

Although DEWs are not specifically cited in the NSS, the intent and vision are clear. The U.S. military must continue to plan, develop, deploy, and employ weapon systems that will provide deterrence, and ensure U.S. military dominance on a global scale.

### ***NATIONAL MILITARY STRATEGY (NMS)***

The NMS describes four strategic concepts that govern the use of our military forces to meet the demands of the strategic agility, overseas presence, power projection, and decisive operations.<sup>62</sup> Chapter two of this paper identified each of these concepts as joint enduring concepts in accordance with Joint Publication 1. Moreover, each of these concepts is supported by the inherent capabilities DEWs bring to the military instrument of power.

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<sup>60</sup> NSS, Pg. 29.

<sup>61</sup> NSS, Pg. 29-30.

<sup>62</sup> U.S. Department of Defense, Chairman of the Joint Chiefs of Staff, National Military Strategy (hereafter known as NMS), (Washington D.C., 1997), NP; available from <http://www.dtic.mil/jcs/core/nms.html>; internet; accessed 9 Sep 03.

The NMS states throughout its entirety that “the U.S. military must have capabilities that give the national leadership a range of viable options for promoting and protecting U.S. interests in peacetime, crisis, and war.”<sup>63</sup> Further, the NMS states that the military must continue to provide the national leadership with the capability to provide strategic deterrence, decisive operations, force protection, and space control. Inherent in these capabilities is the ability to attack global targets rapidly and precisely, unrestricted by geography or political constraints from long range; against a full range of targets in hostile territory.<sup>64</sup> Additionally the military must gain initiative quickly, halt the enemy, reduce his ability to fight, and defeat him through decisive operations. Simultaneously, the military must provide for multiple layers of protection for U.S. forces from home station through predeployment, employment, to redeployment, allowing our forces freedom of action to conduct decisive operations. Lethal and non-lethal capabilities will be required in order to maintain force flexibility and adaptability.<sup>65</sup> Finally, the U.S. must maintain our technological lead in space. Recent operations have highlighted the need to guarantee our access and use of space as part of joint operations. As with force protection, we must ensure our freedom of action in space and if needed deny our adversaries the same. Space control is and will continue to be a critical requirement to ensure our success in future military operations.<sup>66</sup>

Each of these above capabilities/concepts can be met with the employment of DEWs. As cited in chapter two, DEWs may provide our forces with the ability to strike global targets rapidly, protect our forces on the ground and in the air, and provide the necessary space control to ensure our space based navigation, communications, surveillance, and early warning systems remain intact.

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<sup>63</sup> NMS.

<sup>64</sup> NMS.

<sup>65</sup> NMS.

<sup>66</sup> NMS.



## **QUADRENNIAL DEFENSE REVIEW (QDR)**

The QDR, like the NSS and NMS provides very broad guidance and focus to the DoD in terms of strategic threats, required future capabilities, and priorities. The 2001 QDR indicated the military must focus on the ability to act quickly when challenged and to win decisively at a time and place and in a manner of the President's choosing. "Forces must fight from a forward deterrent posture with immediate globally employable forces, including long-range precision strike capabilities from within and beyond the theatre...while limiting collateral damage, increasing deterrence, and denying sanctuary to our potential adversaries."<sup>67</sup> The QDR also warns of the proliferation of threats to U.S. space superiority such as, the use of GBLs, space jammers, and micro-sats and highlights the need to ensure our ability to exploit space for military purposes, while denying our adversaries the same.<sup>68</sup> Like the NMS, the QDR focuses the requirement to protect our forces, friends, and allies through a layered missile defense system, due to the proliferation of ballistic missiles and cruise missiles.<sup>69</sup>

As with the NSS and NMS, the QDR broadly describes/prescribes the development/employment of weapon systems capable of projecting force, deterring adversaries, protecting our forces and our space-based assets.

## **NATIONAL SPACE POLICY**

The National Space Policy specifically mandates the DoD will conduct all space related activities necessary for national security to include deterring, warning, and defending against enemy attack, and enemy control of space assets.<sup>70</sup> The National Space Policy goes on to mandate that the DOD maintain the capabilities to execute mission areas in space support (space lift), force enhancement (communications, navigation, surveillance, missile warning), space

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<sup>67</sup> Department of Defense, Quadrennial Defense Review (hereafter known as QDR). (Washington D.C., 30 Sept. 2001), Pg. 21, 26, and 44.

<sup>68</sup> QDR, Pg. 31.

<sup>69</sup> QDR, Pg. 42.

<sup>70</sup> The White House - National Science and Technology Council, National Space Policy Fact Sheet (hereafter known as National Space Policy Fact Sheet). (Washington D.C., 19 September 1996), Pg. 4; available from <http://www.ostp.gov/NSTC/html//fs/fs-5.html>; internet; accessed 10 Sep 03.

control, and force application.<sup>71</sup> The National Space Policy does not specifically call for the development of space-based weapons under the realm of force application. However, it allows the latitude to conduct any operation in space necessary for national security.

### ***SPACE COMMISSION REPORT***

Unlike the National Space Policy, the Space Commission Report clearly states, “The U.S. must develop, deploy, and maintain the means to deter attack on and to defend vulnerable space capabilities. Explicit national security guidance and defense policy is needed to direct development of doctrine, concepts of operations, and capabilities for space including weapon systems that operate in space.”<sup>72</sup> If this recommendation is instituted it would begin the integration of DEWs such as the SBL into the U.S.’s arsenal of strategic assets.

The Space Commission recommends the U.S. acquire the means of not only negating satellite threats, (temporary and reversible or physically destructive), but also recommends the senior political and military leadership test these capabilities in exercises on a regular basis, both to keep the armed forces proficient in their use and to bolster their deterrent effect on potential adversaries.<sup>73</sup>

The Space Commission strongly supports the development and deployment of space based weapon systems. “Space offers advantages for basing systems intended to affect air, land and sea operations.” “It is also possible to project power through and from space in response to events anywhere in the world. Unlike weapons from aircraft, land forces or ships, space missions initiated from earth or space could be carried out with little transit, information, or weather delay. Having this capability would give the U.S. a much stronger deterrent and, in a conflict, an extraordinary military advantage.”<sup>74</sup> Although space based DEWs are not the only weapon

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<sup>71</sup> National Space Policy Fact Sheet, Pg. 5.

<sup>72</sup> Report of the Commission to Assess National Security Space Management and Organization (hereafter known as Space Commission Report). (Washington D.C., 11 January 2001); found at <http://www.space.gov/docs/fullreport.pdf>; internet; accessed 8 Sep 03.

<sup>73</sup> Space Commission Report, Pg. 29.

<sup>74</sup> Space Commission Report, Pg. 33.

systems being considered, DEWs offer every capability prescribed by the commission from non-lethal disruption of enemy systems, to precision lethal strike, to air and missile defense.

## JOINT VISIONS FOR DE WEAPONS

The Chairman of the Joint Chiefs of Staff's (CJCS) Joint Vision paves the way for the development of service visions, joint doctrine, force structure, and weapon system development and acquisition. JV 2010 and 2020 attempt to predict what the threat environment will look like in the next 6 to 16 years with the intent of guiding the preparation of the armed forces to meet those threats.

### ***JOINT VISION 2010 (JV 2010)***

JV 2010 predicts the next 6 years will be an era of technological change which will impact all the services by providing more robust combat capabilities. These may include long-range precision strike capability, combined with a wide range of delivery systems, as an emerging key factor in future warfare. Specifically, JV 2010 contends that GPS, high-energy research, electromagnetic technology, and enhanced standoff capabilities will provide increased accuracy and a wider range of delivery options. These capabilities will increase the combat power available for use against selected objectives, resulting in enhanced economy of force and a higher tempo of operations.<sup>75</sup> Additionally, JV 2010 recognizes the importance of being able to produce a broad range of weapons effects, from non-lethal to lethal, from sensor-fused to directed energy weapons, each with the ability to further enhance precision capability.<sup>76</sup>

### ***JOINT VISION 2020 (JV 2020)***

JV 2020 updates the premises of the JV 2010. Simply, JV 2020 identifies the importance of creating the desired effects-based lethal or non-lethal precision engagements during all types of operations. Regardless of application in combat or non-combat operations, the capability to

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<sup>75</sup> U.S. Department of Defense, Chairman of the Joint Chiefs of Staff, *Joint Vision 2010* (hereafter known as JV 2010). (Washington: Office of the Chairman, Joint Chiefs of Staff, 1996), Pg. 11.

<sup>76</sup> JV 2010, Pg. 12.

engage precisely allows the commander to shape the situation or battle space in order to achieve the desired effects while minimizing risk to friendly forces and contributing to the most effective use of resources.<sup>77</sup>

## JOINT DOCTRINE

Now that we have looked at the broad policy provided by the national government we must now to look at the current joint and service doctrine to current senior military leaders assess our needs to utilize DE in military operations. Currently, few doctrine documents address the full range of expected capabilities DE may present in the next 20 years, but they all identify needs and missions that DE could support.

### ***JOINT DOCTRINE FOR COUNTERING AIR AND MISSILE THREATS, (JP 3-01)***

The doctrine identifies both offensive and defensive operations as essential to counter the air threat and to creating an effective Theater Missile Defense (TMD). Offensive Counterair (OCA) and Defensive Counterair (DCA) operations can integrate the capabilities of DE in order to destroy, neutralize, or minimize air and missile threats, both before and after launch.<sup>78</sup>

Offensive operations supporting OCA include destroying, disrupting and neutralizing enemy aircraft, missiles, launch platforms, and their supporting structures and systems before they are employed by hostile forces. One of the methods the doctrine recognizes as supporting OCA is electronic warfare (EW). As we will see later in this paper, Joint Publication 3-51-Electronic Warfare currently defines DEWs as a component of Electronic Attack (EA) and Electronic Warfare. One of the key concepts chapter two pointed out is the intention to employ a combination of the ABL, GBL, and SBL as a means to provide air defense, missile defense, and force protection. DEWs would be able to provide non-lethal to lethal effects on enemy systems as determined by the JFC. OCA is one of the mission areas where DE has been already applied in

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<sup>77</sup> U.S. Department of Defense, Chairman of the Joint Chiefs of Staff, *Joint Vision 2020* (hereafter known as JV 2020). (Washington: GPO, June 2000), Pgs. 22-23.

<sup>78</sup> Joint Chiefs of Staff, Joint Publication 3.01 (hereafter known as JP 3-01), *Joint Doctrine for Countering Air And Missile Threats*. (Washington D.C., 19 October 1999), Pgs. v- xii.

the case of high-energy jamming and spoofing systems as we have seen in operations such as the Gulf War and Operation Iraqi Freedom.<sup>79</sup>

Defensive operations supporting DCA include active and passive measures designed to detect, identify, intercept, and destroy hostile forces attempting to attack or penetrate the friendly air. Again, DE systems such as the ABL would be capable of enhancing these operations by providing a standoff defense capability ready to provide immediate protection when and where it needed most.<sup>80</sup>

### ***JOINT DOCTRINE FOR JOINT THEATRE MISSILE DEFENSE, (JP 3-01.5)***

The Doctrine for Joint Theater Missile Defense defines the role of TMD. The capabilities of DE could increase probability of kill and prohibit the enemy from being able to counter our active and passive missile defense systems.<sup>81</sup>

The application of DEW systems integrally linked to airborne, ground and space-based detection architecture optimizes the potential of destruction at the early stage of launch. Current doctrine recognizes the difference between targeting ballistic missiles versus cruise missiles. Coupled with the mobility of cruise missile launch platforms, the small launch signature, reduced radar cross-section, and stealth technologies, cruise missiles are an extremely difficult target using current weapon systems. The application DEWs would counter this threat because of their speed, long-range engagement capabilities, and global presence. These systems would not have to necessarily destroy the threat itself by the current method of applying munitions, but instead the JFC would have the capability to use either lethal force or a more benign method of EW using DEWs.<sup>82</sup>

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<sup>79</sup> Ibid., Pg. I-2.

<sup>80</sup> Ibid., Pg. I-3.

<sup>81</sup> Joint Chiefs of Staff, Doctrine for Joint Theatre Missile Defense, Joint Publication 3-01.5 (hereafter known as JP 3.01.5). (Washington D.C., 22 February 1996), Pg. vii.

<sup>82</sup> Ibid., Pg. III-8.

### ***JOINT DOCTRINE FOR JOINT FIRE SUPPORT, (JP 3-09)***

The Joint Fire Support doctrine directs the JFC and component commanders to “synchronize fires in time, space, and purpose to increase the total effectiveness of the joint force.” One purpose of the doctrine is to give guidance to the JFC on responsibilities an organization.<sup>83</sup> The remainder of the doctrine defines fires and the operations they support.

Fires are the effects of lethal or non-lethal weapons delivered by air, land, naval, special operations forces (SOF), and space assets.<sup>84</sup> The fact that DE falls under both lethal and non-lethal categories illustrates its flexibility. Lethal DE weapon effects could include those from a laser delivered by the ATL, SBL, or GBL. This use of DE would support operations such as joint suppression of enemy air defenses (J-SEAD) and naval surface fire support (NSFS) provided to assist air, land, amphibious, or special operations forces, joint air operations, joint maneuver operations, and joint interdiction operations.<sup>85</sup>

Non-lethal weapons effects include high power microwaves and RF munitions that would be able to blind and incapacitate the enemy where needed. These effects would result in the deception of the enemy, disabling the enemy’s C2 systems, and disrupting their operations. The doctrine acknowledges the importance of non-lethal fires in military operations other than war (MOOTW) when restraint and limitations on the use of deadly force are necessary.<sup>86</sup>

### ***JOINT DOCTRINE FOR INFORMATION OPERATIONS (JP 3-13)***

Information operations (IO) involve actions taken to affect adversary information and information systems while defending one’s own information and information systems. They apply across all phases of an operation, the range of military operations, and at every level of war.

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<sup>83</sup> Joint Chiefs of Staff, Joint Publication 3-09 (hereafter known as JP 3-09), Joint Doctrine for Joint Fire Support, (Washington D.C., 12 May 1998), Pg. I-1.

<sup>84</sup> Ibid.

<sup>85</sup> Ibid., I-1 – I-2.

<sup>86</sup> Ibid., Pg. I-7.

They are a critical factor in the joint force commander's (JFCs) capability to achieve and sustain the level of information superiority required for decisive joint operations.<sup>87</sup>

Offensive IO involves the integrated use of assigned and supporting capabilities to affect adversary decision makers and achieve or promote specific objectives. Electronic Warfare is specifically listed as one of the offensive IO capabilities.<sup>88</sup>

Particularly important to joint information operations is how information operations are organized and planned. JP 3-13 prescribes a fully functional IO cell as part of the JFCs planning staff, responsible for the development and promulgation of guidance/plans for IO that shared with the supporting components and supporting organizations. JP 3-13 further prescribes that the planning organization be sufficiently flexible to accommodate a variety of planning and operational circumstances.<sup>89</sup>

JP 3-13 requires IO planning be accomplished during both deliberate and crisis action planning and that it be incorporated into the JFC's overall operations planning. IO planning due to its strategic nature must include all available capabilities whether they be joint, Service, interagency, and multinational.<sup>90</sup> Finally, IO planning must analyze risk in terms of compromise, reprisal, potential escalation of hostilities, and uncoordinated or inadvertent counteraction of IO by the various joint, Service, and/or interagency IO capability providers that may be released to the combatant commander for employment.<sup>91</sup>

### ***JOINT DOCTRINE FOR SPACE OPERATIONS, (JP 3-14)***

The Joint Doctrine for Space Operations acknowledges there are no force application assets operating in space but also states the application of force from space would target

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<sup>87</sup> Joint Chiefs of Staff, Joint Publication 3-13 (hereafter known as JP 3-13), Doctrine for Joint Information Operations. (Washington D.C., 9 October 1998), Pgs. vii.

<sup>88</sup> Ibid.

<sup>89</sup> Ibid., Pgs. ix.

<sup>90</sup> Ibid.

<sup>91</sup> Ibid.

terrestrial objectives. The current space force application definition includes ballistic missile defense and force projection (approved for inclusion in the next edition of JP 1-02.)<sup>92</sup>

JP 3-14 does not include DE capability in the defined mission areas for any of the Service components of Strategic Command.<sup>93</sup>

### ***JOINT DOCTRINE FOR ELECTRONIC WARFARE, (JP 3-51)***

Joint Doctrine for Electronic Warfare defines the role of EW in military operations. Specifically, JP 3-51 defines the role of DE in electronic warfare. In a military environment, the term EW refers to any military action involving the use of EM or directed energy to control the EM spectrum or to attack the enemy. EW includes three major subdivisions: electronic attack (EA), electronic protection (EP), and electronic warfare support (ES).<sup>94</sup>

DEWs are primarily involved in EA. EA involves the use of EM energy, directed energy, or anti-radiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability and is considered a form of fires. EA includes actions taken to prevent or reduce an enemy's effective use of the EM spectrum, either through jamming and EM deception or employment of weapons that use either EM or directed energy as their primary destructive mechanism (lasers, radio frequency weapons, or particle beams).<sup>95</sup>

As stated in chapter two, DE is an umbrella term covering technologies that relate to the production of a beam of concentrated EM energy or atomic or subatomic particles. A DE weapon is a system using DE primarily as a direct means to damage or destroy adversary equipment, facilities, and personnel. "Directed-energy warfare (DEW) is military action involving the use of DE weapons, devices, and countermeasures to either cause direct damage or destruction of

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<sup>92</sup> Joint Chiefs of Staff, Joint Publication 3-14 (hereafter known as JP 3-14), Joint Doctrine for Space Operations. (Washington D.C., 9 August 2002), Pg. GL-6.

<sup>93</sup> Ibid., Pg II-4.

<sup>94</sup> Joint Chiefs of Staff, Joint Publication 3-51 (hereafter known as JP 3-51), Joint Doctrine for Electronic Warfare. (Washington D.C., 7 April 2000), Pg. I-2.

<sup>95</sup> Ibid.



adversary equipment, facilities, and personnel, or to determine, exploit, reduce, or prevent hostile use of the EM spectrum through damage, destruction, and disruption.”<sup>96</sup>

JP 3-51 highlights that “destructive DE weapons are becoming an increasingly important part of the physical destruction actions of joint operations”<sup>97</sup> JP 3-51 requires joint EW staff personnel work with other joint planners such as air planners, fire support personnel in coordinating the physical destruction actions during combat operations. DE planners would identify assets in support of an operation to destroy adversary emitters in support of military deception, SEAD, OPSEC, and PSYOP efforts.<sup>98</sup>

How EW assets are organized and EW planning is conducted is critical to joint operations. EW must be integrated into joint operation as it supports all phases and aspects of a campaign. EW joint force organization for planning and execution is the prerogative of the JFC.<sup>99</sup>

Just as in other aspects of joint operations, joint EW is centrally planned and decentrally executed. Since most U.S. EW assets come from the Military Services, Service component EW planners should be integrated into the joint planning process. The major requirements of interoperability are to establish standards and practice procedures that allow for integrated planning and execution of EW operations (including joint EW) as well as timely and routine exchange of EW information.<sup>100</sup>

Thus far, we have looked at research sub-questions #1 – 3. First, we reviewed what DEWs are, the capabilities they will bring to bear, and how they fit into joint warfighting. Second, we discussed what U.S. policy and doctrine are and how they are developed. Finally, we reviewed current national policy and joint doctrine to determine the current guidance the U.S. is

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<sup>96</sup> Ibid., Pg. GL-5.

<sup>97</sup> Ibid., Pg. IV-6.

<sup>98</sup> Ibid.

<sup>99</sup> Ibid., Pg. vii - ix

<sup>100</sup> Ibid.

utilizing to guide the development, acquisition, and ultimately employment of DEWs. In chapter four, we will analyze current doctrine and policy to see if it is adequate for the employment of emerging DEW systems (primary research question). In order to do this, we will apply current DEW policy and doctrine to the four criteria listed in chapter one.

## CHAPTER 4: ASSESSMENT OF CURRENT U.S. POLICY AND DOCTRINE

The purpose of this chapter is to analyze the doctrine and policy presented in chapter three and answer sub-question #4: Does current policy/doctrine meet the criteria for effective doctrinal/policy guidance? To do this we will four criteria concerning the effectiveness, development, adaptability, and understandability of current doctrine and policy.

### **CRITERIA #1: Does current doctrine/policy effectively describe how we organize, train, fight, and support these weapons, thereby contributing directly to the successful execution of operations?**

The joint publications and policy cited in this paper generally address the organization, training, execution, and support of the forces and weapon systems necessary to ensure effective execution of joint operations and U.S. national security. Although the need for the potential DEW capabilities addressed in chapter two are cited in multiple national policy documents, joint publications, and service publications, the predominant support for criteria #1 is found in JPs 3-13 (IO) and 3-51 (EW). It is important to remember JP 3-51 places DEWs under EW, and JP 3-13 places EW under IO. The dependence on EM energy by systems that sense, process, store, measure, analyze, and communicate information creates IO opportunities and vulnerabilities we can exploit with EW. Through lethal and non-lethal options, we can affect adversary information and information systems. Therefore, EW and ultimately DEWs are integral to IO operations. It will remain important as DEW technologies mature and are deployed to integrate their capabilities through the IO cell during joint operations. This will ensure we realize the potential synergistic benefit of synchronizing the efforts of all the capabilities and related activities of IO in a coordinated manner.<sup>101</sup>

JP 3-13 and 3-15 provide the JFC guidelines for organizational structure,

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<sup>101</sup> Ibid., Pg. III-4.

planning structure, IO/EW training, exercises, and modeling and simulation across the DoD, interagency, and multi-national operations. JP 3-13 chapter IV Information Operations Organization specifically prescribes a fully functional IO cell for the planning and execution of successful IO. Within the IO cell, JP 3-13 recommends over 20 agencies/staffs for the development and promulgation of guidance/plans for IO that are passed to the components and supporting organizations and agencies for detailed mission planning and decentralized execution. JP 3-13 further identifies the support requirements for each of the IO cell representatives ranging from intelligence support to vulnerability and threat analyses. Finally, JP 3-13 prescribes an organizational structure that is flexible enough to accommodate a variety of planning and operational circumstances.<sup>102</sup>

JP 3-13 chapter V, Information Operations Planning, provides general IO planning methodology, fundamentals, coordination, and integration/deconfliction guidelines. Specifically, JP 3-13 recognizes the need to begin planning for IO operations early in the conflict, ensure IO strategy is linked to national strategic guidance, and that a thorough analysis of enemy and friendly centers of gravity and leverage points must be done prior to operations commencing. Finally, JP 3-13 identifies the requirement to have continuous coordination, integration, and deconfliction between components, groups, organizations, and agencies to ensure proper synchronization and ultimately synergy in joint operations.<sup>103</sup>

JP 3-13 chapter VI, Information Operations in Training, Exercises, and Modeling and Simulation, provides the essential elements of IO training, IO in joint exercises, and their inclusion in modeling and simulation. “Effective employment of IO in joint operations depends on the ability to organize and train in the manner the U.S. intends to employ military force.”<sup>104</sup> JP 3-13 recommends the JFC ensure personnel responsible for planning and conducting IO receive

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<sup>102</sup> Ibid., Pg. IV-1 – IV-9

<sup>103</sup> Ibid., Pg. V-1 – V-4.

<sup>104</sup> Ibid., Pg. x.

joint training in both offensive IO and defensive IO. Specifically, JP 3-13 recommends IO training to include the integration of all available and potentially available offensive/defensive capabilities to execute IO, including multinational and other interagency capabilities.

JP 3-13 goes on to recommend the JFC incorporate IO training into joint exercises in three ways: as a stand-alone capability where IO is the only strategy used to defeat the adversary; as a supported capability, where IO is the main effort, supported by other joint operations; and finally as a supporting capability, where IO is used as a force multiplier within a conventional campaign.<sup>105</sup>

Because IO can be used at each of the levels of war as well as during MOOTW, it requires a strong understanding of organization, planning, execution, and training in order to ensure mission effectiveness. JP 3-13 and 3-15 prescribe basic relationships, support requirements, and planning guidance and allows the JFC full flexibility to tailor forces, planning efforts, and organizations in order to ensure unity of effort in the accomplishment of the overall mission.<sup>106</sup> The guidelines provided by JP 3-13 and 3-15 form an essential framework for incorporating emerging DEW technology into IO and EW operations. However, future DEWs capable of creating effects across the strategic, operational, and tactical levels of war will require the development of more specific guidance in order to properly organized, plan, coordinate, and utilize these weapons. The guidelines spelled out in JP 3-13 and JP 3-15 are very general in nature and will eventually require refinement as DEWs mature; however, they provide a proper step-off point for the development of more specific guidance.

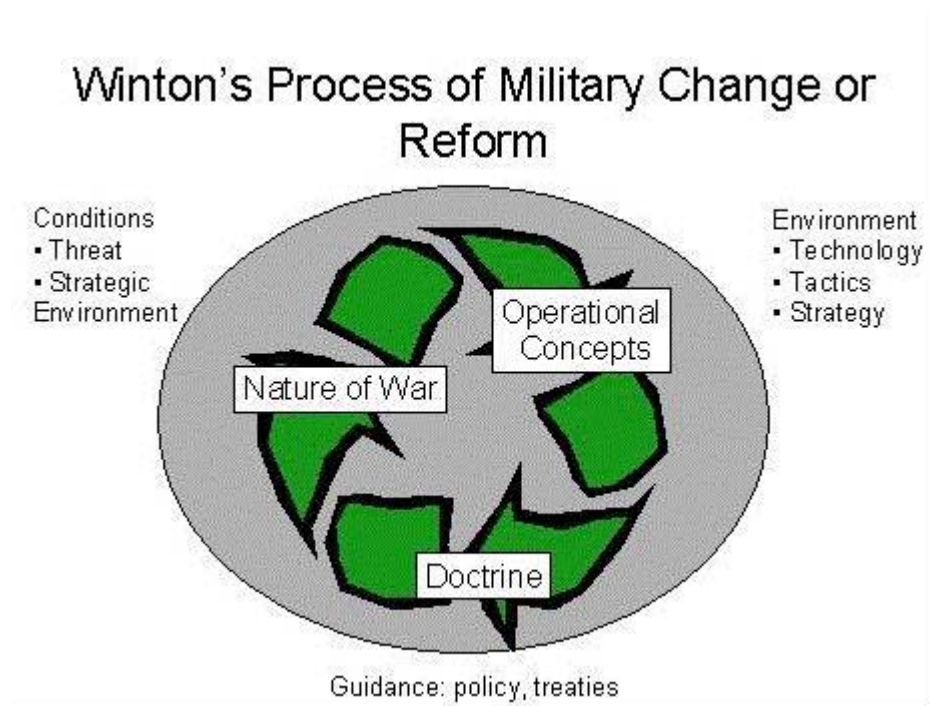
**CRITERIA #2: Does current doctrine/policy incorporate lessons learned from relevant history, exercises, and recent operations, reflecting a solid understanding of the art and science of military operations?**

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<sup>105</sup> Ibid., Pg. VI-1.

<sup>106</sup> JP 3-13, Pg. I-1 and JP 3-51, Pg i.

The current joint doctrine and policy cited in this paper is based on lessons learned from relevant history, exercises, and recent operations. This development process helps the U.S. anticipate future threats, the strategic environment, incorporate new technology, tactics, and strategy in order to ensure our technology and tactics are utilized to their full potential.<sup>107</sup> Harold Winton’s description of military change or reform illustrates this relationship in terms of doctrine, the nature of war, and operational concepts.<sup>108</sup> Each of these facets directly influences the other two. As noted earlier in this paper, doctrine development normally lags behind the development and employment of new technology and tactics.<sup>109</sup> In some cases, it has been 20



**Figure 2.9. Winton’s Description of Military Change or Reform** years or more,

however, this is not the norm. Current doctrine emphasizes the need to keep current doctrine up to date based on threats, technology, and lessons learned from exercises and

<sup>107</sup> Schofield and Lewer, Pg 55.

<sup>108</sup> Harold R. Winton, “Introduction: On Military Change” in *The Challenge of Change- Military Institutions and New Realities, 1918-1941*, ed. Harold R. Winton and David R. Mets, (University of Nebraska Press, Lincoln and London, 2000), Pgs. xi – xix.

<sup>109</sup> Schofield and Lewer, Pgs. 55-56.

operations. “Feedback to the doctrine process from joint exercises and operations is essential for the continuing vitality and improvement of joint doctrine and the consistency of Service doctrine and procedures. This process of deliberate and experience-based doctrinal change is crucial for the present and future effectiveness of the Armed Forces of the United States.”<sup>110</sup> Additionally, JP 3-13 states, “It incorporates time-tested principles for successful military action as well as contemporary lessons which together guide aggressive exploitation of U.S. advantages against adversary vulnerabilities.”<sup>111</sup>

In specific terms, JP 3-13 requires the combatant commander and his staff to capture IO lessons from joint after action reviews and submit them to the Joint Staff J-7 as part of the joint after-action report.<sup>112</sup> J-7 in turn is responsible for reviewing, incorporating, and coordinating lessons learned into joint doctrine. JP 3-15 also requires joint staffs to review and capture lessons learned as an “important and cost effective way to avoid the documented mistakes of previous exercises and operations.”<sup>113</sup> Finally, JP 3-14 highlights that experience gained conducting space operations in support of military operations and the lessons learned from these activities influence the formulation of doctrine (JP 3-14) for mission planning through mission execution.<sup>114</sup>

Current joint doctrine clearly directs joint staffs at all levels to gather lessons learned, document them, and forward them for inclusion in future versions of joint doctrine. This is an ongoing process. As each facet of the military operations changes so will the other two. We must remain vigilant to ensure our doctrine not only changes as the environment and technology do, but that we continue to incorporate doctrinal changes into our training and organizational structures. This requirement will require the development of a robust and detail testing and analysis hierarchy. Currently, we have not incorporated DEWs into full-scale operational level exercises

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<sup>110</sup> JP 1, Pg. I-9.

<sup>111</sup> Ibid., Pg. vi.

<sup>112</sup> JP 3-13, I-7 and IV-5.

<sup>113</sup> JP 3-51, V-3.

where our organization, planning, and execution can be fully tested in a controlled environment. This capability would allow us to realize shortfalls in training, planning, and organizations before these systems are deployed for operational use.

**CRITERIA #3: Does current doctrine/policy account for current and near-term anticipated realities and for force modernization and organizational evolution?**

The NSS, NMS, QDR, National Space Policy, and Joint Visions form the foundation for the development, deployment, and employment of new technologies, tactics, and organizational structure in order to meet and defeat anticipated threats. Likewise, these national policy documents catalyze the formation of doctrine. As stated in chapter 3, current policy predicts an uncertain strategic environment where the military must be “flexible, responsive, and lethal” in order to support national objectives.<sup>115</sup> Additionally, these documents direct the DoD to prepare for the future by developing abilities to conduct remote sensing, long-range precision strike, homeland defense, information operations, ensure U.S. access to distant theaters, and protect critical U.S. infrastructure and assets in outer space.”<sup>116</sup> Finally, these documents identify the need for these new systems to have lethal and non-lethal capability in order to maintain force flexibility and adaptability.<sup>117</sup>

Current national policy recognizes our forces will continue to conduct operations across the spectrum of warfare, from full conventional operations, to counter-insurgency, to peace keeping. These types of operations require our forces to fight from a forward deterrent posture, must be timely and precise, must deny our adversaries sanctuary, and must be able to limit collateral damage.<sup>118</sup> Our current policy and doctrine broadly describes/prescribes the

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<sup>114</sup> JP 3-14, Pg. I-2.

<sup>115</sup> NSS, Pg. 29.

<sup>116</sup> Ibid., Pg. 29-30.

<sup>117</sup> NMS.

<sup>118</sup> QDR, Pg. 21, 26, and 44.



development/employment of weapon systems capable of projecting force, deterring adversaries, protecting our forces and our space-based assets in an uncertain environment.

Our joint doctrine development process ensures future concepts are developed in concert with the emergence of new technology and the attainment of new or enhanced military capabilities. This process further directs the review and refinement of doctrine as these capabilities become operational and are deployed within the U.S. military. In a perfect situation, the validated principles and fundamentals for employing such capabilities are incorporated into joint doctrine concurrent with deployment of the new capabilities.<sup>119</sup>

As discussed earlier in this chapter, current doctrine prescribes proper organization, training, and employment of forces in order to ensure military support of national objectives. Although joint doctrine does make recommendations in these areas, it allows the joint commander the flexibility to organize and train forces as needed to meet operational mission requirements. Instead of specifics, doctrine identifies critical elements, concepts, and enablers, which allow the JFC to practice operational art to achieve strategic goals through the design, organization, integration, and conduct of strategies, campaigns, major operations, and battles.<sup>120</sup>

Although current policy and doctrine do account for current and near-term anticipated realities in terms of developing capabilities to meet emerging threats, they have failed in two areas. First, the U.S. has failed to articulate the U.S. position on the use of DEWs in light of current international treaties and conventions. This area will require further analysis and study to determine the possible impacts. Second, the U.S. has failed to articulate its policy on placing weapons in space. This may become a critical issue with the intended development and deployment of systems such as the SBL and other MD systems.

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<sup>119</sup> Joint Chiefs of Staff, Joint Publication 1-01 (Change 1)(hereafter known as JP 1-01), Joint Doctrine Development System.(Washington D.C., 29 June 2001), Pg. I-6.

<sup>120</sup> Joint Chiefs of Staff, Joint Doctrine Capstone and Keystone Primer, Washington D.C., 10 September 2001, Pg. A-3.

**CRITERIA #4: Does current doctrine convey a common understanding of how to think about conducting operations and provide a common language for discussion? Does it use clear, well-defined terms and concepts and is written to the level of the target audience?**

Modern warfare requires we fight as a joint team. Our joint doctrine enables successful joint operations by providing a common framework and approach to warfighting from which strategy can be developed and executed.<sup>121</sup> Current joint doctrine concerning the use of DEWs as a component of EW and IO does convey a common understanding of conducting these operations and provides a common language for discussion.

JPs 3-13 and 3-51 provide solid background on conducting IO and EW. Specifically each document provides an overview of why EW and IO are important to operations, how to organize for operations, planning requirements, and identifies training and exercise requirements. Specific capabilities and limitations are addressed and ultimately linked back to the key concepts, enablers, and elements of joint operational art found in JPs 1 and 3.0. JPs 3.13 and 3-51, build upon the common understanding of joint operations found in these basic documents by addressing the unique planning and organizational requirements, as well as developing a common language for their use. This is another critical requirement of conducting joint operations.

JP 1-01 requires joint doctrine be written using previously approved terminology contained in JP 1-02, Department of Defense Dictionary of Military and Associated Terms. It also allows stand-alone or single publication terms as long as they are necessary. New terminology is included in the publication's glossary.<sup>122</sup> JPs 3-13 and 3-51 clearly define the terminology and concept of operations specific to IO and EW. This includes terminology concerning the use of DEWs. The terminology described in JP 3-13 and 3-51 is consistent throughout all of the joint publications and policy discussed and reviewed in this paper. Although

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<sup>121</sup> Ibid., Chairman's Letter.

<sup>122</sup> JP 1-01, Pg III-5.

not specifically addressed in this paper, the terminology used is also consistent throughout the Service specific documents concerning IO and EW.

Finally, the doctrine reviewed in this paper is written to the level of the target audience. Joint doctrine is set-up in a building block fashion. JP 1 and the NMS lay out the general foundation for military operations. This foundation is built upon by the base publications in each series (e.g., JP 2.0, 3.0, 5.0, etc). These documents remain general in nature, but contain specifics in terms of their functional area (intelligence, operations, planning). Finally, the documents contained in each series address specific capabilities in each functional area. In this case, IO and EW are discussed as a part of operations.

The Joint doctrine building block approach allows the joint warfighter to understand joint operations from the tactical to the strategic level of operations. This understanding facilitates proper integration and synergy of operations.

## **CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS**

### **CONCLUSION**

The primary research question this paper sought to answer is; does current U.S. policy and doctrine adequately address the employment of emerging directed energy weapons? This question is important because in a dynamic global system where threats to our national interests fall along the full spectrum of warfare our military forces must be properly organized, equipped, and trained to employ the most technologically advanced equipment, tactics, and procedures at a moments notice. Our joint doctrine and national policy must provide the necessary framework to ensure our troops are properly organized trained and equipped and that our systems provide the required capabilities and necessary effects on the battlefield.

In order to answer the primary research question and thereby assess the adequacy of policy and doctrine for employment of DEW emerging technology we had to answer four sub-questions.

1. What are DEWs and why are they an important potential component of joint warfare operations?
2. What is the purpose of policy and doctrine?
3. What is the existing policy/doctrine concerning DEWs?
4. Does current policy/doctrine meet the criteria for effective doctrinal/policy guidance?

Chapter 2 focused on sub-question #1; what are DEWs and why are they an important potential component of joint warfare operations? Directed energy weapons technology is at the forefront of the next revolution in military weaponry. Specifically, we identified that directed energy weapons are systems that use directed energy primarily as a direct means to damage or

destroy enemy equipment, facilities, and personnel.”<sup>123</sup> This study identified three primary types of DE weapon systems; High Power Microwaves (HPM), Radio Frequency Munitions (RFM), and Laser directed energy (LDE).<sup>124</sup>

HPMs are used to disrupt electronic components and in direct engagement of combatants. HPMs can be operated at varying levels resulting in effects ranging from sensor confusion to component burn up.<sup>125</sup> HPMs may also be used to directly attack adversarial combat forces in a non-lethal means through technology known as Active Denial Systems (ADS). RFMs use electromagnetic pulse (EMP) or ultra wideband pulse (UWBP) to produce an effect quite similar to an exoatmospheric nuclear blast resulting in upset, disruption, or burnout of the electronic components within the targeted systems.<sup>126</sup> Finally, LDEs are broken into two primary groups, high-energy lasers (HEL) and low-power lasers (LPL).<sup>127</sup> Each of these systems offers potential application in missile defense, force protection, space control, and tactical direct fire missions.<sup>128</sup>

DEWs offer the military planner and operator a range of lethal and non-lethal capabilities to meet the challenges of a dynamic military environment. First, DEWs lend themselves to being strategically agile because they are inherently flexible, proving just as decisive in a MTW as they do in a in a peace enforcement or peacekeeping mission. Second, DEWs, especially space based DEWs, are able to support force projection missions because they are prepositioned in orbit above the earth’s surface, ready to be employed at a moment’s notice, with the ability to engage at the speed of light.<sup>129</sup> Third, DEWs possess timeliness because of their global presence, flexible engagement protocols, and speed of light transmission. DEWs may achieve the same rapid defeat

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<sup>123</sup> Ibid., Pg. 159.

<sup>124</sup> AGARD., Pg. 51.

<sup>125</sup> Ibid., Pg. 52.

<sup>126</sup> Ibid.

<sup>127</sup> AGARD, Pg. 53.

<sup>128</sup> Ibid., Pg. 17.

<sup>129</sup> AGARD, Pg. 29.

of the enemy as traditional weapon systems without physical destruction, immediate threat of loss of life, or collateral damage.

DEWs also support the elements of joint operational art. First, DEWs if employed properly can provide synergy when employed with the latent lethal capabilities of each service in order to provide the effects needed to obtain victory and end the conflict on terms favorable to the U.S.. Second, DEWs provide simultaneity and depth by amplifying battlespace awareness allowing commanders to bring appropriate elements of the force to bear simultaneously against the opponent's entire structure throughout the depth of the theater in order to multiply the combined effects and increase synergy. Finally, DEWs will provide immediate operational reach in a crisis through lethal and non-lethal precision strike capabilities, space control, and missile defense.

Chapter three focused on sub-questions #2 and #3; what is the purpose of policy and doctrine? Moreover, what is the existing policy/doctrine concerning DEWs? As stated in chapter 3, policy a broad course of action or statements of guidance adopted by a government at the national level in pursuit of national objectives.<sup>130</sup> Policy focuses the national instruments of power by communicating the priorities, vision, strategy, and strategic perceptions of the governing body that produces it.<sup>131</sup> Likewise, "military doctrine presents fundamental principles that guide the employment of forces. Doctrine also fundamentally shapes the way the armed forces think about the use of the military instrument of national power."<sup>132</sup>

Current U.S. policy includes the NSS, NMS, QDR, National Space Policy, Space Commission Report, and JV 2010 and 2020. These documents form the foundation for the development, deployment, and employment of new technologies, tactics, and organizational structure in order to meet and defeat anticipated threats. These national policy documents

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<sup>130</sup> JP 1-02, Pg. 295.

<sup>131</sup> Doctrine Watch #6.

<sup>132</sup> Ibid.

catalyze the formation of doctrine. As stated in chapter 3, current policy predicts an uncertain strategic environment where the military must be “flexible, responsive, and lethal” in order to support national objectives.<sup>133</sup> Additionally, these documents direct the DoD to prepare for the future by developing abilities to conduct remote sensing, long-range precision strike, homeland defense, information operations, ensure U.S. access to distant theaters, and protect critical U.S. infrastructure and assets in outer space.”<sup>134</sup> Finally, these documents identify the need for these new systems to have lethal and non-lethal capability in order to maintain force flexibility and adaptability.<sup>135</sup>

Current joint doctrine which addresses DEWs include Joint Publications 3-01, 3-01.5, 3-09, 3-13, 3-14, and 3-51. Of these publications, only JP 3-13 and 3-51 specifically address DEWs. However, each of the publications specify needs which DEWs could potentially fill including theatre missile defense, direct/indirect fire support, and counter air operations. JPs 3-13 and 3-51 are very specific in terms of the use of DEWs as a component of IO for degrading, neutralizing, or destroying enemy information systems. Each of these documents further identified organizational recommendations, planning considerations, as well as information of conducting training and exercises.

Finally, chapter four addressed sub-question #4, does current policy/doctrine meet the criteria for effective doctrinal/policy guidance? Within this chapter, we applied four criteria to determine if the current policy and doctrine meet the standards for effective doctrinal/policy guidance.

1. Does current doctrine/policy effectively describe how we organize, train, fight, and support these weapons, thereby contributing directly to the successful execution of operations?
2. Does current doctrine/policy incorporate lessons learned from relevant history, exercises, and recent operations, reflecting a solid understanding of the art and science of military operations?

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<sup>133</sup> NSS, Pg. 29.

<sup>134</sup> NSS, Pg. 29-30.

<sup>135</sup> NMS.

3. Does current doctrine/policy account for current and near-term anticipated realities and for force modernization and organizational evolution?
4. Does current doctrine convey a common understanding of how to think about conducting operations and provide a common language for discussion? Does it use clear, well-defined terms and concepts and is written to the level of the target audience?

The joint publications and policy cited in this paper effectively addresses the general organization, training, execution, and support of the forces and weapon systems necessary to ensure effective execution of joint operations. Specifically, they provide the JFC basic guidelines for organizational structure, planning structure, training, exercises, and modeling and simulation across the DoD, interagency, and multi-national operations. Further, current doctrine provides general planning methodology, fundamentals, coordination, and integration/deconfliction guidelines and common understanding of conducting these operations while providing a common language for discussion. Current joint doctrine also enables successful joint operations by providing a common framework and approach to warfighting from which strategy can be developed and executed. It provides a building block approach, allowing the joint warfighter to understand joint operations from the tactical to the strategic level of operations. This understanding facilitates proper integration and synergy of operations.

Despite the general guidance, current doctrine and policy provide for the development and employment of DEWs, it falls short in two areas. First, future DEWs may be capable of creating effects across the strategic, operational, and tactical levels of war and therefore guidance that is more specific must be developed in order to properly organize, plan, coordinate, and utilize these weapons. Second, although current policy and doctrine do account for current and near-term anticipated realities in terms of developing capabilities to meet emerging threats, they fail to articulate the U.S. position on the use of DEWs in light of current international treaties and conventions. Additionally, the U.S. has failed to articulate its policy on placing weapons in



space. Therefore, more research, analysis, and specific guidance is required in these two areas before we can employ more advanced DEW systems such as the ABL, SBL, ATL, and HPMs.

## **RECOMMENDATIONS**

This paper articulates the important role emerging DEW technologies may play in future military operations. In making recommendations to the formulation of DEW policy and doctrine, several considerations must be taken. First, DEWs offer unique capabilities beyond the scope considered when formulating current doctrine and policy. Second, DEWs when fully developed and deployed may become a critical center of gravity given the ability to impact military, economic, information, and diplomatic instruments of power. Third, our ability to use DEWs and deny our adversaries the same abilities will require technological superiority. This superiority will be just as important to military operations as air and space superiority is today. Finally, the capability to operate simultaneously at the strategic, operational, and tactical levels of war will require the development of a single integrated architecture capable of integrating DEW capabilities into all operations, not limiting them to IO or EW. Final recommendations of this paper fall into two categories: Policy development/assessment and Development of specific DEW doctrine.

## **POLICY DEVELOPMENT/ASSESSMENT**

One of the more politically sensitive aspects of developing and deploying DEWs will be the requirement for the U.S. to address our national policy. First, national policy must be addressed because of likely treaty implications and international concerns with employing DEWs, and second, the U.S. has failed to articulate its national space policy regarding space control and force application.

The use of DEWs brings concerns over whether DEWs conform to the basic Law of Armed Conflict and Principles Governing Weapons and hence will they conform to current international treaties governing warfare? In order to address these concerns the U.S. must ensure

DEWs comply with three primary principles when developing and deploying DEWs: unnecessary suffering, discrimination, and treachery or perfidy. “The unnecessary suffering principle prohibits the use of weapons or means of warfare calculated to cause unnecessary suffering or superfluous injury (Hague Regulations, Article 23(e); Protocol I, Article 35(2)).”<sup>136</sup> Second, “the discrimination principle prohibits the use of methods or means of warfare that cannot be directed against a specific military objective and are thus of a nature to strike military objectives and civilians or civilian objectives without distinction (Hague regulations, Protocol I, Article 51(4)).”<sup>137</sup> Finally, “the treachery or perfidy principle prohibits certain perfidious uses of weaponry and may also prohibit weapons that are inherently perfidious (Hague regulations, Article 23 (b)).”<sup>138</sup> These three principles form the initial criteria for acceptance of DEWs by the international community as an acceptable means for conducting warfare, however, a detailed analysis of multiple international treaties, declarations, and conventions must be accomplished before fielding controversial systems. A short list of potential documents include the Hague Convention (IV) Respecting the Laws and Customs of War on Land (1907), Geneva Convention (1949), Geneva Convention, Additional Protocols I and II (1977), and the UN Inhumane Weapons Convention- UNWC (1980). This is not an exhaustive list, but merely represents a starting point for further analysis.

The second area of concern for policy development and assessment involves clearly defining the U.S. policy on weapons in space. Currently, the U.S. policy for placing weapons in space remains ambiguous. It does not specifically call for the development of space-based weapons under the realm of force application or space control; however, it allows the latitude to conduct any operation in space necessary for national security.<sup>139</sup> The reluctance to specify the requirement to develop and deploy weapons in space (kinetic, or otherwise) complicates our

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<sup>136</sup> Schofield and Lewer, Pg. 84.

<sup>137</sup> Ibid., Pg. 84.

<sup>138</sup> Ibid., Pg. 85.

<sup>139</sup> National Space Policy Fact Sheet, Pg. 5.

ability to conduct mission planning, acquisition management, doctrine development, RDT&E activities, and a myriad of other related activities to ensure the freedom of space.<sup>140</sup> This recommendation is supported by the 1999 Space Commission Report, which clearly stated, “The United States must develop, deploy and maintain the means to deter attack on and to defend vulnerable space capabilities. Explicit national security guidance and defense policy is needed to direct development of doctrine, concepts of operations and capabilities for space, including weapons systems that operate in space.”<sup>141</sup>

## DEVELOP SPECIFIC DEW DOCTRINE

Current doctrine clearly defines the function and application of DEWs in terms of IO and EW operations. This doctrine is limited in scope because current DEW technology can only support the role of DEWs in shaping operations. Current systems jam, interfere, or disrupt enemy actions, but they lack the capability to apply lethal force, produce permanent destruction of enemy systems, or conduct operations rapidly on a global scale. As DEWs mature, they will prove to be a significant force multiplier capable of performing decisive operations. It will be very important to gain a universal understanding of how DEWs contribute to joint operations. Additionally, as stated earlier the U.S. must develop/construct a realistic testing hierarchy. Realistic testing is essential to ensuring systems are tested under simulated battle conditions in order to provide meaningful lessons learned and techniques for inclusion in DEW doctrine. Finally, as DEWs mature they should no longer be viewed simply as an extension of IO and EW. DEWs will need to be viewed as a separate and distinct type of operation. Accordingly, a separate and distinct DEW doctrine will need to be more fully developed and implemented as technology matures.

As we stand at the beginning of this new millennium, our nation is faced with a complex and dynamic strategic environment. The static threat of the Cold War has passed and our nation

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<sup>140</sup> Steven Lambakis, *The Two Faces of American Defense Space Policy*, Space News, Vol. 10, No. 33, 6 September 1999.

faces an elusive and resourceful enemy. It is paramount our military possesses the means to conduct global operations rapidly and decisively with little or no notice. While DEWs are not currently mature enough to provide this capability, they possess incredible potential to provide capabilities critical to future military operations. Therefore, if DEWs are to mature in the next 20 years the U.S. must place increased emphasis on the research and development of these systems. Throughout the R&D process, the U.S. must continuously assess and address the international implications in terms of treaties, conventions, and declarations. Second, the U.S. must develop a robust testing hierarchy to ensure DEWs are properly integrated into joint operations. Finally, the U.S. must develop continue to develop specific doctrine and policy for DEWs as they mature and become capable of producing effects across the strategic, operational, and tactical levels of war. At this point, DEWs will have become more than just a subset of IO and EW.

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<sup>141</sup> Space Commission Report, Pg. xvi.

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## APPENDIX - Acronyms

AAM	Air-to-Air Missile
ABL	Airborne Laser
ACTD	Advanced Concept Technology Demonstration
ADS	Active Denial System
ADT	Active Denial Technology
AEF	Air and Space Expeditionary Force
AFDD	Air Force Doctrine Document
AFRL	Air Force Research Laboratory
AFWL	Air Force Weapons Laboratory
ALL	Airborne Laser Laboratory
AO	Area of Operations
AoA	Analysis of Alternatives
ASAT	Anti-satellite
ATL	Advanced Tactical Laser
ATO	Air Tasking Order
BDA	Battle Damage Assessment
BM	Ballistic Missile
CJCS	Chairman Joint Chiefs of Staff
COIL	Chemical Oxygen Iodine Laser
CONOPS	Concept of Operations
CONUS	Continental United States
C2	Command and Control
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
DCA	Defensive Counterair
DE	Directed Energy
DEMP	Directed Energy Master Plan
DEMP Vol I	Directed Energy Master Plan Volume I
DEMP Vol II	Directed Energy Master Plan Volume II
DETF	Directed Energy Task Force
DEW	Directed Energy Weapon
DoD	Department of Defense
DOE	Department of Energy
EA	Electronic Attack
EAGLE	Evolutionary Air and Space Global Laser Engagement System
EM	Electromagnetic
EMP	Electromagnetic Pulse
EMRLD	Excimer Laser Device
EP	Electronic Protection
ES	Electronic Warfare Support
EW	Electronic Warfare



FOC	Full Operational Capability
FYDP	Future Years Defense Plan
GBL	Ground-Based Laser
GHz	Gigahertz
GSTF	Global Strike Task Force
GW	Gigawatt
GWOT	Global War on Terrorism
HAF	Headquarters Air Force
HEL	High Energy Laser
HF	Hydrogen Fluoride
HPM	High-Power Microwave
ICBM	Intercontinental Ballistic Missile
IO	Information Operations
IOC	Initial Operation Capability
ISR	Intelligence, Surveillance, and Reconnaissance
JFC	Joint Force Commander
JOA	Joint Operational Area
J-SEAD	Joint Suppression of Enemy Air Defenses
JV	Joint Vision
kW	Kilowatt
LDE	Laser Directed Energy
LEL	Low-Energy Laser
LEO	Low Earth Orbit
LGB	Laser-Guided Bomb
MCDP	Marine Corps Doctrine Publication
MD	Missile Defense
MNS	Mission Need Statement
MOOTW	Major Operations Other Than War
MOUT	Military Operations in Urban Terrain
MTW	Major Theatre War
MW	Megawatt
NDP	Naval Doctrine Publication
NLW	Non-Lethal Weapon
NMS	National Military Strategy
NSFS	Naval Surface Fire Support
NSS	National Security Strategy
OCA	Offensive Counterair
OSD	Office of the Secretary of Defense
PGM	Precision Guided Munition
PSYOP	Psychological Operations

QDR	Quadrennial Defense Review
RF	Radio Frequency
RFM	Radio Frequency Munitions
ROE	Rules of Engagement
R&D	Research and Development
SA	Situational Awareness
SAM	Surface-to-Air Missiles
SBL	Space-Based Laser
SEAD	Suppression of Enemy Air Defenses
SLBM	Sub Launched Ballistic Missile
SOF	Special Operations Forces
SSL	Solid-State Laser
S&T	Science and Technology
TM	Theatre Missiles
TMD	Theatre Missile Defense
UAV	Unmanned Aerial Vehicle
USMC	United States Marine Corps
UWB	Ultra-wideband
UWBP	Ultra-wideband Pulse
WMD	Weapons of Mass Destruction