# THE DEPLOYMENT OF DIRECTED ENERGY WEAPONS IN OUTER SPACE: AN EVALUATION

A Thesis

by

JEFFREY LYNN PREWITT

Submitted to the Graduate School

Appalachian State University

in partial fulfillment of the requirements for the degree

of

MASTER OF ARTS

December 1981

Major Department: Political Science

THE DEPLOYMENT OF DIRECTED ENERGY WEAPONS

IN OUTER SPACE: AN EVALUATION

A Thesis

by

Jeffrey Lynn Prewitt

December 1981

APPROVED BY:

Dr. Jawad I. Barghothi
Chairperson, Thesis Committee

Dr. Roland Moy
Member, Thesis Committee

Dr. P. Albert Hughes
Member, Thesis Committee

Dr. Richter H. Moore, Jr.
Chairperson, Political Science

Dr. Joyce V. Lawrence
Dean of the Graduate School

ABSTRACT

THE DEPLOYMENT OF DIRECTED ENERGY WEAPONS IN OUTER SPACE: AN EVALUATION. (December 1981)

Jeffrey Lynn Prewitt, B.A.,

Appalachian State University

M. A., Appalachian State University

Thesis Chairperson: Jawad I. Barghothi

This thesis evaluates the logic of deploying directed energy weapons in outer space for use in anti-satellite and in anti-ballistic missile operations. The purpose of this evaluation is to determine if it is in the best interests of the United States to deploy directed energy weapons or to seek a treaty which would ban the deployment of such weapons.

To perform this task, it is necessary to examine various factors that would exercise influence in such a decision. Consequently, this thesis is divided into four parts from which a conclusion is drawn. The first of the four parts examines the current and potential uses of outer space to determine the impact the deployment of directed energy weapons would have. To gain a further insight into the potential of directed energy weapons, the current development of such weapons is

explored. This is followed by an examination of the potential legal barriers of the deployment of directed energy weapons. Strategic theory, as exemplified in deterrence theory, is discussed in the fourth part of the thesis so as to obtain a proper assessment of the military potential of directed energy weapons.

Of the conclusions reached in this thesis, the most significant are that it is in the best interests of the United States to support the banning of directed energy weapons and that such an agreement is unlikely to be forthcoming. The deployment of such weapons would enhance the chance of a nuclear conflict and in such a conflict the United States would suffer more than the Soviet Union should its outer space mechanisms be destroyed. At present there is no mutual interest or trust between the Soviet Union and the United States that could result in a treaty to ban directed energy weapons. Until one of these two qualities emerges, the Soviet Union and the United States will proceed with their plans to deploy directed energy weapons in outer space.

TABLE OF CONTENTS

## LIST OF FIGURES

## ACRONYMS

| | |
|---|---|
| ABM | Anti-Ballistic Missile |
| ASAT | Anti-Satellite |
| ASW | Anti-Submarine Warfare |
| COPUOS | Committee on the Peaceful Uses of Outer Space |
| DEBS | Directed Energy Battle Station |
| DEW | Directed Energy Weapon |
| DIA | Defense Intelligence Agency |
| DOD | Department of Defense |
| GEOSAT | Geostationary |
| HALO | High Altitude Large Optics |
| HEL | High Energy Laser |
| ICBM | Intercontinental Ballistic Missile |
| LASER | Light Amplication by Stimulated Emission of Radiation |
| LEL | Low Energy Laser |
| MAD | Mutual Assured Destruction |
| MHIV | Miniature Homing Interceptor Vehicles |
| NASA | National Aeronautics and Space Administration |
| NAVSTAR | Naval Global Positioning System |
| NOAA | National Oceanic and Atmospheric Administration |
| NSA | National Security Council |

| | |
|---|---|
| PBW | Particle Beam Weapon |
| P-K-O | Protivosmicheskaya |
| P-V-O Strany | Protivovozdushnaya Oborona |
| SDS | Satellite Data System |
| SLMB | Sea Launched Ballistic Missile |
| SSBN | Submarine Ballistic Nuclear |
| TRANSIT | Navy Navigation Satellite System |
| USAF | United States Air Force |

# CHAPTER I

# INTRODUCTION

## Nuclear Era

Directed energy weapons possess the unique ability to provide a nation with what may very well be the ultimate defensive device for both exoatmospheric and endoatmospheric applications. In this nuclear era, when the Soviet Union and the United States are engaged in a continuous race for armaments, directed energy weapons pose the dangerous prospect of expanding that race into outer space. This study will explore the dangers and advantages that deployment of directed energy weapons in outer space may pose to Soviet-American relations.

Currently in the United States, the media has slowly begun to acquaint the American public with the strategic value of such weapons. Indeed, a special presentation on WGBH in 1979 entitled, "The Real War in Space," demonstrated that space may rapidly be changing from a peaceful environment into an armed frontier by the end of the twentieth century.[1] Such reports often

---

[1]WGBH, "The Real War in Space," 1979, Tom Mangold. WGBH is a Boston television station that is a major member of the Public Broadcasting Service (PBS). PBS stations provide a forum for the presentation of educational material to the general public.

lead to claims being made that the Soviet Union is significantly ahead of the United States in the development of directed energy weapons and that a crash program is needed to assure that the United States retains the number one position in the technology and military use of such weapons. Without a crash program, some military figures, such as General George Keegan, former head of United States Air Force (USAF) Intelligence, believe that the Soviet Union will be the first nation to deploy directed energy weapons in outer space, thus gaining a monopolistic control over the portals of outer space.

Basically, there are two types of directed energy weapons; particle beams and laser beams. The concept of using directed energy devices as weapons of war originated with the British during World War II.[2] However due to an inability to produce massive amounts of power, the British project was soon shelved. Presently, both the Soviet Union and the United States are spending tremendous amounts of money and utilization of expertise to develop these devices as weapons that could be used on Earth as well as in outer space.

With the destruction of the Japanese cities of Hiroshima and Nagasaki in 1945, the nuclear era was

---

[2]Nicholas Wade, "Particle Beams as ABM Weapons: General and Physicists Differ," Science 196 (April 22, 1977): 408.

born. This era has been characterized, since the 1950s, by the ability of both the Soviet Union and the United States to launch a nuclear attack which would obliterate the civilization of both nations. Consequently, this has created a stalemate in which both nations cannot win, only lose. In their endeavors to find a way to win such a conflict, both nations are attempting to find ways to neutralize the nuclear missiles of their opposition. Thus, the concept of a highly effective defensive system emerges. As Sigal quoted Kahn in his article, "The Logic of Deterrence in Theory and Practice,"

> Once one accepts the idea that deterrence is not absolutely reliable and that it would be possible to survive a war, then one may be willing to buy insurance--to spend money on preparations to decrease the number of fatalities and injuries, limit damage, facilitate recuperation, and to get the best military result possible.[3]

By 1990, the Soviet Union and the United States will have developed, and very possibly have deployed in outer space, some form of a directed energy weapon. Current specifications call for such weapons to be deployed in outer space on manned or unmanned space platforms called battle stations. In time of conflict, the directed energy battle station would serve as a means of providing the following:

---

[3] Leon V. Sigal, "The Logic of Deterrence in Theory and Practice," International Organization 33 (Autumn 1979): 568.

Air defense
Suppression of airborne warning and control systems
Suppression of look-down/shoot-down interceptor aircraft
Navy fleet defense
Airlift interdiction
Offensive antisatellite use
Defense of counterspace forces
Defense of friendly space assets
Antiballistic missile defense.[4]

The first battle stations however, will probably be limited to serving exoatmospheric functions.

The speed at which aggressive actions can be determined, and the time it takes for a nuclear missile to reach its intended target, determine the successfulness of any nations' attack. Much research, development, and money, have been invested into these areas. Currently, both the Soviet Union and the United States have positioned satellites in Earth orbit to warn of intended attacks and to guide their conventional and nuclear forces. To cut down the attack time, both nations have developed nuclear missiles which pass through outer space to reach their intended targets quickly.

As Henry Kissinger stated, the purpose of defense is to reduce an enemy's attack to acceptable levels while the offense would not be contained by the enemy.[5] By deleting Soviet or American military assets in

---

[4]Clarence A. Robinson, Jr., "Laser Technology Demonstration," Aviation Week & Space Technology, February 16, 1981, p. 18.

[5]Henry A. Kissinger, Nuclear Weapons and Foreign Policy, (New York: Harper & Brothers, 1957), p. 98.

space, warning and communication would make damage assessment in a nuclear conflict difficult and possibly sever the ability of the political-military establishment to communicate on a worldwide or nationwide basis. A highly affective ABM system would give a nation the ability to fight an extended nuclear conflict due to the high percentage of government, military, and industrial components that could be expected to survive. A directed energy weapon system in outer space could serve to make a nuclear conflict successful in the sense it would destroy the enemy's ability and will to wage war, while preserving a nation's ability to wage war.

At the same time it must be remembered that the building of an effective, or what is thought to be an effective weapon system may in and of itself lead to a nuclear conflict. If a nation feels that the nuclear stalemate is on the verge of a significant breakdown it may launch a pre-emptive attack. In doing so it may assure that it alone will not be destroyed. International law, as seen in arms treaties between the Soviet Union and the United States, attempts to restrict the possibility that nuclear arms will be used by these two nations. Yet these treaties place no restrictions on the research and development of weapons except for their testing in the oceans, atmosphere, and outer

space. Consequently, due to the lack of any legal barrier to restrict research and development, any program aimed at perfecting directed energy battle stations may stimulate a non-passive militarization of outer space and a general escalation in the Soviet-American arms race.

## Statement of Purpose

The purpose of this study will be to determine if it will be in the best interests of the United States to deploy directed energy weapons or rather to devise a treaty that would forbid the deployment of directed energy weapons in outer space. By examining current trends in research and development, international law, and deterrence theory, this study will evaluate the national security implications of deploying directed energy weapons in outer space for exoatmospheric purposes.

The evaluation will help define the costs of a directed energy weapon system along with any benefits the United States might hope to attain. In the process of evaluating these security implications, this study will also examine the concept of directed energy battle stations in terms of their possible role as an anti-satellite (ASAT) and an antiballistic missile (ABM) device.

## Objectives and Scope of this Research

It will be the intent of this study to establish if it is in the best interests of the Soviet Union and the United States to place in orbit directed energy battle stations. To achieve this goal, this study will be divided into five parts.

Chapter 2 will begin this study with an examination of what is outer space and how it is used by the Soviet Union and the United States. Therefore, it will be necessary to review and define what is meant by the term outer space. This working definition will be based upon the writings of various experts in regards to where a nation's air space ends and outer space begins. Then the study will focus in on the current uses of outer space by the Soviet Union and the United States. Other aspects of this study, in order to meet the criteria, will be to investigate how valuable an asset outer space is and can be to a nation.

Before the true value of directed energy weapons can be assessed it will be necessary to understand their basic technology and this is the purpose of Chapter 3. Directed energy weapons are divided into two types; particle beams and laser beams. Each of these employ different types of energy to destroy objects and have different ways in which their effectiveness can be impaired. Consequently, the effect of

these factors must be determined. To conclude this chapter the requirements for basing directed energy weapons in outer space will be examined.

In Chapter 4, the legality of deploying such weapons in outer space will be explored in two parts. First, an evaluation will be made of various international agreements that condemn the militarization of outer space. The second of these will center upon bilateral agreements between the Soviet Union and the United States that may in some way forbid the deploying of directed energy weapons. Also, this chapter will examine what a nation needs to be willing to do legally in order to deploy such weapons and what would need to be done to insure that such weapons are never introduced into outer space.

Deterrence strategy will be examined in Chapter 5 to show the possible effects of deploying directed energy weapons in outer space. At the beginning of this chapter it will be essential to show the philosophy behind the nuclear era that according to some has prevented a nuclear conflict. With this in mind it will next be logical to project a hypothetical situation in which an ASAT-ABM system would function in the event of a nuclear conflict.

Chapter 6 of this study will be devoted primarily to drawing a conclusion to the question: Is it in the

best interests of a nation to deploy in outer space directed energy weapons? At that point, recommendations will be made as to the course of action that would be in the best interests of the United States. Chapter 6 will also include a summary of this study which will evaluate the study in terms of its original goals, areas that should be examined and expanded upon in future studies, and ways this may be accomplished to provide a more accurate and detailed study.

## Limits of this Study

Although the purpose of this study will be to evaluate the effects of the possible deployment of directed energy weapons, this study will be limited by various conditions. First and foremost among these will be that the technology of such weapons is a very recent development. This leads to many different and sometimes contradictory versions of how such weapons might be deployed. But the chief source of technical information will come from articles appearing in Aviation Week & Space Technology. As Wade noted:

> Aviation Week is a copious source of military and intelligence information, so much so that it has earned the sobriquet of Aviation Leak.[6]

Unfortunately, Aviation Week often refers to its

---

[6]Nicholas Wade, "Charged Debate Erupts over Russian Beam Weapon," Science 196 (May 27, 1977): 957.

sources not by name but as a Defense Department official or a source in the CIA. Ultimately, this means that the reader of such articles is expected to accept them as fact without being allowed to examine the person's credentials. However, for the purposes of this study much credence will be placed on the articles appearing in Aviation Week & Space Technology since there is so little information appearing in other journals on the topic of directed energy weapons. Furthermore, this publication is an invaluable source of information for the layman since it is presented in a nontechnical fashion.

Another limitation of this study will be the scope of the technology of directed energy weapons examined. This study will examine only the exoatmospheric uses of directed energy weapons that are placed in orbit. Consequently, all parts of this thesis will be limited solely to the concept of such weapons being deployed in outer space unless otherwise stated. It is conceivable that someday nations will develop the capability to destroy cities from outer space thus ending the necessity of nuclear missiles. With all probability this will not be technically feasible until sometime in the twentieth-first century. Therefore emphasis will be placed in this study on the near term uses of directed energy weapons.

Finally, even though this study will be devoted to the exoatmospheric functions of directed energy weapons their use in outer space and on Earth may adversely affect the natural environment. Unfortunately, no information is available if their use would affect the natural environment or to what degree it would prove to be harmful. Therefore another factor that may make this type of weapon system less appealing will not be discussed. Before the deployment of directed energy weapons it would be advisable that such a study be made.

## Summary

In 1945, the first atomic bomb was detonated. Yet in the same time period the potential of directed energy weapons was emerging in Great Britain. Due to technical problems, however, the British directed energy weapon project was soon shelved. Currently, the Soviet Union and the United States are examining the possibility of deploying directed energy weapons in outer space in order to break the stalemate that for so long has virtually guaranteed peace. At current levels of research and development, both nations will have developed and possibly deployed in outer space such weapons by 1990.

A purpose of this study is to determine whether or not it is in the best interest of the United States to deploy directed energy weapons or to seek their

limitation by treaty. To make such an evaluation it will be necessary to examine the current uses of outer space, the technological potential of directed energy weapons, the limitations international law places on the militarization of outer space and the development of directed energy weapons, and the importance of such weapons under deterrence theory.

This is not an inclusive study of the potential of directed energy weapons. The technological scope of this study is limited to their use in outer space for exoatmospheric purposes. Due to the secrecy of both the Soviet Union and the United States, the technical quality of this study will be based heavily upon that appearing in Aviation Week & Space Technology. This is unfortunate since this publication rarely identifies its sources. Yet it does relate the technical features of directed energy weapons in such a manner that the layman can understand it. Finally, this study does not take into account the impact directed energy weapons may have on the natural environment.

## CHAPTER II

## THE USE OF OUTER SPACE

### A Definition

With the reality that mankind can propel vehicles into orbit around the Earth, questions have arisen as to what is and what will be the uses of outer space. By the beginning of the 1980's, France, Japan, India, the People's Republic of China, the Soviet Union, the United Kingdom, and the United States possessed the ability to launch vehicles into outer space.

Many of these vehicles are of a military nature. Their technical features include the gathering of sensitive information on nations, rapid communication, and precise navigation. Because of these features, equatorial nations such as Brazil, Indonesia, and Zaire have expressed a desire for the establishment of an internationally recognized demarcation line that would divide a nation's air space from outer space.

One of the oldest definitions as to where a nation's air space ends and outer space begins is cujus est solun ejus est usque ad coelum.[1] Dating from the

---

[1]Lincoln Bloomfield, ed., Outer Space: Prospects for Man & Society (New York: Prentice-Hall, 1962), p. 153.

time of the Roman Empire, the translation of this maxim states that whoever controls the soil also controls all the region lying above it to the ends of the universe. However, various concepts which are abundant in modern physics make such a definition impractical. Due to the rotation of the Earth and other heavenly bodies, this maxim would mean that ownership of objects would constantly be changing. If this definition were followed, therefore, it would not be in a nation's best interest to launch a vehicle for once it passed into outer space it would be subject to confiscation. According to Andrew Haley in Space Law and Government, in 1946 the United States Supreme Court ruled in United States v. Causby, that this "doctrine has no place in the modern world."[2] Consequently, the idea of a nation owning all the region above its soil is today in general disrepute.

Since 1967, there has been a growing movement toward the concept of res communis in many areas. In this case, outer space should not be allowed to be appropriated, but be held in common for the use of all as a benefit to all mankind.[3] At the time this concept originated, it was meant to insure the equal

---

[2]Andrew G. Haley, Space Law and Government, (New York: Meredith Publishing Company, 1963), p. 95.

[3]Bloomfield, p. 158.

distribution of whatever resources might be discovered in outer space. Yet it failed to recognize where outer space begins. Naturally this concept was meant to apply only to heavenly bodies that might provide valuable resources. But yet another goal was to make certain that outer space would be exploited only for peaceful, scientific purposes.

Between 1970 and 1980, a consensus began to emerge among experts that a demarcation line between a nation's air space and outer space should be placed between 50 and 150 miles above sea level. Various organizations and individuals have offered potential definitions. Despite these efforts there has been no internationally accepted legal definition as to where outer space begins.[4] The Stanley Foundation has long been involved in the search for such a definition. As early as 1974 this foundation proposed that outer space be defined as the

> limitless region lying beyond the highest altitude in the Earth's atmosphere that is accessible to nonballistic airborne vehicles (about 30 miles) and added as a more restricted definition that the inner boundary of outer space could be interrupted as the minimum altitude at which an unpropelled

---

[4]Stephen Gorove, "The Geostationary Orbit: Issues of Law and Policy," The American Journal of International Law 73 (July 1979): 446-447. Mr. Gorove is Chairman of the Graduate Program in Law and Professor of Law at the University of Mississippi, and member of the International Academy of Astronautics.

> satellite can orbit the Earth for an extended period (about 150 miles).[5]

Four years later, the Stanley Foundation revised its definition to state that outer space begins at an altitude of 60 miles.[6] This definition was also accepted by Stephen Gorove of the University of Mississippi, for it is the lowest altitude at which a non-geostationary satellite can be maintained.[7]

When viewed from a strict scientific standpoint there would seem to be a more adequate definition. Approximately 150 miles above the Earth's surface there exists the von Karman line.

> This is a curve of altitude plotted against velocity, connecting the points at which aerodynamic flight effectively ends and centrifugal force takes over.[8]

Although the von Karman line is a physical demarcation line rather than a legal one, it does serve as the best definition of where outer space should properly be said to begin. Consequently for the purpose of this study, outer space will be defined as that limitless region

---

[5]Peter Jankowitsch, International Cooperation in Outer Space (Muscatine, Iowa: The Stanley Foundation 1976), p. 20.

[6]Thirteenth Conference on the Next Decade: Cooperation or Confrontation in Outer Space, by C. Maxwell Stanley, Chairman (Iowa City, Iowa: The Stanley Foundation, 1978), p. 8.

[7]Gorove, p. 447.

[8]Bloomfield, p. 155.

beginning approximately 150 miles above the Earth's sea level. In this region nations have deployed numerous satellites. The presence of these satellites challenges the idea that outer space should remain a peaceful environment that can be of benefit to all mankind.

## The Military Potential of Outer Space

In October 1957, the Soviet Union launched the first man-made object ever to be placed in outer space, Sputnik I.[9] With that event a race began to determine which nation, the Soviet Union or the United States, could most fully develop the technical prerequisites of flight in outer space. With the advent of this space race came the fear that one nation might gain a strategic advantage by turning its peaceful space program into a military program. But as the Center for Defense Information points out, the space programs of the Soviet Union and the United States have always possessed military characteristics.

> Using United Nations and other unclassified data, it can be estimated with some confidence that about 60 percent of the U. S. space launchings have been conducted by the military; a slightly higher percentage is true for the Soviet Union.[10]

Lt. General Kenneth W. Schultz, former Commander of the

---

[9]Haley, p. 128.

[10]Center for Defense Information, "The Militarization of Outer Space," The Defense Monitor IV (July 1975): 2.

U. S. Air Force Space and Missile Systems Organization, in 1974 stated that a

> sharp definition of separate roles for military and civilian space efforts has not always been easy. In actual fact, the two programs have worked in close and economical cooperation, sharing specially qualified manpower, and the ever-broadening expertise that comes with experience.[11]

From this it is logical to conclude that the Soviet Union and the United States are becoming staunch competitors in their exploitation of outer space. Thus it is to be expected that France, Japan, the People's Republic of China, and the United Kingdom, each possessing the indigenous capability to launch vehicles into outer space, may also explore potential military applications. Yet at present, the Soviet Union and the United States are the major users of outer space.

Increasingly, these two nations use outer space for military purposes since

> space technology could free military forces from dependence on foreign bases and from the need for communication and monitoring facilities in other countries. The U. S. Air Force, for example, envisions both manned and unmanned space stations that would be used for targeting, damage assessment and retargeting of strategic weapons, weapons guidance, and real-time battlefield command, control and communications functions.[12]

---

[11]Ibid., p. 7.

[12]Herbet Scoville, Jr. and Kosta Tsipis, Can Space Remain a Peaceful Environment? (Muscatine, Iowa: The Stanley Foundation, 1978), p. 9

Furthermore, today

> both superpowers regard space as a medium--much like the oceans--to be used militarily. From the beginning, the military uses of space have involved more than manned or unmanned spacecraft. Intercontinental ballistic missiles (ICBMs) which by necessity pass through outer space in their trajectories have been part of the American and Soviet inventories for more than a decade-and-a-half.[13]

Consequently, it is to be expected that should the Soviet Union and the United States engage in a struggle for mortal survival that outer space would erupt in a barrage of missiles as the skies over the United Kingdom erupted in 1940 with German aircraft.

Outer space is in a transition phase from use as a passive military medium to an active one. The military establishments of both nations have deployed numerous satellite systems which serve in a passive military mode.

> Satellites are used for such military operations as warning, reconnaissance, communications, and navigation, as well as civilian functions such as meteorology, civil communications, and scientific exploration.[14]

In essence these satellites serve not as weapons of destruction but as a tool for guiding such devices.

---

[13]Center for Defense Information, "The Militarization of Outer Space, p. 2.

[14]U. S. Arms Control and Disarmament Agency, Arms Control Report, "Anti-Satellite Talks," Twentieth Annual Report. (Washington, D. C.: U. S. Arms Control and Disarmament Agency, 1981), p. 92.

"Once enhanced by computers, spy satellites' pictures can show a car license plate on the ground from over 100 miles in space."[15] These pictures provide the Soviet Union and the United States with the assurance that neither side is preparing to launch a massive nuclear attack.

> Launch a ballistic missile almost anywhere, and the heat of the engines will be spotted within two minutes by infrared sensors carried in early warning satellites. These satellites, in very high geosynchronous orbits, remain poised over particular sectors of the world.[16]

Both the Soviet Union and the United States are developing ASAT programs that could be operational within two years. Both nations are conducting such research in the hope of developing the capacity to negate unfriendly satellites thus decreasing the efficiency of the opposition's nuclear forces. Should one nation decide to destroy the military satellites of another, an act of war, equivalent to the Japanese bombing of the U. S. Naval Base at Pearl Harbor in 1945, would be committed. It is logical to assume no nation would commit such an act unless it was willing to unleash its nuclear deterrent. Consequently, the attacked state would realize it had no option but to respond in kind

---

[15]WGBH, "The Real War in Space," p. 2.

[16]Nigel Calder, Nuclear Nightmares (New York: Prentice-Hall, 1979), p. 93.

by unleashing its own nuclear strike force. This in the end may well mean the mutually assured destruction (MAD) of both nations. In the succeeding sections of this chapter, a more detailed analysis will be made of Soviet and American space assets.

## Soviet Space Assets

All anti-air defense operations of the Soviet Union are carried out by P-V-O Strany, a branch of the Soviet military coequal with the Soviet Army, Navy, or Air Force. The new service was named P-V-O Strany for the Russian words protivovozdushnaya oborona meaning anti-air defense.[17] As with all branches of the military, P-V-O Strany is subdivided into specialized units, one of which is P-K-O ("protivosmicheskaya oborona, Russian for defense against space-orbiting combat missiles or intelligence satellites").[18] It is the P-K-O which has primary responsibility for carrying out Soviet military objectives in outer space.

Although detailed information on Soviet space assets is not available, some general characteristics can be outlined. According to the Stanley Foundation, Soviet satellites can be classified in to eight categories

---

[17]American Security Council, "The Soviet ABM Monopoly," Washington Report, April 21, 1969, p. 1.

[18]Ibid., p. 2.

by function.[19] These categories are communications, meteorology, early warning, reconnaissance, intelligence, mapping, navigation, and antisatellite targets and interceptors. Soviet communication and meteorological satellites serve both the civilian and military sectors and therefore are not classifiable as solely military satellites. The purpose of Soviet early warning satellites is the same as it is for American, to detect the launch of enemy missiles. The Cosmos and Salyut satellites serve as a means of closely examining particular areas. These satellites have an operational life span of between 12 and 30 days. Ocean reconnaissance satellites are nuclear powered and provide continuous surveillance of ships. Should the United States have an operational ASAT device and a nuclear conflict occur, these satellites would be the top priority target. Soviet electronic intelligence satellites serve as a means of gathering radio and radar emissions for military analysis. Such emissions would include telemetery information for American missile tests. Mapping satellites serve to provide information to improve missile accuracy. Navigation satellites also serve as a means of improving missile accuracy, and to provide Soviet ships with their

---

[19]In Appendix A, a chart is presented of Soviet Military Space Programs. Karas, p. 29.

location. The Soviet navigation satellites are similar in function to the American Transit system.[20]

The Soviet Union has by 1981 tested the only ASAT weapon that could become operational within a year's time.

> The Cosmos interceptor satellites that have been tested so far work like this: having identified and been guided to the target satellite, the Cosmos maneuvers up beside it and then explodes. The resulting fragments of shrapnel from the explosion will completely wreck the delicate system of the target satellite and put it out of action.[21]

However it cannot be stressed too many times that even though these satellites have been tested in outer space, they have yet to be deployed as an operational weapon system. Furthermore, one Cosmos interceptor satellite can be targeted at only one enemy satellite. As of 1981, the Cosmos interceptor satellite program has conducted tests in outer space eighteen times.[22] Of the first seventeen tests, seven of these are known to be failures.[23] An example of such a failure occurred in 1969.

---

[20]Thomas H. Karas, Implications of Space Technology for Strategic Nuclear Competition (Muscatine, Iowa: The Stanley Foundation, 1981), p. 31.

[21]WGBH, "The Real War in Space," p. 6.

[22]Paul Recer, " 'Star Wars' Weapons May Come True," U. S. News & World Report, July 27, 1981, p. 46.

[23]"Study Group Warns Against Space Wars," The Washington Star, 21 October 1980, sec. D, p. 10.

> Evidence of a Soviet test of anti-space defense was provided by...the U. S. Air Defense Command's "Satellite Situation Report." That document disclosed that between October 19 and the first of November, three space vehicles were launched by the Soviet Union from their Cape Kennedy--known as the Tyuratom Space Center. Cosmos satellite 248 was sent into orbit on a trajectory that would carry it to an angle of 62.2 degrees over the equator. On practically the same course, Cosmos 249 and 252 were sent after it. About 300 miles above the earth, the three satellites were in close proximity. Suddenly, 249 and 252 exploded into lots of little pieces, according to the U. S. Report, Cosmos 248, unharmed, continued on its way.[24]

Soviet tests of interceptor satellites are conducted at an altitude no higher than 600 miles. When perfected, these satellites may pose a threat to the American space shuttle and to some reconnaissance satellites. Yet,

> The Soviet antisatellite weapon has not been tested at the geosynchronous orbital altitude where U. S. warning satellites and a number of communications satellites are stationed. The U. S. Satellite Data System (SDS) satellites, which would relay communications over the North Pole to U. S. bombers, pass the Earth at low altitude but at a higher velocity than the targets against which the Soviet interceptor has so far been tested.[25]

Therefore perfection of the Soviet interceptor satellite weapon, within its current orbital parameters,

---

[24]American Security Council, p. 3.

[25]Karas, p. 19.

would be only an inconvenience to American monitoring of the Soviet Union.

As one of the two major powers, it has long been the supposed intent of the Soviet Union to negate American space assets. But there emerges an equally viable alternative, that is to negate the space assets of the People's Republic of China. For the last twenty years, there has been an uneasy truce between the People's Republic of China and the Soviet Union. At present, both sides use reconnaissance satellites to monitor the movements of the other.

It was noted in a report by the Center for Defense Information, that "Chinese reconnaissance satellites do travel in orbits similar to those of the Soviet test targets."[26] Consequently, the Soviet ASAT program may be aimed at what it considers its most dangerous adversary. Since the People's Republic of China is not a party to the 1968 Outer Space Treaty, it may feel no legal restraint on deploying nuclear warheads in outer space. Therefore, the Soviet Union may require an option to counter such a possible Chinese move.

## American Space Assets

Unlike in the Soviet Union where it is the assigned purpose of the P-K-O to guide the deployment of military objects in outer space, the United States has

---

[26]"Study Group Warns Against Space Wars," p. 10.

no single branch of the military with such responsibilities. Various individuals in the Department of Defense (DOD) and Congress blame the delay of various military space projects due to the division of the military space responsibilities.

> This has led to serious consideration, within the DOD and Congress, of establishing a new branch of the armed services for space warfare, probably Space Command. The reasoning is that the USAF and Navy are seeking to avoid developing space weaponry for defense and that any effort in this area takes away from total obligational authority for other planned strategic weapon systems. There also is some concern over roles and missions between the Army and USAF as to where the Army's ballistic missile defense mission stops and the USAF's traditional space defense mission begins.[27]

Separate satellite communication systems are maintained by the USAF and Navy.[28] Such systems are justified due to the exclusive needs of each service. The creation of a special service, Space Command, would serve to unify the American military program in outer space.

Even without one branch responsible for coordinating military activities in outer space, American military efforts have been far from unsuccessful.[29]

---

[27]Clarence A. Robinson, Jr., "Beam Weapons Technology Expanding," Aviation Week & Space Technology (May 25, 1981): 40.

[28]A brief description of current American Military space assets is provided in Appendix B. Center for Defense Information. "The Military Race in Space," The Defense Monitor IX (1980): 4.

[29]In Appendices C and D, future American military goals in outer space are defined. Karas, pp. 27-28.

American satellites can basically be divided into five categories; communications, surveillance, early warning, meteorological, and navigation.

1) Two-thirds of U. S. military long distance communications are carried by satellites. Twenty-seven of the major U. S. military headquarters receive and issue commands by satellites. Most U. S. warships are directed and controlled by messages sent through satellites.[30]

2) Surveillance satellites fly in a very low, elliptical orbit, with a perigee of 100 miles or less. Sophisticated photo-reconnaissance satellites, carrying powerful cameras, can distinguish a golf ball on a green. The 11-ton "Big Bird" satellite locates targets, monitors troop and missile deployments and watches the world's trouble spots. It can provide live coverage on film packs which it ejects to be recovered by airplanes.[31] A secret Air Force bureau, the National Reconnaissance Office, operates the satellites. A rarely mentioned center at a secret location, the Defense Special Missile and Astronautics Center, collects information from the satellites. This information is analyzed by workers in the CIA, the National Security Agency (DIA), and the intelligence organizations of the Army, Navy, and Air Force.[32]

3) Early warning satellites operating from synchronous orbits of 20,000 nautical miles, can detect either land-based or submarine missile launches almost

---

[30]Center for Defense Information, "Military Race In Space," p. 2.

[31]Center for Defense Information, "The Militarization of Outer Space," p. 4.

[32]Center for Defense Information, "Military Race In Space," p. 2.

instantaneously, using infra-red sensors. There are two early warning satellites in orbit over the western hemisphere, and one over the eastern.[33]

4) Satellites provide weather information to permit continuous planning for offensive and defensive military operations. Two U. S. military weather satellites take pictures of the whole Earth four times a day.[34]

5) The Navy's Transit navigation satellite, in use since the early 1960's, was designed primarily to allow missile submarines to fix their positions at sea. By 1984 this will be replaced by the global positioning system, NAVSTAR.[35] NAVSTAR will provide position accuracy anywhere on the globe within 10 meters or less. This will give warships an instantaneous day and night fix in three dimensions making star navigation as obsolete as the bow and arrow.[36] The United States plans to install bhangmeters, nuclear explosion detectors, on its NAVSTAR satellites.... The ability to learn almost instantly where our nuclear weapons have and have not detonated would be an extremely powerful force multiplier. Today it is generally assumed that an attack on enemy missile silos would require aiming at least two nuclear warheads at each silo, even if the single-shot kill probability of the individual warheads approaches 100 percent. The extra coverage is needed to compensate for missile and warhead unreliabilities which cannot be predicted. If, however, quick damage assessment reports were available, the initial

---

[33]Center for Defense Information, "The Militarization of Outer Space," p. 3.

[34]Center for Defense Information, "Military Race In Outer Space," p. 2.

[35]Center for Defense Information, "The Militarization of Outer Space," p. 4.

[36]WGBH, "The Real War in Space," pp. 3-4.

> attack would need to use only one warhead per silo, followed, if the warhead were to fail, by another directed at the missile silo. Thus the number of warheads needed for a powerful threat against a land-based ICBM force can be reduced about 40 percent.[37]

If an ASAT weapon were developed and deployed it would threaten the ability of the Soviet Union or the United States to carry out a nuclear strike. Therefore, such an advance in technology might increase the need of a pre-emptive strike.

To allow the United States the ability to respond to a Soviet attack on American satellites, the United States has several ASAT programs under development. Unlike the Soviet interceptor satellite, by 1983 the United States will have developed a cylindrical object which contains no explosives. These Miniature Homing Intercept Vehicles (MHIV) will weigh about 34 pounds, and be less than 2 feet in diamter. Due to its small size, it could be thrown into orbit by a F-15 fighter zooming to a high altitude.

> Once ejected, its own rocket motors will maneuver it into an intercept position determined by on-board optical sensors and a small computer. Traveling at an orbital speed of about 17,500 miles an hour, the small vehicle's combination of mass and high speed will cause anything it impacts with to disintegrate.[38]

---

[37]Karas, p. 9.

[38]Benjamin F. Schemmer, "Does U. S. Need Bigger Anti-Satellite Effort?" Armed Forces Journal, July 1980, p. 41.

One possible weapon that the Soviet Union does not have an equivalent to is the American space shuttle.

> The space shuttle is a joint National Aeronautics and Space Administration (NASA) DOD project.... Although the military plans extensive use of the shuttle,...NASA is paying nearly all research and development costs, estimated at $6-8 billion. DOD plans to purchase its own shuttlecraft at $300-500 million each.[39]

Until the military acquires its own shuttle it will be using NASA shuttle flights. "American officials admit that in the next few years at least a third of the shuttle flights will be devoted to military cargo."[40] One such example, is the testing of "mosaic infrared sensors that could track missiles or strategic aircraft with greater precision."[41] Also, another mission "will test a satellite booster rocket, the so-called Inertial Upper Stage...to blast them into higher orbits out of range of Soviet killer satellites.[42] The Soviet Union, perceiving the potential of the space shuttle has attempted to negotiate a halt to its development. Failing this, the official Communist media have condemned the space shuttle's military potential.[43]

---

[39]Center for Defense Information, "The Militarization of Outer Space," p. 5.

[40]Recer, p. 48.

[41]Karas, p. 5.

[42]"America's shuttle: hawk or a dove?" Today, 24 April 1981, p. 5.

[43]Ibid.

## Summary

By the beginning of the 1980's, France, Japan, the People's Republic of China, the Soviet Union, and the United States each possessed the indigenous capability of launching vehicles into outer space. This has led to a desire of equatorial nations to define where their air space ends and outer space begins. The oldest definition is cujus est solun ejus est usque ad coelum, meaning whoever controls the soil also controls all the region lying above it to the ends of the universe. However, in 1946 the United States Supreme Court ruled in United States v. Causby that this doctrine has no place in the modern world. Since 1946, other legal definitions have been offered by the Stanley Foundation and Stephen Gorove. Yet none of these definitions have been universally accepted. For the purpose of this study, the von Karman line, a physical definition, will be used as a demarcation line of where outer space begins and a nation's air space ends.

The use and uses of outer space are currently in a transition phase. Since the 1960's, both the Soviet Union and the United States have deployed satellites into outer space as a means of monitoring the military movements of the other. These passive military satellites are now being followed by a generation of non-passive military vehicles. At present, the Soviet

Union is testing an interceptor satellite which when developed may threaten some low orbiting unfriendly satellites and the American space shuttle. One possible reason for the Soviet program may be to be able to counter actions of the People's Republic of China in outer space.

The United States is also developing an ASAT device known as MHIV which could be deployed as early as 1983. MHIV is a cylindrical, non-explosive device that will destroy an object by impacting with it at a high speed. One American weapon the Soviet Union does not have a counterpart to is the space shuttle. Developed by NASA and the DOD, in its first few years of flights a third of its missions will involve military cargoes. Finally in Appendices A, B, C, and D of this thesis, current and projected Soviet and American space activities are described.

## CHAPTER III

## TECHNICAL ASPECTS OF DIRECTED ENERGY WEAPONS

### Weapon Potential

When the idea of directed energy weapons (DEWs) was conceived by the British in the 1940's, it was to negate invading aircraft. Since the 1940's technical innovations have in many ways revolutionized offensive and defensive actions that could take place in a conflict between the major powers. In the 1980's, one of the new defensive concepts would be the deploying of DEWs in outer space for ABM and ASAT operations. The purpose of this chapter will be to explore the technology and functioning of DEWs and their possible deployment in outer space.

All weapons which transfer energy to an object by use of non-explosive means are categorized as DEWs. The two most prominent members of this category are particle beam weapons (PBWs) and laser (light amplication by stimulated emission of radiation) weapons.

> Both laser and particle beam weapons project a concentrated beam of high energy, either in the form of a continuous wave or a pulsed emmission, that either destroys the target by burning a hole in it or disrupts the path of the target by knocking it off course because of the great atmospheric pressure the

> beam creates. The basic difference between the two weapons is that a laser produces its effects through a light wave, while a particle beam projects highly accelerated neutral atomic and subatomic particles that emit intensive radiation.[1]

Thus the physical aspects of the energy beams differ, one projects light waves or photon bullets while the latter projects atomic or subatomic particles.

As stated, DEWs propagate energy beams in either continuous or pulsed waves. The type of energy beam connotes the amount of time the power output will be sustained.

> Continuous power output connotes a steady and sustained power levels for seconds, minutes, hours, or weeks. The laser device is simply turned on and "runs" for extended periods. Conversely, "pulsed" lasers run only at intervals, which may be very short, for only a small fraction of a second, typically measured in millionths of a second (micro-seconds) or billionths of a second (nanoseconds) but can do so at extremely high power, referred to as "instantaneous" power output.[2]

The environment in which DEWs are deployed will be the determining factor as to the effectiveness of the energy beam. If such a weapon system were ever based on Earth it would be subject to various atmospheric conditions; haze, rain, and clouds. Such conditions would

---

[1]Donald M. Snow, "Lasers, Charged-Particle Beams, and the Strategic Future," Political Science Quarterly, 95 (Summer 1980): 282.

[2]U. S. Department of Defense, High Energy Laser Research Program FY 1980, by Dr. J. Richard Airey, (Washington, D. C.: Government Printing Office, 1979), p. 18.

dilute an energy beam and thereby turn what could be a most effective energy beam at 200 kilometers on a clear day into an ineffective one at 100 kilometers on a cloudy day. Also when based on Earth, it would be difficult to redeploy a DEW in a small amount of time. Thus, the nonmobile weapon system would be limited as to the number of objects it could be employed against.

The most accepted mode for deployment of DEWs will be in outer space so that atmospheric conditions will not become a factor in its performance as an ABM or ASAT device. Once deployed in outer space, a directed energy battle station (DEBS) would have a wider angle from which to acquire targets. Such a weapon station would be able to cope with a larger number of targets consequently decreasing the need for it to be redeployed. When such a need should arise, redeployment would be accomplished efficiently by the firing of a thruster rocket.

Even though the composition of various types of energy beams differ, the attributes upon which such an outer space weapon system would depend would be similar. The operational capabilities of such a weapon system would need to include the ability to:

> Detect and track the target(s) with appropriate sensors.
> Identify the target(s) among decoys.
> Point the beam at a target and follow the target.
> Fire the beam at a target and follow the target.

Determine if the target was hit, or not.
Assess the damage if the target was hit.
Determine the miss vector if the target was not hit.
Correct the aiming of the beam by the miss amount.
Fire the accelerator again.[3]

After the DEBS had destroyed or negated the target, it would then proceed to acquire the next target. According to Dr. J. Richard Airey, Director of the United States Department of Defense high energy laser projects, a DEW system would need to include those elements presented in Figure 1. To be deployed in outer space, this weapon system would need to include each of those elements presented in Figure 1, along with sophisticated communications equipment.[4]

The stationing of DEBSs in outer space requires that they would need to be automated or manned. Should these battle stations be manned, a constant means of preventive maintenance would be available. Yet this would require larger battle stations so as to supply the crew with living and working quarters. This in turn would require a longer time period to deploy manned battle stations than unmanned battle stations. Moreover, this would allow any nation which believed it was threatened by such deployment a greater amount

---

[3]G. Bekefi, B. T. Feld, J. Parmentola, and K. Tsipis, "Particle beam weapons-a technical assessment," Nature 284 (March 20, 1980): 223.

[4]U. S. Department of Defense, High Energy Laser Research Program FY 1980, p. 15.

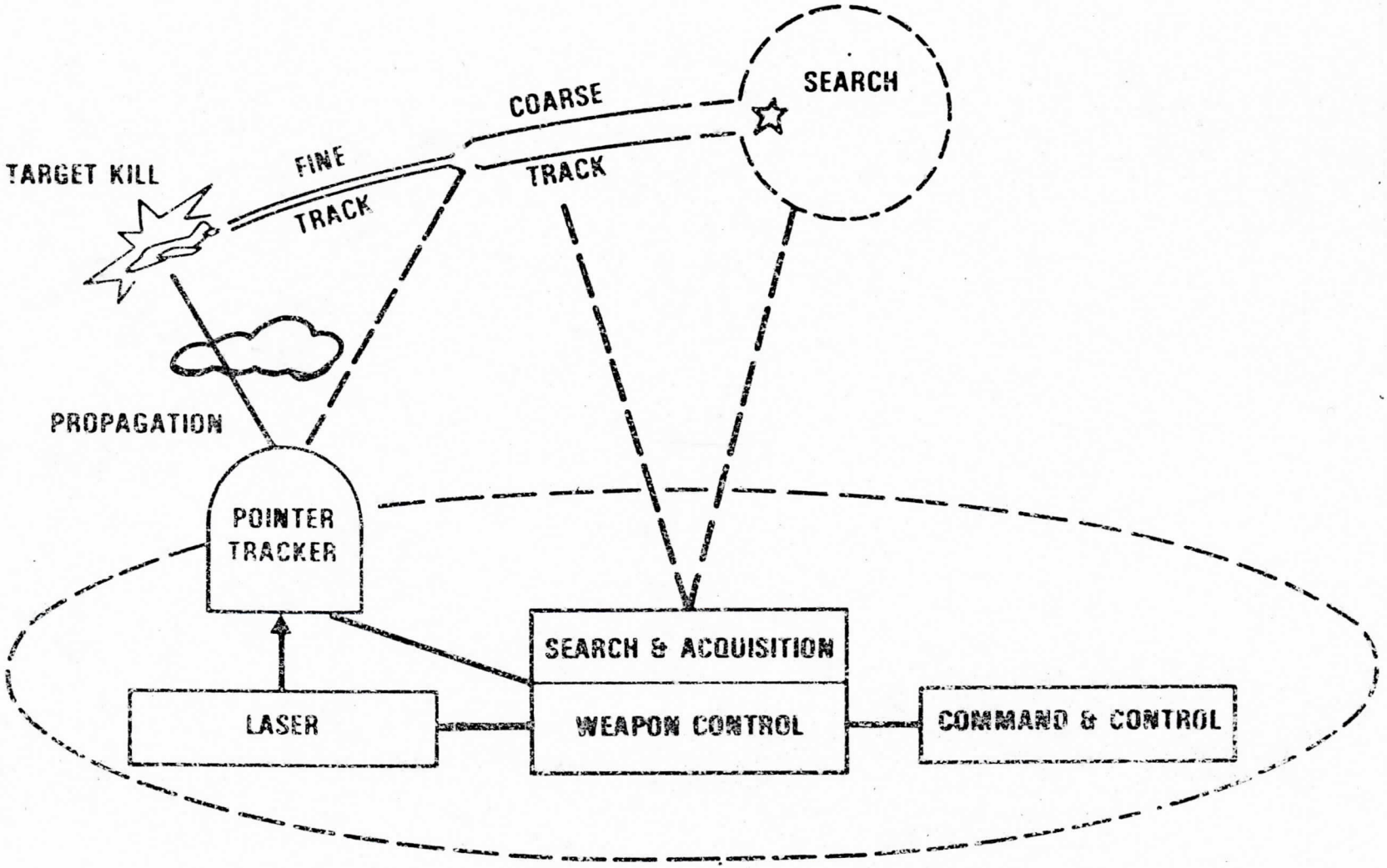


Fig. 1. Elements of a Directed Energy Weapon System

of time to respond militarily before the outer space window was closed to it. Since it would be less time consuming to deploy automated DEBSs, manned battle stations would probably not be deployed immediately. Instead, once a nation believed a sufficient number of automated DEBSs had been deployed, it may then proceed to further fortify its existing battle station system with manned battle stations.

Should DEBSs be deployed, they would be vulnerable to counter-measures. At an altitude of less than 600 miles, they would be a prime target of the Soviet interceptor satellite, or the American MHIV. Yet, should the battle station be approached by such ASAT devices it would seem probable the battle station would detect and destroy it.

Failing to destroy the battle station, the alternative would be to negate the effectiveness of the energy beam. In an ABM mode, the energy beam would have to deposit approximately 1 kilojoule of energy per square centimeter to destroy the booster stage of a ICBM.[5] Destruction of the booster stage would prohibit the possible deployment by the ICBM of more than one warhead. To counter the energy beam without hampering the capability of the ICBM, the missile would simply need to be rotated to make penetration by the energy

---

[5]Robinson, "Beam Weapons Technology Expanding," p. 42.

beam more difficult. Another way to negate the effectiveness of an energy beam would be to apply a coating of a highly reflective material to the outer skin of the missile, or a coating of several centimeters of cork or kevlar armor.[6] Presumably, the addition of armor would require additional rocket power to launch the hardened missile. Thus the benefit of ICBMs would be maintained at a higher cost.

The various countermeasures presented for ICBMs would also be applicable to satellites. To enhance satellite security, it would be necessary to redeploy them as far apart and at the highest functioning altitude. One experiment to be conducted by the American space shuttle will be the testing of an Inertia Upper Stage. This rocket could be attached to an already deployed satellite to propel it into a higher orbit. Should the satellite be a prime target, the DEBs would have to be equipped with a stronger energy beam or redeployed at a higher altitude.

These various countermeasures, along with other more specific ones for particle beam and laser weapons, tend to detract from the optimum performance levels of a DEW system. In the succeeding sections of this chapter a more detailed discussion will take place of

---

[6]Malcolm Wallop, "Opportunities and Imperatives of Ballistic Missile Defense," (Fall 1979): 20.

particle beam and laser devices. However, it must be emphasized that the purpose of this chapter is to discuss particle beam and laser weapons. Subsidiary points such as those presented in Figure 1, (i.e., pointer-tracker, search and acquisition) will not be included due to their highly technical nature.

## Particle Beam Weapons (PBWs)

Unlike an explosive warhead carried in a "ponderous" vehicle such as a missile or an artillery shell, a PBW transports deadly energy to a target through the use of kinetic energy.[7]

> As each particle hits its target it loses energy principally by transferring energy to the electrons in the target in a series of elastic collisions that leave its direction of motion largely undisturbed. Eventually the energy lost in the material manifests itself as heat, raising the temperature of the target where the beam hits it. If the number of particles depositing energy in a piece of matter is sufficiently large (large enough for the rate of energy deposition to be higher than the rate at which the material can radiate or conduct heat away), the temperature could rise until the part of the target struck by the beam either melts or cracks because of thermal stresses. The amount of energy each particle deposits in the target depends on the mass and energy of the particle, the material the target is made of and the total distance the particle travels in the target.[8]

---

[7]Snow, p. 285.

[8]John Parmentola and Kosta Tsipis, "Particle Beam Weapons," Scientific American 240 (April 1979): 55.

A single PBW would have the ability to engage and destroy multiple targets at different locations whereas one nuclear warhead could not.

To propagate a particle beam, a massive amount of electronic gadgetry would be required. By far the most important single component would be the beam generator. Consisting of a particle accelerator and its associated supply of electrical power, energy storage and conditioning, the beam generator is the source of the energy beam.[9] Approximately, 6 times $10^{10}$ joules, over a full second, would be required to power a PBW.[10] Such an energy requirement is within the limits of current technology. However, due to the physical size of the power station it would be impossible to transport it into outer space.

All particle beams are composed of charged or neutral particles. Charged particle beams are composed of electrons or protons whereas a neutral beam is composed of neutrons. Limitations placed on PBWs by technology and physics dictate that they would be useless in outer space for three reasons.

> First, the basic laws of physics that govern the motion of collections of charged particles in space forbid the unlimited propagation of

---

[9]U. S. Department of Defense, Fact Sheet: Particle Beam (PB) Technology Program, (Washington, D. C.: Government Printing Office, 1980), p. 1.

[10]Wallop, p. 18.

> a charged particle beam in a vacuum.... The second constraint would be as serious as the first. Each particle in a beam of similarly charged particles is subject to repulsion by all the other charged particles in the beam. In a uniform beam the net force on each particle is radially outward; as a result the beam tends to diverge and disperse soon after it leaves the exit port of the accelerator. The final constraint is that the charged particles are deflected by the Earth's magnetic field away from the original direction by an amount that is inversely proportional to the momentum of the particles and directly proportional to the strength of the magnetic field. The uncertainity in the amount of the deflection of a charged-particle beam from its original direction would be proportional to the uncertainty of the strength of the geomagnetic field at each point along the beam's path. Thus if the field could be known with an accuracy of, say, one part in 1,000, the uncertainity in the amount by which the beam could be deflected would be a thousandth of the total deflection of the beam. Since the geomagnetic field would deflect a 1-GeV electron beam by 1,000 kilometers over a range of 1,000 kilometers, the uncertainty in the position of the beam at the end of the range would be one kilometer. That would preclude aiming the beam with the accuracy required to hit a target a few meters long.[11]

Given these limitations, it would seem most unlikely that any charged PBW might be stationed in outer space in the near future.

Furthermore, this would seem equally true for the neutral PBWs.

> A neutral particle beam would propagate in space without being deflected by the earth's magnetic field. A beam of neutral hydrogen

---

[11]Ibid., p. 40.

> atoms, for example could be generated by first accelerating negatively charged hydrogen ions in the satellite's accelerator and then stripping the extra electrons from the atoms by passing the beam through a rare field of gas. Assuming that the magnets for bending and focusing the original beam of charged atoms could be shielded from the geomagnetic field, a neutral hydrogen beam of this type would spread from a diameter of one centimeter at the exit port of the accelerator to a diameter of 20 meters at a distance of 1,000 kilometers.[12]

The expansion of the neutral particle beam is coupled with a decline in the strength of energy in the beam. At a distance of 1,000 kilometers, the intensity of one centimeter of the beam would be two-thousandths of the intensity of the one centimeter at the point of origin. From the limitations placed on PBWs, deployment in outer space would be an unlikely event in the twentieth century.

## Laser Weapons

Laser is an acronym derived from the phrase, light amplication by stimulated emission of radiation.

> The difference between laser light and light from normal sources in everyday use is as follows: normal light sources utilize random atomic processes with little regard to the behavior of those atoms (or molecules) surrounding it. Conversely, lasers unify the atoms to emit their latent energy "in step" or "with high coherence." This is usually accomplished by a sort of domino principle in which an energy transition in the first atom

---

[12] Ibid., p. 56.

> stimulates transitions in many other atoms. The result is a cascading amplification of electromagnetic energy at a precise wavelength which can be made unidirectional by the use of very high precision mirrors.[13]

Not until 1960 was a device created by T. H. Maiman that propagated a laser beam.[14] Within two years of this, the U. S. military realizing the potential of such a discovery demonstrated the first military laser rangefinder.[15] Since its earliest demonstration, lasers have been highly regarded by the American military due to their high degree of operating precision.

Current armaments are able to inflict damage by exploding thus launching debris as lethal projectiles or by creating extreme heat. Therefore most weapons, especially nuclear weapons, are indiscriminate in their destruction of a target.

> A laser accumulates energy, concentrates it into an extremely powerful beam of light, and aims it at an object. Thus, the laser creates extreme heat on the object by transferring energy heat from the source of the laser beam to the surface of the object, thereby melting a hole in the object at the point of exposure.[16]

---

[13] U. S. Congress, Senate, Committee on Commerce, Science, and Transportation, Laser Research and Applications. 96th Cong., 2d sess., 1980: vii.

[14] Encyclopedia Americana, 1972 ed., s.v. "Laser."

[15] U. S. Department of Defense, Laser Research (Low-Energy) Program by Dr. George Gamota, (Washington, D. C.: Government Printing Office, 1979) p. 2.

[16] Snow, p. 282.

This would allow a laser beam to destroy a single target that might be surrounded by several nonhostile objects, without causing any damage to the surrounding objects.

Laser devices are divided into two groups; high energy output and low energy output. Low energy laser (LEL) beams are propagated by devices that use more than 1000 joules per pulse or have power levels of 10 kilowatts of average power.[17] High energy laser (HEL) devices have a single pulse of energy of at least 30 kilojoules or an average power output of at least 20 kilowatts. This definition would dictate that the 1962 laser rangefinder be classified as a LEL device. At the same time a HEL is the type of laser device that would be used in a ABM-ASAT mode.

> High-energy lasers offer the potential for directed energy weapons in which hostile targets are disabled or "killed" by the energy in the beam. The beam can be "pulsed" or "continuous" and travels at the speed of light. Such systems require three stressing technology components: Very high power laser devices; precision mirrored optics; and precise pointing and tracking.[18]

---

[17] U. S. Congress, Senate, Laser Research and Applications, p. 4.

[18] Ibid.

In Figure 2, a schematic diagram is presented of a HEL, the type of which might be used on a DEBS according to Dr. J. Richard Airey.[19]

A HEL weapon system would be desirable due to four basic features.

1) Since light travels at 186,300 miles per second, if a laser-directed lethal flux could be made to impinge upon a target, the need for "lead time" calculations to determine the point of aim would be eliminated. This is so, because it takes but a six-millionth of a second for a laser light to travel one mile whereas a supersonic airplane traveling at Mach 2 can move only about one-eighth of an inch in this interval.

2) Laser beams can be rapidly programmed to selectively attack individual targets within a cluster of friendly vehicles and can be expected to handle numerous targets simultaneously and omnidirectionally.

3) Because each shot of laser energy requires relatively small amounts of energy to generate the beam, this makes numerous sequential shots possible, and

4) Because the beam is steered with mirrors, a laser beam weapon will have target acquisition potentials in all fields of view.[20]

However, as was stated in the first part of this chapter, the technical expertise required to station such weapons in outer space has yet to be perfected.

---

[19] U. S. Department of Defense, High Energy Laser Research Program FY 1980, p. 18.

[20] Paul A. Chadwell, "Directed Energy Weapons," National Defense, November-December 1979, p. 58.

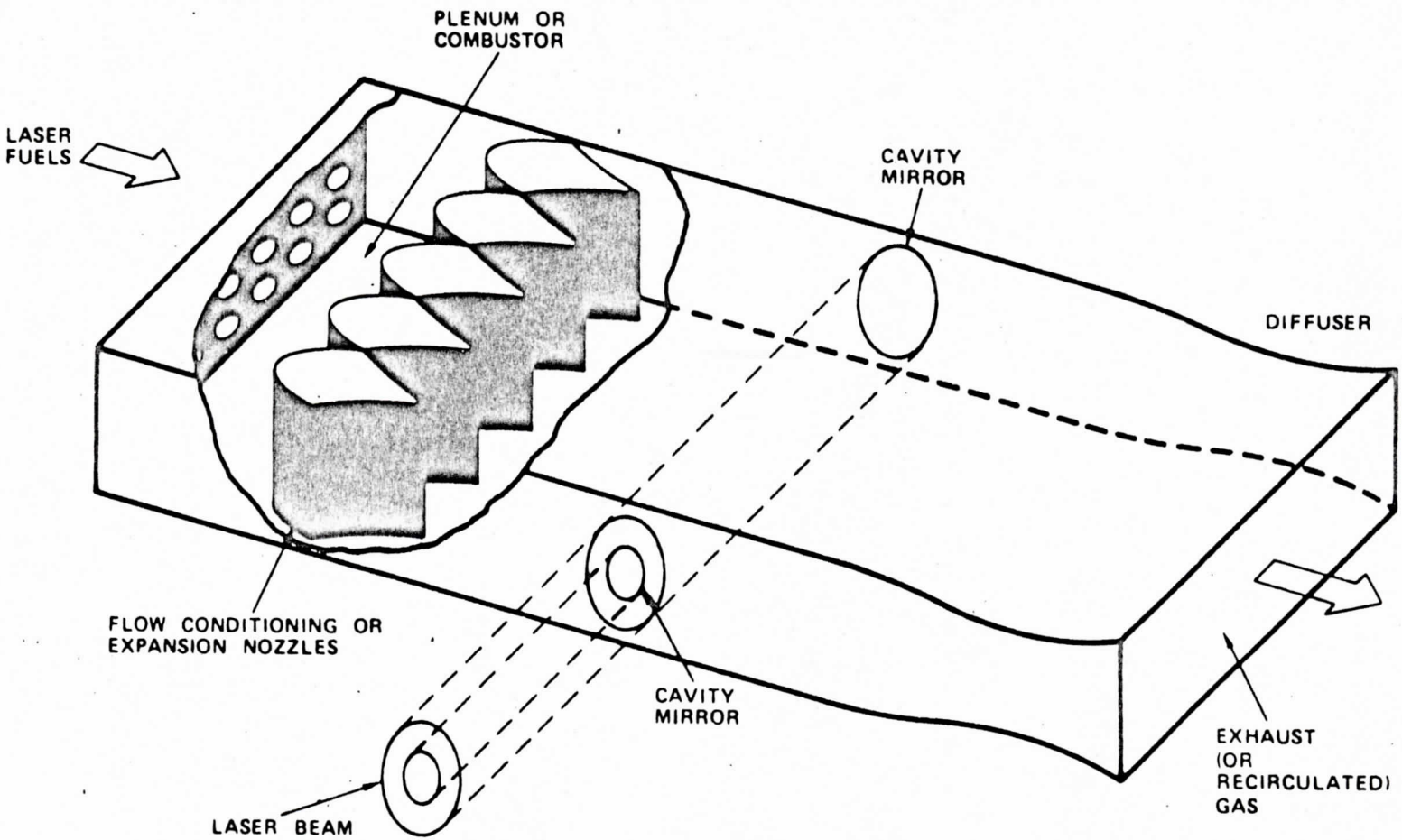


Fig. 2. Schematic Diagram of a High Energy Laser

When, and, if developed, it is possible that laser battle stations could be the most important asset in a nation's arsenal. Unlike a nuclear bomb, laser battle stations could not affect the population of a city when used solely as an exoatmospheric weapon. However, at some future time, they may be perfected and used from outer space to destroy military targets on Earth.

In the ideal situation, in the advent of a nuclear conflict a HEL battle station would

> methodically move from target to target giving all-azimuth coverage; focus the beam on the most threatening target; hold the beam on the selected aimpoint despite the target's distance, speed, and maneuver; burn through the target skin and destroy a vital component.[21]

Yet it must be assumed that any nation which sees its nuclear force being threatened will attempt to harden its missiles' susceptibility to laser energy.

## Deployment in Outer Space

As outer space would be the most favorable medium for deployment of DEBSs, HEL weapons would seem to be the best suited DEW for use on a battle station. Laser technology in the Soviet Union and the United States is far closer to being perfected for near term use than is PBW technology. Also, from the preceding discussion it would seem that a HEL weapon would be more affective in

---

[21] U. S. Congress, Senate, Laser Research and Applications, p. 20.

outer space than a PBW. In this section, a look will be taken at the HEL battle station and its deployment in outer space.

A system of HEL battle stations, like any weapon system, would possess both positive and negative features. In the Summer 1980 edition of the Political Science Quarterly, Donald Snow points out that the

> maximum use of technology requires basing lasers on satellites in space. The basic reason for this is that although a laser beam, like any other form of light is subject to diffusion and refraction in the atmosphere, its direction and intensity is not degraded in the vacuum of space. From this Barry Smernoff, along with others, concludes that space is the best arena to launch potent 'photon torpedoes' toward strategic missiles in the boost phase because during its ascent it can neither achieve maximum speed nor alter its fixed trajectory to permit effective evasive action.[22]

Yet as Clarence Robinson noted in a 1980 edition of Aviation Week & Space Technology,

> While space is a benign environment for laser weapons, it also is more difficult from an engineering standpoint because the system must be remotely controlled through a ground link or through prearranged logic. Lasers in space also will have a finite lifetime because once the fuel is expended refueling will be difficult, if not impossible.[23]

---

[22] Snow, pp. 283-284.

[23] Clarence A. Robinson, Jr. and Philip J. Klass, "Technical Survey: Particle Beams, Laser Weapons-2," Aviation Week & Space Technology (August 4, 1980): 59.

Consequently, the United States is considering development of a disposable nuclear laser. Such a HEL battle station would have several laser projectors each of which would acquire a target independently of the others. Once this was accomplished a small nuclear device would be detonated to create the energy required for the laser beam. This explosion would insure that after the completion of the engagements the battle station would be destroyed.[24]

The degree of effectiveness of any HEL battle station system will be determined by a combination of factors; the type of orbit used, the number of battle stations deployed, the number of beam projectors on board each battle station, and the distance the energy beam could be propagated. When the technical requirements have been achieved for DEBSs, the designers will need to decide what type of orbit will be used for these platforms. Most probably, either a polar orbit or a geostationary (GEOSAT) orbit will be the type used.

A polar orbit would mean the battle station will be placed in an elliptical orbit transversing the poles. According to The Washington Star, the height of a polar

---

[24]Clarence A. Robinson, Jr., "Advance Made on High-Energy Laser," Aviation Week & Space Technology (February 23, 1981): 25-27.

orbit for a DEBS would be at about 1,087 miles.[25] In a GEOSAT orbit, the satellite would be in a fixed relationship with a point on the Earth.

> A satellite placed in this orbit lies in the plane of the equator and turns about the polar axis of the Earth in the same direction and within the same period as the Earth itself.[26]

Considering this, it would seem that a GEOSAT orbit would be best suited for the deployment of DEBSs. Such an orbit would provide a means of positioning these weapon platforms over ICBM fields. However to be placed in such an orbit, the satellite will be positioned at an altitude of approximately 22,300 miles above the earth's equator.[27] To provide complete coverage of all American and Soviet satellites and missiles, a zone beginning at 100 miles above the Earth's surface, and extending to 60,000 miles must be covered. One laser weapon stationed in the center of this zone could not provide cover to the extremities. To attain such coverage, more than one tier of battle stations would be necessary.

The remaining factors are too interrelated for any nonscientific theorization to be given too much

---

[25]"Russian Work on 'Death Rays' Stirs U. S. Efforts," The Washington Star, 3 August 1980, sec. a, p. 1.

[26]Gorove, p. 445.

[27]Wallop, "Opportunities and Imperatives of Ballistic Missile Defense," p. 19.

credence. For example, a DEBS at an altitude of 800 miles and an energy beam with an effective range of 3,000 miles could cover ten percent of the Earth's surface or about 20 million square miles. Thus it might be assumed that with ten DEBSs the entire Earth's surface could be covered preventing the detonation of ICBM warheads on a nation. Yet a DEBS system with each station destroying fifteen ICBMs a minute would only destroy 1800. By adding several beam projectors to each station the kill rate could be increased. Therefore, the only certainty here is that the more laser projectors or battle stations available, the more missiles can be negated in a shorter period of time.

## Summary

Due to the innovative nature of modern technology, the Soviet Union and the United States are attempting to develop DEWs. DEW is a generic term which encompasses both PBWs and Laser weapons. "Both laser and particle beam weapons project a concentrated beam of high energy...a laser produces its effects through a light wave, while a particle beam projects highly accelerated neutral atomic and subatomic particles that emit intensive radiation."

The effectiveness of such energy beams will be determined to a large extent by the environment it is deployed in. On Earth such weapons would be limited

by atmospheric conditions and their stationary nature. In outer space, DEWs would be deployed on space platforms called directed energy battle stations (DEBSs). A DEBS would have a wide range in which it could engage targets and it would be a highly mobile weapon. In Figure 1, a representation is presented of the elements of a target acquisition system as it might appear if it were based on Earth. In outer space, sophisticated communications equipment would also be required, whether the DEBS was manned or automated.

All particle beams are composed of charged or neutral particles. A charged particle beam is composed of electrons or protons whereas a neutral beam is composed of neutrons. Both types of particle beams would be ineffective in outer space due to the dispersion of energy in the beams. Laser beams may well prove to be the ideal DEW for deployment in outer space. Like particle beams, a laser beam is an energy beam that can be targeted with high precision. Laser devices are also divided into two groups: high energy output and low energy output. High energy lasers (HELs) are the type of laser that would be used as ABM-ASAT weapons. Laser devices require three technological components: very high power laser devices; precision mirrored optics; and precise pointing and tracking. In Figure 2, a schematic diagram is presented of a HEL, the type of which might be used on a DEBS.

By far the most favorable medium for deployment of DEBSs is outer space. The degree of effectiveness of any HEL battle station will be determined by a combination of factors; the type of orbit used, the number of battle stations deployed, the number of beam projectors on board each battle station, and the distance the energy beam can be propagated. Most probably, either a polar orbit or a geostationary orbit will be the type used. However, the remaining factors are too interrelated for any nonscientific theorization to be given too much credence. Unfortunately, no scientific information is available in the public domain that takes into account the interrelationship of these factors.

## CHAPTER IV

## INTERNATIONAL LAW REGARDING DEWs

### Minimum Public Order

From the time of the first city-states in ancient Greece, mankind has attempted to proscribe certain rules for the conduct of war. This body of international law originates from treaties and conventions, custom, general principles of law, judicial decisions, and writings of recognized international judicial experts. Article 38 of the Statute of the International Court of Justice places precedence on those sources in this particular order.[1] To determine the legitimacy of DEWs, international law originating from custom, and treaties and conventions will be examined. This will help specify what potential areas of agreement between the Soviet Union and the United States might be used to bar deployment of DEWs in outer space.

The function of these two sources of international law, treaties and conventions and custom, as well as

---

[1]United Nations, Year Book of the United Nations 1946-1947 (Lake Success, New York: Department of Public Information, 1947), p. 847.

the other three, is to insure and strengthen the minimum public order.

> Initially it is assumed that the world generally exists in a state that the prominent international legal scholar Myres McDougal refers to as a "minimum public order" and from which it is disadvantageous to deviate except in so far as such departure is in pursuit of an improved or optimum world public order system. McDougal, Lasswell, and Vlasic perceive the minimum public order in the earth-space arena in these terms: The fundamental constitutional principles of minimum order, so painfully and tentatively established for the earth arena in recent times by the United Nations Charter and other authoritative expressions, would thus appear no less indispensable, in all its detailed nuances, in man's newer, expanding earth-space arena.[2]

International law embodies the concept of "minimum public order" to the extent that it attempts to decrease the chance of war, and, in a war, to protect civilian populations. Consequently to insure the minimum public order nations have attempted to create standards of conduct for the international community. These standards are set forth in international law. As international law is based upon previously accepted fact as seen in custom, and treaties and conventions it does not insure that a new type of weapon is a legal tool of war. Anthony Fessler, current head of the U. S. Security Assistance Branch for the International Law Division of the Navy Judge Advocate General,

---

[2]E. Anthony Fessler, Directed-Energy Weapons: A Juridical Analysis, (New York: Praeger Publishers, 1979), p. 31.

points out in Directed-Energy Weapons: A Juridical Analysis, that to determine the legality of a new weapon, its operation must be compared to that of existing weapons. Then, should the use of the existing weapon be restricted by treaty, one can conclude that the new weapon would also be restricted.[3]

In determining the legality of DEWs, certain inherent characteristics must be restated. First, these weapons would operate in outer space to insure the least amount of degradation to the energy beam. Also in outer space, DEWs would be highly mobile thus allowing for very efficient redeployment. Next, such weapons would serve as a means of negating unfriendly satellites and ICBMs. Third, to achieve sufficient power output for DEWs, some form of a nuclear device would most probably be employed. And finally, a DEW system would destroy its target through the use of a HEL device. Such a laser device would negate a target by melting or burning a hole in it and destroying some vital component.

## Custom

Since 1945, one source of customary international law has been resolutions of the United Nations. The degree to which such resolutions are regarded as

---

[3]Ibid., pp. 103-104.

international law is determined by the votes in favor of it. The more votes in favor of it from a wider range of governments, the stronger it will be perceived as international law. Hence, this is the basis of the statement by Leonard Meek, former Deputy Legal Advisor for the U. S. Department of State, that "when a General Assembly resolution proclaims principles of international law...and was adopted unanimously, it represents the law generally accepted in the international community."[4] The foundation of space law in the twentieth century originates in United Nation resolutions.

United Nations' Resolution 1884 (XVIII), International co-operation in the peaceful uses of outer space, was the first resolution of that body to attempt to preserve outer space as a peaceful environment. In this resolution of 1963, the Soviet Union and the United States expressed their intention "not to station in outer space any objects carrying nuclear weapons or other kinds of weapons of mass destruction."[5] This treaty does not expound upon what is meant by the phrase nuclear weapons or other kinds of weapons of mass destruction. One's first conclusion is that all nuclear weapons are weapons of mass destruction.

---

[4]Ibid., p. 44.

[5]United Nations, General Assembly, 18th Session, 17 October 1963, International co-operation in the peaceful uses of outer space, (1884, XVIII), p. 13.

However, in the 1980s it must be noted that not all nuclear weapons are weapons of mass destruction. As an example, current Soviet and American arsenals include warships powered by nuclear reactors. Under a strict interpretation of the term nuclear weapon, one could conclude they are nuclear weapons.

The equating of nuclear weapons with weapons of mass destruction indicates the writers preferred a much more limited definition. In a U. N. resolution to the Commission for Conventional Armaments dated August 12, 1948, definitions were offered for these terms.

> The resolution defined weapons of mass destruction as 'atomic explosive weapons, radioactive material weapons, lethal chemical and biological weapons and any weapons developed in the future which have characteristics comparable in destructive effect to those of the atomic bomb or other weapons mentioned above.' Some degree of continued UN support for this definitional concept is evidenced by the specific reaffirmation contained in General Assembly 84B (XXXII), adopted in December 1977. This resolution recognizes the problem of adapting the definition of 1948 to innovative weaponry. The resolution recognizes 'that new weapons might be evolved on the basis of scientific principles other than those used in the weapons named in the 1948 definition of weapons of mass destruction....' However, although only Albania voted against the proposal, the Socialist bloc states and a number of third world countries chose to abstain.[6]

The reason for those votes was that the definition was too open ended, thus weapons were not being considered

---

[6]Fessler, pp. 54-55.

separately but rather as a group. One problem with this definition can be demonstrated with DEWs. If a DEBS deployed in outer space was to negate an ICBM passing through outer space, it would not be classified as a weapon of mass destruction. Yet, if the same DEBS were to destroy a dam and the water from it destroyed a city and caused great loss of human life, it would certainly be classified as a weapon of mass destruction.

Perhaps the most important of the General Assembly resolutions was 1962 (XVIII) entitled, The Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space. Enacted on December 13, 1963, this resolution is regarded by some as the "magna carta" of an international legal regime for outer space.[7] This resolution does not deal with the concept of DEWs. But in part four of that resolution, it does state that

> the activities of States in the exploration and use of outer space shall be carried on in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding.[8]

---

[7]Fessler, p. 43.

[8]United Nations, General Assembly, 18th Session, 13 December 1963, Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, (1962, XVIII), p. 15.

The key phrase here is maintaining international peace and security and promoting international cooperation and understanding. By deploying DEBSs, a nation could not enhance or maintain the idea of this phrase. Indeed, even McDougal's state of minimum public order would be challenged, for if anything, deployment of DEBSs will increase East-West distrust.[9]

The reliability of these early U. N. resolutions as a basis for prohibiting DEWs is questionable. As Anthony Fessler points out,

> the ambiguity and absence of credible sanctioning mechanisms eliminates these early UN resolutions as a persuasive institutional basis upon which claims to arms control may be founded. These concepts are poorly suited to the demanding task of controlling innovative weaponry in the earth-space arena.[10]

Although poorly suited, U. N. resolutions do serve as a basis upon which more meaningful agreements can be founded. For example, The Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, was to serve as the foundation upon which the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies" was created.

---

[9]A further explanation of this will be provided in Chapter 5.

[10]Fessler, p. 45.

No U. N. resolution has dealt directly with the topic of DEWs. However,

> General Assembly Resolutions 3479 (XXX) of December 11, 1975 and 76 (XXXI) of December 10, 1976, requested the UN Conference of the Committee on Disarmament to develop an agreement on the prohibition of the development and manufacture of new types of weapons of mass destruction and new systems of weapons.[11]

Therefore measures are being taken that might prohibit DEWs. However, to assure the continuance of outer space as a nonmilitarized zone, it would be more beneficial if an agreement was reached on DEWs by the Soviet Union and the United States.

## Treaties and Conventions

International law, as relating to outer space, is based primarily upon the provisions of the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies" (herein referred to as the Outer Space Treaty). As of 1978, 110 nations, including the Soviet Union and the United States, were party to this treaty.[12] The legal nature of outer space is

---

[11]Fessler, p. 142.

[12]U. S., Arms Control and Disarmament Agency, Arms Control and Disarmament Agreements, 1980 Edition, "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies," August 1980.

set forth in Articles I, II, III, and IV of this treaty. Of these, Article III reemphasizes the phrase found in U. N. Resolution 1962 (XVIII), maintaining international peace and security and promoting international cooperation and understanding.

> ...states parties to this treaty shall carry on activities in the exploration and use of outer space...in the interest of maintaining international peace and security and promoting international cooperation and understanding.[13]

Therefore, this phrase must have been very important to the negotiators of the two major powers. However, there is no available interpretation as to what it meant. In general, one could assume the meaning to be that the minimum public order would be advanced especially as it might involve Soviet-American relations.

Throughout the Outer Space Treaty, the words "peace," "peaceful purposes," and "peaceful uses," are prominently displayed. This would indicate that outer space would not be associated with any aggressive action. Indeed, as Fessler states,

> ...The Soviet bloc position, as interpreted through the socialist dialect of peaceful coexistence maintained this language was synonymous with nonmilitary.... The Soviets argued that under a correct interpretation of peaceful purposes, all military use of outer space, particularly the use of near space for reconnaissance satellites was <u>ipso jure</u> illegal.[14]

---

[13]Ibid.

[14]Fessler, p. 49.

However, the position of the United States was more restrictive on the use of these words.

> Paul G. Demblin, a member of the U. S. delegation to the Legal Sub-Committee of COPUOS (Committee on the Peaceful Uses of Outer Space), reiterated the U. S. interpretation, noting that one 'might conclude that any use of outer space must be restricted to non-aggressive purposes in view of Article III, which makes applicable international law, including the Charter of the United Nations.[15]

The Soviet position to DEWs would prohibit their deployment. Yet the American position would allow their deployment as long as they were not used.

The strongest case against DEWs in the Outer Space Treaty is that presented in Article IV. Here, one finds the statement that

> States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.[16]

Again there arises the question as to what is a nuclear weapon. Physics would dictate that it is a device which destroys objects through the use of nuclear fission or nuclear fussion. If this is accepted as a legal definition then the deployment of the American disposable nuclear laser would be prohibited. However

---

[15]Fessler, p. 50.

[16]"Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies."

the intention of this treaty is vague upon this point. Considering the circumstances under which it was written, one must conclude that the writers were concerned with the damage a nuclear explosion would cause, not how it might be used to power a weapon.

Basing a decision on the Outer Space Treaty, however is not that reliable. Instead, a more reliable case against DEWs can be made by use of the "Treaty Banning Nuclear Weapon Tests in the Atmosphere, In Outer Space and Under Water." According to the treaty, the Soviet Union and the United States agree

> to prohibit, to prevent, and not to carry out any nuclear weapon test explosion, or other nuclear explosion, at any place under its jurisdiction or control: (a) in the atmospheres; beyond its limits, including outer space.[17]

Consequently, any DEW that depended on a nuclear explosion for power might be prohibited by this treaty. Due to the vague language of this treaty, such a diagnosis is open to interpretation.

The Outer Space Treaty was followed in 1972 by the "Limitation of Anti-Ballistic Missile Systems Treaty" (commonly referred to as the ABM Treaty). "The expressed purpose of this treaty was to leave unchallenged each participant's penetration capability of the

---

U. S. Arms Control and Disarmament Agency, Arms Control and Disarmament Agreements, 1980 Edition, "Treaty Banning Nuclear Weapons Tests in the Atmosphere, In Outer Space and Under Water," August 1980.

other's retaliatory missile forces."[18] Under the terms of the ABM Treaty, the Soviet Union and the United States agreed that they will deploy no more than two ABM systems; one to protect the national capital, the other to protect its ICBM fields.

Article I of the ABM Treaty clearly forbids the deployment of any other ABM system.[19] Unlike the U. N. resolutions and the Outer Space Treaty which do not define terms, the ABM Treaty does. According to the ABM Treaty, an

> ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of (a) ABM interceptor missiles,...(b) ABM launchers,...(c) ABM radars.[20]

Yet this definition does not restrict technology to one time period. Instead, the phrase "currently consisting of" indicates that this was designed to provide a non-binding comparison for innovative ABM systems. Should technology perfect a more viable system to substitute for a current one at some point (i.e., ABM interceptor missiles, ABM launchers, and ABM radars), then it would seem the new system would be equally prohibited by the

---

[18]Fessler, p. 67

[19]U. S. Department of State, United States Treaties and Other International Agreements, vol. 23, pg. 4, "limitation of Anti-Ballistic Missile Systems," TIAS No. 7503, 26 May 1972.

[20]Fessler, p. 67.

ABM Treaty. Thus a DEW system would be prohibited. According to the Snow article, "Lasers, Charged-Particle Beams, and the Strategic Future," DEW ballistic missile defenses are not technically ABMs, but as Newhouse points out, it was clearly the intent of the negotiators to ban these kinds of weapons.[21]

In Article V of the ABM Treaty, each part agrees not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based or mobile land-based.[22] The 1982 U. S. Arms Control Impact Statement defines the term "development"

> as used in the ABM Treaty, as follows: The obligation not to develop such systems, devices or warheads would be applicable only to that stage of developement which follows laboratory development contained in the development process where field testing is initiated on either a prototype or breadboard model. (As provided by Ambassador Gerard Smith to the Senate Armed Forces Committee during its hearing concerning ratification of the ABM Treaty.)[23]

Research into DEW technology would not be forbidden. Yet their deployment in outer space would be prohibited.

The other possible use of a DEW system is as an ASAT weapon. Article XII of this treaty forbids interference by a party to this treaty with "the national

---

[21]Snow, p. 291.

[22]"Limitation of Anti-Ballistic Missile Systems."

[23]Chadwell, p. 393.

technical means of verification of the other party."[24] Although not defined, the national technical means are regarded as reconnaissance satellites. Therefore, the use of DEWs against satellites would be in violation of the ABM Treaty.

A standing Consultative Commission is created under Article XIII of the ABM Treaty, to "consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous."[25] It would be within the jurisdiction of this committee to rule upon the legality of a DEW system. Failing to secure a favorable verdict from the committee, it is within the sovereign right of each Party, under Article XV, to, after giving six months notice and explanation why, withdraw from it.[26] If it were stated that the potential of DEWs was the reason for withdrawal then this explanation would be condemned as an act which is a prelude to war.[27]

Under the terms of the ABM Treaty, a reviewal of it must take place every five years. The next reviewal session is scheduled in 1982. In an article in The

---

[24]"Limitation of Anti-Ballistic Missile Systems."

[25]Ibid.

[26]Ibid.

[27]This concept is discussed in more detail in Chapter 5.

Christian Science Monitor, U. S. Senator Peter V. Domenici is quoted as saying, "the United States... should seriously consider whether to continue as a signatory to the 1972 ABM Treaty."[28] Cancellation of this treaty would eliminate a major barrier to the deployment of DEBSs. According to British Air Vice Marshal S. W. B. Menaul,

> (directed energy weapons) are a subject of the utmost importance and one that will occupy the attention of both the United States and the Soviet Union for years to come whatever the outcome of the review of the ABM treaty next year.[29]

One must then assume that the ABM Treaty, in its present state, is incapable of restraining the development of DEWs. Yet it does possess certain characteristics that may bar their actual deployment.

The ABM Treaty was further qualified by the 1972 "Interim Agreement Between the United States of America and the Union of Soviet Socialist Republics on Certain Measure with Respect to the limitation of Strategic Offensive Arms with Protocol" (herein referred to as the Protocol). The Protocol attempts to provide a narrower interpretation of future ABM systems. This bilateral interpretation states that

---

[28] "Study finds defense against missiles can be cheap, safe." The Christian Science Monitor, 9 June 1980, p. 10.

[29] S. W. B. Menaul, Letter from British Air Vice-Marshal, September 28, 1981.

> in order to insure fulfillment of the obligation not to deploy ABM systems and their components except as provided in Article III of the (ABM) Treaty; the Parties agree that in the event ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future, specific limitations on such systems and their components would be subject to discussion in accordance with Articles XIII and agreement in accordance with Article XIV of the Treaty.[30]

Consequently, for DEWs to officially become an ABM system, it would need to be declared as such by the Standing Consultative Committee for the ABM Treaty, and at the treaty's reviewal be declared an ABM weapon system by the Soviet Union and the United States.

Even without being declared an ABM weapon system, an attack on a reconnaissance satellite by a DEW would be a violation of the protocol of SALT I. Therefore, even though deployment in outer space would be prohibited, for DEWs to be used to their maximum potential a nation must first withdraw from SALT I.

The legal framework which has been examined does not provide a sufficient barrier to prohibit the deployment of DEWs in outer space. To bar such active military devices from outer space, the Soviet Union and the United States would need to enter upon negotiations either to prohibit DEWs, or to ban the use of all ABM and ASAT devices.

---

[30]Fessler, pp. 70-71.

Banning DEWs

As stated, agreement between the Soviet Union and the United States during the 1982 reviewal of the ABM Treaty could result in the classification of DEWs systems as ABM systems. Therefore, the primary purpose of DEWs would cease to exist. However, the ASAT role of such weapons would remain. Effective restrictions on DEWs can be achieved only through one of two processes; banning the deployment of directed energy devices or by a series of treaties banning the construction and deployment of ABM and ASAT devices.

By adopting an across the board ban on the construction and deployment of DEWs then some restraint could be provided. But according to James Pope, Public Affairs Adviser of the U. S. Arms Control and Disarmament Agency, "directed energy weapons are not the subject of any arms control negotiations."[31] This lack of negotiations, according to Donald Snow, is due to three interrelated influences: the general nature of the technological process in the development of strategic weapons; the knowledge of Soviet engagement in similar programs; and the difficulty of monitoring arms-control limitations.[32] However, an equally

---

[31]James M. Pope, Letter from the Public Affairs Adviser of the U. S. Arms Control and Disarmament Agency, April 23, 1981.

[32]Snow, p. 279.

plausible argument is that strategic theorists see great promise for DEWs and therefore wish to continue research into DEW technology. Should the technology prove ineffective, as did ABM technology in the 1970's, then the limitation of such weapons would be agreeable to both powers.

The Soviet Union and the United States are beginning to explore the limitation of ASAT weapon systems.

> In March 1977, agreement was reached to establish several U. S.-Soviet working groups to consider a variety of arms control topics including ASAT. In June 1978, the United States and the Soviet Union Delegations met in Helsinki, Finland for initial discussions of anti-satellite matters. The first session was preliminary in nature and devoted to discussion of the scope of a possible agreement.... Two subsequent rounds of ASAT talks were held in Bern, Switzerland from January 23 to February 16, 1979 and in Vienna, Austria from April 23 to June 17, 1979.[33]

To regulate DEWs through an ASAT agreement, it would also be necessary to regulate the Soviet interceptor satellite and the American MHIV. The purpose of the ASAT negotiations, according to the U. S. Arms Control and Disarmament Agency 1980 Annual Report,

> is to prevent an arms race in space, to avoid a destabilizing threat to strategic warning systems, and to minimize the threat to our own and our allies' freedom to operate in space. An ASAT agreement could supplement earlier arms control agreements, for example by specifically

---

[33] U. S. Arms Control and Disarmament Agency, Arms Control Report, Twentieth Annual Report.

> prohibiting attacks on satellites, and by placing limits on the testing and deployment of systems for attacking satellites.[34]

However, it is questionable if the international climate is ready to produce fruitful negotiations. In Chapter 2, the concept of the People's Republic of China orbiting an ASAT device or nuclear weapons was briefly explored. If the People's Republic of China were to become a party to the 1967 Outer Space Treaty, then one possible use of the Soviet interceptor satellite would be eliminated. This might be an added incentive for Soviet officials to accept an ASAT agreement.

According to Anthony Fessler,

> ...international law applicable to the earth-space arena, at least in its present state, is largely an ineffectual means of controlling directed-energy weaponry. Ambiguity, narrow interpretation, unreliable sanctioning mechanisms, and participant interests conspire to prevent application of these institutional bases for the purpose of controlling this innovative weaponry.[35]

Consequently, if one accepts the Royse thesis--"contending efficient weapons will be deemed lawful"--then any agreement on DEWs, before their entire potential is

---

[34]U. S. Congress, Committees on Foreign Affairs and on Foreign Relations, U. S. Arms Control and Disarmament Agency 1980 Annual Report, 97th Cong., 1st Sess., 1981.

[35]Fessler, p. 82.

known, may prove to be ineffective.[36] The only way to limit DEW systems, or any innovative weaponry, is to prohibit the testing and development of new weapons as requested in U. N. Resolutions 3479 and 74. By doing this, possible incentives offered by new weapon systems will never be known by nations or strategic theorists. However, due to the influence of the military establishments in the Soviet Union and the United States, a prohibition forbidding testing and development is unlikely.[37]

## Summary

To determine the legitimacy of DEWs, international law originating from custom, and treaties and conventions will be examined to specify what, if any, areas in which the Soviet Union and the United States are in agreement, might be used to bar deployment of DEWs in outer space. The function of these two sources of international law, treaties and conventions and custom, as well as the other three, is to insure and strengthen the minimum public order. International legal scholar Myres McDougal refers to this as a basic agreement among nations not to impair world stability. In so doing, nations agree on certain restrictions for

---

[36]Fessler, p. 95.

[37]Scoville and Tsipis, p. 18.

the conduct of war. To determine the legality of innovative weaponry, one must examine the characteristics to those of weapons that are barred from use.

Since 1945, one source of customary international law has been resolutions of the United Nations. The more support for a resolution from a wider range of governments the more it will be perceived as international law. The foundation of space law in the twentieth century originates in United Nation resolutions. Resolutions 1884 (XVIII) and 1962 (XVIII) attempt to forbid nuclear weapons and other weapons of mass destruction from being sent into outer space. However, since these terms are not defined, and no enforcement mechanisms were created, the reliability of these resolutions is questionable.

Far more precise guidelines are set forth in the Outer Space Treaty of 1967, the ABM Treaty of 1972, and the Protocol of SALT I. Each of these treaties have characteristics that might be used to argue against DEWs in outer space. However, due to loopholes and ambiguous language they would not prohibit the deployment of DEWs in outer space, but bar their actual use.

Effective restrictions DEWs can be achieved only through one of two processes; banning the actual deployment of DEWs or by a series of treaties banning the construction, testing, and deployment of ABM and ASAT

systems. By doing this, possible incentives offered by new weapon systems would never be known to nations or strategic theorists. However, due to the influence of the military establishments in the Soviet Union and the United States, a prohibition forbidding testing and deployment is unlikely. The promise of limiting DEWs lies in the threat such weapons pose to the nuclear arsenals of both major powers. In Chapter 5 the potential of such weapons is explored.

## CHAPTER V

## STRATEGIC DOCTRINE AND DEWS

### Deterrence

The creation of any type of weapon system necessitates the creation of a policy that will determine under what circumstances it would be injected into a conflict. According to Roger Trinquier, a proper definition of conflict, or warfare, would be that of an interlocking system of actions that aim at overthrowing the established authority through destruction of the political, economic, psychological, and military fiber of a nation.[1] The concept of conflict has an intricate role in the formation of a strategic doctrine.

> It is the task of strategic doctrine to translate into policy the goals of a state whether they are offensive or defensive, whether it seeks to achieve or to prevent a transformation, its strategic doctrine must define what objectives are worth contending for and determine the degree of force appropriate for achieving them.... The crucial test of our strategic doctrine is, therefore, what it defines as a threat.[2]

The basic purpose of strategic doctrine is not to

---

[1]Roger Trinquier, Modern Warfare: A French View of Counterinsurgency, trans. Daniel Lee (New York: Frederick A. Praeger, 1964), p. 6.

[2]Kissinger, pp. 7-8.

destroy an enemy, but to affect his will to fight a war by presenting him with an unfavorable calculus of risks.[3]

In the nuclear era, strategic doctrine is characterized by the Soviet-American concept of deterrence. "Lacking the ability to thwart an attack, deterrence threats have necessarily been based in the promise to punish an aggressor for launching a first strike attack."[4] Therefore, strategic deterrence dictates that a nation's nuclear arsenal must be able to survive a nuclear attack to the point that it can inflict similar damage on the attacking nation.

However, both nations are suspicious of the actions of the other. Due to this difference, the concept of deterrence may be endowed with different meanings to Soviet and American strategists. In Nuclear Nightmares, Nigel Calder puts forward that there is such a difference.

> Western deterrence aims to make the prospect of uncontrollable war so utterly terrifying to the Russians that they will behave themselves and it will never happen. If deterrence fails, the universal massacre takes its course and battle tanks have nothing to do with the case. Soviet nuclear deterrence is very difficult; it aims to prevent nuclear war by convincing

---

[3]Kissinger, p. 226.

[4]Snow, p. 287.

> the Americans and NATO that they cannot in any circumstances hope to win it.[5]

This study will not undertake the task of deciphering Soviet deterrence theory from that presented by propagandists. For the purpose of studying strategic doctrine and DEWs, Western deterrence theory will be relied upon heavily. Consequently, the lack of information on Soviet strategic doctrine is a limitation of this study.

## Nuclear Conflict

It is possible that a nuclear conflict between the Soviet Union and the United States could be fought at different levels of violence. The lowest of these levels would be the detonation of a few nuclear devices on the European battlefield, whereas the highest would be a direct nuclear exchange between the Soviet Union and the United States. The purpose of deterrence theory is to make a conflict between the major powers unacceptable.

Under the policy of MAD, both major powers are deterred from launching a nuclear attack by the knowledge that they could not escape destruction. According to Robert S. McNamara, in the Snow article "Lasers, Charged-Particle Beams, and the Strategic Future," the Soviet Union and the United States are engaged in a

---

[5]Calder, pp. 7-8.

continuous race for sophisticated armaments.

> The Soviet Union and the United States mutually influence one another's strategic plans. Whatever their intentions or our intentions, actions-or even realistically potential actions-on either side relating to the build-up of nuclear forces necessarily trigger reactions on the other side. It is precisely this action-reaction phenomenon that fuels an arms race.[6]

Recognizing the arms race syndrome, Sigal points out that "since each side believes itself to be acting defensively while the other side is taking the offensive, opponents are likely to mistake deterrent for compellent threats and to respond in kind."[7] Since ABM systems are one way to defend against a nuclear attack, the question arises whether defensive weapons are as dangerous to peace as offensive weapons? In "Opportunities and Imperatives of Ballistic Missile Defense," United States Senator Malcom Wallop argues that they are not. To prove his point, Senator Wallop quotes from a London news conference of Soviet Premier Kosygin held on February 9, 1967. "I (Premier Kosygin) think that a defensive system, which prevents attack, is not a cause of the arms race but represents a factor preventing the death of people."[8]

---

[6]Snow, p. 280.

[7]Sigal, p. 577.

[8]Wallop, p. 16.

Granted that defensive weapons do not threaten the lives of people because their purpose is to destroy offensive weapons such as ICBMs. Yet as Herman Kahn argues in his book On Thermonuclear War, if a nation believes it can "prevail" it will attempt to buy insurance.[9] Such insurance could take the form of an ABM system. For an ABM system to be effective, it would threaten to dissolve the existing balance of terror. Briefly stated, the balance of terror theory holds that peace is due to the terror that can be envisioned by a nuclear conflict between the major powers.

> The strength of the balance of terror system has been that no one nation could possibly calculate anything but self-destruction through a nuclear attack. To the extent successful defense becomes conceivable, the ability to calculate (and thus inherently to miscalculate) the possibility of survival emerges, and the inhibitions to cross the firebreak may be lowered.[10]

As stated in Chapter 4, the reason for the 1972 ABM Treaty was that the Soviet Union and the United States did not want to seriously challenge the credibility of their ICBM forces. Under the ABM Treaty, both nations are limited to two ABM systems; one to defend missile sites, the other to defend the national capitol. No ABM systems were allotted to defend industrial centers or large concentrations of the

---

[9]Noted in Sigal, p. 578.

[10]Snow, p. 289.

population. Therefore, by maintaining a credible nuclear force and the means with which to command it, the national government, the balance of terror was being preserved.

> Therefore, the dilemma of the nuclear period can be defined as follows: the enormity of modern weapons makes the thought of war repugnant, but the refusal to run any risks would amount to giving the (opposition) a blank check.[11]

## Strategic Value of DEWs

Once perfected, DEWs may offer the Soviet Union and the United States an ideal ABM-ASAT weapon. As was stated in Chapter 3, DEWs destroy a target by burning a hole through the exterior of the missile and destroying a vital component. Moreover, one DEBS could be used repeatedly to destroy targets, whereas an interceptor missile can be used only once. According to British Air Vice-Marshal S. W. B. Menaul, the United States DOD under the Reagan Administration has submitted a report to Congress explaining the value of DEWs.

> Technology being developed in Defense Department space laser weapons systems could make existing arsenals of strategic nuclear-armed weapons vulnerable, with large numbers of ballistic missiles and aircraft at risk to the deployment of a moderate number of chemical lasers.[12]

---

[11] Kissinger, p. 7.

[12] Stewart W. B. Menaul, Space-Based Strategic Defense (London: Foreign Affairs Research Institute, 1981) p. 1.

Also, DEBSs could be used to destroy enemy satellites thus hampering a nation's ability to guide its conventional and nuclear forces.

By stationing DEBSs in outer space, a nation would in affect gain control of outer space, and thereby exercise considerable influence on the Earth. First, it would be able to break the balance of terror thus creating the impression that from its standpoint a nuclear conflict was winnable. That is, it would remain relatively unharmed while its opposition could be eliminated. In doing so, it would be able to render ultimatums to the effect, surrender unconditionally, or your cities will be destroyed one at a time. To increase the tension of the opposition, the importance of the second factor comes in to action. By the destruction of its outer space satellite possessions, the intelligence gathering apparatus of the opposition government would be severely limited. Also, the vulnerability of a nation's outer space satellites would bring into question its ability to communicate with its forces.

If the outer space satellites of a state were attacked before the launching of nuclear attack...it would signal a pre-emptive attack and it would allow a nation time to prepare for it. Consequently, even though outer space may be deemed a separate environment

from that of the Earth, an attack on the outer space satellite possessions of a nation would be considered the same as an attack on military vessels on the high seas.

## Two Scenarios

Two equally viable scenarios can be envisioned for the deployment of DEBSs. In the first, the Soviet Union and the United States would deploy DEBSs at approximately the same time, whereas in the second only one of the major powers would be able to deploy DEBSs.

If both nations were to deploy DEBSs at the same time, neither nation would gain an advantage over the other. Yet it would mean that the nuclear deterrent to conflict would be gone. No longer would the two major powers be deterred from attack by the threat of their mutual destruction.

Even with their ICBM forces vulnerable, both nations could launch an attack that would be disastrous. With the threat of ICBMs no longer existing, both nations could, and probably would, resort to sea launched ballistic missiles (SLBM), cruise missiles, and biological and chemical weapons to deter an attack. Indeed, the major powers would not want for devices to maintain the balance of terror. Eventually, it is to be expected that both nations would develop DEWs that could attack targets on the Earth from outer space. Thus,

all forms of nuclear missiles might be discarded as was the bow and arrow with the advent of the rifle.

In the second scenario, one of the two major powers would experience a technological breakthrough thus enabling it to deploy DEBSs first. As early as 1957, Henry Kissinger realized the danger that technology posed to Soviet-American relations. "Weapon systems are changing at an ever accelerating rate, and every major power is aware that its survival is at the mercy of a technological breakthrough by its opponent."[13] If as Air Vice-Marshal Menaul concludes that the nation first to deploy DEBSs would "control this planet," then the balance of terror may be shifted too much.

> If the defensive capability were held by only one side, the result would clearly be destabilizing. Strong incentives to launch a preemptive attack would exist for the party with the capability. A controlled initial attack would be particularly appealing, leaving the attacked state with either launching an unsuccessful second strike or capitulating to the demands of the aggressor.[14]

However, the major power that did not possess DEBSs would also have a strong incentive to launch a preemptive attack. If a nation believed that it would be denied access to a strategic medium, outer space, then it may decide that its destruction was inevitable.

---

[13]Kissinger, p. 203.

[14]Snow, p. 289.

Therefore, if it must cease to exist as an entity, then it shall destroy the nation which has dictated this solution.

The deployment of DEBSs would pose a serious threat to deterrence theory. In the most accurate sense, DEWs deployed by one side make a nuclear conflict thinkable and therefore probable. Their purpose goes far beyond that of attempting to save human life, they attempt to allow the Soviet Union or the United States to gain a decisive military advantage over the other if the second scenario is followed.

## Summary

The creation of any type of weapon system necessitates the creation of a policy that will determine under what circumstances it would be injected into a conflict. The concept of conflict has an intricate role in the formation of a strategic doctrine. The basic purpose of strategic doctrine is not to destroy an enemy, but to affect his will to fight a war by presenting him with an unfavorable calculus of risks.

In the nuclear era, strategic doctrine is characterized by the Soviet-American concept of deterrence. Lacking the ability to thwart an attack, deterrence threats have necessarily been based in the promise to punish an aggressor for launching a first strike attack. For the purpose of studying strategic doctrine and

DEWs, Western deterrence theory was relied upon heavily. The purpose of deterrence theory is to make a nuclear conflict between the Soviet Union and the United States unthinkable. Under the policy of MAD, both major powers are deterred from launching a nuclear attack by the knowledge that they could not escape unacceptable destruction.

Since ABM weapons are one way to deter an attack, the question arises whether defensive weapons are as dangerous to peace as offensive weapons. If an ABM system was effective, it would threaten to dissolve the balance of terror and would be a danger to peace.

Once perfected, DEWs may offer the Soviet Union and the United States an ideal ABM-ASAT weapon. By stationing DEBSs in outer space a nation would in effect gain control of outer space, and thereby exercise considerable influence on the Earth.

Two equally viable scenarios can be envisioned for the deployment of DEBSs. In the first, the Soviet Union and the United States would deploy DEBSs at approximately the same time, whereas in the second only one of the major powers would be able to deploy DEBSs. If both nations were to deploy DEBSs at the same time, neither nation would gain an advantage over the other. Yet it would mean that the major powers would have to use other means to deter conflict. Furthermore, this period may see the rise of distrust or suspicion by

other nations of Soviet and American foreign and military policies. Thus the cumulative effect would be the alignment of all nations under the leadership of the Soviet Union or the United States. In the second scenario, only one of the two major powers would deploy DEBSs. This would heighten East-West distrust and foster the option of launching pre-emptive strikes.

# CHAPTER VI

## SUMMARY AND CONCLUSIONS

The purpose of this thesis was to determine the military potential of DEWs and to conclude if it is in the best interests of the United States to deploy them in outer space, or seek their prohibition through a treaty. To achieve this goal it was necessary to inspect the DEW research and development program, international law, and deterrence theory.

This study began with an analysis in Chapter 2 of the current uses of outer space. In this analysis, various legal definitions were reviewed that have been offered in the last two thousand years to delineate a nation's air space from outer space. However, the definitions presented represented the most prominent ones of this period. Failing to secure a legal definition due to a lack of agreement by legal experts, a physical definition was substituted. Accordingly, outer space was defined as beginning at the point where aerodynamic flight ends and centifugal force takes over, 150 miles above sea level on Earth.

Next, this chapter proceeded to discuss the military potential of outer space, and particularly the

military outer space programs of the Soviet Union and the United States. Two basic conclusions were derived from this chapter. One, it is difficult if not impossible to separate civilian and military space programs for there is a sharing of expertise and other resources. The best example of this is the American space shuttle which was built by a civilian agency of the United States Government, but will be flown by military officers, and will conduct both civilian and military operations. The second conclusion is that the Soviet Union and the United States are increasingly shifting operations to outer space that were once performed on Earth. This has led to the creation of both passive and active military programs for outer space. The major difference between these programs is that passive space vehicles are not equipped to destroy objects whereas active space vehicles are. The development of DEBSs would be categorized as an active military program for outer space. Appendices A, B, C, and D, outline current and projected military plans for outer space. However, it is to be expected that both nations have military plans for outer space that have yet to be divulged to the public.

Rather than attempting to discover the secretive DEW research programs of the Soviet Union and the United States, Chapter 3 provides the reader with information regarding the achievements of DEW research, and

some of the limitations that have yet to be overcome. The technology discussed is probably not the most advanced since the major powers would not allow it to become public knowledge. The environment in which DEWs are deployed will be a major factor in the determination of the strength of the energy beam and its use. Due to atmospheric conditions, deployment on Earth of such weapons would limit their energy beams. Atmospheric conditions would not become a factor in their use in outer space for ABM and ASAT operations. It must be noted that the major powers may perfect DEW technology to the point that it can be used to destroy targets on Earth from outer space. The Earth's gravitation field, however, would deflect an energy beam from a PBW. Laser weapons would therefore be most likely to be deployed on DEBSs first.

The degree of effectiveness of any laser battle station system would be determined by a combination of factors: the type of orbit used, the number of battle stations deployed, the number of beam projectors on board each battle station, and the distance the energy beam could be propagated. Due to the interrelated nature of these variables, and the lack of information in print about them, no attempt was made to theorize the characteristics of a system of laser battle stations since it would be doomed to fail due to error.

Chapter 4 provides an examination of the legality of DEWs and their deployment in outer space. International law embodies the concept of minimum public order to the extent that it attempts to decrease the chance of war and, in a war, to protect civilian populations. This study examined only two of the five sources of international law; treaties and conventions, and custom. International law existing in the form of general principles of law, judicial decisions, and writings or recognized international judicial experts, are not accorded the status given treaties and conventions and custom by the International Court of Justice. Future studies could benefit by obtaining a higher degree of precision through their inclusion, and nations could presumably benefit by following some of these guidelines.

In the study presented of international law, an evaluation of the major international and bilateral agreements that attempt to maintain outer space as a peaceful environment was presented. The basic conclusion derived from Chapter 4, is that there are provisions in international law which could be used to forbid the use of DEWs, but not their deployment.

Communication is the basis upon which international law is founded. The more precise an agreement between states, the more status it can be accorded. The opposite is true for agreements that are formed through

the use of vague language. Due to the ambiguous language contained in these agreements, no binding interpretation can be made. Basically, this is due to a lack of precision in defining terms such as "nuclear weapon." By far the 1972 ABM Treaty offers the most hope as a precedent for blocking the deployment of DEWs. As was noted, the main reason this treaty came about was to enable both major powers to insure the credibility of their nuclear deterrents. To amend it to forbid the deployment of DEWs, both the Soviet Union and the United States would have to be in agreement as they were in 1972.

To complete this evaluation of DEWs, Chapter 5 examines the strategic doctrine of deterrence. For a number of reasons Chapter 5 is the most fragile part of this thesis. First and foremost the task of determining the Soviet perception of deterrence theory was not undertaken. This was due primarily to a lack of information in the West on Soviet deterrence theory. Another limitation of this study is that the reaction to the deployment of DEBSs by nations other than the Soviet Union and the United States is not examined. The reaction to this act by other nations, especially nations possessing nuclear weapons, could trigger a nuclear conflict.

DEWs could offer a nation almost comprehensive protection from attack by land based ICBMs. Therefore it threatens the credibility of the belief that each side could punish the other for launching its ICBM force in a first strike. Consequently, it gives the side that does possess DEBSs the incentive to force the surrender of the other side. This possibility would also prompt the nation that does not possess DEBSs to launch a pre-emptive nuclear attack to inflict some damage before its nuclear force was damaged or destroyed.

Future studies of the potential of DEWs need to examine the possible effect the use of such weapons would have on the Earth's natural environment. If it could be proven that such weapons would inflict damage more severe than that of nuclear weapons, then both sides would have a mutual reason to see that such weapons are banned.

This study must conclude that the Soviet Union and the United States will possess the necessary technical expertise to deploy DEBSs by the early 1990s. As of 1981, there exists no mechanism that will bar the deployment of DEWs in outer space. If such deployment is allowed to take place, East-West relations will suffer. Thus the major powers will be susceptible to conflict. Scenario one, would dictate that the arms race would

continue thus leaving the opportunity for conflict open. Scenario two, would increase the chance of conflict at the time of the deployment of DEBSs. This conflict would not necessarily be nuclear because it could be fought with chemical or biological weapons.

It is in the best interests of the United States to promote treaties that would ban the deployment of weapons in outer space. The United States is more dependent upon satellites for communication, navigation, and reconnaissance than is the Soviet Union. Its satellite assets have a longer life span than those of the Soviet Union. Consequently, their destruction would damage American military efforts more than if the Soviet satellites were destroyed.

The major hope for banning DEWs will occur in 1982. In that year the Soviet Union and the United States will review the 1972 ABM Treaty. By declaring DEWs and ABM system the main use of such weapons would be forbidden. Therefore, the current balance of power (or terror) would remain unchanged, and the purpose of the ABM Treaty would be upheld. With the main use of DEWs denied, funding of research and development would probably be reduced. But this would provide only a momentary halt in the race for innovative weapons. To end this race for weapons, the problem must be attacked at its crux, the mutual distrust of the Soviet Union

and the United States. Peace cannot be obtained by out spending one's opponent. Peace can only be obtained by mutual trust and cooperation. As a basis for forming mutual trust and thereby insuring the minimum public order, both nations must determine what are their common interests and goals. Then they will possess the ability to attempt to enhance the minimum public order.

# BIBLIOGRAPHY

## Books

Bloomfield, Lincoln, ed. Outer Space: Prospects for Man & Society. New York: Prentice-Hall, 1962.

Calder, Nigel. Nuclear Nightmares. New York: Penguin Books, 1979.

Fessler, E. Anthony. Directed-Energy Weapons: A Juridical Analysis. New York: Praeger Publishers, 1979.

Haley, Andrew G. Space Law and Government. New York: Meredith Publishing Company, 1963.

Kissinger, Henry A. Nuclear Weapons and Foreign Policy. New York: Harper & Brothers, 1957.

Trinquer, Roger. Modern Warfare: A French View of Counterinsurgency. Translated by Daniel Lee. New York: Frederick A. Praeger, 1964.

United Nations. Year Book of the United Nations 1946-1947. (Lake Success, New York: Department of Public Information, 1947), p. 847.

## Periodicals

Bekefi, G., Feld, B.T., Parmentola, J., and Tsipis, K. "Particle Beam Weapons--a Technical Assessment." Nature 284 (March 20, 1980): 219-25.

Chadwell, Paul A. "Directed Energy Weapons." National Defense, November-December 1979, p. 56-62.

Goreve, Stephen. "The Geostationary Orbit: Issues of Law and Policy." The American Journal of International Law 73 (July 1979): 444-61.

Parmentola, John and Tsipis, Kosta. "Particle-Beam Weapons." Scientific American 240 (April 1979): 54-65.

Recer, Paul. "'Star Wars' Weapons May Come True." U.S. News & World Report, July 27, 1981, pp. 46-48.

Robinson, Clarence A., Jr., and Klass, Philip J. "Technical Survey: Particle Beams, Laser Weapons-2." Aviation Week & Space Technology, August 4, 1980, pp. 44-68.

Robinson, Clarence A., Jr. "Laser Technology Demonstration." Aviation Week & Space Technology, February 16, 1981, pp. 16-19.

_____. "Advance Made on High-Energy Lasers." Aviation Week & Space Technology, February 23, 1981, pp. 25-27.

_____. "Beam Weapons Technology Expanding." Aviation Week & Space Technology, May 25, 1981, pp. 40-71.

Schemmer, Benjamin F. "Does US Need Bigger Anti-Satellite Effort?" Armed Forces Journal, July 1980, pp. 41-42.

Sigal, Leon V. "The Logic of Deterrence in Theory and Practice." International Organization 33 (Autumn 1979): 569-79.

Snow, Donald M. "Lasers, Charged-Particle Beams, and the Strategic Future." Political Science Quarterly 95 (Summer 1980): 277-93.

Wade, Nicholas. "Particle Beams as ABM Weapons: General and Physicists Differ." Science 196 (April 22, 1977): 407-408.

_____. "Charged Debate Erupts over Russian Beam Weapon." Science 196 (May 27, 1977): 957-9.

U.S. Government Documents

U.S. Arms Control and Disarmament Agency. United States Arms Control and Disarmament Agreements, 1980 Edition. "Treaty Banning Nuclear Weapon Tests in the Atmosphere, In Outer Space and Under Water," August 1980.

_____. United States Arms Control and Disarmament Agreements, 1980 Edition. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies," August 1980.

_____. "Anti-Satellite Talks," Arms Control Report. Twentieth Annual Report. Washington, D.C.: U.S. Arms Control and Disarmament Agency, 1981.

U.S. Congress. Committees on Foreign Affairs and on Foreign Relations. U.S. Arms Control and Disarmament Agency 1980 Annual Report. 97th Cong., 1st Sess., 1981.

_____. Senate. Committee on Commerce, Science, and Transportation. Laser Research and Applications. 96th Cong., 2d Sess. 1980.

U.S. Department of Defense. Fact Sheet: Particle Beam (PB) Technology Program. U.S. Government Printing Office: September 1980.

_____. High Energy Laser Research Program FY 1980; by Dr. J. Richard Airey. Washington, D.C.: Government Printing Office, 1979.

_____. Laser Research (Low Energy) Program, Dr. George Gamota. Washington, D.C.: Government Printing Office, 1979.

U.S. Department of State. United States Treaties and Other International Agreements, vol. 23, pt. 4. "Limitation of Anti-Ballistic Missile Systems," TIAS No. 7503, May 26, 1972.

Other Sources

"America's shuttle: hawk or a dove?" Today, 24 April 1981, p. 5.

Encyclopaedia Britannica, 1972 ed. s. v. "Laser".

Jankowitsch, Peter. International Cooperation in Outer Space (Muscatine, Iowa: The Stanley Foundation, 1976).

Karas, Thomas H. Implications of Space Technology for Strategic Nuclear Competition (Muscatine, Iowa: The Stanley Foundation, 1981).

Menaul, Stewart W.B. Letter from British Air Vice-Marshal. September 28, 1981.

_____. Space-Based Strategic Defence (London: Foreign Affairs Research Institute, 1981).

"The Militarization of Outer Space." The Defense Monitor, vol. IV, nu. 5. (Washington, D.C.: Center for Defense Information, July, 1975).

"Military Race in Space." The Defense Monitor, vol. IX, nu. 9. (Washington, D.C.: Center for Defense Information, 1980).

Pope, James M. Letter from the Public Affairs Adviser of the United States Arms Control and Disarmament Agency, April 23, 1981.

"Russian Work on 'Death Rays' Stirs U.S. Effort." The Washington Star, 3 August 1980, sec. A, p. 1.

Scoville, Herbert, Jr., and Tsipis, Kosta. Can Space Remain A Peaceful Environment? (Muscatine, Iowa: The Stanley Foundation, 1978).

"The Soviet ABM Monopoly." Washington Report. (Washington, D.C.: American Security Council, April 21, 1969.

"Study finds defense against missiles can be cheap, safe." The Christian Science Monitor, 9 June 1980, p. 10.

"Study Group Warns Against Space Wars." The Washington Star. 21 October 1980, sec.D, p. 10.

Thirteenth Conference on the Next Decade: Cooperation or Confrontation in Outer Space, by C. Maxwell Stanley, Chairman (Iowa City, Iowa: The Stanley Foundation, 1978).

United Nations. General Assembly, 18th Session, 17 October 1963. Question of General and Complete Disarmament (1884 item 26).

_____. General Assembly, 18th Session, 13 December 1963. Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (1962 item 28).

Wallop, Malcolm. "Opportunities And Imperatives of Ballistic Missile Defense." (Washington, D.C.: Government Printing Office, 1979.

WGBH. "The Real War in Space." Tom Mangold. A BBC Production, 1979.

# APPENDIX A

## Soviet Military Space Programs

SOVIET MILITARY SPACE PROGRAMS

| PROGRAM | FUNCTIONS, COMMENT |
|---|---|
| Communications<br>Molniya series | Orbit provides 12-hour period with most time over USSR. |
| Some of Cosmos series<br>Stationar Series; Ekran, Raduga, Gorizont | Geosynchronous.<br>Soviet military vs. civilian communications satellites not distinguishable in every case. |
| Meteorology<br>Meteor series | Weather observation, some with earth resources scanners. Civilian vs. military not distinguishable. |
| Early Warning | Infrared sensors? for missile launch detection. |
| Photographic Reconnaissance<br>Some Cosmos<br>Some Salyut series | Average life about 12 days, some 30 days. Some do area surveillance, some close-look. Some maneuverable, some may also collect electronic intelligence. Some eject film canisters, some bring back complete cameras for recycling. |
| Ocean Reconnaissance | Nuclear-powered active radar for all-weather, day or night surveillance of ships. After mission portion with reactor raised to 1000 km orbit. Identified as "Priority One" target for US ASAT program. |
| Electronic Intelligence | Gethering radio, radar emissions for military intelligence analysis. |
| Geodetic Satellites<br>Mapping Satellites | Measuring shape of earth and its gravitational field for improving missile guidance, navigation |
| Navigation | Similar to US TRANSIT system. |
| Antisatellite Targets and Interceptors | Killer satellites approach targets, explode on command. Others may inspect or test other damage mechanisms. |

# APPENDIX B

## American Military Space Programs

## AMERICAN MILITARY SPACE PROGRAMS

### Communications

| | |
|---|---|
| Defense Satellite Communications System II | Two-thirds of U.S. military long-distance communications is by satellite. These four satellites (two spare satellites are also being kept in orbit) are part of the Worldwide Military Command and Control System which connects 27 major U.S. military command headquarters. This system carries intelligence information, diplomatic communications, information about arms treaty monitoring, communications during international crisis. |
| Satellite Data System | These satellites relay information from reconnaissance satellites to ground stations in the U.S. |
| Air Force Satellite Communications (Radio relays carried on other satellites) | In a nuclear war, these satellites are intended to allow the President and the major military commanders to communicate with each other and to send out orders to U.S. nuclear missiles, bombers, and subs. |
| Fleet Satellite Communications System | Primary purpose is U.S. Naval communications, but is also used by President when he travels abroad. |
| NATO Satellite Communications | Communications among NATO allies, including U.S. |

Early Warning

Defense Support Program

Like most of above communications satellites, these three satellites are "geostationary," meaning that they revolve around the Earth at the same speed that it turns, thus always remaining over the same places on Earth. One is over the Eastern Hemisphere, two over the Western Hemisphere. They carry special sensors which detect the infrared radiation of rockets blasting off, thereby providing early warning of land-based or sea-based missile launches. The U.S. also has ground-based radars in England, Greenland, Alaska, California, Massachusetts, and Florida to warn of missile attack. Warning messages from these radars would also be sent via satellite.

Intelligence

Photographic Reconnaissance

The KH-11 satellite yields a great deal of detailed intelligence information about the Soviet Union and other countries. The satellite can take pictures of wide areas or zoom in for very close looks. It can be maneuvered on command from the ground to be in a position to take special looks at assigned spots. The cameras and sensors on the satellite can take pictures using light at both visible and invisible wavelengths (such as infrared). Photos can be developed on board and transmitted by a form of television back to the ground. Occasionally another type of satellite is sent up to take even more

| | |
|---|---|
| | detailed pictures, which are then ejected in film capsules recovered by airplanes. Data from such satellites can tell the U.S. military about the size, location, activities, and weapons of Soviet military forces. Treaty-monitoring information is provided. Civilian and military production can be kept track of. Strategic bombing targets can be located. |
| Signals Intelligence | These satellites record and transmit to the U.S. the radio messages and radar emissions of other countries. From this data much can be learned about the military operations and procedures of the target country. |
| Ocean Surveillance | These satellites listen in on naval communications and scan the oceans with infrared and other sensors to help the U.S. Navy keep track of foreign ships. |
| Geodetic (Earth measuring) Satellite Program | The Defense Mapping Agency runs this program in cooperation with NASA and the National Oceanic and Atmospheric Administration Data from various satellites are used not only to make accurate military maps, but to gather radar altimeter readings for our new cruise missiles. Measuring the shape of the Earth's gravitational field is very important for improving the accuracy of inertially guided ballistic missiles, such as the Minuteman III, the Poseidon, the Trident I. |

Weather

| | |
|---|---|
| Defense Meteorological Satellite Program | Two satellites take visible-light and infrared pictures of the whole globe four times a day. Air Force and Navy ground stations receive the data, as do some aircraft carriers. Weather information is useful not only for planning military operations but for steering military photographic reconnaissance satellites to clear areas for best pictures. |

Navigation

| | |
|---|---|
| Navy Navigation Satellite System | For many years the Navy's TRANSIT satellites have helped ships find their locations, especially important for accurately firing ballistic missiles from submarines. |
| Global Positioning System | This system, also know as NAVSTAR, is taking over from TRANSIT. Five satellites now in orbit 11,500 miles out, with 18 planned. Will allow users to determine location to within about 30 feet in three dimensions, speed to within 4 inches per second. Vehicles on land, in sea or air, and even men with radio packs will be able to use the system, thus allowing precise navigation even in darkness and bad weather and allowing greater accuracy in delivery of weapons. The system will also be available to private users around the world, but with less accuracy. |

# APPENDIX C

## American Military Space Programs in Research

## AMERICAN MILITARY SPACE PROGRAMS IN RESEARCH

| | | |
|---|---|---|
| Strategic Laser Communications<br>For Submarines<br>For Aircraft | Experiments with blue-green lasers, (a) reflected off satellites from ground stations to submarines or (b) generated from satellites to submarines, for transmitting command messages. Other lasers for aircraft. | Communication with deeply submerged submarines, which would not have to reveal position by approaching ocean surface. Initial operation not expected until 21st century. |
| Clipper Bow | Navy ocean surveillance program would place high resolution radar on satellites. | Would probably require small nuclear reactor as do Soviet ocean surveillance satellites tracking surface naval vessels. Funds denied by Congress, but still under study. |
| National Ocean Surveillance Satellite (NOSS) | Planned DOD-NASA-NOAA satellites (first in 1986) would have carried microwave radiometer, radar altimeter, and colorimeter to measure variety of oceanic features. Demonstration program. Killed by Reagan administration. Navy may get its own satellite. | Navy would use data for selecting operating areas, avoiding damage, routing ships, operating strategic submarines, making anti-submarine warfare acoustic predictions, and possibly developing other indicators of submarine presence (sea color or temperature). |

| | | |
|---|---|---|
| High Altitude Large Optics (HALO) | Research program toward detecting and tracking aircraft and missiles from satellites using mosaic infrared focal plane sensors. | Teal Ruby to be aboard first Space Test Program Space Shuttle mission. Eventual applications in early warning, air defense, ballistic missile defense. |
| Teal Ruby | Air Force Space Test Program experiment in 1982 to test mosaic sensors. | |
| Mini-Halo | Later satellite to test other parts of HALO technology as well. | |
| Space Laser Weapons | | |
| Talon Gold | Experiment for space-based acquisition of, tracking of, and pointing to objects in space. | Space-based laser weapons could be used in both anti-ballistic missile and anti-satellite roles. |
| Space Chemical Lasers | Program funds laser development and ground-based laser radar precision tracking programs. | |
| Space Defense Operations (ASAT) | There may be testing in 1983 of Miniature Homing Intercept Vehicles carried by two-stage rockets launched at high altitudes from F-15 jet. | MHIV to home in on infrared emmissions of target satellite, collide with target. Alternate ground-based missile launch being considered. MHIV technology also part of US BMD research. |

# APPENDIX D

## Potential American Military Uses of Outer Space

POTENTIAL AMERICAN MILITARY USES OF OUTER SPACE

| TECHNOLOGY | APPLICATIONS |
|---|---|
| Space Radar: large (600 ft diameter) radar antenna and station in orbit | Could provide all-weather surveillance of ground, ocean, air, and space and give three-dimensional information on position and velocity of all types of vehicles, including missiles but excluding submarines. |
| Space-based ASW submarine detection | Measurement of indicators of submarine presence such as ocean color or temperature variations. Another concept is laser radar capable of sea penetration. Space-based detection might allow ballistic missile targeting of SSBNs. |
| Global Positioning System used to guide ballistic missiles | Missile guidance systems could learn exact position early in launch, bringing SLBM accuracy to ICBM equivalence. Maneuverable ballistic missile reentry vehicles could receive final target location information near end of trajectory, allowing precise terminal guidance. System might be used in conjunction with space-based submarine detection for ballistic missile targeting of SSBNs. |
| Solar Power Satellite | Large geosynchronous solar power station might be used to generate high-energy laser beams or microwaves to be directed against targets in space or within the atmosphere. |
| Space Based Command Post | Space Shuttle might be used somewhat as present Airborne Warning and Command Post, perhaps in conjunction with other sensors in space. Command post in geostationary position also possible. |
| Space Cruiser | Small, manned, highly maneuverable military vehicles, to be carried by space shuttle. |

VITA

Jeffrey Lynn Prewitt was born November 30, 1957, in Morganton, North Carolina. He attended elementary school in that city and was graduated from Freedom High School in June, 1976. In August of that year he entered Western Piedmont Community College, and in July, 1978 he received his Associate of Arts degree. The following August he entered Appalachian State University, and in May, 1980 he received his Bachelor of Arts degree. In the fall of 1980, he began study toward a Master's degree in Political Science which was awarded in May, 1982. During his graduate study, Mr. Prewitt held a teaching assistantship in the Political Science Department of Appalachian State University.

The author is a member of Pi Gamma Mu and Pi Sigma Alpha.

Mr. Prewitt's address is: P. O. Box 861, Valdese, North Carolina 28690.

His parents are Mr. and Mrs. Arnold W. Prewitt of Valdese, North Carolina.