

USAWC STRATEGY RESEARCH PROJECT

National Missile Defense

by

CDR Christi-Lynn Jones
United States Navy

COL George Teague
Project Advisor

The views expressed in this academic research paper are those of the author and do not necessarily reflect the official policy or position of the U.S. Government, the Department of Defense, or any of its agencies.

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

REPORT DOCUMENTATION PAGE

Form Approved OMB No.
0704-0188

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

1. REPORT DATE (DD-MM-YYYY) 07-04-2003	2. REPORT TYPE	3. DATES COVERED (FROM - TO) xx-xx-2002 to xx-xx-2003	
4. TITLE AND SUBTITLE National Missile Defense Unclassified		5a. CONTRACT NUMBER	
		5b. GRANT NUMBER	
		5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Jones, Christi-Lynn ; Author		5d. PROJECT NUMBER	
		5e. TASK NUMBER	
		5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army War College Carlisle Barracks Carlisle, PA17013-5050		8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS ,		10. SPONSOR/MONITOR'S ACRONYM(S)	
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT APUBLIC RELEASE			
13. SUPPLEMENTARY NOTES			
14. ABSTRACT See attached file.			
15. SUBJECT TERMS			
16. SECURITY CLASSIFICATION OF:		17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 32
a. REPORT Unclassified	b. ABSTRACT Unclassified	19. NAME OF RESPONSIBLE PERSON Rife, Dave RifeD@awc.carlisle.army.mil	
c. THIS PAGE Unclassified	19b. TELEPHONE NUMBER International Area Code Area Code Telephone Number DSN		
			Standard Form 298 (Rev. 8-98) Prescribed by ANSI Std Z39.18

ABSTRACT

AUTHOR: Christi-Lynn Jones

TITLE: National Missile Defense

FORMAT: Strategy Research Project

DATE: 07 April 2003

PAGES: 32

CLASSIFICATION: Unclassified

After the terrorist attacks on September 11th, 2001, President George Herbert W. Bush gained significant U.S. public support for his administration's idea of ending the Anti-ballistic Missile Treaty and for building a defense system or a missile shield to protect Americans. This was due to the fact that many people were more concerned about their safety than arms control. Further, Russia and most U.S. allies were not going to argue too strenuously with President Bush after his country had been so viciously attacked. The first question that needs to be answered prior to building a missile defense system is: Are long-range missiles realistically a threat to the United States? If it is determined that these types of missiles are a threat, a second logical question is: Does the technology exist to build a system that could realistically counter this threat? And finally, what are the costs of such a system? This paper will first assess the current threat, including recent North Korean developments and the President's solution. It will then address the costs of building a missile defense shield. After discussing current missile defense testing and the state of technology, this paper will examine alternatives to President Bush's defense shield, the effects on Russia and China, and present a recommendation on future U.S. missile defense policy.

TABLE OF CONTENTS

ABSTRACT	iii
NATIONAL MISSILE DEFENSE.....	1
INTRODUCTION	1
THE THREAT	3
NORTH KOREA.....	4
IRAQ.....	5
IRAN.....	5
RUSSIA.....	6
CHINA.....	6
OTHER THREAT ISSUES.....	6
COST	7
CURRENT DEVELOPMENT	9
ALTERNATIVES	12
CONCLUSION	17
READINESS OF TECHNOLOGY	17
THE IMPACT ON ARMS CONTROL AND RELATIONS WITH RUSSIA AND CHINA.....	18
THE COST	18
THREAT.....	18
ENDNOTES.....	21
BIBLIOGRAPHY	23

NATIONAL MISSILE DEFENSE

It is the policy of the United States to deploy as soon as is technologically possible an effective National Missile Defense system capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized, or deliberate) with funding subject to the annual authorization of appropriations and annual appropriations of funds for National Missile Defense.

—U.S. Public Law H.R.4, July 23, 1999

INTRODUCTION

Over approximately the past 50 or so years the United States has poured billions of dollars into the development of various National Defense Missile systems -- "Nike-Zeus," "Star Wars," and "Brilliant Pebbles" to name a few -- however not one of these systems has been successful. The first of these efforts began after World War II, when the United States discovered the fact that the Germans had developed plans for building the world's first intercontinental ballistic missile. This discovery led the United States Air Force and Army to initiate studies of long-range interceptors. During the 1950s and 1960s, however, efforts to develop a long-range missile defense system were low on the priority list.

In 1968, President Richard Nixon refocused work on missile defense with the idea of protecting U.S. deterrent forces and called the program Safeguard. The Air Force managed this program, and in 1975 established the Safeguard system site in Nekoma, North Dakota. Soon after it opened, however, the site was closed due to the fact that a nuclear warhead was required to destroy any incoming missiles. Subsequently, the U.S. Army became the dominant missile defense developer, and in 1984, the Army demonstrated the capability of using sensors and interceptors without nuclear warheads to destroy incoming missiles.

While the U.S. Army worked on its hit-to-kill technology, the Russians continued to improve on long-range missile delivery. U.S. analysts who were worried that Russia would soon develop a long-range missile recommended to President Ronald Reagan that missile defense become a top U.S. security priority. Subsequently, President Reagan directed the establishment of the Strategic Defense Initiative Organization by DoD to develop a missile defense system. After 2 1/2 years of research and development, a missile defense system was

approved for acquisition. This is where the concept of a layered missile defense system was first established. In 1987, the Strategic Defense System Phase I architecture was approved with six subsystems: a space-based interceptor and two sensors, a ground-based interceptor and sensor, and a battle management control system. The new layered system design became well known as “Star Wars” and represented President Reagan’s efforts to fulfill his promise to Americans that he would build a space shield to protect against Soviet nuclear missiles.

With the fall of the Berlin Wall and the end of the Cold War, President George H. W. Bush examined U.S. requirements for the “new world order” that was emerging. This assessment concluded that there was no longer a long-range threat to U.S. soil. Thus, President Bush and his staff redirected the focus of missile defense to protection of forward-deployed U.S. forces. This led to the development of a new concept known as Global Protection Against Limited Strikes (GPALS), and this ideal system was comprised of three components. These components included ground-based National and Theater Missile Defense systems and a Space-based Global Defense system. His successor, President William Clinton, also believed that threats to the U.S. homeland would come from terrorist attacks, not long range missiles, and that the greatest missile threat was to deployed U.S. forces.

In 1993, Clinton’s Secretary of Defense Les Aspin announced a name change from the Strategic Defense Initiative Organization to the Ballistic Missile Defense Organization. The organization not only changed its name, but it also reexamined U.S. required defenses due to the end of the Cold War. This examination was called the Bottom Up Review (BUR), and it put missile defense as the number one defense priority which meant that it would be funded. Secretary Aspin, however, halted plans for the rapid development of a National Defense system and instead put the priority on funding a Theater Missile Defense system to protect allies and U.S. troops. The BUR also laid out a three-project missile defense system that included improvements to the Army’s Patriot missile system, a modification to the Navy’s Aegis air defense system, and a new Army missile defense system known as Theater High Altitude Area Defense (THAAD). There was a massive transformation from the Bush administration’s GPALS to the Clinton administration’s missile defense system. The change was made effectively and without any disruption to the development schedules for theater missile defense programs. The BUR took the missile defense budget from \$39 billion to \$17 billion.

In his campaign for the Presidency, George W. Bush stated that one of his goals was to “build effective missile defenses, based on the best available options, at the earliest possible date.”¹ Since taking office, he has aggressively pursued the development of a missile defense system. Perhaps the most significant action to date came in December 2001, when President

Bush opted to withdraw from the Anti-Ballistic Missile (ABM) Treaty to be free to develop, test, and deploy a missile defense system. He had repeatedly labeled the treaty as “antiquated” in several speeches and gave several indications of his intent to abrogate this treaty. He chose an opportune time to withdraw - a time when the costs to withdraw were low. In a speech given at the National Defense University on 1 May 2001, President Bush said, “We need a new framework that allows us to build missile defenses to counter the different threats of today’s world.” He stressed that the ABM Treaty was built on mistrust between Russia and the United States, and he stated that “this treaty ignores the fundamental breakthroughs in technology during the last 30 years. It prohibits us from exploring all options for defending against the threats that face us, our allies and other countries.”² However, he faced strong opposition to this action both at home and abroad and took no actual steps to repeal the treaty for several months. Some critics feared that ending the ABM Treaty would initiate another nuclear arms race. Others argued that, “the actual threat posed by ‘rogue’ states acquiring missiles that could reach the United States is still years away, and that diplomacy rather than defenses is the better way to deal with the issue of missile proliferation.”³

After the terrorist attacks on September 11th, 2001, President Bush gained significant U.S. public support for his idea of ending the treaty and building a defense system to protect Americans because many people were more concerned about their safety than arms control. Further, Russia and most U.S. allies were not going to argue too strenuously with President Bush after his country had been so viciously attacked. Despite the absence of any significant opposition to U.S. withdrawal from the ABM treaty, many questions remain concerning development of a National Missile Defense system. The first question that needs to be answered is: Are long-range missiles realistically a threat to the United States? If it is determined that these types of missiles are a threat, a second logical question is: Does the technology exist to build a system to counter this threat? And finally, what are the costs of such a system? This paper will first assess the current threat, including recent North Korean developments. Second it will examine President Bush’s solution. It will then address the costs of building a missile defense shield. After discussing current missile defense testing and the state of technology, this paper will examine alternatives to President Bush’s defense shield and present a recommendation on future U.S. missile defense policy.

THE THREAT

Many critics contend that ballistic missiles are the least likely threat to the U.S. homeland, yet the Bush administration continues to program resources for building a missile defense

system. There are those who support a missile defense shield, believing that, especially after 9/11, the United States is vulnerable to missile attacks and needs to protect itself. Ballistic missiles have been around for over 50 years and it is “estimated that 38 countries possess ballistic missiles of one type or another, most of the short-range theatre ballistic missile type, but also including long-range systems such as Trident and Minuteman that are the basis of the nuclear powers’ strategic deterrents”.⁴ This missile threat was appeased with the ABM Treaty and the concept of mutual assured destruction, but the threat of mass destruction may not deter terrorist groups. President Bush’s fear is that “the most urgent threat facing the United States came not from thousands of Russian nuclear-armed missiles but from a small number of missiles in the hands of these states...for who terror and blackmail are a way of life.”⁵ President Bush was referring to Iraq, but probably had Iran and North Korea in mind as well. U.S. Representative Christopher Shays said, “In securing our nation in a volatile world, ranking threats and vulnerabilities is as essential as avoiding illusionary choices. Terrorists, acting as human delivery systems, do not need missiles to bring chemical, biological or even nuclear weapons to this continent. But that fact alone should not blind us to the emerging peril posed by nations developing and proliferating missile technologies.”⁶ The threat is there albeit not the United States’ biggest threat today, but it could become an immediate threat if an unguarded Russian missile arsenal or other mass destruction material got into the hands of terrorists. Is the threat of terrorist ability to get missile materials worthy of building a missile shield to protect the United States? The President, aware of these threats, is insistent on building a missile defense system.

In September 1999, the National Intelligence Council produced an analysis paper assessing the foreign missile developments and the ballistic threat to the United States through 2015. Intelligence specialists projected that the United States will most likely face Inter Continental Ballistic Missile (ICBM) threats from Russia, China, and North Korea. The study also predicted that Iran and Iraq would be possible candidates for missile threats. A review of the threat by country follows.

NORTH KOREA

In 2002, North Korea alarmed the world by demonstrating the capability to successfully launch a multiple-stage missile called Taipo Dong-1 Space Launched Vehicle (SLV). Despite the fact that the missile failed in the third stage, a multiple-stage missile is what is used for long range missiles, and if North Korea solves the problem with the third stage, Taipo Dong-1 SLV could be used to deliver a small nuclear payload to the United States. Analysts predict that

North Korea will test a new version of this missile, Taipo Dong-2, possibly in 2003. The Taipo Dong-2 would be capable of delivering a heavier payload to reach Alaska or Hawaii; and if the third stage is developed, the missile would be capable of hitting anywhere in the United States. Analysts assessing the missile threat believe that North Korea will concentrate on Taipo Dong-2, but not spend any time experimenting with a missile stage three for the Taipo Dong-1 or -2. More recently, North Korea has done several things to cause concern including reopening plutonium production facilities, discussing plans to withdraw from the Nonproliferation Treaty, and developing the capability to produce uranium. North Korea is also exporting complete ballistic missile packages to fund their production of weapons of mass destruction.

IRAQ

Analysts estimate that Iraq could develop long range missiles capable of reaching the continental United States, but only with foreign assistance. Iraq would need help from Russia or North Korea to do so. It is predicted that the country will pursue development of a long-range missile and possibly acquire the technology prior to 2010. Iraq has denied United Nation (UN) inspectors access to conduct inspections and senior officials in Iraq actually direct personnel to hide all banned materials. Iraq has violated UN resolutions by testing missiles beyond the 150 kilometers limit and launching unmanned aerial vehicles beyond permitted limits. These unmanned aerial vehicles are capable of carrying chemical and biological substances. In a recent Central Intelligence Agency worldwide threat summary, the director noted that Iraq has provided training to terrorist groups on the use of poisons, gases, and bomb making as well as provided a safe haven for terrorists members.

IRAN

Iran is a country that the United States must keep their eyes on due to a large portion of the population being under the age of 30 years and the young Iranians are eager to support change. The Director of Central Intelligence reports that for now, Iran is stable, however it is a country with potential for internal conflict, which could lead to desperate acts. Similar to Iraq, Iran is interested in developing weapons of mass destruction for protection of their country. Even with internal unrest, any government that takes office will be interested in developing weapons of mass destruction. Currently Iran relies on assistance from Russia, however, the country is trying to be self-sufficient and develop a nuclear fuel cycle for civil and nuclear weapons purposes.

RUSSIA

Russia currently has 1,000 strategic ballistic missiles and has the second largest nuclear arsenal in the world; however, due to financial constraints that number is expected to decrease. Russia will maintain as many ballistic missiles as it can afford and will remain postured to deter any missile threat. The United States will need to continue to keep Russia in check, regardless of the success of deterrence and reduced missile stockages. National Defense University's "Strategic Assessment for 1999" said that the United States believes that Russia would still like to have parity with the United States as far as nuclear forces go; however, due to financial constraints, this is not possible for Russia. Instead, the United States' position is that Russia will concentrate more on treaties, negotiations, partnerships, and nuclear arms reduction. The results of the 1999 assessment showed that the U.S. foreign policy is more concerned about the control of Russia's weapons, fissile material, and scientific expertise than their use of long range missiles. The United States is assisting Russia with their weapons control, infrastructure up-keep, and clean up.

CHINA

China seems like the biggest threat to U.S. soil because China's strategic plan includes the development of a long-range missile specifically targeted at protecting China from the United States. China already possesses 20 CSS-4 ICBMs which have the capability of reaching the United States, and they are building a new mobile, solid propellant ICBM. Analysts suspect that China will use U.S. technology acquired through espionage to add sea-based and mobile missiles to their arsenals for use against the United States.

OTHER THREAT ISSUES

Countries could use space-launched vehicles to mask long-range missile development as Korea did in 1998 with Taepo Dong-1. Analysts' report that it will be difficult to provide ample warning of a hostile country possessing long-range missile capability if it already uses a space launch vehicle for other purposes such as satellite launches. In their September 1999 assessment of the National threat, the National Intelligence Council stated, "We consider space launch vehicles, especially in the hands of countries hostile to the United States, to have significant ballistic missile potential."⁷

Besides space launched vehicles, countries could easily develop other weapons of mass destruction vehicles such as sea-based platforms, ships pulling into ports, or airplanes. Analysts believe that several countries have the technological capability of developing forward-

based missile launch systems for use against U.S. targets. If North Korea continues to sell its No Dong missile the stability in the region will continue to deteriorate and countries will strive to have the capability of firing accurate missiles.

There are those who disagree with the accuracy of the long-range missile threat, believing that there are numerous other damage delivery systems that are less costly. Although non-missile means of delivering weapons of mass destruction are not as prestigious or noteworthy as the capability to deliver them via a long range launch system and they don't provide any deterrence to adversaries, what they do provide is an inexpensive and difficult to detect means of delivery. CIA analysts report that non-missile weapons of mass destruction will most likely be more accurate and more reliable than long-range missiles that have not been thoroughly tested. The bottom line is that the National Intelligence Council, using intelligence information and expertise, state that it is possible and likely that a country, hostile to the United States, will develop a missile capable of reaching the U.S. soil by 2015 (independent of significant political and economic changes.)⁸

COST

There are three phases in the life of a missile. The boost phase (before the payload is released), the mid-course phase (more than 80 percent of the missile's total flight time), and the terminal phase (the final minute or two when the payload re-enters the atmosphere). The boost phase is from launch until the missile stops accelerating under its own power and is the ideal phase to kill a threat missile. Usually this phase ends within one hundred to three hundred seconds and at altitudes of 200 kilometers or less. Destroying a missile during the boost phase prevents the launching of midcourse decoys and allows U.S. systems to protect a larger area. Funding for programs included in the FY03 budget is broken down by the different phases. The terminal phase program is funded for \$1.1 billion, the midcourse phase program has \$3.8 billion, and the boost phase programs are allocated \$797 million.

President Bush has been unclear as to exactly what his missile defense shield will look like. He has not laid out the architecture to date, but has made it clear that his goal is a robust, ambitious long-range missile defense system. Two systems are currently under consideration. One is a land-based system with interceptors aimed at hitting warheads in space and the other proposed system is ship-based with interceptors that would be targeted at missiles in the boost and ascent phases. In addition to the ground-based and shipboard missile defense systems, the Bush administration is also looking at a space-based system. The President's goal is to

have a “layered” defense shield that would be capable of shooting down a missile at any stage of its trajectory.

The question that many critics are asking is if long range missiles are not the immediate threat, is missile defense worth the cost? The Bush administration requested \$7.8 billion for 2003. Much of the FY03 dollars will be spent on research and development, and the Pentagon envisions missile defense spending to surge to \$11 billion by FY07. Beyond FY07, due to the fact that an overall system is not designed, it is difficult to estimate missile defense spending. However, the Congressional Budget Office offered a broad estimate for a land-based midcourse system, a sea-based midcourse system, and a space-based system to reach \$200 billion during the next twenty years. The Budget Office reported that a ground-based system would cost between \$26 and \$74 billion (through 2015), a system launched from a ship would cost between \$50 and \$64 billion (through 2015), and a space-based would be between \$82 and \$100 billion (through 2025).

A large portion of the FY03 missile defense budget will go to robust, realistic testing capabilities. System level tests include testing synergy, interoperability, command and communication links across elements, as well as measurements of adversary missile characteristics. All this information becomes important in the design and development of accurate missile defenses. The President’s Budget FY03 request for research, development, test, and evaluation is \$1.1 billion.

The \$1.1 billion budget for the Terminal Defense Segment includes Theater High Altitude Area Defense (THAAD), Patriot Advanced Capability Level 3 (PAC-3), Medium Extended Air Defense System Improvement Program, and a sea-based terminal concept. The Terminal Defense Segment is designed to intercept short to medium range ballistic missiles in the terminal phase of the missile’s trajectory. The terminal phase of the missile or its warhead is the final stage of the flight. This is where the warhead reenters the atmosphere and it is a very short phase lasting less than a minute. The Midcourse Defense Segment budget for FY03 is about \$3.2 billion and includes the Ground-Based Midcourse Defense and Sea-Based Midcourse Defense elements. The Ground-Based system is designed to engage the enemy missile during the descent phase of the midcourse flight while the sea-based system will intercept missiles early in the ascent phase of the midcourse flight. The FY03 budget includes \$797 million for the Boost Defense Segment. The Boost Phase is the first phase of a missile trajectory and the most ideal time to kill the threat missile. Defense for this phase includes the development of high-powered lasers and speedy intercept capabilities for multiple shot opportunities and basing in various geographic areas. Included in this portion of the budget are

space laser technology and kinetic energy concepts. The Missile Defense Agency will tap the brightest minds in the public and military to develop an attack on the boost phase of the missile. Several valuable technology concepts are already being looked at including fast burn and flexible axial propulsion technologies, agile kill vehicles, early detection and track sensors, and more affordable weapon platforms. The Missile Defense Agency has a program to ensure that the United States and its allies are protected against missiles should the need ever arise.

CURRENT DEVELOPMENT

Current missile defense development can be looked at using the three phases of the missile path. For the boost phase, the United States is exploring the use of directed and kinetic energy platforms both at sea and in space to kill a missile in the boost phase. Also, testing has begun using a powerful laser (the Airborne Laser or ABL) which has been placed on a modified 747. Specialized optics and computerized equipment are used to detect the missile and then a lethal amount of energy is used to heat the threat missile to destruction. Attacking a ballistic missile during this phase requires a system that can respond immediately, a system that makes confident decisions, and a system that offers several opportunities for a quick kill. The first flight test of the ABL is expected in FY04.

During the midcourse phase a missile follows a more predictable, set path and this is when a defense system has the best opportunity for a kill. It is during this phase that the missile has stopped thrusting, allowing more time for tracking and killing. However, it is during this long phase where the enemy has a greater chance of being successful with decoys. Defenses are directed at the missile once it is in the exoatmosphere and before the warhead comes back to the earth's atmosphere. With the United States continuing to test its systems the ability to detect decoys continues to improve as well. President Bush has continued to develop a missile defense system using the Clinton Administration's design for mid-course phase destruction and by far this is the most developed of the current programs. The idea is for a high-speed vehicle to maneuver to kill the missile in space. The system is ground-based and sea-based and is designed to protect the United States against long range missiles. The ground-based system has two components including the Booster Vehicle and the Exoatmospheric Kill Vehicle launched from a fixed, land-based booster. The Exoatmospheric Kill Vehicle is boosted high above the earth and is designed to collide with the enemy missile at extremely high speeds, roughly 15,000 mph. The ground-based interceptor has the capability of identifying the target even after being launched in a cluster of objects. The kill vehicle carries small rockets to assist with maneuvering to collide with the target.

The Bush Administration has had some success with midcourse systems. A working paper released by the Union of Concerned Scientists in January 2002 provided information that out of five hit-to-kill tests of the ground-based system, three were successful. However the paper pointed out that there were several flaws in the testing including releasing the same objects (payload bus, warhead, and decoy) for each test and at the same time of day. Also, the decoys were obviously different from the warhead making it easy to determine a decoy from the real thing. In *The Phantom Defense: America's Pursuit of the Star Wars Illusion* the authors write, "the problem isn't technology, it's physics. Decoys and warheads can always be made to emit almost identical signals in the visible, infrared, and radar bands; their signatures can be made virtually the same."⁹ Despite the concern for decoys, a successful test was completed in March 2002 using three decoys instead of one to increase detection difficulties. Although critics argue that the test was still not conducted in a real world situation because the infrared signals used on the decoy balloons were different than the target. The Center for Defense Information reported that there were actually eight tests and of the eight, five intercepted the target. The October 2002 test of the ground-based midcourse system displayed the successful use of Aegis SPY-1 radar. Information from the ship's radar was passed to the missile system's battle management section. Again, however, the test was not realistic because the same three decoy balloons were used as in the previous test.

As reported by the Center for Defense Information, the sea-based system completed three successful tests in January 2002, June 2002, and November 2002. Lieutenant General Ronald T. Kadish, Director of the Missile Defense Agency, stated that the United States withdrawal from the Anti-Ballistic Missile Treaty meant that the President Bush's missile defense plan could accelerate to include the ship-borne interceptor development and testing that was not authorized under the treaty. The sea-based missile defense system builds upon the already existing Aegis weapons system. The Aegis cruiser uses its own radar and equipment to launch the Standard Missile 3 (SM-3) and then the kinetic warhead searches and tracks the ballistic missile in space until the kill. The SM-3 is a solid propellant-fueled, tail-controlled surface to air missile. Currently there are more than 60 Aegis-outfitted cruisers and destroyers capable of carrying the Standard Missile 3 and the Navy plans to give 25 additional ships this capability. Sea-based missile defense seems to be the most promising defense system due to the fact that it is deployable in half the time and at one-tenth the cost of the land-based system. The equipment is already available on the ships, so the investment in installing resources for missile defense has previously been made for other purposes. On November 21, 2002, Pentagon officials announced that the third successful intercept test from a sea-based system was

conducted. USS *Lake Erie*, an Aegis Cruiser, launched a SM-3 missile just two minutes after the target was launched. The SM-3 missile's kinetic warhead acquired, tracked, and diverted into the target, thus demonstrating the ability to destroy enemy missiles. The short-range targeted missile was intercepted during its ascent phase. Since the missile was intercepted while rising, it was possible to attack the missile at several points along its trajectory. The target was an Aries rocket simulating a Scud short to medium range missile similar to those weapons used by Iraqi forces during Operation Desert Shield/Storm in 1991. It is believed that Iraqi forces still possess these weapons, possibly equipped with chemical or biological components. Hence it is possible to assume that the SM-3 will protect the United States and its allies using shipboard missile defenses.

The Terminal Defense Segment has two main elements - the Patriot Advanced Capability 3 (PAC-3) and Theater High Altitude Area Defense (THAAD). These systems are mobile with the exception of some radar equipment. The Patriot system is the first completed system to be turned over to the respective service (Army) for maintenance and upkeep. When operational testing and evaluation is complete it will be turned over. The PAC-3 ground system uses a high-velocity hit-to-kill missile and has increased capability in altitude and range from the old PAC-2 system. The PAC-3 canister is about the same size as the PAC-2 canister but it carries four missiles instead of one. It uses active radar to directly hit the target. The program is managed by the Missile Defense Agency, but executed by the Army. Approximately 13 tests have been completed with only one failure. The THAAD system is designed to protect against short to medium range ballistic missiles at endo – and exo – atmospheric altitudes. The system has interceptors, the THAAD radar system, and the THAAD battle management command and control system. It is fired from a truck-mounted launcher and consists of a single stage booster and a kinetic kill vehicle that destroys the target on impact. Two successful test intercepts were completed in 1999 using the THAAD system and additional testing is planned to begin in 2004 or 2005, with initial fielding beginning in 2007.¹⁰

The Navy is focusing on contributing to long range missile defense with its forward-deployed SPY-1 radar. Forward-based radar can be of value in tracking fast-moving warheads and in discriminating whether it is a missile part or a decoy. The Navy ships are already deployed year-round and can easily be used to track missile launches. SPY-1 radar has already been used to successfully track Chinese missiles launched near Taiwan and also a North Korean flight test. In addition, the SPY-1 radar on the Aegis destroyer USS *John Paul Jones* participated in the fourth successful ground-launch kill test mentioned above.

Due to the favorable terminal phase hit-to-kill tests, senior White House officials believe that the ground-based missile defense program will be successful and say that they are on track to open a working ballistic missile defense site as planned in 2004 at Fort Greely, Alaska. Five 80 feet by 16 feet holes are being dug in Alaska to hold from 50 to 200 hundred missiles.

Last year, General Kadish held a meeting with top minds from industry, academia, and the National laboratories to discuss the growing complexity of how to build a missile defense shield. As a result of this meeting, Boeing was awarded a \$24 million contract to lead the system building team in system engineering and integration. Lockheed Martin received a \$23 million contract to lead the command and control and communications component of the systems battle management. In late September 2002, the Missile Defense Agency reportedly paid Boeing an additional \$125 million and Lockheed Martin another \$108.7 million to speed up work on the missile shield.¹¹

ALTERNATIVES

Many critics believe that long range missiles are not currently a threat to the United States and, based on the results of the National Intelligence Council report, do not have the potential to be a threat for at least another 10 years. Although indicators suggest that China and Russia will not use long-range missiles against the United States, this cannot be guaranteed. One alternative for defense would be to curtail missile defense shield spending and use all money intended for missile defense on perceived current threats such as terrorism or possible rogue state violence. The Executive Branch could then use defense dollars on whatever was needed to keep Russian weapons of mass destruction or hazardous materials out of the hands of terrorists. He could also put more money towards homeland defense, including guarding borders, defense teams, and immigration controls. All missile defense testing and design could be deferred until a later date.

At the other end of the spectrum would be to continue full-blown testing and development of a missile shield as planned. Contracts have already been awarded to Boeing and Lockheed Martin, and Congress has granted additional defense money, hence the United States could continue with the defense missile shield as prescribed. The technology may not be fully available at the current time depending on the final architecture, but the idea is to develop a missile shield system over a ten-year period. By then, rogue states could have the capability to send a missile and decoys to the United States. The United States would need to have a robust missile defense system as outlined by the Bush administration including land, ship, and space based systems to defend against missiles capable of hitting U.S. soil.

Another alternative would be to focus on a system that will kill a missile in just one of the three phases with near 100% accuracy, rather than one that covers the entire flight path. The ideal phase to kill a missile is during the boost phase, intercepting the missile before the enemy could deploy countermeasures. To accomplish this, however, the system must be based within several hundred miles of the missile launch which makes putting the system on a mobile base or ship the best possible defense.

Numerous issue papers have been written describing the pluses and minuses of various missile defense plans and also suggesting courses of action for the direction that the United States should go in protecting its homeland and its allies. In 1996, the Clinton Administration presented a three-stage plan for development and deployment of a National missile defense. This plan was designed for small-scale missile contingencies unlike the plan previously developed by President Reagan, which was for a space-based shield against all missile attacks. Clinton's plan was based on desired capabilities and provides a good basis for analyzing current missile defense initiatives.

The first stage planned was Capability-1 (C-1), which included 20 interceptors based in Alaska; upgrades to existing radar; a new X-band radar; and a battle management system. This capability was to be available in 2005 to provide defense against a simple attack (a few warheads using a limited number of countermeasures). The second stage planned was Capability-2 (C-2), and included 100 interceptors based in Alaska and the addition of X-band radar in Alaska, Great Britain, and Greenland. Interceptors were to be operational by 2007. This capability could handle a launch of tens of warheads with simple countermeasures. Finally, Capability-3 (C-3) included up to 250 interceptors based in Alaska and an additional site North Dakota. X-band radar was added to the U.S. coastline and one possibly in South Korea. This capability was to be available in 2010/11 and would handle the same attack in Capability-2 except that the ability to defeat sophisticated countermeasures was added.¹²

In 1999, the Clinton administration decided to skip development of Capability-1 and go straight for Capability-2. David C. Gompert and Jeffery A. Isaacson of the National Defense Research Institute wrote an excellent issue paper looking at the prospect of building a National Missile Defense and relating world activity to the Clinton administration's plan for defense. The paper pointed out that particular events such as nuclear tests by India and Pakistan, the Rumsfeld Commission report of 1998 that warned of the possibility of missile attacks without warning, and North Korea's Taepo Dong-1 missile test initiated recent concern for a quick missile defense solution. The paper suggested that a defense for the immediate attack or threat was essential, however, developing a long-term solution was just as important because the

missile development was still evolving. The paper also suggested that although it is a good goal to have a missile defense plan in place by 2005, the overall missile defense plan must work indefinitely and broadly to deny hostile states an ability to coerce the United States by threatening the lives of Americans. The authors of the paper consider missile defense to not only be a shield but an enabler of U.S. action to protect vital U.S. interests. The paper raises an interesting point relevant to the threat of rogue states today -- if the United States has been so successful with deterrence of Russia and other large countries, why wouldn't deterrence work with rogue states as well. The authors give the following reasons why rogue states may not be intimidated by U.S. deterrence methods, and these reasons must be kept in mind when developing the ultimate missile defense system:

- Rogue states with small arsenals are more vulnerable to U.S. preemptive strikes and therefore may be quicker to push the attack button;
- A rogue state may feel more comfortable trying to threaten the United States in an attempt just to see if it would work because they have nothing to lose; and,
- A rogue state may be more inclined to use a chemical or biological weapon because they realistically don't expect retaliation from the United States in the same form.¹³

In summary, the paper expresses the general solution to missile defense as a "system of systems" based in layers including: fixed U.S. based defenses to ensure the homeland is protected even with little or no warning; a means to kill the threat missile in its boost phase and before any countermeasures can be deployed; and a flexible, deployable defense capable of destroying a missile in the boost phase or at the very least in the terminal phase.

The Clinton Administration set four specific criteria for answering the question of whether there really is a need for a missile defense system. The questions used for a go/no go decision were:

- Is the technology ready?
- How will a defense system effect relations with Russia and China?
- Is an appropriate system affordable?
- Does a threat to U.S. soil really exist?

These same questions can be applied to President Bush's current plan for missile defense. An article in *Foreign Policy The Magazine of Global Politics, Economics, and Ideas*

titled, "National Missile Defense: Is There Another Way?," evaluated each of these four criteria. The article first addressed the missile threat to the United States. The authors -- Hohn Deutch, who is an institute professor at the Massachusetts Institute of Technology, former U.S. Deputy Secretary of Defense, and former Director of Central Intelligence; Harold Brown, who is a senior partner of E.M. Warburg, Pincus & Co. and former U.S. Secretary of Defense, and John P. White, who is a lecturer in public policy at the John F. Kennedy School of Government at Harvard University and former U.S. Deputy Secretary of Defense -- agree that a threat exists and continues to grow, and that the United States needs a well-balanced defense against the range of possible attacks. The article also states that there is currently a bigger threat from theater ballistic missiles that could hit U.S. interests overseas rather than from long range missiles aimed at the United States proper.

In referencing President Clinton's measurement of technical capabilities the writers noted that the National Missile program has been unsuccessful due to the fact it is seeking too many solutions to the problem. Valuable resources are stretched too thin and not allowed to focus on making one defense the best. The article also mentions that the missile defense program has been driven by a schedule vice events or realistic defined requirements. Another technical flaw mentioned in the article is the idea of the artificial boundary between National and Theater Missile Defense. If the developers can design and implement a successful Theater Missile Defense system, then possibly a National Missile Defense system could evolve from the Theater Defense system and save United States' defense dollars. The authors of the article felt that the United States could afford the current projected missile defense spending, but felt that the United States should focus more resources on defending its soil against terrorists attacks. In describing the effect of developing a missile defense system on Russia and China, the authors thought that building a system would make relations tense. The article goes on to make the following recommendations:

- Deploy an Aegis cruiser as soon as possible off the coast of Korea to intercept any threat missiles.
- Upgrade the forward-based, boost-phase-intercept naval system off North Korea with higher-acceleration boosters and maneuverable kill vehicles. Consider using ground-based interceptors developed for National Missile Defense in a forward theater supporting boost phase interception.
- Continue research and development, testing, and evaluation of the National Missile Defense system and air-launched boost-phase systems.¹⁴

The writers believe that these alternatives provide greater flexibility to meet all threats over time. They also state that building a National Missile Defense system from the Theater Missile Defense system will be less costly and less technically challenging.

One final article reviewed that has significant relevance presented a different view in evaluating missile defense plans with Clinton's four criteria. In *Pushing the Limits The Decision on National Missile Defense*, written by the Council for a Livable World National Arms Control Center, the council expresses the idea that through active diplomacy the development of weapons could be blocked. The article cites several examples of how diplomacy through arms control agreements, economic sanctions, or reduction of all nuclear arsenals can eliminate the need for a National Missile Defense. In the 1980s and 1990s, for example, both Argentina and Brazil were searching for the technology to build a nuclear arsenal; however, through pressure from the United States and regional neighbors, both countries abandoned the search. Economic sanctions forced Iraq to allow weapons inspectors into their country for many years, and the Council believes that efforts to reduce tensions, especially in the Middle East, will help to reduce missile threats because the need for weapons of mass destruction is reduced. With an active foreign policy program and a solid international structure, perhaps the likelihood of state-to-state conflict will be eliminated. With treaties such as START and the Anti-Ballistic Missile Treaty, the authors assert that far more weapons have been destroyed by diplomacy than by a missile defense system. In addition, they argue that efforts should be concentrated on reducing the potential threat of an unintentional weapon firing by insisting that weapons be unfueled. The United States and Russia are already working to establish a joint early warning center and a Global Monitoring System. The Council believes that pursuing these types of defenses is worthwhile and increases the defense of all countries. The United States should spend more defense dollars destroying weapons on the ground rather than after they have already been fired. They argue that deterrence remains a solid defense while others argue that many rogue states will act irrationally in using missiles, and that they will build up their missile arsenal (WMD capabilities) with intentions of hitting the United States. The Council for a Livable World instead argues that rogue states are building arsenals to protect themselves and the likelihood of rogue states risking total annihilation by the United States is not probable. The Council does not think that spending billions of dollars on missile defense is worth it; rather, defense dollars should be spent on conventional forces that are a major part of the U.S. deterrence.¹⁵ In summary, using Clinton's four criteria:

- The technology will not be ready and the cost of trying to figure out how to hit a bullet with a bullet is too much. It is just too difficult to defend the country in a real life situation with many attacks, from many directions and on top of that, the enemy maintains a capability for deploying decoys.
- If the United States pursues a missile defense system, Russia and China will increase efforts to maintain/build up their arsenals. It will also be difficult to bring other nuclear capable countries into the arms control process.
- The United States has already spent billions of dollars on research for a missile defense system and it will have to spend billions more to deploy and maintain an active defense system. With the adverse implications of building a system and the alternative defense options available, it is not justifiable.
- The probability of a long-range attack is low and deterrence remains the better defense solution.

Finally, the question is asked will the United States be better protected? If the missile defense technology is successful, if North Korea really does build a long range, accurate missile, and if China and Russia do not increase efforts to build/maintain missiles, then yes, it may be realistic and worth the money to build a good missile defense system. However, if all that is not true and in fact the reverse happens where Russia and China do increase missile arsenal focus, then the billions of dollars that will be spent on a missile defense system is not worth it.¹⁶

CONCLUSION

In conclusion, each of President Clinton's four criteria for reaching a decision on whether or not the United States should pursue a missile defense system are summarized below.

READINESS OF TECHNOLOGY

Successful system tests have already been completed. The tests have not had perfect results, and future aggressive testing is planned. Israel has proven that a missile defense system is possible by establishing a defense system using U.S. technology. Two problems with today's technology are one, detecting decoys launched to confuse the U.S. defense system and two, accuracy of U.S. launched missiles. The United States has proven that it is possible to "hit a bullet with a bullet," however the United States has not proven the accuracy of this challenge over a wide range. Ground-based and sea-based system testing has had successful results

and with extensive testing, the maturity of the system can be evaluated and then fine-tuned. A rogue state or a terrorist does not have to be successful with the accuracy of a missile, however the United States must be able to accurately intercept a threat missile and then accurately retaliate against the location from which the missile was fired.

THE IMPACT ON ARMS CONTROL AND RELATIONS WITH RUSSIA AND CHINA

Russia has already accepted the fact that the United States has opted out of the Anti-Ballistic Missile Treaty. This issue was of extreme concern to Russia after President Bush's decision to abrogate the ABM Treaty and prior to September 11, 2001. The United States must continue to negotiate arms reductions with Russia and China. The United States must also continue to express that the missile shield is to protect the United States and its allies against threat missiles. The United States is most concerned with China's military buildup and their military focus on Taiwan.

THE COST

The cost to build a missile shield as described by President Bush, one that will be capable of destroying a threat missile at any point, is astronomical. With the extensive research, development, and testing required per year and then follow on maintenance, costs will only continue to climb. After thorough research, cost seems to be the determining factor and should be what directs the President toward one method of missile defense. Missile defense needs to be mobile. Being mobile affords the best opportunity to strike a missile in the boost phase. The closer that the missile defense system is positioned to the target the greater its effects. The sea-based system is the best route to go. Ships with missile defense capabilities are deployed every day in key locations. Maintenance personnel (contractual and Sailors) are already placed aboard those ships and deployment costs are already in the budget. Maintenance of the missile defense system simply becomes a part of the required maintenance aboard ship as opposed to having to add maintenance and upkeep personnel to a land based system.

THREAT

With the development and testing of space launched vehicles, the threat of a long-range missile or some other type of weapon of mass destruction reaching U.S. soil exists today. The Central Intelligence Agency September 1999 report, which included input from missile experts, estimated that U.S. adversaries could have weapons capable of reaching the United States within 15 years. The threat already exists from Russia and China; however, the likelihood of

hostilities with either state is assessed as low. To this point, the United States has been able to deter threat countries with agreements and negotiations. It is often difficult to predict other countries' ballistic missile capabilities. Countries often do not visibly display their weapons production and instead, progress is often held in secrecy until testing. The threat to United States interests abroad, including allies and U.S. forces, continues to grow. Due to the fact that North Korea is selling No Dong missiles, some countries, especially in Asia and the Middle East, feel compelled to develop missile programs to protect themselves. In addition, there is a high probability that a terrorist group could acquire weapons of mass destruction to be used against U.S. interests overseas.

The best alternative is to continue with development and testing of a missile defense system, but to limit development to a mobile shipboard based and ground based system. The ground-based interceptor system planned to be permanently positioned in the United States may be comforting for Americans, however, the cost of maintaining this type of system is not worth it given the low probability of a long-range missile being fired at the United States. What is more likely is that further terrorist attacks will come to the United States and so defense spending should focus on protecting U.S. citizens in the homeland and our troops serving overseas. If long-range missiles become an expected threat, then the United States would simply have to reposition ships or mobile ground-based launchers to combat the threat. United States policy has always been deterrence. It is better not to have to intercept the missiles at all and instead use the threat of military retaliation to prevent others from delivering missiles. With the possibilities of rogue states or terrorist groups developing or acquiring missiles, the threat is there and the United States needs to have a defense against any threat to citizen's freedoms. The United States should, however, bring plans for developing a mobile, shipboard-based or ground-based missile defense system to the negotiation table with Russia and China. As explained in the Quarterly Defense Review, the United States needs to put forth a better effort in consulting with allies and explaining the U.S. strategic rationale for developing a missile shield. The United States needs to ensure China understands the missile shield's capability and intent so that they don't build up their arsenal to combat the United States' decision. The United States needs to make it clear that the missile system being developed can be used to support allies, which at the current time is its most likely use. The United States has paid for half of Israel's working missile defense shield, the Arrow, that experts call a Theater Defense System designed to intercept medium and short-range missiles. Although the system is not designed for intercontinental missiles, the system is more advanced than the Patriot used in the Gulf War to fight Scud missiles. The success of the Arrow and the success of U.S. National Missile

Defense systems' testing proves that technology is coming to fruition and more countries benefit from a missile defense shield. As James Lindsay and Michael O'Hanlon stated in the Washington Quarterly, "Missile defense, against long-range and short-range threats, continues to make sense for the US as well as for its allies. Too much missile defense or too little diplomatic care to go along with the defense systems, however can be harmful to US security."¹⁷

WORD COUNT = 8,462

ENDNOTES

¹ James M. Lindsay and Michael E. O'Hanlon, "Missile Defense after the ABM Treaty," Washington Quarterly (Summer 2002): 163.

² James M. Lindsay and Michael E. O'Hanlon, "Missile Defense after the ABM Treaty," Washington Quarterly (Summer 2002): 164.

³ BBC News, "Analysis: Uncertain end to ABM Treaty," 13 June 2002; available from <http://news.bbc.co.uk/1/hi/world/americas/2044034.stm>; Internet; accessed 24 September 2002.

⁴ Etsnews, "Backing Ballistic Missile Defense," available from <http://www.global-defence.com/missile-ballisti.htm>; Internet; accessed 28 August 2002.

⁵ James M. Lindsay and Michael E. O'Hanlon, "Missile Defense after the ABM Treaty," Washington Quarterly (Summer 2002): 164.

⁶ US Representative Christopher Shays, Hearing on Missile Defense, 16 July 2002; available from <http://web.lexis-nexis.com/universe/document>; Internet; accessed 25 September 2002): 2.

⁷ National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015;" available from <http://www.cia.gov/cia/publications/nie/nie99msl.html>; Internet; accessed 14 January 2003.

⁸ National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015;" available from <http://www.cia.gov/cia/publications/nie/nie99msl.html>; Internet; accessed 14 January 2003.

⁹ Craig Eisendrath, Melvin Goodman, and Gerald Marsh, The Phantom Defense: America's Pursuit of the Star Wars Illusion (Missile Shield or Holy Grail); available from http://www.pepeace.org/current_reprints/03/misile_shield.htm; Internet; accessed 30 August 2002: 3.

¹⁰ Missile Defense Agency, MDALink. "Terminal Defense Segment," Available from <http://www.acq.osd.mil/bmdo/bmdolink/html/terminal.html>; Internet, accessed 21 January 2003.

¹¹ Top Stories – Reuters, "Bush Urged to Narrow Missile Shield Focus," Available from <http://story.news.yahoo.com/news>; Internet; accessed 23 September 2002: 2.

¹² Council for a Livable World Education Fund, "Briefing Book on Ballistic Missile Defense;" available from <http://www.clw.org/pub/clw/coalition/nmdbook00intr.htm>; Internet; accessed 23 December 2002: 3-4.

¹³ David C. Gompert and Jeffrey A. Isaacson. "Planning a Ballistic Missile Defense System of Systems," National Defense Research Institute; available from <http://www.rand.org/publications/IP/IP181>; Internet; accessed 27 December 2002: 10.

¹⁴ John Deutch, Harold Brown, and John P. White. "Foreign Policy : National Missile Defesne: Is ther another way?" The Magazine of Global Politics, Economics, and Ideas, 4.

¹⁵ Council for a Livable World Education Fund, "Briefing Book on Ballistic Missile Defense," available from <http://www.clw.org/pub/clw/coalition/nmdbook00threat2.htm>; Internet; accessed 23 December 2002.

¹⁶ Council for a Livable World Education Fund, "Briefing Book on Ballistic Missile Defense," available from <http://www.clw.org/pub/clw/coalition/nmdbook00conclusion.htm>; Internet; accessed 23 December 2002: 1-2.

¹⁷ James M. Lindsay and Michael E. O'Hanlon, "Missile Defense after the ABM Treaty," Washington Quarterly (Summer 2002): 175.

BIBLIOGRAPHY

- "Backing Ballistic Missile Defense" etsnews. Available from <http://www.globaldefence.com/missile-ballistic.html>. Internet. Accessed 28 August 2002.
- Baucom, Dr. Donald R. Missile Defense Agency. MDALink. "Ballistic Missile Defense: A Brief History." Available from <http://www.acq.osd.mil/bmdo/bmdolink/html/origins.html>. Internet. Accessed 6 January 2003.
- "Bush Urged to Narrow Missile Shield Focus." Top Stories – Reuters. Available from <http://story.news.yahoo.com/news>. Internet. Accessed 23 September 2002.
- Center for Defense Information. "Missile Defense Flight Tests" January 2003. Available from <http://www.cdi.org/missile-defense/tests-aegis-pr.cfm>. Internet. Accessed 30 March 2003.
- Childs, Nick. "Analysis: Uncertain end to ABM Treaty," BBC News, 13 June 2002. Available from <http://news.bbc.co.uk/1/hi/world/americas/2044034.stm>. Internet. Accessed 24 September 2002.
- Council for a Livable World Education Fund. Briefing Book on Ballistic Missile Defense. Maryland: Council for a Livable World Education Fund, 2001.
- Council for a Livable World Education Fund. Briefing Book on Ballistic Missile Defense. 2002. Available <http://www.clw.org/pub/clw/coalition/nmdbook00intr.htm>. Internet. Accessed 14 January 2003.
- Council for a Livable World Education Fund. Briefing Book on Ballistic Missile Defense. 2002. Available <http://www.clw.org/pub/clw/coalition/nmdbook00threat2.htm>. Internet. Accessed 14 January 2003.
- Council for a Livable World Education Fund. Briefing Book on Ballistic Missile Defense. 2002. Available <http://www.clw.org/pub/clw/coalition/nmdbook00conclusion.htm>. Internet. Accessed 14 January 2003.
- Deutch, John, Harold Brown, and John P. White. "National Missile Defense: Is There Another Way?" Foreign Policy. Available from <http://www.foreignpolicy.com/specials/deutch.html>. Internet. Accessed 27 December 2002.

Director of Central Intelligence. "The Worldwide Threat in 2003: Evolving Dangers in a Complex World" 11 February 2003. Available from <http://www.cdi.org/missile-defense/tests-aegis-pr.cfm>. Internet. Accessed 30 March 2003.

Eisendrath, Craig, Melvin Goodman, and Gerald Marsh. "The Phantom Defense: America's Pursuit of the Star Wars Illusion." Available <http://www.foreignpolicy.com/specials/deutch.html>. Internet. Accessed 27 December 2002.

Fitzgerald, Frances. Way Out There in the Blue. New York: Simon & Schuster, 2000.

Gaffney Jr., Frank J. "Missile Milestone." National Review on line 25 November 2002. Available from <http://www.Nationalreview.com/gaffney/gaffney112502.asp> Internet. Accessed 16 December 2002.

Gompert, David C. and Jeffrey A. Isaacson. "Planning a Ballistic Missile Defense System of Systems." Available from <http://www.rand.org/publications/IP/IP181>. Internet. Accessed 27 December 2002.

Kadish, Lieutenant General Ronald T. "Fiscal Year 2003 Budget". Briefing. Congressional Committee.

Lindsay, James A. and Michael E. O'Hanlon. "Missile Defense after the ABM Treaty." Washington Quarterly (Summer 2002): 163-175.

Missile Defense Agency. MDALink. "Airborne Laser." March 2002. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html>. Internet. Accessed 24 September 2002.

Missile Defense Agency. MDALink. "Ballistic Missile Defense Challenge." March 2002. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html>. Internet. Accessed 24 September 2002.

Missile Defense Agency. MDALink. "Boost Phase Missile Defense." March 2002. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html>. Internet. Accessed 24 September 2002.

Missile Defense Agency. MDALink. "Midcourse Defense Segment" Available from <http://www.acq.osd.mil/bmdo/bmdolink/html/midcrse.html>. Internet. Accessed 21 January 2003.

Missile Defense Agency. MDAlink. "Patriot Advanced Capability-3." March 2002. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html>. Internet. Accessed 24 September 2002.

Missile Defense Agency. MDAlink. "Sea-based Midcourse Defense Flight Test Successful." June 2002. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html/fm3.html>. Internet. Accessed 22 November 2002.

Missile Defense Agency. MDAlink. "Sea-based Midcourse." October 2002. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html>. Internet. Accessed 21 January 2003.

Missile Defense Agency. MDAlink. "Terminal Defense Segment." Available from <http://www.acq.osd.mil/bmdo/bmdolink/html/terminal.html>. Internet. Accessed 21 January 2003.

Missile Defense Agency. MDAlink. "Test and Evaluation." March 2002. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html>. Internet. Accessed 24 September 2002.

National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015." September 1999. Available from <http://www.cia.gov/cia/publications/nie/nie99msl.html>. Internet. Accessed 14 January 2003.

"Responses to the Threat." Available from <http://www.clw.org/pub/clw/coalition/nmdbook00threat2.htm>. Internet. Accessed 14 January 2003.

Shay, Christopher, US Representative. "Hearing on Missile Defense." Internet. Available from <http://web.lexis-nexis.com/universe/document>. Accessed 25 September 2002.

Smith, Daniel, COL, USA (Ret.) "Technological Challenges in National Missile Defense." Center For Defense Information. Internet. Available from <http://www.cdi.org/hotspots/issuebrief/ch4/>. Internet. Accessed 14 January 2003.

U.S. Department of Defense. Defense Link. "Flight Mission 4 Missile Test Successful." 21 November 2002. Available from http://www.defneselink.mil/news/Nov2002/b112112002_bt594-02.html. Internet. Accessed 16 December 2002.

U.S. Department of Defense. Defense Link. "Missile Defense Deployment Announcement Briefing." 17 December 2002. Available from <http://www.defneselink.mil/news/Dec2002/t12172002.t1217missilefef.html>. Internet. Accessed 27 December 2002.

U.S. Department of Defense. Defense Link. "Missile Defense Operations Announcement." 17 December 2002. Available from http://www.defneselin.mil/news/Dec2002/b12172002_bt642-02.html. Internet. Accessed 21 January 2003.