



**STRATEGY  
RESEARCH  
PROJECT**

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

**US NUCLEAR DEFENSE STRATEGY: A HOLISTIC APPROACH  
FOR THE NEAR AND MID TERM**

**BY**

**LIEUTENANT COLONEL KOREY V. JACKSON**  
United States Army

**DISTRIBUTION STATEMENT A:**  
Approved for Public Release.  
Distribution is Unlimited.

USAWC CLASS OF 2001



**U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050**

**20010622 049**

USAWC STRATEGY RESEARCH PROJECT

**US Nuclear Defense Strategy: A Holistic Approach for the Near and Mid Term**

by

Lieutenant Colonel Korey V. Jackson  
United States Army

Project A Colonel Glenn Trimmer, USAF  
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

DISTRIBUTION STATEMENT A:

Approved for public release.  
Distribution is unlimited.



## ABSTRACT

AUTHOR: KOREY V. JACKSON, LTC, USA  
TITLE: US Nuclear Defense Strategy: A Holistic Approach for the Near and Mid Term  
FORMAT: Strategy Research Project  
DATE: 10 April 2001      PAGES: 43      CLASSIFICATION: Unclassified

Nuclear weapons will threaten U.S. vital interests and future freedom of action through a variety of delivery systems, to include ballistic missiles, cruise missiles, or terrorist delivery through commercial or private vehicle. I propose looking at maintaining future U.S. freedom of action to pursue it's goals through a three-pronged strategy consisting of "attack operations", "active defense", and "passive defense". Attack operations incorporate special operations, precision conventional strikes, and the nuclear deterrent option. Active defense includes the means to interrupt the delivery of nuclear weapons, to include national and theater missile defenses, port entry scanners, and any other developing devices. Passive defense includes a broad area which includes pragmatic arms control, national intelligence activities, application of the full realm of national economic, information, and political means, and ensuring critical national infrastructure not only survive but operate in the event of a nuclear event. The difficult decisions that remain then become how to balance the resources necessary to pursue this holistic strategy. How do we properly prioritize a mix of attack operations, active defense, and passive defense?



## TABLE OF CONTENTS

ABSTRACT .....	iii
PREFACE .....	vii
LIST OF ILLUSTRATIONS.....	ix
<b>US NUCLEAR DEFENSE STRATEGY: A HOLISTIC APPROACH FOR THE NEAR AND MID TERM.....</b>	<b>1</b>
<b>THE NEED FOR NUCLEAR DEFENSE .....</b>	<b>1</b>
<b>THE THREAT .....</b>	<b>2</b>
<b>NUCLEAR WEAPONS CAPABLE STATES .....</b>	<b>4</b>
<b>DELIVERY SYSTEMS: .....</b>	<b>4</b>
<b>BALLISTIC MISSILE CAPABLE STATES.....</b>	<b>5</b>
<b>CRUISE MISSILE CAPABLE STATES .....</b>	<b>5</b>
<b>OTHER DELIVERY SYSTEMS.....</b>	<b>6</b>
<b>MILITARY ASPECTS OF NUCLEAR DEFENSE: THE NUCLEAR DEFENSE TRINITY.....</b>	<b>7</b>
<b>ATTACK OPERATIONS .....</b>	<b>8</b>
<b>The US Strategic Nuclear Triad.....</b>	<b>8</b>
<b>Nonstrategic Nuclear Weapons .....</b>	<b>10</b>
<b>Other Options.....</b>	<b>10</b>

ACTIVE DEFENSE .....	10
PASSIVE DEFENSE.....	12
C4I.....	13
ENVIRONMENT .....	14
<b>INTEGRATION OF THE NUCLEAR DEFENSE TRINITY.....</b>	<b>15</b>
DIMENSIONAL BALANCE.....	17
THE SCUD AND SUBMARINE WARFARE MODEL APPLIED TO ATTACK OPERATIONS	18
<b>SHAPING THE ENVIRONMENT .....</b>	<b>19</b>
JOINT DOCTRINE.....	20
OTHER CONCERNS.....	20
<b>CONCLUSIONS AND RECOMMENDATIONS:.....</b>	<b>21</b>
ENDNOTES .....	23
BIBLIOGRAPHY.....	31

## PREFACE

I would like to thank the faculty of Army War College for providing me insights and the opportunity to research this subject area. In particular, I wish to thank COL Cortez Dial, COL John Bonin, Professor Robert Coon, and Mr. Anthony Williams for their comments and support. I also want to thank CDR Chris Janiec, Prof Bert Tussing, and Dr. Kent Butts for their support of a Weapons of Mass Destruction elective at the Army War College providing a variety of subject matter experts challenging my preconceptions in this topic. My appreciation is also extended to my colleagues at the Defense Threat Reduction Agency (DTRA) and the U.S. Army Nuclear and Chemical Agency (USANCA). The specific support of my research advisor, Colonel Glenn Trimmer, is most appreciated, with his encouraging words and rapid but detailed and thorough edits of my drafts, and who earns my deep respect and gratitude. Lastly I thank my wife Tana and my children Katrina, Matthew, and Bethany, for their tolerance, patience, and unquestioning support through my hours of research into a fascinating and important topic.



**LIST OF ILLUSTRATIONS**

FIGURE 1. IRANIAN SHAHAB-3 MEDIUM RANGE BALLISTIC MISSILE.....5

FIGURE 2. NUCLEAR DEFENSE HOLISTIC CONCEPT .....7

FIGURE 3 NATIONAL MISSILE DEFENSE SYSTEM ELEMENTS ..... 11

FIGURE 4 THE NUCLEAR DEFENSE FACADE ..... 16

FIGURE 5. BALANCING IN THREE DIMENSIONS..... 17



## US NUCLEAR DEFENSE STRATEGY: A HOLISTIC APPROACH FOR THE NEAR AND MID TERM

### THE NEED FOR NUCLEAR DEFENSE

Despite the jubilant expectations of western policy makers following the Cold War, nuclear weapons are a growing threat to the United States. True, the demise of the Soviet Union and the reunification of Germany brought about dramatic reductions in the nuclear weapon threat and East-West tensions. The Bulletin of American Scientists even turned back the dial on their Doomsday clock to its lowest setting in its history.<sup>1</sup> Unilateral actions by the existing nuclear powers, most notably the United States and Russia, reducing their formidable arsenals and voluntarily stopping their investment in new nuclear weapons accomplished much.<sup>2</sup> Ukraine and other former Soviet Union states became nuclear free. The United States removed the bulk of its battlefield nuclear weapons, including artillery and short- to medium- range rockets, from its active inventory and aggressively dismantled them. Nunn-Lugar funds were used to assist the Russians in securing and to begin dismantling their strategic nuclear weapons.<sup>3</sup> But the favorable trend toward moderating nuclear threats reversed course in the late 1990's. It became obvious that Iran, Iraq, North Korea, and other so-called rogue nations maintained nuclear aspirations and that they possessed active programs to develop or otherwise obtain nuclear weapons. The Russian military reaffirmed their doctrine and utilization of nuclear weapons as battlefield weapons.<sup>4</sup> China embarked on a nuclear weapon modernization program.<sup>5</sup> In 1998, both Pakistan and India conducted nuclear weapons tests despite strong international protests.

Current threat assessments place renewed emphasis on the threat of WMD from not only other nations but also from transnational groups, with attacks not only against American symbols and forces overseas but also upon the U.S. homeland.<sup>6</sup> The U.S., as the world's sole superpower over the near term, will attract the attention of peoples whose interests are contrary to U.S. interests. Some might attack with whatever means available merely because of a resentment of the United States' power and dominance in the international community. Consequently, the United States should focus means and resources to thwart these threats. Countries and terrorist organizations armed with nuclear weapons restrict the United States' options and freedom of action to pursue foreign policies favorable to the U.S. and its allies. Nuclear weapons may be used by certain states, regardless of the U.S. deterrence capability, to "blackmail" the U.S. to abandon its support for its allies, or to coerce the U.S. to pursue less vigorously or even abandon certain foreign policies.<sup>7</sup>

This paper examines a coherent and comprehensive full-dimensional nuclear defense strategy. It will begin by reviewing the threat. Following that, this paper will present a holistic or

systemic concept of nuclear defense, portrayed as a system within an overall security environment. It will then identify the major components of that system, briefly describe how they interrelate, propose a theoretical construct on how to view the proper balance of system components, comment on shaping the nuclear defense environment, and review current doctrine.

## **THE THREAT**

A threat assessment normally includes a measure of capabilities and intent. However, in forecasting future nuclear threats, a reasonable measure of probable intent becomes increasingly difficult.<sup>8</sup> Intent changes and evolves, especially as key figures change in nations with strong central leadership such as dictatorships. With higher levels of uncertainty, the threat forecast becomes more an estimate of probable capabilities. In developing a defense strategy, it is risky in long-range forecasts to acknowledge a party as having a significant threat capability that discount a threat because they don't intend to use it against the United States, its allies, or its interests. Thus a nuclear weapons threat assessment becomes more a worldwide inventory of future capabilities of various parties throughout the world. For the purposes of this study, near-term is defined as out to the period 2008 (coincidentally, the period of the current POM build cycle) and the mid-term the years 2009 to 2015.

The nuclear weapons threat must be also be measured by both nuclear weapons capability and delivery capability. Typically, the delivery capability of most concern to the U.S. is that of Intercontinental Ballistic Missiles (ICBMs), which are a recognizable means to directly threaten the American homeland. Since the Gulf War, short-range and medium-range ballistic missiles such as variants of Russian-based Scuds, the North Korean No Dong MRBM and Iran's Shahab-3 have garnered renewed emphasis. These not only threaten American forces overseas, but more significantly, threaten the homelands of our allies. Increasingly, though, there is a recognition that nuclear weapons may be delivered much more cheaply by an air-breather, such as a cruise missile or conventional aircraft not openly displaying hostile intent, or by surface in a ship anchored in a harbor in the fashion of the attack on the USS Cole in Yemen, or even by a small man-portable nuclear device.<sup>9</sup>

Overall, even though the total number and yield of nuclear weapons in the world have decreased, the threat of nuclear weapons is increasing.<sup>10</sup> A recent report from the Central Intelligence Agency, titled "Global Trends 2015: A Dialogue About the Future With Nongovernment Experts," forecasts the increased nuclear threat to the year 2015 with the following statement:

Strategic WMD threats, including nuclear missile threats, in which (barring significant political or economic changes) Russia, China, most likely North Korea, probably Iran, and possibly Iraq have the capability to strike the United States, and the potential for unconventional delivery of WMD by both states or nonstate actors also will grow.<sup>11</sup>

That publication goes on to further state:

Prospects will grow that more sophisticated weaponry, including weapons of mass destruction – indigenously produced or externally acquired - will get into the hands of state and nonstate belligerents, some hostile to the United States. The likelihood will increase over this period that WMD will be used either against the United States or its forces, facilities, and interests overseas.<sup>12</sup> (emphasis added)

Robert Walpole, in testimony before the Senate Foreign Relations Committee in 1999, stated: “The probability that a missile with a weapon of mass destruction will be used against US forces or interests is higher today than during most of the Cold War.”<sup>13</sup> This comment was echoed by the Center for Strategic and International Studies (CSIS), in its recent report “Defense of the U.S. Homeland Against Strategic Attack,” which said:

Nations are pursuing new strategic capabilities because they perceive their security to be at risk in ways it was not during the Cold War. U.S. defense planners include ballistic missiles as part of the so-called asymmetric threats being acquired by potential adversaries as a way of countering U.S. conventional superiority. What they often fail to fully appreciate is the extent to which the search for asymmetric responses to U.S. power reflects a deep concern regarding how the U.S. is behaving in the world and an apparent belief that the U.S. can be deterred by such new style threats. This suggests that under the right circumstances proliferating states may not be deterred by the U.S. advantage in strategic nuclear forces from brandishing their ballistic missiles or even using them.<sup>14</sup>

Director of Central Intelligence George Tenet testified before the Senate Armed Services Committee on 3 February 2000 on the subject of “Global Realities of Our National Security.” Regarding transnational issues and the broader WMD threat, he stated “Many states over the next ten years will find it easier to obtain weapons of mass destruction and the means to deliver them.”<sup>15</sup> One year later in his testimony before the Senate Select Committee on Intelligence, George Tenet expanded his assessment of the nuclear threat to also include terrorist organizations with the following statement:

Terrorism groups are actively searching the Internet to acquire information and capabilities for chemical, biological, radiological, and even nuclear attacks. Many of the 28 officially designated terrorist organizations have an interest in unconventional weapons, and Usama bin Ladin in 1998 even declared their acquisition a “religious duty.”<sup>16</sup>

## NUCLEAR WEAPONS CAPABLE STATES

The nuclear weapons capable states are typically considered to be the original five signatories of the Non Proliferation Treaty (NPT), including the United States, United Kingdom, France, Russia, and China. Additionally, though not declared, Israel is assumed to possess nuclear weapons.<sup>17</sup> India and Pakistan demonstrated nuclear capability as recently as 1998. North Korea may possess at least one nuclear weapon, and has enough nuclear material for at least one and possibly two nuclear weapons.<sup>18</sup> Many other states remain capable of constructing nuclear weapons within a reasonable period due to their inherent nuclear power generation capability and technical expertise, including Germany, Japan, South Korea, and Taiwan. At least three of the so-called Middle East rogue states (Iran, Iraq, and Libya) are pursuing their own nuclear weapons programs. Though not states, entities such as Aum Shinrikyo and Usama Bin Laden are both known to have pursued nuclear material to construct their own nuclear weapons.<sup>19</sup>

Of the original five nuclear powers, the United States maintains a very friendly and special relationship with both the United Kingdom and France. The nuclear threat of Russia appears to have stabilized after a huge reduction and withdrawal of capability; most of the weapons are within storage locations within Russia and are waiting to be dismantled. China, which can reach the United States with around twenty ICBMs, is pursuing some modernization efforts. If the Chinese perceive National Missile Defense (NMD) to be a direct degradation to China's ICBM deterrence capability, the Chinese might increase by up to ten-fold the number of their ICBMs.<sup>20</sup> This could result in increased tensions with India, who may in turn increase their nuclear capability.<sup>21</sup> The result in this case might exacerbate Pakistan's suspicions of India and would lead to pressure on Pakistan to increase their own nuclear capability. This spiraling arms escalation across the globe is the basis for a line of serious argument against fielding an effective national missile defense system.

## DELIVERY SYSTEMS:

When considering the nuclear weapon threat to the United States, most Americans consider the threat posed by Russian and Chinese Intercontinental Ballistic Missiles. Some Americans are aware that the threat to the United States may also be delivered by Russian sea launched ballistic missiles and manned aircraft delivering air launched cruise missiles and gravity bombs. There remains other more conventional and perhaps more sinister means to deliver nuclear weapons. We now turn to examine threat capability to deliver nuclear weapons.

## BALLISTIC MISSILE CAPABLE STATES

Though over twenty nations have ballistic missile technology, most are short-range ballistic missiles of the Scud variety. Though they do not directly threaten the American homeland, these short-range missiles do threaten our deployed forces overseas, our allies, and our interests. Nations currently capable of reaching the United States with ICBMs remain only Russia and China<sup>22</sup>. Unconstrained, North Korea is suspected to be able to threaten the United States with its Tae Po Dong II rockets by the end of 2005, while experts believe that by the year 2015 probably Iran and possibly Iraq will be able to reach the U.S. with their ICBMs. Iraq, Iran, and Libya have ongoing programs to improve the accuracy and ranges of their missiles. By 2015 Libya may have missiles capable of reaching southern Europe.

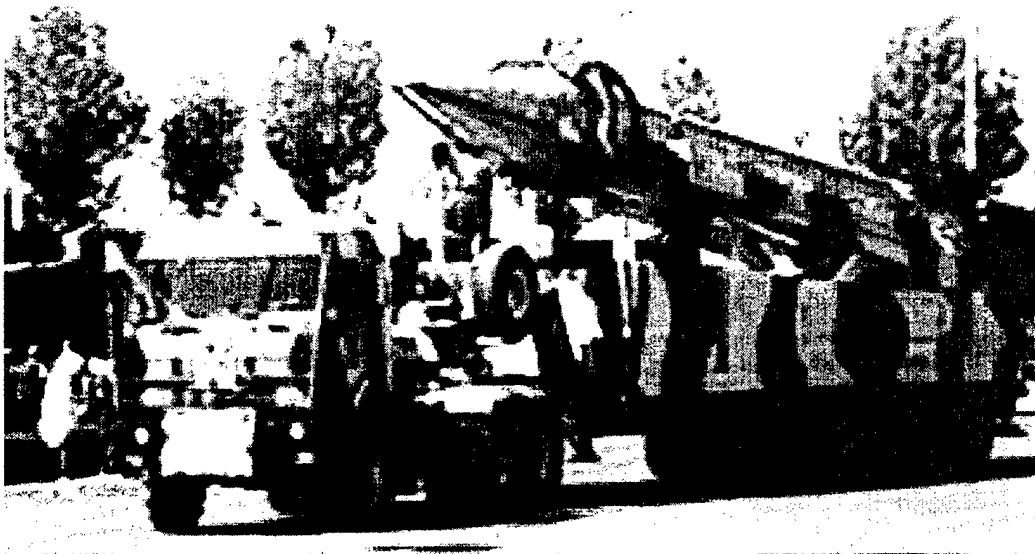


FIGURE 1. IRANIAN SHAHAB-3 MEDIUM RANGE BALLISTIC MISSILE<sup>23</sup>

## CRUISE MISSILE CAPABLE STATES

Many nations possess cruise missiles for both anti-ship and land attacks. The growing cruise missile threat is forecast as a potentially more serious threat than ICBMs. Since cruise missiles fly relatively low and at varying speeds, protection of the American homeland is a challenge considering the United States' vast borders and coastlines. Defeating a cruise missile attack against American shores involves detection, identification, and acquisition. Russia's inventory includes nuclear-tipped land attack and anti-ship cruise missiles. China currently possesses an anti-ship cruise missile capability and is aggressively pursuing, with Russian assistance, modern land attack cruise missiles<sup>24</sup>. Many of the United States current and

potential future adversaries cannot escape the conclusion that cruise missiles are cheaper than ICBMs, easier to build, and often preferable.

#### OTHER DELIVERY SYSTEMS

More common, less exotic weapons than cruise missiles or ballistic missiles can deliver nuclear weapons. Aircraft or other conventional transportation means such as trucks or ships might more easily deliver nuclear weapons. The United States and the Soviet Union both designed and fielded conventional nuclear artillery rounds to be fired out of 155 mm and larger howitzers. In the 1990's, the U.S. and the Soviet Union removed these small nuclear artillery rounds from their fielded inventories. Additionally, nuclear weapons were configured by both the United States and the Soviet Union into man-portable nuclear devices. Within the United States, these included the Special Atomic Demolition Munitions (SADMs). Actually the size of a garbage can, these munitions could be emplaced by small teams.<sup>25</sup> Although credible published sources do not reveal that any other countries have developed these small devices, there are many indications that several nations have within their means the capability to construct large first-generation nuclear weapons. Indeed, the requirement for a nuclear weapon to be small enough for missile delivery places strong technical challenges on the weapon designers. Should some potential adversary somehow obtain sufficient special nuclear material to construct such a device, it is technically simpler to deliver that weapon to its target by surface ships or transport aircraft. Missile systems and fighter aircraft as delivery vehicles limit nuclear weapons design in size and weight, presenting difficult technical challenges to those who build them. A medium or large body aircraft is a more feasible delivery system, as are boats, submarines, and conventional land transport capable of hauling large loads.

In summary, the evidence of publicly available documents indicates a very real nuclear weapon threat with a variety of delivery means. While the Russian nuclear threat has been reduced since the end of the Cold War, there is evidence that the nuclear threat from other nations, including China, India, Pakistan, the rogue nations listed as Iraq, Iran, and North Korea, and even extreme terrorist organizations such as Usama Bin Laden is growing. Prudent security strategists should plan on developing security and defense mechanisms to counter this growing nuclear threat. We will now investigate and propose a concept for an effective, robust, and flexible nuclear defense that is responsive to an evolving and uncertain threat.

## MILITARY ASPECTS OF NUCLEAR DEFENSE: THE NUCLEAR DEFENSE TRINITY

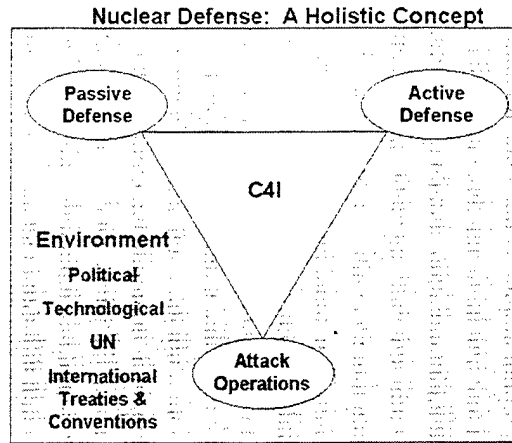


FIGURE 2. NUCLEAR DEFENSE HOLISTIC CONCEPT

A holistic concept of defense can be theorized as having three primary components operating within an overall environment, integrated by Command, Control, Communications, Computers, and Intelligence (C4I) systems. This is a method of system analysis: define the system, the major subsystems, and the environment in which it operates. From this perspective, the three components include the military concepts of attack operations, active defense, and passive defense. This nuclear defense concept is similar to concepts behind other types of military operations to include antisubmarine warfare, air defense operations, and land warfare. All three components of this concept interact with each other for overall goal accomplishment. The environment, consisting of international norms, existing technology, treaties, and conventions, provides both constraints and restraints to the overall nuclear defense system.

In regards to this proposed nuclear defense concept we are considering, the author defines the system, major subsystems and components, and environment in this fashion:

- **Attack Operations:** those activities associated with denying the ability to commit nuclear weapons or their delivery systems. The U.S. strategic nuclear triad of manned bombers, submarines, and ICBMs are a major component of attack operations, although there are conventional activities that accomplish the same purpose.
- **Active Defense:** those activities associated with actively disrupting committed nuclear weapons or their delivery systems. Examples of active defense against ballistic missiles include the NMD and THAAD systems. Within the U.S. Army, these

activities are typically within the realm of the Air Defense Artillery (ADA) corps. Active defense is not limited, however, to just air and missile defense operations, but includes all means to disrupt the delivery of any committed nuclear weapon system.

- **Passive Defense:** those activities associated with denying or mitigating the use of or effects of committed nuclear weapons. Examples include hardening critical systems to nuclear weapons effects, to include EMP hardening of electronics, blast hardening and burying critical command posts. The ultimate objective is to render the use of nuclear weapons irrelevant.
- **Command, Control, Communications, Computers, and Intelligence (C4I):** this includes those activities that enable and integrate the overall response to the nuclear threat and nuclear defenses. Not a separate “pillar”, as defined in emerging air and missile defense doctrine, but the overall “glue” of the defense.<sup>26</sup>
- **Environment:** those activities that influence, constrain, restrain, or create the need for a nuclear defense system. In a system analysis view, the environment includes concepts of non-proliferation and counterproliferation not included in the above four concepts of the nuclear trinity plus C4I. The environment also includes the activities whereby governments can influence other nations by their agreements and internationally and locally recognized norms of behavior, including treaties and diplomatic actions.

Thus we can define a nuclear defense system composed of a trinity of attack operations, active defense, and passive defense integrated by C4I, shaped by an external security environment. We now examine the U.S. capabilities of each component in further detail.

## ATTACK OPERATIONS

U.S. attack operations capability includes the U.S.’s strategic nuclear triad plus associated conventional and unconventional warfare capability useful in attacking an enemy’s nuclear forces. As stated above, those activities associated with denying an adversary the ability to commit nuclear forces or their delivery systems include all elements of power and the full range of military options, conventional and unconventional, which may be brought to bear to disrupt and deny the launch of aircraft or ballistic missiles, or to communicate an attack order, or to destroy or damage the nuclear weapons themselves prior to commitment. Of these, we first describe the current U.S. strategic nuclear triad.

### **The US Strategic Nuclear Triad**

The US strategic triad consists of manned bombers, fleet ballistic missile submarines, and intercontinental ballistic missiles. The US manned bombers associated with nuclear delivery include:

- B-2. The United States currently maintains 21 B2 Spirit stealth bombers, stationed at Whiteman Air Force Base in Missouri. With a range of 9,600 kilometers, these multi-role bombers were first used in combat over Kosovo, and have a two-man crew.<sup>27</sup>
- B-52. The legacy workhorse of the Nuclear Triad, the B-52 was first fielded in 1954. The current model, the B-52H, was delivered to the USAF in 1961 and 1962, with 102 B-52H's delivered to USAF Strategic Command. Only the H-model is still flown. With a crew of 5, the B-52 unrefueled operating range is over 14,000 kilometers. It can carry up to 70,000 pounds of mixed ordnance, to include Air Launched Cruise Missiles (ALCMs) and Harpoon Anti-Ship missiles.<sup>28</sup> The B-52's nuclear ordnance may include any of the nuclear gravity bombs in the U.S. inventory and the ALCM.

The U.S. Fleet Ballistic Missile Submarines, or SSBN, are entirely of the *Ohio* class. Each nuclear-powered submarine is designed to operate 15+ years between overhauls. With the first deployed in 1981, they are armed with either 24 *Trident I* C-4 ballistic missiles or the newer, more capable *Trident II* D-5 missiles. There are eight SSBN *Ohio*-class ships home-ported in Bangor, Washington, and another ten home-ported in Kings Bay, Georgia. The SSBN provides the most survivable and enduring nuclear strike capability, and the fleet carries 50% of the total U.S. strategic nuclear warheads.<sup>29</sup>

U.S. Intercontinental Ballistic Missiles, or ICBM's, equipped with nuclear warheads are of two types, as follows:

- The LGM-30 Minuteman III ICBM missiles are located at Malstrom AFB, Montana; Minot AFB, North Dakota; and F.E. Warren AFB, Wyoming. The Minuteman III has a range of over 6000 miles, and should START II go into effect, will be the only land-based nuclear-equipped ballistic missile in the U.S. inventory. Also, under START II terms, it is subject to being permanently "deMIRVed", going down to one warhead. With only one warhead, a reasonable assumption is that the accuracy will be enhanced to increase mission effectiveness.<sup>30</sup>
- The LG-118A Peacekeeper missile is able to carry up to 10 Multiple Independent Reentry Vehicles (MIRV). This four-stage missile has a range of over 6000 miles and at burn-out, achieves a speed of over 15,000 miles per hour (Mach 23 plus).

Although the newest ICBM in the U.S. inventory, achieving full IOC in 1988, it is subject to elimination under START II.<sup>31</sup>

The U.S. military has additional nuclear weapons capability not defined as “strategic” weapons by current strategic arms treaties with the Russians. These nonstrategic or tactical nuclear weapons systems include gravity bombs and our sea-launched cruise missiles.

### **Nonstrategic Nuclear Weapons**

The U.S. maintains a ready inventory of nuclear B61 gravity bombs for use by both strategic and non-strategic missions. These bombs may be delivered by nuclear-certified fighter-bomber aircraft, also called dual-capable aircraft (DCA), to include the USAF F-15 and F-16. Additionally, the U.S. Navy maintains an inventory of nuclear capable Tomahawk Land Attack Missile (TLAM/N) Sea Launched Cruise Missiles (SLCM) that may be launched by attack submarines.<sup>32</sup> With a 2500 km range, the TLAM/N was removed from ships in 1992 per President Bush’s unilateral order and placed in storage. The TLAM/N was considered by some strategists in the 1980’s to be the “fourth leg” of the U.S. strategic nuclear triad.

### **Other Options**

The United States maintains a robust unconventional warfare capability (e.g., U.S. Special Forces) and conventional warfare capability that may be utilized to deny an enemy’s nuclear weapons commitment capability. With conventional weapons precision strike weapons such as the Joint Direct Attack Munitions, laser-guided munitions, ATACMs, conventional ALCMs and Tomahawk SLCMs, the author believes these will often be weapons of first consideration. Additionally, those weapons designed to attack the enemy’s command and control are useful as a nuclear defense attack operational capability, since most nations (but perhaps not all) presumably have centralized nuclear release procedures. Also, some forms of information operations offensive capability may provide a significant role under certain circumstances to deny the ability to commit nuclear weapons.

### **ACTIVE DEFENSE**

Unlike Russia, the United States today does not have an effective antiballistic missile system to protect either its capital or any other portion of its homeland. Though permitted such a system by the 1972 Anti-Ballistic Missile Treaty (ABM Treaty), the SAFEGUARD system was mothballed shortly less than two years after its activation in 1974<sup>33</sup>. Today there is a concerted national effort to develop an effective National Missile Defense (NMD) System. This system is being hotly debated throughout the world. As currently designed, the proposed land-based NMD

system would place 100 missiles in Alaska to be guided during boost by an X-Band radar in Shemya, one of the Aleutian Islands. Early detection and warning would be provided by a variety of NORAD radar systems across the northern tier of the globe. Additionally, warning and in-flight discrimination would be provided by constellations of satellites including DSP, Space Based Infra-Red System – High (SBIRS-H), and Space Based Infra-Red System – Low (SBIRS-L).<sup>34</sup>

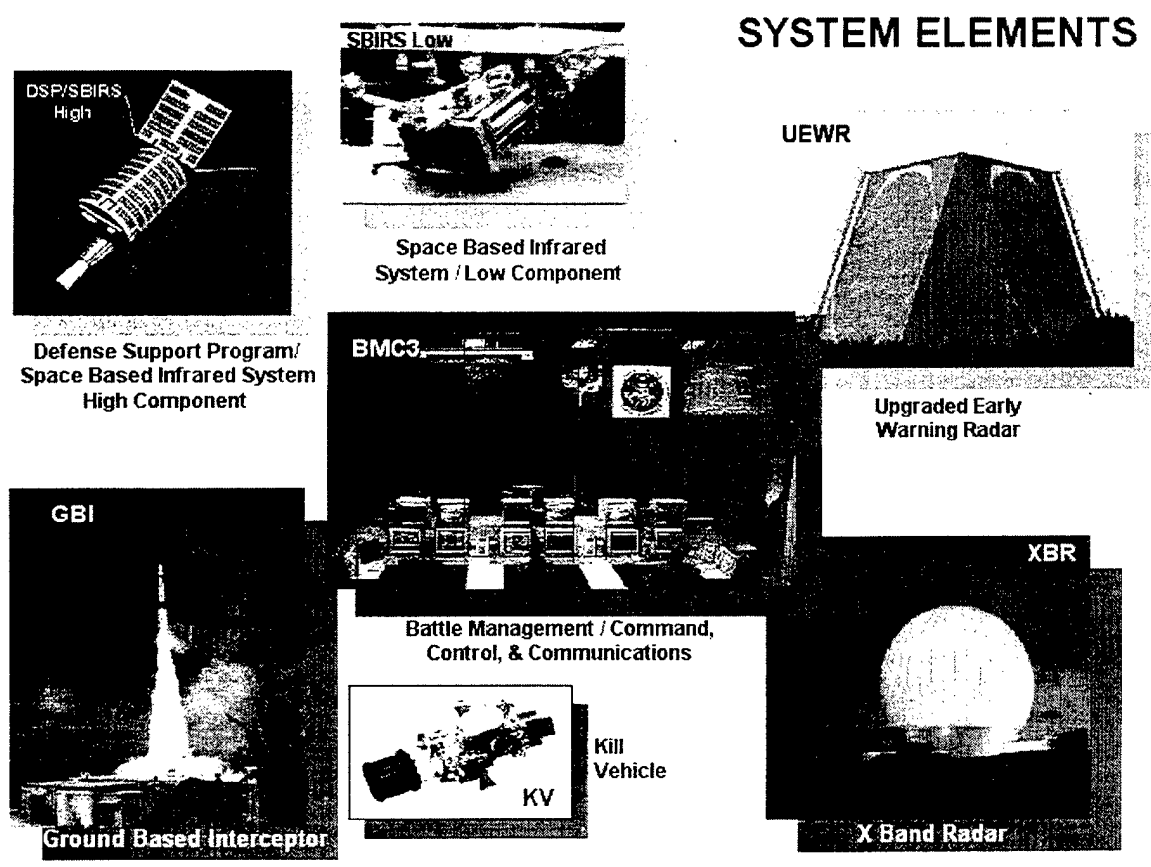


FIGURE 3 NATIONAL MISSILE DEFENSE SYSTEM ELEMENTS<sup>35</sup>

NMD as a concept is strongly supported by the new Bush administration and senior cabinet officials, but the proposed land-based system has its shortcomings. As designed, the current program is intended to respond to only the rogue threat.<sup>36</sup> It is not designed to defend the United States from the full and sophisticated ICBM threats from China and Russia.<sup>37</sup> As it is now, either significant modifications to the existing ABM Treaty or scrapping the treaty all together will be required to field an effective NMD system. China and Russia strongly oppose

U.S. fielding of any NMD system and associated modifications to the ABM Treaty. This will be discussed further later.

The only existing U.S. capability to provide any defense against ballistic missiles of any nature are the Army's Patriot Air Defense System and the Navy's Aegis ships with their Standard missiles. These systems, however, are of limited range in regards to a nuclear threat, and are considered point defense systems, capable of engaging only the relatively slow short- and medium-range ballistic missiles. These systems are not technically capable of providing defense against ICBMs. The Army is currently upgrading its Patriot systems to the Patriot Advanced Capability – 3 (PAC-3) version, increasing its range and incorporating a hit-to-kill kinetic energy warhead. Additionally, the Navy is upgrading their Aegis capability to also increase ranges, speeds, and also incorporating a kinetic energy kill mechanism into the warhead design. Most significantly, the Army is beginning production of the Theater High Altitude Air Defense System (THAAD), which also utilizes a hit-to-kill kinetic energy warhead and provides significant improvements to probability of kill, speed, and range. Similarly, the Navy is developing advances to the Aegis ship – Standard missile combination to provide Navy Theater Wide coverage from the sea. Perhaps most exciting is the Air Force's ongoing development of the Airborne Laser (ABL) intended to destroy the ballistic missile during boost phase, far from its intended target, and quite possibly over enemy territory.

## PASSIVE DEFENSE

Nuclear defense passive measures include a whole suite of often-overlooked options. The ultimate intent is to render the use of nuclear weapons irrelevant. Passive defense includes measures that protect, mitigate, or nullify nuclear weapons effects. Passive defense concepts include survivability, operability, and the concept of nuclear hardening. Also included and closely linked is the concept of warning. In the past, the U.S. Civil Defense system with its community fallout shelters and civil defense training programs provided passive defensive measures. Ongoing federal-state-local exercises intended to support community WMD response preparedness are examples of a passive defense activities, as are the associated decontamination, mass casualty exercises, community evacuation plans, etc.

During the Cold war, U.S. strategic systems were hardened to survive nuclear weapons effects, with detailed military specifications developed to describe the even included in military standards. With DoD acquisition reform, military standards are commonly considered to no longer be in effect.<sup>38</sup> Commercial off-the-shelf systems often do not meet the pre-existing military standards, specifically for the areas of EMP hardness, or the nuclear event hardness

requirement is waived during the acquisition and procurement process. This area remains of continuing concern by certain senators and OSD officials.

Passive defense includes these three functions: contamination avoidance, consequence management, and nuclear survivability.<sup>39</sup> Military units and personnel incorporate nuclear contamination avoidance into training, with existing doctrine and procedures available to survey and mark contaminated areas, and procedures to exclude personnel from nuclear hazard areas. Survivability is incorporated into military acquisition processes, with survivability specifically identified as a performance requirement.

The function receiving the most attention of late is consequence management. The United States has formed consequence management teams within its Army and Air National Guard structure to respond to WMD events within the continental United States. Called WMD Civil Support Teams (CST), and with up to 32 teams stationed across the United States, these military units work closely with local civil authorities under control of their state governors.<sup>40</sup> These WMD CST's have expertise in detecting and surveying nuclear and radiological hazards, and their personnel provide technical expertise to local responders. If federalized, the WMD-CST would likely fall under the Joint Forces Command's Joint Task Force – Civil Support.<sup>41</sup>

General opinion of the effectiveness of the overall federal response in preparation for consequence management is mixed and currently being debated. The Clinton administration conducted a series of TOPOFF Exercises to flesh out some of the problems and demonstrate areas needing improvement. Unanswered questions include should the U.S. form a separate Homeland Defense Command? Who is in charge of the response? In actuality, most of the efforts in this area have been focused on a response to an Aum Shinrikyo - type terrorist threat, with chemical or biological weapons, or possibly a radiological dispersal device (RDD), and not the response to a nuclear weapon event in or over a community.<sup>42</sup>

Other passive defense concepts tend to blend with the concept of environment outlined below. In some regards, international norms, diplomatic actions, arms control treaties and verification might be considered as passive defensive measures. For the purpose of this construct, though, they are better considered as part of the overall nuclear defense environment, as they influence active defense and attack operations functions directly.

#### C4I

The force that provides the interaction between various elements of the nuclear defense trinity is the concept of command, control, communications, and intelligence, or C4I. This concept is global and continuous. It includes the concept of the military officer following the

commander-in-chief with the "football", or nuclear release authority. Nuclear defense C4I is highly reliant on real-time and near-real-time superb intelligence, and depends on MILSTAR, NUCWARN systems, many imbedded systems of the various strategic intelligence agencies, the in-place national nuclear policies, and much more.<sup>43</sup>

## ENVIRONMENT

Using the author's concept and definition, the environment includes all external factors that impact the nuclear defense trinity or system. The environment also includes those "soft" items dependent upon human action (or inaction) for compliance. This includes the concepts of the various treaties, the perception of various threats (both real and imagined), economics, and national scientific and technical capability.

The environment's role in nuclear defense cannot be overstated. The environment provides the constraints, restraints, and energy food supply for the nuclear defense system. In some respects, the environment establishes not only the conditions but also the basic requirements for nuclear defense. The environment embodies many of the concepts of proliferation, non-proliferation, counterproliferation, and the overall world defense and security posture. By defining the nuclear defense system's environment in this manner, we can logically separate in a logical and pragmatic fashion the nuclear defense trinity and C4I from the complex debates associated with nuclear weapons ideology. Still, it is useful to attempt to shape this environment to establish conditions that will improve the overall security of the United States. The environment affecting the nuclear weapons trinity includes a spectrum bridging extreme views. On one end of the extreme, the non-proliferators' ultimate objective is the elimination of all nuclear weapons. On the other extreme, proliferators feel that they must obtain nuclear weapons for their own various political and security agendas. Within this environment resides the need for a holistic system of nuclear defense.

Counterproliferation of WMD includes similar components to our theory for nuclear defense, to include active defense, passive defense, and deterrence (a form of attack operations). But counterproliferation policy also includes concepts intended to slow down proliferation through relevant multilateral arms control regimes, such as the NonProliferation Treaty and the Nuclear Test Ban Treaty. Counterproliferation policy incorporates other means, too, such as measures intended to encourage moderation in the policies of proliferating regimes.<sup>44</sup> A counterproliferation policy is useful in public statements and is useful in international negotiations and debate, but is flawed from a holistic nuclear defense standpoint. It does not provide sufficient emphasis on the concept of attack operations and its vital role; rather

it disguises the role of attack operations under the umbrella of “deterrence.” It also tends to emphasize areas that, from the nuclear defense system defined in this paper, are properly environmental shaping issues.

Having addressed each of the components of the nuclear defense system, we will now examine how these components relate to each other. How can we view the relationship of the nuclear defense trinity components? Is there a method available to consider how attack operations affect passive defense and active defense? What is the proper balance of these three components of the nuclear defense trinity?

### **INTEGRATION OF THE NUCLEAR DEFENSE TRINITY**

During the latter stages of the Cold War, the foundations of nuclear defense rested on the concept of the nuclear deterrent, or attack operations. The concept of Mutual Assured Destruction, or MAD, was considered by strategists to bring some defensive stability between the western bloc and the Soviet Union and the Warsaw Pact powers. For the most part, the nuclear club was limited to the original five members of the Non-proliferation treaty (NPT): the United States, Soviet Union, France, United Kingdom, and China. In many regards, the west counter-balanced the communist powers. Only the Soviet Union and the United States developed effective ballistic missile defense systems, and in 1975 the United States abandoned its Safeguard program and with it any semblance of continental missile defense.

If we consider nuclear defense to be a three dimensional construct, with active defense along one axis, passive defense along another axis, and attack operations along another, we find that since 1975 the United States has had a facade or two-dimensional figure facing the Soviet threat. Figure 4 provides a graphical representation of the facade. The active defense dimension associated with a national nuclear defense has been missing since the Safeguard program was terminated.

Facades can be effective if you are limited to two dimensions in response and action. Consider an old western movie set, with the buildings being facades, or just the front walls. To the cameras limited in view and motion to two dimensions (for the most part), it looks like a real town. And for the gunfight in the streets, or in the scenes of townspeople shooting from the windows at the marauders shooting up the streets, the facades are effective. You see the same concept today in some training areas for military operations in urban terrain or police training. The range of shooter to target motion is restricted in one dimension.

## Nuclear Defense without NMD

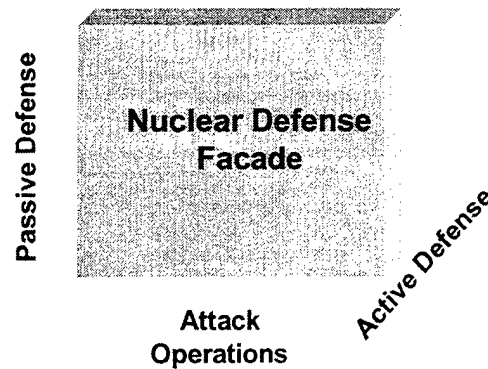


FIGURE 4 THE NUCLEAR DEFENSE FACADE

In the 21<sup>st</sup> century, the restrictions or common ground rules placed on the nuclear players are no longer effective. If operating in an environment constrained in one dimension, such as on an urban combat fire range, if the shooter ignores the range restrictions, he may just walk around the side of the façade and blast the targets from their mounts with his weapon. The strong dimension in the defenses is identified and is flanked; in other words, the weak dimension is identified and the offensive approach is made from that direction. The shooter has the choice; either follow the range rules; or ignore the rules and attack from the weakly protected or unprotected dimension. What is needed is a proper balance to meet the requirements for nuclear defense in this new global environment of national and transnational threats. A facade consisting of only two dimensions of nuclear defense is readily defeated by a smart and determined foe; an asymmetric attack on the weak dimension may not overwhelm the defense, but will render what defenses are in place irrelevant.

Additionally, the nuclear players are arising from uncommon quarters. While counterproliferation efforts have succeeded in delaying the aspirations of non-nuclear powers to obtain nuclear weapons, this delay cannot continue indefinitely. Within the past five years, there are indications that North Korea, for example, may now have several nuclear weapons, and even some indications that Iraq is now a nuclear power.<sup>45</sup>

## DIMENSIONAL BALANCE

Just as the facade may no longer be effective, an overwhelming domination by one dimension over the other two dimensions of nuclear defense is not desirable. Consider the

### BALANCING IN THREE DIMENSIONS

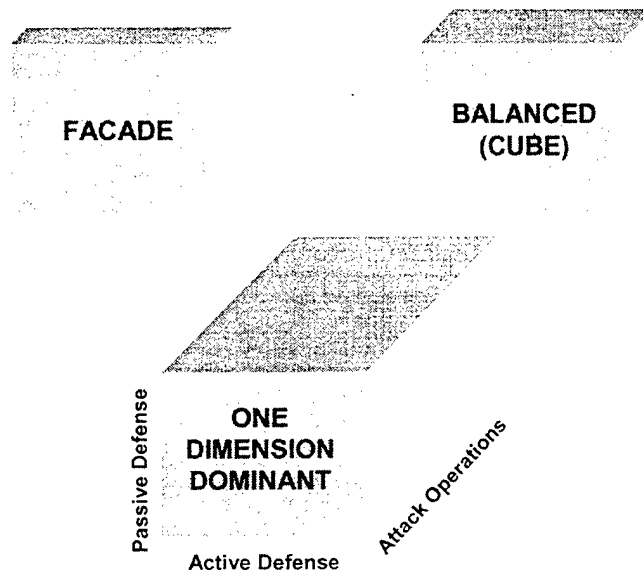


FIGURE 5. BALANCING IN THREE DIMENSIONS

volume of the cubes in Figure 5 to equate to resources, including time, manpower, political will, and money. If resources are unlimited, then certainly one dimension might dominate with little impact to overall effectiveness. However, resources are always limited in some fashion, and should one dimension dominate, then the other dimensions suffer.

Another consideration: The effectiveness of the overall nuclear defense system may be considered to be a function of the total surface area of the cube, and not the volume.

Mathematically, assuming a cubic structure, the total surface area is portrayed as

$$\text{Surface Area} = 2xy + 2xz + 2yz$$

While the volume is portrayed as

$$V = x * y * z$$

Where Surface Area is a measure of the defense system effectiveness;

X is active defense;

Y is passive defense;

Z is attack operations;

And Volume is a measure of total system costs.

For this model to be effective, corresponding units of measure must be defined for each dimension of defense. Units of measures for the attack operations dimension may not be the same as measurements for the passive defenses dimension and active defenses dimension. Although a common unit of measure may be, in certain arguments, dollars appropriated or invested, it is impractical to some extent. What is desired is effectiveness, not dollars spent. Kilotons equivalent yield cannot be directly compared to the probability of kill of missile defense systems or to the peak volts per millisecond of electronic survivability. More research is needed in this area to determine an effective means to compare effectiveness.

Assuming the effectiveness of the overall nuclear defense system is robust and pragmatically balanced, particular challenges remain in defending the United States from nuclear threats. One of these is improving attack operations to go beyond the concept of Mutual Assured Deterrence to that of specifically targeting the nuclear threat. We now examine a method of approaching this challenge.

#### THE SCUD AND SUBMARINE WARFARE MODEL APPLIED TO ATTACK OPERATIONS

After Desert Storm, attention was placed on the problems of Scud hunting. The U.S.-led coalition placed extraordinary effort during Desert Storm's air campaign to search for and attack Iraqi mobile Scud launchers, with little overall success. Though all the fixed Scud launch areas were destroyed, many of the mobile systems were able to hide from the air attacks, and some remain unaccounted for yet today.

James Wirtz of the Navy Postgraduate School portrayed the problems associated with Scud hunting as analogous to the problems of antisubmarine warfare (ASW), or for this argument, submarine defense operations. He stated that the American and British experience and their lessons learned from the Atlantic campaigns of WWII against the German U-boats could be applied to the problems of theater missile defense. The problems of ASW are divided into five procedures:<sup>46</sup>

- 1) the continuous collection and analysis of intelligence on all known platforms
- 2) continuous monitoring of all probable launch areas
- 3) generation of cueing (warning) when specific platforms move to a launch status
- 4) localization of specific systems
- 5) attack

Professor Wirtz's paper goes on to explain how these procedures can be applied to theater missile defense measures. Some of these procedures and concepts are now integrated into missile defense planning. The critical procedure is the localization of specific systems for attack. Identifying the location of mobile offensive systems requires great skill, intelligence, and training. As Professor Wirtz explains, "officers and policymakers cannot expect that the skills, experience, hardware and communication architectures (fusion) necessary to localize a target can be improvised at a moment's notice."<sup>47</sup> This comment is also applicable for theater missile defense planning in the United States today.<sup>48</sup>

The same concept of theater missile defense can also be applied to national missile defense and be expanded to include the concept of nuclear defense. In constructing policy and doctrine for national nuclear defense, the immediate threat of ballistic missiles armed with nuclear warheads should not overwhelm the overall concept of nuclear defense. As some opponents to National Missile Defense aptly remind us, nuclear warheads are a threat by any delivery system, not just ballistic missiles. The emerging threat of cruise missiles remain a serious concern, as are the threat of delivery by a ship in Baltimore harbor, a truck from Canada, or even a man-portable backpack bomb. The same functions of continuous collection of intelligence, monitoring of specified areas, warning of movement and increased hazards, localization (such as identification of likely ports of entry), and interception/attack/disruption may still be applied to these other scenarios. Again, for this concept to be effective, superb intelligence is required.

We have discussed the need for a cohesive total dimensional missile defense and the nuclear defense trinity of attack operations, active defense and passive defense, with particular discussion on the difficulties of attack operations against mobile delivery platforms. We now turn our focus on some of the external environmental issues that shape and drive the total three-dimensional nuclear defense system.

### **SHAPING THE ENVIRONMENT**

Some of the major issues that tend to blur national and international debate in the view of many are those defined in this nuclear defense system definition but issues more properly categorized as shaping the environment. Issues of technological feasibility, arms control issues, ABM treaty issues.

The NMD system architecture as defined today is not politically feasible internationally. The NMD system architecture must shift to accommodate political reality. Specifically, for some ballistic missile trajectories from rogue nations to the United States, the current NMD system

architecture relies on foreign-based radar systems for cueing, identification, and discrimination. These include radars in England, and Greenland, a sovereign territory of Denmark. Both nations must grant the U.S. permission for use of their sovereign territory for these purposes. Conceivably some rogue threat against the U.S. may choose to attack these "softer" targets within the United Kingdom, Greenland, and perhaps Denmark itself as a prelude to an attack on the United States. Assuming American national missile defense were extended to its European allies, even if the current radars operate as intended, Alaskan-based interceptor missiles may not be able to defend the soil of England or Denmark. This creates a requirement to place additional interceptor missiles in locations to provide capability to protect England and Denmark from ICBMs. Currently the United States is offering to extend NMD coverage to our western European allies in exchange for their support. A proposed NMD system architecture to accommodate this proposal expanding the NMD protection area has not yet been made public. The bottom line: the support of both Denmark and the United Kingdom will be necessary for the current NMD architecture to work.

## **JOINT DOCTRINE**

Joint Publication 3-11, Joint Doctrine for Operation in Nuclear, Biological, and Chemical (NBC) environments covers one facet of the nuclear defense trinity, passive defense, while Joint Publication 3-01, Joint Doctrine for Countering Air and Missile Threats, and Joint Publication 3-01.5, Doctrine for Joint Theater Missile Defense, focus more on the pillars of missile defense: attack operations, active defense, passive defense, and C4I. This is a good start for the defined systems of nuclear defense, but differs from this treatise in that joint doctrine focuses on air-breathers and ballistic missiles as nuclear weapon delivery vehicles. Joint Publication 3-12, Doctrine for Joint Nuclear Operations, mentions that offensive and defensive operations must be integrated, but its focus is on how defensive operations support offensive operations, and it considers active defense and passive defense to be different components of defensive operations. Another concern is that joint doctrine is somewhat limited in recognizing that successful intercepts may result in which nuclear explosions could complicate or render impossible the ability for follow-on intercepts.

## **OTHER CONCERNS**

While the National Missile Defense program debate renews United States' emphasis on its weak dimension of Active Defense, the integration of NMD into an overall nuclear defense architecture incorporating the attack operations and passive defense dimensions has not undergone serious public scrutiny or debate. What will be U.S. policy should a rogue nation

launch nuclear-tipped ballistic missiles at the United States which are subsequently intercepted by a NMD system? Will the U.S. retaliate in kind? Is the response a U.S. Strategic Command mission or that of a unified command such as U.S. Pacific Command or U.S. Central Command? Should something like a Homeland Defense Command be formed, what will the command and control relationship be with U.S. Joint Forces Command, U.S. Space Command, and U.S. Strategic Command? These are all questions that are today unanswered. The best opportunities for successful attack operations may be in a narrow time-window surrounding the nuclear weapons attack, and command relationships become critical in these time-sensitive operations.

#### **CONCLUSIONS AND RECOMMENDATIONS:**

The United States faces a real and growing nuclear threat.<sup>49</sup> To defend itself from the nuclear threat, the United States military should develop, field, and maintain a robust, adequate, and feasible nuclear defense strategy revolving around three primary functions: active defense, passive defense, and attack operations, all integrated with appropriate C4I. There must be a balance among these functions to provide a three-dimensional capability, meaning that nuclear defense with only attack operations (or deterrence) and passive defense functions without active defense provides only a defensive façade. Simultaneously, these functions should be balanced in effectiveness to ensure that concentration of resources for one resource (e.g., NMD's \$60 billion dollars) should not unduly weaken the continued capability of the passive defense and attack operations functions. Finally, efforts to shape the overall world security environment through arms control measures, diplomacy, and other instruments of power should continue to delay or defer any potential nuclear threat growth.

WORD COUNT = 7,394



## ENDNOTES

<sup>1</sup> "The History of the Doomsday Clock," The Bulletin of the American Scientists. Available from <<http://www.bullatombsci.org/clock.html>>; Internet; accessed 9 March 2001. The clock first appeared in 1947 and was set at seven minutes before midnight. Since then, it has been reset 16 times in reaction to substantial world events. In 1991, Presidents Bush and Gorbachev announced a series of unilateral but parallel initiatives taking most intercontinental missiles and bombers off hair-trigger alert, and withdrawing thousands of tactical nuclear weapons from forward bases. The December 1991 issue set the clock back to seventeen minutes before midnight.

<sup>2</sup> George Bush, "Address to the Nation on Reducing United States and Soviet Union Nuclear Weapons," 27 September 1991. Available from the Bush Presidential Library, at <<http://bushlibrary.tamu.edu/papers/1991/91092704.html>>; Internet, accessed 9 March 2001.

<sup>3</sup> William S. Cohen, "Proliferation: Threat and Response," January 2001, p 17; available from <<http://www.defenselink.mil/pubs/ptr20010110.pdf>>; Internet; accessed 11 January 2001. This report describes that over the past nine years, \$3.2 billion has been spent in the Cooperative Threat Reduction Program. Recently, in the Washington Post, CTR experts are requesting another \$30 billion for the next ten years. While it is reasonable to conclude that the CTR program will continue at some reasonable funding level for the near-term, concern remains that the cash-strapped Russian Federation uses the cash in-flow to indirectly fund their own weapons modernization programs.

<sup>4</sup> Tim Zimmerman, "Russia's Ace in the hole: Resurrecting a nuclear Maginot line," U.S. News, 2 June 1997, available from <<http://www.usnews.com/usnews/issue/970602/2nuke.htm>>; Internet; accessed 6 March 2001. This article claims that Russia provided a public indication in 1993 that Russia renewed its emphasis on nuclear weapons, predating NATO expansion. In 1993, Russian military doctrine also reversed a 1982 pledge never to use nuclear weapons first.

<sup>5</sup> Philip C. Saunders and Jing-dong Yuan, Monterey Institute of International Studies, "China's Strategic Force Modernization: Issues and Implications for the United States," in CNS Occasional Paper #4, Proliferation Challenges and Nonproliferations Opportunities for New Administrations, Michael Barletta, ed. September 2000. Available from <[http://cns.miis.edu/cns/projects/earnp/conf/op4\\_sid.pdf](http://cns.miis.edu/cns/projects/earnp/conf/op4_sid.pdf)>; Internet; accessed 15 March 2001.

<sup>6</sup> George J. Tenet, Director of Central Intelligence, "Statement by Director of Central Intelligence George J. Tenet before the Senate Select Committee on Intelligence on the "Worldwide Threat 2001: National Security in a Changing World." Available from <[http://www.cia.gov/cia/public\\_affairs/speeches/UNCLASWWT\\_02072001.html](http://www.cia.gov/cia/public_affairs/speeches/UNCLASWWT_02072001.html)>; Internet; accessed 9 March 2001.

<sup>7</sup> Lewis Dunn, Peter Lavoy, and Scott Sagan, "Conclusions: Planning the Unthinkable," Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons (Cornell University Press, 2000), 232. The authors describe how the Democratic Peoples Republic of Korea (DPRK) chemical and nuclear programs appear intended to blackmail the United States to abandon South Korea in conflict.

<sup>8</sup> Robert D. Walpole, National Intelligence Council, "The Evolving missile Threat in the Current Proliferation Environment," Foreign Missile Developments and the Ballistic Missile

Threat through 2015, September 1999; available from <http://www.cia.gov/cia/publications/nie/nie99msl.html>; Internet; accessed 9 December 2000. The document states "We expect the threat to the United States and its interests to increase over the next 15 years. However, projecting political and economic developments that could alter the nature of the missile threat many years into the future is virtually impossible. The threat facing the United States in the year 2015 will depend on our changing relations with foreign countries, the political situation within those countries, economic factors, and numerous other factors that we cannot predict with confidence." After giving some specific examples, the document goes on to state, "Recognizing these uncertainties, we have projected foreign ballistic missile capabilities into the future largely based on technical capabilities and with a general premise that relations with the United States will not change significantly enough to alter the intentions of those states pursuing ballistic missile capabilities." This author further believes that an important assumption will be that friendly nations will remain friendly. While these documents refer specifically to the ballistic missile threat, the concept and difficulty in addressing the general nuclear threat is similar.

<sup>9</sup> "Global Trends 2015: A Dialogue About the Future with Nongovernment Experts," prepared under the direction of the National Intelligence Council, December 2000, publication approved by the National Foreign Intelligence Board under the authority of the Director of Central Intelligence. Available from <http://www.cia.gov/cia/publications/globaltrends2015/index.html>; accessed 9 March 2001. It states:

Other means to deliver WMD against the United States will emerge, some cheaper and more reliable and accurate than early-generation ICBMs. The likelihood of an attack by these means is greater than that of a WMD attack with an ICBM. The goal of the adversary would be to move the weapon within striking distance by using short- and medium-range missiles deployed on surface ships or covert missions using military special operations forces or state intelligence services. Non-military delivery means, however, do not provide the same prestige, deterrence, and coercive diplomacy associated with ICBMs.

<sup>10</sup> Bulletin of Atomic Scientists. Available from <http://www.bullatomsci.org/clock/doomsdayclock.html>; Internet, accessed 9 March 2001. In 1998, the hands moved forward to nine minutes before midnight, dramatizes the increase in the worldwide nuclear threat. In May, India and Pakistan each tested a series of nuclear devices, adding two more states to the list of declared nuclear powers. But the clock move was also made to dramatize the failure of world diplomacy in the nuclear sphere; the increased danger that the nonproliferation regime might collapse; and the fact that deep reductions in the numbers of nuclear weapons, which seemed possible at the start of the decade, had not been realized.

<sup>11</sup> "Global Trends 2015: A Dialogue About the Future with Nongovernment Experts."

<sup>12</sup> *Ibid.*

<sup>13</sup> Robert D. Walpole, National Intelligence Officer for Strategic and Nuclear Programs, testimony before the Senate Foreign Relations Committee, September 16, 1999. Available from [http://www.cia.gov/cia/public\\_affairs/speeches/archives/1999/walpole.html](http://www.cia.gov/cia/public_affairs/speeches/archives/1999/walpole.html); accessed 9 March 2001.

<sup>14</sup> Daniel Gouré, Defense of the U.S. Homeland Against Strategic Attack, Center for Strategic and International Studies (CSIS), Washington, DC, December 2000, pg 2. Available from < <http://www.csis.org/homeland/reports/defenseofushml.d.pdf> >; accessed 3 February 2001. This document highlights the need for national and theater missile defense systems to face a growing ballistic missile threat. It also goes on to say that traditional deterrence strategy is less relevant today and even unsuitable.

<sup>15</sup> George J. Tenet, Director of Central Intelligence, "Statement by Director of Central Intelligence George Tenet Before the Senate Committee on Armed Services 3 February 2000 on The World Wide Threat in 2000: Global Realities of our National Security". P. 2. Available from < [http://www.senate.gov/~armed\\_services/statemnt/2000/000203gt.pdf](http://www.senate.gov/~armed_services/statemnt/2000/000203gt.pdf)>; accessed 9 March 2001.

<sup>16</sup> George J. Tenet, Director of Central Intelligence, "Statement by Director of Central Intelligence George C. Tenet before the Senate Select Committee on Intelligence on the "Worldwide Threat 2001: National Security in a Changing World.".

<sup>17</sup> Shimon Perez, former Prime Minister of Israel, 13 July 1998, as quoted in Israel Wire 14 July 1998. Available from <<http://www.fas.org/news/israel/980714-israel1.htm>>; accessed 9 March 2001 The articles states:

In an unprecedented statement, former Prime Minister Shimon Peres stated yesterday that Israel "built a nuclear option, not in order to have a Hiroshima but an Oslo." To date, no Israeli leader has made any public statements admitting to Israeli nuclear capabilities, prior to Peres' statement yesterday.

Peres added, "We thought the reason that Israel was attacked 5 times was because some of our neighbors thought they can overcome us." He concluded that he believes if not for it [the nuclear option], we would not have Oslo. The former prime minister made the statements during a press conference in Jordan, following his meeting with King Hussein.

<sup>18</sup> Cohen, "Proliferation: Threat and Response," pp. 9-10.

<sup>19</sup> Cohen, "Proliferation: Threat and Response," pg 61, and testimony at the trial of four alleged terrorists for the World Trade Center bombing. Jamal Ahmed Fadly, a Sudanese militant, testified before a federal grand jury on 7 February 2001 that while working for Usama Bin Laden, the group attempted to purchase South African uranium for \$1.5 million. Further information may also be found in the Washington Post, 8 February 2001, Page A01, in a story by Colum Lynch.

<sup>20</sup> Charles Ferguson, "Sparking a Buildup: U.S. Missile Defense and China's Nuclear Arsenal," Arms Control Today, March 2000, pp 13 – 18, available from <<http://www.armscontrol.org/ACT/march00/cfmr00.htm>>; Internet; accessed 15 March 2001.

<sup>21</sup> Aaron Karp, "The Spread of Ballistid Missiles and the Transformation of Global Security," The Nonproliferation Review, Fall-Winter 2000, pg 118.

<sup>22</sup> This ignores the fact that several allies, specifically Great Britain, France, and Japan have space launch vehicles that could also reach the United States, while Germany is very

much technically capable of developing ICBMs. For the mid-term outlook, we assume these nations remain staunch allies with the United States.

<sup>23</sup> Unattributed photo, Centre for Defense and International Security Studies (CDISS), Lancaster, United Kingdom; available from <<http://www.cdiss.org/98oct1.htm>>; Internet; accessed 13 December 2000.

<sup>24</sup> Cohen, "Proliferation: Threat and Response," pg 17.

<sup>25</sup> Army Field Manual 5-102, Countermobility, 14 March 1985, Chapter 6; available from <<http://hosta.atssc.eustis.army.mil/cgi-bin/atdl.dll/fm/5-102/Ch6.htm#s6>>; Internet; accessed 17 March 2001. This chapter describes U.S. Army doctrine for the use of special atomic demolition munitions to create countermobility obstacles in the AirLand Battle. Because of the precision in emplacing a SADM, a small yield would provide the same effect as a much larger bomb or missile with the associated Circular Error Probable (CEP) estimates.

<sup>26</sup> The acronym C4I for Command, Control, Communications, Computers, and Intelligence, has grown from the term C3I, which didn't specifically call out the term Computers. In much of U.S. doctrine the concept is further evolving to C4ISR, for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance. This author believes that surveillance and reconnaissance are inherent functions of intelligence and the addition of these two terms dilutes the overall concept and definition of intelligence. Additionally, the inclusion of computers in the concept of C3I may be redundant and one can argue it improperly elevates the role of computers to a separate entity rather than as a tool enabling the concepts of command, control, communications, and intelligence.

<sup>27</sup> USAF Fact Sheet, "B-2 Spirit," available from <[http://www.af.mil/news/factsheets/B\\_2\\_Spirit.html](http://www.af.mil/news/factsheets/B_2_Spirit.html)>; Internet; accessed 7 December 2000.

<sup>28</sup> USAF Fact Sheet, "B-52 Stratofortress," available from <[http://www.af.mil/news/factsheets/B\\_52\\_Stratofortress.html](http://www.af.mil/news/factsheets/B_52_Stratofortress.html)>; Internet; accessed 7 December 2000.

<sup>29</sup> USN Navy Fact File, "Fleet Ballistic Missile Submarines – SSBN," available from <<http://www.chinfo.navy.mil/navpalib/factfile/ships/ship-ssbn.html>>; Internet; accessed 7 December 2000.

<sup>30</sup> USAF Fact Sheet, "LGM-30 Minuteman III," available from <[http://www.af.mil/news/factsheets/LGM\\_30\\_Minuteman\\_III.html](http://www.af.mil/news/factsheets/LGM_30_Minuteman_III.html)>; Internet; accessed 7 December 2000.

<sup>31</sup> USAF Fact Sheet, "LG-118 A Peacekeeper," available from <[http://www.af.mil/news/factsheets/LG\\_118A\\_Peacekeeper.html](http://www.af.mil/news/factsheets/LG_118A_Peacekeeper.html)>; Internet; accessed 7 December 2000.

<sup>32</sup> Joint Staff, Doctrine for Joint Nuclear Operations, Joint Publication 3-12, 15 December 1995, pages III-2 to III-5.

<sup>33</sup> Federation of American Scientists, "Antiballistic Missiles (ABMs): the Safeguard System," available from <http://www.fas.org/nuke/guide/usa/facility/docs/dd/part16.htm>; Internet, accessed 6 January 2001. This is an excellent history of the Army's Safeguard system. The Safeguard system incorporated two missile systems: The Sprint and the Spartan. The Sprint missile exceeded Mach 10, carried a 5Mton nuclear warhead, and had a maximum engagement altitude of 330 miles. The smaller Sprint was for lower intercepts, incorporating a low-kiloton nuclear warhead and a 24 miles maximum engagement altitude.

<sup>34</sup> Ballistic Missile Defense Organization, "National Missile Defense," BMDO Fact Sheet 123-00-06, available from <http://www.acq.osd.mil/bmdo/bmdolink/pdf/jn0025.pdf>; Internet, accessed 13 March 2001. Additional information from Ballistic Missile Defense Organization, "National Missile Defense System Architecture," BMDO Fact Sheet 106-00-11, available from <http://www.acq.osd.mil/bmdo/bmdolink/pdf/jn9906.pdf>; Internet, accessed 15 March 2000.

<sup>35</sup> Ballistic Missile Defense Organization, "NMD System Elements, BMDO Link Image. Available from <http://www.acq.osd.mil/bmdo/bmdolink/images/syselem.jpg>; Internet, accessed 13 March 2001.

<sup>36</sup> Steven Mufson, "A 'Rogue' is a 'Rogue' is a 'State of Concern'", Washington Post, 20 June 2000, pg A16. Available from <http://www.washingtonpost.com/wp-srv/WPlate/2000-06/20/145I-062000-idx.html>; Internet, accessed 15 March 2000. The article reports that Secretary of State Madeline Albright, in a National Public Radio on 19 June 2000, Dr. Albright declared that the term "rogue nation" was dropped from official State and White House terminology, and replaced with the term "nations of concern." However, internally within the United States, the concept of a rogue threat is more readily understandable. Most consider the rogue threat to include the nations of North Korea, Iraq, Iran, and possibly Libya and Syria. Russia and China are officially (and publicly) not included in this list of nations, and the NMD system currently in development is not designed to defend the U.S. against the sophisticated and multiple ICBM threat from these two nations.

<sup>37</sup> William S. Cohen, Office of the Secretary of Defense, "Secretary Cohen Testimony Before the Senate Armed Services Committee on National Missile Defense," 25 July 2000. Available from <http://www.usinfo.state.gov/topical/pol/arms/stories/00072501.htm>; Internet, accessed 15 March 2001. In Section VI, titled "Discussions with China," Secretary Cohen made the point that he told the Chinese that the NMD system under consideration is not designed against China.

<sup>38</sup> Department of Defense, Operation of the Defense Acquisition System, Department of Defense Instruction 5000.2 with Change 1 dated 4 January 2001. In previous DoD Directives, nuclear survivability was specifically identified. The current version does not mention the term "nuclear survivability", although the more general and inclusive concept of survivability remains a requirement for DoD acquisition systems. Older documents and standards presumably do remain in effect, to include ABCA's Quadripartite Standardization Agreement (QSTAG) 244, Edition 4, Nuclear Hardening Criteria for Military Equipment; MIL-STD-2169B, High-Altitude Electromagnetic Pulse (HEMP) Environment; NATO's Allied Engineering Publication (AEP) 4, Edition 3, Change 1, Nuclear Hardening Criteria for Armed Forces Material and Installations; NATO's Allied Engineering Publication (AEP) 7 Edition 3, Nuclear, Biological and Chemical (NBC) Defense Factors in the Design, Testing and Acceptance of Military Equipment; and the Department of the Army NBC Contamination Survivability Criteria for Army Materiel.

<sup>39</sup> Joint Staff, Joint Doctrine for Operations in Nuclear, Biological, and Chemical (NBC) Environments, Joint Publication 3-11 dated 11 July 2000, pp III-6 to III-7. The current doctrine defines the terms slightly differently: contamination avoidance (synonymous to consequence avoidance), decontamination (a function of consequence management), and NBC protection (a function of consequence survivability and operability).

<sup>40</sup> Gerry J. Gilmore, "Congress Funds Five More WMD Civil Support Teams", American Forces Press Service, Washington, D.C., 8 December 2000. Available from <[http://www.defenselink.mil/news/Dec2000/n12082000\\_200012083.html](http://www.defenselink.mil/news/Dec2000/n12082000_200012083.html)>; Internet, accessed 15 March 2001. This news release stated that DoD would stand up five more reserve component WMD civil support teams using funding from the Fiscal 2001 National Defense Authorization Act, bringing the total number of teams to 32.

<sup>41</sup> Joint Forces Command, Joint Task Force – Civil Support Implementation Plan, 24 September 1999. This document describes how the major focus of JTF-CS is consequence management in support of the Federal Emergency Management Agency (FEMA) as the Lead Federal Agency (LFA).

<sup>42</sup> John Stanton, "U.S. Homeland Defense Policy Mired in Competing Interests," National Defense, February 2001, pg 10. Available from <<http://nationaldefense.ndia.org/article.cfm?Id=420>>; Internet; accessed 23 February 2001.

<sup>43</sup> William S. Cohen, Office of the Secretary of Defense, "Annual Report to the President and Congress", Chapter 8. Available from <<http://www.dtic.mil/execsec/adr98/chap8.html>>; Internet, accessed 9 March 2001.

<sup>44</sup> Martin S. Indyk, Assistant Secretary for Near Eastern Affairs, "United States Policy Toward the Middle East," DISAM Journal, Summer 1999, Volume 1, no 4, pp 21-31.

<sup>45</sup> Uzi Mahnaimi and Tom Walker, "Defectors say Iraq tested nuclear bomb", London Sunday Times, 25 February 2001. Available from <<http://www.sunday-times.co.uk/news/pages/sti/2001/02/25/stifgnmid03001.html>>; Internet, accessed 27 February 2001. Two Iraqi scientist defectors claimed that Iraq tested a nuclear device beneath Lake Rezzaza southwest of Baghdad in September 1989. According to the defectors, due to limited western detection capability and the configuration of the device in the test chamber, the blast was undetected. Furthermore, Gwynne Roberts, in a companion article in the same issue of the Sunday Times, titled "Was this Saddam's Bomb?", graphic evidence was presented to support the story. Available from <<http://www.sunday-times.co.uk/news/pages/sti/2001/02/25/stirevnws01015.html>>; Internet, accessed 27 February 2001. These articles claim that Iraq now has two operational nuclear weapons. The author has not been able to separately substantiate this rather incredible report.

<sup>46</sup> James Wirtz, Allies and Theater Missile Defense: The Benefits of an ASW Approach to Counterforce, May 1994, Naval Postgraduate School, NPS-OR-94-007, pp 5-6.

<sup>47</sup> Wirtz, pg 8.

<sup>48</sup> The recently created Army Air and Missile Defense Command headquarters is built around four operational elements, or pillars: attack operations, active defense, passive defense, and C4I. It includes a robust intelligence section working closely with the three pillars of attack ops, active defense, and passive defense. With sophisticated state-of-the art intelligence reach-back and analysis capability, the intelligence personnel receive special training in searching for Scuds and their support infrastructure. The U.S. currently has two of these commands focused on defeating a theater air and missile defense threat, the 32d AAMDC (a mixed active and Florida National Guard unit) and the newly activated 263<sup>rd</sup> AAMDC, South Carolina Army National Guard. Further information may be found in Joint Pub 3-01.5. The author was assigned to the 32d AAMDC during its activation and subsequent participation in Operation Desert Fox.

<sup>49</sup> George Tenet, "Worldwide Threat 2001: National Security in a Changing World."



## BIBLIOGRAPHY

- Bush, George. "Address to the Nation on Reducing United States and Soviet Union Nuclear Weapons," 27 September 1991. Available from the Bush Presidential Library, at <http://bushlibrary.tamu.edu/papers/1991/91092704.html>. Internet. Accessed 9 March 2001.
- Bulletin of Atomic Scientists, "History of the Doomsday Clock." Available from <http://www.bullatomsci.org/clock.html>. Internet. Accessed 9 March 2001.
- Bulletin of Atomic Scientists. "Part 3: Midnight Never Came." Available from <http://www.bullatomsci.org/clock/nd95moore3.html#anchor111327>. Internet. Accessed 9 March 2001.
- Clark, Mark T. "The Clinton Legacy on Ballistic Missile Defense," Comparative Strategy, Volume 19 (2000).
- Cohen, William S. Annual Report to the President and Congress, 1998. Office of the Secretary of Defense, 1998. Available from <http://www.dtic.mil/execsec/adr98/chap8.html>. Internet. Accessed 9 March 2001.
- Cohen, William S. Proliferation: Threat and Response. Office of the Secretary of Defense, 10 January 2001. Available from <http://www.defenselink.mil/pubs/ptr20010110.pdf>. Internet. Accessed 11 January 2001.
- Cohen, William S. Secretary Cohen Testimony Before the Senate Armed Services Committee on National Missile Defense. 25 July 2000. Available from <http://www.usinfo.state.gov/topical/pol/arms/stories/00072501.htm>. Internet. Accessed 15 March 2001.
- Federation of American Scientists, "Antiballistic Missiles (ABMs): the Safeguard System." Available from <http://www.fas.org/nuke/guide/usa/facility/docs/dd/part16.htm>. Internet. Accessed 6 January 2001.
- Ferguson, Charles, "Sparking a Buildup: U.S. Missile Defense and China's Nuclear Arsenal," Arms Control Today, March 2000, pp 13-18. Available from <http://www.armscontrol.org/ACT/march00/cfmr00htm>. Internet. Accessed 16 March 2001.
- Gilmore, Gerry J. Congress Funds Five More WMD Civil Support Teams. American Forces Press Service, Washington, D.C., 8 December 2000. Available from [http://www.defenselink.mil/news/Dec2000/n12082000\\_200012083.html](http://www.defenselink.mil/news/Dec2000/n12082000_200012083.html). Internet. Accessed 15 March 2001.
- Gouré, Daniel, Defense of the U.S. Homeland Against Strategic Attack, Center for Strategic and International Studies (CSIS), Washington, DC, December 2000, pg 2. Available from <http://www.csis.org/homeland/reports/defenseofushmld.pdf>. Internet. Accessed 3 February 2001.
- Hamza, Khidhir, with Jeff Stein, Saddam's Bombmaker: The Terrifying Inside Story of the Iraqi Nuclear and Biological Weapons Agenda. Scribner Books, December 2000.

- Indyk, Martin S., Assistant Secretary for Near Eastern Affairs, "United States Policy Toward the Middle East," DISAM Journal, Summer 1999, Volume 1, no 4.
- Karp, Aaron, "The Spread of Ballistic Missiles and the Transformation of Global Security", The Nonproliferation Review, Fall-Winter 2000, pp 105-122.
- Lavoy, Peter R., Scott D. Sagan, and James J. Wirtz, eds. Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, & Chemical Weapons. Cornell, NY: Cornell University Press, 2000.
- Mahnaimia, Uzi, and Tom Walker, "Defectors say Iraq tested nuclear bomb." London Sunday Times 25 February 2001. Available from <<http://www.sunday-times.co.uk/news/pages/sti/2001/02/25/stifgnmid03001.html>>. Internet. Accessed 27 February 2001.
- Manning, Ronald A., Ronald Montaperto, and Brad Roberts, Cochairs. China, Nuclear Weapons, and Arms Control: A Preliminary Assessment. Chairmen's Report of a roundtable jointly sponsored by the Council on Foreign Relations, the National Defense University, and the Institute for Defense Analysis. Council on Foreign Relations, Inc., 2000.
- Mustafson, Steven. "A 'Rogue' is a 'Rogue' is a 'State of Concern'." Washington Post. 20 June 2000 pg A16. Available from <<http://www.washingtonpost.com/wp-srv/Wplate/2000-06/20/145I-062000-idx.html>>. Internet. Accessed 15 March 2000.
- Perez, Shimon, statement 13 July 1998 as quoted in Israel Wire 14 July 1998. Available from <<http://www.fas.org/news/israel/980714-israel1.htm>>. Internet. Accessed 9 March 2001.
- Roberts, Gwynne, "Was this Saddam's Bomb?" London Sunday Times 25 February 2001. Available from <<http://www.sunday-times.co.uk/news/pages/sti/2001/02/25/stirevnws01015.html>>. Internet. Accessed 27 February 2001.
- Saunders, Phillip C. and Jing-dong Yuan, Monterey Institute of International Studies, "China's Strategic Force Modernization: Issues and Implications for the United States," in CNS Occasional Paper #4, Proliferation Challenges and Nonproliferation Opportunities for New Administrations, Michael Barletta, ed. September 2000. Available from <[http://cns.miis.edu/cns/projects/earnp/conf/op4\\_sjd.pdf](http://cns.miis.edu/cns/projects/earnp/conf/op4_sjd.pdf)>. Internet. Accessed 15 March 2001.
- Stanton, John, "U.S. Homeland Defense Policy Mired in Competing Interests," National Defense. February 2001, pg 10. Available from <<http://nationaldefense.ndia.org/article.cfm?id=420>>. Internet. Accessed 23 February 2001.
- Tenet, George, National Intelligence Council, Global Trends 2015: A Dialogue About the Future With Nongovernment Experts. Available from <<http://www.cia.gov/cia/publications/globaltrends2015/index.html>>. Internet. Accessed 23 January 2001.

- Tenet, George, Director of Central Intelligence, "Statement by Director of Central Intelligence George Tenet Before the Senate Committee on Armed Services 3 February 2000 on The World Wide Threat in 2000: Global Realities of our National Security". Available from <[http://www.senate.gov/~armed\\_services/statemnt/2000/000203qt.pdf](http://www.senate.gov/~armed_services/statemnt/2000/000203qt.pdf)>. Internet. Accessed 9 March 2001.
- Tenet, George, Director of Central Intelligence, "Statement by Director of Central Intelligence George C. Tenet before the Senate Select Committee on Intelligence on the "Worldwide Threat 2001: National Security in a Changing World." Available from <[http://www.cia.gov/cia/public\\_affairs/speeches/UNCLASWWT\\_02072001.html](http://www.cia.gov/cia/public_affairs/speeches/UNCLASWWT_02072001.html)>. Internet. Accessed 9 March 2001.
- U.S. Army. Countermobility, Army Field Manual 5-102 Washington, D.C.: U.S. Army, 14 March 1985. Available from <http://hosta.atsc.eustis.army.mil/cgi-bin/atdl.dll/fm/5-102/Ch6.htm#s6>. Internet. Accessed 17 March 2001.
- U.S. Joint Forces Command. Joint Task Force – Civil Support Implementation Plan. Norfolk, Virginia. 24 September 1999.
- U.S. Joint Staff. Joint Doctrine for Countering Air and Missile Threats, Joint Publication 3-01. Washington, D.C.: U.S. Joint Staff, 19 October 1999.
- U.S. Joint Staff. Aerospace Defense of North America, Joint Publication 3-01.1. Washington, D.C.: U.S. Joint Staff, 4 November 1996.
- U.S. Joint Staff. Doctrine for Joint Theater Missile Defense, Joint Publication 3-01.5. Washington, D.C.: U.S. Joint Staff, 22 February 1996.
- U.S. Joint Staff. Joint Doctrine for Operations in Nuclear, Biological, and Chemical (NBC) Environments, Joint Publication 3-11. Washington, D.C.: U.S. Joint Staff, 11 July 2000.
- U.S. Joint Staff. Doctrine for Joint Nuclear Operations, Joint Publication 3-12. Washington, D.C.: U.S. Joint Staff, 15 December 1995.
- Walpole, Robert D., National Intelligence Officer for Strategic and Nuclear Programs, testimony before the Senate Foreign Relations Committee, September 16, 1999. Available from <[http://www.cia.gov/cia/public\\_affairs/speeches/archives/1999/walpole.html](http://www.cia.gov/cia/public_affairs/speeches/archives/1999/walpole.html)>. Internet. Accessed 9 March 2001.
- Walpole, Robert D., National Intelligence Council, "The Evolving missile Threat in the Current Proliferation Environment," Foreign Missile Developments and the Ballistic Missile Threat through 2015, September 1999; available from <<http://www.cia.gov/cia/publications/nie/nie99msl.html>>. Internet. Accessed 9 December 2000.
- Webster, William, Project Chair. Wild Atom: Nuclear Terrorism; Global Organized Crime Project. Center for Strategic and International Studies (CSIS) Task Force Report, 1998.
- Wirtz, James. Allies and Theater Missile Defense: The Benefits of an ASW Approach to Counterforce. May 1994. Naval Postgraduate School, Monterey, California. NPS-OR-94-007.

Zimmerman, Tim. "Russia's Ace in the hole: Resurrecting a nuclear Maginot line," U.S. News, 2 June 1997. Available from <<http://www.usnews.com/usnews/issue/970602/2nuke.htm>>. Internet. Accessed 6 March.