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SHIELDING THE SWORD:
A STRATEGY FOR PROTECTING THE AEF

BY
THOMAS W. BERGESON

A THESIS PRESENTED TO THE FACULTY OF THE SCHOOL OF
ADVANCED AIRPOWER STUDIES FOR COMPLETION OF GRADUATION
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AIR UNIVERSITY
MAXWELL AIR FORCE BASE, ALABAMA

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The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

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Abstract

The dramatic changes in the strategic environment since the end of the Cold War have led to significant changes in US military strategy. US military strategy is now dependent on the ability to project power rapidly anywhere in the world. The strategic environment has also seen the proliferation of new, asymmetric threats such as ballistic missiles, cruise missiles, and UAVs. When armed with nuclear, chemical, or biological warheads, these weapons pose a serious threat to US power projection capabilities, especially if they are used to deny access to a theater of operations.

The Air Force is restructuring its forces to provide the geographic CINCs with airpower that is lighter, leaner, and more lethal. The new Expeditionary Air Force will consist of ten Air Expeditionary Forces; packages of aerospace power that can be tailored to meet the CINCs' requirements and available within 48 hours. The Air Force is currently taking a "blue only" approach to this endeavor, at its peril.

The USAF currently has no organic self-defense capability against ballistic missiles, and limited capability against cruise missiles. Instead it relies on the CINCs to assign US Army Air Defense Artillery for its air base air defense. Designed in the 1970's for defense of ground forces in Europe, US Army Patriot is not a logistically light asset and has a limited capability to intercept ballistic or cruise missiles. Several initiatives are underway to create a "family of systems" capable of robust defense-in-depth, but most are years away from becoming operational.

The Air Force now faces the problem of how to rapidly deploy to an austere environment, with the threat of asymmetric attacks. The solution requires both a technological approach to field defensive systems that are more expeditionary, and

organizational solutions to ensure defenses are ready for rapid deployment, logistically light, and interoperable.

The solution requires close coordination and cooperation between the Air Force and the Army. Army ADA batteries should be assigned as organic units to the AEFs. This would solve logistical problems that can occur during crisis deployment, and allow for peacetime training opportunities. The Army and Air Force should formally cooperate on the development of lighter ADA systems designed specifically for air base air defense against ballistic missile, cruise missiles, and UAVs. A DoD directive will be required in order for these solutions to have staying power.

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Chapter 1

Introduction

Projecting power on short notice into the backyard of a major regional power is an inherently demanding enterprise. This is particularly true when that enemy is willing to accept vastly more casualties than the United States. In this situation, there is a high premium on forces that can deploy rapidly, seize the initiative, and achieve our objectives with minimal risk of heavy casualties.

—National Defense Panel, 1997

The inability of the US military to successfully defend against Iraqi Scud missiles during Operation Desert Storm highlighted new shortfalls in US counterair capability. Not since World War II had the friendly rear area been successfully attacked from the air. The years since the Gulf War have seen a large reduction in US military power, especially at permanent overseas locations. This has created the need for the US military to develop a more rapid and robust power projection capability from the CONUS, including to austere locations. Adding to the challenge is the wide proliferation of ballistic missiles, and soon cruise missiles, among America's potential enemies. When armed with nuclear, chemical, or biological warheads, these weapons pose a serious threat to US military deployments, especially if they are used to deny access to a theater of operations.

The Air Force's contribution to power projection has been to restructure its forces in order to provide the geographic commanders-in-chief (CINCs) with airpower that is lighter, leaner, and more lethal. The new Expeditionary Air Force (EAF) consists of 10 Air Expeditionary Forces (AEFs); these are packages of aerospace power that can be tailored to meet the CINC's needs and available within 48 hours. Noticeably absent from the USAF inventory however, is any capability to defend itself against ballistic missiles,

and a limited capability to defend against cruise missiles. Instead the USAF relies on the CINC to assign US Army Air Defense Artillery (ADA) to defend its air bases.

Ensuring the survival of America's airpower will be key in future conflicts. Large amounts of time, effort, and money have been invested in the research and development of defensive systems and in improving our capability to detect and attack mobile missile launchers. This study seeks to answer whether these efforts have gone far enough, and if not, to identify what else should be done. The central question it addresses is whether or not Air Force assets at deployed air bases can be properly protected from air and missile attack under the current arrangements.

Evidence and Methodology

Chapter 2 provides an overview of the Expeditionary Air Force. It traces the EAF's origins, explains how the AEFs will be organized, and describes how the Air Force envisions their employment under the strategy of Global Engagement Operations. It concludes with an identification of some of the problems inherent in the rapid deployment of airpower.

Chapter 3 examines the asymmetric weapons and strategies possessed by potential enemies. It begins with a discussion of the technical characteristics of ballistic and cruise missiles, as well as other aerodynamic weapons such as UAVs and large caliber rockets. Then each major region of the world is examined to highlight areas of US concern, assess the proliferation of weapons of mass destruction, and underscore the problems these types of weapons will pose for US forces in future conflicts. The chapter concludes with a discussion of the type of strategy that an enemy might use when confronted with overwhelming US conventional power.

Chapter 4 is an examination of how the United States military plans to defeat these types of threats. It examines both US counterair doctrine and the systems designed for this mission. The USAF currently contributes to missile defense primarily with attack operations. Two historical case studies are examined to show the difficulty inherent in attack operations against mobile targets, such as missile launchers, to underscore the need for airborne and surface based interceptors. Finally, the capabilities and limitations of

current and future defensive systems are examined, highlighting the need for a full complement of weapon systems for successful defense-in-depth.

Chapter 5 identifies two major limitations to deploying rapidly US Army Air Defense Artillery (ADA) to a theater of operations. The first is the procedural process used by the CINCs to assign ADA for air base air defense. The other is Patriot's extensive airlift requirement. These two limitations arise from the fact that the CINC, rather than a service, is responsible for air base air defense.

An examination of the history of Army-Air Force cooperation in air base air defense is offered in Chapter 6 to answer four questions: Why does the Army own ADA? Why has the USAF largely discounted the importance of point defense weapons? What is the current status of Army-Air Force cooperation on air defense? Are USAF air base air defense requirements likely to be filled in the foreseeable future? The answer to these questions reveals the root cause of air defense problems: a lack of inter-service cooperation.

Chapter 7 offers two solutions to ensuring that CINCs can rapidly deploy airpower to a theater of operations without leaving it vulnerable to enemy missile attack. Using the analogy of a Navy carrier battle group and a Marine Air Ground Task Force, this chapter offers a method of making Army ADA "organic" to the AEF through close Army and Air Force cooperation. It explains the benefits for each service, and more importantly for the CINCs, if this approach is used. Next, this chapter identifies the need to develop future ADA systems that are designed specifically for air base air defense, systems that are more "expeditionary" and interoperable with Air Force assets. The study concludes with examination of the bureaucratic hurdles that must be overcome to implement this plan. It identifies the Air Force and Army parochial concerns that may inhibit joint cooperation and the implications if they are unresolved.

Chapter 2

The Expeditionary Air Force

Driven by the realities of the post Cold War security environment and the corresponding reduction of US military forces, the USAF is undertaking a major reorganization of its assets and adopting a new operational strategy. This chapter begins with an overview of the Expeditionary Air Force: the factors behind its origin, how its forces are structured and employed under Global Engagement Operations, and how the Air Force views its role in power projection for the 21st century. Then the strengths, weaknesses and limitations of this strategy are identified to determine what non-USAF assets, such as US Army ADA, must be integrated with the Aerospace Expeditionary Forces in order for them to accomplish the commander's objectives.

Origin of the Expeditionary Air Force (EAF)

The fall of the Berlin Wall and the breakup up the Soviet empire marked an end to the US strategy of containment and the beginning of the strategy of engagement and enlargement.¹ With this shift in US national strategy came a commensurate change in US military commitments and force structure.

The monopolar (arguably multipolar) world brings with it new security challenges. Rogue nations, failing states, and international terrorist organizations are likely to continue to threaten US interests worldwide, forcing the United States to maintain a great deal of strategic flexibility. During the Cold War, the US military based massive amounts of men and equipment overseas because it could not project power from the CONUS fast enough to thwart Soviet aggression. However, a forward deployed, stationary defensive posture is not sufficiently flexible to respond to the diversity of the

¹ *National Military Strategy of the United States of America; A Strategy of Flexible and Selective Engagement*, Office of the Secretary of Defense, 1995, i.

current threat -- leading to the need for a new strategy, a strategy of "flexible and selective engagement."²

The strategy of selective engagement comprises three sets of tasks: remaining constructively engaged in peacetime; acting to deter aggression and prevent conflict; and fighting and winning the nation's wars; all of this at a time when our force structure is significantly reduced from its Cold War size.³ Should US vital interests be challenged, the 1995 *National Military Strategy* highlights the need to be able to respond quickly through a wide spectrum of deterrent options and preventive measures.

The key to this strategy lies in the ability to rapidly project power to a variety of locations, including those that may have austere conditions.⁴ According to the 1997 National Defense Panel;

[in order to] meet future requirements to project military power and conduct combat operations, the United States must transform the present force, taking advantage of new technology, operational concepts, and force structures....We must be able to project military power much more rapidly into areas where we may not have stationed forces. The ability to project lethal forces--in the air, on the sea, or on the land -- will be essential...In short, we must radically alter the way in which we project power.

The Air Force's answer to the new security problems was threefold. First, it would "reorganize its forces into a more efficient structure to meet the demands of national policy in the international security environment."⁵ Second, it would employ "aerospace power using an operational concept that fulfills mission requirements in peacetime and in conflict," and third it would "transform the Air Force culture to inculcate an expeditionary mindset."⁶ By reinventing itself as an Expeditionary Aerospace Force (EAF) the USAF hopes to be light, lean and lethal, a deployable instrument of national power that the National Command Authority (NCA), and geographic Commanders-in-Chief (CINCs) can employ in peacetime to shape the

² Ibid., iii.

³ Ibid., 6.

⁴ For a good overview of the draw down of US forces and bases worldwide, see Mark Alan Gunziger, *Power Projection* (Maxwell AFB, AL: Air University Press, June 1993).

⁵ *Expeditionary Aerospace Force; Instrument of Global Engagement* (Draft Copy, Version 2, 18 December 1998), 1. This is a draft of the most current "white paper" produced by AF/XO, the lead agency for AEF development.

⁶ Ibid., 1.

security environment or wield in wartime to combat aggression in defense of national interests.⁷

Aerospace Expeditionary Force (AEF) Organization

The Expeditionary Aerospace Force consists of ten AEFs. Each AEF contains a mixture of squadrons with complementary capabilities, drawn from active duty, Guard, and Reserve forces. Units in the AEF will train and exercise together to form a cohesive team before being deployed to support a contingency. The elements of the AEF that deploy are organized into an Aerospace Expeditionary Task Force (ASETF) consisting of Aerospace Expeditionary Squadrons, Groups, or Wings (AES, AEG, AEW). Two of the AEFs will be continually postured for rapid mobility. According to the USAF Chief of Staff, Gen Michael E. Ryan, the goal of the "on-call" AEFs is forty-eight hours from "AEF notification to bombs on target."⁸ Additionally, two AEWs located at Seymour Johnson AFB and Mountain Home AFB will be on call for Small Scale Contingency (SSC) tasking.

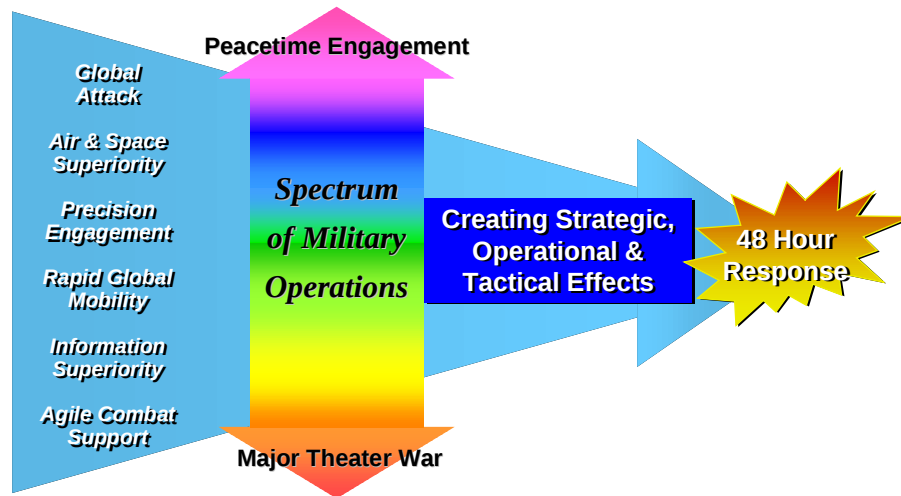
The AEFs are a fundamental change in how the Air Force presents its forces to the CINCs. In the past the Air Force has presented its forces to the CINCs by squadron, with each squadron containing the same type of aircraft. Squadrons then had to be mixed with other units, by the CINC, on an ad hoc basis to get the desired capabilities. The EAF converts the Air Force from threat-based planning and force structure to mission-based planning and force structure (Figure 1). Under the AEF concept, the CINCs will request a capability from a full menu of aerospace options. The Air Force will then "tailor" its forces from the on-call AEFs to form an Aerospace Expeditionary Task Force (ASETF). The AEFs can therefore be seen as the "buckets" from which the CINCs can draw the full range of aerospace power's effects, from humanitarian support to decisive combat operations.

⁷ Ibid., 3.

⁸ "Air Force Launches into Expeditionary Mission", Air Force News. On-line. Internet, 8 Nov 1998. Available from http://www.af.mil/news/Oct 1998/n19981022_981610.html.

Figure 1
EAF: Expeditionary Vision

*Rapidly Executable Course of Action, Tailored to meet
a Joint Force Commander's Needs*



Source: Colonel Robert Allardice, Chief, EAF Implementation Division.

The "tailoring" of the AEF is somewhat analogous to how the Marine Corps tailors its Marine Expeditionary Force (MEF) to deploy a Marine Air Ground Task Force (MAGTF). The benefit to the CINC is that he no longer has to decide what platforms he wants, but instead what effects he wants achieved, and he can have those effects quickly. The benefit to the USAF is that it can more predictably schedule its forces and better provide the CINCs with what they need.

The composition of the deploying ASETFs is driven solely by the CINCs needs (there is no "standard" ASETF). Therefore AEF "on call" units must be logistically light and flexible in their mobility operations. AEF forces include more than just aircraft. They also contain USAF Security Forces for Air Base Ground Defense (ABGD) as well as all of the support personnel and equipment required to conduct sustained combat operations at an *austere* location for seven days, until follow-on forces or additional supplies arrive.

In a separate "bucket" outside of the AEF structure are the critical high value assets required for most any aerospace operation to be successful. The USAF calls these assets with unique mission capabilities "enablers."⁹ Enablers include F-117s, E-3 Airborne Warning and Control System (AWACS) aircraft, E-8 Joint Surveillance Targeting and Attack Radar System (JSTARS) aircraft, combat search and rescue forces, RC-135 Rivet Joint and U-2 reconnaissance aircraft, Ground Theater Air control System, and unmanned aerial vehicles (UAVs). Because of the limited number of these important assets, their management is especially critical. These enablers are not dedicated to specific AEFs because of their Low Density/High Demand (LDHD) nature. Instead, senior leadership carefully monitors their scheduling, as they are essentially "on call" for real world contingencies all of the time.

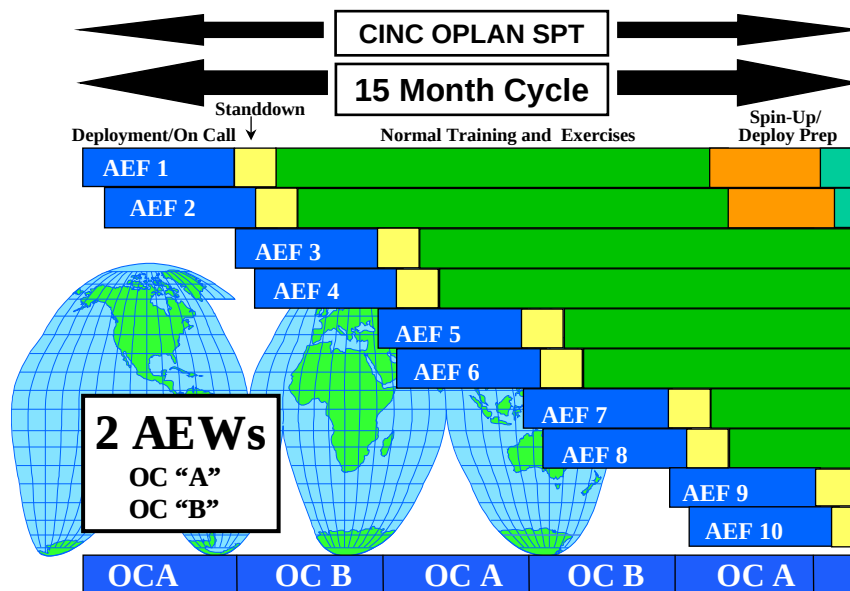
Rotational Cycle

The AEFs will follow a 15 month rotational cycle in a method very similar to that of a US Navy carrier battle group (Figure 2). Two of the AEFs will be either deployed for contingency tasking, or on-call ready to respond rapidly to real world crises. Units not on-call will conduct unit training for ten months followed by a vigorous two-month work-up program, integrating all of that particular AEF's units prior to assuming the on-call status.¹⁰

⁹ Colonel Robert Allardice, Chief, EAF Implementation Division. Personal interview conducted at the Pentagon on 22 Apr 99.

¹⁰ *Expeditionary Aerospace Force; Instrument of Global Engagement*, 12.

Figure 2
AEF Rotational Cycle



Source: Colonel Robert Allardice, Chief, EAF Implementation Division.

AEF Command and Control

Individual units in the AEFs are geographically separated but use information technologies in order to remain operationally connected. Ten wings are designated AEF "Lead Wings." The Lead Wings are responsible for acting as the AEF headquarters and for supplying team tasks when units of the AEF deploy. Team tasks include security forces, fire fighters, communications, and medical teams. Other wings are designated as AEF Support Wings, responsible for such things as transportation, supply, administration, and services.¹¹

The command structure of the AEF accommodates different levels of responsibility from training to deployment. The AEF Lead Wing Commander possesses Direct Liaison and Coordinating Authority with the units allocated to the AEF until changed by a deployment order. This allows the Lead Wing Commander to schedule

¹¹ Ibid., 13

composite training exercises, while the units remain under the command of their home wings.¹²

With a deployment order, the designated units are assigned to an AES, an AEW and /or an AEG and placed under their command. Once in theater, the deploying unit is attached to an ASETF, or a Numbered Air Force (NAF). The NAF has the regional expertise and will designate a commander of air force forces (COMMAFFOR) who will serve as the ASETF commander.¹³

Global Engagement Operations

The Global Engagement Operations strategy is the Air Forces vision of how the EAF can best meet the CINCs' needs. Air Force leadership claims it is designed to exploit the flexibility and lethality of aerospace forces in conjunction with land and sea power. Global Engagement Operations will purportedly employ AEF assets to;

- **Shape** the security environment with peacetime deployment and operations.
- **Respond** rapidly to crises to **deter** enemy aggression.
- **Halt** enemy aggression to **deny** enemy success, then **control** the enemy as necessary to exercise options to **win** any conflict.
- **Reshape** the environment to achieve a better state of peace.¹⁴

According to Major General Donald G. Cook, the director of EAF implementation, the CINCs can use expeditionary airpower to "enhance the deterrent posture of the friendly forces, and prepare to conduct high tempo operations if necessary."¹⁵ The establishment of a strategic air bridge would show the imminence of increased airpower.

[m]ore robust responses require us to concurrently strengthen the strategic air bridge, to ensure the smooth flow of combat and logistic forces to the crisis region as we prepare for decisive action. The [NCA] and the [CINC] could deploy AEF forces to the crisis region. These expeditionary military capabilities are enabled by the ability to rapidly mobilize tailored logistics and/or combat forces. The combat aircraft of the AEF represent the tangible forces that signal US intentions. The strategic air-bridge permits

¹² Ibid., 15.

¹³ Ibid.

¹⁴ Ibid., 5.

¹⁵ Ibid., 2.

the AEF to arrive within days, and sometimes hours, ready to execute combat operations.¹⁶

Early intervention would normally begin by using command and control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) assets for intelligence preparation of the battlespace (IPB).

Should deterrence fail, airpower would be in a position to try to seize the initiative through operations that the Air Force refers to as the "halt phase." The Air Force envisions that the CINCs will use rapidly deploying aerospace power as an important tool to help gain control of crisis situations, whether it be in the case of domestic disasters, humanitarian relief, non-combatant evacuation operations, peace enforcement, or even major theater war. The 1997 Quadrennial Defense Review recognized that halting enemy advances short of their objectives could make subsequent campaign objectives less costly and could also give commanders options for follow-on operations, such as swinging assets to another theater if required.¹⁷ If national leadership decided to continue military operations after the initiative was seized, aerospace power could be used to gain air and space superiority and protect friendly forces during deployment and assembly.

Responsive and overwhelming aerospace power could provide military leverage to diplomatic negotiations at the cessation of hostilities. Aerospace power might give leadership the ability to enforce end-state conditions by holding things of strategic value at risk. AEF forces could also quickly return to the theater should the need arise.¹⁸

Strengths and Weaknesses of the GEO Strategy

Because of airpower's unique ability to deliver effects quickly anywhere in the world, it is likely to be an expeditionary force of choice by the CINCs in future operations. The GEO strategy recognizes the advantages that aerospace power can provide -- speed, range, flexibility, and lethality. Although the USAF has been projecting power for its entire existence, recent technological innovations in the areas of communication, intelligence, stealth, and advanced precision munitions, allow the Air Force to deliver more firepower, more quickly, than ever before.

¹⁶ Ibid., 2.

¹⁷ *Report of the Quadrennial Defense Review* (May 1997), 12.

The USAF's tremendous conventional capability may also be its biggest weakness. Because most enemy nations have little ability to stand "toe-to-toe" with the United States in a conventional battle they may be forced to turn to asymmetric means, such as Iraq did during the Gulf War with its *Scud* missile attacks. During Operation Allied Force, NATO aircraft were packed into just a few bases with over 100 at Aviano Air Base alone. Fortunately, Yugoslavia had little capability to attack them.

Air Base Vulnerabilities

The major limitation of aircraft is their dependence on bases. To account for this vulnerability, USAF and CINC planners attempt to base friendly aircraft outside of the combat radius of the enemy's attack aircraft and exploit the US military's distinct air refueling advantage over all potential enemies. Depending on the theater of operations this may or may not be possible, or practical. Bombers can normally be stationed well away from the fight but aircraft that must generate high sortie rates, such as fighters, AWACS, JSTARS, tankers, etc., must be located in the theater. Even if friendly aircraft are based outside of threat aircraft range, they may be well inside of enemy ballistic and cruise missile range. Given the vast proliferation of missile threats, and our limited capability to defend against them, it is clear what strategy future enemies might employ.¹⁹

Lack of Missile Defenses

An examination of the USAF's inventory reveals a lack of any capability to defend against ballistic missile attack, and a limited capability to defend against cruise missiles. In fact, the USAF is the only US combat service that does not contain organic Air Defense Artillery (ADA) for its defense. Instead, the USAF is dependent on Army ADA batteries, using the Patriot missile system to protect its airfields from ballistic missile attack. The proliferation of ballistic and cruise missiles, which can penetrate friendly air defenses, increases the importance of ADA for air base air defense. US

¹⁸ Major General Donald G. Cook, "Global Engagement with Air Force Aerospace Power," 3.

¹⁹ If the enemy were a rational actor, then game theory would lead us to believe that an asymmetric strategy to deny US access to a theater would be his dominant strategy. For an excellent book on game theory, see *Thinking Strategically*, by Avinash K. Dixit and Barry J. Nalebuff, 1991.

Army ADA is a key "enabler" for the Air Force and yet it is not currently included in an AEF.

Summary

Driven by changes in the strategic environment, the US National Security Strategy shifted from containment to engagement. The National Military Strategy reflected that change, leading to a major force reduction, withdrawal from overseas bases, and an increased reliance on the ability to rapidly project power worldwide. The USAF's answer to this strategy was to reinvent itself as an Expeditionary Aerospace Force, reorganizing into ten light, lean, and lethal AEFs which use an operational strategy called Global Engagement Operations.

The GEO concept relies on airpower's strengths: speed, range, flexibility, and lethality. The USAF leadership believes that the CINCs will see aerospace power as the force of choice for rapidly deploying and engaging in the full spectrum of military contingencies. The USAF will provide the CINC with a carefully tailored package of aerospace capabilities that can quickly deliver the CINC's desired effects.

Adversaries are likely to use asymmetric strategies to thwart our overwhelming conventional capability by attacking a key Air Force center of gravity, the air base. The USAF has no organic capability to defend itself against ballistic missile attack and only a limited capability against cruise missiles. It instead depends on Army ADA to counter these threats. US Army ADA is a key "enabler" for the GEO strategy to be successful; therefore, the USAF has a vested interest in ensuring that ADA is integrated into the AEF concept.

Chapter 3

The Threat

Indeed, a paradox of the new strategic environment is that American military superiority actually increases the threat of nuclear, biological, and chemical attack against us by creating incentives for adversaries to challenge us asymmetrically. In warfare, these weapons may be used to attack US and coalition vulnerabilities, such as air bases and seaports. They may also be used in an attempt to counter US dominance on the battlefield, neutralize vastly superior US conventional forces and power projection capabilities, or deter US involvement in a conflict.

—William Cohen, Secretary of Defense
Proliferation: Threat and Response

Unless there is the reemergence of a peer competitor to US military power, a future opponent of the US will have two choices: to fight conventionally and be quickly defeated, or to fight unconventionally. Fighting unconventionally is certainly not a new idea. What is new however, is the method by which future enemies may attack. An enemy is not likely to challenge US airpower in great aerial battles; instead he is likely to use asymmetric means to keep US airpower grounded.

The US military currently possesses limited capability to defeat ballistic missiles or cruise missiles, especially those with low radar-cross-sections (RCS). These weapons are not an overwhelming threat when armed with conventional warheads. However, if armed with nuclear, biological, or chemical agents, they become a tremendous threat. This chapter investigates the asymmetric weapons and strategy an enemy may use to attack US forces in future conflicts.

Lessons of the Gulf War

The Gulf War was a resounding success for the US military, with one exception--*Scuds*. Prior to the war, the US did not consider ballistic missiles to be a significant

threat. Their poor accuracy coupled with a small conventional payload led planners to believe that they were tactically insignificant and this largely proved to be true. Their strategic impact however, was unforeseen. When Iraq began to use the *Scud* missiles for "coalition busting" by attacking Israel, US leaders feared that Israeli retaliation would have dramatic consequences and potentially drive a wedge between coalition members.

The US military scrambled to find a solution to defeat *Scud* attacks in order to deter Israel from entering the war. The coalition spent approximately 2000 sorties hunting *Scuds* in a high tech "cat and mouse" game, efforts that met with very little success.²⁰ The initial ADA PATRIOT batteries deployed to the region had no ability to intercept the *Scuds*.²¹ PATRIOT PAC-2 Guidance Enhancement Missiles (GEM) were rushed to the theater, five months ahead of their scheduled initial operational capability (IOC) date, for *Scud* defense.²² Post war analysis of their tactical effectiveness in intercepting *Scuds* and destroying the warheads shows poor results.²³ However, the strategic impact was tremendous. The perception in the mind of the Israeli public was that they were being defended. This pacified them and kept Israel from entering the war.

The Iraqi success with *Scuds* has not been lost on the rest of the world. Weapons with the capability to penetrate air defenses have continued to proliferate at an alarming rate.

Tactical Ballistic Missiles (TBM's)

TBMs include short-range ballistic missiles (SRBMs) with ranges up to 1,000 kilometers and medium range ballistic missiles (MRBMs) with ranges from 1,000 to

²⁰ Earl I. Ficken, *Tactical Ballistic Missile Defense: Have We Learned Our Lesson?* (Maxwell AFB, AL : Air War College, 1995), 10.

²¹ Paul Weeks, "The Story of PATRIOT," *Air Defense Artillery Yearbook*, Jan 1993, 40.

²² "Operation Desert Shield / Storm; Chronology of Events, 2 Aug 90 - 11 Apr 91," Netstorm. Redstone. On-line. Internet, 7 March 1999. Available at <http://www.redstone.army.mil/history/netstorm/appen.html>.

²³ The debate over Patriot's success continues today. Most of the argument stems over the connotation of the term "successful intercept." Is deflecting the missile off its intended path good enough, or must the missile be destroyed in mid-air? Even if a missile is intercepted, the warhead must be rendered impotent, not an easy task considering the end-game closing velocity. The bottom line is that without test range data, it is difficult to determine success or failure. The debate is important however because it drives the requirements for future anti-ballistic missile weapons systems. For a good overview see: Richard S. Barbera, *The Patriot Missile System: a Review and Analysis of Its Acquisition Process*, Naval Post Graduate School, March 1994.

3,000 kilometers.²⁴ These missiles are surface-launched with ballistic trajectories. TBMs are often launched from highly mobile, transporter-erector-launchers (TELs) making them very difficult to detect. Most current TBMs are single stage missiles with a circular error probable (CEP) on the order of one-tenth of one per cent of the launch range.²⁵

The two major trends in current TBM upgrades are increased range and accuracy. Solid fuels and multiple staging increase both payloads and ranges. Modern guidance systems, including GPS, can reduce CEPs below 50 meters.²⁶ TBMs themselves are not cheap, but are often less expensive than building and operating a conventional air force. Because TBMs are by their nature "single use only," it remains likely that these weapons will be used to target centers of gravity, such as air bases and other high payoff targets. Payload and accuracy limitations of ballistic missiles can be overcome by combining them with NBC warheads, sub-munitions, or both.

Large Caliber Rockets

Large Caliber Rockets (LCRs) are similar to SRBMs in size, trajectory, and warheads, but have a shorter range. Rockets are proliferating because they are relatively inexpensive, can produce a high volume of fire, and can be equipped with multiple warheads.²⁷ Rockets are difficult to intercept because of their short time of flight.

Rockets have been used quite often for attacks on air bases. During the Vietnam War, the Viet Cong used rocket attacks against many USAF operated air bases, causing severe damage.²⁸

Aerodynamic Missiles

The term "aerodynamic missiles" includes cruise missiles (ground, sea, or air launched), and tactical air-to-surface missiles (TASMs). Even though these are regarded

²⁴ *FY 99 Air and Missile Defense Master Plan* (Fort Bliss, Texas: US Army Air and Missile Defense Command, 1999), 2-3.

²⁵ *Ibid.*

²⁶ *Ibid.*

²⁷ *Ibid.*, 2-4.

²⁸ Alan Vick, *Snakes in the Eagles Nest: A History of Ground Attacks on Air Bases* (RAND Corp., Santa Monica, CA, 1995).

as distinct threats, new technologies are making TASMs virtually indistinguishable from cruise missiles.²⁹

Cruise Missiles

Cruise missiles (CMs) are unmanned, powered, self-guided vehicles that exhibit sustained flight through aerodynamic lift at one or more constant "cruise" altitudes. There are two types of cruise missiles, land attack (LACMs) and anti-ship cruise missiles (ASCMs).

Land attack cruise missiles appear attractive to many countries because of the excellent combat record that they achieved in US service during and after Desert Storm.³⁰ Television broadcasts from Baghdad, Sudan, Bosnia, and Yugoslavia have displayed the remarkable accuracy of these GPS-guided weapons. This publicity has perhaps exacerbated the proliferation of cruise missiles.

Cruise missiles pose a serious threat because of their unique operational characteristics. The incorporation of new technologies in airframe and warhead design, propulsion systems, and guidance systems has led to vastly improved missile capabilities. Composite materials and a range of low observable technologies have led to stronger airframes with very low radar cross sections. Modern turbojet and turbofan engines permit long duration flights and can cost as little as \$50,000 apiece.³¹

Guidance systems such as GPS and INS coupled with terrain following technologies allow cruise missiles to fly at altitudes as low as 20 meters above ground level, utilize terrain masking, fly unpredictable flight paths, and attack from any direction.³² Two limitations of these weapons are a need for excellent intelligence to map the expected terrain, and a mission planning capability to program the route of flight. These limitations are quickly being overcome by low priced technologies such as ER Mapper, a mission planning kit that runs on a Sun workstation and costs about \$20,000. Couple this with widely available commercial satellite imagery capable of 1-meter

²⁹ *FY 99 Air and Missile Defense Master Plan*. 2-5

³⁰ *Ibid.*, 2-5

³¹ Dr. Matt Ganz, "Cruise Missile Defense," Transcript of speech available on-line. Internet., 9 March 1999. Available from <http://www.darpa.mil/ARPATech-96/transcripts/ganz/.html>. 3.

³² *FY 99 Air and Missile Defense Master Plan*. 2-5.

resolution, and all of the necessary pieces can be put together.³³ Cruise missiles are also an excellent delivery method for biological or chemical weapons.³⁴

Tactical Air to Surface Missiles

TASMs are similar to cruise missiles except they are normally smaller, lack the wings and corresponding aerodynamic lift of their cruise missile cousins, and therefore have shorter ranges. Most TASMs owned by America's potential enemies are of Soviet or Russian origin and employ radio command, laser, anti-radiation homing, or electro-optical guidance systems. Some of these missiles have ranges in excess of 100 km.³⁵

Unmanned Aerial Vehicles (UAVs)

UAV's include drones, characterized by preprogrammed flight paths and patterns, and remotely piloted vehicles (RPV's), controlled by ground based operators. UAVs are similar to cruise missiles in that they can fly for a long time and can be difficult to detect. A limitation of an RPV is that the flyer must maintain data link with the aircraft. This means that there must be continuous line-of-sight from the transmitter to the aircraft, which is usually accomplished through antennas located on high terrain or satellites. These links are susceptible to electronic jamming or can be cut if the ground relay station is damaged or destroyed.³⁶

UAVs are easy to produce and their production can take place in inconspicuous locations; this makes the status of the current UAV threat difficult to judge. Most UAVs are currently used for gathering intelligence but they have also frequently been used as

³³ Dr. Matt Ganz, "Cruise Missile Defense," 3.

³⁴ For an excellent discussion of the use of UAVs for delivering chemical or biological weapons, see: Jeffery N. Renahan, *Unmanned Aerial Vehicles and Weapons of Mass Destruction: A Lethal Combination?* (Maxwell Air Force Base, Alabama: School of Advanced Airpower Studies, June 1996).

³⁵ *FY 99 Air and Missile Defense Master Plan*. 2-6.

³⁶ *Ibid.*, 2-7.

decoys. They can easily be converted to deliver ordnance, especially chemical or biological weapons.³⁷ Some examples of UAVs are shown in table 1.

³⁷ Renehan.

Table 1
Common Unmanned Aerial Vehicles

UAV	Launch Weight (kg)	Payload (kg)	Range (km)	Loiter Time (hrs)	Guidance	Dimensions(m)	Cost Per Vehicle
<i>Exdrone</i>	40.5	11	120	2.5	Man/Auto	1.6 x 2.5	\$20k
<i>Pioneer</i>	200	50	185	6-9	Man/Auto	4.3 x 5.1	\$660k
<i>Hunter</i>	667	143	150	14	Man/Auto	7 x 9	\$1.2M
<i>Delilah</i>	180	55	400	5	Man/Auto	2.7 x 1.5	\$200k
<i>Scarab</i>	1077	132	3150	---	Auto	6.2 x 3.4	---
<i>Model 410</i>	817	227	2000	10	Man/Auto	6.6 x 9.6	---
<i>Tier II Plus</i>	10394	907	5000	42	Man/Auto	---	\$10M
<i>Tier III Minus (Dark Star)</i>	---	230	800	---	Man/Auto	---	\$10M

Source: Jeffery N. Renahan, *Unmanned Aerial Vehicles and Weapons of Mass Destruction: A Lethal Combination?* (Maxwell Air Force Base, Alabama: School of Advanced Airpower Studies, June 1996), 14.

Regional Proliferation

As the world's lone superpower, the United States has interests worldwide. This section offers a tour of America's strategic interests in the various regions of the world and highlights the possible threats in those regions. It underscores the existence of the types of threats that have just been discussed.

Northeast Asia

The strategic significance of Northeast Asia continues to grow. US ties to Asian allies and friends span the range of security, economics, culture, and politics. The importance of long-standing US alliances and security relationships in this region is further buttressed by the region's unprecedented economic growth over the past decade. Security and stability in this region are essential if economic relations are to continue to flourish.³⁸

North Korea and China possess substantial NBC weapons and missile capabilities. Should there be a conflict involving the United States and North Korea or

³⁸ *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 3.

China, the United States must be able to defend itself against the use of ballistic missiles and chemical weapons.³⁹ North Korea supplies missiles and related technologies to countries in the Middle East, while China supplies various NBC and missile related equipment to countries in the Middle East and South Asia. An overview of North Korean and Chinese weapons and missile programs is shown in Tables 2 & 3.

Table 2 North Korea: NBC Weapons and Missile Programs	
Nuclear	-Signed the 1994 Agreed Framework, freezing nuclear weapons material production at Yongbyon complex. -Produces enough plutonium prior to 1994 agreement for at least one nuclear weapon -Ratified the Nuclear Non-Proliferation Treaty; Later decided it had special status. Has not signed the Comprehensive Test Ban Treaty
Chemical	-Produces and is capable of using wide variety of agents and delivery means, which could be employed against U. S. and allied forces -Has not signed the Chemical Weapons Convention
Biological	-Pursued biological warfare research and development for many years. -Possesses biotechnical infrastructure capable of supporting limited biological warfare effort. Ratified the Biological and Toxin Weapons Convention
Ballistic Missiles	-Produces and is capable of using <i>Scud</i> B and <i>AScud</i> C missiles. -Developed the No Dong Missile (approx. 1000 km) --Taepo Dong 1 (more than 1500 km) --Taepo Dong 2 (4000-6000 km) -Not a member of the Missile Technology Control Regime
Other Means of Delivery	-Land and sea launched anti ship cruise missile; none have NBC warheads. -Aircraft (fighters, bombers, helicopters). -Ground systems (artillery, rocket launchers, mortars, sprayers)

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 5.

³⁹ Ibid., 4.

Table 3 China: NBC Weapons and Missile Programs	
Nuclear	-Completed series of tests in 1996. -Deployed over 100 warheads on ballistic missiles. -Maintains stockpile of fissile material. -Ratified the Nuclear Non-Proliferation Treaty and signed the Comprehensive Test Ban Treaty.
Chemical	-Produces and is capable of using wide variety of agents and delivery means. -Ratified the Chemical Weapons convention
Balli	-Possesses infrastructure necessary for biological warfare program. -Likely has maintained an offensive biological warfare program since acceding to the biological and Toxin Weapons Convention in 1984.
Ballistic Missiles	-Produces wide variety of land and sea based ballistic missiles -Fired missile near Taiwan (1995 and 1996) -Embarked on modernization program. - Pledged to adhere to the Missile Technology Control Regime.
Other Means of Delivery	-Land, sea, and air launched cruise missiles, mostly anti-ship. -Aircraft (fighters, bombers, helicopters). -Ground systems (artillery, rocket launchers, mortars)

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 9

Appendices A & B display the estimated ranges of North Korean and Chinese ballistic missiles.

South Asia

The United States has important security interests in South Asia, including preventing another Indo-Pakistani war, enhancing regional stability, and stemming the proliferation of weapons of mass destruction. Deployment of ballistic missiles would pose especially troubling security risk, given the relatively short distances between major population centers in South Asia and the brief time required for missiles to travel such distances. *This factor will compress decisionmaking cycles for national leaders and battlefield commanders, reducing stability during times of crisis.* [emphasis added]⁴⁰

After 50 years of independence and three wars, territorial disputes and mistrust continue to divide India and Pakistan. Each country maintains substantial forces along their shared border and often exchange small arms and artillery fire, and more recently air

⁴⁰ Ibid., 15.

attacks.⁴¹ Both countries nuclear programs recently came "out of the closet" when each country conducted overt nuclear tests. India and Pakistan are both developing ballistic missiles, including MRBMs. These weapons are being pursued largely due to a desire to counter their rival's perceived capabilities.⁴² A summary of India's and Pakistan's NBC weapons and missile programs is shown in table 4.

Table 4 India and Pakistan: NBC Weapons and Missile Programs	
Nuclear	-Both possess adequate fissile material and components to assemble a limited number of nuclear weapons. -Both have substantial nuclear infrastructures -Both conducted nuclear tests in 1998 -Neither has signed the Nuclear Non-Proliferation Treaty nor the Comprehensive Test Ban Treaty
Chemical	-India has a sizable chemical industry and recently declared its chemical warfare program, as called for under the CWC. -Pakistan has the ability to transition from research and development to chemical agent production. -India and Pakistan have ratified the Chemical Warfare Treaty.
Biological	-India has R&D facilities geared toward biological warfare defense. -Pakistan may have the capability to support a limited biological warfare program. -Both have ratified the Biological and Toxin Weapons Convention.
Ballistic Missiles	-India: - Prithvi - two version - 150-kilometer range; 250km range. - Agni - testing stage; intended range: 2000 km. -Pakistan: - Hatf I - 80 km range. - Mobile SRBM - 300 km range. -Neither is a member of the Missile Technology Control Regime.
Other Means of Delivery	-India has shipborne and airborne anti-ship cruise missile; Pakistan has shipborne, submarine launched, and airborne anti-ship cruise missiles; none have NBC warheads. -Aircraft: both have fighter bombers. - Ground systems: both have artillery and rockets.

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 15

Estimated ranges of India and Pakistani's current and potential ballistic missile capabilities are displayed in appendices C & D.

The Middle East and North Africa

US goals in the Middle East and North Africa include securing a just, lasting and comprehensive peace between Israel and all Arab parties;

⁴¹ Ibid., 15.

⁴² Ibid., 15.

maintaining a steadfast commitment to Israel's security arrangements that assure the stability of the Gulf region and unimpeded commercial access to its petroleum reserves; combating terrorism; ensuring fair access for American business to commercial opportunities in the region; and promoting more open political and economic systems and respect for human rights and the law.⁴³

The Middle East and North Africa continue to present the most likely locations for US military involvement. These regions have also seen use of chemical weapons in the recent past, as well as the employment of ballistic missiles and large-scale rockets. So far there is no clear evidence why Saddam did not use chemical weapons in the Gulf War, although it is commonly assumed that he was inhibited from using them because of fear of massive retaliation by the US or Israel. Former Secretary of Defense William J. Perry summarized US policy on retaliation,

If some nation were to attack the United States with chemical weapons, then they would have to fear the consequences of a response from any weapon in our inventory...we could make a devastating response without the use of nuclear weapons, but we would not foreswear that possibility.⁴⁴

There is no guarantee that potential adversaries in this region will behave as "rationally" in future conflicts.

Iran, Iraq, Libya, and Syria are aggressively seeking NBC weapons and increased missile capabilities and are the most pressing threats to security in this region. Iran and Iraq each desire to dominate the Gulf region and control access to critical oil supplies. Possession of nuclear

Table 5 Iraq: NBC Weapons and Missile Programs	
Nuclear	-Suffered considerable damage from Coalition bombing and IAEA monitoring; all fissile material removed. -Retains considerable expertise (scientists); possibly hidden some documentation, infrastructure. -Could manufacture fissile material for nuclear device in 5 or more years, if sanctions were lifted. -ratified the Nuclear Non-Proliferation Treaty; has not signed the Comprehensive Test Ban Treaty

⁴³ Ibid., 23.

⁴⁴ Ibid., p 35.

Chemical	-Considerably damaged by Coalition bombing and UNSCOM destruction. -Probably has hidden precursor chemicals, agents, munitions, and documentation for future effort; has rebuilt key portions of production facilities for commercial use. -Could restart agent production and have small usable stockpile in several months, if sanctions and monitoring were lifted or substantially reduced. -Has not signed the Chemical Weapons Convention
Biological	-Prior to Desert Storm, had largest and most advanced program in Middle East. -Iraq may retain elements of its old program, including some missile warheads. -Could restart some limited agent production quickly, if sanctions and monitoring were lifted or substantially reduced. -Ratified the Biological and Toxin Weapons Convention.
Ballistic Missiles	-Considerably damaged by Coalition bombing and UNSCOM destruction. -Allowed to maintain 150 km missile program (Ababil) under UNSCR 687; likely using this effort to support future long range missile effort. -Continues to conceal <i>Scud</i> missiles and launchers. -Could restart limited missile production within one year, if sanctions and monitoring were reduced or lifted. -Not a member of the Missile Technology Control Regime.
Other Means of Delivery	-Land-launched anti-ship cruise missile; air-launched tactical missiles; none have NBC warheads; stockpile likely is very limited. -Aircraft (fighters, helicopters). -Ground systems (artillery, rockets)

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 30.

weapons by these nations would likely lead to further intimidation of their neighbors, as well as an increased willingness to confront the United States.

Table 6 Iran: NBC Weapons and Missile Programs	
Nuclear	-Attempting to acquire fissile material for weapons development. -Chinese and Russian supply policies are key to Iran's success; Russia has agreed to build power reactor. -Ratified the Nuclear Non-Proliferation treaty and signed the Comprehensive Test Ban treaty.
Chemical	-Employed chemical agents on limited scale during Iran-Iraq war. -Produces chemical agents and is capable of use on limited scale. -Seeking future independent production capability; Chinese assistance will be critical to Iran's success. -Ratified the Chemical Weapons Convention.
Biological	-Possesses expertise and infrastructure to support biological warfare program. -May have small quantities of agent available; seeking larger capability. -ratified the Biological and Toxin weapons Convention.

Ballistic Missiles	-Maintains and is capable of using <i>Scud</i> B/Cs and CSS-8s. -Produces <i>Scud</i>S with North Korean help. - Seeks to purchase loner range missiles (1000km or more). -Not a member of the Missile Technology Control Regime.
Other Means of Delivery	-Land, sea, and air launched anti-ship cruise missiles; air-launched tactical missile; none have NBC warheads. -Aircraft (fighters). -Ground systems (artillery, rocket launchers)

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 28.

Libya remains a significant proliferation concern. "Libyan leader Muammar Qadhafi has shown that he is willing and capable of using chemical weapons and missiles against his enemies", employing them against Chadian troops in 1987.⁴⁵ Additionally, Qadhafi is a known sponsor of terrorist organizations and could provide them with chemical agents. Libya also sees the United States as its primary external threat.⁴⁶

⁴⁵ Ibid., 23.

⁴⁶ Ibid., 23

Table 7: Libya: NBC Weapons and Missile Programs ⁴⁷	
Nuclear	-Has long standing goal of acquiring or developing a nuclear weapon. -Suffers from mismanagement; little foreign assistance -Ratified the Nuclear non-Proliferation Treaty; has not signed the comprehensive test Ban Treaty -Signed the African Nuclear Free Zone Treaty.
Chemical	-Employed chemical agents against Chadian troops in 1987. -Produced blister and nerve agents in 1980s at Rabta -Began construction of underground chemical agent production facility at Tarhunah. -Has not signed the Chemical Weapons Convention.
Biological	-Lacks scientific and technical base. -Remains in research and development stage. -Ratified the Biological and Toxin Weapons convention
Ballistic Missiles	-Fired <i>Scud</i> missiles at an Italian island in 1987. -Maintains aging <i>Scud</i> B force but remains capable of limited missile use. -Has made little progress acquiring or developing long range missile. -Not a member of the Missile Technology Control Regime.
Other Means of Delivery	-Land and sea launched anti ship cruise missiles; none have NBC warheads. -Aircraft (fighters, bombers, helicopters, transport planes). -Ground delivery systems (artillery, rocket launchers)

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 30.

Syria has an active chemical weapons program and possesses a substantial ballistic missile capability. These missiles have the range to reach Israel, which Syria views as its primary external threat. The Syrian leadership believes its chemical weapons and ballistic missiles are the primary means to counter Israel's conventional superiority.⁴⁸ Turkey is also considered a threat, and is well within missile range.

⁴⁷Ibid., 34

⁴⁸Ibid., 23.

Table 8 Syria: NBC Weapons and Missile Programs⁴⁹	
Nuclear	- Is not pursuing development of nuclear weapons. -Ratified the Nuclear Non-Proliferation Treaty; has not signed the Comprehensive Test Ban Treaty.
Chemical	-Produces and is capable of using chemical agents. -Seeking independent chemical warfare capability. -Has not signed the Chemical Weapons Convention
Biological	-Possesses adequate biotechnical infrastructure to support biological warfare program. -May be conducting research related to biological warfare. -Signed the Biological and Toxin Weapons Convention.
Ballistic Missiles	-maintains and is capable of using <i>Scud B</i>, <i>Scud C</i>, and SS-21 missiles. -Nearing production of <i>Scud</i> missile with North Korean help. -Not a member of the Missile Technology Control Regime.
Other Means of Delivery	-Land and sea launched anti-ship cruise missiles; none have NBC warheads. -Aircraft (fighters, helicopters). -Ground systems (artillery, rockets)

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 32.

Estimated ranges of Iraq's, Iran's, Syria's, and Libya's missiles are displayed in appendices E through G.

Russia, Ukraine, Kazakhstan, and Belarus

The United States has a tremendous stake both in the democratization and reform of Russia, Ukraine, and the other New Independent States (NIS) and in the further normalization of US relations with NIS governments, militaries, and other institutions. The United States desires Russia to play a constructive role in European affairs, in partnership with NATO, and to maintain strong relations with an independent Ukraine.⁵⁰

With the breakup of the Soviet Union, Russia inherited the largest stockpile of nuclear weapons in the world. It also has the largest stockpile of chemical agents: 40,000 tons, most of which is weaponized in the form of artillery, rockets, bombs, and missile warheads.⁵¹ Russia's effort to eliminate its chemical arsenal is proceeding slowly, complicated by a number of factors.

⁴⁹ Ibid., 38.

⁵⁰ Ibid., 41.

⁵¹ Ibid., 45.

The United States assumes that Russia will seek money by selling its weapons, including those addressed in this chapter, on the international black market. There are many indications that Moscow is not able to fully control its personnel, resources, or delivery systems involving chemical, biological and even nuclear weapons. A summary of the region's NBC weapons and missile programs is listed in Table 9.

Table 9: Russia, Ukraine, Kazakhstan, Belarus: NBC Weapons and Missile Programs ⁵²	
Nuclear	-Operational strategic nuclear warheads reduced by about 40% since 1991. -All strategic and tactical nuclear warheads consolidate in Russia. -All states have ratified the Nuclear Non-Proliferation treaty and signed the Comprehensive Test Ban Treaty. -Ukraine, Kazakhstan, Belarus are nuclear free.
Chemical	-Russia has declared the world's largest chemical agent stockpile: 40,000 metric tons. -Russia may be developing a new generation of chemical agents. -Ukraine, Kazakhstan, Belarus have no chemical warfare programs. -Russia and Belarus have ratified the Chemical weapons Convention. Ukraine and Kazakhstan have signed it.
Biological	-Key components of the Former Soviet Union's biological warfare program remain intact in Russia. -Russia may be continuing some research related to biological warfare. -Ukraine, Kazakhstan, Belarus have no biological warfare program. -Russia, Ukraine and Belarus have ratified the Biological and Toxin Weapons Convention; Kazakhstan has not signed it.
Ballistic Missiles	-Operational strategic nuclear delivery vehicles have been reduced by nearly half since 1991. -No operationally deployed ICBMs remain in Ukraine, Kazakhstan, or Belarus. -Russia has a large SRBM force and reportedly is marketing SRBM-related technology. -Ukraine, Kazakhstan, and Belarus also have SRBM forces. -Russia is a member of the Missile Technology Control Regime; Kazakhstan and Belarus are not. While Ukraine is not a member of the MTCR, it has committed to unilaterally adhere to the MTCR Guidelines and Annex.
Other Means Of Delivery	-Russia and Ukraine have land, sea, and air-launched cruise missile; some are anti-ship; some have longer ranges. Kazakhstan and Belarus have air-launched tactical missiles. Only Russia has any land-attack, nuclear-capable cruise missiles. -All have a variety of combat aircraft and ground systems.

Source: *Proliferation: Threat and Response* (Office of the Secretary of Defense, November, 1997), 34.

Asymmetric Strategy

The May 1997 *Report of the Quadrennial Defense Review* concludes that the threat or use of chemical and biological weapons is a "likely condition of future warfare,

⁵² Ibid., 42.

including in the early stages of war to disrupt US operations and logistics. These missiles may be delivered by ballistic missiles, cruise missiles, aircraft, special operations forces, or other means."⁵³ **Therefore the first forces that arrive in a theater of operations must have the ability to defend themselves against these attacks.**

Summary

The US has an overwhelming conventional capability when compared to the majority of its potential foes and is likely to maintain this for the foreseeable future. Many nations are attempting to counteract this difference with asymmetric weapons and strategies, leading to proliferation of ballistic missiles, cruise missiles, and weapons of mass destruction.

A survey of regional adversaries' capabilities and intentions highlights the areas where the United States is likely to engage in military operations and what type of threat it will face, most likely an opponent that is armed with the aforementioned weapons. The QDR concluded that these weapons might be used early in a conflict, targeting air bases in order to disrupt US power projection and deny access to the theater.

⁵³ *Report of the Quadrennial Defense Review*, 1997, 13.

Chapter 4

Joint Counterair Operations

counterair -- *air operations conducted to attain and maintain a desired degree of air superiority by the destruction or neutralization of enemy forces. Both air offensive and air defensive actions are involved. The former range throughout enemy territory and are generally conducted at the initiative of the friendly forces. The latter are conducted near or over friendly territory and are generally reactive to the initiative of the enemy air forces.*

—Department of Defense Dictionary of Military and Associated Terms

Defeating the asymmetric weapons and strategies discussed in the previous chapter is a major objective of counterair operations. Detection and destruction of ballistic missiles, cruise missiles, and UAVs is an extremely complex endeavor requiring both attack operations to suppress enemy weapons prior to their launch, and a fully integrated family of systems arrayed in a defense in depth to intercept enemy weapons once they are launched. This chapter examines both the US joint doctrine on counterair operations, and the weapon systems used to accomplish it.

Doctrine

Joint Publication 3-01 *Joint Doctrine for Countering Air and Missile Threats* is the primary document outlining joint strategy for counterair operations. Subsets of this master document are Joint Pub 3-01.5, the *Doctrine for Joint Theater Missile Defense*, Joint Pub 3-01.6 (not yet written), *Joint Doctrine for Air Defense Operations (JADO)*, and *JAOC / AAMDS Coordination*, the doctrine outlining multi-service tactics, techniques, and procedures (TTPs) for conducting theater air defense operations.

Counterair Strategy

The objective of counterair missions is to facilitate friendly operations against the enemy and protect friendly forces and vital assets by attaining air superiority.⁵⁴ Air superiority is defined as that degree of dominance in the air battle of one force over another, which permits the conduct of operations by the former and its related land, sea, and air forces at a given time and place, without prohibitive interference by the opposing force.

Counterair operations usually begin early in the conduct of a campaign to gain the desired degree of air superiority at the time and place of the Joint Force Commander's choosing. The counterair mission employs aircraft, surface-to-air missiles, surface-to-surface missiles, artillery, special operations forces, and information operations against a variety of threats. Air superiority may not completely eliminate air and missile opposition, so operations to maintain it will need to continue throughout the campaign. Ultimately, the degree of air superiority required to conduct other operations is driven by the JFC's concept of operations.⁵⁵

US military strategy for counterair operations is threefold. It consists of: *attack operations*, intended to destroy enemy weapons prior to launch, *active defense* to intercept threats once airborne, and *passive defense* to reduce the effectiveness of enemy attacks.⁵⁶ Counterair operations can be divided into two categories, offensive counterair operations (OCA), and defensive counterair (DCA) operations (figure 3).⁵⁷

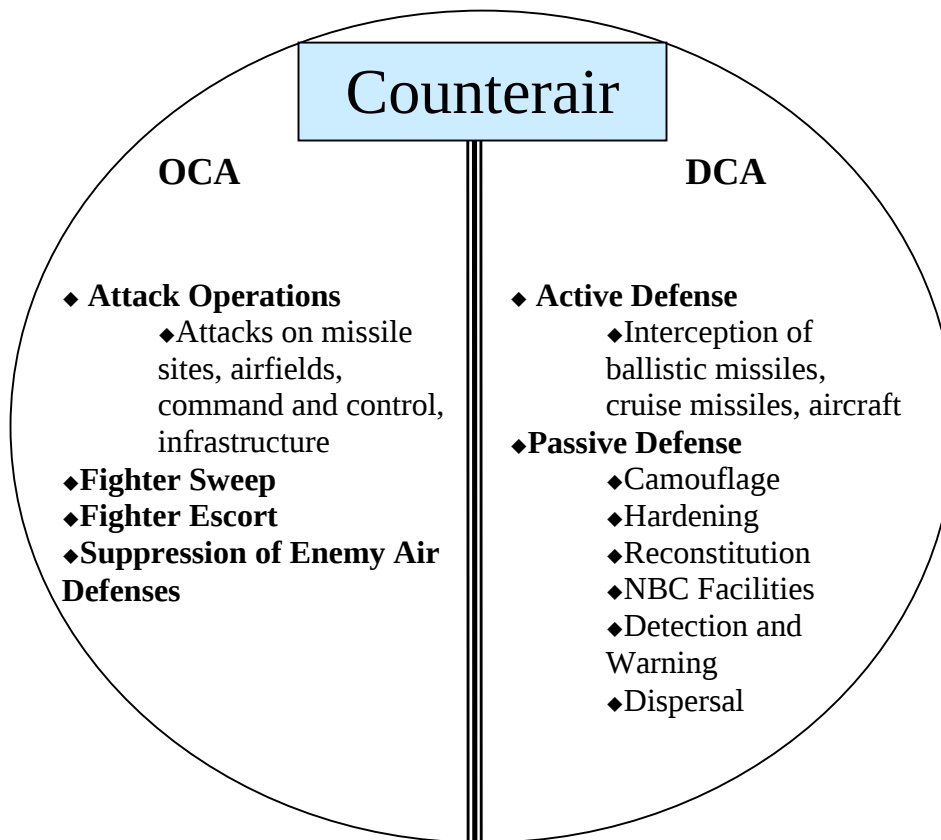
⁵⁴ Ibid., x.

⁵⁵ Joint Pub 3-01 *Doctrine for Countering Joint Theater Air and Missile Threats*, 1999, draft version, v.

⁵⁶ Joint Pub 3-01.5 *Doctrine for Joint Theater Missile Defense*, 22 Feb 1996, x.

⁵⁷ JAOC /AAMDC *Coordination*. Final Draft (Langley AFB, VA: Air Land Sea Application Center, February 1999), I-2.

Figure 3
The Counterair Framework



Source: Joint Pub 3-01 *Doctrine for Countering Joint Theater Air and Missile Threats*, 1999, draft version, v.

According to Joint Pub 3-01,

OCA operations seek to dominate the enemy's airspace, prevent the launch of threats, and deny sanctuary to its forces. OCA consists of offensive measures to destroy, disrupt, or neutralize enemy aircraft, missiles, launch platforms, and their supporting structures and systems. Ideally, most joint OCA operations will prevent the launch of aircraft and missiles by destroying them and their supporting infrastructure prior to launch.⁵⁸

Therefore, OCA includes attack operations, fighter sweep and escort missions, and suppression of enemy air defenses.

⁵⁸ Joint Pub 3-01 *Doctrine for Countering Joint Theater Air and Missile Threats*. v.

DCA operations protect friendly forces and assure their freedom of action by intercepting enemy aircraft (manned or unmanned), ballistic missiles, and cruise missiles.⁵⁹ DCA consists of all measures designed to detect, identify, intercept, and destroy or negate enemy threats attempting to attack or penetrate the friendly air environment, through the use of both active and passive methods of protection. DCA can be divided into two types, area defense and point defense.

As a general guideline, the closer to the launch point that an enemy aircraft or missile system can be defeated, the greater the relative area of defense provided. Attack operations in effect offer the greatest area of defensive coverage, an area equal to the radius of the enemy missile or aircraft in all directions. Area defense offers the next highest volume of coverage by engaging airborne threats as far from friendly territory as possible, while point defense offers the least amount of coverage and is normally reserved for high value assets. All three are needed to overcome the problems of detection, identification and interception.

Detection and Identification

Before an enemy air or missile threat can be engaged it must be detected and identified. Detection is done with electronic sensors or visually, and identification usually involves electronic, visual and/or procedural means. Identification includes more than distinguishing friend from foe. It also includes discriminating enemies from decoys, discriminating enemies that are not an immediate threat from those that are, and determining whether an enemy can be engaged under the rules of engagement (ROE).⁶⁰ Attack operations must overcome the most difficult detection problems, often hindered by enemy concealment and deception. Area and point defense systems normally have fewer detection problems; however, discrimination of friend from foe or unknowns is more difficult.

When successful, attack operations offer the most effective means of achieving air superiority and are the preferred method for countering enemy air and missile threats. But as the next section discusses, successful attack operations against mobile targets such

⁵⁹ Ibid.

⁶⁰ Joint Pub 3-01.5 *Doctrine for Joint Theater Missile Defense*, x.i.

as ballistic or cruise missiles is extremely difficult, and can consume a disproportionate amount of combat sorties. Therefore, area and point defense weapons will continue to play a critical role in the counterair mission.

Attack Operations -- History

The objective of attack operations is to prevent the launch of aircraft or missiles by attacking each element of the overall system, including launch platforms, reconnaissance assets, command and control nodes, missile stocks, and infrastructure.⁶¹ Attack operations are highly dependent on predictive and well-developed intelligence.

The Gulf War was not the first time airpower was used to try to counter enemy ballistic or cruise missile attacks. Operation Crossbow was the Allied plan in World War II for defeating German V-1s and V-2s during the spring and summer months of 1944.⁶²

Operation Crossbow

Hitler had set the end of December 1943 as the target date for the start of the V-1 and V-2 assault against England, however it was delayed until the Allied invasion of Normandy due to developmental problems. According to Gen Dwight D. Eisenhower,

if the Germans had succeeded in perfecting and using these new weapons six months earlier, our invasion of Europe would have been exceedingly difficult, perhaps impossible...if the Portsmouth-Southampton area had been one of the principal targets, OVERLORD might have been written off.⁶³

Despite the Allies' best efforts the Germans launched approximately 15,500 V-1 and V-2 missiles between June 1944 and March 1945. The subsonic V-1 was vulnerable to AAA or interceptor attack; American and British pilots even resorted to tipping the V-1s off their course once they had run out of ammunition.⁶⁴ There was no defense against a V-2 ballistic missile once it was in flight, however. Therefore Eisenhower directed that

⁶¹ Ibid., xi.

⁶² Mark Kipphut, *Theater Missile Defense Reflections for the Future* (Airpower Journal 10:35-52, Winter 1996), 36.

⁶³ Ibid., 36.

⁶⁴ Adam L. Gruen, *Preemptive Defense; Allied Air Power Versus Hitler's V-Weapons, 1943-1945* (Air Force History and Museums Program, Washington D.C. 1998), 36.

Crossbow take priority over all other Allied air operations, including those in support of the Normandy invasion and the Combined Bomber Offensive.⁶⁵

The objectives of Crossbow were to delay the beginning of missile attacks and limit their intensity once begun. The British focused on destroying the launch sites, while the American strategy was to target the supporting infrastructure, such as production facilities and electric power grids.

The Allies succeeded in destroying or neutralizing all permanent V-weapon sites, but the Germans were nevertheless able to continue launch operations by creating new ones with some modifications. The new sites were very hard to identify, protected by extensive camouflage, concealment and deception techniques.⁶⁶ The United States Strategic Bombing Survey concluded that air attack against the V-weapon system was effective in slowing down the German efforts and that the US approach was more successful than the British one. However, despite the application of thousands of sorties against over 250 targets, the Germans still averaged over 80 launches per day.⁶⁷

The total weight of effort for Crossbow between August 1943 and April 1945 was immense; totaling 68,913 strike sorties delivering 136,789 tons of munitions.⁶⁸ Between those dates, Crossbow consumed 14 percent of all Allied strategic sorties and 16 percent of the total tonnage. Tactical assets devoted 17 percent of total sortie generation and 13 percent of total tonnage to these operations. Crossbow consumed 40 percent of all reconnaissance sorties after 1943.⁶⁹

According to Mark Kipphut, in his article, "Theater Missile Defense Reflections for the Future," the important lessons to draw from the allied effort in Operation Crossbow are:

- Attacking an enemy's missile infrastructure can be effective as a long term strategy, but won't have an immediate impact.
- Effective attacks against small, mobile targets require real time reconnaissance support.

⁶⁵ Wesley Frank Craven, James Lee Cate, and Richard Davis, *Carl A. Spaatz and the Air War in Europe* (Washington D.C.: Smithsonian Institution Press, 1992), 428.

⁶⁶ Mark Kipphut, "Theater Missile Defense Reflections for the Future," *Airpower Journal*, Winter 1996, 10:36.

⁶⁷ Phillip Henshall, *Hitler's Rocket Sites* (New York: St. Martin's Press, 1985), 187.

⁶⁸ *V-Weapon (CROSSBOW) Campaign* (United States Strategic Bombing Survey), 25-29.

⁶⁹ Mark Kipphut, 38.

- Planning requires comprehensive intelligence support that understands and investigates the enemy missile system in its totality.
- Political pressure can directly determine resource allocation.⁷⁰

Unfortunately for the USAF, it would be forced to relearn these same lessons in another war years later.

Operation Desert Storm

Almost 50 years after Operation Crossbow, US forces were again engaged in a difficult operation designed to detect mobile missile launchers and stop them in their tracks, this time in Iraq. Within 24 hours after the beginning of Operation Desert Storm, Iraq launched the first of 88 *Scud* missiles at Israel and Saudi Arabia. Just as in Crossbow, the coalition was required to divert resources from the rest of the counterair campaign.

The Iraqi's had three mobile *Scud* variants in its inventory during the Gulf War. They were the original Soviet-supplied SS-1 with a 160 mile range, the 325 mile Al Husayn, and the 400 mile Al Hijarah. All were deemed capable only of area attacks because of their poor accuracy. The Defense Intelligence Agency estimated that the Soviet Union had delivered at least 600 missiles to Iraq, but post war estimates place the number closer to 800.⁷¹

The Iraqis used Soviet tactics for concealment and deception to complicate the coalition's targeting problems, including careful electronic silence, high fidelity decoys, and building fixed sites that were not actually used. After firing, *Scuds* were quickly retreated into hiding. Detection of mobile TELs was very difficult, and when coalition pilots did detect a TEL it was more often than not a decoy. Destruction of these decoys led coalition pilots to believe that their attacks had been successful, thereby perpetuating a failing strategy. After at least 1460 sorties and 80 post-flight reports by aircrews of confirmed kills, it turned out that all "hits" were on *Scud* decoys -- none of the real launchers had been destroyed.⁷²

⁷⁰ Ibid., 4.

⁷¹ Ibid., 6.

Preemptive Attack

The best time to attack enemy missile systems is preemptively. As adversaries become more likely to use missiles early in a war, the US either has to attack first, or be prepared to absorb the first blow. From a pure military perspective, the first option is undoubtedly more attractive, but the political reality is that the United States will most likely not attack first since this is inconsistent with its non-aggressive, democratic ideals. As Gen Chuck Horner, CENTAF commander during Desert Storm said,

...it is not illegal under international law for a state to obtain nuclear, biological, or chemical weapons if it does not belong to regimes like the Nuclear Non-Proliferation Treaty (NPT) and the Biological and Chemical Weapons Conventions. It is illegal, however, to use those weapons against a peaceful state. It is also illegal to preemptively attack a state in all but the rarest of cases. Unless the United States is highly confident that it is about to be attacked by an adversary's NBC/M forces, there is little or no legal justification for preemptively attacking those forces.⁷³

There are three notable exceptions to this unstated policy, each occurring during the Clinton administration. They are: the bombing of the Sudanese pharmaceutical plant; the bombing of the Bin Laden terrorists camp in Afghanistan, and the attacks on Yugoslavia during Operation Allied Force. The first two were carried out by the United States under the auspices of "preventing" further terrorist activity in order to defend US citizens, and not as punishment for the bombings of the US embassies. This distinction is important because under international law the US has the right to take unilateral action if its citizens are threatened, but it does not have the unilateral right to punish, *per se*, leaving open the possibility of using preemptive attacks in the future.

Attack Operations -- Current Capabilities

Barring the conduct of overwhelming preemptive attacks, airpower will likely once again be in the "Scud hunt" business. Many new capabilities exist to detect mobile launchers and quickly pass that information directly to the cockpit of aircraft that are on

⁷² David Eshel, "Ballistic Missile Defence: In search of an Effective Defence," *Jane's Defence Weekly*, Vol. 31, 10 March 1999, Issue no.10, 71.

⁷³ Charles A. Horner and Barry R. Schneider, Chapter 12, "Counterforce," in *Countering the Proliferation of Weapons of Mass Destruction* (New York: McGraw-Hill, 1998), 244.

airborne alert. Ideally, as Gen Ronald Fogelman said, "if the missile flies, the TEL dies."⁷⁴

Numerous initiatives are underway to streamline the sensor-to-shooter loop, enhancing the USAF's ability to detect and destroy mobile launchers. The DSP satellite system is currently the primary means of detecting ballistic missile launch. This system is being replaced by the much more capable SBIRS satellite constellation. Additional sensors include JSTARS, U-2, F-15E, and F-16 radars. All of these will provide automatic target cueing and recognition. Transmission of near-real time digital targeting data from U-2s and UAVs into an F-15E cockpit will facilitate pilot identification of TELs for attack.

The results of recent exercises go a long way toward proving that US forces possess a much greater ability to conduct successful attack operations against mobile TELs than they did in Desert Storm. During ROVING SANDS '95, roughly 17 percent of the entire air effort went into TBM attack operations over five days. Joint air forces were able to decrease enemy TBM infrastructure (TELs, cranes, and support equipment) by 40 percent. U2s and UAVs detected numerous TELs before missile launch. According to Gen Fogleman, "a recent study by the Joint TMD Project office...showed a 61 percent reduction in enemy missile launches, elimination of 85 percent of enemy TELs, a 71 percent reduction in active defense missiles employed and a 50 percent reduction in missiles that leak through all defenses when attack operations are combined with terminal defenses." [emphasis added]⁷⁵

Attack operations will no doubt make it more difficult for an enemy to launch ballistic missiles, but certainly not impossible. Cruise missiles and UAV's pose an even greater problem because of their increased difficulty in detection during construction, launch and flight. Active defense will provide the next layer of protection.

Active Defense

⁷⁴Gen Ronald Fogleman, "The Air Force Role in Theater Ballistic Missile Defense," Remarks delivered to the American Defense Preparedness Association/National Defense University Foundation Breakfast Seminar Series on Missile Defense, Counter-Proliferation, and Arms Control, Washington, D.C. June 16, 1995.

⁷⁵ Ibid.

Active Defense means intercepting an enemy target once it is airborne. It includes area and point defense weapons, as well as the systems that support them. Fighter aircraft and SAMs are the primary shooters, while AWACS, Rivet Joint, and other sensors help with detection and identification.

The US has a robust capability to detect and intercept air breathing threats, but a very poor capability versus ballistic missiles, or cruise missiles with low observable signatures. Patriot is the only current US system that has been proven capable of intercepting theater ballistic missiles. There are several theater missile defense systems currently in development under the supervision of the Ballistic Missile Defense Office (BMDO), and the Joint Air and Missile Defense Organization (JTAMDO), which will be discussed in the next section. None of these systems will be operational until well into the next decade.

The US fares slightly better against cruise missiles, unless they are in the category of "low observable."⁷⁶ The exact capability of individual platforms to detect and intercept cruise missiles is classified, but in general it is limited. The USAF Airborne Warning and Control System (AWACS) has some ability to detect low radar cross section targets. USAF F-15's, armed with AIM-120 AMRAAMs or AIM-7M H-Build missiles have the most capability of any current USAF aircraft against cruise missiles, and Patriot also some capability to intercept them.⁷⁷

Several initiatives are also underway for cruise missile defense. One such program is JLENS, a tethered aerostat with onboard radar capable of detecting targets such as cruise missile or UAVs and then passing this information via data link to Patriot or other air defense weapons. While this and other surveillance enhancements may help solve long-range detection problems, they do not necessarily make it more likely that an

⁷⁶ Most cruise missiles have smaller radar-cross sections than aircraft simply because of their physical size. Most older cruise missiles can be detected by both AWACS and fighters, although at reduced ranges. However, newer missiles that use radar cross section reduction techniques are difficult to detect. The world of "low observables" such as stealth is highly classified, as is our capability to defend against them.

⁷⁷ AMRAAM stands for Advanced Medium Range Air-to-Air Missile. Author served for 4 years as the AIM-7 instructor at the USAF Weapons School and presents this information as an expert in the field. Capability versus cruise missiles is a function of the radar's ability to detect and track the target and in the case of the AIM-7, provide illumination for missile seeker guidance. Currently, the APG-63 and the APG70 (F-15 radars) are able to do this at longer ranges than other fighters. The ranges themselves are classified.

intercepting missile will have a higher probability of success, because the missile must also be able to acquire the target with its seeker.

Air Defense -- The "Family of Systems" Approach

The Ballistic Missile Defense Office and the Joint Theater Air and Missile Defense Office are the two agencies primarily responsible for the development and integration of theater air and missile defense systems. According to the BMDO,

Joint Theater Air and Missile Defense (JTAMD) revolves around the capability to detect, classify, intercept, and destroy (or negate the effectiveness of) enemy aircraft and missiles prior to launch or while in flight in order to protect US and coalition forces, selected assets, and population centers within an assigned area of operations.⁷⁸

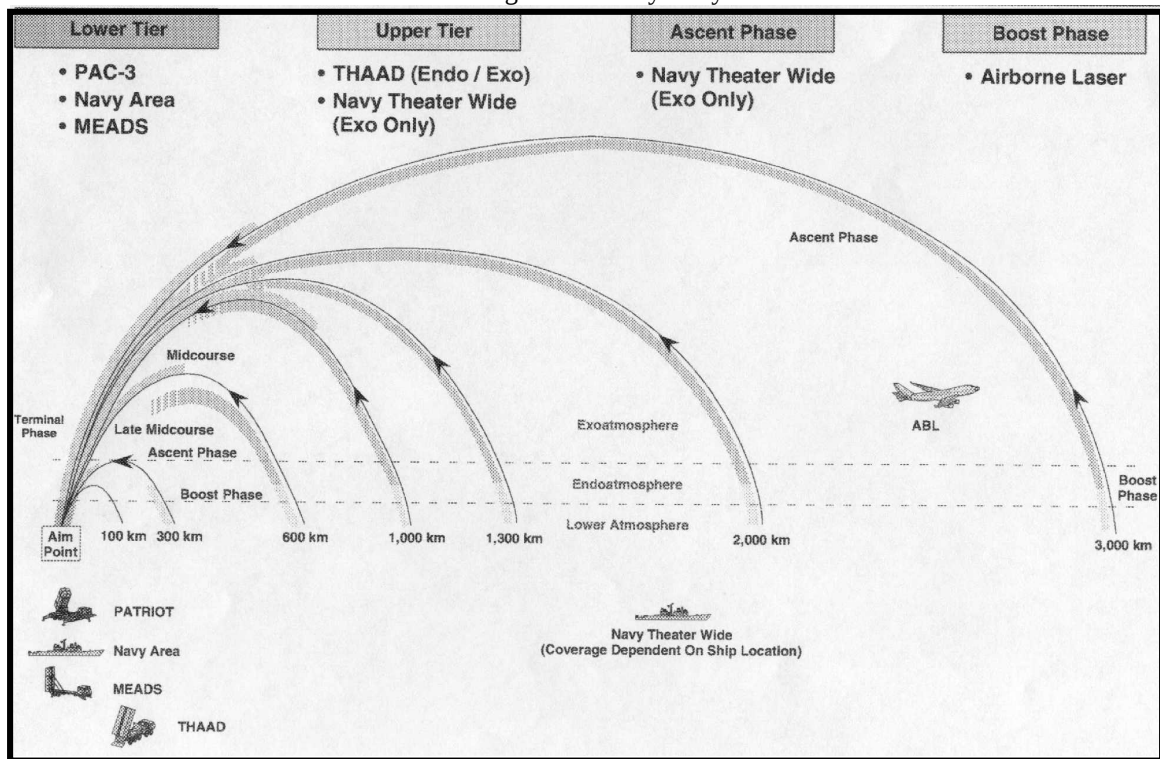
Due to the complexity and diversity of the missile and aircraft threats, a single system is not capable of performing theater air and missile defense; instead, a family of systems is required. The "family of systems" is intended to provide defense in depth.⁷⁹

Ballistic missile defense systems can be divided into two categories, upper and lower tier (terminal phase). Upper tier systems can be further divided into categories based on when they intercept the missile, during the boost phase, ascent phase, mid-course, or descent (figure 3). Upper tier systems are usually capable of engaging the target either in or above the atmosphere (endo- or exo-atmospheric).

⁷⁸ *The Family of Systems Concept* (BMDO Fact Sheet AQ-99-16. March 1999), 1.

⁷⁹ *BMDO Technology Master Plan, Executive Summary* (Ballistic Missile Defense Office), On-line. Internet, 10 April 1999. Available from <http://www.bmdo.mil>. 3.

Figure 3. Family of Systems



Source: *The Family of Systems Concept* (BMDO Fact Sheet AQ-99-16, March 1999), 1.

Boost phase interceptors (BPI) attempt to intercept missiles early in their flight. Their objective is to destroy the missile over enemy territory, creating a disincentive for the adversary to use missiles or WMD. The USAF Airborne Laser (ABL) is a BPI program undergoing testing and development; an ABL prototype should be ready by 2002.⁸⁰ The unmanned aerial vehicle boost phase interceptor (UAV BPI) is an Israeli-American cooperative program, currently only a concept.

Ascent phase and upper tier systems are long range weapons able to engage enemy missiles either endo- or exo-atmospherically, allowing them to defend a wide area. Navy Theater Wide (NTW) is the designated ascent phase interceptor which builds on improvements to the Standard Missile (SM-2) IV A, the 1992-1995 Navy TERRIER Missile/Light Exoatmospheric Projectile (LEAP) flight demonstration, and modifications

⁸⁰ Gen Ronald Fogleman, "The Air Force Role in Theater Ballistic Missile Defense," Remarks as delivered to the American defense Preparedness Association/National Defense University Foundation Breakfast Seminar series on Missile Defense, Counter-Proliferation, and Arms Control, Washington, D.C. June 16, 1995.

to the AEGIS weapon system.⁸¹ Designated the SM-3, its ability to engage a missile during the ascent phase is a function of how close the mother ship is able to get to the launch point. The US Army's Theater Area Air Defense system (THAAD) is an upper tier weapon to be stationed in the friendly rear area. The US is also working with Israeli on the development of the Arrow program, an upper tier area defense to be used for defense of Israel.

Lower tier systems have a shorter maximum range than upper tier systems and are normally used for point defense of specific high value assets, such as air bases or command and control facilities. Lower tier systems include Patriot, Multi-national Extended Air Defense System (MEADS), and Navy Area TBMD. Patriot is operational in the US Army as well as several allied nations. MEADS is a developmental multi-national SAM designated as the replacement for HAWK. Funding for MEADS however, is endangered due to the programs high cost (estimated at over \$3 billion).⁸²

The Need for Layered Defense

The "family of systems" approach is designed to provide defense in depth. The family of systems depends on four major components, a system to detect the target and guide the missile, a launcher, the interceptors, and a command and control architecture that links the systems together. The need for this robust of an approach arises from the difficulty of detecting, identifying, and intercepting ballistic or cruise missiles. During each of these phases of the intercept, there are unique technical problems to overcome which can reduce overall operational effectiveness of any individual system.

Missile Detection

Long range detection helps to position fighters properly for intercept or to provide an alert to awaiting SAMs. Depending on the speed of the incoming threat, late detection can result in a missed intercept. The two primary means of detection are radar and infrared search and track (IRST).

⁸¹ *Ballistic Missile Defense - The Core Programs*, BMDO FACT SHEET AQ-99-01. February, 1999. 1.

⁸² COL Barry Ford, USMC, JTAMDO Office of TAMD Requirements and CINC Liaison. Telephonic interview conducted on 6 May 1999.

Radar is a "flashlight-like" beam that spreads and decreases in intensity as range increases. Radar detection is constrained by range to the target, the radar cross section of the target, line-of-sight to the target, and other factors such as enemy electronic counter measures (ECM), or unfavorable atmospheric conditions. Line-of-sight is dependent on the terrain and the target's altitude. Even in flat terrain the curvature of the earth limits ground based radar detection of low altitude targets to approximately 17 nautical miles. Airborne radars are less hampered by curvature problems and often use pulse-Doppler signals to filter the target's returns from ground clutter.⁸³ Targets can avoid being detected by direct terrain masking (flying behind a ridgeline), indirect terrain masking (flying directly in front of a ridge), stealth, or approaching the SAM from a direction he is not looking -- an off-axis attack.

IRST systems detect the heat generated by the missile. The plume of a ballistic missile is very bright and easily detected. However, the thermal signature of a cruise missile or UAV can be minimal. But against low observable threats, IRST systems often fare better than radar. IRST systems generally cannot see through clouds and can be severely hindered by the sun's reflection off of clouds or the earth's surface.

Target Identification

Combat identification is a major weakness of current US weapon systems. In order to eliminate fratricide or the destruction of neutral aircraft, stringent identification procedures and rules of engagement (ROE) are usually established during wartime operations. Combat identification is a very complex endeavor and confusion in the congested, rear areas of a theater is normal. The ROE can impact a SAM or aircraft's ability to engage a target at its maximum launch range, if at all. Enemy aircraft, cruise missiles, or UAVs can attack from any direction and their benign flight profiles can allow them to blend in with other traffic. However, ballistic missiles have such a unique flight profile that their identification is easier.

Identification methods normally include electronic or procedural means. The primary electronic means is IFF (Identification of Friend or Foe), friendly aircraft transponders that emit a signal such as mode 1, 2, 3, or the encrypted Mode 4. The

⁸³ Pulse-Doppler radars use both high and medium pulse repetition frequencies (PRFs).

absence of IFF returns is not sufficient to verify a contact as an enemy however, since IFF failures can occur. Therefore an additional electronic means, such as Non Cooperative Target Recognition (NCTR), or a procedural method, such as airspace control measures, is also used. Airspace control measures dictate altitudes, speeds and headings that aircraft must follow when approaching an air base in order to be identified as "friendly." If a defensive weapon system is not capable of fulfilling all of the identification methods required by the ROE, it must get a "hand-off" from some other system, such as AWACS. The goal is to identify targets as soon as possible so that they can be engaged at the missile's maximum range.

Missile Launch

Defensive weapons are arrayed so that they can engage a target at their maximum range, allowing them time to reengage should they miss. A missile's maximum range (a.k.a. its maximum weapons engagement zone or WEZ) is determined by its speed, the target's speed and the angular difference between the flight paths. The faster the target is, the smaller the angular difference that can be accepted due to the extreme energy and maneuvering problems faced by the missile at the end of its intercept. Ballistic missiles in the descent phase can achieve velocities in excess of Mach 6; therefore, terminal defense weapons must therefore be placed in as close as possible to the asset they are defending, and aligned with the expected flight path of incoming targets. As General Charles Horner said while planning Operation Desert Storm,

[a]t the time, Patriot was believed to have the capability to intercept ballistic missiles, so I took the Patriot air defense circle and put it on my maps. When we plotted those circles, they just about covered the map. Of course, we learned in Saudi Arabia that the Patriot ballistic missile defense circle looks more like the head of a pin.⁸⁴

Missile Guidance and Fusing

It is not sufficient for the radar alone to detect the target, the intercepting missile must be able to "see" it as well. Semi-active radar missiles have passive seekers; they capture and track the energy from the ground-based radar that is reflected off of the

⁸⁴ Gen Charles A. Horner, "New-Era Warfare," *Air Chronicles*. Chapter 2. On-line. Internet, 10 April 1999. Available from <http://www.airpower.maxwell.af.mil/airchronicles/battle/chp2.html>, 2.

target. Actively guided missiles, such as the AMRAAM, contain their own internal radar. The launch platform provides target location information to the missile via data link messages until the missile is close enough to detect the target with its own radar.

Fusing is one of the most technologically difficult problems associated with intercepting cruise or ballistic missiles. Missiles usually contain two types of fuses for triggering warhead detonation, a proximity fuse and a contact fuse. The active proximity fuse is small radar contained in the missile. Because of its low average output power, this type of fuse detects the target only when it is very close. The contact fuse works by sensing the rapid deceleration that occurs if the missile runs into the target. Either one of these fuses can detonate the missile warhead, leading to destruction of the target. "Hit-to-kill" interceptors overcome fusing problems associated with intercepting ballistic missiles by using the kinetic energy of the impact to destroy the ballistic missile warhead.⁸⁵ "Hit-to-kill" interceptors require extremely precise guidance and a sophisticated control system.

Upper Tier Weapons

Intercepting a ballistic missile will become an increasingly complex endeavor as future missiles are designed to be more survivable. Since most upper tier systems will not be fielded until late in the next decade, engineers must build robust capabilities into the interceptors. According to BMDO, these capabilities are:

discrimination (the process of differentiating the missile warhead from the various other incoming objects such as warhead countermeasures/decoys, deployment debris, and jammers), *interceptor agility* (the ability of an interceptor to engage a maneuvering target); *sensor accuracy* (including radiometric and angular position measurements); and *information* (including all sensor data, data processing and communications required to support an intercept.)⁸⁶

THAAD

⁸⁵ *Unmanned Aerial Vehicle Boost Phase Intercept Program*, BMDO FACT SHEET TO-99-06, March 1999, 2.

⁸⁶ *BMDO Technology Master Plan, Executive Summary*, On-line. Internet, 15 April 1999, Available from <http://www.bmdo.mil>, 4-5.

THAAD is designed for area defense against *ballistic missiles only* and is projected to be operational in 2008⁸⁷. THAAD, like Patriot, consists of radar, launcher, Ballistic Missile Command, Control, Communication center (BM/C3I), and missiles.

The THAAD radar is a phased array system capable of autonomous detection of exo-atmospheric ballistic missiles. The radar tracks both the target and the missile, providing data links to the missile all the way until the final intercept when the missile acquires the target on its own. The radar interfaces with the BM/C3I center for launch commands based on the calculated trajectory. The BM/C3I center also performs threat assessment and prioritization and is capable of linking with other assets (such as space-borne detection systems) for target cueing.

The launcher is a mobile design based on the Palletized Load System (PLS) truck, a vehicle that can hold 10 missiles and can be reloaded rapidly. It interfaces with the BM/C3I center for launch messages.⁸⁸ The missiles are "hit-to-kill" interceptors consisting of a single stage solid propellant booster with autonomous on-board navigation. The missile refines its navigation with in-flight updates from the BM/C3I.

Navy Theater Wide

NTW is an upper tier weapon designed to provide an exo-atmospheric theater ballistic missile defense capability from AEGIS equipped US Navy surface combatants. AEGIS equipped ships currently consist of the *Ticonderoga* class guided missile cruisers, and the *Arleigh Burke* class guided missile destroyers. NTW will intercept missiles either in the ascent, mid-course, or descent phase of their flight profile, depending on where the ship is positioned. The closer the ship is positioned to the threat, the more relative area that it is able to defend.⁸⁹ NTW is not designed to intercept cruise missiles.

⁸⁷ "Cohen Announces Plan to Augment Missile Defense Program," *DefenseLINK News*. On-line. Internet., 19 March 1999. Available from http://www.defenselink.mil/news/jan1999/b1201999_bt018-99.html.

⁸⁸ "Theater High Altitude Area Defense System," *BMDO Fact Sheet*. On-line. Internet, 19 March 1999. Available from <http://www.bmdo.mil/>

⁸⁹ "Navy Theater Wide Ballistic Missile Defense Program," *BMDO Fact Sheet AQ-99-03*. On-line. Internet, 19 March 1999. Available from <http://www.bmdo.mil/>, 2.

Airborne Laser

ABL is a USAF designed weapon intended for boost phase intercept. The ABL is an air refuelable, wide body aircraft based on the Boeing 747-400 airframe. It will have an on-board, passive infrared sensor operating in a 360-degree sweep, capable of autonomous detection, acquisition, and tracking of TBMs with no external cueing required, but will accept external cueing when available. The ABL will utilize a high energy, chemical laser in the multi-hundred kilowatt class.⁹⁰ ABL will be able to engage at least three targets nearly simultaneously, but only above any clouds. ABL will carry sufficient laser fuel to engage 30 to 40 targets per twelve to eighteen hour mission. It will also have some capability to intercept cruise missiles or enemy aircraft. A demonstrator aircraft should be fielded by 2002 but the ABL won't be operational until 2009.

Boost phase interception is attractive for several reasons including ease of detection and missile vulnerability during the boost phase.

All ballistic missiles, regardless of their size or range, are most vulnerable during the first minute or two after they are launched. During this phase, they are large, slow moving, and have very bright exhaust gases that are easy to detect and track using infrared sensor or even the spotted with the naked eye. In fact, during the gulf War, many US fighter pilots spotted the *Scud* missiles during their boost phase, but without adequate weaponry were unable to do anything. The vulnerability during their boost phase makes the job of targeting and destroying theater ballistic missiles much easier than trying to find and destroy their mobile transporter erector launcher.⁹¹

An additional benefit of using a laser instead of a missile is the elimination of guidance and fusing problems.

The two main limitations of ABL are range and clear weather requirements. The current unclassified laser range is estimated to be 350 km or less, meaning the ABL will need to be positioned close to, or even over, enemy territory to engage a missile in the boost phase. A 747 orbiting at 40,000' would be a lucrative target for any credible air or surface-to-air threat; therefore, at least a moderate level of air superiority would need to be achieved before this high value asset could be used. The ABL will have some

⁹⁰ Gen Ronald Fogleman, "The Air Force Role in Theater Ballistic Missile Defense."

⁹¹ "Unmanned Aerial Vehicle Boost Phase Intercept Program," *BMDO Fact Sheet TO-99-06*. On-line. Internet, 19 March 1999. Available from <http://www.bmdo.mil/>, 1.

capability for self-defense. It can detect and target SAMs, although its effectiveness in doing so is yet to be determined. It could also target aircraft, but would require a target cue and identification from an off-board source such as AWACS.⁹² Finally, ABL's infrared detection system and laser would be adversely affected by weather.

UAV Boost Phase Interceptor

The UAV BPI is a concept under consideration as a joint venture between the US and Israel. The system would include a constellation of high altitude, stealth UAVs flying deep over enemy territory, armed with kinetic kill interceptors. UAVs are attractive because of their ability to stay airborne for very long duration. The UAV BPI is being considered as either a cost-effective alternative, or a follow on, to ABL, but is years away from being fielded.⁹³

Lower Tier Weapons

Patriot

The Patriot program officially began in August 1965 with the Secretary of Defense's authorization of a concept definition, but wasn't in full production until 1982, finally achieving IOC in 1983.⁹⁴ Patriot was bought to replace HAWK and Nike, and was initially designed to intercept air-breathing threats only.

Each Patriot battery consists of a radar, an Environmental Control Station (ECS), eight launchers, and 32 missiles. The Patriot phased-array radar detects and tracks the targets and provides continuous data link with in-flight interceptors, but is only capable of searching in azimuth approximately 90 degrees. It is important to note that Patriot does not provide 360-degrees coverage and therefore suffers from a large blind zone. Patriot units try to compensate for this by overlapping radar coverage with other units, and by positioning the radars based on predictions of the enemy's likely avenues of attack.

⁹² Lt Col Dave Sullivan, AF/XORT, Telephonic interview conducted 21 Apr 1999. This is the office responsible for defining the ABL requirements (ORD).

⁹³ "Unmanned Aerial Vehicle Boost Phase Intercept Program."

⁹⁴ Richard S. Barbera, *The Patriot Missile System: a Review and analysis of Its Acquisition Process* (Monterey, California: Naval Post Graduate School, March 1994), 9.

The ECS is the central nervous system of the Patriot. The ECS computes fire control solutions, provides fire control, and a communication link with other Patriot units. It also provides the link with the battalion Information Coordination Central (ICC), required in order to communicate with other command and control systems such as AWACS.

Although a Patriot battery is capable of autonomous operations, the ICC link is normally required to meet theater identification requirements for air-breathing threats; however, ballistic missile threats can be autonomously detected, identified and engaged. Data link with other units can also provide advanced warning of inbound threats. All components are air transportable, but Patriot's airlift requirements are quite extensive.

When Patriot was first deployed to DESERT SHIELD, it had little capability to intercept ballistic missiles. About 60 Patriot launchers were deployed to protect airfields and other critical areas.⁹⁵ A modernization program known as PAC (Patriot Advanced Capabilities) was an ongoing effort intended to increase Patriot's capability versus ballistic missiles. The PAC-2 missile was months away from being operational when the decision was made by the Program Manager to speed up production. At the time of the Iraqi invasion, only three PAC-2 missiles were in the Army's inventory. By February 1991 approximately 600 PAC-2 missiles had arrived in theater.⁹⁶ As was discussed in previous chapters, the tactical success of Patriot during Desert Storm is subject to debate, but its strategic impact was considerable.

Patriot upgrades have continued since the war. The PAC-2 missile incorporates an improved fragmentation warhead as well as a dual beam fuse for quicker reaction.⁹⁷ The Guidance Enhancement Missile (GEM) uses a new Low Noise Front End (LNFE) receiver and a quicker response fuse, which makes the GEM more capable against ballistic missiles or low flying, low radar cross section cruise missiles, than its predecessor.

The PAC-3 upgrade is ongoing, and should be completed by 2001. PAC-3 includes improvements to the radar, the engagement control station, and a new missile.

⁹⁵ Ibid., 50.

⁹⁶ Ibid., 50.

⁹⁷ "Fact Sheet: Patriot Advanced Capability-3" (Ballistic Missile Defense Organization. Washington D.C), 2.

PAC-3 that gives the Patriot launch point determination capability (the ability to determine the location of the enemy launch site based on the missile's trajectory), substantial improvements against ballistic missiles, and minor improvements against cruise missiles. The PAC-3 missile use "hit-to-kill" technology and a radical departure from both PAC-2 and GEM. It was designed specifically to defend against theater ballistic missiles, including long range TBMs not previously within Patriot's capabilities. The PAC-3 missile is much smaller in diameter (10" versus 16") which increases the number of missiles per battery from 32 to 68, with three of the eight launchers equipped with 16 PAC-3 missiles each.⁹⁸ The missiles also use a Lethality Enhancer (LE) to provide increased probability of kill when facing an air-breathing or cruise missile threat. The LE is a ring of metal fragments that deploy just prior to impact to increase the kill radius of the missile. Missile maneuverability is also increased by the addition of attitude control motors.

MEADS

MEADS is a lower tier system capable of 360 degree coverage, designed to defend the ground maneuver force, and to have a significant capability against ballistic and cruise missiles using "hit-to-kill" technology.

MEADS traces its origins to the Corps SAM project of the late 1980s and early 1990s. Corps SAM, a joint Army and Marine Corps program, was intended to replace the rapidly aging HAWK air defense system that had been in service since the early 1960s. The Army and Marine Corps started the Corps SAM program in recognition of their common need to find a new air defense system against air breathing threats and short-to-medium range missiles, that could be rapidly deployed anywhere in the world. In 1995, Germany, Italy, and France signed a joint statement of intent to cooperate in the development, and the Corps SAM officially became known as the Multi-national Extended Air Defense System. France subsequently dropped out of the program and in May 1996, the remaining partners signed a memorandum of understanding to commence project definition-validation.⁹⁹

⁹⁸ Ibid.

⁹⁹" Medium Extended Air Defense System," *BMDO Fact Sheet AQ-990-11*, February 1999, 2.

Recent ballistic missile funding prioritization decisions have made the status of MEADS uncertain. MEADS was not scheduled to receive any additional funding after 1999; however, according to Lt Gen Lester Lyles, the Director of the BMDO, \$150 million dollars is being reinstated into the year 2000 budget for investigation into MEADS or a suitable replacement.¹⁰⁰ This system won't be fielded until at least 2010.

Conclusion

The US military uses counterair operations to gain air superiority in a theater of operations. Counterair operations can be divided into two categories, offensive counterair and defensive counterair. OCA attack operations are the preferred method of destruction because they minimize the enemy's initiative. However, as the US learned in Operation Crossbow and Desert Storm, detecting and targeting mobile missile systems can be very difficult. Therefore, DCA missions are designed for defense-in-depth in an attempt to thin out the threat, preferably over enemy territory. This defense is to be provided by a family of systems, each with a unique role to play.

Detection, identification, and interception of ballistic missiles, cruise missiles and UAVs is a very difficult matter. Even with a combination of attack operations, boost phase interceptors, and upper-tier interceptors, ballistic missiles can still leak through. Additionally, the TBM defensive architecture provides no additional protection against cruise missiles or UAVs. For these two reasons, point defense weapons will continue to play an important role in the future of air defense.

When we separate future systems from current systems, we are left with a very dim picture of US defensive capabilities for the next several years. Fighter and surveillance aircraft have little capability to detect and destroy cruise missiles, and no capability to destroy ballistic missiles. In fact the only current US system with the capability to destroy MRBMs is Patriot. Patriot is limited to point defense against ballistic missiles, and must be positioned very close to the asset it is defending. It has limited radar coverage, which leaves a large blind zone that could be exploited by off-

¹⁰⁰ Lt. Gen. Lester L. Lyles, Director, BMDO DoD News Briefing, Wednesday, January 20 1999 -11:20 a.m. (EST). On-line. Internet, 19 March 99. Available from http://www.defenselink.mil/news/Jan1999/t01201999_tgen.html.

axis, or multi-axis attacks. MEADS, the one SAM with a 360-degree search and destroy capability, is in danger of being cancelled.

Chapter 5

Protecting the AEF -- Problems to Overcome

As US military assets in overseas locations are further reduced, it will become incumbent upon the US military to project not only offensive forces, but defensive forces as well, including an integrated air defense system. This air defense system must be built in a layered fashion, initially providing defense of key air bases, and then expanding over the theater of operations as assets arrive into the theater. Since the USAF contains no organic assets for ballistic missile defense, it depends on the supported geographic CINC to assign Patriot for protection from these threats. The two major problems with this approach are logistical constraints, and the methodology for determining which assets will be protected, both of which can delay the deployment of ADA units into the theater.

Deploying Patriot

Patriot is not a logistically "light" asset. Designed in the late 1960s and early 1970s primarily for corps defense, its designers did not envision the need for it to be deployed very rapidly. Instead it was assumed that Patriot forces would be stationed at overseas bases, or would be deployed as part of a long build-up phase which would occur prior to an offensive ground campaign. While these assumptions were consistent with the Cold War military environment, they are no longer holding true. It is therefore necessary to devise a method to rapidly deploy Patriot units.

Patriot Airlift Requirements

Patriot battalions consist of five batteries and an ICC for command and control. Each battery, or firing unit (FU), consists of a radar, an antenna mast group (AMG), an ECS, an electronic power plant (EPP), eight launchers, and 32 missiles. Moving a single Patriot battery it requires 15 x C-5s, 23 x C-17s, or 40 x C-141s (not including transport for personnel).¹⁰¹ In order for Patriot to have roll-on-roll-off (RORO) capability it must be transported by C-5s or C-17s because of the oversize nature of its major components. If transported by C-141, many of Patriot's major components must be disassembled prior to loading and reassembled after arrival. This assembly is difficult, can take several days to accomplish, and can result in equipment that doesn't function within tolerances.¹⁰²

In order to be more logistically lean, a Patriot battery can be reduced to a minimum engagement package (MEP) which provides a minimum engagement capability (MEC). The MEP consists of the radar, AMG, ECS, EPP, two launchers, and eight missiles (deployed in the tubes). This leaves six launchers and 24 missiles from the battery behind for follow on lift to deliver. The MEP significantly reduces the airlift requirement when compared to a full battery; it can be delivered with just three C-5s and one C-141.¹⁰³ However, there are three major limitations of the MEP: reduced maintenance sustainability, the lower number of missiles, and limited command, control, and identification capability.

Because the MEP does not include the battalion ICC, the Patriot ECS cannot communicate with other command and control assets such as AWACS, or even other Patriot units. This leaves the Patriot unit to detect and identify threats autonomously, reducing the Patriot unit's ability to comply with theater identification requirements. This constraint does not limit the Patriot unit's ability to detect and identify ballistic missiles, because of their unique signature. A battalion command and control capability can be deployed with one additional C-5.

¹⁰¹ John Hill, Patriot logistics office, the Pentagon, personal interview on 15 Feb 99. Mr. Hill also provided me with Patriot logistics requirements that can be found in the appendices.

¹⁰² Anthony P. Scotto Jr., Joint Cruise Missile Defense Office, Eglin Air Force Base, Florida, Personal interview conducted on 10 May 99. This office has recently been stood up to run a joint cruise missile defense test, somewhat analogous to ASCIET's tests of Joint Engagement Zones.

¹⁰³ John Hill.

US Army Patriot Units

Patriot battalions can be divided into three categories; corps, echelon above corps (EAC), and training units. Corps ADA battalions are organic to the corps to which they are assigned, while EAC assets are assigned at the Army level, to be used for defense of key assets in the friendly rear area. Training units are used for initial training of Patriot soldiers at the Army's Air Defense Artillery School, Fort Bliss Texas. Table 10 shows how Patriot units are currently assigned.

Table 10
US Army Patriot Units

<u>Corps</u>	<i>III Corps</i> 31st ADA Brigade ➤ 1-1 ADA (P) ➤ 3-2 ADA (P)	<i>V Corps</i> 69th ADA Brigade ➤ 5-7 ADA (P) ➤ 6-52 ADA (P)	<i>XVIII Corps</i> 108th ADA Brigade ➤ 1-7 ADA (P) ➤ 2-43 ADA (P)
<u>EAC</u>	<i>Third US Army / FORSCOM (Ft Bliss)</i> 11th ADA Brigade ➤ 3-43 ADA (P) ➤ 5-52 ADA (P)	<i>Eighth US Army / FORSCOM (Ft Bliss)</i> 35th ADA Brigade ➤ 2-1 ADA (P)	<i>Eighth US Army / USFK</i> ➤ 1-43 ADA (P)
<u>Training</u>	<i>TRADOC (Ft Bliss)</i> 6th ADA Brigade ➤ 3-6 ADA (P)		

Source: Interview with John Hill Patriot logistics office, the Pentagon, 15 Feb 99.

Assigning ADA to Defend Air Bases

The geographic CINCs are ultimately responsible for force protection of the assets under their command. Because of the limited number of ADA units, and the vast number of assets that require protection, the job of matching ADA units to defensive requirements is left to the CINCs. Even though air bases receive a very high priority for defense, a lengthy process is completed before ADA units are actually assigned to defend air bases. The end result of this process is the defended asset list (DAL).

The DAL is created during peacetime when the CINCs prepare their major operational war plans (OPLANs). These OPLANs are then put on the shelf for use as a

basis for planning should a crisis arise. However rarely, if ever, does the course of action determined during crisis action planning match the OPLAN. Also, flexible deterrent options or small-scale contingencies are not a part of an OPLAN. Because there are no ADA units that are specifically "earmarked" for defense of air bases in peacetime, this "ad hoc" method must again be used during crisis action planning -- which can result in a delay in the deployment of ADA units.

Determination of the Defended Asset List (DAL)

When a contingency requiring military action arises, the Joint Forces Commander normally designates a Joint Forces Air Component Commander (JFACC) and an Area Air Defense Commander (AADC). According to Joint Pub 3-01, the JFACC normally comes from the service that provides the preponderance of air assets to the theater. The AADC is normally, "the component commander with the preponderance of air defense capability and the command, control, and communications, computers, and intelligence capability to plan, coordinate, and execute integrated air defenses."¹⁰⁴ If the JFACC comes from the USAF then the JFACC is also normally dual-hatted as the AADC, although this is not a doctrinal requirement.¹⁰⁵ If the US Navy is assigned the duties they prefer to have a separate JFACC and AADC because of the command and control capabilities inherent in their Aegis equipped ships.¹⁰⁶

The AADC is responsible for development of the Air Defense Plan (ADP). The Air Defense Plan is developed based on such factors as the threat, forces available, mutual support opportunities, and development of a layered defense. Part of the Air Defense Plan is the prioritized Defended Asset List (DAL). The DAL is the JFC's list of assets that must be defended by ADA or other means. Once the DAL is completed, then Echelon Above Corps ADA units are assigned to defend specific assets, such as air bases. The JFC can also strip a Corps of its ADA, once it is assigned to his theater of operations, if it is needed for defense of a higher priority requirement.

¹⁰⁴ Joint Pub 3-01, *Doctrine for Countering Air and Missile Threats*, (Draft), vii.

¹⁰⁵ Ibid., vii.

Problems with the Process

Problems with the DAL determination process can arise if the CINC wants to project forces to the theater before planning is completed, such as in the case when airpower is used as a flexible deterrent option (FDO). FDO's are often used early in the hostilities as a show of force, intended to intimidate the adversary by displaying the United State's resolve. The forces used as part of a FDO may deploy to the theater before a complete time-phased force deployment list (TPFDL) is developed because FDOs can be executed well before a Course of Action (COA) is finalized. The TPFDL is critical because it ensures that the forces arrive in theater in the correct order. To streamline the process, the CINC's immediate staff (normally the J3) would determine the deployment requirements.

Sequencing men and equipment into a theater can be a monumental and complex task. If forces don't arrive in to the theater in the proper sequence, then a "window of vulnerability" can develop. For example, during Desert Storm, the first forces to arrive in theater were F-15C's from Langley Air Force Base. The Patriot battalion assigned to defend their air base did not arrive until two weeks later. Although the threat was considered to be low at the time, there was a period when forces were not being properly defended. According to Gen Chuck Horner, the flow of equipment into theater was very difficult, resulting in equipment that was often scattered throughout the theater and was either lost, misplaced or improperly positioned until it was too late to use.¹⁰⁷ Anything that can be done during peacetime to make the flow of equipment into theater more efficient would be beneficial.

Under the current system of assigning ADA to air bases, even when there is a valid threat to friendly air bases, other concerns may override the need for deploying ADA units for their defense. As an example, Army ADA units were removed from the defense of Incirlik Air Base, Turkey, shortly after the Gulf War. When hostilities threatened to arise in 1997 between Syria and Turkey, no ADA units were redeployed to Incirlik, even though Syria possessed a significant ballistic missile capability.

¹⁰⁶ CAPT Daniel M. Smith, "Area Air Defense Commander Capability," Presentation to the National Fire Control Symposium, August 3, 1998. Copy of the slides is available at the Air Force Doctrine Center, Maxwell AFB, AL.

Operational tempo constraints on highly tasked ADA units, levied by senior US leadership, overrode the military requirement for air base air defense.¹⁰⁸ In fact, Patriot units were not deployed until requested by the Turkish Prime Minister, in January 1999 after Iraq made overt threats toward the Turkish government.¹⁰⁹ This is not to suggest that ops tempo concerns are unimportant, or that military leadership was taking an unnecessary risk by leaving Incirlik without ADA, but to highlight that under the current system many factors can preclude the assignment of ADA to the mission of air base air defense.

Recent exercises, such as Global Engagement '98, underscore the ramifications of these problems when they are manifested in the operational environment. During Global Engagement '98 AEF assets were deployed to the theater first, prior to their ballistic missile defenses. The ADA units were assigned to protect them, but they were not scheduled to arrive in theater until after the arrival of the AETF. The enemy exploited this vulnerability by launching preemptive missile attacks on the major air bases. The strategy was highly successful in denying the deployment of USAF airpower.¹¹⁰

The results of war games, such as GE '98, have spurred senior military leadership to question the future efficacy of our power projection capabilities. Admiral Jay Johnson, the Chief of Naval Operations expressed concern when he declared, "Over the past 10 years, it has become evident that proliferation of weapon and information technologies will enable our foes to attack the ports and airfields we need for the forward deployment of our land based force."¹¹¹ General Ronald Fogelman, the former Air Force Chief of Staff, observed that

¹⁰⁷ Gen Chuck Horner, Personal interview, 6 April 99. The buildup for Desert Storm took six months. Although the logistic support was tremendously successful, tons of equipment was either lost or misplaced.

¹⁰⁸ Interview with a senior USAF military officer directly involved in Operation Northern Watch.

¹⁰⁹ Linda D. Kozaryn, "Patriots Deploy to Turkey," *ADA Magazine* (American Forces Press Service), On-line. Internet, 7 March 99. Available from <http://147.71.210.21/adamag/turkey.htm>.

¹¹⁰ Col Thomas Bowermeister, AF Doctrine Center, Director of Doctrine Development (AFDC/DR), Personal Interview on 15 May 99. Col Bowermeister was a red team member during Global Engagement '98.

¹¹¹ Andrew F. Krepinevich, "Revolution in Military Affairs; Transformation Strategy," Testimony before the house National Security Committee Subcommittee on Military Procurement and Research and Development, October 8 1998. *ADA Magazine*. On -line. Internet, 19 March 1999. Available from <http://147.71.210.21/adamag/transfor.htm>, 4.

Saturation ballistic missile attacks against littoral forces, ports, airfield, storage facilities and staging areas could make it extremely costly to project forces into a disputed theater, much less carry out operations to defeat a well-armed aggressor. Simply the threat of such enemy missile attacks might deter US and coalition partners from responding to aggression in the first instance.¹¹²

It is clear that the future power projection capability of the USAF will depend on the ability to first establish a defensive shield, protecting assets from ballistic and cruise missile attack.

Summary

The USAF contains no organic assets for ballistic missile defense, instead it depends on Army Patriot for its protection from these threats as determined by the supported CINC and expressed in the DAL. Inefficiencies in this process, coupled with the fact that Patriot is not a logistically "light" asset, could mean that a rapidly deploying ASETF might arrive the theater prior to its supporting ADA, as happened in Desert Storm. The CINC has two options; he can either accept this "window of vulnerability" and the associated risk, or the CINC can delay the ASETF until the ADA is in place. The former option can prove fatal if the enemy employs an asymmetric denial strategy as illustrated in Global Engagement '98. The latter option means that airpower may not get to the theater as quickly as the CINC needs, a condition which could be unacceptable in times of reduced strategic warning and defeating the whole AEF concept of rapid deployment.

¹¹² Ibid., 4.

Chapter 6

History of Air Base Air Defense

[All airmen] ought to be armed with something - a rifle, a tommy-gun, a pistol, a pike, or a mace [and trained] to fight and die in defense of their airfields; ...every airfield should be a stronghold of fighting air-ground men, and not the abode of uniformed civilians in the prime of life protected by detachments of soldiers.

—Winston Churchill, May 1941

Current air and missile defense capabilities may not fully protect US, allied, and coalition forces, and other defended assets within assigned theaters of operations from air and missile attack to a level of protection required by a joint force commander. Protection is also required during initial crises and contingency responses, and forcible entry scenarios, in which US forces have a limited ability to protect US interest ashore from attack. With the exception of most recent active defense system developments, US systems have predominantly been developed to counter the manned aircraft threat. Current air and missile defense capabilities are insufficient to counter the full spectrum of anticipated threats.

—USACOM, March 1991

The Army and Air Force have a long history of budgetary debate over the joint use of critical assets, including air defense artillery. This chapter traces the evolution of the cooperation between the Army and Air Force in the area of air base air defense in order to answer four questions: Why does the Army own ADA? Why has the USAF largely discounted the importance of point defense weapons? What is the current status of Army-Air Force cooperation on air defense? Are USAF air base air defense requirements likely to be filled in the foreseeable future?

Origin of Army ADA

The Army's ADA branch traces its roots to the American Revolution and the Coast Artillery Corps, the parent of field artillery, and later air defense artillery that

debuted in World War I.¹¹³ World War I also saw the birth of disagreement between soldiers and fliers as to the importance of air base air defense.

Concerted American planning for air defense on the Western Front began in 1917, when Brig Gen James A Shipton, Chief of Anti-Aircraft Services, First U.S. Army, American Expeditionary Forces, formed an antiaircraft school in France.¹¹⁴ On March 5th, an American Army board of officers recommended AA protection of rear areas, where many of the air bases were located. Air bases however, were not included on the list of places to be defended.¹¹⁵ Lt Col Carleton V. Chapman, the only aviator on the board, objected to giving the preponderance of AA protection to ground units. He wanted more explicit planning for AA weapons deployment, and insisted on revising the list to include aerodromes. American AA was slow to arrive in the war and made little impact before the war's end.¹¹⁶

During World War II US Army AAA was a robust force. It provided air base defense for friendly assets located throughout the world and scored numerous kills at places such as Anzio, where friendly AAA downed so many enemy aircraft that the Germans were deterred from conducting daylight operations.¹¹⁷

There are also several examples in World War II in which a lack of effective air base air defense contributed to major US failures, such as the destruction of the Pacific Fleet at Pearl Harbor; the B-17s at Clark Air Base, the Philippines, in 1941; and the B-17s located at Poltava in 1944 part of Operation Frantic. Although AAA was somewhat effective against aircraft and even the V-1 "buzz bombs", it had no capability to defend against Germany's V-2 rocket attacks. Fortunately for the allies, the V-2's use was limited.¹¹⁸

Following World War II, the National Security Act of 1947, Executive Order 9877 of July 26, 1947, and the Key West and Newport agreements of 1948 defined

¹¹³ "ADA in Action," *ADA Magazine*, Summer 98, On-line. Internet, 14 April 99. Available from <http://147.71.210.21/summer98/nmd.htm>.

¹¹⁴ John F. Kreis, *Air Warfare and Air Base Air Defense 1914-1973* (Washington, D.C.: Office of Air Force History, United States Air Force, 1988), 15. This is an excellent book as a single source document for history on air base air defense in WW I, WWII, Korea, and Vietnam.

¹¹⁵ Ibid.

¹¹⁶ Ibid. 16.

¹¹⁷ "ADA in Action," *ADA Magazine*, Summer 98.

¹¹⁸ Ibid.

service roles and missions and assigned the Air Force the responsibility for conducting prompt and sustained combat operations from the air, to include air superiority, strategic warfare, air defense, and air transport.¹¹⁹ These agreements required the Air Force to furnish close combat and logistical support to the Army, however no formal agreement required the Army to provide air defense artillery support specifically to the Air Force, but instead "in accordance with joint doctrines and procedures approved by the Joint Chiefs of Staff."¹²⁰ The wording is clear evidence that the Army was to be the supported service. This also meant that ADA systems would be designed and used first and foremost for defense of ground forces.

The Birth of US SAMs

When North Korea launched its surprise invasion of the South, an anti-aircraft task force airlifted from Japan was the first American unit to arrive on the ground in Korea. The unit shot down two enemy aircraft within hours of arriving at Suwon Air Base, South Korea. This ended the contribution of AAA to the air defense mission in Korea, as the USAF quickly gained air superiority over the peninsula. As a result, AAA units shifted from air defense to ground support, and their 90mm guns were frequently used for indirect fire on contested ridgelines.¹²¹

Arguments about roles and missions that arose during the Korean War were tentatively resolved after the war by Secretary of Defense Charles E. Wilson. In a memorandum of November 26, 1956, to the Armed Forces Policy Council, Wilson recognized the importance of newly developed weapons and technology, such as surface-to-air missiles, to the service's interests. Wilson assigned to the Army responsibility for "point air defense," including "missiles designed for that function" while giving the Air Force responsibility for area air defense, including "ground-to-air missiles necessary for that function."¹²² On March 18, 1957, Wilson issued DOD directive 5160.22, which repeated the roles, missions, and definitions but also stressed the Air Force's requirement

¹¹⁹ Richard I. Wolf, *The United States Air Force Basic Documents on Roles and Mission* (Washington D.C.: Office of Air Force History, 1987), 151.

¹²⁰ *Ibid.*, 151.

¹²¹ "ADA in Action," *ADA Magazine*, Summer 98.

¹²² Richard G. Davis, *The 31 Initiatives; A Study in Air Force-Army Cooperation* (Washington D.C.: Office of Air Force History, 1987), 14.

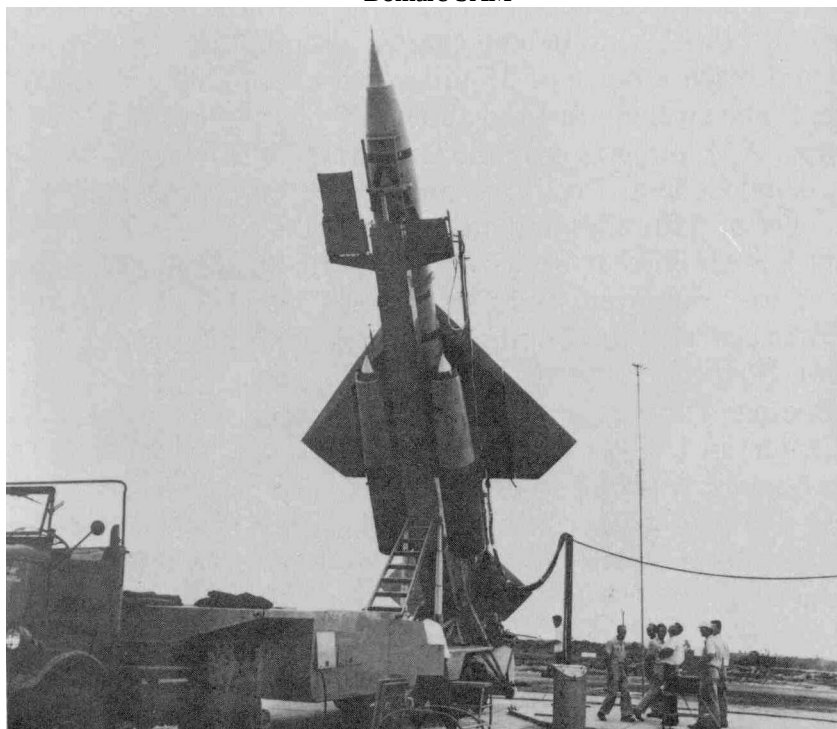
to meet Army close combat and logistical needs from the onset of hostilities, through all combat operations, and for peacetime training.¹²³ No mention was made of any Army responsibility to meet Air Force point defense requirements for defense of its air bases and assets. It was clear that the Army was to be the supported service in matters of joint "cooperation."

Driven by the fear of a perceived "bomber gap" with the Soviet Union and a corresponding belief that the United States was vulnerable to attack, the Army developed the Nike I, Nike II and the TALOS for point defense and the Air Force developed the Bomarc (Boeing, University of Michigan Aeronautical Research Center) SAM, a large, nuclear tipped missile, for area defense (Figure 4). Bomarc was essentially an unmanned aircraft capable of speeds up to Mach 2.8. In May 1959 it successfully intercepted a Regulus II target drone at 100,000 feet, 446 miles from its launch point. The Air Force built several Air Defense Missile Wings as part of the Air Defense Command (ADC). Boeing built 700 Bomarcs at a cost of \$1.6 billion.¹²⁴

¹²³ Ibid.

¹²⁴ Kenneth P. Werrell, *Archie, Flak, AAA, and SAM: A Short Operational History of Ground-Based Air Defense* (Maxwell Air Force Base, Alabama: Air University Press, 1988), 89.

Figure 4 .
Bomarc SAM



Source: Kenneth P. Werrell, *Archie, Flak, AAA, and SAM: A Short Operational History of Ground-Based Air Defense*, (Maxwell Air Force Base, Alabama: Air University Press, 1988), 89.

The Air Force unquestionably preferred offense to defense as noted by its senior leadership and reflected in its acquisitions. In 1956 Gen Earle E. Partridge, the ADC commander, stated, "we believe that the best defense is a good offense, and we believe that our primary mission in the Air Defense Command is to defend air bases from which Strategic Air Command is going to operate."¹²⁵ They did this primarily through use of air defense fighters. Gen Thomas D. White, the Air Force Chief of Staff, while testifying before congress in 1960, remarked, "of course, our philosophy is based on the fact that offense is the best defense....I am perfectly certain that....air defense could absorb the national budget, and still could not guarantee 100-percent defense."¹²⁶ The Air Force saw its mission primarily as strategic nuclear bombardment using CONUS-based bombers.

¹²⁵ John R. Carter, *Airpower and the Cult of the Offensive* (Maxwell Air Force Base, Alabama: Air University Press, October 1998), 83.

¹²⁶ *Ibid.*, 85.

When the 1961 budget debate forced the USAF to choose either the B-70 bomber or the F-108 interceptor, the B-70 won out despite the objections of the NORAD commander, Gen Laurence S. Kuter.¹²⁷ The USAF consequently paid little attention to its development of an area defense SAM that could be deployed outside the United States -- the Bomarc was to be the one and only Air Force SAM.

In 1958, the appearance of an apparent "missile gap" led to a modification of the Nike missile called the Zeus. The Nike Zeus was a point defense SAM with a nuclear warhead designed to intercept incoming ICBMs. In 1958 the new Secretary of Defense, Neil H. McElroy assigned primary responsibility for ballistic missile defense to the Army and scaled back Air Force programs such as Project Wizard, a University of Michigan antiballistic missile system designed to reach ranges of 550 miles and altitudes of 500,000 feet.¹²⁸ On July 19, 1962, a Nike Zeus missile fired from the Army's Kwajalein test facility intercepted a dummy warhead from an Atlas ICBM certifying its capability.¹²⁹

The Vietnam War Years

During the Vietnam War, the USAF relied on the Army for point defense as well as air base ground defense. As in the Korean War, the North Vietnamese all but conceded air superiority to the US over Thailand and South Vietnam. USAF operated air bases suffered no damage from enemy air attack; however, the bases did come under attack on numerous occasions from Viet Cong and North Korean standoff mortar and rocket barrages, resulting in the loss of many friendly aircraft throughout the war. A partial explanation for these defensive lapses was the relatively low priority placed on air base ground defense by the MACV commander, GEN William Westmoreland, due to a limited number of US Army soldiers.¹³⁰ Less capable South Vietnamese forces were assigned to provide the bulk of the air base ground defense, limiting the range of the perimeter that was to be swept for enemy forces. The enemy was able to launch

¹²⁷ Ibid., 78.

¹²⁸ *Missile Defense Milestones 1944-1997*, Ballistic Missile Defense Organization. Internet. On-line. Available at <http://www.acq.osd.mil/bmdo/bmdolink/html/milestone.html>. Download date 4/25/99, 2.

¹²⁹ Ibid., 3.

¹³⁰ Alan Vick, *Snakes in the Eagles Nest: A History of Ground Attacks on Air Bases* (Santa Monica, CA: RAND Corp, 1995).

successful artillery attacks from outside of the defended perimeter. Losses in Vietnam prompted Air Force leadership to question the decision to rely on the Army for defense of its air bases.

On 14 March, 1969, President Richard Nixon announced his decision to deploy a missile defense system designed to protect US ICBM fields from Soviet ICBM attack. This system retained the same missiles that were to be deployed as part of the Johnson administration's Sentinel system. The missile defense system was renamed Safeguard and included the option to someday become an area defense system designed for protection of major population centers.¹³¹

Following the Vietnam War, TAC and TRADOC continued to cooperate on many joint issues and on November 10, 1976, they signed a Memorandum of Agreement (MOA) to provide close surveillance of joint requirements.¹³² During the year they further institutionalized their ideas by establishing the Air-Land Program Offices (ALPOs) to oversee areas of mutual interest. New studies began on several areas, including joint air base defense, resulting in an Air Force compromise of a long held principle: the USAF agreed to accept preplanned deployment of personnel rather than their employment on an emergency basis.¹³³

SDI

On January 6, 1984 President Ronald Reagan signed Presidential National Security Decision Directive 119 that established the Strategic Defense Initiative (SDI) to explore the possibility of developing missile defenses as an alternative means of deterring nuclear war.¹³⁴ The technology plan developed by the Fletcher Committee was to be the general guide for initiating this program. The directive also made the Secretary of Defense responsible for the new program; significant in that it did not assign a service as the lead agent but instead a joint and civilian organization. The SDI office tested several concepts

¹³¹ *Missile Defense Milestones 1944-1997*, Ballistic Missile Defense Organization, On-line. Internet, 25 April 1999. Available at <http://www.acq.osd.mil/bmdo/bmdolink/html/milestone.html>. 4.

¹³² Richard G. Davis, *The 31 Initiatives; A Study in Air Force-Army Cooperation*, 29.

¹³³ *Ibid.*, 29.

¹³⁴ *Missile Defense Milestones 1944-1997*, Ballistic Missile Defense Organization, On-line. Internet, 25 April 1999. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html/milestone.html>. 4.

during the 1980s but finally recommend Brilliant Pebbles, a space-based, boost-phase kill system.

The 31 Initiatives

On May 22, 1984 the Chief of Staff of the Army, GEN John A. Wickham Jr., and the Chief of Staff of the Air Force, Gen Charles A. Gabriel, signed a MOA to further inter-service cooperation on the battlefield.¹³⁵ The agreement was the culmination of a decade of increasing interest in more closely coordinating war-fighting issues that affected both services. The MOA detailed 31 areas of potential joint action or conflict and provided guidance for resolving them. The resulting 31 initiatives fell into three broad categories; eliminating duplication of effort, roles and missions, and specific aspects of combat, doctrine, or funding that required close cooperation.¹³⁶

The 31 Initiatives were formulated by the Joint Force Development Group (JFDG), an ad hoc body consisting of six majors and lieutenant colonels from each service, each selected because of their joint backgrounds, and experience in tactical warfare.¹³⁷ The JFDG was given an unprecedented level of autonomy and freedom in making their assessments and were not to be constrained by "traditional service missions."¹³⁸

Three weeks after the release of the initiatives, the Chiefs established the Joint Assessment and Initiatives Office (JAIO) for the purpose of institutionalizing the cooperative process. It was to monitor the progress of the initiatives, assist in their implementation, and serve as the focal point for future joint efforts.¹³⁹ The JAIO was collocated with the Air Force's Project CHECKMATE, a special USAF planning organization that assessed the conventional war-fighting capabilities of the USSR and its allies through use of a move, counter-move approach.¹⁴⁰ Generals' Gabriel and Wickham

¹³⁵ Ibid., 2.

¹³⁶ Ibid., 2.

¹³⁷ Lt Gen Joseph Redden, Commander, Air University. Personal Interview on 10 May 1999. Lt Gen Redden (then Colonel Redden) was a key player in the 31 initiatives. According to Gen Redden, the 31 Initiatives were largely driven by a close friendship between General's Wickham and Gabriel, which allowed them to overcome parochial interests and focus on what they felt was best for the nation.

¹³⁸ Richard Davis, *The 31 Initiatives*, 3.

¹³⁹ Ibid.

¹⁴⁰ Ibid., 66.

set the objective of the JAIO as "offering new and innovative ideas and approaches to complementary force development and joint service force employment."¹⁴¹ The JAIO briefed the Chiefs quarterly to keep them abreast of the initiatives' progress and allow them to intervene if the process was lagging.

Initiatives #1, #2, #3, #4, #5, and #12 concerned USAF-Army cooperation on various aspects of the air defense of friendly forces against enemy air and missile attack. Initiative #1 and #2 dealt with surface-to-air missile systems designed for area and point defense. Initiatives #3 and #4 addressed two emerging threats to the friendly rear area: helicopters and tactical missiles. Initiative #5 suggested electronic identification methods for incorporation into friendly air defense systems, while initiative #12 recommended the cancellation of the Air Force Comfy Challenge program in favor of the Army's Air Defense Electronic Warning System (ADEWS) for the mission of ground based electronic jamming of enemy radar.¹⁴²

Initiative #1 -- Area Surface-to-Air Missiles / Air Defense Fighters

Initiative #1 consisted of three recommendations dealing with various aspects of area air defense weapon systems. First, the Air Force was to participate in the requirement and development phases of any new SAM systems, giving it a voice in what had previously been an exclusively Army domain. Second, the Air Force was to lead a joint net sensitivity analysis that would determine the proper mix of fighters and area defense SAMs. Finally, the Army was to study the feasibility and advisability of transferring responsibility for area SAMs to the Air Force, suggesting a major restructuring of forces.

This initiative was the first time that the issue of who should own area defense SAMs had been officially discussed since Secretary of Defense Wilson's memorandum in 1957. General Wickham's acceptance of this proposal surprised many members of the JFDG since a recommendation to transfer SAMs to the Air Force would mean a considerable shift of money and personnel from the Army.¹⁴³ Army commanders also questioned the decision, but Unified commanders were much more supportive.

¹⁴¹ Ibid.

¹⁴² Ibid., 109-110.

CINCLANT remarked "we should have jumped on board," and GEN Bernard W. Rogers, Supreme Allied Commander, NATO, required that his deputy chiefs of staff and key O-6s be briefed as well.¹⁴⁴

Initiative #2 -- Point Air Defense

Initiative #2 also contained three recommendations, each concerning point air defense. First, the services agreed to develop jointly and review annually a plan to resolve point air base defense requirements for USAF air bases, with the Air Force being responsible for providing the Army with a list of outstanding worldwide point air defense needs. Second, "the two services would develop a joint statement of need for future rear-area point air defense systems."¹⁴⁵ Third, the Army agreed to Air Force participation in an Army review of air defense requirements and capability at corps and echelons above corps. The first two recommendations would ensure protection of USAF.¹⁴⁶ The third recommendation allowed Air Force input into the air defense schemes of the key Army operational command, control, and communications centers on the battlefield, in order for the Air Force to better integrate with point air defense systems.¹⁴⁷

Initiatives #3 and #4 -- Countering New Threats

Initiatives #3 and #4 were intended to counter the expanding Soviet helicopter and ballistic missile threat to Europe. Both helicopters and missiles represented unique threats because of their ability to penetrate air defense systems, helicopters by their low, slow profile which made them difficult to detect and identify, and ballistic missiles because of their high speed and altitude, which made them difficult to intercept. The Army was to lead a study to determine the technical characteristics and operational implications of the future helicopter threat and then participate in fielding joint capabilities to counter that threat. The Army and the Air Force were to complete a tactical missile threat assessment and then using this assessment as a baseline, establish a

¹⁴³ Ibid., 49.

¹⁴⁴ Ibid., 45.

¹⁴⁵ Ibid., 49.

¹⁴⁶ Ibid., 49.

¹⁴⁷ Ibid.

joint anti-tactical missile program.¹⁴⁸ This program was to focus both on suppression of enemy missile launch sites as well as destruction of inbound missiles.

Initiative #5 -- IFF Systems

Initiative #5 emphasized the need for improved identification methods to enhance the effectiveness of air defense systems in the increasingly cluttered environment of the European Theater. The Air Force and the Army were tasked with developing and fielding an IFF (identification of friend or foe) system to include cooperative as well as non-cooperative methods for determining positive friendly hostile identification.

Memorandum of Understanding

To implement the initiatives, the Army and Air Force service Chiefs published a memorandum of understanding (MOU) outlining the specific responsibilities of the two services for air base air defense. The language was similar that of the 1947 Key West Agreements with one major exception. The Army was specifically assigned to organize, train and equip air defense units in accordance with doctrines established by the JCS, just as it had always done. Likewise, the Air Force was to organize, train and equip forces for air defense from land areas, and coordinate with other services on matters of joint concern. But to attain a credible worldwide air defense system, it was recognized that a concerted effort to develop complementary systems was necessary. Therefore, the Army and the Air Forces were charged with coordinating plans and programs to enhance integrated air defense -- a new concept in joint cooperation.

The Air Force and the Army established a Joint Air Base Air Defense Working Group (JABADWG) for the purpose of coordination on air defense matters. It additionally tasked the co-chairman of the working group to conduct a yearly review of service air defense programs prior to the initiation of the DoD POM cycle. This review was intended to establish agreement on specific programming actions and ensure mutual support for service and joint programs.

The End of the Initiatives

¹⁴⁸ Ibid., 108.

The 31 initiatives were truly a model for inter-service cooperation. Unfortunately, many of the initiatives did not survive after new service Chiefs were appointed.¹⁴⁹ In fact, the JAIO, the major watchdog group established to institutionalize the initiatives, and the JABADWG, the mechanism where by the USAF could give its air base air defense requirements to the Army, were disbanded by the end of 1988. This occurred as a result of a reorganization of the Air Force Staff.¹⁵⁰

The 1990s -- Back to the Future

While the 1980s may be seen as the high point in Army-Air Force cooperation, the 1990s brought two new service Chiefs, revived parochialism, and an unraveling of many of the initiatives, especially after Desert Storm.

As in Korea and Vietnam, the USAF quickly gained air superiority over Iraq in Desert Storm, this time through overwhelming offensive counter air operations, effectively eliminating the threat of conventional air attack on friendly forces. Entering Desert Storm the US had no capability to intercept tactical ballistic missiles, and little ability to effectively detect and attack launch sites, despite the same problems having occurred in World War II some 45 years earlier.

Who to blame for this apparent failure continues to be the subject of much debate. The usual argument is that the Iraqi *Scuds* were of no tactical value and their strategic impact was unforeseen. This argument assumes that CINCCENT's requirements were driving Army and Air Forces capabilities, or lack thereof. However, this discounts the importance of the European theater, where numerous Soviet tactical ballistic missiles armed with nuclear warheads had been poised to strike at NATO airfields and troop concentrations for many years. Certainly this was a bigger, and much more dangerous

¹⁴⁹ Lt Gen Redden, person interview. Once Generals Wickham and Gabriel retired, there was not enough institutional "buy in" to continue promotion of the 31 Initiatives. As a result, they were largely left to fade into anonymity.

¹⁵⁰ There is very little history of the JABADWG or the JAIO. The official History of USAF, 1986 confirms their existence. The History of HQ USAF, 1988, page 163, from a paragraph describing the Directorate of Warfighting Analysis (AF/XOC) ends with the following sentence: "On 1 July its analysis and wargaming functions transferred to XOX while its deception oversight went to XOO and the directorate was disestablished." Checkmate currently (1999) is known as AF/XOOC and has evolved into a division of the Directorate of Operations and Training. The JAIO and JABADWG no longer exist.

threat, that should have been accounted for. Why almost 10 years after the Soviets fielded tactical nuclear weapons was the only defense against these weapons deterrence?

The most likely answer to this question is twofold. First, there was an inhibition on the part of the Carter administration to overtly challenge the 1972 ABM treaty.¹⁵¹ The Reagan administration didn't share the same inhibitions, but felt there was a more compelling need to field a national missile defense system than theater defenses. SDI's priority led to a reduction in funds for research and development of more robust theater defenses. Theater defense would quickly become the priority however, after two significant events, the end of the Cold War and the success of the *Scuds* during Desert Storm.

In his State of the Union address on January 29, 1991, President George Bush formally announced the shift in focus in the SDI program to the concept known as Global Protection Against Limited Strikes (GPALS). The President said, "I have directed that the Strategic Defense Initiative program be refocused on providing protection from limited ballistic missile strikes, whatever their source. Let us pursue an SDI program that can deal with any future threat to the United States, to our forces overseas and to our friends and allies."¹⁵² His statement gained a sense of urgency when on February 25th a *Scud* missile struck a barracks housing Army reservists at Dhahran, killing 28 US soldiers.

The shift in priorities was completed in 1993 when Secretary of Defense Les Aspin announced that the SDIO was re-designated as the Ballistic Missile Defense Office (BMDO) and its first priority was theater ballistic missile defense, followed by national missile defense.¹⁵³ A Bottom Up Review (BUR) completed in September 1993 laid out the three primary systems for missile defense: improvements to Patriot, a modification to the Navy's Aegis system, and a new SAM known as the Theater High Altitude Area Defense (THAAD), the nation's first area defense SAM since the Air Force's Bomarc.¹⁵⁴

¹⁵¹ Lt Col Pete Hayes, Personal Interview conducted 4 May 1999. Lt Col Hayes is professor of Comparative Military Studies at the School of Advanced Airpower Studies (SAAS), Maxwell AFB, AL. He is also a subject matter expert on US counterproliferation initiatives.

¹⁵² *Missile Defense Milestones 1944-1999*, 12.

¹⁵³ *Ibid.*, 14.

¹⁵⁴ "Ballistic Missile Defense: A Brief History," Ballistic Missile Defense Organization, On-line. Internet, 19 March 1999. Available from <http://www.acq.osd.mil/bmdo/bmdolink/html/origins.html>. 4.

The BUR also concluded that the Army was to be the service responsible for fielding THAAD.

In the mid 1990s, the Army gradually retired its HAWK missile system from active duty. The lack of official opposition by the Air Force was noteworthy because HAWK was the only operational SAM with a 360-degree capability and Corps SAM, its scheduled replacement, was years from being fielded. Also noteworthy was the lack of public support by the Air Force for the Corps SAM (now known as MEADS), especially when the DoD removed its funding in 1998. MEADS has recently been revived but will not be operational until well into the next decade, if at all.

In October 1994, two months prior to his retirement, Air Force Chief of Staff Gen Merrill A. McPeak gave a controversial speech to the Heritage Foundation on service roles and missions.¹⁵⁵ McPeak suggested several modifications to current service structures including the cancellation of the Army's deep attack missile (ATACMS), the withdrawal of the Air Force from the close air support mission (CAS) and the transfer of Army theater air defenses to the Air Force. General McPeak acknowledged that he had, "violated one of the cardinal rules of civil discourse within the Pentagon by questioning the need for a system being fielded by another service."¹⁵⁶ General McPeak went on to state that

...each service has an inherent right to self defense, but over time, the exercise of this right has led to significant overlap in capabilities and to the world's most *disintegrated* air defense system. As a result, we are spending a lot more for theater air defense than we need to and, even so, cannot be confident that our air defenses will be effective.¹⁵⁷

The basis for McPeak's argument came from his notion of the four divisions of the battlespace: the rear battle, the close battle, the deep battle, and the high battle. According to McPeak, this division of the battlespace stems from the core competencies of each of the services, what they do best and bring to the joint fight. McPeak felt that air component commander was uniquely suited to fight the high and deep battles while the ground commander was suited for the rear and close battles. The significance of these

¹⁵⁵ John T. Correll, "Roles and Missions Ride Again," *Air Force Magazine*, February 1995. 10.

¹⁵⁶ *Ibid.*

¹⁵⁷ *Ibid.*, 11.

competencies was that "how you allocate combat roles and support functions among the services should relate to how we fight on the battlefield."¹⁵⁸

Gen McPeak's remarks further widened the chasm in Air Force and Army relations. Several Army officers were quick to respond to the remarks, with controversial remarks of their own. GEN Frederick J. Kroesen, USA (Ret.), senior fellow at the Institute of Land Warfare, wrote to the *Washington Post*, "The crux of the matter is that Gen Merrill McPeak and many of his mentors, followers, and supporters believe that the Air Force can win wars, that firepower from the air will drive an enemy into submission."¹⁵⁹ Lt. Gen. Jay M. Garner of the US Space Command added that, "airpower contributes at the margins" in battle and the air forces and navies are merely "add-ons" to armies, which are "the foundation of nearly all national military forces."¹⁶⁰

When Gen Fogelman replaced McPeak, he was quick to capitulate on these positions in order to promote harmony among the services, even though he generally thought McPeak was right concerning air defenses. He told the Commission on Roles and Missions on December 14, 1994 that the Air Force would prefer to work the air defense integration problem "under existing ownership arrangements" thus ending, at least temporarily, the debate over which service should own ADA.¹⁶¹

JADO-JEZ / ASCIET

In the early 1990s a Joint Requirements Oversight Council (JROC) established the Joint Air Defense Operations/Joint Engagement Zone (JADO-JEZ) organization for the purpose of determining the current state of Army and Air Force interoperability in the area of air defense. The JADO-JEZ office conducted a series of tests to investigate the feasibility of a Joint Engagement Zone consisting of US Army HAWK and Patriot units as well as USAF fighters. The tests took place on the aerial test ranges located north of Nellis Air Force Base, Nevada. The JEZ did not work well, primarily due to identification problems stemming from both systems limitations and lack of joint training. The final report went on to recommend the immediate acquisition of new

¹⁵⁸ Ibid.,

¹⁵⁹ Ibid., 12.

¹⁶⁰ Ibid., 10.

¹⁶¹ Ibid.

identification systems for Patriot and the deployment of Army ADA to Air Force exercises such as Red Flag.

Following these tests, the JADO / JEZ office was re-designated the All Services Combat Identification and Evaluation Team (ASCIET). ASCIET was tasked to investigate problems and offer solutions to the combat identification problems that existed in all services, especially in joint operations. Recent tests have concluded that many of Patriot's problems have still not been addressed and to this day the Air Force and Army still do not operate a Joint Engagement Zone. It is important to remember that the 31 initiatives, authored 15 years earlier, recommended adoption of these same identification systems and training methods.

Joint Theater Air and Missile Defense Organization (JTAMDO)

In January 1997 the department of defense stood up a new office to "represent the services and Warfighting Combatant Command requirements and act as their proponent for Theater Air and Missile Defense."¹⁶² JTAMDO's mission is to define the joint requirements and operational concepts to ensure the joint development and fielding of an integrated theater air and missile defense capability.

JTAMDO has lofty goals. It hopes to coordinate the development of a robust integrated air defense system capable of defeating all air or missile threats. It focuses on five concepts; a single integrated air picture (SIAP), a joint collaborative planning and engagement capability, combat identification, automated decision aids, and attack operations. The end product is to be an IADS that is fully interoperable, uses a common picture to allow a theater-wide JEZ, with decision aids that help select the best weapon for each target.

"JTAMDO, BMDO, the services, and the CINCs communicate via a Working-level Integrated Product Team (WIPT) process, also know as the JTAMDO process."¹⁶³ Through this process, the participants hope to develop the operational concepts, advanced technologies, organizational architectures, and doctrine necessary to turn the vision into reality by 2010. The presence of the JTAMDO does not alter service responsibilities for

¹⁶² "JTAMDO; Joint Theater Air and Missile Defense Organization," pamphlet available from the JTAMDO office. No date, 1.

theater area missile defense program execution and resource management. The JTAMDO has no authority to direct what a service should or should not procure; instead it exists to help coordinate efforts.

Summary

The US Army ADA first came into service as an evolution from the Army's Coastal Artillery Corps. In World War II ground commanders came to rely on AAA and saw it as critical for the organic air defense of their ground forces, a view that holds today, even though no US soldier has been killed by enemy air attack since World War II.

The USAF has largely discounted ADA's importance because it has been so successful in gaining air superiority through offensive means in all conflicts since World War II. The offensive nature of airpower has led the Air Force to traditionally focus on the purchase and employment of offensive weapons, the Bomarc SAM being the only Air Force area defense weapon until the Airborne Laser. US aircraft were vulnerable to attack by threats that could not be negated by aircraft on three occasions; German V-2 missile attacks, Viet Cong rocket and mortar attacks, and Iraqi *Scud* attacks.

The Air Force view towards ADA began to change in the late 1970s, coinciding with the fielding of Soviet tactical nuclear weapons, threatening air bases in Europe. This renewed interest in ADA was expressed in the 31 Initiatives, the zenith of Army-Air Force cooperation. The Air Force sought for the first time to define its air base air defense requirements to the Army and also to participate for the first time in the development of any new surface to air weapons, through a formal process known as the Joint Air Base Air Defense Working Group.

The current status of Air Force and Army capabilities for air base air defense against ballistic missile or cruise missile attacks is marginal. The Army's Patriot is logistically heavy, does not provide 360-degree coverage, and has limited identification systems. The Air Force and Army do little day-to-day training on integration of air defense, and the Army and Air Force still cannot effectively operate a Joint Engagement Zone. The watchdog groups of the 31 Initiatives did not survive the 1980s, eliminating the avenues the Air Force had to deliver its requirements or make inputs into the

¹⁶³ Ibid., 4.

development of new systems. The prospect of ABL has once again led Air Force leadership to discount the need for point defenses, demonstrated by the lack of public service response to the retirement of HAWK and the initial cancellation of MEADS.

Chapter 7

Defending the AEF-- A Joint Solution

*The principal objective of an integrated air and missile defense is force protection. Clearly this can best be achieved through technical interoperability supported by non-material means.*¹⁶⁴

To make the "family of systems" viable, it must be capable of rapid deployment to a theater of operations. Land-based airpower offers the CINC the most rapid and robust offensive firepower, but it must survive in order to operate. The AEF must therefore expand beyond a "blue only" initiative to present the CINC with forces capable of "full dimensional protection," a pillar of Joint Vision 2010. The solution consists of two steps, both involving a high degree of cooperation between the Army and the Air Force. They are:

- 1) Incorporating Army ADA into the AEF. ADA should be added to the bucket of forces available for deployment as an "enabler."
- 2) Formal participation by the Air Force in the development of new air defense systems for air base air defense that are more expeditionary.

Inter-service cooperation begins with the recognition that it is in everyone's interest. Point defense assets will be more important to the Air Force as the threat of ballistic and cruise missile attack increases, even with the procurement of ABL. A secure air base is a prerequisite for Army deployments, so it is in their interest to ensure that one exists. Finally, the CINCs would realize benefits from efficiencies gained through peacetime force packaging -- forces would arrive more quickly, better integrated, and capable of defending themselves.

The Carrier Battle Group and the MAGTF as Models

¹⁶⁴ "Mission Need Statement for Joint Theater Air and Missile Defense," USACOM Final Draft March 1999, 4.

The Navy Carrier Battle Group (CVBG) and the Marine Air Ground Task Force (MAGTF) are excellent examples of forces tailored to meet the CINC's needs, and capable of self-protection. The CINC does not need to arrange for defensive assets in an "ad hoc" fashion because they are organic to it these units. In fact no one would think of deploying a carrier into a theater of operations without its full defensive suite of cruisers and destroyers. Yet land-based airpower must rely on the CINC to assign defensive assets when deploying to a foreign air base.

The AEF is not intended to replace a carrier battle group. A carrier battle group offers forward "presence." However, the deployment of land based air power to a region is generally seen as an escalation in the show of force because of its superior, sustained firepower. Additionally, an ASETF has the ability to reach areas where a carrier task force cannot, or it can fill a gap if no carrier is available.

Making ADA Organic to the AEF

When a military service is dependent on a system or capability to successfully conduct its missions, it naturally wants to "own" that system. For example, the Navy has long coveted the Air Force's tankers, the Army would like more airlift and CAS, and the Air Force would like to control all assets that contribute to the counterair mission, including SAMs. However, with a limited budget "sharing" is normally a reality and inter-service trust must prevail, such is the case with ADA.

In the near term Patriot will provide the only US military capability to intercept ballistic missiles. Assigning ADA units to AEFs would result in several benefits: it would guarantee that ADA units are available for air base air defense, it would ensure the proper sequence of assets into the theater, and it would result in more peacetime training and integration of USAF and Army air defense forces.

Assumptions

This solution is based on the validity of two assumptions. First, land based air power will be the power projection force of choice early in future conflicts. Sufficient historical evidence exists in the 1990s alone to suggest that it will be. Second, the CINC will want his airpower defended; air bases will be a high enough priority in a conflict to

warrant the assignment of ADA. It is difficult to imagine a scenario with an aircraft or missile threat in which the CINC would not assign ADA to defend air bases. Therefore, assigning ADA to an AEF in peacetime merely allows for better logistical coordination and interoperability during a crisis.

Scheduling

One Patriot battery could provide adequate defense for one air base from ballistic missile attack against a minor threat, such as Iraq. If requirements were greater than this, then deployment of forces would be slower, probably as part of an OPLAN rather than a FDO. One Patriot battery should be assigned to each of the AEWs, and one or two batteries should be assigned to each of the AEFs. If there are insufficient ADA batteries to meet these requirements, then at a minimum the two "on call" AEFs should get them.

Patriot is a low density, high demand assets; therefore, scheduling of ADA should be left to the Army. For the maximum interoperability benefit, the Army would attach specific batteries to the AEFs and AEWs and schedule their rotation with the AEF rotation. This would allow for joint training opportunities during exercises such as Red Flag or Roving Sands. There are currently 20 total EAC Patriot batteries, and 30 Corps ADA batteries. There are two EAC ADA brigades located at Fort Bliss, Texas, and one EAC Brigade located in Korea. Each of these brigades contains two battalions and each battalion contains five batteries.

Deployment of the ASETF

A Patriot battery would need to structure its deployment so that a MEP deployed first. The MEP would deploy and establish an air defense umbrella within 48 hours of notification. The rest of the battery would deploy within 7 days. An "on-call" battery would tailor its deployment package based on the expected threat, made easier because its mission was pre-determined, and because it would know the defensive counter air capability contained within the AEF. The MEP might also contain a battalion ICC if the expected enemy had a significant air or cruise missile capability, allowing the MEP to communicate with AWACS. If Patriot was deploying for the purpose of ballistic missile defense only, then the ICC would still be desired, but not required.

Command and Control

Assigning ADA units to AEFs would not mean that the Air Force would have peacetime command and control over them. The AEF Lead Wing commander would have coordinating authority, similar to the relationship he has with the other AEF assets. This authority would allow him to know who his attached ADA was, coordinate peacetime scheduling to enhance the probability of joint training, determine their deployment requirements to better coordinate logistics, and build a peacetime rapport with the ADA units.

The Lead Wing-ADA relationship would end once an ASETF was formed and deployed. The battery would then come under the COCOM of the supported CINC, and the OPCON of the AAMDC, with the AADC having Coordinating Authority. If there were not an initial AAMDC, as would likely be the case if an ASETF were used for a flexible deterrent option, then the AADC would have OPCON. If there were not yet a designated AADC, then the CINC would retain OPCON.

Implementing This Plan

When AEF scheduling begins in 2000, forces currently deployed to contingency operations such as Turkey and Saudi Arabia will be designated as the two AEFs and their Patriot units would simply become "attached." A Patriot battery would need to be assigned to each of the two stateside AEWs to fill the requirement. Because of the high demand on Patriot units, one for one assignment of batteries to AEFs may not be currently possible. In fact, the Army is currently detaching Corps ADA to fill EAC requirements, such as in Turkey. The bottom line is that the Army would still be responsible for the scheduling of its assets, but it would earmark units to a specific AEF. The closer it could follow the AEF schedule, the better. When forces eventually return from deployed locations, and redeployment once again becomes an issue, the AEF process would already be in-place.

Development of New Air Defense Systems

The Air Force has no official role in defining its requirements to the Army for air base air defense, and has no participation in the development of SAMs for that mission. There is no Operational Requirements Document (ORD) for a system designed solely for air bases air defense. If the Air Force were to design a SAM specifically for this mission, it would certainly look quite different than Patriot. A premium would be placed on ease of deployment, 360-degree coverage, interoperability with USAF systems, and ability to intercept ballistic and cruise missiles. Such a system would not require a tracked vehicle.

While tracked vehicles have the advantage of superior cross-country mobility and can work with armored and mechanized units, they are more expensive to procure, operate, and maintain, and have less strategic mobility.¹⁶⁵

It may not be possible for one light SAM system to be capable of both ballistic missile and cruise missile defense. The answer may be to develop entirely new systems, or create lighter derivatives of current systems. Without a formal venue for the Air Force to voice its air base air defense requirements, it is doubtful that such systems will be developed.

Designing "Lighter" SAMS

JTAMDO is currently exploring air defense systems that are logistically lighter than Patriot is. The impetus for these developments comes from the Army, to support its Force XXI and Army After Next vision, as well from as the Marine Corps, which is currently without point defenses since the retirement of HAWK. Two systems under consideration are a 5-ton truck version of Patriot (compared to the current 10-ton vehicle), and the HUMRAAM, a jeep mounted AMRAAM intended for defense against aircraft and cruise missiles.

The 5 ton chassis is half the size and weight of the current Patriot vehicle (33,750 pounds versus 80,830 pounds). The vehicle is compatible with PAC-3, THAAD, or MEADS, and can be transported by C-130.¹⁶⁶ The Marine Corps Complementary Low

¹⁶⁵ Christopher F. Foss, "Moving Targets," *Jane's Defense Weekly*, 20 January 1999, Volume 31, Issue 3, 28.

¹⁶⁶ COL Barry Ford, USMC, "5-Ton MTV Chassis," (JTAMDO TAMD Requirements & CINC Liaison, 10 May 1999). 1.

Altitude Air Defense Weapons (CLAWS) ORD defines a requirement for a low altitude weapon system optimized for defense against cruise missile, air breathing threats and UAVs. A short-term solution under investigation is the HUMRAAM.¹⁶⁷

Examining Foreign Systems

Several foreign militaries have already recognized the need for air base air defense systems that are more easily deployed, and are developing them based on either wheel mounted, or shelter mounted designs.

The French Army, for example, "has already received 20 Euromissile shelter-based Roland SAM systems mounted on a semi-trailer towed by a 6 x 6 tractor truck and, later this year, Germany will take delivery of 10 similar systems carried on a 6 x 6 chassis for use by its rapid-reaction forces. The shelter can be rapidly loaded into transport aircraft."¹⁶⁸

In both cases, Roland systems previously used on a tracked chassis have been repackaged for the new mission.

Will ABL, THAAD, and NTW Solve the Problem?

Area defense weapons will certainly increase the effectiveness of rear area defense, but they will not eliminate the need for point defense of an air base. An area defense system will also need be easily deployed, or in-place at the time of hostilities for it to be relevant to the fight.

ABL appears to offer the best potential for an AEF because of its ease and speed of deployment but its maximum employment range is limited. Improvements in laser optics may lead to an increased maximum range by the time ABL becomes operational. However, even if the laser's range is increased, it is possible that the curvature of the earth may limit ABL's line-of-sight to a target in the boost phase, and therefore prevent it from employing at its maximum range.

If a carrier task force is already in place, then NTW might offer a better solution during the initial stage of the war. NTW wouldn't help if the conflict occurred in a region

¹⁶⁷ COL Barry Ford, Memorandum for Record, subject: Maneuver Force Protection Technology VTC.

¹⁶⁸ Christopher F. Foss, "Moving Targets," 28.

without littoral areas within range of the threat, or if there wasn't a CVBG currently operating in the theater.

THAAD is even larger than Patriot is and it therefore may be too logistically heavy to be of value early in a conflict. If ABL and NTW prove viable, THAAD might best be relegated to foreign military sales in order to ensure our allies have ballistic missile defenses in place should they be needed. Finally, it is important to remember that none of these area defense systems are designed to engage cruise missiles. Even if an area defense weapon solved the problem of ballistic missile attack, point defense of air bases would still be required.

Required Joint Agreements

For the two solutions offered in this chapter to be successfully implemented, the services should look to the past and restore the recommendations of the 31 Initiatives. Then, the Secretary of Defense should formalize the cooperation by issuing a DoD directive.

Army-Air Force Cooperation

First, there should be a Joint Air Base Air Defense Working Group established to resolve key issues such as Air Force world-wide air base air defense requirements, AEF scheduling, ASETF logistics flow, command and control relationships, and coordination with USAF Security Forces for protection of ADA located on air bases. This JABADWG should meet on a recurring basis, perhaps semi-annually. Next, the services should practice rapid ASETF deployments by participating together in exercises such as Red Flag and ROVING SANDS. Finally, the service Chiefs should sign a memorandum of agreement, detailing the relationship, and formally coordinating with the Joint Staff and the geographic CINCs.

DoD Directives

The dissolution of the JABADWG and the JAIO in the late 1980s underscores the potential vulnerability of ad hoc organizations to survival once a new service chief takes the helm. The only way to ensure long lasting cooperation between the Air Force and the

Army is with a DoD directive, perhaps formulated as part of the tri-annual Committee on Roles and Missions. A good example of such an agreement is DoD directive 5160.22, dated March 18, 1957, which makes the Air Force responsible to the Army for providing CAS and logistical support and states that a significant portion of the Air Force's funding should be used to support the Army. The new directive would make the Army responsible for ensuring that the Air Force has sufficient ADA capability for the full spectrum of activities, from peacetime training to hostilities. The Air Force would be responsible for determining its ADA requirements and providing them to the Army. The Air Force would directly participate with the Army in the development of new SAMs designed for air base air defense.

Overcoming Bureaucratic Resistance

The primary resistance to this plan would most likely come from bureaucratic politics within the services themselves. The Air Force desires a "blue only" approach so that it is not dependent on another service to make it "expeditionary." While this approach may make the AEF concept easier to implement, it does not ensure full dimensional protection of its assets; therefore, the concept might not meet the CINCs needs.

The proposed DoD directive would recognize the fact that the Air Force should be the supported service *for the initial phases of a campaign*. According to the roles and missions statements, the Army has always been the supported service in areas of Army-Air Force "cooperation." But over the last 50 years, air superiority has become a prerequisite to the conduct of a ground campaign. In fact, no US soldier has died from enemy aircraft attack since 1944. Because ADA may be most important early in a conflict, then two of its most important traits should be its ease of deployment and interoperability with Air Force systems. By changing the acquisition requirements to reflect the way that the United States fights wars, defensive systems can be procured that ensure air bases are quickly and adequately protected.

An Alternative Solution

More than 50 years after the roles and missions agreements established the Army as the service responsible for ADA, Air Force and Army defensive systems still cannot adequately operate together. In fact, "the CINCUSACOM/BMDO-sponsored Flag and General Officer TMD Workshop held during August 1998 identified *interoperability* as the single most pressing need for effective air and missile defense."¹⁶⁹

USAF Owned ADA

Many in the Air Force suggest that the problem of interoperability between air defense systems is best solved by moving ADA to the Air Force. One can only speculate that if the Air Force had developed Patriot it would be more compatible with USAF fighters, and a JEZ would be a standard operating procedure.

The US Army ownership of ADA began in World War I because AAA was a derivative of surface-to-surface artillery and because the Air Force was not yet an independent service. The US Army kept ADA after the USAF became independent because a lack of trust between the two services and a general disdain by airmen of purely defensive systems.

Integrating AAA into the overall counterair mission was relatively simple in World War II, because AAA itself was simple. Close integration with USAF aircraft was not required for the overall success of counterair objectives, although there were several instances of fratricide in World War II when integration broke down. For the most part, the reliance on visual identification and the short employment ranges of AAA, kept it isolated from the larger air war. Today, however, SAMs are capable of exo-atmospheric ranges and often depend on off-board systems, including USAF airborne and spaceborne sensors, for target cues.

For mobile ADA to be fully integrated, it must also be coordinated with the ground commanders. If "blue-suiters" were operating the ADA, it would still remain organic to the Army's ground units, and little would change in the way of command and control except within the ADA unit itself. The most appropriate USAF career field to integrate with USAF owned ADA would be "air battle management." This career field

¹⁶⁹"Mission Need Statement for Joint Theater Air and Missile Defense," USACOM Draft, March 1999, 4.

currently consists of senior directors that control counterair operations aboard AWACS. These operators train with USAF pilots on a daily basis and have a thorough understanding of air traffic control, counterair operations, and the air and missile threat. It is easy to foresee the importance of a fully integrated air defense system in future conflicts-- USAF ownership of ADA may be the best way make it a reality.

If the USAF were to take over ADA today, it would not be unprecedented. Britain had a special air force regiment for providing point defense of air bases, and the German and Israeli air forces continue to provide their militaries with well-integrated air defense artillery in support of both their ground and air commanders.

Should the USAF Own ADA?

Although the argument for the Air Force to take over ADA is logical, it may not be practical for two major reasons. First, the benefits may not be worth the costs in terms of dollars, personnel turbulence, and inter-service harmony. Over the last 50 years, ADA has become so imbedded within the Army that removing it is probably unrealistic. Second, there is no guarantee that the Air Force would be a good steward of ADA. During Air Force budget deliberations, ADA would likely be cut before any aircraft or space systems, which could potentially leave the Army ground commanders without their organic air defenses. Therefore, if the Air Force was to takeover ADA it would be necessary to codify the Army's ADA requirements in a DoD directive, similar to the way that CAS is, because of the Air Force's demonstrated ambivalence toward ground- based defenses.

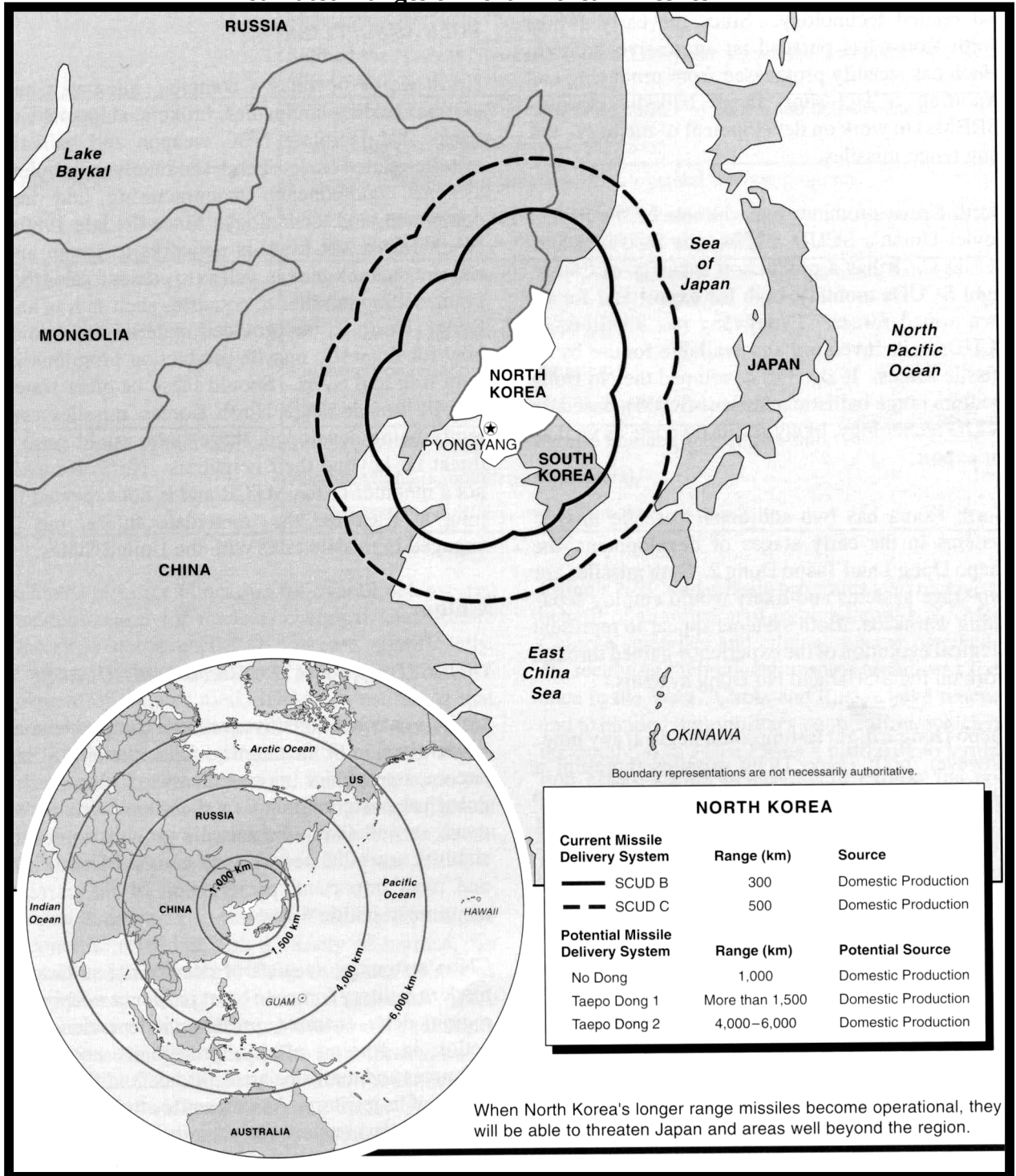
Conclusion

The best way for the Air Force to present its forces to the CINC is similar to a carrier battle group; a combination of offensive forces with organic defenses. Assigning Patriot batteries to AEFs will guarantee more coordination in peacetime and better interoperability in wartime. Both the Army and the Air Force must recognize the need for this level of cooperation and take positive action to carry it out; first through a JABADWG, then peacetime exercises, and finally formal coordination via a MOA. This solution will only have staying power if it is incorporated into a DoD directive that makes

the Army responsible for meeting USAF air base air defense requirements and allows the Air Force to participate in the development of any new SAM.

Appendix A

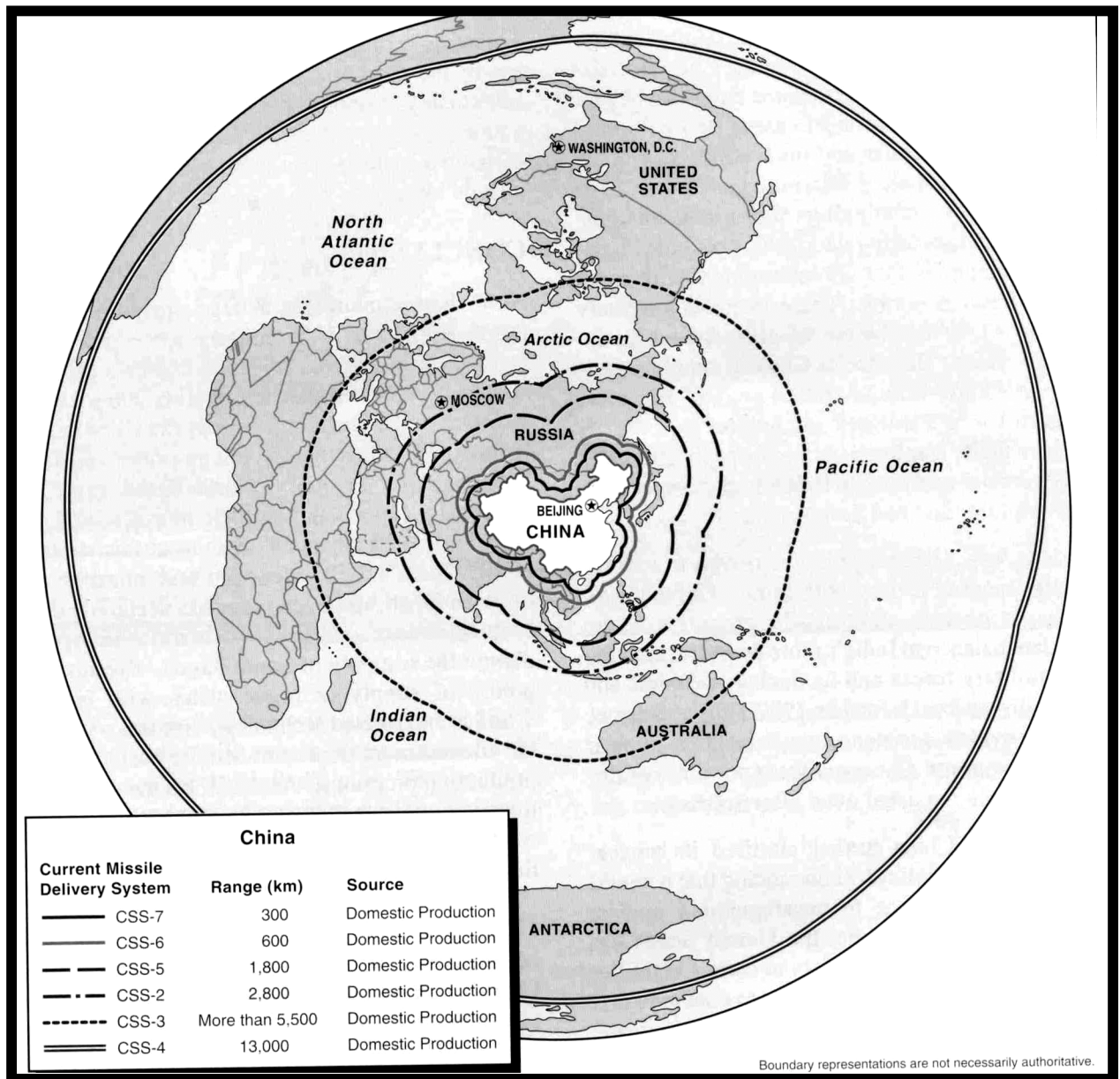
Estimated Ranges of North Korean Missiles



Source: *PROLIFERATION: THREAT AND RESPONSE*, Office of the Secretary of Defense, November 1997, 11.

Appendix B

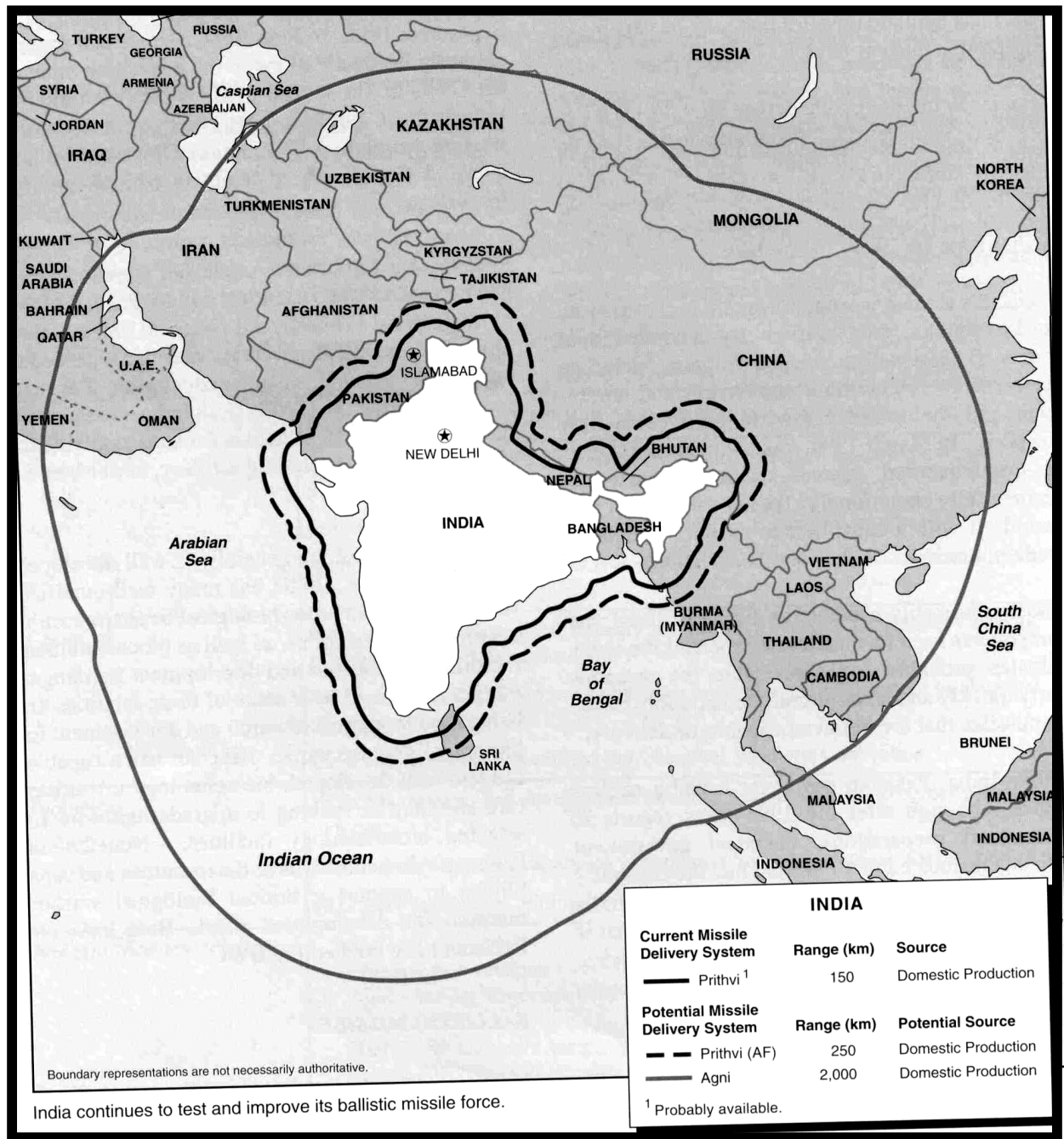
Estimated Ranges of Current Chinese Ballistic Missiles



Source: *PROLIFERATION: THREAT AND RESPONSE*, Office of the Secretary of Defense, November 1997, 11.

Appendix C

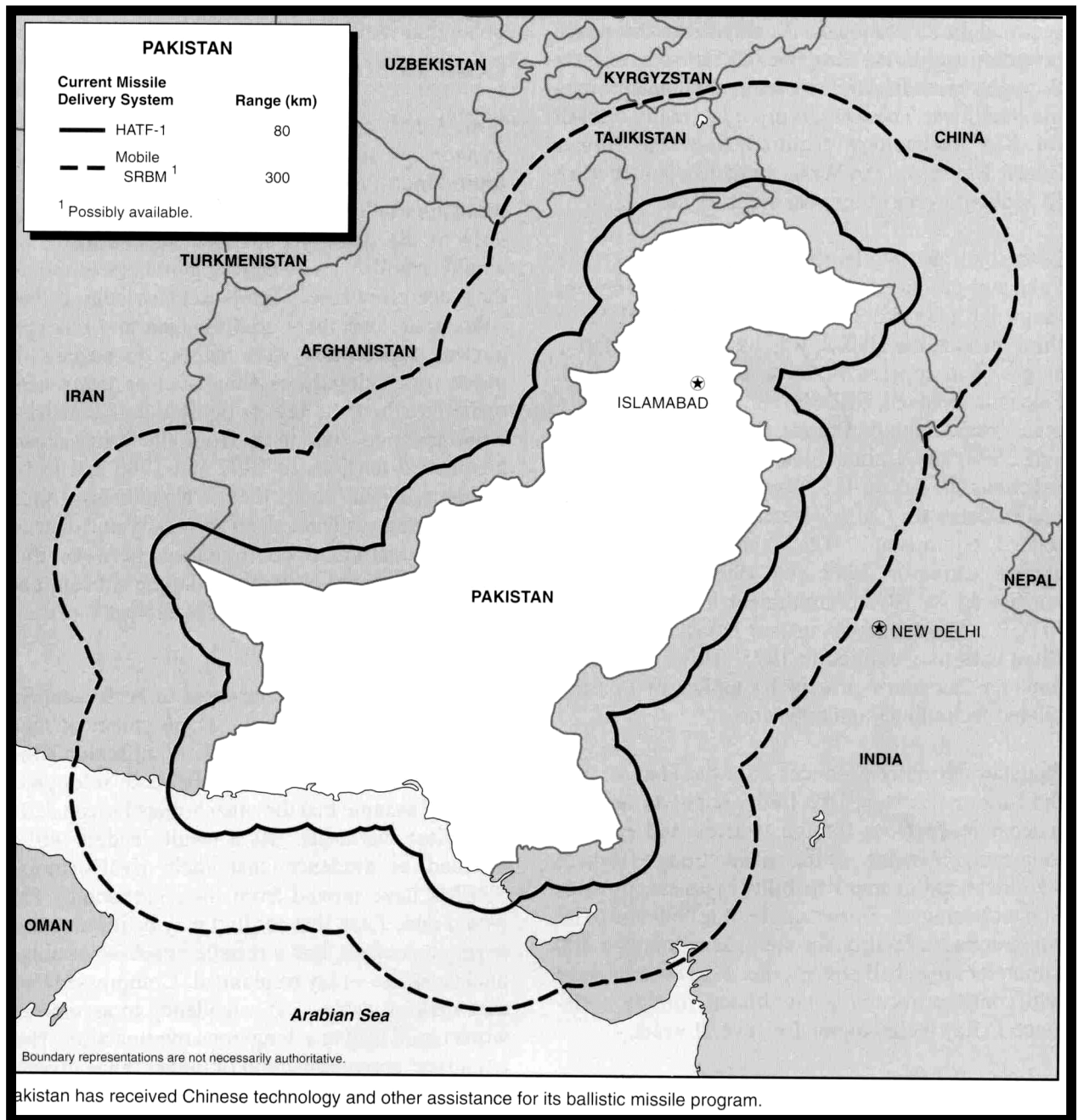
Estimated Ranges of Current and Potential Indian Ballistic Missiles



Source: *PROLIFERATION: THREAT AND RESPONSE*, Office of the Secretary of Defense, November 1997, 18.

Appendix D

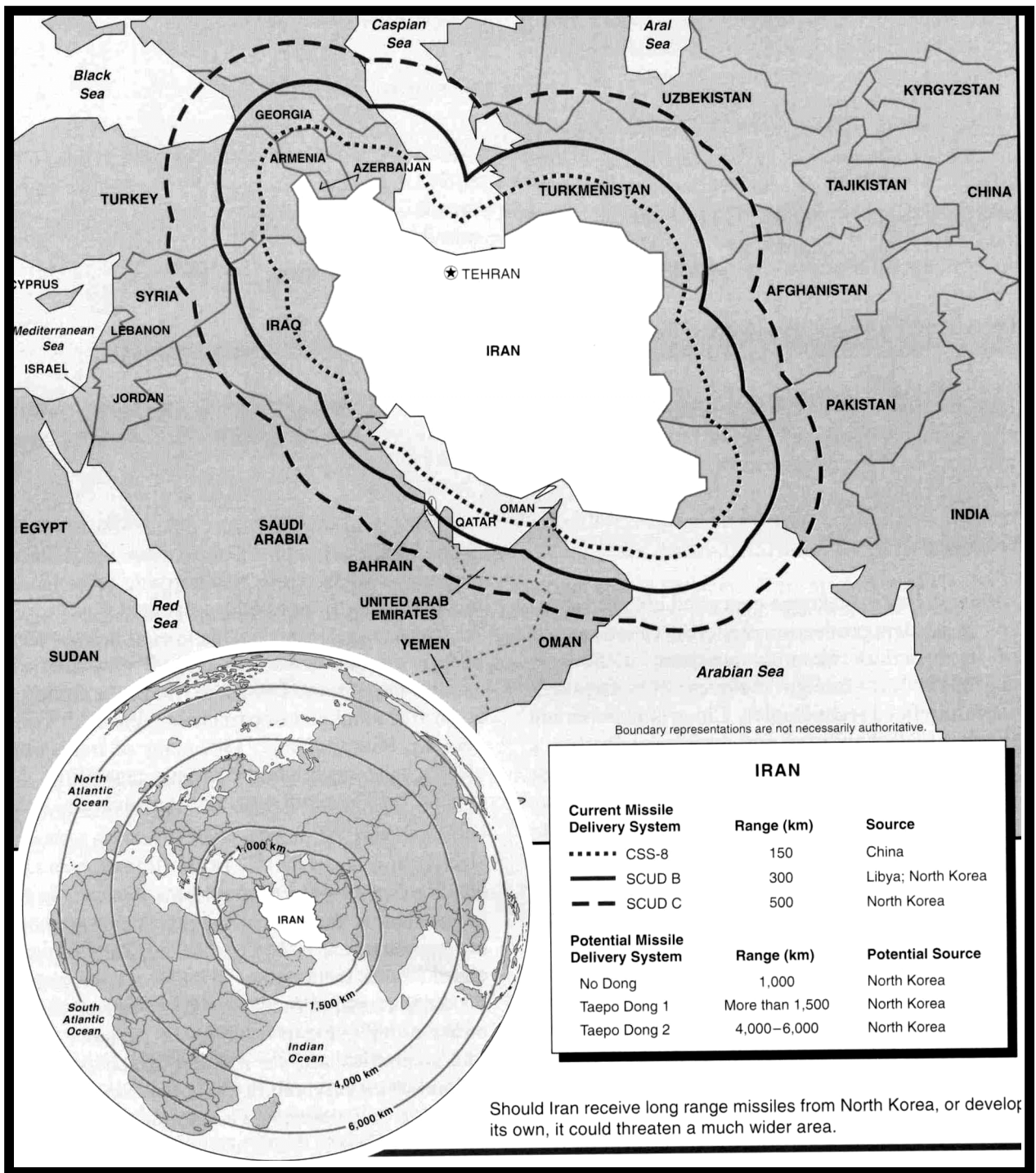
Estimated Ranges of Current Pakistani Ballistic Missiles



Appendix E

Estimated Ranges of Current and Potential Iranian Ballistic Missiles

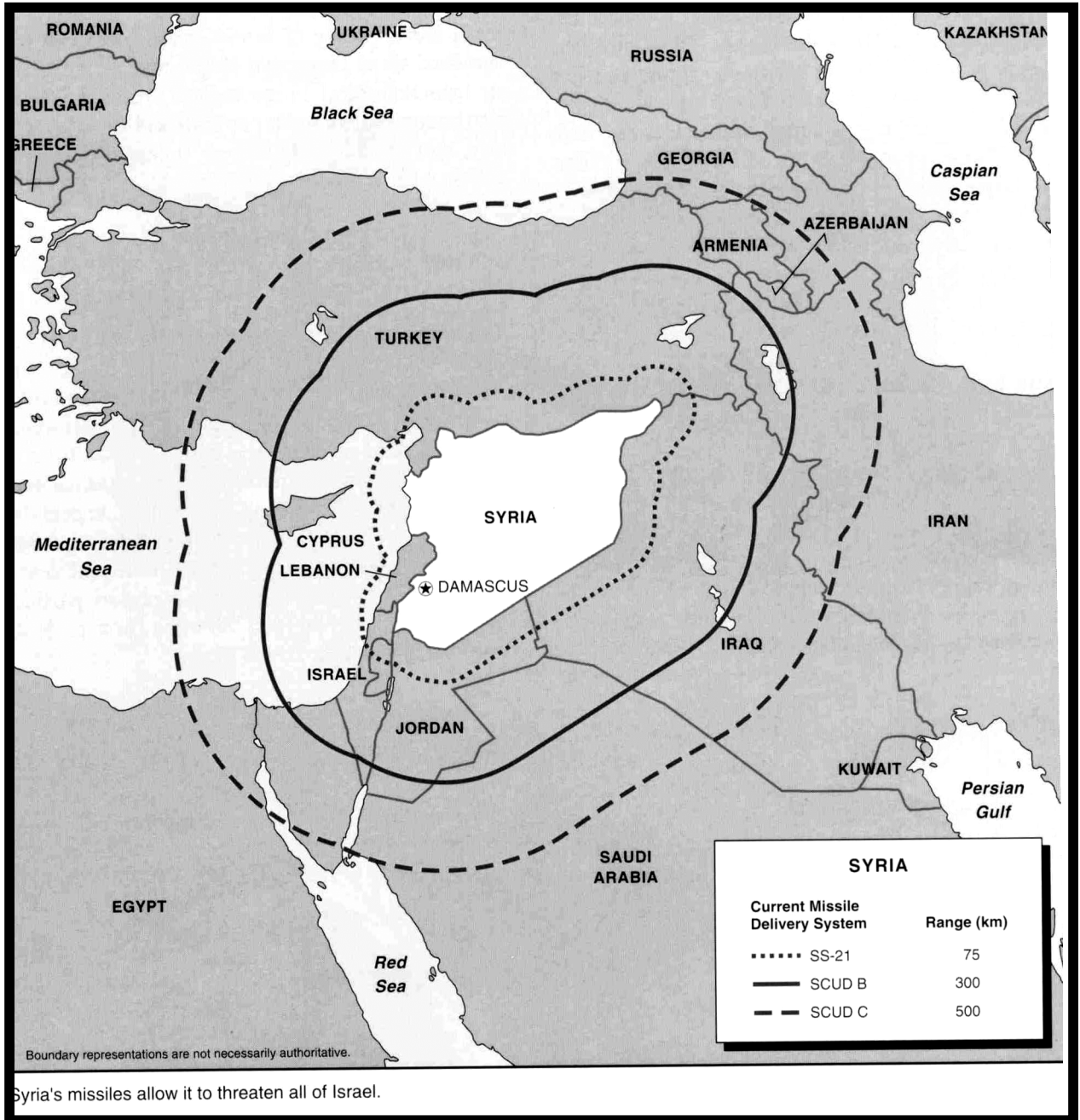
Source: *PROLIFERATION: THREAT AND RESPONSE*, Office of the Secretary of Defense, November 1997, 19.



Appendix F

Source: *PROLIFERTION: THREAT AND RESPONSE*, Office of the Secretary of Defense, November, 1997, 28.

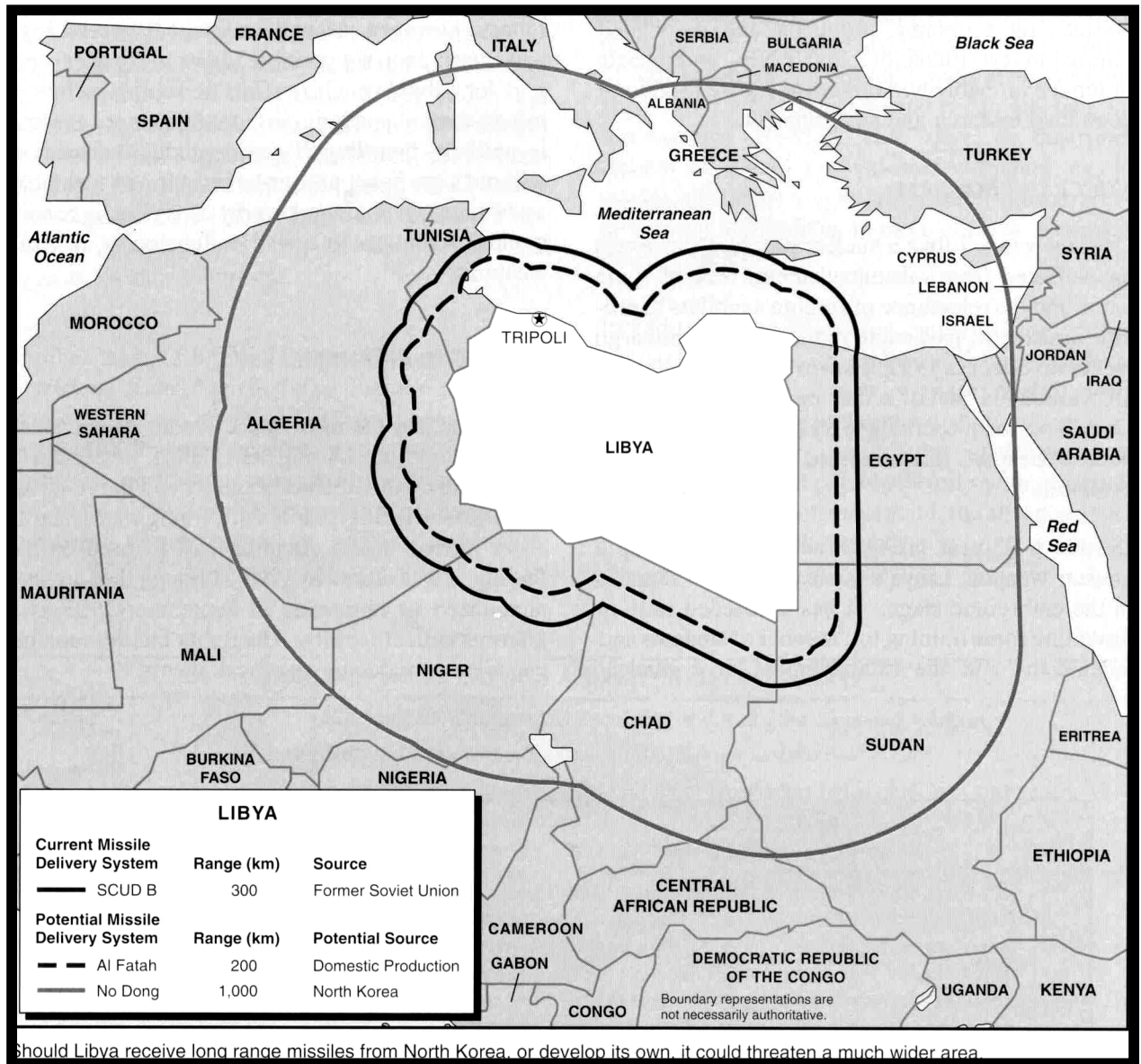
Estimated Ranges of Current Syrian Ballistic Missiles



Source: *PROLIFERATION: THREAT AND RESPONSE*, Office of the Secretary of Defense, November 1997, 39.

Appendix G

Estimated Ranges of Current and Potential Libyan Ballistic Missiles



Source: *PROLIFERATION: THREAT AND RESPONSE*, Office of the Secretary of Defense, November 1997, 36.

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