# Roles and Relevance: Army Air and Missile Defense (AMD) in the Post 9/11 World

**A Monograph**

**by**

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# Abstract

ROLES AND RELEVANCE, ARMY AIR AND MISSILE DEFENSE (AMD) IN THE POST 9/11 WORLD by MAJ Tristan S. Higgins, 54 pages.

In August of 2006, the world witnessed a guerilla air war. Hezbollah, a non-state actor, attacked Israel from the air. The Israeli Defense Force was unable to counter this assault and its second largest city, Haifa, came under attack from long-range rockets. In addition, Hezbollah was able to launch three armed UAVs against the Israeli capital of Tel Aviv. The UAV missions failed but the precedent had been set. These events told the world that nations, which in the past could never field or employ a manned air force, were able to attack well-equipped nations from the air. The combination of commercial high technology and old weapons defines the concept of guerilla air war. The emergence of guerilla air war further enables and empowers small groups to challenge wealthy nations for control of the battlefield.

This monograph examines two critical issues: one, guerilla air war; and two, whether or not the existing US Army AMD structures can meet the challenge of such attacks and defeat them at the tactical level. The US Army has recently removed all tactical level AMD units. Army maneuver commanders do not posses organic surface to air systems that would enable them to engage current air threats from a guerilla air war. The US Army's AMD force has prepared for operational threats like TBMs, but these systems are judged to have limited value to the tactical commander.

The monograph concludes with the argument that the removal of AMD units from the tactical level has left the Army dangerously and unnecessarily weak in certain respects. This has operational effects on the Army and the nation. As will be made clear, the Army's current AMD force is not integrated with the tactical level Army. The primary reason for this is the removal of AMD units from Corps and division level formations. By removing the AMD force from the tactical level, training has suffered and put the Army and its soldiers at risk. The most promising tactical system is C-RAM, which is revolutionizing the battlefield due to its ability to detect and destroy enemy artillery while in flight, however, C-RAM was an unexpected requirement. As a result, there are very few systems available and no clear plan for making C-RAM available to the rest of the larger Army structure. This study argues for the relevance and usefulness of mobile C-RAM systems that would allow greater protection of the Army's tactical formations, and reunite the AMD force with the tactical Army. Such a system structure would greatly enhance the Army's ability to engage and defeat guerilla air wars.

My recommendation as set out in the monograph is to reintroduce a tactical level AMD system. This would take the shape of a mobile C-RAM system, combining the current C-RAM turret on a mobile vehicle. This has the benefit of being both inexpensive and straightforward. This new system could be ready very quickly because of the experience that AMD forces already have with the Vulcan and current C-RAM systems. In addition, I recommend that the AMD force should add a battalion to the Maneuver Enhancement Brigade. The reintroduction of a tactical level AMD unit would enable better combined training with the tactical level Army. Combined arms training is essential for the AMD force because AMD units will operate closely with tactical level Army units in future conflicts. Failure to conduct this training will result in more friendly fire incidents and a reduction in the capabilities of the tactical Army. Finally, the AMD branch must become more involved with the tactical level training centers and replicate a more realistic air threat to provide Army leaders with the experience they need to meet the challenge of guerilla air war.

# TABLE OF CONTENTS

# Introduction

## Statement of the Problem:

This monograph represents an attempt to address the current and future challenges of the US Army's Air and Missile Defense (AMD) forces at the tactical level. This monograph represents an effort to examine, in detail, how current and future hostile forces have modified their aerial systems to attack the US Army. Air threats to the Army have not gone away; rather, they have simply diversified towards unconventional asymmetric systems. The US Army's AMD branch must change its way of thinking as well as its force structure, to prevent current and future US adversaries from capitalizing on AMD shortcomings. There is a widely held misconception among the Army leadership that no current or near-term hostile force is capable of attacking the US Army from the air, therefore, making the US Army impervious to such attacks.[1] This potentially dangerous misconception has resulted in the loss of all divisional level AMD forces. The clear evidence from current conflicts around the globe (Lebanon) forcefully highlights the ingenious use of high technology by small nations and organizations to attack nation states from the air. Current and future enemy forces will use this technology to mount successful air attacks against US Army forces. The development of these weapons is an operational level problem because the US Army AMD force has no defense against them. Furthermore, the Army has continued to develop new AMD weapon systems that are unable to address the full spectrum of potential problems presented by the air threat.

When faced with the accumulated intelligence and strategic information, this position cannot be argued with any confidence. Rather than the air threat going away, the enemy has pursued a modified strategy to take advantage of current US weaknesses. The enemy has

[1]Lieutenant Colonel Tony English, Tactical Systems Manager-LT, United States Army Air Defense Artillery School, "Air, Missile Defense Command," Briefing to the Students, Command and General Staff College, Fort Leavenworth, KS, August 2006.

capitalized on new technology, giving added lethality to old weapons. The proliferation of sophisticated commercial technology over the last sixteen years has allowed the enemies of the US to create sophisticated air threats. These new weapons may appear to be tactical problems, but they have significant operational consequences.

The current AMD force is unable to defeat AMD threats at the tactical level. Ballistic missiles, cruise missiles, armed unmanned aerial vehicles (UAVs), rockets, artillery, and mortars are the weapon of choice for enemy forces. These weapons are now more effective offensive strike systems because of the application of commercial technology. This technology will enable current US adversaries to deliver accurate long-range aerial fire on US tactical level Army forces. If the Army cannot protect its tactical force from air attack then it risks battlefield failure at the operational level. The US Army has not adequately assessed the nature of the new circumstances. Consequently, military planners have not yet put strategies in place that would secure the Army against these threats.

This monograph will explore the concept of the Asymmetric Air Threat (Guerilla Air War).[2] This monograph will outline the implications of the threat for the US Army at the tactical level. To understand the threat thoroughly, it is necessary to explore the framework and context of different threat systems. This monograph will then concentrate on the current AMD force structure of the US Army and explore what relevance it has in the face of the new threat. The AMD branch is fielding several new weapon systems, and it is important to investigate if these systems address the threat. In order for this to occur, a careful, well-documented account of the nature and extent of the threat will be needed. It will then discuss the potential deficiencies in the current force structure. Finally, this monograph will offer suggestions on how the Army can overcome the new air threat.

[2]The Asymmetric Air threat concept is based on the author's 13 years of experience as an AMD officer and personal study on how hostile nations and non-state actors will use high technology civilian electronics to enhance existing weapons like artillery and missiles to attack US forces in future conflicts.

## Methodology and Analysis:

The first task this monograph will address is the nature of the threat. It is important to lay the conceptual framework for an air war strategy against a technologically advanced force like the US Army. Current and future hostile powers will be able to apply their version of air power to take advantage of perceived US Army AMD weakness. Enemy forces will try to exploit the fissure between the Air Force and the Army at the tactical level.[3] This monograph will define the specific uses and applications of UAVs, cruise missiles, ballistic missiles, and conventional artillery systems. Further, this monograph will explain how these systems will be employed against the US Army. It will be important to look at the recent conflict in Lebanon to understand the evolving nature of guerilla air war. A small, non-state actor (Hezbollah) was able to utilize new technology and deliver long-range aerial fire on a technologically advanced force.[4] Hezbollah's strategy will become the blueprint for how to attack US Army forces from the air.

The next significant issue this monograph will explore is the status of the current US Army AMD force, and its role in protecting the US Army. What is the current make-up of AMD forces, and why has the Army moved away from tactical AMD forces to protect the ground force? The enemy use of artillery in Iraq and Afghanistan has forced the AMD community to create a counter artillery system. This has led to the development of a new system and a new capability that has significantly altered the battlefield. It will also be necessary to define the complex Command, Control, Communications, Computers, and Intelligence (C4I) systems that govern today's AMD systems. These C4I systems have a critical role in protecting the Army and the rest of the military by providing early air warning and situational awareness. How these Army

[3]Lieutenant General (Ret) James C. Riley and Brigadier General (Ret) Michael Means, "The Looming Force Protection Crisis for Brigade Combat Teams," *Air Defense Artillery Magazine* (October-December 2006): 9-11.

[4]Alex Exum, Policy Focus #16, *Hezbollah at War, Weapons and Tactics* (Washington, DC: Washington Institute of near East Policy, December 2006), 21.

AMD systems interact and cooperate with the joint force has significant impacts at the tactical, operational, and strategic levels.

After this monograph has identified key deficiencies in the current AMD force, it is important to apply possible solutions to each issue. The purpose of chapter 3 is to offer insights on how the AMD branch can protect the Army tactical level maneuver force. Each issue will have a suitable solution that can be applied quickly. For example, the answer to countering hostile long-range rocket artillery may not require the development of new costly weapons programs. It may simply require an older weapon system being reintroduced with added capabilities. The emphasis of this chapter will explore the reintroduction of tactical level AMD systems and their possible roles. The conclusion will draw these solutions together.

# Chapter One: The Threat

## Guerrilla Air War

Iraq 2008: After almost a decade of conflict with Iran over their nuclear power and weapons program, the Israeli government decides to force the issue. Rather than allow Iran to become a nuclear power, Israel decides to attack. With long-range Israeli Air Force (IAF) assets and submarine launched cruise missiles, the IAF succeed in significantly damaging one half of Iran's nuclear facilities. Rather than retaliate against Israel, Iran does nothing and lets world opinion build against the US and Israel. After several months of letting world anger boil over against the US and Israel, Iran decides to strike. Iran decides to attack US forces in Iraq and end the sectarian civil war that has been raging in Iraq for three years.

Iran knows it cannot win a conventional fight against the US military. Iran also knows the US military is far more vulnerable than they realize. Iran decides on a strategy that served Hezbollah well in Lebanon during the 2006 conflict with Israel. Iran knows the US military has no anti-tactical ballistic missile (TBM) systems in Iraq and no organic air defense units. Iran plans to strike key US bases in the region with a combination of aerial strike assets. Then, using

manned and unmanned air assets, Iran will strike large concentrations of US ground forces and large Sunni Iraqi population centers.[5] Iran moves hundreds of long-range rocket launchers closer to the Iraqi border. Shiite groups sympathetic to Iran smuggle hundreds of 122 millimeter rockets into Iraq and position them within range of US bases. Iranian UAVs make initial reconnaissance missions into Iraq to ID key targets. The US forces see the Iranian UAVs, but poor airspace management and lack of an effective Identification Friend Foe (IFF) for UAVs allows the Iranians to operate unchallenged in the skies above Iraq. Due to the US Army's own large use of UAVs, the US forces simply assume the aircraft belong to them. Long-range Surface-to-Surface Missiles (SSM) units inside Iran are brought to full readiness. Using off the shelf global positioning system (GPS) technology, the missiles are targeted on the biggest US Command and Control (C2), logistics, and air bases in the region. Ground launched long-range cruise missile units move closer to the border and are targeted with the same GPS data to attack key targets.

At dawn the next day, 100+ SCUD-D and SHABAB-3 SSM attack main US bases in the region. The SSMs are able to land within 50 meters of their aim points thanks to the GPS equipment on the missiles. Using a mix of fuel air explosive warheads and Dual Purpose Improved Conventional Munitions (DPICM) warheads, the missiles devastate their targets. At the same time, thousands of short-range rockets attack key C2 and troop targets including the US military HQ in Baghdad. Over 100 enhanced CS-802 cruise missiles launched from inside Iran fly nap of the earth patterns and attack key US supply and naval bases within the region. Armed UAVs attack US troop concentrations and logistic bases leaving US forces cut-off and without supplies. Casualties are enormous; thousands of US service personnel are killed and wounded. Hard-line Shiite militia forces use the surprise air attack to launch their own ground offensive against government building and police stations. By nightfall, the young democratic nation of Iraq is on the edge of collapse.

[5]English.

The Iraq scenario discussed above is a blue print for a concept called guerilla air war. Guerilla air war involves the deliberate use of air and missile systems to take advantage of weaknesses in an advanced nation's air defense systems. Applying commercial technology to old weapons will make them far more effective and accurate. The real genius of guerilla air war is that it does not require expensive manned aircraft to deliver accurate aerial fire. For almost fifty years, the US military has been concerned with countering a manned air threat. Specifically, a communist Soviet/Warsaw Pact air force designed and operated in the same way as the US Air Force. With the fall of the Soviet Union, the US military made the mistake of assuming their air superiority would go unchallenged for decades to come. In some ways, the authors of this strategy were correct. No nation on earth can train and deploy a sophisticated manned air force capable of challenging the US Air Force or US naval air power. The US Army failed to understand how the electronics revolution of the late 1990's and today would alter the battlefield. This technological revolution is turning old systems into precision strike weapons against which the Army has little defense.

This scenario is intended to draw attention to the weakness of the US Army's AMD forces, and to examine the nature of the new air threat. The US Army possesses some of the most advanced AMD weapon systems on the planet. However, they are poorly deployed; badly integrated with the rest of the Army, and often focused on the wrong threat.[6] In the scenario listed above, four main types of weapons were combined with off the shelf navigation technology to achieve devastating results. TBMs, UAVs, cruise missiles, and artillery have been around for decades. These systems were limited in effectiveness due to the expense and unavailability of navigation systems that could guide these weapons to targets. Today, cheap, easy to use, and highly accurate commercial global positioning devices can be fitted to these weapons to make them effective. These advances empower small, poor nations and organizations to have a credible

[6]Ibid

offensive strike capability. It is this threat that the US Army has not taken seriously. It is this threat that the US Army's AMD branch must understand in order to live up to its name "Nobody Targets or Attacks the US Army from the Air."[7]

The guerilla air war concept takes advantage of capability gaps in enemy forces. Careful planning and study can reveal where these gaps are located and what can be done to exploit them. Manned air forces are expensive; a brand-new F-22 Raptor for the US Air Force is $147 million per aircraft.[8] The rising cost of manned aircraft and the additional cost of training and maintaining these systems makes a large air force out of reach for all but the most powerful nations on earth. However, this does not mean poor nations are unable to field aerial attack systems. By applying commercial technology to older weapons, small nations, and non-state actors can field weapons that allow them to strike wealthy nations.

Applying commercial technology to existing weapons is easy. A commercial GPS receiver placed onto a short-range ballistic missile will immediately turn an unguided ballistic missile into a well-aimed strike weapon. Adding a few cell phone components to the missile and you can communicate with the weapon and even make in-flight corrections. A powerful laptop computer with wireless Internet can act as a C2 workstation. One can then identify and even see the target with little commercially available programs like Goggle earth. All of these components combine to make a complete precision guided weapon that will be able to attack a better-equipped opponent. These technological innovations that combine old weapons with new technology represent a significant tactical and operational problem for the US Army. This strategy is a serious problem for large wealthy nations that are under the misapprehension that their military superiority is unquestioned.

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[7]Ibid

[8]Global Security, F-22 Raptor Cost, February 2005, Available from http://www.globalsecurity.org/military/systems/aircraft/f-22.htm; Internet; accessed on 10 February 2007.

Another key to the guerilla air war concept is accurate information and intelligence. Today, information is available to anyone with a cell phone or Internet access. An enemy force is able to access public websites of the US Army's AMD brigades and battalions. A quick scan of the web site will reveal where the unit is located, how the unit is configured, even the names of its unit leaders. Once an adversary has identified the military unit they want, they can then use one of the many military analyst sites to obtain specific information. This information can include the weapon systems they are equipped with as well as how these types of units are employed. A couple of hours work on the Internet will provide an enemy force accurate intelligence on the disposition of US forces, and enable them to employ weapons against US forces.

With adequate intelligence and the innovative adaptation of existing weapons, an adversary can then make plans to attack. As the world witnessed in the August 2006 war between Hezbollah and Israel, a small terrorist organization was able to attack the major population centers of Israel. These attacks did little real damage. Nevertheless, the psychological effects were enormous and directly affected the psychology of the Israeli population. The operational effect led Israeli people to question the ability of their government to protect them, and to question the policies that led them into conflict.[9] The most significant event of this conflict was not the attacks themselves, but the evidence of a sophisticated, planned strategy. This strategy accepted Israeli military superiority in some areas, but also took advantage of known Israeli weaknesses such as inadequate protection against long-range rocket strikes.[10] Guerilla air war, when used effectively, can have strategic implications and affect the mindset of the adversary by taking advantage of unforeseen weaknesses.

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[9]Exum, 21.
[10]Ibid.

## Unmanned Aerial Vehicles (UAVs):

This monograph will explain in detail the UAV threat and its implications for the US Army. UAVs are in the service of more than 100 nations, in roles such as target drones all the way up to unmanned strike aircraft.[11] Over eighteen nations develop and manufacture their own organic UAVs. This monograph will detail some of the more significant UAV systems that are in service of potential hostile nations such as Iran and North Korea. UAVs represent the most significant tactical level threat to the US Army today.

If one system personifies the concept of guerilla air war, it is the UAV. The key components of a UAV include an airframe platform, (either rotary or fixed wing); a navigation control system; a payload such as a sensor, video camera, weapon, or warhead; a communications relay to transmit data, video, or imagery; and a ground control station. The larger the tactical level systems, such as the Iranian Arabil, also require equipment or infrastructure to launch and recover the UAV. However, systems such as mini-UAVs are small enough to be carried by one person and can be launched from anywhere on the battlefield. They are cheap, easy to assemble, and provide "good enough" capability due to smaller more advanced components that are available on the commercial market or through the Internet. For example, the airframe can be a model airplane and the control station can be a laptop computer with the appropriate software. Operating and employing small UAVs in today's tactical environment is not a significant challenge for US Army's potential adversaries.[12]

UAVs represent a significant threat to US forces because of their small size and lack of expense. The US military makes extensive use of UAVs as reconnaissance and long-range strike aircraft. UAVs are in use at all levels of war. From man portable systems in use by tactical units to the multi-million dollar strategic level Global-Hawk that can travel the globe to provide

[11]Riley and Means, 9-11.
[12]Ibid.

valuable strategic intelligence in areas too risky for manned aircraft. Surprisingly, little thought and effort have gone into the idea of a hostile force using UAVs against US forces.

While almost every Soldier knows about the use of UAVs for the US Army, little effort has gone into protecting US Army forces from UAVs. For many officers in the Army, an enemy UAV is more a nuisance that an actual threat. This perception changed after the Israeli-Hezbollah conflict in August of 2006. Hezbollah flew three Arabil UAVs into Israel in an attempt to attack Tel Aviv in a long-range Kamikaze type mission.[13] The Israeli Air Force was able to identify and destroy all three aircraft before they reached their target. Despite Hezbollah's failure, the significance of a non-state actor being able to attack a nation's capital is significant. If a small terrorist organization can use UAVs to attack a nation's capital, what could a large regional power like Iran do with such weapons?[14] If there were ever a conflict with Iran, US forces could see armed UAVs attacking its forces.[15]

The war in Lebanon has given the US Army a vision of the future air threat. Despite the conflict in Lebanon, there is still very little training on the part of tactical maneuver units in dealing with enemy UAVs. Army leaders today are not uncaring or indifferent to the UAV threat. They simply have never trained for or had to deal with an enemy that is equipped with such systems. Every Soldier that has trained at one of the combined arms training centers has encountered a manned air threat. However, nowhere is an Opposing Force (OPFOR) UAV employed against the US forces at any of the Combat Training Centers (CTC).[16] UAVs are real

[13]Wikipedia, Hezbollah Israel/Lebanon Update Stratfor (2008-08-08), Available from http://en.wikipedia.org/wiki/2006_Israel-Lebanon_conflict; Internet; accessed on 10 November 2006.

[14]Global Security, Armed UAVs, Available from http://www.globalsecurity.org/org/news/2006/060714-hizbollah-airpower.htm; Internet; accessed on 6 January 2007.

[15]Riley and Means, 9-11.

[16]Based on the authors four rotations at the National Training Center, Joint Readiness Training Center, and the Combined Arms Maneuver Training Center. In addition, the author has had extensive contact with the head AMD Observer Controllers who all report this training oversight.

and they will only become more sophisticated and deadly.[17] Given the rising cost of manned aircraft, nation states and non-state organizations may opt for a UAV force. This "poor man's" air force has the potential to cause significant damage to US Army forces. The US Army does not possess the capability to shoot down UAVs because they have removed tactical AMD units from Army. The US Army must acknowledge the problem, and deal with enemy UAVs or risk significant losses on future battlefields.

## Tactical Ballistic Missiles (TBMs)

TBMs are another important weapon of choice for current and future enemies of the US. TBMs represent the most significant long-range strike capability nations have in their arsenal.[18] TBMs have also benefited from rapid commercial advances in both electronics and rocket fuels. These advances make them less costly to set up, harder to identify, and much more accurate. To fully understand the TBM threat, it is important to look at their past and see what the future may hold for these weapons. TBMs are one system in which the US military has devoted considerable time and resources into developing countering strategies. Today, most of the remaining AMD battalions are deployed to counter the enemy TBM threat.[19] However, Patriot, the most effective land based anti-TBM system, is well known by the enemies of the US, and TBMs are being modified to defeat it.

A ballistic missile is a large rocket with a fuel source (liquid or solid), a launching platform (mobile, fixed), a guidance system, and a payload. The German military designed the first modern TBM. The German V-1 was a cruise missile, and the V-2 was the first modern ballistic missile. The German military employed the V-2 to strike long-range priority targets in

[17]Global Security, Armed UAVs. Note: Armed UAVs are used by US forces regularly. Hezbollah armed Aribl UAVs during the August 2006 conflict and the president has been set.

[18]Hezbollah was equipped with an unknown number of Fajar-5 333 millimeter rockets. These weapons have a range of 75 kilometers and can be classified as rocket artillery or TBMs.

[19]English.

England and had a range of 300 kilometers. The V-2 was not very accurate, but its primary mission was the creation of psychological terror among the population at large.

The Royal Air Force was able to identify and shoot down large numbers of older V-1 missiles, but was helpless against the V-2. The V-2 attacked large English cities with no warning. The German goal was to terrify the English public and lessen support for the war. The V-2 was more effective than the V-1 because it was a ballistic missile and not a flying bomb. A ballistic missile launches and quickly reaches its maximum height or apogee. The missile then points its nose down and makes its descent or terminal dive onto the target. What makes these weapons so difficult to defend against is their speed. Short-range TBMs, like the Russian SS-21 (Scarab), travel at 6-7,000 kilometers per hour when they re-enter the atmosphere.[20] Long-range ballistic missiles, like the US MX (Peacekeeper), travel at close to 22,000 miles-per-hour (MPH) when their warheads re-enter the earth's atmosphere. The ability to hit these fast weapons is one of the most significant technical challenges today.

TBMs have largely been ineffective as precision strike weapons. Old TBMs were inaccurate because of their guidance systems. Nuclear-armed, long-range missiles have such destructive power that they do not have to hit the target directly to be effective. Conventionally armed TBMs are effective against large immobile targets, such as a city. They are less effective against moving and dispersed targets. The commercial electronics revolution had changed the situation considerably.

In 1991, Iraq was able to launch dozens of SCUD TBMs at Saudi Arabia and Israel. Saddam Hussein's goal was similar to the Germans in World War II. Saddam wanted to terrorize the population, and to break the will of the coalition. The attacks were tactically insignificant

except for one lucky strike, which killed twenty-eight US Soldiers.[21] However, the operational and strategic effect of those weapons was significant. Strikes against Israeli cities threatened to bring Israel into the war and ruin the coalition. Today's commercially available global positioning systems can greatly enhance TBM's accuracy by providing guidance from launch to impact. The US military's most successful strike weapons use the same GPS technology to guide bombs and missiles to their targets. The US military has been very concerned with the advances in TBM accuracy. This is the reason so much effort has gone into long- and medium-range TBM defense systems. The TBM can now be a precision strike weapon and greatly enhance an adversary's offensive weapons capability.

The US military's anti-TBM systems have been in development for decades. These systems are designed to counter the TBM threat that grows each year. However, accurate short-range TBMs are a significant threat to Army tactical units. New US systems, such as the Patriot PAC-3, THAAD (Terminal High Altitude Air Defense), and the US Navy's SM-3ER, are all operational level, dedicated anti-TBM systems.[22] However, nations building TBMs are aware of the US Army's new AMD systems. These same nations are building advanced TBMs that have different flight patterns, decoys, and dummy warheads in order to confuse US defensive systems.

Throughout military history, nations and weapons manufactures' have battled with new systems designed to defeat older existing systems. Today, the success of the US anti-TBM systems has led nations such as China and Russia to design new TBMs around the known capabilities of the US AMD systems. The Soviet Union may be history, but Russia still possesses some of the finest military engineers in the world. All current Russian weapons are designed to work against a Western weapon or system. For example, new versions of the SS-21 and SS-23

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[20]Department of the Army, Field Manual 3-01.87, *Patriot Tactics Techniques and Procedures* (Washington, DC: Government Printing Office, August 2006), 67.

[21]John Keegan, *The Iraq War* (New York, NY: Alfred A. Knopf Publishing, 2004), 79.

[22]Charles Babers, "The Art of Missile Defense: Common Considerations in Missile Defense Planning," *Air Defense Artillery Magazine* (January-March 2006): 4.

short-range TBMs will fly indirect ballistic trajectories to take advantage of a specific weakness of the Patriot system.[23] TBMs will continue to represent one of the greatest threats to US forces for the next several decades.

## Rockets, Artillery and Mortars (RAM)

Conventional artillery systems have benefited from advances in commercial technology. Conventional artillery includes all tube and rocket launched projectiles from as small as 60 millimeter mortar rounds all the way up to the mammoth 330 millimeter rockets. These weapons in Iraq and Afghanistan represent a leading cause of death for US service members.[24] The US Army has noted this trend. Enemy RAM forces are difficult to see and to target. Insurgent RAM forces consist of small mobile teams that may not even be present when they fire their weapons. The Army concluded that it needed to be able to counter enemy RAM forces in present and future conflicts.

Remote rocket and mortar launches in Iraq and Afghanistan are common. Enemy tactics are designed to overcome the US Army's ability to detect and destroy hostile artillery. Counter battery radar can identify hostile artillery locations and direct friendly artillery and aviation onto the enemy positions. Using remote rocket launchers, an insurgent team can set up several rockets and can link the weapon to a timer, such as a cell phone or alarm clock. When the insurgents are done setting up, they simply walk away and the attack occurs. The launch sites are usually identified but killing the enemy personnel has proved very difficult. This threat will continue to challenge the Army, the Field Artillery, and the AMD branches recognize the threat as a key mission requirement for future forces.[25]

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[23]Global Security, SS-21 SCARAB, Available from http://www.globalsecurity.org/military/world/russia/ss-21-specs.htm; Internet; accessed on 10 November 2006.

[24]Colonel Harry L. Cohen and Colonel Gregory C. Kraak, "Finding Common Ground: Air Defense Artillery and Field Artillery," *Air Defense Artillery Magazine* (January-March 2006): 36.

[25]Major General Robert P. Lennox, "Joint Net Fires Concept," Brief to Students, Command and General Staff College, Fort Leavenworth, KS, 12 April 2006.

Hezbollah demonstrated the effect of this tactic on Israel. In August of 2006, Hezbollah was able to attack Israel's second largest city, Haifa. Using remote timed rocket launchers, Hezbollah attacked northern Israeli population centers at will. Thousands of small to medium caliber rockets were launched into Israel. Civilian activity in these northern towns was severely disrupted. Israel's inability to defend its own people from this type of attack proved a major embarrassment for the Israeli Defense Force (IDF). Continuing insurgent attacks in Iraq and Afghanistan demonstrated to the US military the need for some form of defense against this threat. The US and Israel worked for almost a decade in the 1990s on a tactical laser designed specifically to destroy these types of weapons.[26] The system was expensive and required large amounts of power to employ. The tactical high-energy laser (THEL) was mothballed in early 2001. Since the Israeli-Hezbollah war, there has been renewed interest in the program. The THEL was a solid-state chemical laser that succeeded in destroying dozens of 122 millimeter rockets in flight. However, it was very expensive to maintain and operate. An interim solution is currently operational in Iraq; called C-RAM (Counter Rocket Artillery Mortars). This system uses a naval version of a 20 millimeter gun as a means to destroy incoming RAM fire. The C-RAM system has had some success, however; only a few systems are operational. Using a large caliber high-speed cannon in a congested urban area presents tremendous challenges to eliminate civilian and friendly casualties. This system will be discussed later in chapter 2.

Enemy RAM fire will continue to be a problem for the Army. With GPS it is possible for the enemy to make their RAM fire more accurate. Once the enemy can effectively place RAM fire on Army units, US causalities will increase. While it is unrealistic to expect complete protection from enemy RAM fire, some form of protection is needed. As threat capability

[26]Global Security, Tactical High Energy Laser (THEL), Available from http://www.global security.org/space/systems/thel.htm; Internet; accessed on 12 August 2006.

increases the Army must be able to provide some form of mobile RAM protection to the US Army.

## Cruise Missiles

Another significant threat system in the guerilla air war concept is the cruise missile. These weapons are difficult to categorize since they tend to have similar components and capabilities of UAVs. Cruise missiles can be small short-range weapons traveling less than 15 kilometers. Cruise missiles can be long-range weapons such as the US Tomahawk, which in some versions can travel close to 3,000 kilometers.[27] What makes cruise missiles so dangerous is their combination of long-range, small-radar signature, elusive flight patterns, and their low altitude. Nations and non-state actors could conceivable deploy hundreds of highly sophisticated cruise missiles to wreak havoc on the US military and its allies. Continued advancement of commercial GPS and communications systems will make cruise missiles more difficult to defeat.

A cruise missile has a missile fuselage similar to a small aircraft. Cruise missiles have an engine to provide a constant speed over long distances. Cruise missiles have a warhead, either conventional or NBC (Nuclear, Biological, Chemical) warhead, to detonate on its target. Cruise missiles have a navigation system and a communication system to let the launch authority know its location and allow course corrections. Some older less sophisticated cruise missiles are also equipped with radar or infrared seeker. These seeker heads guide the missile to its target. Many of today's land attack cruise missiles are modified versions of naval anti-ship missile such as the SS-N-1 Styx and the CS-802 missile.[28] Here again, the advancement of civilian electronics has made navigation and targeting much easier for small nations who cannot afford a high quality manned attack aircraft.

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[27]Global Security, Cruise Missiles, Available from http://www.globalsecurity.org/wmd/intro/cm.htm; Internet; accessed on 10 September 2006.

[28]Ibid.

Cruise missiles are much harder to detect and destroy than UAVs and TBMs. UAVs are generally slow and operate within the tactical range of less than 100 kilometers.[29] TBMs, while very fast and mobile, fly predictable flight trajectories. TBMs can be detected from launch to impact vastly improving chances for identification and destruction. Cruise missiles are very hard to detect because they fly as low as 50 feet and use the terrain to mask their approach to a target. Without long-range radar coverage, cruise missiles can surprise targets. Even with overhead radar, a cruise missile's small size means they can be lost in the ground clutter. The US military has used cruise missiles very effectively over the last sixteen years. Recent advances in commercial communications combined with advanced composite airframes threaten to turn cruise missiles into more deadly weapons. Precision-guided cruise missiles will pose a direct threat to US Army tactical units. Current Army tactical units do not have defensive systems to counter this threat.

Despite the successful use of cruise missiles in the US military, little attention is given to the threat that enemy cruise missiles pose for the US. The potential options these weapons give to non-state actors and nations needs to be more fully understood. Hezbollah demonstrated this concept in Lebanon when they launched a C-802 anti-ship cruise missile and severely damaged an Israeli naval vessel. The C-802 is the Chinese version of the legendary *Exocet* anti ship missile.[30] While Israel knew about the sale of these weapons to Iran, none were thought to be in the hands of Hezbollah. Further Israel did not anticipate Hezbollah would be able to employ such a sophisticated weapon. This oversight cost lives.[31] There has been a failure on the part of the AMD branch to see the cruise missile threat in its true context. The IDF assumed high technology enemy cruise missiles were limited to wealthier nations, such as China and Iran. Little thought was given to small nations and non-state actors being able to field these weapons. Given what

[29]Riley and Means, 9-11.

[30]Bill Samii, Radio Free Europe/Radio Liberty, Iran: Navy Stresses Area Denial, Available from www.rferl.org; Internet; accessed on 21 February 2007.

Hezbollah accomplished in Lebanon, the prospect of US forces being attacked by cruise missiles is real.

Expensive high technology anti-TBM systems are little help against cruise missiles. High-powered radar systems are pointed at the atmosphere to detect TBMs reentering the atmosphere. Another problem with ground-based radar is their inability to see over terrain creating “dead space” which cruise missiles can use to reach their target. The only truly effective cruise missile defense is an Integrated Air Defense System (IADS). IADS is defined by multiple redundant radar systems connected to a widely distributed group of defensive weapon systems. This type of IADS systems would allow detection of cruise missiles from their launch point and along their flight route. Accurate cruise missiles will threaten Army tactical formations who are without the means to deal with them effectively.

The argument posed in this chapter can be easily summarized: the air threat has not been removed. This chapter has examined four major enemy weapon systems to point out their possible impact when used by the enemy on the US Army. These systems are not very new, having been around in more advanced nations’ militaries for decades. The threat these systems pose to the US results from the rapid growth and the sophistication of commercial electronics, navigation, and communication systems. These advances have allowed nations and non-state actors to operate an air force where none existed before. This new type of air force is capable of attacking the US Army at a time and a place of its own choosing. Ironically, these advances are occurring at a time when the US Army has eliminated the very units that would have been most effective against this threat.

## Chapter Two: U.S. Army Air and Missile Defense Forces

This monograph will now address the current composition of the active duty missile defense forces in the US Army. First, it will be necessary to set the context of the current AMD

[31]Exum.

force. Second, it is necessary to explain how the Army came to lose all of its short-range tactical AMD units. The loss of these units removed all organic surface-to-air weapon systems from Army tactical formations. This monograph will then address the key weapon systems of the AMD branch. This monograph will explain how to counter current and future AMD threats. It is important to discuss the key weapon systems of the AMD branch. In addition, this writing will explore how these weapon systems do or do not adequately protect the US Army from threat weapons. The AMD force is fielding many new weapon systems. The majority of these systems focus solely on the ballistic missile threat, and they operate at the strategic and operational level. The air threat to tactical level US Army units has been ignored, thus few of these systems have any capability at the tactical level.

The US Army's current active duty AMD force is fourteen AMD battalions.[32] Five AMD brigades and two Army Air and Missile Defense Commands (AAMDC) serve as the higher headquarters to these forces. Three AMD brigades support the Army's Corps tactical level formations. For instance, the 108th AMD brigade is intended to support the Army's XVIII Airborne Corps. However, the 108th and the other two Corps AMD brigades (31st-III Corps, 69th-V Corps) operate at the theatre army level. These AMD units do not answer to their Corps commanders; rather they share an uneasy relationship between the AMD branch leadership and their supported units. Fort Bliss tasks these AMD units to rotate to Korea and other theatres without their supported units consent. This issue is one of many problems the AMD branch has in relating to the rest of the Army.

The Patriot air defense system forms the base of the current AMD force. Designed and fielded in the 1980's, Patriot was to protect static assets from the numerically superior Warsaw Pact air forces. Patriot's accuracy and state of the art radar system made it possible to intercept ballistic missiles. During Operation Desert Storm, Patriot battalions acted as a TBM defense

[32]English.

system with limited success. The successful design and deployment of the PAC-3 missile along with significant electronics upgrades have made the Patriot a true anti-TBM system.

Today, Patriot battalions are the main land-based TBM defensive system in the US military. Patriot units are now theatre level units protecting strategic and operational assets. During OIF, Patriot forces operated at the tactical level with mixed results. Because Patriot units had never trained with maneuver forces, they did not fully understand how to integrate to meet their mission objectives. Today Patriot battalions train to fight in two geographic regions where the TBM threat to US forces is the greatest, Iran and North Korea. Is the current and future force organized and equipped to deal with the four threats outlined in chapter one? The answer is no. US Army AMD forces cannot protect the US Army at the tactical level. This monograph will now define the current composition of the current AMD force.

## The Death of the Short Range Air Defense Battalion

Prior to January 2004, the AMD branch was really two distinct organizations. On one side, with most of the money, was the HIMAD (High Medium Air Defense) force. With the exception of two in Korea and one in Germany, the remaining battalions were based at Fort Bliss. The HIMAD battalions were all Patriot equipped. Approximately one half of the Patriot battalions had fielded the new PAC-3 anti-TBM missile. The other half of the AMD branch was spread out across the Army in each of the ten active duty divisions. Each Army division, along with the separate combat maneuver brigades, has its own AMD unit. These types of units were habitually located with their supported unit.

Short-range Air Defense Artillery (SHORAD) units consisted of short-range weapon systems built around the Stinger infrared surface-to-air missile (Avenger, Linebacker). These SHORAD battalions and separate batteries were also equipped with advanced search radar (Sentinel). This radar provided target data and early warning to the weapon system operators. The

Sentinel was further data linked through advanced data radios to receive and send air pictures. This air picture came from AWACS and Patriot units forming the C4I system.

The SHORAD battalion was different from a Patriot battalion because of its decentralized deployment and execution. SHORAD battalions deploy across a maneuver division's area of operation. Young privates and sergeants make the decision to launch a weapon. HIMAD units have a central command and control station that approves all missile launches under close supervision from senior officers. The smallest unit of action in a Patriot battalion is the battery. Each battery is linked to the Integrated Command and Control (ICC) van commanded by the battalion commander. The effect of these systems led to the development of vastly different types of cultures within HIMAD and SHORAD units.

SHORAD units believed they were superior Soldiers and genuinely better led than HIMAD units were. SHORAD units had older weapons and a much smaller budget, but they felt part of the "Real Army." SHORAD units looked down upon the HIMAD units who they felt were poorly led and not real Soldiers. Because SHORAD units operate in a decentralized manner, junior leaders developed leadership and troop skills that HIMAD units did not have. The senior leadership of the SHORAD battalion engages with the supported division and brigades to determine AMD priorities. SHORAD units were an integral part of the divisional combined arms team. Young SHORAD platoon leaders would find themselves attached to an infantry or armor battalion and their squad leaders were directly supporting maneuver companies. As a consequence, these relationships allowed SHORAD leaders to cultivate leadership skills unavailable to their HIMAD counterparts.

HIMAD Soldiers felt SHOARD was a waste of Soldiers and equipment. HIMAD units knew the Army had never deployed in mass without Patriot units. HIMAD Soldiers felt it was Patriot units, and not SHORAD units that had engaged targets in Desert Storm and OIF. HIMAD units were equipped with arguably the finest land based Air Defense system ever made. Their units were also blessed with almost limitless budgets. They resented the attitude of SHORAD

units and questioned their relevance. The situation resulted in bad feelings throughout the branch, and a reduced overall fighting ability of the AMD force in the Army. Adding to the problem was an effort on each side to keep their own kind of officers and NCOs in-house and not foster cross cooperation between the groups within the branch. In reality, the complex relationship within the AMD branch is a simple result of two distinct cultures. Soldiers developed differently within each of those cultures with predictable results.

In 2004, the Army leadership, led by the Army Chief of Staff, General Schoomaker, restructured the tactical Army force. General Richard Cody the US Army Vice Chief of Staff directed the Army to eliminate the SHOARD battalions in the divisions.[33] The reason for the removal of SHORAD was to make room for the new modular force structure that was taking place throughout the Army. While the active duty force would lose SHORAD battalions, it would gain key engineer and civil support units necessary in Iraq. It is important to note that the AMD branch was not the only branch to lose units, and was not singled out by General Schoomaker. The plan was for all of the SHORAD battalions to remove their division patches and deactivate five battalions. Four SHORAD battalions would be reconfigured into composite AMD battalions (1-44 ADA, 4-5 ADA, 2-44 ADA, and 3-4 ADA). These battalions would be a mix of Patriot, Sentinel radar, and Avenger SHORAD systems. One battalion, the 5th battalion, 5th Air Defense Artillery of the 2nd Infantry Division, would remain on active duty and convert into a pure Avenger battalion.[34] Retrained SHORAD Soldiers would be trained to operate and man the new Patriot equipment. The equipment would come from the ten active duty patriot battalions. Patriot battalions would lose their fifth missile battery and move this equipment into the newly created composite AMD battalions.[35]

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[33]Based upon a conversation with an AMD HRC Career Manager, January 2007. The source wishes to remain anonymous.

[34]Lennox.

[35]Ibid.

SHORAD units were deactivated because of the perception that no real air threat existed to the Army's tactical maneuver force. The lack of any real manned air threat and the absolute dominance of the Air Force convinced senior Army officials that these units were surplus to requirements. They were right. No enemy aircraft had attacked US forces in Iraq or Afghanistan. The only air weapons Iraq had launched at the US military were short-range SSMs. SHORAD units could not destroy TBMs and so it appeared to be unneeded on the battlefield. The senior AMD leadership failed to provide a justifiable mission and purpose for the SHORAD battalions in Iraq. Moreover, the AMD branch did not argue for alternative roles for these units. AMD branch could have argued that while the current air threat was low these units could perform other missions. AMD forces have a history of performing force protection and convoy support missions. SHORAD battalions in Iraq were conducting non-traditional AMD missions for their supported division.[36]

The SHORAD battalions are gone, and no AMD assets exist at the division level or below. The actual number of AMD battalions performing anti-TBM missions is up to fourteen. The AMD branch is ignoring the tactical level Army force in favor of the strategic and operational TBM mission. The AMD branch agreed to place an ADAM (Air Defense Air Management) cell in every maneuver brigade combat team and division headquarters. The ADAM cells have no capability to defeat tactical level AMD threats.

The ADAM cell is a part of the BCT Tactical Operations Center (TOC). ADAM cells would have the primary responsibility for managing the airspace around the BCT.[37] In addition, the ADAM cell will provide air defense early warning through the AMDWS (Air Missile Defense Work Station). Army and joint detection systems can provide a live air picture for the BCT

[36]Based on conversations with the authors' former unit 4-5 ADA, 1st CD, Colonel Todd Morrow Battalion Commander of 4-5 during OIF II. 4-5 ADA served as a motorized infantry battalion assigned to the 2nd BCT, 1st CD (Blackjack). 4-5 relived 1-4 ADA the direct support ADA battalion for 1st AD and then redeployed to Germany where it was deactivated.

[37]English.

through the AMDWS. Army divisions were to be reequipped with an unspecified number of Sentinel radars for their own organic air warning capability.[38] However; at the time of this monograph, the exact number of radars and who will own them is undecided.

The ADAM cell's primary mission is to provide airspace management and control of all air assets in the BCT or division area of operation. This mission has become very important because the Army has added a large quantity of UAVs to maneuver units. The new BCTs and divisions possess large numbers of tactical UAVs. De-conflicting air space between these UAVs, field artillery fire, and manned aviation assets is very complex and demanding. Why the AMD branch became the Army proponent for airspace management is unclear, and more training is needed before these cells can fully fulfill their mission. In addition, none of the BCTs subordinate battalions had access to an air picture or early warning. While it is possible to receive air warning from battalion level C4I systems, no AMD personnel exist at the battalion level. The ADAM cell can warn a maneuver BCT of an air attack, but provides no organic weapon system to protect the BCT from an air threat. In Iraq, the AMD branch was confronted with a mission that it had not anticipated in Iraq.

## Counter Rocket Artillery and Mortars

Shortly after the fall of Bagdad and the transition to stability operations, US forces came under attack from insurgent artillery. While artillery attacks were not a new threat to US forces, the means employed by the insurgents were frustrating US efforts to overcome this threat. Using small mobile teams, the insurgents would set up and quickly fire several rounds at large US bases, and flee before the US could react. On other occasions, insurgents would set up rockets with delay-timing mechanisms so that rockets would fire after the set-up team had left the area. While these attacks were not accurate, they did cause casualties and, more importantly, they affected the

[38]Based on the author's time in BCTP and conversations with Major Scott Flanders the 10th MTN ADADO. 10th MTN was one of the first Army units to convert to modular BCTs. 10th MTN experienced

psychology of US troops. US forces are on high alert outside of their bases, but they often let their guard down and removed their body armor when they returned to base. Indirect fire became the second leading cause of death among US forces killed in 2004 and 2005.[39] The artillery attacks caught the attention of senior coalition officers. TRADOC formed a working group to deal with the problem and come up with solutions.

The first branch of the US Army to respond to this challenge was the Field Artillery Branch (FA). FA units train against enemy artillery in a role called counter battery. Counter battery is simply attacking the enemy artillery units before the enemy can cause more damage to friendly forces. Advanced FA weapon systems connected to counter battery radar allow them to see the enemy launch point and return fire. US forces were able to detect and identify enemy artillery fire, but were unable to affect the rounds that were already in the air. Training and Doctrine Command (TRADOC) organized a joint task force with the Navy, and C Battery, 5th Battalion, 5th Air Defense Artillery. This task force began work on the first C-RAM system.[40]

C-RAM is a new capability for the US military. Artillery and air defense radars could track enemy artillery in flight, and then pass that data on to warning and interception assets. Never before has US ground forces been able to target enemy artillery in the air. Using the same radars that detect enemy artillery, the C-RAM system passes that data onto a gun system that can destroy rounds in flight before they impact on US bases. If successful, this new concept could change the battlefield profoundly. The ability to destroy enemy artillery rounds in the air has been impossible. If C-RAM was successful, it would take away one of the primary insurgent weapon systems and save Soldiers lives.

The C-RAM system has four primary goals:

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severe shortages of ADAM cell equipment specifically the lack of Sentinel radars.

[39]Lennox.

[40]Ibid

Detection: The first task is detection, identifying enemy artillery fire when it starts. The FA community has developed two state of the art detection radars designed to track and pinpoint enemy artillery fire. The Q-36 radar will locate and track medium- to large-caliber artillery rounds fired by cannons. The Q-37 is a longer-ranged system that tracks and locates long-range rocket artillery.[41] Additionally, a new mortar detection called the lightweight mortar radar can detect enemy mortar fire. This radar specifically detects the much shorter range but higher arc trajectory of mortar fire.[42]

Warning: The second task of C-RAM is warning. One of the major problems with early C-RAM was warning an entire base of an incoming attack. Enemy artillery attacks are frequent. The Army needed to be able to identify where enemy artillery rounds would fall. The warning system is an advanced network of sensors and alarms that can identify where the enemy rounds will land. If an area on a base is under attack, there will be an alert siren. Other parts of the base will be aware of the attack but can continue their missions without disruption. The purpose of the warning system was to remove the enemy effect of disruption on large US bases. The effect of forcing a large US base into reacting to RAM fire has a ripple effect on US forces across the country. By shutting down entire bases, the enemy could delay logistical and command support to those units deployed outside the base.

Interception and Destruction: The third goal of C-RAM was the interception and destruction of the incoming rounds. For this mission, the Army went to the Navy to get an advanced gun system capable of shooting down artillery rounds. The Naval designed the Close In Weapon System (CIWS) as a final defense against anti-ship missiles. The CIWS is six-barrel 20 millimeter cannon with a rate of fire around 4,500 rounds a minute.[43] Counter battery radar, air defense search radar, and optical sensors on the ground direct this weapon to the enemy rounds.

[41]Ibid
[42]Ibid

The CIWS would then open fire on the incoming round and destroy it before impact. The Army opted for high explosive rounds in the CIWS that would self-destruct in flight before hitting the ground.

Destroy: The fourth and final goal of the CRAM system was to destroy the enemy RAM launch site. FA units can identify and target the launch site by connecting to the system that alerted the CIWS guns. Airborne strike assets can also be alerted by C-RAM and attack enemy launch sites. The C-RAM system was a holistic approach to a problem. Instead of addressing one symptom of enemy RAM fire, the C-RAM system dealt with the threat. On the bases C-RAM is located; C-RAM has been very successful in eliminating this threat. However, there are issues that need resolution before the system can be deployed throughout Iraq.

The most significant problem of the new C-RAM system was clearance of fire. At the tactical level, the clearing of fires before the gun could engage a hostile round resulted in failed interceptions. Enemy RAM fire travels very quickly. The hostile round is only in the air a few seconds before impact. Unfortunately, the Army could not clear the area in the air and on the ground prior to the enemy round being destroyed. Short bursts from the CIWS fire close to 200 rounds-a-second. While 10 percent may destroy the incoming round, the other 180 plus rounds will return to earth and cause damage if the area is not cleared.[44] A naval ship in the middle of the ocean has a far easier time clearing fire than a gun located in Baghdad. In addition to clearing the ground area of friendly forces, it is important not to fire over populated areas. The Army has tried to solve this problem by using high explosive ammunition that self-destructs in air. It is unclear if this has solved the clearance of fires issue.

Another problem with C-RAM is the gun system is large and cumbersome. It takes almost eighteen hours to emplace the gun system. Once the gun is set, it cannot be moved

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[43]Department of the Army, Field Manual 3-01.60, *Counter Rocket Artillery and Mortar (CRAM) Intercept Operations* (Washington, DC: Government Printing Office, March 2006), 5-38.

quickly. This significantly reduces the area it can protect. Commanders must decide what parts of their base are covered, and what areas will go without coverage.[45] A system that provides the same protection but is self-propelled and mobile will be discussed in chapter 3. The C-RAM system has the makings of an effective deterrent to one of the enemy's most devastating weapons. C-RAM works well where it is located. The Army has not made a full commitment to the system so there are very few operational units.

This monograph has already detailed the culture shift within the AMD branch, a shift that saw the elimination of the divisional SHORAD battalions and the creation of more Patriot battalions. AMD branch largely ignored the threat of enemy artillery. Tactical level AMD missions, like C-RAM, is a distraction to the AMD branch because of the money and prestige involved with countering ballistic missiles. With budgets tight across the military, a system like C-RAM would threaten resources meant for longer-range TBM systems still in development. Several successful interceptions made C-RAM a valuable tool in Iraq. Word of C-RAM quickly spread throughout Iraq and the C-RAM system is in high demand throughout Iraq. The Marine Expeditionary Force (MEF) fighting in Al Anbar province immediately requested the system.[46] MEF units operate in arguably the most hostile part of Iraq and are subject to regular artillery fire. The challenge remains of how to field this new complex system throughout Iraq without large amounts of money.

## Joint Fires Center for Excellence

The Department of Defense's Base Relocation and Consolidation Study (BRAC) in 2004-2005 had significant implications for the AMD branch. The AMD branch will move its

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[44]Lennox. This led to the decision to adopt 20 millimeter high explosive ammunition which self destructs in the air rather than traditional naval ammunition which uses tungsten penetrators.

[45]Ibid.

[46]Based the author's conversation with Major General Lennox following Joint Net Fires Concept Brief in April 2006. Major General Lennox stressed that the C-RAM system when cleared to fire had been successful and those results has caught the attention of the Marines in Al Anbar province.

school from Fort Bliss, Texas, to Fort Sill, Oklahoma.[47] This move would reunite the FA branch and the AMD branch under the title of Joint Fires Center of Excellence. The FA and AMD had been one branch until 1968 when AMD became a separate branch.[48] At the time of this report, there are no plans for combining the branches, but the possibility does exist. Combining C-RAM with both AMD and FA branches makes a great deal of sense. It is the one area where the two branches can significantly aid each other.

The FA community is struggling with the current global situation. Like the AMD branch, FA branch has reinvented itself to remain relevant in the current conflict in Iraq and Afghanistan. The FA branch embraced the C-RAM concept and was immediately ready to participate. The "Joint Fires Center of Excellence" approved by the commanders of AMD and FA branches, will allow collaboration and cooperation between the two branches at the tactical level.[49] FA can significantly aid the C-RAM program by applying counter battery radar to assist in detection of enemy artillery rounds. The FA branch is in position to attack the enemy launchers on the ground to reduce the threat, while the C-RAM guns destroy incoming rounds. This sensor-to-shooter link will enable the C-RAM system to be more than a defensive weapon. C-RAM will become part of a larger network that deals with enemy artillery from a holistic approach.

This holistic approach forms the foundation of the Joint Fires Center. FA can bring lethal fire on enemy launch points because tactical FA assets connect electronically to the C-RAM system. Well-trained FA units will use non-organic firepower, such as attack aviation and air force fighters, to further engage enemy artillery assets. By working closely with the FA branch on C-RAM, the AMD branch gains experience dealing with aviation assets. By working closely with Army aviation, the AMD branch can better understand A2C2 issues and improve airspace management.

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[47]Colonel Heidi Brown, Fort Bliss Transformation Brief, Command and General Staff College, Fort Leavenworth, KS, 21 August 2006.

[48]Cohen, and Kraak, 38.

Currently, the AMD branch has primary responsibility for the C-RAM mission. In February of 2007, 2-44 (Composite Air Missile Defense Battalion) at Fort Campbell will stand up as a C-RAM battalion. It is still unclear if any FA units will be permanently assigned with these C-RAM units. The Joint Fires Center of Excellence (JFCE) will further test and evaluate the C-RAM concept. The JFCE will then recommend to the Army what the permanent make-up of the Army C-RAM force should be. Regardless of this outcome, a close working relationship with the FA branch will be a positive step and help the AMD branch integrate with the tactical Army. The AMD branch has emerged from the uncertainty of 2004 with a renewed mission. How the AMD branch and the Army choose to confront these issues, and apply resources, will shape the force for the next twenty years. This monograph will now address key organizations within the AMD branch.

## The Composite Air and Missile Defense Battalion

The composite AMD battalion is a new battalion structure using assets of both HIMAD and SHORAD battalions. The composite battalion combines the long-range protection of Patriot, with the Avenger weapon system, and the Sentinel radar. The purpose of the composite AMD battalion is to augment existing Patriot pure battalions. Composite AMD battalions are supposed to provide a measure of cruise missile defense to the Army. By linking the Patriot with Sentinel radar and Avengers, the composite AMD battalion can provide coverage over a larger area. These combined system battalions will be able to cover pieces of terrain and air avenues of approach that the Patriot pure units cannot see.

The Patriot air defense system is arguably the finest long-range surface-to-air weapon in existence today. However, the system does have some employment limitations that prevent it from combating all current AMD threats. The radar can see 300 kilometers by itself, but only on a

[49]Lennox.

110-degree azimuth. This means commanders must decide which direction to point the radar while leaving specific areas uncovered. The Patriot system can be augmented with data from other radars. However, the Patriot cannot launch a missile unless its own organic radar can see the target. The Patriot radar cannot see through terrain. In places such as Korea, the inability to see through terrain makes US forces vulnerable to enemy forces using terrain to make their approach. Careful planning and proper analysis of enemy air avenues of approach can offset this disadvantage. The composite AMD battalion further reduces this threat by putting Sentinel radar in locations the Patriot cannot see. The Sentinel can only see 40 kilometers but it is a 360-degree system. It is now possible to launch Patriot missiles from a Sentinel radar track using an updated software package.

Each composite AMD battalion will be equipped with a Battery of twenty-four Avenger systems organized into four platoons of six Avengers.[50] The Avenger is a two-man short-range surface-to-air weapon system equipped with eight stinger missiles and a .50 caliber machine gun. The key to the Avenger systems is the ability to shoot its missiles beyond visual range. Prior to 2003, all Stinger-based air defense systems had to visually identify a target as hostile prior to engagement.[51] That restriction made the employment of short-range systems very difficult due the ranges of current threat weapons. While the Avenger is still limited by the short range of the Stinger missile, it is a far more capable system.

Adding a radar system that digitally connects the fire unit makes it possible for that system to launch beyond the visual range. That is because the connecting radar's have already identified the threat and cleared the missile unit to engage. Freed from the restrictive rules of engagement, the Avenger can fire at close to 8 kilometers.[52] This system known as "Slew to Cue"

[50]English.

[51]Babers, 12.

[52]Department of the Army, FM 44-44, *Avenger Platoon, Section, Squad Operations* (Washington, DC: Government Printing Office, 1995).

was successfully fielded in the most advanced SHORAD battalions.[53] Following the terrorist attack of 11 September 2001, the Army ordered several of these units equipped with STC Avengers to protect critical CONUS government sites.[54] The success of these systems and their value allowed them to survive the death of the SHORAD battalions.

A serious problem for the composite battalions is their lack of a permanent supported unit. The AMD branch is reluctant to assign Patriot units to maneuver commanders because they fear losing control. Removing these AMD battalions from divisions and corps will hurt their ability to be part of the combined arms team. It is very difficult for these battalions to train with and learn from their supported units. AMD units that do not regularly train with maneuver units risk disaster on the battlefield.[55] AMD units who are unfamiliar with ground maneuver operations will be a hindrance to maneuver commanders. By taking these AMD battalions out of Divisions, the AMD branch risks turning itself into a specially trained TBM defense force. The AMD force will be unable to contribute to a combined arms fight because they will have never trained with their supported units. AMD branch must address wither they support the tactical maneuver commander.

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[53]Based upon the author's experience in 4-5 ADA, 1st CD, June 2001 to October 2003. In January of 2002, 4-5 ADA took delivery of 24 new Avenger systems with Slew To Cue capability. The STC allow the weapon system to be aimed by radar. This capability eliminated the need for the operator to see the target before engaging. The final two Platoons of Avengers in 4-5 ADA were modified to STC standards with the entire battalion being operational in May of 2002.

[54]Based upon the author's experience and deployment while in 4-5 ADA, following 9/11 and the activation of 4th ID for OIF, 4-5 ADA, 1st CD was directed to perform AMD over President Bush's Crawford ranch on short notice. The battalion conducts several Crawford missions with Sentinel Radar's and Avenger STC systems. In December of 2002 4-5 ADA (-) deployed TF Delta in support of Operation Enduring Freedom to the national Capital region. TF Delta provided early warning and short range air defense to selected NCR assets with Avenger and Stinger MANPADS units. TF Delta was integrated into a joint reaction force within the NCR. The Mississippi NG relived TF Delta in July of 2002, the mission continues today.

[55]United States Army, Attack on 507th Maintenance Company, Available from http://www.army.mil/features/507thMaintCmpy/; Internet; accessed on 10 November 2006.

## Command, Control, Communications, Computers, and Intelligence (C4I)

The systems used to track enemy weapons and direct friendly AMD systems to eliminate threats are the most important part of AMD. This complex web of systems and sensors is critical to the US Army's ability to provide AMD to Army forces. This monograph will address these key systems in today's current AMD force. In addition, it will be necessary to include joint C4I systems as they play a fundamental role in US Army AMD operations. Further, this monograph will explain how C4I systems provide situational awareness and improve combat effectiveness.

The most important AMD sensor today is radar. Radar is the eye of the AMD force that allows threats to be identified and dealt with. The US Army AMD branch has three major radar systems. The Patriot Radar, the Sentinel Radar, and the Terminal High Altitude Air Defense (THAAD) Radar are all in service today. Each of these systems is an active radar source. This means they each emit a specific radar wave to identify and track airborne objects. The Sentinel Radar is the smallest covering a 40 kilometers radius around the radar. The Patriot Radar can see out to 300 kilometers but it is unidirectional radar, and it can only look out at a 110-degree angle. The newest of the systems is the THAAD Radar. It has a classified range, but estimates of the radar are close to 1,000 kilometers. The THAAD Radar is the most successful part of the THAAD program. Similar to the Patriot Radar, THAAD can look in a 160-degree arc.[56] Individually these systems can provide good air warning to friendly units in close proximity. When these systems are networked together, their value is greatly enhanced.

The air picture of these separate systems can be linked and provide the commander with a real time air picture over a vast area. The Joint, Tactical, Information, and Distribution System (JTIDS) radio consolidates radar data and combines it into a single picture. The combination of these linked systems allows the commander to see great distances. Further, these Army AMD

[56]English.

radars can be joined with Air Force and Navy radars (Airborne, Warning Airborne Control System (AWACS), and Naval AEGIS) to further enhance situational awareness.[57] These combined systems can provide worldwide coverage 24/7, and allows maneuver commanders accurate air pictures of their area of operation. Another significant benefit of C4I is providing a local air picture to local fire units. Traditional ADA systems used to have their own radar and do their own early warning. The new C4I system allows short-range weapon systems to populate the battlefield but not be identified. Enemy air systems have no way of knowing they are being tracked and targeted because there is not an active radiation source.

The complex nature of the current and future AMD threat means that no single service is capable of defeating the threat by itself. Therefore, incorporating joint systems into a combined AMD force is necessary to neutralize this threat. The ability of the Army AMD force to tie into joint systems makes US Army Soldiers safer. The problem for the Army is that it can see approaching air threats better than it can deal with them. The Army now has great situational awareness. But the Army does not have the ability to destroy tactical level air threats. This monograph will now examine future AMD systems and discuss their potential for overcoming current tactical vulnerabilities.

## Future Army Air and Missile Defense Systems

Three new AMD weapon systems are currently in development for the US Army. Each system addresses a specific need to the Army and the joint AMD force. These systems are important because they have an impact on the Army at the tactical level. Each of these systems will be ready within the next ten years. Specific numbers of how many systems will be deployed is currently unknown. The first system called Terminal High Altitude Air Defense (THAAD) has been around the Army since 1996. THAAD is a medium-range anti-ballistic missile system that

[57]Ibid.

augments and supports shorter-range systems like Patriot.[58] The second system is Medium Extended Air Defense System (MEADS), and is the replacement for Patriot. MEADS is currently being developed in conjunction with a half-dozen other nations.[59] The final weapon system for Army AMD forces is Surface Launched Advanced Medium Range Air to Air Missile (SLAMRAAM). SLAMRAAM uses the AIM-120 radar guided fire and forget missile. SLAMRAAM will mostly defeat cruise missiles and manned aircraft. All three-weapon systems will address current weaknesses and augment existing capability.

THAAD is the first AMD designed for the sole purpose of intercepting ballistic missiles. Patriot was never designed to destroy TBMs. It was supposed to guard fixed sites in Europe from the Soviet Air Force. THAAD will need to defeat short- and medium-range ballistic missiles. THAAD is designed to destroy TBMs at terminal altitude when the warhead re-enters the earth's atmosphere.[60] THAAD has not been successful. The first nine-missile tests in the late 1990s resulted in failure. The future of the system was in doubt. The development of THAAD continued because of aggressive North Korean missile testing and contractor pressure.

The only real success with the THAAD system was the radar. The THAAD Radar was a major advance in solid-state radar systems. The radar was able to see and track objects the size of a baseball and ranges of up to 1,000 kilometers.[61] The problem was the missile. At the time of this writing, the THAAD missile had its first successful kinetic intercept in July 2006.[62] THAAD is due to activate its first operational battery in Fiscal Year 2008, with the first battalion operational in Fiscal Year 2009. The final number of THAAD equipped battalions is unknown. Given THAAD's lack of a thorough record of accomplishment and the fact that military budgets

[58]Global Security, THAAD, Available from http://www.globalsecurity.org/space/systems/thaad.htm; Internet; accessed on 12 December 2006.

[59]Global Security, MEADS, Available from http://www.globalsecurity.org/military/library/budget/fy2001/dot-e/other/01meads.html; Internet: accessed on 16 January 2007.

[60]Lieutenant Colonel Jeff Preacher, Directorate of Training-Upper Tier, THAAD Overview Brief, Command and General Staff College, Fort Leavenworth, KS, 21 August 2006.

[61]Ibid.

[62]Ibid.

are strained, it seems unlikely this system will exist in large numbers. THAAD will need to show a consistent record of successful intercepts before Congress will fund the system.

MEADS is the newest system and the farthest from actual deployment. MEADS is an eventual replacement for PATRIOT. The US along with a half a dozen allied nations, is developing the system.[63] MEADS is a medium-range system with anti-TBM and cruise missile defense applications. MEADS is supposed to be a fully joint system that is compatible with all current and future US and allied systems. In conjunction with THAAD, SLAMRAAM, and Naval SM-3, MEADS is supposed to provide complete air and missile defense against all threats including cruise missiles and UAVs.

The most fundamental question is whether or not MEADS will be able to operate at the tactical level. If it is to replace Patriot and be a tactical system, it must be more mobile and deployable. The Patriot systems major weakness is its size, weight, and length of emplacement time. MEADS must be a more mobile system. MEADS must be able to set-up quickly and keep pace with the maneuver force. If MEADS is not more mobile, then it will be another operational level system unable to fight effectively at the tactical level. It is difficult to assess this program since no actual equipment exists. As a concept, it appears to address all current AMD threats except for Rockets, Artillery, and Mortars (RAM). The fact that the designers recognize the need for this system to work with other AMD systems is promising. Time will tell if MEADS becomes a real weapon, and if the money will be there to buy it.

Of all the new AMD systems in development, SLAMRAAM is the most combat ready and is relatively cheap since it uses equipment already in service. The heart of SLAMRAAM is AIM-120, the advanced medium-range air-to-air missile. The AIM-120 is radar guided “fire and forget” missile fielded in the 1980’s to replace the Sparrow air-to-air missile.[64] The AMRAAM

[63]Global Security, MEADS.

[64]Global Security, AMRAAM, Available from http://www.globalsecurity.org/military/library/budget/fy1997/dot-e/airforce/97amraam.html; Internet; accessed on 4 January 2007.

was the first fire and forget medium-range air-to-air missile. Traditional radar guided missiles required the firing aircraft to keep radar lock on the target. The AMRAAM missile launches, attacks its target, and releases the launching aircraft to do other things. Unlike an infrared (IR) guided missile, it is not susceptible to IR decoys like flares. The AIM-120 can hit targets out to 40 kilometers, well beyond visual range. The AIM-120 revolutionized air combat and gave western forces a decisive advantage in air combat that continues today.

In the late 1990s and early 2000, there was concern in the AMD community about the threat of cruise missiles. The US Army lacked a medium range surface-to-air system to engage them. Patriot was effective against cruise missiles but was usually employed against TBM threats. In TBM mode, the Patriot radar is looking in the wrong direction to detect low flying cruise missiles (Patriot in TBM mode points the radar up towards the atmosphere). Short-range Stinger-equipped units could spot cruise missiles but lacked the range to effectively defend against this threat. The possibility of launching the AIM-120 AMRAAM on the ground to counter cruise missiles was investigated. SLAMRAAM uses the Sentinel Radar to detect targets and pass air tracks to the missile launch vehicle. The AMRAAM's organic active radar would guide the missile to its target. The missile would launch and attack the target on its own out to 40 kilometers.[65] The missile launches from a modified HMMW-V carrying five missiles. The beauty of this system is it required almost no research and development and will be fielded using equipment already in service.

SLAMRAAM will make an immediate impact on the Army, and provide critical protection for US forces. Currently, the plan is for all Avenger batteries in composite AMD battalions to be replaced by SLAMRAAM. The exact date and number of units involved is still an open question. The real concern with the SLAMRAAM is the relationship between the supported unit and the SLAMRAAM unit. To be truly effective and protect the maneuver force,

[65]English.

SLAMRAAM units need constant training with maneuver units. Without assigning SLAMRAAM units to divisions, the AMD force will not be an effective part of the combined arms team. SLAMRAAM holds promise as a tactical level asset but it needs to operate with other tactical units to be effective.

The US AMD force has effective weapon systems deployed today to meet the tactical ballistic missile threat. The AMD force does not have an effective cruise missile defense system. The new composite AMD battalions can be effective against cruise missile. However, the threat of TBMs means that these battalions are deployed primarily as traditional Patriot battalions. Removal of these battalions from the corps and divisional structure ensures these battalions will have little understanding of combined maneuver operations. At the tactical level, these battalions will not be properly integrated. The composite AMD battalions will not form the close relationship with their supported unit, which will limit combat effectiveness. The Army does have an effective C-RAM system, but not enough weapons. The C-RAM system is a very promising weapon system that needs to be fielded in greater quantities. To be able to eliminate the artillery threat against US forces is a truly revolutionary capability. Why, then, are there so few C-RAM systems? Why is the C-RAM system on such a limited platform? What is the correct way to apply AMD forces to protect the tactical level Army? These issues will now be addressed in more detail, and they will be accompanied by proposed solutions.

## Chapter Three: Issues and Recommendations

To conclude, this monograph will address the significant issues and challenges facing the US Army's AMD force. It will offer recommendations on how best to overcome each of the challenges. It is important first to review the conclusions of the first two chapters. The basic premise of this work has been to show that there is a viable and lethal air threat. This air threat is characterized by the emergence, in several theatres of operation, of the phenomenon of guerilla air war. Guerrilla air war uses advanced civilian technology to make old weapons into efficient

aerial strike platforms. The US Army's AMD force is not equipped to defeat this threat at the tactical level. The removal of tactical level AMD assets has left Army maneuver forces vulnerable to guerilla air war. The Army's new weapon systems will not address this threat completely. The remainder of these pages will now address potential solutions to these problems.

The first issue facing the Army is the lack of an organic tactical surface-to-air system. The loss of this asset has made Army maneuver forces vulnerable to artillery, UAVs, and cruise missiles. Making the C-RAM system mobile will solve this challenge. The second issue is the lack of integration between the AMD branch and tactical level units of the Army. AMD branch is not rotating combat battalions to Iraq or Afghanistan. The removal of tactical-level AMD assets has removed the AMD branch from the Army's current mission. Adding an AMD force at the division level would protect the Army from new AMD threats. It would also provide the Army with another force protection asset. The final issue involves training the Army against realistic air threats. AMD branch leadership must communicate with the rest of the Army about the true nature of the air threat and enhance Army training and education.

## Mobile C-RAM: The Return of the Vulcan

The US Army traditionally has approached a new enemy threat by fielding a new weapon. This process takes years and can cost millions of dollars. The AMD branch has already had one famous weapon system cancelled because of inflated costs and poor system performance. The SGT York was supposed to provide the Army with a short-range tactical air defense system, and to counter the new Soviet Mi-24 Hind attack helicopter. While the threat was legitimate, the SGT York was a complete failure. The SGT York was cancelled, and the Army did not receive a new short-range ADA system for another ten years.[66] There is currently no money or political or

[66]Global Security, SGT York, Available from http://www.globalsecurity.org/military/systems/ground/m247.htm; Internet; assessed on 11 January 2007.

military will to design and field a new SHORAD weapon system. The SHORAD weapon that would most benefit the AMD branch is a mobile C-RAM.

The M-163 Vulcan is an armored vehicle carrying a six-barrel, 20 millimeter cannon, which is capable of firing close to 4,500 rounds a minute.[67] The M-163 Vulcan became operational in the 1960s. The M-163 Vulcan exists in both the towed and self-propelled models, and is still in service with some allied nations.[68] This system used to be one of the primary tactical level air defense assets of the Army. The Vulcan became a force protection asset in Vietnam, Panama, and Desert Strom when there was not an enemy air threat. The C-RAM and the Vulcan use the same cannon and the same ammunition. To become a mobile C-RAM system, the Vulcan needs to be upgraded.

The Vulcan left the active Army in 1994. The Avenger and the Bradley Linebacker replaced the Vulcan. The fundamental weakness of the Vulcan as an AMD weapon was its lack of range. Capable of engaging aircraft and helicopters out to only 1,300 meters, the Vulcan was unable to protect Army assets from the top-of-the-line Soviet aircraft, and helicopters.[69] Today, the manned air threat no longer exists or it exists in such a limited form that the Air Force has little trouble establishing air supremacy. The Vulcan is an old weapon that can be upgraded with tracking and early warning software. The added advantage of the Vulcan is the mobility and its application as a force protection asset.[70]

The M-163 Vulcan has the capability to become an effective C-RAM system by upgrading its tracking and targeting electronics. The C-RAM is one of the most advanced weapon systems in service. Each C-RAM is equipped with a tracking and targeting radar, a Forward-

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[67]Global Security, M163 Vulcan, Available from http://www.globalsecurity.org/military/systems/ground/m163.htm; Internet; accessed on 12 November 2006

[68]Based upon the author's personal experience as a Avenger platoon leader in Korea from 1995-1996. The South Korean Army's primary ADA system along the DMZ is the towed Vulcan. An estimated 3,700 systems are in service.

[69]Ibid.

[70]Ibid.

looking Infrared (FLIR) sight, and a low-light television sight. By placing the advanced C-RAM turret on an M-113 or an MLRS vehicle, one could field a mobile C-RAM. This weapon could continue to accomplish the C-RAM mission and more. The mobile C-RAM can assist the tactical Army by guarding convoys and doing other force protection missions. It is beyond the scope of this monograph to evaluate the effects of using 20 millimeter cannon in a direct fore mode. However, AMD assets have undertaken this mission for decades. AMD assets of the 4th Infantry Division used the M-42 Duster during Vietnam as a direct fire convoy escort asset. The M-42 was a self-propelled vehicle armed with twin 40 millimeter cannons primarily designed as an anti-aircraft system. There was no air threat in Vietnam, but there were plenty of force protection missions. The M42 Duster became very effective at providing force protection to unarmored convoys and breaking up dismounted enemy attacks. The real advantage to the Vulcan is that it is not a brand new weapon. The Army would be able to bypass the usual procurement process, and all the costs incurred. A new version of the Vulcan could be available in a relatively short time.

## The Return of AMD to the Tactical Army

The AMD branch has no weapon system at the tactical level, a fact that has led to the removal of the AMD branch at the tactical level. Failure to have integrated AMD forces at the tactical level puts the Army in danger. The reintroduction of the Vulcan would immediately reintegrate the AMD branch into the Army at the tactical level. No tactical maneuver commander has the ability to deliver surface-to-air fires to protect their forces from the air. The Army needs a tactical level AMD force to become a more effective part of the combined arms team.

Despite the lack of organic weapons, the Army has maintained the staff AMD role at the BCT level. The ADAM cell does not function as a pure AMD asset. ADAM cells are an airspace manager in cooperation with Army aviation to track and manage airspace in the brigade AO. The ADAM cell is equipped with an AMDWS workstation and is capable of receiving early warning of an impending air attack through the same complex C4I systems Patriot battalions' use.

However, the ADAM cell has no ability to defeat a hostile air-track, and it has no representation at the battalion level. The removal of tactical level AMD assets has put a further burden on junior and mid-grade leaders by placing them in integrated combined arms units without assets. If the ADAM cell identifies an AMD threat to the maneuver BCT, they are powerless to provide a solution. Maneuver BCT commanders are genuinely concerned about AMD threats, but have little time for "extra staff" that can do nothing but identify problems. This situation hurts the reputation of the AMD branch throughout the Army.

The AMD branch is the only branch of the Army not actively engaged in Iraq and Afghanistan.[71] It is easy to argue that the lack of a TBM threat means Patriot battalions should not be pulling duty in Iraq. The AMD force must reintegrate itself into the tactical level by providing assets that help the tactical level commander. By not participating in Iraq and Afghanistan, the AMD branch is not gaining experience and leadership needed for its Soldiers. Iraq is a dangerous place, but for the thousands of Soldiers who complete a tour there usually return as stronger Soldiers. The AMD branch is putting its Soldiers at risk. AMD Soldiers will be judged for promotion and advancement against the rest of the Army. What happens to officers and NCOs who have not had a combat tour in Iraq and Afghanistan? Will promotion boards be able to objectively identify the fact that AMD Soldiers do not go to Iraq because of mission, or will they be considered "soft," and incapable of the hard duties associated with combat?

If the Army has to fight in another war, none of the current AMD battalions have any experience with Army maneuver units. In a new conflict, AMD units would have to work closely with tactical maneuver units. These units would have to learn about how the tactical Army fights while in contact. This task is enormously complex and requires regular combined training so that

[71]Based upon the author's knowledge of current unclassified AMD battalion deployments. Currently, there are 14 active duty AMD battalions. Two are in Korea, one is in Germany, one is in Japan and the remaining ten are in CONUS. No Patriot equipped AMD battalions have served in Iraq following OIF which saw the deployment of all active duty patriot equipped battalions.

units and Soldiers understand how each other operate in tactical combat. Currently, active duty AMD battalions do not train with maneuver BCTs or divisions.

The reintroduction of a tactical level AMD system that directly serves the BCT or division commander is the only realistic solution to this problem. By incorporating a mobile C-RAM system, the AMD branch will be able to be an effective player in the combined arms force. The AMD branch can then be more engaged in the conflicts in Iraq and Afghanistan by having these types of units. The reality is that SHORAD battalions were engaged in that very mission prior to their deactivation. Later, 4-5 ADA deployed to Iraq with the 1st Calvary Division in March of 2004. 4-5 ADA acted as an ad hoc motorized infantry battalion for the 2nd BCT and DISCOM, 1st Cavalry Division. Latter 4-5 ADA guarded route "IRISH" (Baghdad Airport Road), freeing up infantry and armor units for other important missions.[72] Despite these successful missions, the AMD leadership failed to recognize the value of their own units, and they were deactivated.

The solution is to place an AMD battalion into the Maneuver Enhancement Brigades (MEB). The MEB augments each of the ten divisions with additional engineer and chemical assets. It would be possible to combine a mobile C-RAM system with Avenger (STC) and Sentinel Radar to form a new SHORAD battalion. A battery of SLAMRAAM, added to the battalion will provide the division with long-range AMD protection. While this battalion would primarily be an AMD force, it would train for secondary missions like force protection and convoy escort. AMD would return to the tactical level, and give the BCT ADAM cells something real to work with.

[72]Based upon the author's discussions with Colonel Todd Morrow who commanded 4-5 ADA, 1st CD during OIF rotation II. 4-5 was assigned tow 2nd BCT, 1st CD as a motorized infantry battalion conducting security operations in Bagdad.

## AMD Education and Training

The final issue this monograph will address is the process of educating and training the Army with regard to the nature of the air threat. The Israeli war with Hezbollah and the conflict in Iraq have changed the perception within the Army about air threats. Prior to these conflicts, the Army did not have a clear idea of what air threats were facing US forces. The uses of armed UAVs, long-range rockets, and enemy artillery have highlighted the air threat that exists today. An aggressive plan within TRADOC is needed to educate Army leaders on the threat of guerrilla air war. Only by education and training can the Army come to terms with this new threat. It is important Soldiers understand and train against this threat before they see it for the first time on a battlefield.

The next step is for the AMD branch to fully understand the nature of this threat, and apply solutions to the tactical force. This entails TRADOC spending time teaching the nature of the threat throughout the current Army education system. Command General Staff College and Captains Career Course should revamp their training to portray a realistic air threat during exercises. All levels of enlisted education and training should contain descriptions of the new air threat. US Army NCOs should clearly understand the diverse nature of the air threat, and the way it makes use of technology. These courses should not continue to use old manned air systems to articulate the nature of the air threat.[73] The value in this approach goes beyond the education of the air threat. By teaching US Army Soldiers about learning about adaptive enemies, the Army is better preparing them to face the real thing.

The CTCs should adopt a more asymmetric training air threat. CTCs should include UAVs and guided artillery to highlight the threat and to foster debate within the service. CTCs are perhaps the most important training tool within the tactical level Army. CTCs have allowed

[73]Based upon the author's experience at Command and General Staff College 2005-2006. The capstone division tactics exercise was a typical high intensity conflict computer simulation with enemy fixed wing aircraft attacking US forces.

US Army tactical forces to train against real, thinking enemies. This tough realistic training has made the US Army the premier tactical force on the planet. It is time to apply the same principles to fighting an enemy air threat. It is not enough for US Army forces to receive a briefing on enemy UAVs or cruise missiles. It is important for Soldiers to see and train against a real thinking enemy using guerilla air-war tactics. Once BCTs are attacked by an armed UAV or have to deal with a cruise missile strike, they will begin to understand and eventually overcome the threat. By applying this new threat model, tactical level forces will recognize and adapt operations to meet this new threat.

## Conclusions

The US Army AMD force is at an historic crossroads. For the next ten to fifteen years, a peer competitor with a manned air threat is not a realistic probability. However, current and future enemy forces are capable of attacking US forces from the air. The enemy, as seen today in Iraq and Afghanistan, regularly attacks US forces with artillery and rocket fire. The enemy will adapt existing commercial high technology to enhance these older weapons. These weapons, while old, will only become more accurate. Hezbollah has given extremist organizations and nations a blueprint to attack Western nations from the air. Hezbollah was able to challenge the most advanced military force in the Middle East. A nation using Hezbollah's strategy in a conflict with the US could cause significant casualties.

The US Army's AMD branch has the direct responsibility for protecting the US Army from air attack. The AMD branch has done a good job protecting operational assets from TBM threats. However, the AMD branch has failed to recognize the true nature of the air threat against US forces at the tactical level. The Army will develop and field three new AMD systems. They are good systems. However, none of them addresses the threat to the Army tactical force. THAAD will be an excellent medium-range operational-level TBM defense system. THAAD will augment and enhance current Patriot equipped forces. However, it is not designed to be part of a

maneuver force. MEADS is supposed to be a replacement for Patriot. MEADS is years away from deployment, and its equipment currently does not exist. There is no indication that MEADS will be any more mobile than the current Patriot force. SLAMRAAM can provide effective cruise missile defense. However, it is a pure AMD system offering no other application to today's current fight. C-RAM is the most important tactical level AMD system fielded in the last forty years, and it has not received the attention or money it deserves.

The solution to this problem is the reintroduction of a tactical level AMD system. This system must be organic to the division modular structure. This system must be able to do more than just AMD specific missions. The M-163 Vulcan can provide the AMD force with a tactical system. The advantage of the Vulcan is that it is self-propelled, and can perform in an offensive and defensive role. The Vulcan already exists so there will be no costly development process. Putting the current C-RAM turret on a mobile vehicle will enable the AMD branch to protect the tactical Army.

The Army needs to place a SHORAD battalion in the maneuver enhancement brigade. By putting a tactical-level AMD force in an MEB, divisions are better prepared to respond to the existing air threat. These battalions do not need new weapons and the Soldiers already exist. Combining Sentinel Radar, Avenger STC, and a mobile C-RAM system, the Army will be protected at the tactical level.

In addition to the reintroduction of a SHOARD battalion, the Army must do a better job educating and training the force with regard to this threat. Today's CTCs do not include a robust enemy air threat that adequately replicates enemy tactics. Incorporating these threats into CTC rotations would allow the Army to educate current and future leaders on the nature of the air threat. Army Soldiers must train against "guerilla air war" before they encounter the real thing on the battlefield. The new training program will require aggressive implementation by TRADOC. This must occur not only at the CTCs, but also at key leadership development schools so Army leaders can see and understand current AMD challenges.

The AMD branch is a relevant force in today's Army. No nation on earth has the ability to challenge US manned Air Forces. However, the enemies of the United States have been able to adapt old weapons and enhance them with commercial technology. These enhanced weapons have the capability to threaten US forces from the air. While the AMD branch has many effective weapons, none of these systems can protect US Army forces from all threats. The most serious gap in AMD coverage is at the tactical level. The removal of dedicated tactical AMD system has left US Army forces vulnerable to the new air threat. A solution to this problem exists and can be fielded for far less money than a new weapon system. This solution will not solve all of AMD problems. Nevertheless, it will move the AMD branch back into the tactical maneuver level and contribute to the combined arms team.

# Bibliography


Babers, Charles. “The Art of Missile Defense: Common Considerations in Missile Defense Planning.” *Air Defense Artillery Magazine* (January-March 2006): 4.

Baumann, Gary. “100th Missile Defense Brigade: Homeland Security for the Future.” *Air Defense Artillery Magazine* (October-December 2005): 10-12.

Bowen, Gregory S. “Defending the Homeland: 49th Missile Defense Battalion (Ground Based Midcourse Defense).” *Air Defense Artillery Magazine* (October-December 2005): 13-15.

Brown, Heidi, Colonel. Fort Bliss Transformation. Briefing to Command and General Staff College, Fort Leavenworth, KS, 21 August 2006.

Caffrey, Mathew B. “Red Flag for Joint Campaigns: Building a More Effective Air and Joint Force Through Better Operation And Strategic Wargaming.” *Air and Space Power Chronicles* (21 April 2004). Available from http://www.airpower.maxwell.af.mil/airchronicles/cc/Caffrey1.html. Internet. Accessed on 12 January 2007.

Cohen, Harry L., and Gregory C Kraak. “Finding Common Ground: Air Defense Artillery and Field Artillery.” *Air Defense Artillery Magazine* (January-March 2006): 10-15.

Cosumano, Joseph M., Jr. “Global Air and Missile Defense: Weapons Centric to Joint Domain.” *Army Magazine* 53 (December 2003): 26.

Curtis, Nicole. “C-RAM Task Force, Air Defense Artillery School Continues Quest for Ultimate Counter Rocket Artillery Mortar System (CRAM*).” Air Defense Artillery Magazine*. (July-September 2005): 7.

Department of Defense. *Integrated Air and Missile Defense Joint Integrating Concept, Version 2.1.* Washington, DC: Government Printing Office, 2004.

_____. Organization and Functions Guidebook, *Ballistic Missile Defense Organization.* Available from http://www.defenselink.mil/odam/omp/pubs/Guide Book/BMDO.htm. Internet. Accessed on 8 February 2007.

Department of the Army. FM 100-12, *Army Theatre Missile Defense Operations.* Washington, DC: Government Printing Office, March 2000.

_____. FM 3-01.4, *J-SEAD, Multiservice Tactics, Techniques, and Procedures for Joint Suppression of Enemy Air Defenses.* Washington, DC: Government Printing Office, May 2004.

_____. FM 3-01.60, *Counter Rocket Artillery and Mortar (CRAM) Intercept Operations.* Washington, DC: Government Printing Office, March 2006.

_____. FM 3-01.7, *Air Defense Artillery Brigade Operations*. Washington, DC: Government Printing Office, October 2001.

_____. FM 3-01.87, *Patriot Tactics, Techniques Procedures*. Washington, DC: Government Printing Office, August 2006.

_____. FM 44-44, *Avenger Platoon, Section, Squad Operations.* Washington, DC: Government Printing Office, 1995.

_____. TRADOC Pamphlet 525-3-01.94 O & O, *The United States Army Air and Missile Defense Concept and Operational and Organizational (O&O) Plan for Future Force,*

*Concept* Coordinating Draft, version 3.0. Washington, DC: Government Printing Office, 2004.

_____. *US Army, Operation Iraqi Freedom Observations, Quick Look.* Washington, DC: Government Printing Office, 2003.

Dodgen, Larry J. "Space: The Evolving Importance of the Final Frontier." *Air Defense Artillery Magazine* (October-December 2005): 6-9.

English, Tony, Tactical Systems Manager-LT, United States Army Air Defense Artillery School. "Air Missile Defense Command." Briefing to Students, Command and General Staff College, August 2006.

Exum, Alex. Policy Focus #16, *Hezbollah at War, Weapons and Tactics*. Washington, DC: Washington Institute of near East Policy, December 2006.

Fontenot, Gregory, E. J. Degen, and David Tohn. *On Point: The United States Army in Operation Iraqi Freedom.* Fort Leavenworth, KS: Combat Studies Institute Press, 2004.

Global Security. AMRAAM. Available from http://www.globalsecurity.org/military/ library/budget/fy1997/dot-e/airforce/97amraam.html. Internet. Accessed on 4 January 2007.

_____. Armed UAVs. Available from http://www.globalsecurity.org/org/ news/2006/060714-hizbollah-airpower.htm.; Internet. Accessed on 6 January 2007.

_____. Cruise Missiles. Available from http://www.globalsecurity.org/wmd/ intro/cm.htm. Internet. Accessed on 10 September 2006.

_____. F-22 Raptor Cost, February 2005. Available from http://www.globalsecurity. org/military/systems/aircraft/f-22.htm. Internet. Accessed on 10 February 2007.

_____. Home Page. Available from http://globalsecurity.net. Internet. Accessed July-December 2006).

_____. MEADS. Available from http://www.globalsecurity.org/military/library/ budget/fy2001/dot-e/other/01meads.html. Internet. Accessed on 16 January 2007.

_____. M163 Vulcan. Available from http://www.globalsecurity.org/military/systems/ ground/m163.htm. Internet. Accessed on 12 November 2006.

_____. SGT York. Available from http://www.globalsecurity.org/military/systems/ ground/m247.htm. Internet. Assessed on 11 January 2007.

_____. SS-21 SCARAB. Available from http://www.globalsecurity.org/military/ world/russia/ss-21-specs.htm. Internet. Accessed on 10 November 2006.

_____. Tactical High Energy Laser (THEL). Available from http://www.global security.org/space/systems/thel.htm. Internet. Accessed on 12 August 2006.

_____. THAAD. Available from http://www.globalsecurity.org/space/ systems/thaad.htm. Internet. Accessed on 12 December 2006.

Keegan, John. *The Iraq War*. New York, NY: Alfred A. Knopf Publishing, 2004.

McConkey, Mark S. "Ballistic Missile Defense and National Defense Strategy, Striking a Balance Between Defense, Cost and Risk." Research Project, U.S. Army War College, Carlisle Barracks, PA, 4 July 2004.

McGhee, Mark. "What is the Future of Army Air and Missile Defense?" Research Project, US Army War College, Carlisle Barracks, PA, 7 April 2003.

32d Army Air and Missile Defense Command (AAMDC), *Operation Iraqi Freedom, Theater Air and Missile Defense History*." September 2003. Available form http://www.cdi.org/PDFs/OIF_history.pdf. Internet. Accessed on 5 February 2007.

Preacher, Jeff, Lieutenant Colonel, Directorate of Training-Upper Tier. THAAD Overview Brief. Command and General Staff College, Fort Leavenworth, KS, 21 August 2006.

Riggs, Robert. CBS 11 News. "Blue on Blue" How Did An Army Patriot Missile Battery Shoot Down a Navy F-18? 5 February 2004. Available from http://www.globalsecurity.org/org/news/2004/040205-patriot-shootdown.htm. Internet. Accessed on 21 January 2007.

Riley, James C., Lieutenant General (Ret), and Brigadier General (Ret) Michael Means. "The Looming Force Protection Crisis for Brigade Combat Teams." *Air Defense Artillery Magazine* (October-December 2006): 9-11.

Rostker, Bernard. "Transformation and the Unfinished Business of Jointness: Lessons Learned for the Army from The Persian Gulf, Kosovo, and Afghanistan." Monograph on-line. Available from http://rand.org/pubs/monograph_reports/MR1657/MR1657.ch7.pdf. Internet. Accessed on 21 January 2007.

Samii, Bill. Radio Free Europe/Radio Liberty., Iran: Navy Stresses Area Denial. Available from www.rferl.org. Internet.; Accessed on 21 February 2007.

Slayden Patricia H. "NetFires Center of Excellence: Chief of ADA Comments On Consolidation of Air Defense Artillery and Field Artillery Schools and Possible Merger of Branches." *Field Artillery Journal*. (January-February 2006): 10-18.

Spier, William A. "Operational Art Considerations for Army Air and Missile Defense: Lessons for the October War." Monograph, School of Advanced Military Studies, Ft Leavenworth, KS, 22 May 2003.

Swicker, Charles C. "Ballistic Missile Defense from the Sea, Commander's Perspective." *Naval War College Review* 1, no. 2 (Spring 1997). Available from http://www.nwc.navy.mil/press/Review/1997/spring/art1sp97.htm. Internet. Accessed on 14 January 2007.

Turabian, Kate L. *A Manual for Writers of Term Papers, Theses, and Dissertations*. 6th ed. Chicago: University of Chicago Press, 1996.

United Kingdom, Directorate of Air Staff. Ministry of Defense. Military Aircraft Accident Summary, Aircraft Accident to Royal Air Force Tornado GR MK4A ZG710. 22 March 2003. Available from http://www.iwar.org.uk/news-archive/2004/pdf/maaszg710.pdf. Internet. Accessed on 10 January 2007.

United States Army. Attack on 507th Maintenance Company. Available from http://www.army.mil/features/507thMaintCmpy/. Internet. Accessed on 10 November 2006.

Vane, Michael. "Historic Transformation." *Army Magazine* 54, no. 12 (December 2004): 3-6

Vane, Michael, Tim Keppler, and Goulas Agee. "Army Air and Missile Defense Transformation." *Army Magazine* 53, no. 12 (December 2003): 37.

Wallace, William S. "A Joint context for training at the Combat Training Centers." *Military Review*, (September-October 2004) Available from http://www.findarticles.com//articles/mi_m0PBZ/is_5_84/ai_n7069225/print

Wikipedia. Hezbollah Israel/Lebanon Update Stratfor (2008-08-08). Available from http://en.wikipedia.org/wiki/2006_Israel-Lebanon_conflict. Internet. Accessed on 10 November 2006.