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Divisional Air Defense: The Shield of Blows

A Monograph
by
Major Cornell T. McGhee
Air Defense Artillery

School of Advanced Military Studies
United States Army Command and General Staff College
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ABSTRACT

Divisional Air Defense: The Shield of Blows
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This monograph examines whether the air defense artillery battalion organic to armored or mechanized divisions is necessary for operations on future battlefields. To explore relevant issues in this area, historical examples from World War I, the Falkland Islands Conflict, the Afghanistan War, and the Israeli invasion into Lebanon in 1982 are cited as lessons learned. An examination of the air defense Battlefield Operation System functions as specified in TRADOC Pamphlet 11-9 then serves as a baseline for comparison against currently fielded air defense weapon systems and their ability to accomplish the mission assigned them.

The study determines that American mechanized and armored divisions are vulnerable to engagement from modern attack helicopters. Additionally, divisions are vulnerable to detection from enemy unmanned aerial vehicles and remotely piloted vehicles, which can relay friendly unit locations to threat target engagement systems. The division air defense battalion is severely limited in its ability to engage these weapon and information systems at their maximum effective ranges. A materiel solution to the problem is required.

The study concludes that the Army must continue to develop and field a complementary system of divisional air defense artillery weapons which can engage rotary wing targets, low observable targets (UAV/RPV), as well as fixed wing close air support aircraft. In our weapons acquisition process, we must not favor the offense to the exclusion of the defense. We must continue to advance our technological edge in order to defeat a variety of threat aircraft that could interfere with our ability to defend our national interests.

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INTRODUCTION

> Desert Storm will go down as the most successful AirLand operation to date. . . . Out of the 68 army divisions available to Saddam Hussein on 15 January [1991, the commencement of the air war], air, ground and naval assault rendered 42 of them combat ineffective.[1]

During Operation Desert Storm, coalition air forces (United States, Great Britain, Kuwait, Saudi Arabia, France, Italy, Canada) rapidly achieved air superiority[2], then air supremacy[3], suffering no losses in air-to-air combat. The Iraqis did not bring their aircraft to combat and chose to abandon aerial operations rather than press home an attack. In addition, at least 37 Iraqi aircraft flew low and fast to Iran where they remain as property of the Iranian government.[4] For whatever reason, Iraq did not attack American forces with fixed or rotary wing aircraft throughout the duration of the conflict. The research question I intend to address is: given the current and projected superiority of American airpower, does the requirement for divisional air defense artillery systems still exist? This monograph will address the current mechanized and armored division air defense battalion and its ability to defeat postulated threat aircraft on the modern battlefield. The air defense battlefield operating system (BOS) functions will serve as the baseline for comparison.

The perception of political and Army officials is that the currently fielded divisional air defense systems are sufficient for the future threat.

A dangerous assumption to make, is expressed by Colonel Wolf-Dietrich Kutter in a recent Army magazine article:

> Operation Desert Storm demonstrated the extent to which superior weapon systems, in sufficient quantity, contribute to the successful outcome of a campaign; yet, in the rush to harvest a "peace dividend," enormous political pressures have been generated to curtail that very investment stream that would offer the sons and daughters of our republic the opportunity to succeed in land campaigns of the twenty-first decade.[5]

Air Defense is but one of seven battlefield operating systems in which the Army wants to modernize currently fielded weapons to counter future battlefield threats. The problem is that divisional air defense has still not fully modernized to the same levels as other battlefield operating systems such as maneuver, fire support, and combat support. The maneuver BOS has fielded the M1A2 Abrams main battle tank, the M2 and M3 Bradley fighting vehicle system, the AH-64 Apache helicopter, and the OH-58D Kiowa warrior helicopter. The fire support BOS has fielded the Army tactical missile system (ATACMS), the multiple launch rocket system (MLRS), and the air to ground missile system (AGMS). The combat support BOS has fielded the Blackhawk helicopter, the armored combat earthmover (ACE), the high mobility multipurpose wheeled vehicle (HMMWV), and numerous special operations aircraft. The air defense BOS has fielded one operational system, the PATRIOT, and one tactical system, the Avenger. A question that must be answered is: in view of future threats to the armored and mechanized division does the air defense BOS at the tactical level need to modernize?

An examination of the defensive and offensive theories of warfare of Carl Von Clausewitz, Giulio Douhet, and Colonel John A. Warden provides the framework for discussion of the monograph. The monograph will then present a doctrinal summary of the air defense BOS in relation to Army operations. In this manner the relationship between offensive and defensive theories of warfare, as practiced by the American military will be examined. A historical examination of World War I, the Falklands Crisis, the Afghanistan War, and the Arab-Israeli Conflict in Lebanon, 1982 will provide evidence for the value of low level air divisional defense systems. A critical analysis will then identify the ability of the air defense battalion to accomplish the mission according to the air defense BOS functional description and the most likely air threats to the division. The summary comments on the relevance of the monograph to the future heavy division air defense battalion and the Army.

There are several assumptions necessary for the conduct of the research and analysis contained in this monograph. First, the air threat to front line army divisions will not deviate significantly from current intelligence projections; there are no threat aircraft in development that will suddenly present a new and significant danger to U. S. military forces or national interests. Second, continued funding for military research, development and acquisition projects will continue to decline. The anticipated peace between nations will force the country to allocate resources to nonmilitary purposes, as America cannot afford to purchase

every competent weapon system currently in development. Finally, the Air Force and the Army's PATRIOT units will provide high to medium range air defense coverage to the forward battle area and beyond. The air-battle above 10,000 feet is not within the purview of the division commander. The weapons that fight the air-battle above 10,000 feet (fixed wing aircraft and high altitude air defense weapons) neither belong to the division commander, nor are they under his command and control.

DEFENSIVE VS OFFENSIVE THEORY

Although Carl Von Clausewitz wrote his famous treatise "On War" immediately after the Napoleonic period, its relevance to today's armed forces remains clear.

> Defense, as we see it, is nothing but the stronger form of combat. The preservation of one's fighting forces and the destruction of the enemy's--in a word, victory--is the substance of this struggle; but it can never be its ultimate object.[6]

Clausewitz believed defensive warfare was inherently stronger than offensive warfare. This was a radical change in thought for 19th century tactical warfare. Previous military theorists believed that success on the battlefield required an offensive minded enemy. The stronger force would venture out into the countryside seeking and devouring weaker armies. After the campaign both the victor and the vanquished suffered tremendous losses in personnel and equipment that

often negated the success achieved on the battlefield. Clausewitz believed this offensive minded concept was dated and should be revised, hence the development of his concept of the defensive form of war.

> What is the concept of defense? The parrying of a blow. What is its characteristic feature? Awaiting the blow. A battle is defensive if we await the attack-await, that is, the appearance of the enemy in front of our lines and within range.[7]

This was the strength of the Clausewitzian form of combat. One army would prepare intricate defensive positions on native ground and would await the arrival of the attacking army. The defender would construct positions designed to absorb the blows of the attacker.

The next phase of the operation was the absorption of blows by the attacking force. If the defense had successfully accomplished its mission, the attacker's force should be weakened. "When one has used defensive measures successfully, a more favorable balance of strength is usually created."[8] The defending force had the advantages of time while constructing defensive positions on familiar terrain. The offensive force could potentially attack into the strength of the defense. The attacking force would not know where the defenders' positions and forces were located and would suffer numerous losses as a result. The conditions for the third phase of the defense would now be set.

"But if we are really waging war, we must return the enemy's blows. . . ."[9] The defense is not a passive act. After a successful defense, a portion of the defending army should return the blows of the

attacker. This counterattack would theoretically reduce the attacking army to a combat ineffective status forcing his retreat.

Therefore there are three components to the defense, the construct of defensive positions, the initial parrying of the blow that allows the defender to protect and preserve the force and the counterthrust that strikes back at the enemy and totally reduces his capacity to wage war.

Air defense artillery is the shield of blows. Clausewitz could not have imagined the development of air defense artillery, yet the principles of the defense retain a universal character that makes them applicable to all forms of defensive warfare. A properly equipped and arrayed air defense force has the potential to weaken significantly the attacking force. A properly deployed air defense artillery shield protects and preserves the defended force and allows the maneuver forces to return the blows of the attacker. The air defense force also has the potential to weaken significantly an attacking force (aircraft) that stumbles into the defended area, further reducing the combat power of the attacker. This also creates conditions for the defending force to return the blows of the enemy and successfully conquer their foe.

One of the significant applications of Clausewitz to air defense artillery is that the defender can choose the terrain on which he will defend. For the air defense artillery the ability to set the terms for combat provides a tremendous advantage. The offensive force generally does not know where the defensive forces are located, and will

potentially attack into the defense's strength. Technology will enhance an air defense artillery battalion's ability to share target tracking and engagement information without giving away the defensive position.

A properly planned defense allows the defender to counterattack under conditions and at positions of choice. "The defender . . . . is able to surprise his opponent constantly throughout the engagement by the strength and direction of his counterattacks." [10] The defender absorbs the blows of the attacker and preserves his force for the counterattack.

Does the attacker have any advantages during this interchange? Certainly! "The one advantage the attacker possesses is that he is free to strike at any point along the whole line of defense, and in full force." [11] The defensive force must take this into account and design the counterattack force accordingly.

The central question of the interpretation of Clausewitz' principles to air defense artillery force structure is the mixture of the defensive forces (air defense weapons) and the counterattack or offensive forces (aircraft) a nation can afford. Either aircraft or air defense artillery could be the shield of blows that protects and preserves the maneuver force. Each has its own advantages and disadvantages. Air defense artillery weapons are primarily static and remain with the protected force throughout the duration of the battle. Division air defense artillery can protect the maneuver force twenty-four hours per day, in all weather conditions. The primary disadvantage is that an adequate air defense is

directly proportional to the number of operational systems available for area or force coverage. Historically, there have not been an adequate number of systems to protect all the high priority division assets.

The advantage of an aircraft defense force is that these weapon systems may be utilized in the defense as well as the counterattack role. Technology has afforded modern aircraft the capability to perform a wide variety of combat and combat support missions. However, the defended ground forces are left without adequate protection from threat aerial engagement when aircraft counterattack. In theory this problem is nonexistent as long as the defending force absorbs all the blows of the attacking army and destroys their offensive capability during the counterattack phase. Whether or not a defending force could accomplish those objectives in actual combat is subject to debate.

While Clausewitz provided the theoretical base for the air defense artillery, General Giulio Douhet fathered airpower theory. Douhet professed a doctrine that differed significantly from that of Clausewitz in that he favored offensive versus defensive actions. Douhet wrote prolifically during the early twentieth century. The object of his studies was to support the offensive use of airpower. By the outset of World War I, Douhet had already formulated a substantial portion of his theories, in particular the idea of forcing an enemy nation to capitulate by means of a bombing campaign directed against the morale of its population. This line of reasoning was novel in that the air arm of military power was

deemed to be independent from the land and sea based forces. In Douhet's mind, an independent air force was the proper military arm to rain death and destruction upon one's enemies.[12]

The airplane for Douhet represented a manner in which the dangers and stalemate of World War I trench warfare, defensive warfare, could be avoided. The airplane represented the offensive vehicle long sought out to project combat power. "For it is possible to go far behind the fortified lines of defense without first breaking through them. It is air power which makes this possible." [13] This capability presented new opportunities for those who could use it properly. "The airplane has complete freedom of action and direction; it can fly to and from any point of the compass in the shortest time--in a straight line--by any route deemed expedient." [14] Airpower should be used to destroy the enemy air force, not in aerial combat but on the ground. A nation then had to choose which military branch of service could best protect the interests of the nation, an offensive air force or a defensive army. Douhet did not believe that the defensive form of war applied to the modern airplane.

Douhet's antagonists stated that every innovation and weapon system had favored the defense. Smokeless gunpowder, the rifled bullet, and the machine gun are examples. They believed the airplane would naturally follow suit. Douhet disagreed.

> But to say that the increased power of new weapons favors the defensive is not to question the indisputable principle that wars can be won only by offensive action. It means simply that, by virtue of increased firepower, offensive operations demand a much larger force proportionately than defensive ones.[15]

It was Douhet's assertion that a nation must act offensively against its enemies for adequate self-defense against air attack.

Douhet did not believe any defense was possible against the airplane; neither did he believe the airplane itself could be used for defensive purposes. Since in his view, the airplane is "preeminently an offensive weapon." [16] Douhet predicted neither the defensive use of fighters and pursuit aircraft, nor the ascendancy of anti-aircraft artillery weapons. Douhet neglected to foresee the ability of ground forces to defend themselves from the air. In fact, Douhet did not even think this possible:

> Nothing man can do on the surface of the earth can interfere with a plane in flight, moving freely in the third dimension. All the influences which have conditioned and characterized warfare from the beginning are powerless to affect aerial action.[17]

The outcome of Douhet's assertion is that the potential offensive power the airplane is capable of generating favors the production of these forms of warfare over other, less capable, defensive oriented weapons. A nation with a strong offensive air force can travel to other nations and impose their will without suffering the drastic effects of those incurred during World War I. The prioritization of national resources becomes the primary question, buying offensive or defensive oriented systems.

A contemporary military airpower theorist who has adopted many of Douhet's contentions is Colonel John A. Warden III. Colonel Warden asserts that no defense against the proper use of airpower is presently possible, but he does acknowledge the future possibility of a credible defense.

> This situation could arise if a state were able to create a sufficiently strong ground-based air defense system. To date, no ground system has given this degree of protection, but it is theoretically possible.[18]

Colonel Warden recognized Clausewitz' doctrine, yet it was not applicable to his particular offensive theory of warfare. "The defense, in classical land warfare, may well be stronger than the offense, as Clausewitz postulated. In air war, however, the opposite seems to be the case." [19] Colonel Warden felt there were three reasons for such a belief. First, air forces can move with such freedom on the battlefield that they can instantaneously attack from numerous directions, something a land army cannot do very well. Second, because the air force could move so swiftly, it would be impossible to concentrate a defensive force against it. Third, since previous air defense systems did not fire on the move, Colonel Warden believed when air defenders moved out of prepared positions they would lose their positional advantage over the attacker.

Colonel Warden is a strong proponent for offensive action. Military airpower is the vehicle Colonel Warden believes is most capable to deliver the offensive blows to the enemy. "Whenever possible, the offensive course should be selected--if for no other reason than it is a

positive measure that will lead to positive results." [20] Clausewitz also believed this possible.

AIR DEFENSE DOCTRINE

In the division area of operation, the air defense battalion must shield the combined arms, combat support and combat service support forces from the blows of enemy air attack. The mission of the division air defense artillery battalion is to ensure the combined arms force retains the freedom to maneuver, to protect division command, control and intelligence elements, to sustain the battle, and to kill enemy aircraft the first time.[21] By protecting his critical assets, the division commander is capable of conducting offensive or defensive operations as tasked by higher commanders.[22]

Air superiority in the AirLand battlefield could be limited, and apply to specific areas for short periods. The keys to effective division air defense are economic air defense force allocation, sound planning, and proper employment of air defense resources on the AirLand battlefield.

Draft Field Manual 100-5, Operations, is the Army's current warfighting doctrine. The object of Army operations is to "impose our will upon the enemy--to achieve our purposes." [23] Success on the battlefield depends upon our ability to conduct operations according to the five tenets of Army operations: initiative, agility, depth, synchronization, and versatility.[24]

Initiative sets or changes the terms of the battle by action. It implies an offensive spirit in the conduct of all operations. The basic purpose of initiative is to force the enemy to conform to our operational tempo while retaining our freedom of action.[25] Divisional air defense artillery supports the seizing and maintaining of the initiative by protecting command and control centers, maneuver units, and controlling the air environment at the critical time and place. Air defenders must possess a dynamic offensive spirit. The air defense plan must focus on the destruction of enemy aircraft. The plan should be based upon the intelligence preparation of the battlefield conducted in conjunction with intelligence and operations personnel. During defensive operations, air defenders must anticipate enemy courses of action and negate any possible initial advantage of the attacker. In the attack, air defenders should never allow the enemy the opportunity to recover from the initial shock of the attack.[26]

Agility is the ability of friendly forces to act faster than the enemy. The implication of the above statement is that agility is a prerequisite for seizing and holding the initiative. Agility enables friendly forces to concentrate sufficient forces at the decisive place and time by being flexible to the tactical situation. Air defenders should not be restricted to a single course of action and possess the capability to adjust missions and priorities when required. Air defenders must also be physically and psychologically prepared to respond to the rapidly changing environment; this requires mental preparedness as well as a high level of training.[27]

Depth is the extension of operations in time, space, and resources. The divisional air defender must protect friendly maneuver units in the close, deep, and rear areas of the battlefield. Given the division commander's priorities, air defenders should be prepared to provide counterair protection to the complete range of battlefield operating systems against the enemy's ability to attack throughout the battle space. The divisional air defense battalion must deny the enemy aerial reconnaissance of unit systems, locations, and intentions, deny sanctuary to weapons systems such as attack helicopters, and integrate the counterair operations of other organizations involved in the fight.[28]

Synchronization is the use of time, space and resources to produce maximum relative combat power at the decisive time and place. Synchronization is both a process and a result. Key systems in the division's synchronization effort that should have priority air defense protection are the fire support, maneuver, and command and control elements. Coordination with adjacent and higher units is an important consideration to ensure all elements of power are synchronized in the fight.[29]

Versatility is the ability to shift focus, to tailor forces, and to move from one mission to another rapidly and efficiently. The suite of weapons in the division air defense artillery battalion (Stinger-Fighting Vehicle, Avenger, Stinger) should enable the commander to tailor forces to protect priority elements of the division. There is a mental state of preparedness required to ensure the battalion is well trained, well led and properly equipped to perform the necessary tasks when called upon to do so. This

requires air defense units to move rapidly from direct support to general support and vice versa as required.[30]

Since the inception of the airplane, Air Defense doctrine has adapted to the needs of the supported force. While it is dangerous to study the past to predict the future, an examination of several historic events will demonstrate whether air defense doctrine or the application of that doctrine is flawed.

HISTORICAL PERSPECTIVES ON AIR DEFENSE

Britain began investigating its ability to resist attack from airplanes or airships in 1908. A general awareness existed among politicians, defense officials, and military officers of the threat that Germany's growing fleet of Zeppelins posed to Britain. No important action occurred before World War I to provide air defense coverage for Britain.[31]

When the war began, Britain had no air units available for air defense and the responsibility to organize these efforts fell upon the State Secretary of the Admiralty, Winston Churchill. In the initial composition written on air defense theory, Churchill stressed the importance of several synergistic solutions that included target detection, target identification, dissemination of information and command and control, the engagement and/or destruction of enemy aircraft, and assessment of target engagements. Churchill's air defense organization included pursuit airplanes for engaging targets as they approached the protected

area, searchlights and sound detectors for nighttime identification, observers for daytime positive identification and early warning, and anti-aircraft artillery for target engagement. He also emphasized that it would be necessary to destroy an enemy's attacking aircraft or airships as far away from the target as possible.[32]

The air defense lessons that emerged from World War I required a wide array of air defense elements. It would be necessary to receive early warning information on aircraft entering the area of interest.[33] The enemy's planes should be tracked as they entered the area of operation,[34] with some method to indicate direction, height, speed, and size of the incoming force. Identification of the inbound aircraft was a key to prioritize possible engagements. A communication system was necessary to inform either friendly pilots or anti-aircraft artillery units of the enemy's location. Finally the ground commander should assess all the information on target engagements and control the interception of the attacking forces.[35]

During World War II radar, identification, friend or foe (IFF), and the radio were used extensively in the air defense role. Britain, out of necessity, pioneered low level air defense techniques in Europe in response to the offensive actions of Germany. Procedures such as early warning, command, control and coordination of different army and air corps weapon systems were improved throughout the war. U. S. forces also learned several unique air defense lessons in the Pacific Theater of Operations during World War II.

> The Congressional investigation of the Pearl Harbor incident pointed to the lack of coordination, inadequate command and control procedures, and a lack of dissemination of intelligence. . . . and that an effective air defense organization must be available, trained, and ready to fight *before it is needed*--not after.[36]

As previously discussed, the United States learned these lessons during World War I yet chose to ignore them. This is an example where the military decided to accept risk by not developing and fielding a proper low level air defense system and suffered the consequences as a result.

The conflict between the United Kingdom and Argentina, from 2 April to 14 June 1982 over the Falkland Islands, again demonstrated the necessity to deploy complementary air defense weapon systems. The conflict was a limited war and involved the unique conditions of hostile and difficult terrain, isolation from other land masses, the difficult logistical situation and the long lines of communications for both combatants.[37]

The conflict confirmed that the air threat in third world countries could not be ignored. Neither Great Britain, nor Argentina had a modern air force, at least in comparison to the United States and the former Soviet Union. "Both sides lacked the most modern airborne early warning, command, control, communications and intelligence, and reconnaissance assets and could not deploy a balanced force of such assets." [38] Even though Argentina did not own the most modern aircraft, the Argentine air force used them with increasing expertise and effectiveness.

> Argentine pilots rapidly adapted to flying very demanding low altitude sorties, they achieved very high rates of accuracy with iron bombs, and that they could penetrate British air and missile defenses when they concentrated large numbers of aircraft on a given target.[39]

The danger for air defense forces is to take for granted a less than modern air force. In this instance, Argentine pilot training, not the age of the aircraft, was the effective combat multiplier.

The destruction of enemy air forces is desired but not necessary as long as threat close air support aircraft cannot engage maneuver forces. This is an important air defense doctrinal implication that is often overlooked by other combat arms personnel. The Argentines used anti-aircraft guns in the Falklands against both aircraft and ground targets. Anti-aircraft guns were reinforced with various low-level surface to air missiles. The primary effect of low level air defense artillery systems has been in deterring attacks by close air support aircraft rather than destroying them.[40] The British lost eight aircraft due to low level air defense gun and missile sytems.

British troops benefited from high numbers of short range surface to air missile systems such as the American Stinger and British Blowpipe. "British data indicate that approximately 23 aircraft were destroyed due to low level air defense artillery systems."[41] The Argentines failed to use their Pucara ground attack aircraft effectively because of fear from engagement from these systems if they attacked at low altitudes. A number of these aircraft were destroyed by these missiles. Those aircraft that continued to attack from low altitudes were rarely successful in hitting ground targets and often failed to aggressively seek penetration routes.[42]

The overall lessons learned in the Falklands Conflict indicate a continuing value for low level surface to air missile systems such as the

Stinger and Blowpipe. Anti-aircraft artillery guns proved especially effective not necessarily in destroying aircraft but in reducing the effectiveness of close air support aircraft.

On 27 December 1979, the Soviet Union invaded Afghanistan. For ten years they engaged in combat with Afghan resistance fighters, also know as the Mujahideen. Throughout the duration of the conflict, both the Soviets and the resistance fighters adapted their fighting tactics to the demands of the terrain and the availability and usefulness of weaponry and resources. The Soviets, though not constrained by numbers and resources, had to refine their tactical approach to mountainous warfare and adapt their weaponry, especially the use of rotary wing aircraft.[43] The information collected by western military tacticians throughout the duration of the conflict provided numerous military lessons learned. The helicopter was the most effective weapon employed against the Afghan resistance.

The weapon most feared by the Afghan people was the Mi-24 Hind helicopter that was used for close air support, convoy escort, bombing of villages, patrolling, and search and destroy missions. The early tactics used by the Hinds indicated a total lack of respect for the resistance fighters. The aircraft engaged the ground forces from a hover or diving attack. The shoulder--fired, surface-to-air missiles later employed by the Mujahideen changed their tactics for the duration of the war. The Hinds learned to operate from safer altitudes of 1,000 feet or higher as well as flying nap of the earth techniques to avoid early detection from Mujahideen anti-aircraft gunners.

From 1981 onwards, the Mujahideen actively sought to obtain more and better anti-aircraft guns and anti-aircraft missiles. The Mujahideen acquired an impressive variety of anti-aircraft weaponry. Their stockpile of weapons included the People's Republic of China (PRC) 14.5mm and 12.7mm anti-aircraft guns, the 20mm Oerlikon-Buhrle cannon from Germany, the British Blowpipe surface-to-air missile, captured Soviet and American supplied SA-7 shoulder fired surface-to-air missiles, and the American made and supplied Stinger missiles. The U.S. also supplied a 12.7mm round that had a tungsten penetrator that could punch through Soviet cockpit armor and a phosphorous charge to start fires on any aircraft it hit.[44]

The Mujahideen first used the SA-7 Grail to counter Soviet aircraft. The resistance fighters soon discovered several deficiencies with the weapon that hampered their anti-aircraft efforts. The SA-7 required a very hot target source and therefore could only target engine exhausts. The weapon did not have the speed to chase high performance fighters. If the gunners aimed the missile within 20° of the sun, the missile would "acquire" the sun and chase it. The SA-7 left a trail of white smoke that enabled pilots to find the firing positions of the gunners. The Soviets also learned to defeat their own missiles by dropping flares from their helicopters. As a result of these deficiencies, the American and British advisors felt the rebels needed more sophisticated weapons like the Blowpipe and the Stinger.[45]

The Central Intelligence Agency (CIA), initially disapproved providing these nonaligned rebels with these front-line weapons. The

CIA changed their attitude and provided the Afghan rebels with Stinger and Blowpipe shoulder-fired surface to air missiles. The Mujahideen shot down three Hind helicopters with Stinger missiles on 26 September 1986. The Mujahideen soon killed enough Soviet fixed wing aircraft with Stingers to force them to greatly increase attack air speed and stop spending time over target. The Stingers forced fighters and fighter-bombers to increase their attack height from 2,000-4,000 feet to around 10,000 feet. Most pilots cannot visually identify targets from such a height. Soviet combat helicopter and fighter losses went from to 1.2 to 1.4 aircraft a day and dropped only after the USSR cut back sharply on its air operations. Even after the Soviets changed tactics the Mujahideen apparently killed one aircraft for every three missiles fired.[46]

Although the Stinger and Blowpipe missiles accounted for less than 50 percent of the air losses in Afghanistan, they did decrease the ability of fixed wing aircraft to find and kill targets, and they allowed the Mujahideen to move freely through their own country. The Soviet loss of the ability to control the air environment in combat gave the Mujahideen far greater freedom of action.[47] One Mujahideen commander described the impact of the Stinger as follows:

> How could we stop all the Soviet aircraft because we had 25 to 30 Stingers? No, it is impossible . . . . We have hit their morale. They have changed their flying, they use different aircraft and their best pilots. This is the effect . . . . Conventional armies cannot do it with all their equipment, and we cannot do it with Stinger.[48]

This is an unexpected benefit provided by air defense to the supported force. In a campaign of exhaustion, the Stinger and Blowpipe became weapons targeted against the morale of the enemy. By attacking the

Soviet will to fight a protracted war in foreign land, the Mujahideen believed they could outlast the invading army.

In the June to September 1982 War in Lebanon, the Israeli military attacked several hostile forces including the Syrian Army and Air Force, the military arm of the Palestine Liberation Organization (PLO), and various leftist Lebanese groups.[49] The PLO had approximately 15,000 soldiers in Lebanon to meet the Israeli invasion. Besides the PLO forces, there were five brigade equivalents of Syrian or Syrian-controlled Palestine Liberation Army (PLA) troops in Lebanon.[50]

In an event foreshadowing the future Persian Gulf Conflict, the Israeli Air Force (IAF) achieved air superiority in the initial days of the conflict. The raid on the Syrian surface to air missile batteries was a textbook example of the use of current technology on the modern battlefield. On 9 June 1982, the IAF attacked surface to air missile batteries in the Bekaa Valley. The Israeli defense forces used the Mastif and the Scout remote-piloted vehicles (RPV's) to achieve their success against the Syrian air and air defense forces.

The Israelis first flew Mastif RPV's over the battlefield, emitting dummy signals designed to confuse missile-tracking radar into thinking they were tracking actual aircraft instead of drones. The Syrian air defenders tracked the RPV's and the Mastif subsequently relayed the missile tracking signals to the Scout RPV that orbited the battlefield out of range of the SAMs. The Scout RPV relayed the missile tracking signals to E2C Hawkeye airborne warning and control system (AWACS) aircraft orbiting off the coast. The command and control aircraft gathered and

analyzed the missile tracking data generated by the RPV's to formulate attack plans for the air force. The electronic data gathered by the RPV's enabled intelligence analysts to determine the type of surface to air missile system in operation. This same information enabled operations officers to determine the optimum weapons and tactics to destroy the SAM systems. Of the nineteen SAM batteries available to Syrian forces, the IAF damaged or destroyed seventeen. [51]

The IAF also used RPV's to attack air targets as well. The IAF positioned RPV's over three major airfields within Syria to gather data on when and how many aircraft were taking off from them. The RPV's immediately relayed this data to E2C Hawkeye aircraft responsible for guiding IAF aircraft to their targets. The Syrian Air Force rose to the skies to defend their homeland to no avail. The IAF destroyed twenty-two MIG's and damaged seven others. [52]

The use of anti-aircraft artillery during the war in Lebanon provided some valuable lessons for all the combatants. The Israeli air-defense-suppression effort was so efficient that neither Syria nor the PLO made much use of anti-aircraft guns except in the area fire mode ". . . . the PLO seems to have had no idea of how to use its anti-aircraft guns effectively." [53] The IAF made good use of their organic anti-aircraft artillery guns. The IAF used the Vulcan system in the familiar dual purpose role of ground defense and anti-aircraft. The Israeli Vulcan's shot down an unspecified number of aircraft, including an Su-7 Fitter (fixed wing-ground support aircraft).[54]

The surface to air missile systems supporting the Syrian and PLO organizations included the Soviet made SA-7, SA-8, and SA-9 systems. The SA-8 and SA-9 systems are missile systems mounted on wheeled vehicles. Each wheeled vehicle has its own radar for fire control and target acquisition. The IAF successfully suppressed these systems throughout the duration of the conflict. The following methods all successfully contributed to the suppression of air defense gunners: visual detection of the air defense systems, flares, decoy techniques, aircraft-to-aircraft communications, and unmanned aerial vehicles. The Israelis possessed the HAWK and Chaparral missile systems for protection from air attack. Due to the success of the IAF (in the counterair role) the missile systems destroyed only one Syrian aircraft, primarily because of lack of opportunity to engage other aircraft.

Both Syria and Israel had been impressed by the U. S. experience with combat helicopters in Vietnam. Both nations built up a significant force of rotary wing aircraft that they used for support and close air support. Israel had 12 AH-1Gs Cobras and 30 Hughes 500 MD attack helicopters. Syria possessed at least 16 attack helicopters including 12 Mi-24 Hinds. Syria fitted a number of Mi-8 and Gazelle helicopters with ordnance and used them in the close air support role on an infrequent basis.

> Although the Israelis enjoyed air superiority high above the battlefield, they were unable to prevent Syrian attack helicopters skimming along below in spite of the fact that the Syrian pilots were mediocre. They avoided detection by air defense radar and in one case surprised Israeli columns moving through the Chouf mountains, causing mayhem. Tank crews were very concerned about attack by these.[55]

The Israeli use of armed helicopters was also successful. Using the aircraft for interdiction missions, the helicopters could kill armored targets and assist in striking mountain defenses that other weapons could not reach with any degree of accuracy. Syrian forces were vulnerable and often suffered from their inability to negate the effects of the helicopters.

It is interesting to note that in the wake of its success in the Lebanon conflict, Israel continues to rely on its fighters for air defense and it has not modernized its land-based air defenses as much as the other elements of its land forces. The Israeli Defense Force has two active air defense brigades with Vulcan and Chaparral systems. It has 50 rebuilt Soviet ZSU-23-4 self-propelled, radar guided anti-aircraft guns as well as the ZSU-23-2 towed gun. It also has several other larger caliber anti-aircraft guns employed around major population centers and airbases.

The former Soviet Union studied the results of the Israeli-Syrian conflict with tremendous interest. They were surprised at the lack of success of the SA-8 and SA-9 air defense systems. The Israelis were able to knock out the SA-8 and SA-9 with the same frequency as they did the older SA-6 system.[56] Regardless of what the Syrians learned, the Soviets went on to rebuild their entire air defense system--a process that the Commonwealth of Independent States continues today.[57]

The American military also learned an important lesson during this conflict. If the U. S. Air Force could rapidly achieve air superiority or even air supremacy, then American ground force vulnerability to attack from

the air would be reduced significantly, whether the American military is just as vulnerable to attack helicopters remains to be seen.

ORGANIZATION FOR DIVISIONAL AIR DEFENSE

On 27 August 1985 the Secretary of Defense, Caspar Weinberger announced his decision to terminate the Sergeant York, division air defense (DIVAD) gun program. Mr. Weinberger directed that the Under Secretary of Defense for Research and Engineering, in concert with the Secretary of the Army, develop solutions to the urgent requirement for effective air defense for army divisions. On 3 September 1985, at the direction of the Chief of Staff of the Army, the Forward Area Air Defense (FAAD) Working Group met to seek solutions to this requirement. The group completed their work in January 1986.[58]

The working group determined that past attempts to provide effective forward area air defense for our maneuver forces had failed due to the lack of a systemic approach to the problem. Previously the Army had attempted to acquire single air defense systems to counter individual threats from the air. As threat weapon systems evolved, air defense systems were expected to develop further. Second, the Army and Air Force approached FAAD from a relatively narrow perspective, single systems, instead of an integrated FAAD system. For the Army, the ultimate air defense weapon was an anti-aircraft artillery system. For the Air Force, the obvious air defense weapon platform was an aircraft.

Third, the working group determined that no single weapon system was capable of providing adequate and comprehensive forward area air defense for our maneuver forces. Neither aircraft nor anti-aircraft artillery guns could be expected to defeat the postulated enemy threat alone. The working group felt the Air Force was limited in its ability to destroy airborne helicopters.[59]

The working group also stated the suppressive and killing effects of combined arms' guns used in isolation are limited against aircraft due to doctrine, inadequate training, munitions, fire control deficiencies, and poor target acquisition. The primary weapon system on the main battle tank and the infantry fighting vehicle were not effective in the air defense mode. The time units devoted to anti-aircraft training did not adequately prepare crews to perform air defense missions. Fire control and weapon distribution were beyond the scope of tank and mechanized infantry company commanders when they are forced to fight the ground as well as the air battle simultaneously with organic systems. Finally, the sights on the main battle tank and the infantry fighting vehicle are not adequate for ground and aerial target engagement with equal precision.

Even though the Army accepted and approved the working group's recommendations and allocated and appropriated funding to the FAAD programs (the air defense anti-tank defense system or ADATS, the fiber optic guided missile or FOG-M, the pedestal mounted Stinger or Avenger, and various command and control improvements), the Army

fielded only one related materiel component before the conduct of military operations against Iraq in 1990. Deployed with the 1st Cavalry Division, the 3rd Armored Cavalry Regiment, and the 11th Air Defense Artillery Brigade, the pedestal mounted Stinger (PMS), or Avenger, was the sole FAAD component deployed to Southwest Asia for Operation Desert Storm.

The 1992 mechanized and armored division air defense battalion has three primary air defense weapon systems, the Bradley Stinger fighting Vehicle (SFV), the Stinger, and the Avenger. The division air defense battalion has 3 batteries of 8 each Bradley Stinger fighting vehicles (24 total) and 10 each Stinger teams. one battery of 36 Avengers and a Headquarters and Headquarters Battery that controls 8 ground based sensors (radar). A description of the divisional air defense battalion will indicate that the system strengths do not outweigh the system weaknesses.

The Bradley Stinger fighting vehicle is an interim concept that fulfills the Forward Area Air Defense Line of Sight Forward Heavy (LOS-F-H) FAAD requirement. The air defense anti-tank system (ADATS), currently in development could fulfill the LOS-F-H requirement, yet the Army budget will not support the system acquisition. The Army developed the LOS-F-H requirement to protect the front line maneuver forces deployed in main battle tanks and infantry fighting vehicles. The system requires the identical chassis as the force it supported for movement and survivability on the battlefield. The primary target of the

weapon is hostile aircraft engaging the supported forces from just beyond visual range, with a rotary wing engagement system optimization.

The SFV replaced the Vulcan Air Defense System in mechanized and armored divisions. The SFV uses the identical M3A2 Bradley fighting vehicle as the infantry and cavalry units. Besides the 25mm chain gun and TOW missile systems, the SFV carries six Stinger missiles. The SFV has a five man crew consisting of squad leader, assistant squad leader/senior gunner, and vehicle driver.

For all the benefits of the SFV, the system is not optimized for the air defense mission, although it is better than the Vulcan. The 25mm chain gun's maximum range is less than the engagement range of enemy attack helicopters. There is a distinct possibility the crew could be absorbed in an anti-tank engagement and fail to engage hostile aircraft. The Stinger team members must open the hatch and expose themselves to battlefield dangers while firing the missile. While the SFV is a welcome alternative to the Vulcan, it is still an interim vehicle.

A second front line air defense artillery weapon system is the Stinger surface to air missile. The Army developed the Stinger to provide the individual combat soldier with effective air defense in the forward combat area. The fire-and-forget Stinger features quick-reaction acquisition and tracking and the ability to engage aircraft approaching from any direction, including head-on.[60] The Stinger is a very capable weapon, yet its usefulness depends on the situation. The gunner and accompanying team chief must visually acquire and positively identify

the target before engagement. Unfortunately the target continues to perform hostile actions during this manual process. Another major restriction of the system is its range limitation, which is well short of the standoff range of modern attack helicopters firing precision-guided munitions. A modern attack helicopter firing precision guided munitions is capable of hovering outside the effective range of the Stinger while delivering ordnance to prospective targets. Stinger gunners must expose themselves from concealed hiding positions to fire the weapon in contrast to firing from the protection of an armored vehicle. A materiel change currently in development will enable the SFV gunner to fire Stinger missiles mounted on the turret from inside the vehicle.

The PMS, or Avenger is the newest divisional air defense weapon system. The Army designed the Avenger to protect brigade and division rear areas from air attack. The Avenger uses the HMMWV for transportation, the Stinger as the primary weapon, optical sights and the forward looking infared radar for acquisition, and a .50-caliber machine gun for close-in self-defense protection. The Avenger is a very capable weapon system. It does suffer some of the same limitations of the Stinger, its primary weapon, when employed outside division and brigade rear areas. The Avenger is a thin skinned, wheeled vehicle with relatively little or no protection from artillery shrapnel and small arms fire.

The range of the Stinger missile is approximately six kilometers while the range of missiles fired from many attack helicopters is more than ten kilometers. Enemy helicopters can standoff and deliver precision guided munitions and the Avenger must be employed close to

the front lines to compensate for the threat's ability to outrange the weapon system.

The inherent system limitations of a line of sight system necessitated a complementary system to engage targets beyond the LOS-F-H line of sight, i.e., attack helicopters hovering behind hills. This system was known as the non-line of sight weapon, or NLOS. The U. S. Army Missile Command laboratories developed such a weapon system that would meet the NLOS requirement; this system was the fiber optic guided missile (FOG-M). FOG-M or NLOS is a lightweight missile with a television camera in the nosecone. The missile transmits an image of the target to the operator through a strand of fiber optic cable while the operator guides the missile to the target as he watches the display on a television monitor inside the transporter-launcher vehicle. The missile is launched vertically from missile canisters on the back of a HMMWV. A heavy variant of the system could use the multiple rocket launcher system armored chassis as the launch vehicle.[61]

The Secretary of Defense terminated the FOG-M system due to cost overruns and reliability problems. The original system design appeared sound, but the political establishment of the Pentagon and the Congress mandated a new and improved design. The system that underwent full scale development had an extended range, a variable-speed sustainer motor, and TV and imaging infared seekers for day and night and limited visibility respectively.[62] The termination of the

FOG-M system angered not only air defenders, but concerned military enthusiasts such as Army Times military columnist Fred Reed.

> Why don't we have this simple, cheap missile? Army politics. Instead of just building the thing in large numbers (a better, cheaper system of which you can buy more), the Army decided to develop a fancy model with a two-speed engine, night-vision gear, more range, and other bells and whistles. The result is, of course, that the missile is over budget in a big way, so complicated that manufacturing it in any quantity will be impossible, and it isn't ready when we need it (Operation Desert Storm).[63]

A contributing problem to the demise of the NLOS program was the squabbles among three branches of the Army over the tactical control of the weapon system. Central to the dispute was the issue of weapons proponency between the Air Defense Artillery, Artillery, and Infantry branches. The Infantry branch claimed the system should be deployed as the currently fielded mortars, requiring a separate NLOS platoon in every line infantry company. The Artillery community believed any system deployed in an indirect manner belongs in their purview for organization as well as command and control. Air Defenders stated that they had originated the system requirement and as such should employ it in its primary intended role as a counterair weapon system. The Army recently resurrected the requirement for the NLOS system with a primary anti-armor orientation. Current plans call for a simplified, shorter range system much as the one originally designed and tested by the U. S. Army Missile Command (MICOM) research and development center.[64]

The primary threats to future heavy divisions will be the attack helicopter and UAV/RPVs. Future threats to the heavy division will require a suite of short range air defense weapons and medium-to-short

range low-altitude sensors. The required systems must protect the force, permit the uninhibited movement of maneuver forces, enable the maneuver commander to press the initiative, destroy the enemy air threat, and reduce enemy combat power.

Some current military theoreticians predict the attack helicopter in the year 2000 will be what the tank was after World War II.

> Every recent conflict has seen helicopters used to a greater extent than the last, although there are no examples of them being used in really high intensity mechanized war. If skillfully flown, helicopters are very difficult to see and to hit.[65]

The Ka-50 Hokum, produced in the Commonwealth of Independent States is one such helicopter. Before its breakup, the Soviet Union had two attack helicopters in development, the Mi-28 Havoc (the replacement to the Mi-24 Hind) and the Ka-50 Hokum. The Hokum won a final design competition and became the future attack helicopter platform for the Soviet armed forces. The primary mission of this new attack aircraft was to provide close air support for front line maneuver units.[66] The Kamov General Designer Sergei V. Mikheyev stated, "The company applied lessons learned during the Vietnam War and the subsequent Soviet army battles in Afghanistan." [67] The system is armored to protect the pilot against anti-aircraft rounds up to 20mm. To provide protection against missiles, the system is protected by infrared reduction shields that are integrated into the engine exhaust assemblies. The two stub wings on either side of the fuselage can carry a variety of ordnance including the new Vikhr laser-beam-riding antitank rocket, rocket pods for free flight projectiles and air to air missiles.[68]

Major General Donald Lionetti said it best, "The U.S. Army cannot have it both ways: we can't love the attack helicopter in our force for the great battlefield leverage it provides and not expect our potential enemies to do the same." [69] Attack helicopters could be a significant threat to our armed forces against an enemy who knows how to properly employ his forces and weapon systems. Attack helicopters of the future will be the close air support aircraft for third world nations who cannot afford a modern high performance air force. Attack helicopters flying at nap-of-the-earth are difficult targets for advanced air force look-down/shoot-down systems. Any interceptor attempting to go low and slow to engage an attack helicopter becomes vulnerable to enemy anti-aircraft systems as well as small arms fire from enemy tanks and infantry fighting vehicles.[70] A thorough examination of Operation Desert storm demonstrates the lack of effectiveness of a low level air defense system could be fatal for a nation that ignores the lessons learned.

> The recent Gulf War emphasized the importance of the new threats from the air (cruise missiles, air-to-surface standoff precision weapons, anti-radiation missiles, etc.) that were used massively for the first time and against which only short-range air defense systems can provide credible protection. It should be pointed out that both sides lacked the required defense against these threats, although only one of them [Iraq] was affected by the deficiency.[71]

A recent technological innovation is the tactical use of radio controlled airplanes on the modern battlefield to gather information and further reduce uncertainty in the commander's mind. Unmanned aerial vehicles (UAVs) and remotely piloted vehicles (RPVs) will provide commanders the ability to fly over a given target area and transmit real-time information to field headquarters for use in targeting and

intelligence gathering. UAVs and RPVs are well within the technological capability for any country that can build a remote-controlled model airplane. UAVs and RPVs are a simple, effective way to monitor enemy activity.[72] A colorful story from Operation Desert Storm involved a group of Iraqi soldiers who surrendered to an UAV. The coalition forces frequently used UAVs equipped with television cameras to reconnoiter Iraqi positions before air and artillery attacks.

> The Pioneer UAVs apparently became a fairly routine sight for the increasingly beleaguered Iraqi forces--perhaps too routine for the troops in this tale, who must have seen enough UAVs to realize that a visit from a Pioneer usually was followed by a visit from several hundred rounds of high explosives.[73]

A credible foe could use UAVs to target high priority assets in the division area of operations such as artillery target tracking radar, air defense radar, and ground surveillance radar. A case in point is the Israeli use of drones against the Palestine Liberation Organization armed forces during Operation Peace for Galilee in Lebanon in 1982.

Cruise missiles such as the TOMAHAWK demonstrated their effectiveness during the Persian Gulf conflict. At first glance one would question whether these weapons pose a threat to the division, I believe they could. Considering the low threat (no pilot), the potential destructiveness and the precision delivery possibility, a credible enemy could target high priority division assets, such as helicopter assembly areas, Multiple Launch Rocket Systems, and command and control centers with cruise missiles. While cruise missile defense is not, nor should it be, a primary mission of division level air defense forces, the

missiles could be a significant threat to divisional combat units on the future battlefield.

ANALYSIS

The central question of this monograph is "Do we still need divisional air defense?" To answer this question we must analyze whether the current divisional air defense artillery battalion can accomplish the mission as defined in TRADOC Pamphlet 11-9 against the most likely threats to the division area of operation. TRADOC Pamphlet 11-9 defines the air defense BOS as all measures designed to nullify or reduce the effectiveness of attack by hostile aircraft or missiles after they are airborne.[74]

The first logical step of the air defense BOS is to process air targets. This is defined as selecting targets and matching the appropriate response to them, taking account of operational requirements and capabilities. To select targets the air defense artillery battalion must determine if a specific target should be attacked and if so, when. This requires early warning as well as the maneuver commander's guidance on which divisional priorities to protect.

The divisional early warning system relies on human eyes to locate and disseminate target information. There is no currently fielded radar system to assist in this process. The time it takes the manual early warning section to locate the target, identify it and relay the information to a fire unit, allows the target to move out of range. A radar system that

could resolve this dilemma is the ground based sensor that is currently in development. The radar can detect targets out to 40 kilometers. The new Ka-50 attack helicopter can travel 40 kilometers in 5 minutes.

Most modern attack helicopters are protected against destruction by 20mm ammunition. To destroy such a helicopter will require an effective short range missile for the engagement. UAV/RPVs are not armored and could be destroyed with small arms fire or a dedicated air defense anti-aircraft artillery gun, once they are located. Cruise missiles travel at moderate to high speeds yet are not normally armored. An air defense gun could be effective against these targets.

The second process of the air defense BOS is to attack enemy air targets, to intercept, engage, destroy or neutralize enemy aircraft and missiles in flight. The Army has chosen several systems to accomplish this mission including the SFV, the Avenger, the Stinger, the AH-64 Apache and OH-58D Kiowa, and various electronic warfare assets. Each system is capable of engaging airborne targets to reduce the effectiveness of enemy aviation assets. The problem becomes one of synchronization on the battlefield to ensure all critical priorities in the division area are protected. Bad weather can ground aviation assets, thus depriving the commander a significant portion of his air defense firepower.

To deny airspace is the final process of the air defense BOS. Airspace denial is defined as the prevention of enemy use of airspace through fire potential or other means without direct attack of air targets. This can be accomplished with smoke, barrage balloons, etc. Airspace

denial can also occur by the fielding of a potent suite of air defense weapons that do not give an enemy any preferred attack option on the division's forces. The use of smoke and other techniques does not belong under the purview of the division air defense battalion. Again, to use all the tools in the division commander's kitbag requires synchronization of all the battlefield operating systems to maximize the commander's opportunity for success.

As stated, the division air defense battalion has three primary weapon systems, the Stinger Fighting Vehicle, the Stinger, and the Avenger. Each of these weapons are line of sight systems that require the operator to see the target. If the target hides behind a hill or other terrain feature during the engagement process, then the target will most likely survive the engagement. Additionally, modern attack helicopters are capable of staying outside air defense engagement range to fire their precision guided munitions against the force. The Apache fires the Hellfire missile from more than four miles away from its target.[75]

The Air Force contributes to the air defense function by engaging enemy helicopters with precision guided munitions such as the Maverick missile. The missile is capable of destroying an armored helicopter in flight and was rumored to have been used during Operation Desert Storm in this manner. Even if this type of tactical role became an Air Force versus Army mission, the long term tactical air defense problem would not be resolved. The problem is the division commander does not control the allocation of Air Force assets to the air defense role in his area of operation.

SUMMARY

The American military has chosen the offensive versus defensive form of war as the primary combat orientation. The offensive nature of Clausewitz' defensive form of war has been abandoned in favor of the theories of Douhet and Colonel Warden. With our continued orientation on the offensive form of war, we have neglected to provide the best defensive technology our nation is capable of producing to our maneuver forces. The military establishment has accepted risk by not fielding a comprehensive air defense system that continually shields the maneuver forces from the blows of the attacker, and creates the conditions for counterattacking a weakened enemy.

The Army faces similar problems Winston Churchill faced during World War I: receiving early warning on attacking aircraft, tracking aircraft as they transited the area of operation, selecting the optimum system for target engagement, and assessing the results of the engagement. Churchill did not organize an effective defense against enemy aircraft until the war was underway. As long as America fights wars with cooperative enemy forces such as Saddam Hussein's 1991 Army, the Panamanian Defense Forces and Somalian "technicals", we will not have to worry about threats from the air.

The current mechanized and armored division air defense artillery battalion cannot adequately shield the maneuver force from the blows attack by enemy aircraft. The solution requires the continued development and fielding of a complete suite of complementary air defense weapons that will deny the enemy any preferred attack options

against deployed armored or mechanized divisions. This includes the non-line of sight weapon system to engage targets hovering behind terrain objects or features. Also required is a dedicated anti-aircraft artillery gun system that could engage targets out to greater than 3,000 meters. The gun should be radar as well as optically/visually directed to provide the maximum engagement flexibility in all types of tactical environments. A missile system capable of engaging both tanks and flying tanks (helicopters) is required on a separate chassis than the anti-aircraft gun. This would deny attacking systems the ability to concentrate on defeating only one defensive system in the forward area with any possibility of success. Finally, the division needs a competent array of sensors to provide early warning information to divisional air defense weapon systems.

The reasons to continue development of air defense systems is stated below:

> Because of the brilliant air operation conducted by coalition forces, forward area air defense systems did not have the opportunity to demonstrate their inherent abilities to protect ground maneuver forces. This fact cannot dilute our support for expeditious completion of Forward Area Air Defense Modernization. One only has to observe the devastation caused by coalition air on Iraqi ground forces to recognize the essentiality of effective air defenses. We cannot permit the technology that defeated Iraq to be imposed, in some future war, on U.S. maneuver forces.[78]

Achievement of air superiority during the opening days of a conflict does not guarantee immunity from aerial attack by hostile forces. The Air Force cannot engage the threats to the division area of operation on a consistent basis. The currently fielded fighter and fighter/bomber

aircraft are not optimized to destroy UAV/RPVs and rotary wing aircraft. Neither can the division commander control the allocation and distribution of systems that might attempt to do so.

The attack helicopter and cruise missiles pose the most significant threats to destroy or disrupt division maneuver forces on the modern battlefield. UAV/RPVs have the potential to locate division maneuver forces and other high value assets and target them for destruction by enemy systems. Unless the division is capable of reducing the effectiveness of these enemy systems with organic air defense assets, it will suffer tremendous losses of equipment and personnel.

END NOTES

[1] Barbara Starr, John Boatman, Nick Look, Bill Sweetman, Joris Janssen Lok, Charles Bickars "Figures that add up to Success" Jane's Defense Weekly (6 April 1991), 529.

[2] That degree of dominance in the airbattle of one force over another which permits the conduct of operations by the former and its related land, sea, and air forces at a given time and place without prohibitive interference by the opposing force. Air Force Manual 1-1 Volume II Basic Aerospace Doctrine of the United States Air Force (March 1992), 273.

[3] That degree of air superiority wherein the opposing air force is incapable of effective interference. Air Force Manual 1-1 Volume II Basic Aerospace Doctrine of the United States Air Force (March 1992), 273.

[4] Barbara Starr, John Boatman, Nick Look, Bill Sweetman, Joris Janssen Lok, Charles Bickars "Figures that add up to Success" Jane's Defense Weekly (6 April 1991), 529-532.

[5] Colonel Wolf-Dietrich Kutter "Army Weapons Edge Threatened by Budget Crunch" Army Magazine (January 1992), 14.

[6] Carl von Clausewitz On War, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, (1976), 484.

[7] Ibid.

[8] Ibid.

[9] Ibid.

[10] Ibid., 360.

[11] Ibid., 484

[12] Giulio Douhet The Command of the Air, (1983), 9.

[13] Ibid.

[14] Ibid., 9.

[15] Ibid., 12.

[16] Ibid., 17.

[17] Ibid., 9.

[18] Ibid., 14.

[19] Ibid., 66.

[20] Ibid.

[21] FM 71-100 (16 June 1990), 2-5

[22] Ibid.

[23] Draft FM 100-5 (21 August 1992), 2-7.

[24] Ibid.

[25] Ibid.

[26] Ibid.

[27] Ibid.

[28] Ibid.

[29] Ibid.

[30] Ibid.

[31] Kenneth Schaffel The Emerging Shield: The Air Force and the Evolution of Continental Air Defense 1945-1960. (1990), 3.

[32] Ibid., 3.

[33] Area of interest is defined by FM 101-5-1 as that area of concern to the commander, including the area of influence, areas adjacent thereto, and extending into enemy territory to the objectives of current or planned operations. This area also includes area occupied by enemy forces who could jeopardize the accomplishment of the mission.

[34] Area of operations is defined by FM 101-5-1 as that portion of an area of conflict necessary for military operations. Areas of operations are geographical areas assigned to commanders for which they have responsibility and in which they have authority to conduct military operations.

[35] Kenneth Schaffel The Emerging Shield: The Air Force and the Evolution of Continental Air Defense 1945-1960. (1990), viii.

[36] Ibid., 1-4.

[37] Anthony H. Cordesman "The Falklands Crisis: Emerging Lessons for Power Projection and Force Planning" Armed Forces Journal International (September 1982), 29.

[38] Ibid., 32

[39] Ibid.

[40] Anthony H. Cordesman and Abraham R Wagner. The Lessons of Modern War Volume III, The Afghan and Falklands Conflicts. Boulder: Westview Press, (1990), 295.

[41] Ibid.

[42] Ibid., 298.

[43] Editor "Battle Study: The Soviet War in Afghanistan" Marine Corps Gazette (July 1986), 58.

[44] Anthony H. Cordesman and Abraham R Wagner . The Lessons of Modern War Volume III, The Afghan and Falklands Conflicts. Boulder: Westview Press, (1990), 175.

[45] Ibid.

[46] Ibid.

[47] Ibid.

[48] Anthony H. Cordesman, and Abraham R. Wagner. The Lessons of Modern War Volume III, The Afghan and Falklands Conflicts. Boulder: Westview Press, 1990, 176

[49] Anthony H. Cordesman and Abraham R. Wagner The Lessons of Modern War Volume I, The Arab-Israeli Conflicts, 1973-1989. 1990, 117.

[50] Ibid., 122

[51] Richard Gabriel,. Operation Peace for Galilee: The Israeli-PLO War in Lebanon. New York: Hill and Wang, 1984, 98.

[52] Ibid.

[53] The area fire mode of control focuses on placing a volume of anti-aircraft artillery fire in the air around the vicinity of an expected air attack. This mode of fire is inherently less accurate, especially since the object is not to hit anything in particular but to deny airspace to hostile aircraft.

[54] Anthony H. Cordesman and Abraham R. Wagner The Lessons of Modern War Volume I, The Arab-Israeli Conflicts, 1973-1989. (1990), 185.

[55] Chris Bellamy,. The Future of Land Warfare. New York: Saint Martin's Press, 1987.

[56] Ibid., 221.

[57] Threats Update, (15 June 1992), 2-1.

[58] FAAD Working Group Final Report, (January 1986), 2-1.

[59] Ibid., 2-5.

[60] "Army Weaponry" Army Magazine. (October 1991), 286.

[61] John Boatman. "FAADS ready in part," International Defense Review (November 1991), 1209-1212.

[62] "Army Weaponry," Army Magazine. (October 1991), 286.

[63] Fred Reed. "Army's muddled thinking may cost lives," Army Times. (December 24, 1990), 70.

[64] "Army Weaponry," Army Magazine. (October 1991), 286.

[65] Stephen P. Rosen, Winning the Next War Ithaca: Cornell University Press, (1991), 202.

[66] Boris Rybak and Jeffrey M. Lenorovitz "Naval Design Experience Applied to Ka-50 Hokum" Aviation Week & Space Technology (August 24, 1992), 42.

[67] Ibid.

[68] The Vikhr laser-beam-riding rocket is a supersonic antitank weapon with an estimated standoff range of between 8 and 10 kilometers.

[69] Major General Donald M. Lionetti "The Way Ahead" 1991 ADA Yearbook (1991), 10.

[70] Major General John H. Little "Air Defense for AirLand Battle Future" 1991 ADA Yearbook (1991), 53.

[71] "The HVSA/ADAM Air Defence System" Military Technology (December 1991), 40.

[72] Major General John H. Little "Air Defense for AirLand Battle Future" 1991 ADA Yearbook (1991), 52.

[73] Stephen M. Hardy "Finding a Place on Board" Journal of Electronic Defense (February 1992), 28.

[74] TRADOC Pamphlet 11-9 (27 April 1990), 58.

[75] Frederick Sutter "The Weapons of the Gulf War" U.S. News and World Report (4 February 1991), 42.

[76] Major General Donald M. Lionetti "The Way Ahead" 1991 ADA Yearbook (1991), 9.

BIBLIOGRAPHY

Books

Bellamy, Chris. The Future of Land Warfare. New York: Saint Martin's Press, 1987.

Cordesman, Anthony H., and Wagner, Abraham R. The Lessons of Modern War Volume I, The Arab-Israeli Conflicts, 1973-1989. Boulder: Westview Press, 1990.

Cordesman, Anthony H., and Wagner, Abraham R. The Lessons of Modern War Volume III, The Afghan and Falklands Conflicts. Boulder: Westview Press, 1990.

Douhet, Giulio, The Command of the Air. Washington DC: Office of the Air Force History, 1983.

Gabriel, Richard Operation Peace for Galilee: The Israeli-PLO War in Lebanon. New York: Hill and Wang, 1984.

Herzog, Chaim. The Arab-Israeli Wars. New York: Random House, 1982.

Rosen, Stephen P. Winning the Next War. Ithaca: Cornell University Press, 1991.

Schaffel, Kenneth. Captain, United States Air Force. The Emerging Shield: The Air Force and the Evolution of Continental Air Defense 1945-1960. Washington DC: Government Printing Office, 1991.

Warden, John A. The Air Campaign. Washington DC: Pergamon-Brassey's, 1989.

Von Clausewitz, Carl. On War. , ed. and trans. Michael Howard and Peter Paret, Princeton, NJ: Princeton University Press, 1976.

Articles

Adelsberger, Bernard. "Air defenders' mission under attack," Army Times (October 19, 1992): 42-42.

Anderson, Gary W. Captain, United States Marine Corps. "Finding Tactics to Match Technology," Marine Corps Gazette (February 1982): 19-22.

Boatman, John. "FAADS ready in part," International Defense Review (November 1991): 1209-1212.

Brooks, Harvey. "Notes on Some Issues on Technology and National Defense," Daedelus (Winter 1981): 129-136.

Daskel, Steven E. "Looking at a New Concept: Air Defense Against the Evolving Threat, " Army Research, Development and Acquisition Bulletin (March-April 1990): 23-25.

"FAADS: In Search of a Programme," Military Technology (October 1987): 92-103.

Gorman, P. T. General, United States Army. "What the High Technology Edge Means," Defense/83 (June 1983): 22-27.

Karp, Aaron. "Blowpipes and Stingers in Afghanistan: One Year Later," Armed Forces Journal International (September 1987): 36-40.

Lionetti, Donald M., Major General, United States Army, "Air Defense: No Road to Basra," Army (July 1991): 16-26.

Meeks, Chuck "GE and the Air Defense Solution," Military Technology (June 1991): 33-35.

Nelson, Denny R. "Soviet Air Power: Tactics and Weapons Used in Afghanistan," Air University Review : 31-44.

Segal, David. "Desert Storm and Divisional Air Defense," Armed Forces Journal International (May 1991): 34-36.

Shutler, Philip D., Lieutenant General (United States Marine Corps, Ret). "Thinking About Warfare," Marine Corps Gazette (November 1987): 18-26.

Starr, Barbara; Boatman, John; Look, Nick; Sweetman, Bill; Lok, Jaris Janssen; Bickars, Charles. "Figures that add up to Success," Jane's Defense Weekly (6 April 1991): 529-532.

"Thomson-CSF/DSE: The Overall System Approach to Air Defense," Military Technology (November 1991): 74-80.

Wilson, J. R. "FAADS serves the US Army Doctrine," International Defense Review (September 1989): 1185-1187.

Sams Monographs

Curran, Robert J., "The ADA Battalion in the Heavy Divsion: Can it Provide the Necessary Support?", Sams Monograph. Fort Leavenworth, Kansas, 5 January 1985.

Mattox, Philip M., "The Silent Killer: Grants Logistical Requirements 1864-1865," Sams Monograph. Fort Leavenworth, Kansas, 15 May 1991.

Manuals

United States Air Force, Air Force Manual 1-1, Volume II Basic Aerospace Doctrine of the United States Air Force, Washington D. C., March 1992.

United States Army, FM 44-1 Air Defense Artillery Employment., Washington D. C., 1983.

United States Army, FM 71-100 Division Operations, Washington D. C., June 1990.

Untied States Army, Draft FM 100-5 Operations, Washington D. C., 30 August 1992.

United States Army, FM 101-5-1 Operational Terms and Symbols, Washington D. C., October 1985.

Papers

Forward Area Air Defense Working Group. "Forward Area Air Defense Working Group Final Report." Washington, D. C. , 3 March 1986.

United States Army Combined Arms Command, Threats Update, Fort Leavenworth, Kansas, 15 June 1992.