A joint publication for U.S. Artillery professionals

ADA 50th Anniversary Issue

Fires

AIR DEFENSE ARTILLERY 50TH ANNIVERSARY

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Purpose

Originally founded as the Field Artillery Journal, Fires serves as a forum for the discussions of all Fires professionals, Active, Reserves and National Guard; disseminates professional knowledge about progress, development and best use in campaigns; cultivates a common understanding of the power, limitations and application of joint Fires, both lethal and nonlethal; fosters joint Fires interdependency among the armed services; and promotes the understanding of and interoperability between the branches, all of which contribute to the good of the Army, joint and combined forces and our nation.

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WASHINGTON, D.C., *14 June 1968*

AIR DEFENSE ARTILLERY BRANCH

Effective 20 June 1968, pursuant to the authority contained in Title 10, United States Code, Section 3063(a)(13), Air Defense Artillery is established as a basic branch of the Army.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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Brig. Gen. Randall McIntire
U.S. Army Air Defense Artillery
School commandant

Fifty years of US Army Air Defense Artillery

As we approach our Fifty Year Anniversary this year in 2018, the Air Defense Artillery branch finds itself in the midst of an unprecedented period of transformation and growth that will fundamentally change the way we man, train and equip the ADA force. In order to effectively support U.S. tactical and strategic operations throughout this period and into the future, the branch must renew its emphasis on developing Air Defenders to meet the complex security challenges of tomorrow. This requires us to invest in our most precious resource –Soldiers. We must continue to provide world class units to Commanders around the globe in support of all operations.

Air Defense plays a significant role in setting our global force posture, reassuring allies and deterring aggression. ADA does this through a Total Force approach – using both active and reserve components to fight interdependently with joint and combined forces to enable the defeat of the entire range of aerial threats facing our forces and allies.

It is an exciting time to be in the Air Defense Artillery branch. The growth of the branch, coupled with the modernization of equipment, will continue to solidify our strategic and operational importance across the force.

First to Fire!

Coin Graphic will go here.

ADA's approach to multi-domain operations

Air and missile defense's contribution to multi-domain operations

By Brig. Gen. Randall McIntire

"For decades, the United States has enjoyed uncontested or dominant superiority in every operating domain. We could generally deploy our forces when we wanted, assemble where we wanted and operate how we wanted. Today, every domain is contested – air, land, sea, space and cyberspace"

—National Defense Strategy 2018

Multi-domain operations – the concept

Multi-domain operations is a concept that addresses increasingly capable adversaries who pose strategic risk to U.S. interests before and after the initiation of armed conflict. It postulates "how the Army as part of a joint force, will operate against peer adversaries to maintain U.S. interests, deter conflict and, when necessary, prevail in war."[1] The multi-domain operations objectives are: compete short of war, turn denied spaces into contested spaces, defeat the enemy campaign and consolidate gains.[2] These objectives must be pursued and achieved in a contested environment of increased lethality, complexity and challenged deterrence that extends from local areas to across continents.

The multi-domain concept proposes three interrelated components to meeting these objectives and solving the problems inherent in the projected multi-domain environment: calibrate force posture, employ resilient formations and converge capabilities. Force posturing constitutes a "dynamic mix of forward presence forces and capabilities, expeditionary forces and capabilities and partner forces" to deter an adversary and prevail in armed conflict. It is calibrated to be a proactive exploitation of threat vulnerabilities, rather than reactionary response to threat actions. Resilient formations are "scalable and task-organized units, empowered by the mission command philosophy, capable of conducting semi-independent, dispersed … cross-domain operations." They possess the right capabilities to support continued operations over longer periods of time and larger geographical spaces. Resilient formations are employed with multi-domain capabilities to contest threat multi-domain capabilities. The component of converging capabilities is "an evolution of combined arms." It applies "a combination of capabilities (lethal and nonlethal …) in time and space" and "requires organizations and elements that are organically organized, trained, authorized and equipped to access, plan, sequence and operate together in and across multiple domains at all times, not just in conflict."[3]

To combat adversaries in the described environment, achieve the stated objectives and solve multi-domain operation problems requires integrated efforts across all domains by all Army warfighting functions in collaboration with their joint and multinational partners.

This paper looks at a slice of the multi-domain operation in an environment of competition with peer adversaries. It focuses on winning the battle in the third dimension – the air – through the contributions of air and missile defense (AMD) systems, keying on the Army's AMD capabilities.

Multi-domain threats

Threats in and through the air are the predominant concern of the AMD force as they can create catastrophic impacts on national objectives at the strategic level through military missions at the tactical level. These aerial threats consist of a wide range of missiles, aerial platforms, rockets and projectiles. They range from intercontinental ballistic missiles with warheads of mass destruction to artillery and mortar rounds with conventional munitions. Of these, the intercontinental missiles pose the most dangerous threat. Today's adversaries, North Korea and Iran, have aggressive programs to develop and field missiles capable of threatening the U.S. homeland and Europe, respectively. However, the most likely threats in the third dimension are ballistic missiles, cruise missiles, unmanned aircraft systems (UASs), rockets, artillery and mortars, and to a lesser extent rotary- and fixed-wing aircraft (lesser only because the Air Force, Navy and Marine Corps aircraft provide significant capabilities and preponderant forces to counter these platforms). Ballistic missiles can carry a variety of warheads and, with sophisticated guidance systems, have accuracies to less than 50 meters. Cruise missiles can fly indirect routes at low altitudes and attack a target from any direction. UASs can host a variety of payloads and conduct such missions as reconnaissance, surveillance, target detection and designation and attack oper-

1 *Multi-Domain Battle: Evolution of Combined Arms for the 21st Century 2025-2040 Version 1.0, December 2017.*
2 *Ibid.*
3 *Ibid.*

ations. The low, slow, small variants present significant detection and engagement problems for brigade combat teams and their subordinate formations. Rotary-wing aircraft are still the greatest threat to maneuver forces. Fixed-wing aircraft, though no longer a predominant aerial concern, is a major threat to friendly forces given their offensive and defensive capabilities. Multiple-rocket launchers have high rates and volumes of fire therefore artillery remains a prevalent and lethal threat to ground forces. Mortars provide simple, close-in, indirect fire capabilities to target facilities and troops. The aerial threats, while dangerous individually, become increasingly so when the enemy employs them as components of complex integrated attacks – synchronized attacks of a friendly asset by a mix of air and missile threats, arriving near-simultaneously from different directions, altitudes and ranges.

Threats in the land domain that impact winning the battle in the air, include military, paramilitary, terrorist or other ground-force factions that can attack friendly force locations and facilities. An individual armed with nothing more than a rifle can fire at a radar and cause various states of inoperability and mission degradation. Enemy forces, with indirect fire weapon capabilities, can attack and disrupt or destroy command and control elements used in the conduct of air operations. Land-based Fires, coupled with ground or air intelligence, surveillance and reconnaissance capabilities, can delay or disrupt force entries into theater and prevent sustainment of combat power once in theater.[4] In addition, land-based Fires can restrict or deny maritime access to sea lanes.

Threats in and from the sea domain replicate many of the aerial threats found in the air domain. Submarine-launched ballistic missiles, with potential weapon of mass destruction warheads, comprise significant threats to land-based strategic assets. Ballistic missiles may be used to target such formations as carrier task forces, and anti-ship cruise missiles and fixed-wing aircraft may target individual ships. Ship-borne cruise missiles and aircraft can conversely strike land-based assets. UASs can surveil and report ship movements, promoting situational awareness and facilitating subsequent engagements.

Attacks in the cyberspace domain may be initiated against command and control nodes, data and voice networks, sensors and guidance systems. They can deny information flow and situational awareness through such means as electromagnetic jamming or degrade detection of aerial platforms, for instance, by projecting false information to radar operators. Threats may also use cyber capabilities to hack networks for data collection and exploitation. Combining cyberattacks with aerial attacks can dramatically increase operational risk to friendly forces.

The space domain is recognized as a strategic enabler and adjunct to the other domains. Peer competitors are pursuing satellites for communications, navigation, intelligence and surveillance means. Adversaries are also examining jamming as a potential counter-space capability. And, a land-based anti-satellite missile has been tested and is likely a significant threat in the not-too-distant future. Jamming and anti-satellite missiles constitute critical threats to the U.S. forces' satellite capabilities. U.S. forces may likely operate in a denied, degraded or disrupted space operational environment. There is no "silver bullet" solution to threats described above. It will require an integrated tiered and layered approach to protect the joint force.

Air, missile defense counters to aerial threats

Winning the battle in the air calls for a concerted effort across all domains. It requires Army, joint and multinational elements to contest threats on the land, at sea, and in cyberspace and space. Army field artillery, aviation and special operating forces, in conjunction with joint counterparts, can conduct attack operations against enemy command and control nodes, launch sites and supporting facilities on the ground. Such operations can profoundly reduce the number of air platforms and missiles that an enemy might launch. Cyber capabilities embedded with land forces can execute non-lethal engagements of aerial platforms, disrupting the downlinks of data that support enemy attacks. Maritime forces can defend land forces in the littoral areas, as well as ships at sea, from air and missile attacks launched from the land or sea. Space elements can enhance surveillance and enable early warning for elements in the other domains.

Key contributors to the air battle are the shooter, sensor and command and control systems and capabilities depicted in the Army AMD portfolio (Figure 1). The figure highlights the U.S. joint AMD systems, with a further focus on Army capabilities. And, though not presented, it is representative of the multinational AMD capabilities, many of which are the same as the portrayed U.S. systems. The Army is optimizing for interoperability to strengthen alliances, attract new partners and deliver more effective coalition operations.

The air and missile defense portfolio consists of Army and joint systems and capabilities to deny, disrupt and defeat air and missile threats, from outside the atmosphere to within the atmosphere and across the strategic, operational and tactical realms. AMD sensors and shooters, enabled by command and control elements, are employed in four areas: ballistic missile defense, cruise missile defense/air defense, counter-UAS, and Counter-Rocket, Artillery and Mortar (C-RAM). These four areas span the multi-domain battle's operational framework: the ballistic missile defense capabilities protect assets in the strategic through tactical support areas and assist other forces to get to and conduct the deep fight; cruise missile defense and air defense elements protect assets in the operational and tactical support areas and the close area; and the counter-UAS and C-RAM capabilities support the fight in the close area. Many of the sensors and shooters are encapsulated in more than one area, as they have capabilities against more than one threat set.

Satellite, depicted at the top of the figure, and command and control systems, depicted across the bottom, connect the systems and capabilities that operate in and across all four areas. They provide crucial and timely situational awareness, warning and battle management.

Today's command and control systems include the strategic-level Command and Control Battle Management and Communications (C2BMC) system and the Army's Patriot and Forward Area Air Defense (FAAD) command and control (C2) systems. The C2BMC system integrates and globally synchronizes individual ballistic missile defense systems and operations to provide an optimized, layered defense against ballistic missile threats of all ranges and in all phases of flight. It allows combatant commanders to systematically plan the fight, see it unfold and dynamically direct

4 *Ibid.*

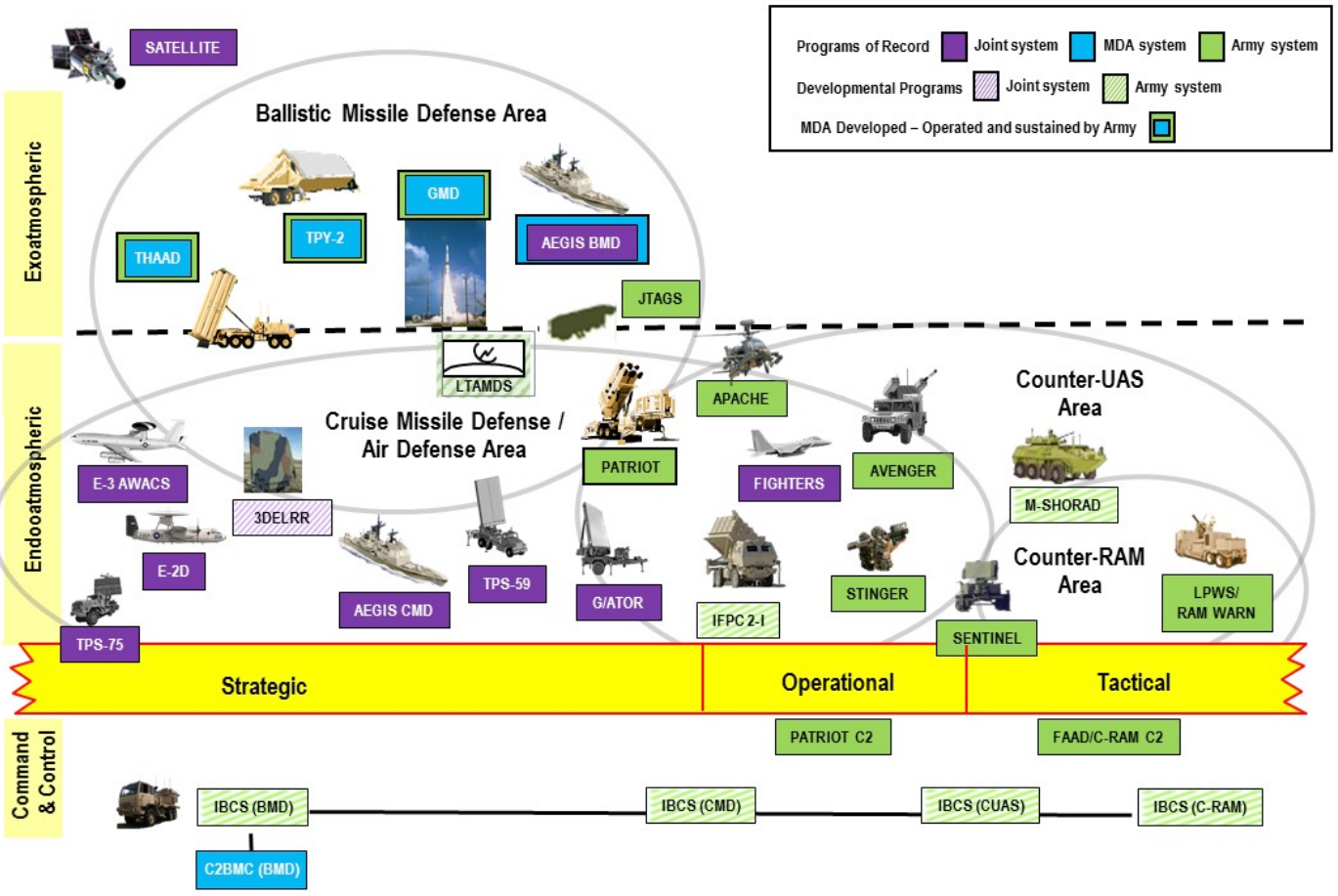

Figure 1. *The Army Air and Missile Defense (AMD) portfolio with highlights of the U.S. joint AMD weapon systems. (Courtesy illustration)*

networked sensors and shooters. The Patriot C2 components at battalion and battery levels provide system-unique capabilities encompassing planning, coordination and sustainment activities through battle management and engagement operations. FAAD C2 collects and disseminates target tracking and cueing information to Avenger systems. The C-RAM C2 is a variant of FAAD C2. It provides air battle management for the C-RAM shooters. The Integrated Air and Missile Defense Battle Command System (IBCS) is the Army's emerging common, integrated and networked AMD mission command capability. At its core, IBCS will allow the warfighter to fully integrate deployed joint and, potentially, multinational AMD capabilities in a given theater of operations, providing the commander the ability to tailor his force to achieve the most effective and efficient mix for defeating the full range of aerial threats. IBCS will enable this integration by serving as the foundation of a "componentized" force of sensors, shooters and common command and control nodes across the strategic, operational and tactical realms. With its "plug and fight" architecture, IBCS will support dynamic defense designs and the linkage of joint AMD capabilities, such as joint kill chain engagements with the Navy, to the supported force's scheme of operations and maneuver.

The ballistic missile defense set includes the fielded Ground-Based Midcourse Defense (GMD), Joint Tactical Ground System (JTAGS), Terminal High Altitude Area Defense (THAAD), Aegis Ballistic Missile Defense (BMD), AN/TPY-2 radar, and Patriot systems, and the under development Lower Tier Air and Missile Defense Sensor (LTAMDS) and Three-Dimensional Expeditionary Long-Range Radar (3DELRR). The GMD system protects the homeland against attacks by intercontinental missiles. It consists of numerous sensors deployed around the world, in-orbit, ground-based interceptors deployed in the United States, and fire control capabilities. JTAGS serves as the down-link processor of space-based data for the warning, alerting and cueing of ballistic missile threats in theater. THAAD, with its long-range radar and hit-to-kill missiles, has the capability to shoot down short-, medium- and intermediate-range ballistic missiles in defense of strategic and operational assets in theater and across regions to support homeland defense. The Aegis BMD sea variant, with its SPY-1 radar and standard missiles, is designed to provide both regional and homeland missile defense and surveillance by intercepting short-, medium- and intermediate-range ballistic missiles in the midcourse and terminal phases of flight. An on-shore Aegis BMD capability is also currently deployed. Patriot is primarily used to counter ballistic missiles, though it also has capabilities, as noted below, against cruise missiles, fixed- and rotary-wing aircraft and UASs. The Patriot radar provides search and detection and target track and illumination. Patriot's PAC-3 and Missile Segment Enhancement (MSE) interceptors provide a hit-to-kill capability against close-, short- and medium-range ballistic missiles. The GMD system, THAAD, and the sea and land variants of Aegis BMD (with Standard Missile-3s) are often referred to as upper tier systems, as they engage ballistic missiles at very high altitudes within the atmosphere and outside the atmosphere. Patriot and Aegis BMD (with Standard Missile-6s) are considered lower tier systems, in that they conduct engagements in a layer of low-to-high airspace within the atmosphere. These "shooters" are supported by three sensor

A AN/TPS-75 radar rests on the back of a transport vehicle at the Alpena Combat Readiness Training Center, Mich. (Senior Airman Ryan Zeski/U.S. Air National Guard)

systems. The AN/TPY-2 radar, in its forward-based mode, provides surveillance, tracking, external cueing, launch and impact point estimates, and discrimination of re-entry vehicles of ballistic missiles in their boost phase. The Army's LTAMDS program will provide 360-degree sensing capabilities within the lower tier portion of the ballistic missile defense battlespace. The Air Force's 3DELRR will have the capability to detect, track and transmit target information on ballistic missiles to command and control nodes, such as the Air Force's Control and Reporting Center, to disseminate for warning and engagement.[5]

Numerous Army and joint shooters, sensors and command and control systems contribute to the defense against cruise missiles and fixed- and rotary-wing aircraft. Army capabilities depicted are Patriot, LTAMDS, Apache helicopter, Indirect Fire Protection Capability (IFPC) Increment 2-Intercept, Avenger, man-portable Stingers and Sentinel. Patriot's Guidance Enhanced Missile, a medium-to-long range interceptor, is optimized against cruise missiles and other air threats, such as fixed-wing aircraft. LTAMDS will address critical capability gaps in the defense against complex integrated attacks from the full-range of aerial threats. LTAMDS replaces the legacy Patriot sensor with a modern, 360-degree capability. It leverages the full battle space of the Patriot MSE interceptor and increases reliability and maintainability over the current Patriot radar. The Apache helicopter, with its rockets and 30-millimeter cannon, can engage enemy helicopters and, when sufficiently cued, is capable of engaging cruise missiles in its vicinity. IFPC Increment 2-Intercept uses the AIM-9X interceptor, mounted on a multi-mission launcher, to defeat cruise missile, fixed- and rotary-wing aircraft attacks and UAS surveillance of fixed and semi-fixed assets. In planned future improvements, other interceptors will be added to the launcher. Avenger, while focused on the low-level rotary- and fixed-wing threats, has some capability with its Stinger missile pods against cruise missiles. The Stinger icon represents both the Army and Marine Corps Stinger man-portable systems. The man-portable Stinger missiles in both services provide a limited close-in, low-altitude defense of forward combat areas and other critical assets against fixed- and rotary-wing aircraft and, to a limited degree, cruise missiles. The Army's man-portable Stinger is currently being fielded to maneuver elements to provide an organic capability to actively combat, or in self-defense against, fixed-and rotary-wing threats. Sentinel can acquire, track and classify cruise missiles, as well as unmanned and manned aircraft systems. The Navy provides the Aegis Cruise Missile Defense (CMD) and E-2 Hawkeye. The Aegis CMD uses the Standard Missile-2 to counter high-speed, high-altitude anti-ship cruise missiles in an advanced electronic countermeasure environment.[6] The E-2 Hawkeye is the Navy's carrier-based tactical battle management, airborne early warning command and control aircraft. It performs these functions for the carrier strike group and joint force commander[7]. The Air Force contributes the E-3 AWACS, 3DELRR, and AN/TPS-75. AWACS is an airborne element of the Air Force's tactical air control system. It is capable of continuous operations providing 360-degree wide-area surveillance, early warning, battle management, target detection and tracking and weapons control

5 *Raytheon article, Three-Dimensional Expeditionary Long-Range Radar (3DELRR).*
6 *U.S. Navy Fact File, Standard Missile, 30 January 2017.*
7 *U.S. Navy Fact File, E-2 Hawkeye Early Warning and Control Aircraft, 5 January 2018.*

functions. The 3DELRR and the AN/TPS-75 provide long-range, ground-based detection, identification and tracking of aircraft and missiles. The Marine Corps contributes a ground-based air defense capability with the Stinger missile (the man-portable Stinger noted above), Ground/Air Task Oriented Radar (G/ATOR), and AN/TPS-59 radar. The AN/TPS-59 radar provides long-range, three-dimensional, air surveillance and ballistic missile detection. The G/ATOR system is a three-dimensional, short- to medium-range radar designed to detect low observable/low radar cross-section cruise missiles, UASs, fixed- and rotary-wing aircraft, rockets and artillery and mortar munitions. Service fighters, such as the Air Force's F-22, can engage fixed-wing and rotary-wing aircraft and some cruise missiles in flight, as well as attack missile sites.

Many of the same service systems participate in countering UASs – the Army's Patriot, Apache, Avenger, man-portable Stinger, IFPC Increment 2-Intercept and Sentinel; the Marine Corps man-portable Stinger and AN/TPS-59; and some fighters. Patriot and Apache can engage the higher-end tactical UASs, while Avenger, man-portable Stinger, and IFPC can engage the low, slow and small tactical variants. The Army is also developing the Maneuver-SHORAD (M-SHORAD) capability. M-SHORAD will provide defense for maneuver formations on the move against UASs, rotary- and fixed wing aircraft, and rockets, artillery and mortars. A directed requirement for an initial M-SHORAD capability, with the ability to defeat UASs and rotary-and fixed-wing aircraft, was recently signed by the Vice Chief of Staff of the Army. The initial capability will mount a gun and missile mix on a Stryker vehicle. It is projected to be fielded in the next few years. The objective M-SHORAD capability may consist of a new platform, possibly the Army's next generation combat vehicle, and will have more lethal and extended range effectors. The effectors under consideration are a directed energy variant and a new missile.

Countering rockets, artillery and mortars is primarily a ground commander's responsibility. Key Army capabilities are the fielded C-RAM system, RAM Warn and Sentinel, and a future version of IFPC. The C-RAM system leverages the Sentinel radar, Lightweight Counter Mortar Radar, and Firefinder radar to provide alerting and curing information. The C-RAM shooter is the Land-Based Phalanx Weapon System, a multi-barreled 20-millimeter gun system, to destroy incoming RAM threats. RAM Warn provides early warning and impact point predictions. The future IFPC version will contain a new interceptor to improve the C-RAM capability; it is projected for development and fielding in the post FY25 timeframe.

The AMD systems discussed above provide a substantial mix of legacy and emerging replacement capabilities to counter the diverse aerial threats. At a glance, they appear to be numerous and have similar or overlapping abilities. From a quantitative perspective, none of the systems in any of the services are fielded in sufficient quantities to defend all of the critical assets in a given theater of operations. Qualitatively, many of the capabilities are complementary rather than duplicative, as they provide different proficiencies, whether in lethal means or detection ranges and altitudes, against the threats. Ultimately, successful air and missile defense is achieved through the integration of the available capabilities through a tiered and layered approach. The AMD Cross-Functional Team is working tomorrow's solutions with directed energy in coordination with Space and Missile Defense Command.

As the primary land-based component of this holistic fight for the third dimension, the Army AMD force is vital to our nation's ability to achieve the stated objectives of multi-domain operations. Army AMD forces are an integral element of all components of the solution to the challenges presented by peer adversaries.

As our nation competes short of war, Army AMD forces will be critical to the calibrated force posturing that must occur at key strategic locations across the globe. The Army AMD force is globally deployed and regionally engaged as a key strategic enabler to the joint force and the nation. While fulfilling a similar role in previous operational concepts, Army AMD forces, as well as those of other service components, have frequently been postured in forward stationed or forward deployed capacities, or as task-focused expeditionary forces. Patriot units, for example, have been routinely forward stationed for more than 25 years. These forces constitute, in many ways, a flexible deterrent option to show U.S resolve and to support friendly nations.

Given the potential for failed deterrence and an enemy bent on area denial, however, current conceptions of forward deployment and stationing must account for the need to turn denied spaces into contested ones. Calibrated force posturing must be complemented by the employment of resilient formations that can operate under the direction of a designated engagement authority or as "semi-independent" forces using procedural controls and mission command. Scalable and task-organized, these deployed Army AMD forces, along with other joint and multinational assets, must be able to span the multi-domain operational framework and deter or fight the collective air and missile threats with a "dynamic mix" of capabilities. When supported by enablers within the air, sea, space and cyberspace domains, a responsive warning system and interoperable command and control nodes, these forces provide defenses that are mutually supporting and facilitate the timely massing of effects to counter the projected aerial threats to critical facilities and maneuver forces.

While calibrated force posturing and employing resilient formations build upon existing operational measures, converging capabilities, which will be required to defeat the enemy campaign and consolidate gains, has no conceptual precedent. Fortunately, as the Army and the joint force initiate the doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy initiatives that must underpin this. The Army AMD force has been working toward the full integration of its capabilities as a precursor to achieving wider convergence across the other domains. As we move closer to this capability, we, along with the joint services and the cooperation and contributions of multinational forces, will be able to execute AMD actions with lethal shooters and non-lethal means to disrupt or destroy enemy surveillance and attacks from the air, land or sea. In anticipation of this, the AMD elements routinely train with their counterparts, facilitating collaborative planning, cooperative staff work, and coordinated AMD actions. Training enables precise execution. Precise execution with converging capabilities can ultimately facilitate freedom of entry, freedom of maneuver and successful culmination of air battles.

In summary, the AMD systems and capabilities described above, when employed as part of an integrated joint and multinational AMD effort, will enable our forces to win the air domain and support the fight across all domains.

Air defense artillery in World War I

By David Christensen

This year marks the 100-year anniversary of the U.S. participation in World War I. It was in 1917 that Gen. John Pershing and his American Expeditionary Force embarked onto the shores of France to begin training and readiness into what became known globally as The Great War. As America entered World War I, new technologies from the Industrial Age were introduced into combat. These became overwhelming combat force multipliers to those who mastered their lethality; one such asset was the introduction of the aero-plane. The aero-plane soon became adapted by war planners to serve in a variety of missions ranging from aerial observation to long-range bombing missions deep behind enemy lines. By 1915, the Germans developed bombers that terrorized Paris and by 1917 Germany's Goth bombers were crossing the English Channel and successfully bombing London. To counter this new emerging threat, the war department reached out to the coastal artillery and elected Brig. Gen. James Shipton to be the first chief of the Anti-Aircraft Service. Shipton soon departed for France where he stood up the first American Anti-Aircraft School Sept. 26, 1917, while in theater with the AEF.

Original class of 1917

The first course of 25 coastal artillery officers, received their anti-aircraft instruction from French officers. After completing their training, this first group of officers served as cadre for the artillery section of the American AA School. Two more sections of instruction were soon added to the school: a machine gun section and the searchlight section. Shipton augmented these two courses of instruction by outsourcing other branches within the AEF. The machine-gun training was provided by infantry officers and the searchlight instruction was taught by engineer officers. In all, the American AA School produced 659 officers and 12,000 enlisted Soldiers by war's end.

Doctrine and tactics

The AA Service had a maxim that "firing should not be adjusted, but prepared." This maxim was adopted because of the inaccuracy of the 75 mm cannon and aiming adjustments became an impossible task. American gun crews developed the practice of preregistering their guns. This pre-registration consisted of firing a volley of rounds into the air, to determine where the desired air burst would occur. With multiple gun systems concentrating on the same avenue of approach, "volume of Fires" soon became the solution to the aerial problem. This solution was also a result of how the aircraft was typically employed. Aircraft pilots used terrain features to navigate, and they preferred linear routes. These observations of aircraft techniques allowed AA units to develop plans that employed their guns along these predicted routes. Diversity of Fires along these routes was also important. Machine guns were used against low-altitude targets, while air bursts delivered from the 75 mm engaged the high-altitude threat.

The Anti-Aircraft Service also developed a doctrine of deterrent Fires. It had become widespread knowledge that "although hitting a plane was common, bringing one down was regarded as a fortunate incident."

From this lesson learned, American AA students were instructed on techniques to deter the aircraft and keep it at a distance. Instructors drilled into the students that forcing an aircraft to fly at a higher altitude would decrease their accuracy, as was the belief that a successful volume of fire would discourage the pilot from reaching their objective.

The American AA Service was the principal user of searchlights during World War I. In all, the AA Service had 34 searchlight platoons activated while in theater. Most Europeans believed searchlights were impractical and would give frontline positions away to enemy targeting. The Americans however, adopted the searchlights primarily for rear defense. The searchlight made an impact as a deterrent to nighttime-bombing raids. Their success was achieved, in part, by the ability to track and highlight a threat. However, the nighttime tracking of aircraft by a searchlight hindered a pilot's ability to see and would cause them to become disoriented and ineffective, often abandoning the target.

The highlight for the newly formed service came to fruition May 18, 1918. A German observation plane was crossing between the security of the German lines and into the buffer of no-man's land, trying to collect information on AEF and French unit positions. An alert crew of the 2nd Anti-aircraft Battery was located approximately 2,700 meters away and was armed with two French 75 mm guns. As the crew prepared the shell fuses for the desired altitude, Lt. A. T. Slaten calculated the necessary data on range, location and speed.

Soon the air was filled with the burst of powder and fragmentation, and the effects provided results. The German observation plane went into a dive, followed by an uncontrolled spiral, finally crashing into the 500 meters of ground known as no-man's land. The crew managed to survive the crash and was viewed scrambling from the wreckage and behind German lines. That night, a French infantry patrol ventured across friendly lines to strip the enemy plane of its machine guns and other useful equipment.

The patrol was also successful in cutting away a piece of the aircraft underbelly and later presented it to the American battery commander, Capt. E. A. Mellon, as a souvenir and confirmation of the American's first recorded kill.

By the end of the war, America's AA Service was the most successful anti-aircraft service among the allies. The success was attributed to the tenets of good training, the developed doctrine and to the skill and discipline of the crews operating the weapon systems. When comparing the data, it took a British gun crew 10,000 rounds and the French crew 6,000 rounds to down a single plane. But, it took only 600 rounds for the Americans to bring one down.

First to fire!

David Christensen is the U.S. Army Air Defense Artillery School historian at Fort Sill, Okla.

Brig. Gen. James Shipton. (Courtesy photo)

Bolts, gears and wires

British-American cooperation in Operation Crossbow and the defense of Antwerp

By Capt. David Degenhardt, Jr.

Former U.K. Prime Minister Winston Churchill and Mrs. Clementine Churchill visit an anti-aircraft artillery battery. (Courtesy photo)

After four years of siege by the Luftwaffe, the summer of 1944 saw British air defense forces facing a new and dangerous threat: the V1 "robot bomb." British and American anti-aircraft artillery worked together to defeat this threat by sharing technology and equipment, training together and fighting cooperatively as a unified force.

Training together built a foundation that allowed American and British troops to work together in the joint defense of London and Antwerp, sharing technology such as the paired SCR-584 radar and M9 director, Bofors anti-aircraft gun, and VT radar proximity fuse. This exchange of technology supported British and American efforts to defend critical areas, allowed them to share targeting data and saw joint forces engage incoming threats while working on the same gun sites. Without this extensive effort, neither force would have been as capable of defending their homes and comrades against Germany's last-ditch bombardment.

Before American entry into the war there was a significant degree of interest within American military circles regarding British anti-aircraft artillery tactics and equipment. The news and comments section of the January-February 1938 volume of The Coast Artillery Journal features no less than five notes referring to British developments, including remotely controlled airplane and boat targets for gunnery practice, reports of a new anti-aircraft gun, pre-building factories so that they could be rapidly manned to increase industrial output and the use of barrage balloons.[1] The same section in the May-June volume for 1938 included a summary of an article on anti-aircraft defenses from the Journal of the Royal Artillery as well as references to an article in the London Daily Express concerning secret anti-aircraft guns guarding London.[2] British anti-aircraft measures were undergoing rapid development at the time and American forces were eager to learn what they could to prepare for the possibility of joining the war.

Cooperation between British and American forces began with observers, attachés and volunteers traveling to the United Kingdom in 1939. These interactions were not always positive, as described by Gen. Frederick Pile of the British Anti-Aircraft Command's in his post-war memoir, "Ack-Ack: Britain's Defense Against Air Attack During the Second World War." Pile notes multiple attempts by the American military attachés to determine the number of anti-aircraft artillery pieces the British possessed, with all such attempts being firmly but politely refused.[3] More positive interactions occurred when the British established a site to train scientists to assist in operating radars at gun sites and received a number of enthusiastic American volunteers who worked side-by-side with British forces while insisting that they were civilians.[4] These scientists provided key assistance in the development and implementation of gun-laying radar at anti-aircraft sites, which greatly increased effectiveness by allowing guns to be mechanically aimed to line up with incoming air threats as soon as they were detected.[5] By autumn of 1940, official American observers traveled to Britain and had begun actively assisting the British air defense establishment, providing advice and staff assistance for English defense against the Luftwaffe.[6] Although the United States had not officially entered the war, American scientists and Soldiers were operating with their British counterparts and serving on what was effectively a joint staff.

1 *News and Comments," The Coast Artillery Journal January-February (1938): 63-66.*
2 *"News and Comments," The Coast Artillery Journal May-June (1938): 214-215.*
3 *Frederick Pile, Ack-Ack: Britain's Defence Against Air Attack During the Second World War (London: Harrap & Co., 1949), 113.*
4 *Pile, 114.*
5 *Pile, 196-7.*
6 *Pile 175-6.*

A V1 flying bomb — also known to the Allies as the buzz bomb — was an early cruise missile. (Courtesy photo)

Following Pearl Harbor and the official entry of the United States into the war, a substantial time passed before American units began to train with their British counterparts. Members of the British Anti-Air Command were actively engaged in sharing their experience with American forces during this period, contributing educational articles and sending personnel to train forces in the United States. The May-June volume of The Coast Artillery Journal, for example, features an article on the operation of mixed-sex anti-aircraft batteries re-published with the permission of Journal of Royal Artillery for the education of American forces.[7] The notes section of the next volume records the arrival of a British training unit to the United States with the specific mission of educating the American force on the use of 3.7-inch guns, the Bofors gun and searchlight equipment.[8] Pile refers to the same unit in more detail in his memoirs, claiming it gave more than 250 demonstrations for American air defense units over the course of five months while participating in a number of fundraising and publicity events to increase goodwill between American and British forces.[9] By the end of the tour, American forces begun to travel to Britain to train with British anti-aircraft artillery. The first units to train were en route to the North African theater while subsequent units trained to assist in the defense of Britain before moving on to mainland Europe.

In an article from the September-October 1943 volume of The Coast Artillery Journal, Maj. Henry Von Kolnitz described his battalion's journey to Britain in the late summer of 1942. In those six weeks, junior officers and non-commissioned officers observed gun sites while mechanics and electricians trained in maintenance before the unit practiced amphibious landings and proceeded to Oran.[10] Other American units followed a similar pattern of traveling to the United Kingdom, training for a short period and proceeding to the front. Pile references the first full United States anti-aircraft brigade in Britain becoming operational in December of 1943, followed by a large-scale training mission. This mission gave American forces an opportunity to observe British gun sites and aiming devices such as the Stiffkey Stick. American forces educated British forces on the SCR-584 radar and its director.[11] The Americans gained the most benefit from this arrangement, greatly improving their maintenance practices, which in some cases were as rudimentary as pouring oil down the barrel of their guns on the theory that it would eventually work itself into all the critical components.[12] These lessons produced an immediate battlefield result for American troops by improving equipment readiness, while the British applied their new familiarity with the SCR-584 at London and Antwerp.

The SCR-584 radar was a crucial piece of equipment for British and American forces. It developed means to direct anti-aircraft guns as it could track aircraft by both azimuth and elevation and could be adjusted to deal with anti-radar measures such as chaff.[13] The accompanying director was a mechanical computation device that fed the radar data on targets to the guns, allowing gunners to lead incoming targets and ac-

7 *J.W.N., "Mixed Batteries," The Coast Artillery May-June (1943): 18. The British mixed batteries included both men and women in the same unit, with women participating in all tasks except for the actual firing of the guns.*
8 *"News and Comments," The Coast Artillery Journal July-August (1943): 65.*
9 *Pile, Ack-Ack, 292-293.*
10 *Henry von Kolnitz, "An AW Battalion in North Africa," The Coast Artillery Journal September October (1943): 4.*
11 *Pile, Ack-Ack, 293-294.*
12 *Pile, 295.*
13 *Air Defense: An Historical Analysis 1914-1962 Volume II (Fort Bliss: U.S. Army Air Defense School, 1965, 104.*

curately fire on fast-moving targets.[14] United States Air Defense Artillery conducted analysis following World War II that compared similar equipment between United States and German forces. They found that when combined with its accompanying M9 director, the SCR-584 roughly doubled the effectiveness of anti-aircraft Fires.[15] British analysis supported this assessment, and Pile wrote that the SCR-584 nearly eliminated human input into gunnery and represented the best possible answer to the V1 as "a robot gun for a robot bomb."[16]

Following the determination that the SCR-584 and M9 were necessary to defeat the V1 rocket, the British Air Defence Command requested 134 sets of the new equipment, with an eventual goal of having 430 operational radar sets.[17] Acquisition of the system was slower than anticipated and Pile eventually sent Maj. Blair from his staff to visit the United States to ask for more equipment. Blair traveled with V1 parts recovered from the first salvo into Britain and his visit made such an impression on Gen. George Marshall Jr., the United States Chief of Staff of the Army, that 165 SCR-584s with all associated equipment were shipped on the next boat to England.[18] Considering that the SCR-584 was the most recent development in United States radar technology, commitment of so many sets represented an enormous contribution to the defense of Great Britain.

In addition to providing radar sets for British use, the United States also provided the automatic 40 mm Bofors gun, which the United States produced for the United Kingdom under the Lend-Lease program.[19] The Bofors gun was noted for its accuracy and ability to use a director to increase the accuracy of Fires, resulting in the United States Navy adopting it for ship-based anti-aircraft in February of 1941.[20] The Bofors gun provided a significant combat capability, with a notable example being the presence of four Bofors on the beach at Dunkirk, defending the location where British troops loaded up on ships to escape.[21] The Bofors was also heavily used by the British at Malta, where they destroyed more than 1,000 Axis aircraft over the course of two years.[22] The United States produced more than 2,800 Bofors guns for the United Kingdom over the course of the war, many of which were engaged in the defense of London and Antwerp against the V1.[23] That may seem like an enormous amount of guns, but British faced the problem of defending their entire island against the attacks by the Luftwaffe. To do so, required thousands of guns to protect the most critical areas.

While developments in radar technology and reliable guns greatly contributed to the overall effectiveness of the anti-aircraft artillery, the single greatest improvement might arguably be in the relatively obscure realm of artillery fuses. The United States began World War II using "powder-train" fuses that burned for a specified amount of time before triggering the main explosive and then transitioned to a mechanical fuse that used clockwork and gears to provide a more dependably-timed explosion.[24] Pile's memoirs reference a similar development among the British anti-aircraft artillery units, accompanied by a fuse-setting machine that largely automated the process and eliminated human error.[25] Pile notes that the British used clockwork fuses before 1943, but credits a disruption in the supply of gears from Switzerland as the source of difficulty in producing fuses of equivalent quality until a particularly brilliant Dr. Vick solved multiple quality control issues.[26] Fuses were of particular importance as they determined the altitude at which artillery shells burst, and unreliable fuses caused shells to burst either above or below their targets. Setting fuses, by hand or by machine, required a fairly good idea of the elevation of incoming aircraft obtained by either direct observation or radar.

The solution to these problems lay, as in so many aspects of the fast-paced task of shooting down aircraft in flight, with the removal of the human factor from the equation. In terms of fuses, the Holy Grail of fuse design was one that did not need to be pre-set, but would instead explode when in close proximity to an aircraft. The resulting proximity fuse was developed in 1942 and was initially used only by naval anti-aircraft gunners to prevent dud shells from being recovered by Germans and reverse-engineered.[27] The proximity fuse was a hybrid development, with British innovations being further developed by American experts to overcome the technical challenges involved. With radar development largely taking place in the inter-war period, the creation of a miniaturized version that could be packed into a shell was a significant advance. The first radar apparatus small enough to be put into a shell and robust enough to be fired without being destroyed was developed by the Pye Radio company in Britain, with the technology being swiftly transferred to the United States and improved until the finished project could enter mass production.[28]

The significance of the resulting product for the success of anti-aircraft artillery, commonly referred to as the VT fuse, is difficult to overstate. Post-war analysis by the United States Air Defense Artillery School on the introduction of the VT Fuse against the V1 in southern England found that it contributed to a stunning increase in successful engagements from 17 to 74 percent.[29] In his more detailed description of the British experience with the VT fuse in the conflict Pile cites a similar increase in efficacy, but notes that this was in part a result of British troops becoming more familiar with associated equipment as well as making better use of what they were given.[30] Pile also records complaints from his gunners because the shell burst before hitting the target, resulting in shots that would have hit the target detonating at a distance and making

14 *Air Defense: An Historical Analysis 1914-1962 Volume I (Fort Bliss: U.S. Army Air Defense School, 1965), 50-51.*
15 *Air Defense: An Historical Analysis 1914-1962 Volume II, 45.*
16 *Pile, Ack-Ack, 313-314.*
17 *Pile, 314.*
18 *Pile, 339.*
19 *Semmens, The Hammer of Hell (self-pub., 1990), 8*
20 *Semmens, 8.*
21 *Air Defense: An Historical Analysis 1914-1962 Volume II, 66-67.*
22 *John F. Kreis, Air Warfare and Air Base Defense (Washington D.C.: Office of Air Force History, 1988), 124.*
23 *Terry Gander, The Bofors Gun (Annapolis: The Naval Institute Press, 2014), 87.*
24 *Air Defense: An Historical Analysis 1914-1962 Volume II, 26-27.*
25 *Pile, Ack-Ack, 301.*
26 *Pile, 265-266. Vick's work included heading a committee that reduced the number of dud rounds on a monthly basis and at the height of their efforts produced a fuse that was four times as efficient as the best Swiss clockwork fuses. Unfortunately for Vick, his work was overshadowed by development of the proximity fuse.*
27 *Air Defense, 51.*
28 *Pile, Ack-Ack, 340.*
29 *Air Defense: An Historical Analysis 1914-1962 Volume II, 144.*
30 *Pile, 343-344.*

Soldiers man an M1 anti-aircraft gun. (Courtesy image)

their gunnery appear inaccurate.[31] Despite these complaints the improvements produced were impossible to deny. Analysis conducted by the United States Eighth Air Force projected that had Germany been in possession of similar technology, losses among American bombers would have been three-to-five times heavier and that an air campaign over Germany might have been unsustainable.[32]

Joint training and shared equipment came together in Operation Crossbow, the defense of London against the V1 flying bomb. This took place in three phases from June 13, 1944, through March 29, 1945.[33] The November-December 1944 volume of The Coast Artillery Journal notes in its news and comments section that multiple battalions of American anti-aircraft artillery participated in the fight against the V1 threat while also detailing the contributions of British pilots, searchlights and even barrage balloons to the defense.[34] Pile indicates that Gen. Dwight D. Eisenhower authorized the use of 20 American batteries equipped with 90 mm anti-aircraft guns for the defense of London, resulting in the destruction of 447 V1 bombs over the course of the operation.[35] In the outer belts of defense against the V1, Pile counts seven American battalions among the forces that deployed while also recounting the astonishing efficiency of the American troops who stated that they could accomplish the deployment of nearly 400 guns in four days as compared to the British estimate of 18 days. American troops actually managed the feat in 24 hours.[36] The degree to which American forces were integrated into and contributed to the British defense against the V1 is particularly important when one considers the actual results that the combined force were able to achieve.

The V1 represented an almost perfect target for anti-aircraft gunners, traveling in a straight line and maintaining a constant speed and altitude, while still presenting a challenge as it was a small and fast-flying target that could absorb more damage than an airplane.[37] Pile puts the initial success rate against the threat at 13 percent based on what he calls a "generous assessment," while also noting that in many cases the V1 flew at a particularly inconvenient altitude of between 2,000 and 3,000 feet, which was too high for light anti-aircraft guns while being too low for heavy guns.[38] Once the guns were properly deployed and the SCR-584 and M9 American equipment had been delivered, Pile chronicles a steady improvement over the course of five weeks that saw gunners shooting down 55 percent of V1 bombs that entered their field of fire.[39] Joint forces engaging the V1 were reorganized to replace ineffective weapon systems, resulting in a weekly success rate of 74 percent in August of 1944 with an all-time high of 82 percent on a single night. During the first phase of the battle, American and British artillery destroyed more than 1,550 V1s.[40] A more advanced V2 ballistic missile was developed and posed a more serious threat, as it traveled at more than 3,500 miles per hour and could only be stopped by destroying a warhead encased in a quarter-inch of steel armor. Although the British developed a plan to engage the threat using anti-aircraft artillery, this plan was not put into action before Allied forces captured the launch sites in Holland.[41]

This first phase of the German V1 attacks signified the peak of "robot bomb" attacks on England, with London receiving the majority of attacks. The overall frequency decreased significantly over the following two phases. The second phase of the V1 battle saw a shift to V1 bombs that were air-launched from planes, with 495 entering the engagement zones of anti-aircraft artillery and 320 being summarily shot down for a success rate of 65 percent.[42] The third phase saw an even smaller number of launches from the ground as Allied forces began to apply pressure to the German Army and overtake launch sites, with a total of 158 launched and 87 percent of those destroyed by anti-aircraft fire.[43] Based on the previous two phases it can be extrapolated that Allied success rates during this phase were comfortably in the realm of 70 percent. In total, this denotes some 1,900 V1s shot down by American and British anti-aircraft forces, with American forces directly contributing to more than 20 percent of the total successful engagements.

31 *Pile, 340.*
32 *Air Defense, 52.*
33 *Air Defense: An Historical Analysis 1914-1962 Volume II, 142.*
34 *"News and Comments," The Coast Artillery Journal November-December (1944): 72-73.*
35 *Pile, Ack-Ack, 339-340.*
36 *Pile, 327-329.*
37 *Air Defense, 143.*
38 *Pile, Ack-Ack, 329-330.*
39 *Pile, 343.*
40 *Pile, 344.*
41 *Pile, 386-388*
42 *Air Defense: An Historical Analysis 1914-1962 Volume II, 146.*
43 *Air Defense: An Historical Analysis 1914-1962 Volume II, 146.*

Soldiers man a Bofors 40 mm gun. (Courtesy image)

The lessons learned in the battle against the V1 over Britain were applied in the defense of Antwerp in Belgium, which began in October of 1944. The defensive strength of Antwerp eventually included more than 600 guns, of which at least 128 were British 3.7-inch weapons.[44] In the September-October 1945 issue of The Coast Artillery Journal, Brig. Gen. George Badger described a process by which American forces gradually replaced British troops on the ground and established an efficient enough engagement strategy that personnel were awakened by gunfire and returned to sleep within moments after the threat had been neutralized.[45] Badger's observations included a note that all batteries in the defense were equipped with M9 directors, that the British helped the Americans in every way possible, and that the best form of defense was a layered defense surrounding the target area.[46] Careful positioning of anti-aircraft batteries along likely avenues of approaches allowed for between 74 to 92 percent of V1s entering the protected area to be engaged, with kill rates on some specific occasions ranging as high as 94 percent for V1s entering the main defended zone.[47]

A companion article in the same volume notes that during the defense of Antwerp, British early warning systems were actually feeding data through American operations centers, which in turn used this data to direct Fires and allow for more effective engagement of the incoming V1 targets.[48] Sharing target data at this level demonstrated a truly integrated force that allowed Americans and British cooperation in engaging a formidable threat. The total number of destroyed V1s en route to the "vital area" was 1,766 out of 2,523, or approximately 70 percent, with only 211 V1s successfully landing within the defended area while the remainder missed their target.[49] Common claims that Allied forces achieved an overall success rate of over 90 percent against the V1 thus represent a mistaken comparison of weapons launched versus weapons that successfully hit the target. The 90 percent figure assumes that all weapons that did not hit their target were shot down, rather than simply landing elsewhere, and presents an inaccurate picture of what actually occurred.

In the final analysis, victory in the air over London and Antwerp depended on American production of equipment combined with British training and battlefield experience. The United States provided guns, radars, directors and additional forces, while the United Kingdom shared their extensive experience with keeping equipment operational over a long period of time and battle-tested tactics for engaging the Luftwaffe. In the fight against the "robot bombs" this union produced dramatic improvements in an extremely short period of time during the defense of London, and this directly affected the even more impressive defense of Antwerp. The V weapons were meant to break the will of their civilian targets, and by shooting down more than 70 percent of incoming V1 bombs, American and British forces completely defanged this threat. Working together, British and American forces were able to leverage shared technology and equipment to conduct joint training and engagements, achieving a level of success that would have been difficult for either force to accomplish on their own.

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44 *Air Defense, 147.*
45 *George M. Badger, "Sidelights on Antwerp X," The Coast Artillery Journal September October (1945): 11.*
46 *Badger, "Sidelights on Antwerp X," 12.*
47 *Air Defense: An Historical Analysis 1914-1962 Volume II, 153.*
48 *A. R. Dallmeyer, Jr., "Antwerp X," The Coast Artillery Journal September October (1945): 3.*
49 *Air Defense, 154.*

Attention to orders!

The President of the United States of America, authorized by Act of Congress, July 9, 1918, takes pleasure in presenting the **Distinguished Service Cross** to **Private Albert A. Darago, Jr.** (ASN: 33731341), United States Army, for extraordinary heroism in connection with military operations against an armed enemy while serving with the **143rd Anti-Aircraft Artillery Battalion (Mobile)**, attached to the **40th Infantry Division**, in action against enemy forces on Dec. 19, 1944, in Belgium. During a strong German counteroffensive, the rumbling of an indeterminate number of hostile tanks was heard approaching Private Darago's 90 mm gun position. When an Infantry officer from an adjacent unit suddenly appeared in search of two rocket launcher gunners, Darago was one of two men to volunteer for the dangerous mission of stopping the tank advance. Although he was unfamiliar with the weapon, he courageously crawled to within 40 yards of the tanks. Ignoring the devastating machine-gun fire placed upon him, he fired a rocket and scored a direct hit. He returned to the officer to have his weapon reloaded and with undiminished daring crawled back to his original position and, while subjected to intense machine gun fire, scored a second hit and completely destroyed the tank. Darago's great valor, outstanding personal courage and zealous devotion to duty exemplify the highest traditions of the military forces of the United States and reflect great credit upon himself, the 40th Infantry Division, and the United States Army.

General Orders: Headquarters, First U.S. Army, General Orders No. 23 (Feb. 9, 1945)

Nike missiles stand at the ready. (Courtesy photo)

By Capt. Peter Mitchell

The spindly Nike missile stands like the hand of a clock at the start of a new era. The Rocket Age that had been birthed in America with Robert Goddard's 1914 liquid-fueled engine was baptized with fire in the seaside laboratories of 1944 Peenemünde and confirmed with the moniker of Aggregat-4.[1] That very same year the turbojet-powered Messerschmitt Me 262 Schwalbe took to the skies above Germany with speeds of 560 mph, blistering its nearest rival in the P-51 Mustang escort fighter (top speed 440 mph) and striking terror into the hearts of Allied bomber crews. The U.S. War Department demanded a weapon that could deal with the speed and altitude of the new jet fighters, since the gun systems on all contemporary aircraft could not keep up. Thus did the Third Reich both cause and cure a problem at the same time. The Army Ordnance Department issued a requirement on Jan. 26, 1945, for a surface-to-air missile.[2] Bell Telephone Laboratories was contracted to build a system code-named Project Nike. To get the Nike in the air, however, the Ordinance Department and Bell needed to solve three nagging complications: propellant, guidance and inter-service politics.

Problem One: The propellant

Von Braun's A-4 was a tactical ballistic missile, the first of its kind, and not designed to be fired in a reactionary manner. It was loaded up with a 74 percent ethanol/water mixture for fuel and liquid oxygen (LOX) for oxidizer, pointed in the direction of England and fired off without any delay.[3] But the War Department wanted an anti-aircraft missile that was always ready to fire. Laboriously loading up a missile with LOX when waves of nuclear-armed Soviet bombers are on the way is a luxury that few air defense sites could afford given the limitations of mid-20th Century radar. A storable oxidizer was needed that could be kept preloaded and then fired off at a moment's notice. This cannot be done with oxygen, which cannot be kept liquid above minus 119 degrees Celsius and has the nasty habit of being unbelievably corrosive towards any metal container bold enough to store it.[4] So American chemists promptly set about trying to find a suitable oxidizer that was shelf stable, hypergolic (ignites on contact with the fuel), and liquid at low temperature (the Army and Navy decided that minus 54 degrees Celsius would be acceptable for most purposes).

Oxygen obviously couldn't be used, since it couldn't be stored as a liquid for any period of time. Practically everything else they tried literally blew up in their

1 *Better known by its propaganda name Vergeltungswaffe-2.*
2 *The verbose first request from the Army Ground Forces in 1944 was for a "major caliber anti-aircraft rocket torpedo". The first use of the word 'missile' as applied to a guided rocket wouldn't come about until 1945.*
3 *Frank H. Winter, "V-2 Missile," Smithsonian Natl Air and Space Musueum, July 3, 2000, accessed February 28, 2018, https://airandspace.si.edu/collection-objects/missile-surface-surface-v-2-4.*
4 *F. W. Fink, Earl L. White, Corrosion Effects of Liquid Fluorine and Liquid Oxygen On Materials of Construction, CORROSION. 1961; 17 (2):58t-60t. https://doi.org/10.5006/0010-9312-17.2.80*

face. Fortunately the war ended a year later. The parallel German work on propellants came to light and things began to take off. Von Braun and his de-Nazified associates arrived at the Ordinance Research and Development Division Sub-Office (Rocket) at Fort Bliss, Texas, in 1945 armed with knowledge, experience, and dozens of A-4s rescued by American ingenuity from the clutches of the Soviets. The alcohol-LOX combination that was used in the A-4 was fine for long-range ballistic missiles, but not for surface-to-air missiles. Experiments commenced on using aniline fuel (an organic compound C6H5NH2 synthesized from benzene with an odor of rotten fish) with a red fuming nitric acid oxidizer (RFNA, compound HNO_3).

The aniline-RFNA mixture was hypergolic and efficient, but amazingly toxic. RFNA in particular is so corrosive that it had to be loaded into the missile just before firing, which meant ordering Soldiers to handle it in the field. Additionally, RFNA gives off dense clouds of highly poisonous nitrogen dioxide when poured and the liquid produces extremely painful burns.[5]

As for the aniline, it is toxic by inhalation of the vapors, ingestion or percutaneous absorption. "If a man is splashed generously with it he usually turns purple and then blue and is likely to die of cyanosis in a matter of minutes."[6] Toxicity aside, aniline also froze at minus 6.2 degrees Celsius, far lower than the aforementioned minus 54 degrees Celsius limit. To lower the freezing temperature, scientists at Jet Propulsion Laboratory mixed their aniline with 20 percent furfuryl alcohol, which lowered the freeze point to minus 17.8 degrees Celsius, keeping the hypergolic reaction while reducing the toxicity.[7] JPL also swapped out RFNA for white fuming nitric acid, which retained many of the same qualities of RFNA while eliminating the billowing clouds of nitrogen dioxide.[8] This was the combination used in the Douglas Aircraft WAC Corporal (the first U.S. sounding rocket) which was launched on Sept. 16, 1945, from White Sands Missile Range.[9]

For Project Nike however, more efficiency and a still lower freezing temperature was demanded by the Ordinance Department for tactical deployment. In 1946, Metallectro and Aerojet hit upon unsymmetrical dimethyl hydrazine (UDMH or H2NN[CH3]2.), a "magnificent fuel" which provided excellent thrust and melted at minus 57.2 degrees Celsius.[10] For oxidizer, Bell decided to use the recently standardized jet fuel JP-4, a 50-50 kerosene-gasoline hydrocarbon blend that froze at minus 60 degrees Celsius and had the additional feature (appreciated by smokers) of not bursting into flame even if a lit match is dropped into it.[11] These became the ingredients for the Nike's considerably less toxic liquid-fueled engine. This is was only half the solution though. As any player of Kerbal Space Program can attest, Tsiolkovsky's rocket equation demands that ~66 percent of a two-stage rocket's mass be first stage propellant. The Bell JP-4/UDMH engine was too weak to get the missile off the ground and needed an assist to get through the thickest part of the atmosphere.

Bell determined that the assistance needed to be in the form of a solid fuel first-stage booster. Solid fuel provides better thrust-per-pound than liquid fuel, but the thrust is locked at 100 percent and cannot be shut down once it is started. Due to this solid rockets cannot be vectored at the exhaust nozzle and require aerodynamic action via controls surfaces such as fins in order to steer. Solid fuel rocket research had followed a different path than the volatility of the liquid fuel experiments. The eccentric scientist, Jack Parsons, developed a mixture of roofing asphalt and potassium perchlorate for Hap Arnold's pet Jet-Assisted Take-Off (JATO) program in 1942.[12] For the Nike, Aerojet initially provided some small left-over JATO solid fuel boosters. These were bolted around the base of the missile like buttresses on a Romanesque cathedral along with four massive fins to provide stability and control. The first static firing of a Nike missile occurred at White Sands Proving Ground, New Mexico, Sept. 17, 1946, with eight missiles launched without guidance systems from Sept. 24, 1946, through Jan. 28, 1947.[13]

The development schedule optimistically projected that the Nike would be ready for production in 1949.[14] This schedule was not met. Unfortunately, incremental differences in thrust between the different trashcan-shaped solid-fuel boosters overwhelmed even the giant stabilizer fins. Several of the dummy missiles exhibited "intermittent motor operation" and "poor separation of the missile-booster combination."[15] The separation problem repeated itself in the fourth and fifth rounds, the sixth and seventh rounds were wrecked by booster explosions during launch, and the ninth round's booster fizzled.[16] These problems with the first-stage were unable to be resolved by any amount of telemetry study or tinkering, and by early 1948 Bell was forced to admit to the Army that the Nike project was behind schedule.

Luckily for Bell, the Navy came to the rescue with the fearsomely named Project Bumblebee[17] anti-aircraft missile, jointly developed by JPL and John Hopkins University. Allegheny Ballistics Laboratory had designed a successful solid-fuel booster for the Bumblebee that was adapted by Bell and Douglas Aircraft engineers to be installed aft of, and in line with, the missile itself. This resulted in a 10-meter long missile-booster combination because sufficient space had to be provided between the booster and missile to avoid obstruction of the missile motor exhaust (which would result in a fiery explosion).[18] Armed with their new design, Bell went back to White Sands in 1948. The new Allegheny solid booster provided 55,000 pounds to force, (by contrast the gimbaled liquid-fueled second stage provided only 2,600 pounds to force) and accelerated the Nike to Mach 1.7

5 *John Drury Clark, IGNITION! an informal history of liquid rocket propellants (S.l.: Rutgers University Press, 2018), 23.*
6 *Ibid.*
7 *"Furfuryl alcohol," The National Institute for Occupational Safety and Health (NIOSH), April 11, 2016, accessed February 28, 2018, https://www.cdc.gov/niosh/npg/npgd0298.html.*
8 *Clark, 27.*
9 *"History of the WAC Corporal Missile," June 12, 2007, accessed February 28, 2018, https://web.archive.org/web/20070612033539/http://www.boeing.com/history/mdc/wac.html.*
10 *Clark, 43.*
11 *"Jet Fuels JP-4 and JP-7," accessed February 28, 2018, https://www.atsdr.cdc.gov/ToxProfiles/tp76-c3.pdf.*
12 *Parsons was allegedly inspired to add asphalt instead of black powder by the ancient incendiary weapon Greek fire. He went on to be one of the founders of Jet Propulsion Laboratory (JPL) and die at the age of 37 in an explosion caused by a laboratory accident. JPL later substituted synthetic rubber and ammonium perchlorate to create the standard solid fuel still used today in the Patriot and THAAD.*
13 *"Nike Ajax (SAM-A-7) (MIM-3, 3A)," Federation of American Scientists, April 29, 1999, accessed February 28, 2018, http://webcache.googleusercontent.com/search?q=cache%3Ahttps%3A%2F%2Ffas.org%2Fnuke%2Fguide %2Fusa%2Fairdef%2Fnike-ajax.htm.*
14 *Ibid.*
15 *Mary T. Cagle, "Nike Ajax Historical Monograph," June 30, 1959, accessed February 28, 2018, http://ed-thelen.org/mono-1-2.html#table.*
16 *Ibid.*
17 *Bumblebee led to the RIM-2 Terrier, devised as a test vehicle, and later evolved into the RIM-66 Standard.*
18 *Cagle.*

in less than three seconds.[19] In all but one of the 17 launches made in 1948 (the first missile was destroyed by the Allegheny booster exploding seconds after launch), the missile's outlook appeared positive, but austerity measures forced by changing priorities in 1949 put the entire program on ice until January 1950.

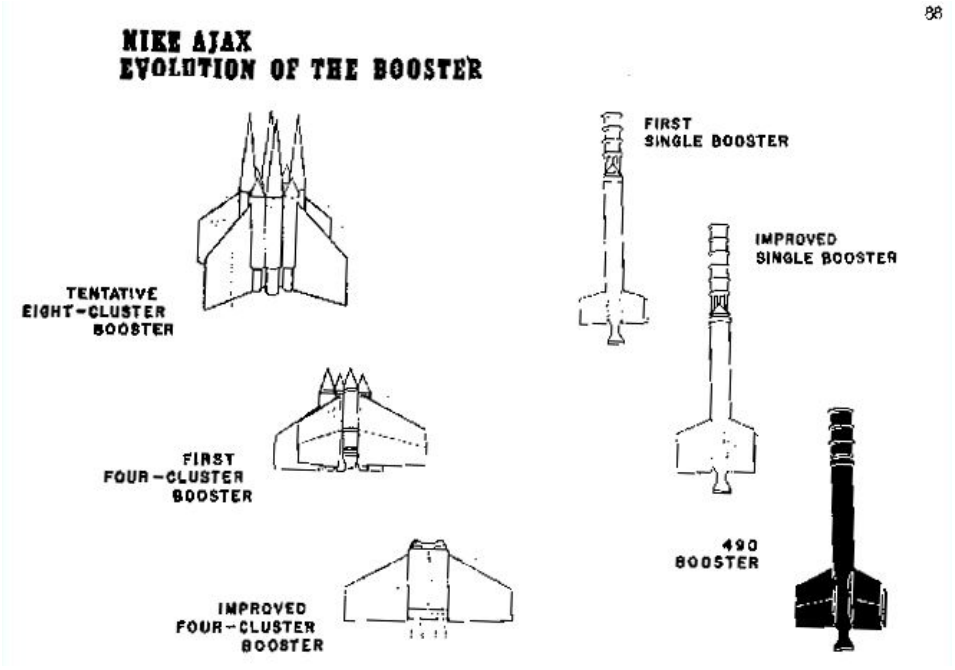
The Bell engineers worked closely with their Douglas Aircraft subcontractors to make the best use of the time. A particular program that was fixed was unusual lateral accelerations produced during the first stage, apparently as a result of eccentric motor thrust.[20] When the money was turned back on in 1950, the missile needed only a few more tests to iron out the remaining deficiencies. Test Flights (or Rounds) 60 and 61 at White Sands in the spring of 1951 had nominal boost on both stages and showed no indication of propellant loss.[21] These were the last tests to assess the engine. Rounds 62 through 65 in July 1951 were launched to test revisions in the central network and guidance, which had experienced a different but no less complicated journey.

Problem Two: Guidance system

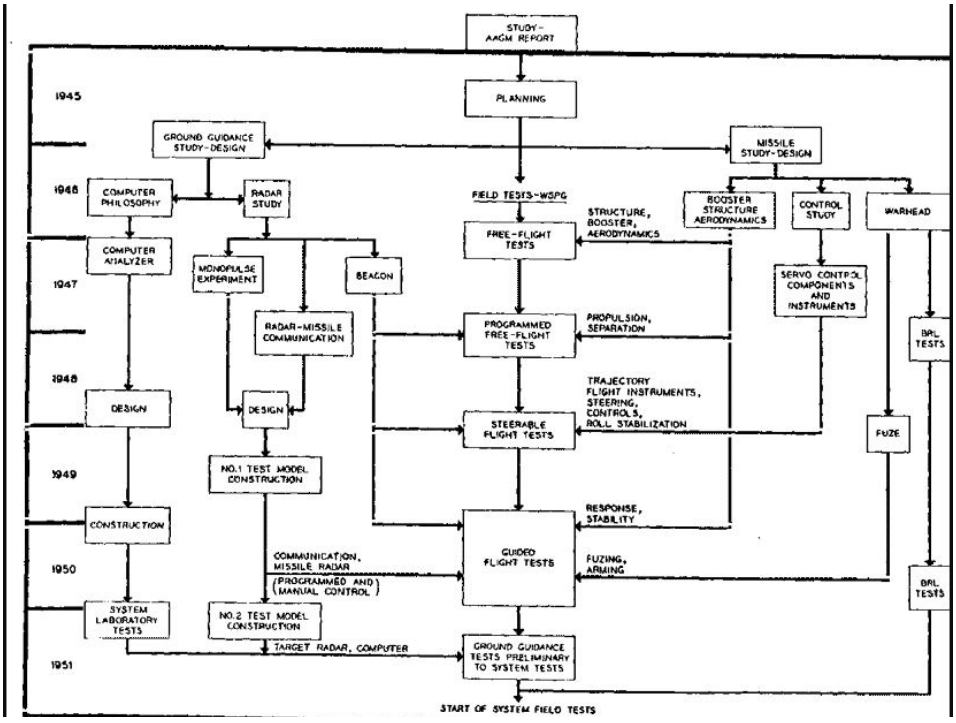
"A formation of Tu-4 bombers has been spotted on radar approaching defended asset X at a speed of 155 meters/second, altitude of 10,000 meters, and distance of 100 kilometers. Given a Nike site located at X armed with a missile that travels an average of 750 m/s and has a maximum range of 48 km, at what distance from X should the Soviet formation be when the missile is fired in order to ensure maximum standoff at intercept? You have 10 minutes until X is annihilated by thermonuclear weapons. Show your work."

The Army needed a computer system that could:

1. Provide Predicted Intercept Point (PIP) and Predicted Flight Time (PFT).
2. Provide predicted intercept azimuth angle to missile during pre-launch.
3. Provide steering commands after launch.
4. Provide detonation command at correct time (about 0.1 seconds before reaching target center of mass).
5. Be easy to test, reliable, accurate, testable and maintainable.



The evolution of the Nike missile boosters system. (Courtesy illustration)

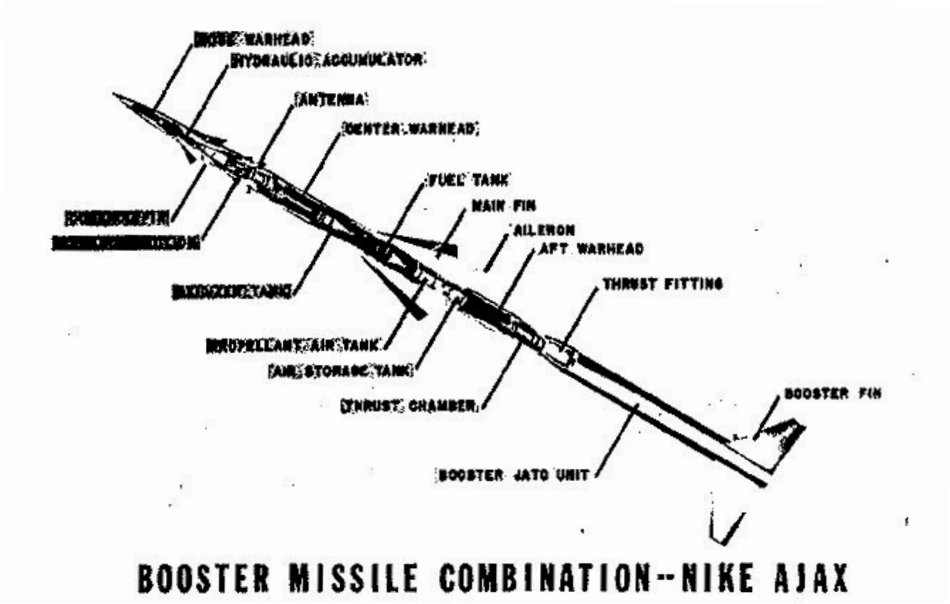


A synopsis of the major steps in the development of the Nike missile. (Courtesy illustration)

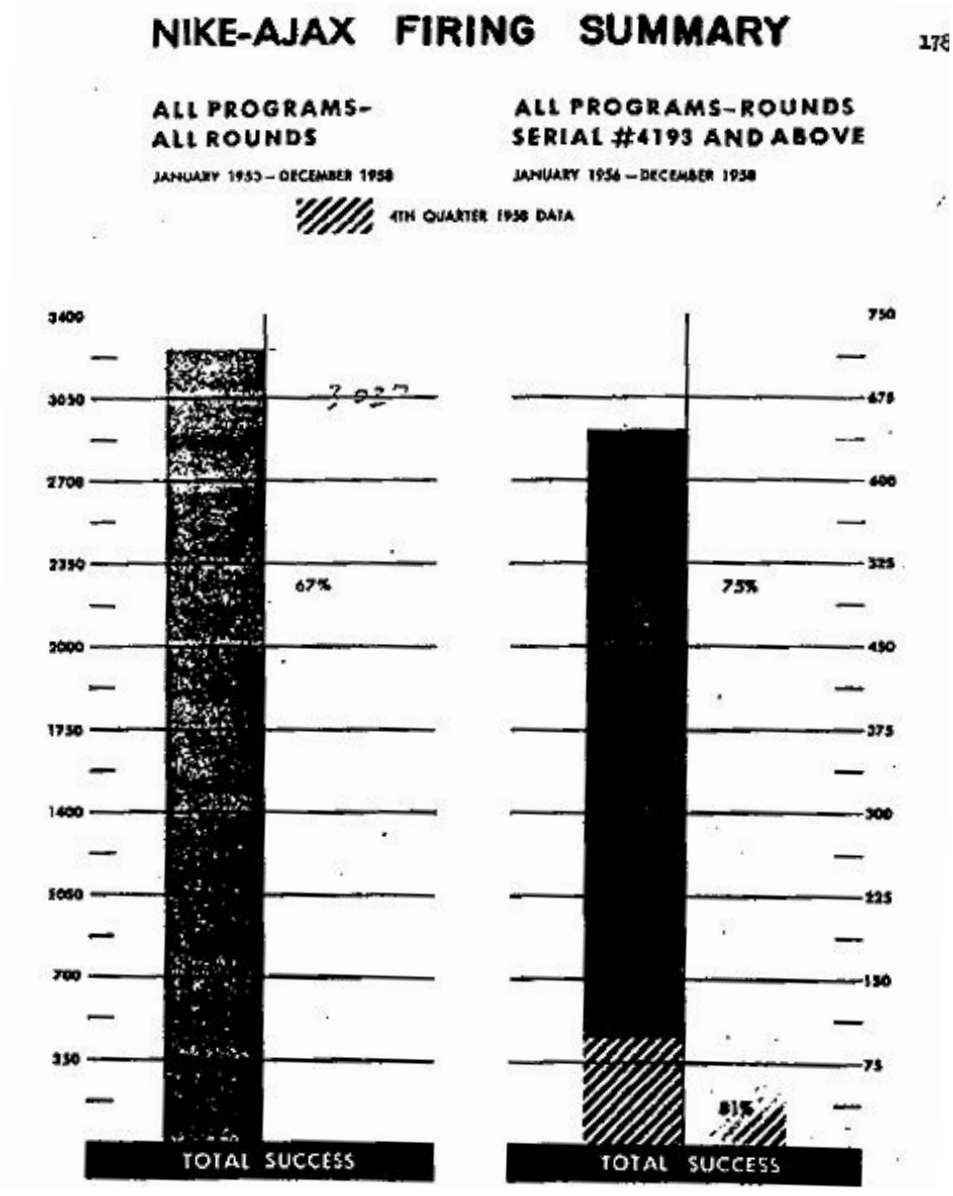
6. Be compact enough to fit into a van.[22]

The 1940s were a time of great stratification in the computing world between newfangled electronic computers and more reliable, but primitive mechanical analog computers. The compactness criteria completely eliminated any contemporary electronic computer, as 1946 cutting-edge digital tech resided in the behemoth Electronic Numerical Integrator and Computer (ENIAC). Yes, the ENIAC could calculate a ballistic trajectory in 30 seconds that took 20 hours for a mathematician, but it also was the size of a small house, weighed 30 tons, contained 20,000 vacuum tubes that needed to be replaced constantly, and consumed

19 *Ibid.*
20 *Ibid.*
21 *Ibid.*
22 *"Nike Computer," Nike Missile, February 3, 2018, accessed March 01, 2018, http://www.ed-thelen.org/computer.html.*



The components of the Nike missile system. (Courtesy illustration)



Nike missile firing summary. (Courtsy illustration)

130 kilowatts of electricity.[23] Fortunately for the budding Nike program, the basic math involved in aiming a missile at a bomber is not much different than aiming a gun. Bell subcontracted Western Electric Company to find a solution. Gun-laying mechanical devices were plentiful after the end of World War II and Western Electric simply borrowed some obsolete Mark 33 Gun Fire Control Systems from the U.S. Navy.

The analog Mk 33 computer was able to calculate firing solutions for targets moving at up to 320 knots (the max speed of the Tu-4 was 301 knots), and paired with a strong enough sensor was more than sufficient to determine PIP, PFT and proper intercept azimuth to the missile before launch.[24] It was also more reliable than an electronic vacuum tube computer, as it performed mathematical operation by voltage.[25] The modified Nike Mk 33s were initially put together in Whippany, N.J., and shipped to White Sands in early 1951 to be tested with its associated radar equipment.[26] Since this was a time before phased array radars, three separate radar systems were required to provide data to the fire control computer. These were the 250 kilowatt X-band Target Tracking Radar (TTR), 1000 kilowatt S-band radar for target detection and 250 kilowatt X-band Missile Tracking Radar (MTR).[27] All distance and elevation were measured from the TTR, regardless of the physical locations of the other two radars. Since the Nike was a static defense system, the locations of the TRR and MTR relative to the TTR were entered into the fire control computer and nulled during calculations.[28] During pre-launch, the TTR and TRR would send the initial PIP and estimated time of flight to the fire control plotting boards. The predicted intercept azimuth was sent via radio signal to the gyro in the selected missile.[29] A human operator then needed to make the optimal decision as to when to launch according to target closing speed and pre-calculated charts. Upon launch, the computer sent steering commands to the missile via the missile tracking radar to guide the mis-

23 *"ENIAC," The Free Dictionary, accessed March 01, 2018, http://encyclopedia2.thefreedictionary.com/ENIAC. Interested parties can see parts of an ENIAC at the Field Artillery Museum in Fort Sill, OK.*

24 *"Nike Computer."*

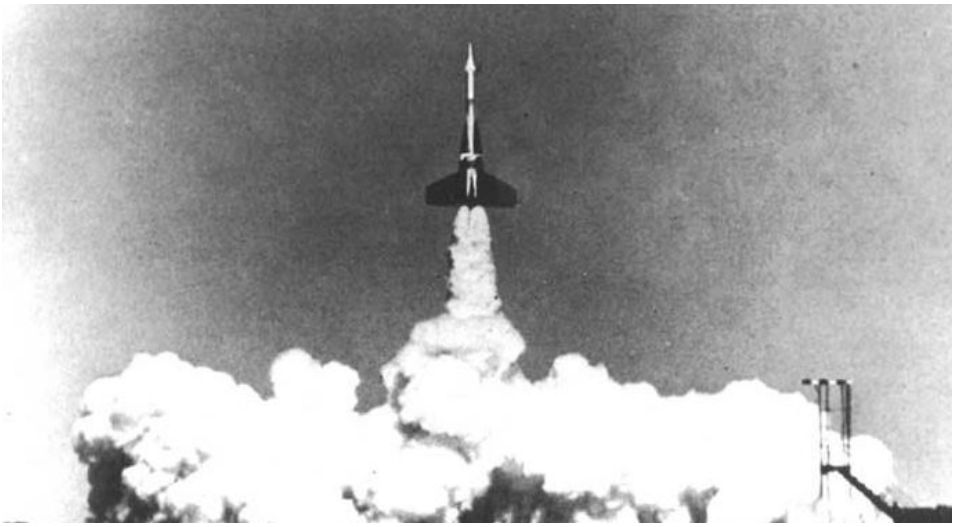
25 *On a mechanical voltage computer, positive integers are represented by positive voltages and negative integers are represented by negative voltages. So the analog computer does not subtract 20 km from 45 km to obtain 25 km but instead subtracts 4 volts from 9 volts to obtain 5 volts. This is displayed on a voltmeter. The operator reads this in accordance with an arbitrarily specified scale (i.e. 1 volt equals 5 km).*

26 *Cagle.*

27 *Ibid.*

28 *"Nike Computer."*

29 *Cagle.*



A Nike missile is launched using the Jet-Assisted Take-Off booster system. (Courtesy illustration)

sile using gimbals and fins to the continuously updated PIP. The final missile burst command was sent through the missile tracking radar automatically before estimated impact, which was pretty high-tech for the time (most comparable weapons were detonated via proximity fuse).[30]

The component development and proof test phase of the Nike project was scheduled to end with Round 65 in July 1951, and demonstration of the complete system (tentatively named Nike-I) was to begin with the firing of Round 66 in October 1951.[31] Several control circuit modifications were completed and successfully tested with Round 66 on Oct. 16, 1951.[32] This was the first flight of the Nike-I, and the official birth of the Nike family of missiles. The first firing (Round 69) of a Nike-I at an airborne target took place at White Sands on Nov. 27, 1951. The missile burst (a small, smoky explosive charge was used to simulate full detonation) 57 feet away from the remote-control QB-17 flying 33,000 feet high and 12 miles away.[33] This was the first successful engagement of a target by an anti-aircraft guided missile system. Rounds 90 (April 10, 1952) and 92 (April 24, 1952) were fired with live warheads against more QB-17s in front of a grandstand of high-ranking Army, Navy and Air Force personnel, including the incoming Army Anti-Aircraft Command commander, Lt. Gen. John T. Lewis. The results were spectacular.

As Ms. Cagle clinically records in the official records of the project, "The crews would have been wiped out (with the possible exception of the tail gunners). Fuel fires were set. Holes were bored through the propellers and the structures first weakened by fragments were deformed by blast and gust. To a considerable extent, the wreckage was molten and dispersed ... it was the general consensus of opinion that the time and expense involved were eminently justified."[34]

The Nike was operational.

Problem Three: Interservice politics

The defense of the U.S. homeland was entrusted in 1907 to the Coastal Artillery, the heavy defensive cousin to the Field Artillery and predecessor to the Air Defense Artillery. Despite public claims to the contrary, the Coastal Artillery was not trained to fight against the German Empire, which at the end of the World War I didn't have an army, let alone a navy. The needs of the interwar period directed the Coastal Artillery to defend against the two greatest threats to American security: the Imperial Japanese Navy in the Pacific and the British Royal Navy in the Atlantic.[35] World War II reduced the IJN to scrap metal and the Royal Navy to an underfunded shell of its former self. By 1945, the U.S. Navy was the undisputed master of the seas. The threat to the homeland now came in the form of jet aircraft and nuclear weapons, threats that required new weapons and new doctrines to counter. Nike was the first true air defense artillery weapons system, necessitating by its complexity and deployment the abolition of Coastal Artillery and the creation of an entirely new branch of the U.S. Army. While the Army Ordinance Board and Bell were busily building the Nike, other elements within the War Department set their sights on an even more ambitious air defense system. Three and a half months after the Nike Project was started, the Army Ground Forces Equipment Review Board (also known as the Cook Board after its chairman Maj. Gen. Gilbert R. Cook) submitted a report on recommended equipment for the postwar Army on June 20, 1945. Particularly worthy of note was a section advising that, "high velocity guided missiles, preferably capable of intercepting and destroying aircraft flying at speeds up to 1,000 miles per hour at altitudes up to 60,000 feet or destroying missiles of the V-2 type, should be developed at earliest practicable date."[36]

On May 29, 1946, the War Department's Joint Committee on New Weapons and Equipment (also known as the Stilwell Board after the chairman Gen. Joseph "Vinegar Joe" Stilwell) published their report on a "Proposed National Program for Guided Missiles," noting that missiles with "intercontinental ranges of over 3,000 miles and payload sufficient to carry atomic explosive are to be expected."[37]

They suggested that air defense should be "accorded priority over all other National Defense projects" and that the system be capable of supersonic speeds and 100,000 yards (91 kilometers) range.[38] These initial specifications were folded into the Army Air Corps Project Thumper and Wizard in 1946, completely separate from the Ordinance Board's Project Nike. But the Air Corps was not satisfied with merely long-range air defense.[39] In 1946, the AAC sent

30 *Ibid. The missile was also programmed to automatically explode if it did not recieve steering commands for two seconds.*
31 *"Nike Computer."*
32 *Cagle.*
33 *Ibid. The QB-17 was a good test subject for the Soviet Tu-4, which had been reverse-engineered from interned B-29s landing in the USSR after bombing raids over Japan.*
34 *Cagle.*
35 *Codenamed by the Joint Army and Navy Board's Rainbow Plans as War Plan Orange (Japan) and War Plan Red (Britain). War Plan Red caused quite a stir north of the border when it was declassified in 1974 due to its extremely detailed plan for the invasion and subsequent annexation of Canada.*
36 *Barry Leonard, History of Strategic Air and Ballistic Missile Defense, vol. I (Washington, D.C.: Center of Military History, U.S. Army, 2009), 217.*
37 *James Walker, Lewis Bernstein, and Sharon Lang, Seize the High Ground: The Army in Space and Missile Defense (Redstone Arsenal, AL: Historical Office, USASMDC, 2003), 20.*
38 *Ibid, 21.*
39 *Leonard, 38.*

a proposal to the War Department which urged integration of all air defense into the Army Air Corps. The Army Ground Forces reacted with a tersely written circular titled "Security from Enemy Action," which insisted that defense against air attack was a ground force responsibility.[40] This war within the War Department smoldered until it came to a head with the creation of a separate United States Air Force on Sept. 18, 1947. The War Department was forced to divide up roles between the Army, Navy and the Air Force in a series of compromises that became known as the Key West Agreements. As the various flag officers wrangled over details throughout March 1948, there was especially fierce debate over the future of surface-to-surface and surface-to-air (SAM) weapons. The Air Force argued that it should be placed in command of all anti-air forces, including anti-aircraft artillery, as they would be operating in concert with the Air Force's fighters in the defense role and able to better identify friendly aircraft.[41]

"This is contrary to the best principles of organization," the Army replied in a tersely worded memo to the Simpson Board, because that would "in effect, constitute an admission that every Service must be completely self-contained."[42]

When the Key West Agreement crossed President Truman's desk in April 1947 for his signature, Projects Thumper (anti-bomber) and Wizard (the "beyond state-of-the-art" anti-missile system) were assigned to the Air Force. The Army retained only one SAM project, Nike, as this had originally been part of the Army Ordnance Department, not the Army Air Force.[43] Air Material Command estimated in 1947 that it would be five-to-ten years before the necessary long-range radars, highly accurate guidance systems and long-range radar seekers could be developed for Thumper and Wizard. In the process, considerable overlap began to form between weapons systems. Thumper was canceled in 1949 after several fiery accidents and the money re-directed into Boeing's oddly named Ground-to-Air Pilotless Aircraft (GAPA[44]). Despite its name, GAPA looked suspiciously similar to a Nike-I, had very similar range, and had worse performance. By 1949, the newly-renamed Department of Defense caught on to the Air Force's game and said that it was a colossal waste of taxpayer money for both the Army and the Air Force to be building systems that were so similar as to be identical. That was the end of GAPA. Not to be dissuaded, the Air Force redirected the money and Boeing support into Michigan Aeronautical Research Center's (MARC) Wizard, which was impressively pitched (on paper) to be able to intercept missiles traveling at up to 6,400 kilometers per hour at altitudes up to 150 kilometers.[45] This combination of Boeing and MARC resulted in Project Wizard being renamed BOMARC in 1950. In the meantime, Nike-I had been christened Ajax[46] and put under an initial order in August 1952 for thousands of missiles and 60 launch defense sites.[47] By the 1950s, all three services were developing anti-aircraft missiles of various ranges and capabilities. Big budget missile development was great for the bottom line, but redundancy was anathema to the Eisenhower Administration trying to cut costs during the post-Korean War drawdown.

It was left up to Ike's Secretary of Defense Charles Erwin Wilson to divide the pie. On Nov. 26, 1956, Wilson ordered that the Army would be in control of "point defense" systems, and that the Air Force would be responsible for "area defense" systems. This had always unofficially been the case. The Army's weapons had generally been placed around their targets simply due to performance limits, but Wilson specified these to mean 200 miles (320 kilometers) range in the surface-to-surface role, while surface-to-air systems would be limited to 100 miles (160 kilometers).[48]

The Air Force's BOMARC missile project didn't fare well, with a majority of the 25 test launches taking place by 1956 being failures ranging from simple to catastrophic. By this point the Army had begun early production of the improved Nike Hercules missile, which offered supersonic speeds, 30 kilometers intercept altitude, 121 kilometers range, and (because this was the 1950s) an optional nuclear warhead. Although BOMARC's possible range was greater than Nike Hercules, the DoD deemed the mission of protecting cities from Russian strategic bombers was adequately served, and the Army was firmly in charge of tactical air-defense missile systems, a situation that has continued unchanged until the present day.

Capt. Peter Mitchell is an air defense battery commander at Fort Sill, Okla. The views expressed in this article are those of the author and do not reflect the official policy or position of the U.S. Army, Department of Defense, or the U.S. Government.

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40 Walker, Bernstein, and Lang, 201.

41 Leonard, 16.

42 Ibid.

43 Ibid, 20.

44 At the time the Air Force officially considered missiles to be unmanned aircraft, in order to lend the appearance that all missiles were 'Air Force Property' and that the Army had no business being around them. The BOMARC was named the F-99 (a fighter plane designation) until 1962 when the DOD forced them to rename it the CIM-10 in accordance with standardized joint nomenclature.

45 Richard McMullen, "History of Air Defense Weapons 1946-1962," ADC Historical Study 14 (January 25, 1980): accessed March 5, 2018, https://web.archive.org/web/20140106215227/http://www.northcom.mil/Portals/28/ Documents/FOIA/History%20of%20Air%20Defense%20Weapons%2C%201946-1962.pdf.

46 In keeping with the Greek mythology theme of Nike, the systems were named Ajax, Hercules, and Zeus. This author believes that Ajax was picked over his better-known Iliadic counterpart Achilles due to implications of critical weakness.

47 Walker, Bernstein, and Lang, 24. Total Nike Ajax production was 350 launch systems and 13,714 missiles.

48 Douglas Larsen, "New Battle Looms over Army's Newest Missile," Sarasota Journal, August 1, 1957, https://news.google.com/newspapers?nid=1798&dat=19570801&id=DuIiAAAAIBAJ&sjid=x4oEAAAAIBAJ&pg=7135,197246.

US Army ADA active duty and National Guard Units

Active US Army ADA Units

Anderson Air Force Base, Guam

Task Force Talon

Fort Bliss, Texas

32nd AAMDC

11th ADA BDE
1st BN, 43rd ADA
2nd BN, 43rd ADA
3rd BN, 43rd ADA
5th BN, 52nd ADA

Fort Bragg, N.C.

108th ADA BDE
3rd BN, 4th ADA
1st BN, 7th ADA

Fort Campbell, Ky.

2nd BN, 44th ADA

Fort Hood, Texas

69th ADA BDE
4th BN, 5th ADA
1st BN, 44th ADA
1st BN, 62nd ADA

Fort Leavenworth, Kan.

MCTP, 32nd AAMDC

Fort Sill, Okla.

5th BN, 5th ADA

30th ADA BDE
2nd BN, 6th ADA
3rd BN, 6th ADA

31st ADA BDE
3rd BN, 2nd ADA
4th BN, 3rd ADA

Joint Base Pearl Harbor-Hickam, Hawaii

94th AAMDC

Kadena Air Base, Japan

1st BN, 1st ADA

Kaiserslautern, Germany

10th AAMDC
5th BN, 7th ADA

Kyogamisaki, Japan

14th MDB

Osan Air Base, South Korea

35th ADA BDE
2nd BN, 1st ADA
6th BN, 52nd ADA

Shariki, Japan

10th MDB

National Guard ADA Units

Alaska

49th Missile Defense BN

Colorado

100th Missile Defense BDE

Florida

164th ADA BDE
1st BN, 265th ADA
3rd BN, 265th ADA

Mississippi

1st BN, 204th ADA

North Dakota

1st BN, 188th ADA

Ohio

174th AD BDE
1st BN, 174th ADA
2nd BN, 174th ADA

South Carolina

263rd AAMDC
2nd BN, 263rd ADA

678th ADA BDE
1st BN, 178th FA

Washington, D.C.

NCR-IADS HQ


Fort Leavenworth, Kan.
Fort Bragg, N.C.
Fort Bliss, Texas
Fort Campbell, Ky.
Fort Sill, Okla.
Fort Hood, Texas
Joint Base Pearl Harbor-Hickam
Anderson Air Force Base
Kaiserslautern
Shariki
Kyogamisaki
Osan Air Base
Kadena Air Base

Ambush on Route 9

Capt. V.J. Tedesco decorates Soldiers of C Battery, 1st Battalion, 44th Artillery. Spec. 4 Joseph Belardo, wearing his Purple Heart, is second from right. (Courtesy photo)

Originally printed in the ADA Magazine March-April 1996 issue.

On Jan. 24, 1968, when North Vietnamese Army regiments ambushed a U.S. convoy on National Route 9 in Quang Tri Province, the northernmost province of South Vietnam, three air defense artillerymen earned Silver Stars. The desperate action on Route 9 is noteworthy not because it was unique, but because it was typical of the daring and determination routinely displayed from the demilitarized zone (DMZ) to the Mekong Delta by the "First to Fire" branch's automatic weapons crews. The Duster, quad .50 and searchlight battalions that served in Vietnam never engaged a single enemy aircraft, but they nevertheless revived the fighting spirit of air defense artillery, a spirit that had been buried for more than a decade in the concrete of Nike Hercules sites around the world.

Three automatic weapons battalions (1st Battalion, 44th Artillery; 4th Battalion, 60th Artillery; and 5th Battalion, 2nd Artillery) served in Vietnam. With a personnel strength, counting attachments, of approximately 1,000, the automatic weapons battalion was one of the larger battalions in Vietnam. Each battalion had a battalion headquarters, four Duster batteries, an attached quad .50 battery and an attached searchlight battery. Each Duster battery had a battery headquarters and two firing platoons. The machine gun batteries had a battery headquarters and six machine-gun sections, while the searchlight batteries consisted of a battery headquarters and three searchlight platoons.

The Duster was one of the oldest weapons in the Army inventory. Its ancestor was the M-19, which had turreted dual Bofors L-60 guns on a modified T-24 chassis. This was the "Flak Wagon" of the Korean War. The M-42 Duster, which had more power and more efficient sights, also had twin 40 mm Bofors guns, but was mounted on a modified T -41 chassis. Some 2,625 Dusters were produced and reached the Army inventory by 1954. A modified version of the Duster, called the M-42A 1, had a fuel-injected engine. This was the Duster that saw action in the jungles and rice paddies of Southeast Asia.

With its high silhouette, open turret and bulky configuration, the Duster wasn't sleek or impressive-looking, but the infantry and cavalry recognized a good anti-personnel weapon when they saw one, and they liked what they saw. They put the Dusters to work as point security for convoys, assigned them the most likely avenues of approach to cover on perimeter defense and used them to conduct recons by fire. The Duster gunners, thus, added their firepower to the tremendous volume of fire American units expended in Vietnam. The noncommissioned officers and enlisted Soldiers on the Dusters seldom saw their battery headquarters or an air defense of-

ficer. They were orphaned out to mechanized infantry or armored cavalry outfits scattered the length and breadth of South Vietnam. They provided convoy escorts on the "Street Without Joy," circled the wagons with combat engineers in places like the Ia Drang Valley, conducted recons by fire for infantry heading into the Michelin Rubber Plantation and served with the 101st Airborne Division (Airmobile) and the Third Marine Division in Northern I Corps.

Convoy duty was dangerous and nerve-racking. During World War II and the Korean War, U.S. convoys operated behind frontlines with virtual impunity. Things were different in Vietnam: There were no front lines and Viet Cong or NVA ambushes were a constant threat along most supply routes. Ambushes posed a serious logistics problem since truck traffic provided most of the supplies for inland installations and combat bases. Military Assistant Command Vietnam assigned routes red, amber or green classifications, with red representing the most hazardous.

Normally, the lead Duster, at or near the front of the convoy, covered the left side of the road while the rear track, at or near the end of the convoy, covered the right side. Truck-mounted quad .50s were positioned near the middle of the convoy. Dusters caught in an ambush pulled off the road, traversed their guns and provided covering fire. The convoy's other vehicles, with the quad .50s blazing away in the center, accelerated to escape the kill zone. The tactic was effective, but it meant Duster crews spent eternities in the kill zone.

Sometimes, ambushes threatened to overwhelm even the combined firepower of the Dusters and quad .50s. When this happened, a reaction force would roll to the rescue out of a nearby base camp or fire base, as one did the day in 1968 that the NVA ambushed the convoy on Route 9.

In 1968, Quang Tri, along with Thua Thien and the Quang Nam, Quang Tin and Quang Ngai provinces, made up Northern I Corps. The region, which stretched southward from the DMZ past Hue, Da Nang and Chu Lai, was later renamed Military Region One. Most of the civilian population in the region was squeezed onto a narrow coastal plain that lay between the towering mastiffs of the Chaine Annamitique to the west and the South China Sea to the east. The mountains, cloaked in triple-canopy jungle, were shrouded during the northwesterly monsoon with dark, menacing avalanches of clouds that could "sock in" mountain fire bases for weeks at a time. Ridges pushing eastward out of the mountain range to the sea dissected portions of the coastal plain into mountainringed valleys. The close proximity to the DMZ to the north and Laos to the west made it easy for the North Vietnamese to infiltrate entire regiments, and North Vietnamese artillery dug into the hills just north of the DMZ outranged American 105 mm and 155 mm howitzers. The five provinces at the tip of South Vietnam, which encompassed Hue, the A Shau Valley, Hamburger Hill, The Rockpile, Mutter's Ridge and Khe Sahn, accounted for more than 55 percent of America's Vietnam casualties.

In January, the northern provinces, caught in the grip of the northwestern monsoon, were cold, wet and windy. Duster and quad .50 crewmen assigned convoy or reaction force duty along Route 9 wrapped themselves in ponchos to ward off the chill. Route 9 originated at Dong Ha on Highway 1 adjacent to the South China Sea. Roughly paralleling the DMZ, it wound its way west through battle-scarred mountains past Cam Lo and Camp J.J. Carroll, which everyone called, simply, Camp Carroll, to the besieged Marine combat base at Khe Sanh.

At 1140 hours on Jan. 24, 1968, a two-and-a-half-ton truck traveling from Camp Carroll to Cam Lo along Route 9 received small-arms fire. An Army vehicle following the truck received mortar fire as well as small-arms fire. The occupants of both vehicles, upon reaching Cam Lo, warned a convoy pulling out of Cam Lo for Camp Carroll that Route 9 had been interdicted, but the Marine captain in charge of the convoy disregarded the warning. The NVA regulars hidden in the hills overlooking Route 9 ambushed the convoy as it approached a bridge across a minor tributary of the Mieu Giang River with small arms, automatic weapons, recoilless rifles, rocket-propelled grenades (RPGs) and mortars. The convoy halted and the troops, shocked by the intensity of incoming fire, took cover along the road.

The C Battery, 1st Battalion, 44th Artillery (Automatic Weapons) (Self-Propelled), observation post (OP) at nearby Camp Carroll, the 4th Marine Regiment's combat base, observed large numbers of enemy moving along the river and ridge lines north of the ambush site. The anti-aircraft artillerymen manning the OP were unaware that an ambush was taking place, but could see NVA infantry crossing the Mieu Giang River in boats and the flash and smoke of firing. The OP requested permission to fire on the enemy and the request was granted by the 4th Marines. At 1145 hours, five Dusters located along the camp's northern perimeter opened up, expending about 8,000 40 mm rounds in 15 minutes. An aerial observer reported excellent target coverage and three secondary explosions.

At 1315 hours, the 4th Marines organized a reaction force of one Marine platoon supported by two M-48 tanks and two of C Battery's Dusters commanded by 1st Lt. Steve Hardin. At 1330, the relief column stopped 100 meters from the ambush site to direct fire against enemy positions on the ridges. The Duster crewmen could see American wounded and dead lying in the kill zone, but there were no NVA in evidence. One tank and one Duster proceeded into the kill zone to extract the wounded. As they neared the ambush site, NVA infantrymen armed with RPGs suddenly popped out of concealed positions. A volley of RPGs quickly put both vehicles out of action. Two anti-aircraft artillerymen aboard the Duster were seriously wounded and four received minor wounds. Hardin, riding on the disabled Duster, called Camp Carroll for assistance.

The remaining Duster, commanded by section chief Sgt. Chester Sines, and the other M-48, a flame-thrower tank, took up a position on a small hill overlooking the convoy, Hardin's destroyed Duster and the disabled M-48 tank. Sines' Duster immediately opened fire on the RPG teams dug in along the road. The handful of Marines that had been riding on the tops of the Duster and M-48 dismounted, dug in and covered the west and south slopes of the hill. At 1345 hours, Sines requested reinforcements from Camp Carroll. The base camp advised: "Hold position. Recover men, casualties and equipment from ambush. Return to Carroll."

Sines' Duster proceeded slowly toward the entrapped convoy. The NVA opened fire on the advancing Duster as it neared the ambush site with RPGs, recoilless rifles and mortars. Supported by the M-48's machine gun and flame thrower, Sines' Duster momentarily held its ground, raking enemy positions with its 40 mm guns, and then moved to within 50 meters of the convoy. Unable to disperse the concentrated NVA RPG teams, Sines decided to withdraw to the hilltop and regroup. At 1415 hours, Sines' driver, Spec. 4 Joseph Belardo, radioed Camp Carroll that ammunition was down to 60 40 mm rounds. They would not

Route 9 ran through the center of "Leatherneck Square," a rough rectangle formed by Marine combat bases. (Courtesy photo)

abandon the convoy, said Belardo, but expected to be overrun. "Awaiting reply," he signed off.

Conserving its 40 mm ammunition, the Duster continued to spray the area with its M-60. The crew called in artillery fire and directed air strikes on the NVA positions.

Camp Carroll radioed that a resupply truck, driven by Spec. 4 Robert Williams, was on the way. The truck, said Carroll, was carrying infantrymen as well as ammunition.

Fearing the ammo truck would run into the NVA, Belardo proceeded alone down the west slope of the hill, hoping to intercept the truck before it reached the kill zone. Firing his M- 16 rifle and throwing grenades into enemy positions, Belardo made his way to Route 9. After a short wait, he realized the truck wouldn't be arriving. It had run into a second ambush sprung between Camp Carroll and the ambush site. Williams was among the few who weren't wounded. Returning to the Duster, Belardo saw the situation atop the hill had grown more desperate. The Duster crew radioed the base camp that they were almost completely out of ammunition.

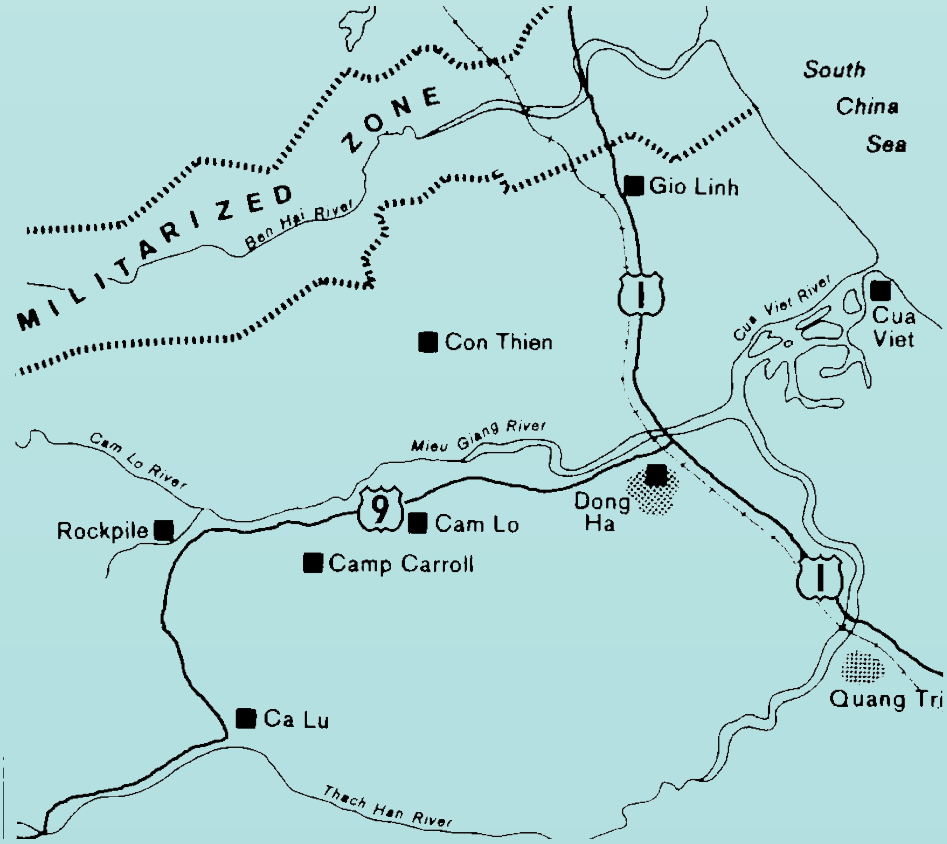
Camp Carroll dispatched a second ammunition truck with Marine Cpl. Roger Blentlinger's weapons team aboard. Belardo again descended the hill to intercept the second ammunition truck. Reaching Route 9, he engaged and dispatched one of the enemy in hand-to-hand combat. Hastily moving west on Route 9, Belardo waved down the second ammo truck and directed it to the waiting Duster.

Resupplied with ammunition, Sines directed fire at NVA soldiers who had now crossed the river and were moving in his direction and toward Camp Carroll. Sines estimated that hundreds of NVA had taken up positions along the eastern and western slopes of the hills north of Route 9. The Duster crew had fired about 2,200 40 mm rounds, along with small arms and M-60 machine gun fire, and the M-48 tank had continually raked enemy positions with its machine gun. NVA bodies lay everywhere. Sines estimated that more than 250 NVA had been killed in action.

Sines now directed the Duster to once again move toward the ambushed convoy. As they approached, two 40 mm rounds unexpectedly jammed in the breech. The crew worked frantically, but was unable to clear the jam. With the Duster's 40 mm guns suddenly silenced, emboldened NVA RPG teams scored a hit, wounding Belardo and squad leader Sgt. Sam Lewis. Simultaneously, the jammed 40 mm rounds exploded in the breech, wounding Pvt. Dave Lewis and wounding Belardo for a second time.

Sines advised Camp Carroll of the Duster's condition and received orders to return to the base camp. The Soldiers and Marines placed the wounded inside the Duster and M-48. With the Marines lying on the decks of the Duster and M-48, they departed the hilltop at 1700 hours. Sines drove the Duster with Belardo at the M-60 and Blentlinger throwing grenades. With the ammo truck in the middle and the M-48 bringing up the rear, they blasted their way through enemy positions and slowly returned to Camp Carroll. Later that evening, they medevaced the wounded to Dong Ha and Da Nang.

Capt. V. J. Tedesco, the 1-44th Artillery liaison officer, was in the officer's club at Dong Ha drinking a cold beer when word came that C Battery was in deep contact on Route 9 and needed bailing out. At 5 feet 7 inches, Tedesco was about the same height as Audie Murphy, the legendary but diminutive combat infantryman who parlayed fame as World War II's most decorated Soldier and baby-faced good looks into a movie career. But that's where the physical similarity ended. The burly, cigar-smoking anti-aircraft artilleryman looked more like a miniature version of the middle linebackers that his alma mater, Penn State, was famous for producing than a matinee idol. His contemporaries called him "Vinnie," and he was to endure "short jokes" made at his expense throughout his career, even at the end when he wore a full colonel's insignia and commanded a brigade, with gruff good humor. Perhaps the Silver Star he was to earn that afternoon made the good-natured hazing easier to bear.



An operational map of the area containing Route 9. (Courtesy illustration)

As liaison officer, it wasn't Tedesco's job to take out the Dong Ha reaction force, but the reaction force commander couldn't be located. At 1730 hours Tedesco led two Dusters and two truck-mounted quad .50s to the rescue. The following morning, he described the action in a tape made for his wife Suzanne.

"I don't know where to start to tell you, Suzanne, about what happened yesterday, well last night, to be exact," Tedesco said. "I guess I'll start from the beginning. I was over in the club around a quarter-to-five when we got word that C Battery was in contact with the enemy on Route 9 between Cam Lo and Camp Carroll. They had gone to try to relieve a convoy that had been ambushed on that road, and they were in deep contact. They needed help and Rick Taylor wasn't around. He is the reaction force commander. I'm the alternate commander. Rick wasn't around, so it was my job to take the reaction force in there and try to bail C Battery out.

"We left Dong Ha about 5:30, or 1730, and it took us a half hour to get out to the ambush site," he continued. "I had with me two Dusters and two quads. I was in the lead Duster, the quads were in the middle, and there was one Duster in back. When we approached the ambush site, I saw a tank off to the side of the road. Apparently knocked out of action, it was abandoned. Later, I found dead lying on the front deck of the tank. There were four trucks and a jeep in the convoy, lined up straight down the middle of the road. Every one of them knocked out. The jeep had been knocked out by an RPG, which is similar to our bazooka or 3.5 rocket launcher. The people from the convoy were hiding against the vehicles and against the sides of the road; not doing anything very much but looking very horrible and scared and frightened. I saw, farther up the road and across a little bridge, C Battery's track off to the side of the road. The guns pointed crazily up at the sky, the hatch in front was open and nobody was visible around the track. I took my track and we drove past the tank and pulled off the side of the road and proceeded toward C Battery's track to find out what the story was with them and to give them any support we could.

"As we started moving along the road," Tedesco continued, "we had to pull way off the road into the bushes because there were so many wounded all along the side of the road. They were dragging wounded out from in front of our track as we rolled. I noticed a man lying right under us, and before I could stop the driver, we rolled right over him. He's dead now. I know he's dead. I just hope he was dead before we rolled over him. We caught him right below the buttocks and right across the legs. I don't know if that was enough to kill him or not. He was dead when we did finally get out of the area. We moved back on the road and across the bridge, and I moved my track off the road to my right and saw where the fire was coming from. We were receiving sniper fire, and the Air Force was putting air strikes into the area."

Tedesco directed the track commander, Staff Sgt. Vincent DeSantis, to return the fire raking the column. DeSantis had been assigned to a Hawk missile battery at Cam Ranh Bay, a relatively safe job. Hoping to get closer to the action, he kept putting in paperwork for a transfer without success. Finally he met a sergeant who worked in personnel assignments and, a couple of weeks later, found himself on a Duster in Northern I Corps. "The crew," he said, "taught me everything I needed to know. I learned on the gun." With DeSantis directing fire and loading the guns, the Duster delivered effective fire against the automatic weapons, recoilless rifle and mortar positions in the surrounding hills.

Tedesco left the track and ran across the road to C Battery's track, looking for the officer or NCO in charge, hoping to find out what had happened. He found Harding and discovered three of Hardin's five-man crew had been wounded when RPGs had slammed into the track. Sgt. Gilbert in the turret had had both arms blown away by the first RPG. The gunner, Pvt. Solomon, had been wounded by the second RPG. The explosion had ripped the muscles, tendons and flesh from the back of his legs. Then the track has taken two more RPG hits in quick succession. Marines who had been riding on Hardin's track were also wounded. Nearby, a Marine lieutenant, who could not speak because his lower jaw had been shot away, was calmly writing down grid coordinates on a piece of paper. He passed the piece of paper to his radio operator, who called in the fire mission.

Running in a low crouch across the road, Tedesco re-crossed the bridge and made his way past the main body of the convoy, past the knocked-out tank to where he had left the two Bravo Battery quad .50s and rear Duster. He directed their fire on the hills on either side of the road, at the same place the infantrymen were placing their fire and where the sniper fire was coming from. Satisfied the rounds were on target, he moved

back down the line, trying to find the officer in command of the convoy.

"There were two officers, a Marine captain and an Army lieutenant present," Tedesco said. "All they could do was hide up against the track. There were wounded all over the place. Suzanne, it was horrible. People dead and wounded all over the place. There was a warrant wounded and in a very complete state of shock. It was almost impossible to get them to move off the road, set up some security and try to get the convoy functioning. Anyway, when I saw that these two officers weren't very willing or capable of taking command, I took command of the entire convoy. And my first problem was trying to get the wounded out. We got on the horn and notified Carroll what the situation was, the fact that we needed infantry security and needed aircraft in to evacuate the wounded."

While Tedesco was busy trying to reorganize the convoy, the NVA concentrated their fire on B Battery's lead Duster. Seriously wounded in the back, DeSantis refused medical aid and continued to direct his crew's fire and load the guns. Then, an RPG struck the rear of the turret, killing a cannoneer and wounding the rest of the crew. Wounded a second time, DeSantis continued to refuse medical aid and, with bullets showering all around him, began evacuating the casualties from the stricken vehicle.

"I moved back down the road across the bridge and headed to my track to try to find out what was going on," said Tedesco, "and I noticed that my track — the track I had come in on — was not firing," he continued. "As I crossed the bridge someone called to me from the bushes on the bank of the little stream the bridge goes over. And it was the sergeant [DeSantis] who had been aboard the track. He had taken a small arm sniper round in his back and fragments in his arm. Two of the other three people who had been in the tub with the sergeant were both wounded and in the bushes with him. We didn't know where the fourth man who had been up in the tub was at the time. We later found out later that he [Spec. 4 Billy Strickland] had been killed.

"The sergeant told me that they had been hit," Tedesco continued. "I ran around to the front of the track to try to get to the radio to let them know we had lost another track, and I saw a horrible, horrible sight. The driver, the man who had driven me in there, had apparently been sitting with his head out of the hatch when an RPG or an aerial bomb, I'm not sure which one it was, landed near the track, and it just blew shrapnel and debris all over his face and shoulders and neck. I thought the man was dead. As of now, he's still alive. He's still in critical condition but they think he might pull through now. The radio was out of action, everything was covered with blood. I moved across the road back to Hardin's track again, trying to get medical aid for the guy in the track, in case he was still alive, and for the sergeant and his people.

"Meanwhile, all of this time I ran across more and more wounded, more and more dead and more and more scattered groups of infantrymen; trying to organize them, trying to move them," he continued. "We had a medevac chopper come in, and we started taking small arms all over the place. I ran over to the chopper and got him out of the area before he got downed right in the middle of our area, so we'd never get anything in or out. This went on and on and on, Suzanne, just on and on and on. I kept moving up and down the convoy, kept calling for the infantry. I kept calling for the artillery. As it started getting darker, I kept calling for illumination."

The illumination rounds, bursting high overhead, released parachute flares that bathed the terrain in an eerie orange glow. Tedesco knew the NVA might use the cover of darkness to move in for the kill.

"Finally," he continued," I decided we were going to load all the wounded on the two quads and on the tracks and make a run for it. Well, we had gotten one of the quads loaded with wounded when two Seabee trucks came in to help us on their own, and we got the dead and some more wounded loaded on those two trucks. They headed out under the protection of the quads with wounded on it, and then, all of a sudden, the choppers started coming in. The choppers started landing all around us, taking out the wounded.

"Now that the wounded were going," Tedesco said, "my main concern was my two tracks that were out of action. I moved back across the bridge. There were at least 50 civilians in the area. We had fired over their heads to keep them down. We weren't sure whether they were VC or what they were doing. We had a Marine sergeant covering them the whole time with a machine gun. We finally got some trucks in and got the wounded moving out on the trucks, and then the helicopters came in and we kept evacuating. We started pulling back toward the main convoy, evacuating all the wounded with us, picking up all the weapons. I left Lt. Gregg, one of the officers from B Battery, in charge there, and he saw to it that the wounded were medevaced.

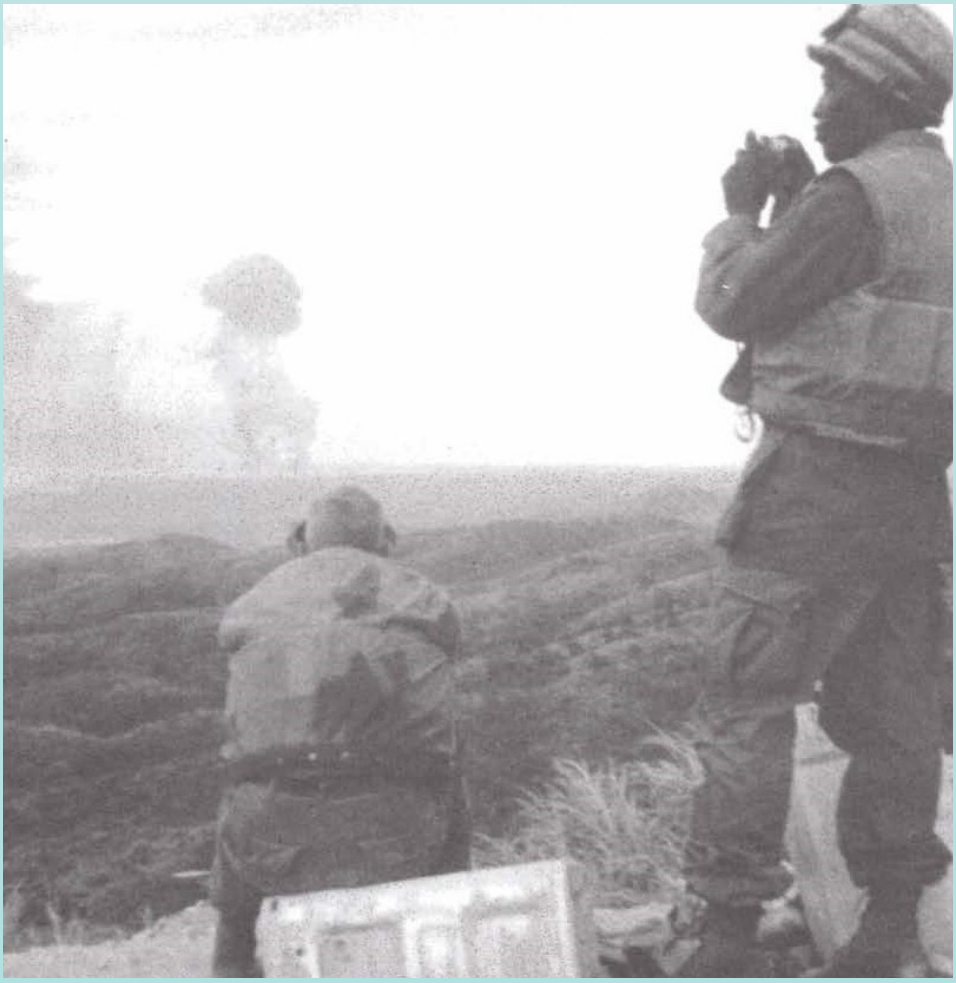
"Hardin and I returned with a bunch of Marines to secure our Dusters," he continued. "This was my main concern now. What were we going to do with the Dusters? I didn't want to leave them to the enemy. I requested permission to destroy the Dusters, and this permission was denied by battalion. They said the relief column was on their way."

A third reaction force commanded by Capt. Charlie Vickers, the 1-44th Artillery S-4, roared out of Dong Ha. The reaction force consisted of 1-44th personnel acting as infantry, two Dusters from A/1-44th and two quad .50s from G/1-44th, and four ammunition-laden five-ton trucks from Headquarters and 1-44th 's Headquarters Battery. They reached the ambush site at 1900 hours.

"Well, about 7 o'clock, or 1900, it was getting pretty dark, and I was just about to say to hell with battalion and blow them [the Dusters] anyway, when I saw the headlights of the relief column," Tedesco said. "Charlie Vickers had come in with the relief column. Once Charlie got there with his extra force and his people, things cleared up pretty quickly. We got the rest of the wounded out and as many of the dead as we could get out. Steve Hardin started my original track and found it could run, and he drove that out. Charlie brought one of his tracks across the bridge and hooked the C Battery track (Hardin's original track) up with the tow cable, and we towed that out, with Charlie covering my withdrawal with one of his tracks that was still operational. And finally at 0930, or 7:30, we left the ambush site.

"We moved out to Cam Lo at the district headquarters there," Tedesco said. "There we left the vehicles that weren't operative, and with the help of the Huey gunships we came the rest of the way back into Dong Ha. We got back to Dong Ha about 10 o'clock, or 2200 hours. It was a very, very horrible — unbelievably horrible — experience. I don't guess I will ever forget the sight of that guy's body going underneath the track or the look on the face of that poor kid that was driving me after I got back to the track and found that they had been hit. I didn't sleep very much ... in fact, I didn't sleep at all last night!"

The 3rd Battalion, 4th Marines Regiment, moved in to secure the ambush site,



C Battery's observation post reported large numbers of North Vietnamese Army regulars moving along this ridgeline above the ambush site. (Courtesy illustration)

standing watch through the night over the dead and disabled vehicles. Following the ambush, the survivors discovered that they had gone up against elements of the NVA's 320th Division's 48th and 52nd Regiment. Total friendly casualties were seven killed in action, 42 wounded seriously enough to require medical evacuation and 13 with minor wounds. First-44th Artillery had committed 11 Dusters, five quad .50s and 152 Soldiers. They had fired 11,628 40 mm rounds and 28,000 .50-caliber rounds.

After the battle, someone — not the Duster crewmen — placed an NVA skull atop a mile marker adjacent to the ambush site, then added a helmet and a poncho. The macabre scarecrow stood along Route 9, symbolizing the savagery of combat in Northern I Corps. Weeks later, the NVA dead were buried in a mass grave on the west side of the stream north of Route 9.

Tedesco, Hardin and DeSantis were awarded Silver Stars for their part in the action. C Battery initiated paperwork to decorate Sines' crew. They had been told to expect, at a minimum, Silver Stars, and were disappointed to receive only Purple Hearts. The paperwork, they were told, had been fouled up. Their first-person narrative accounts of the action had not been rewritten, as required, in third person. The paperwork, they were promised, would be rewritten and resubmitted, but nothing ever came of it, except that Pvt. 1st Class Earl Holt, the driver on Sine's track, received an Army Commendation Medal with a "V" device. Tedesco became C Battery's commander in time to pin on the Purple Hearts.

The 1st Battalion, 44th Artillery, was the first automatic weapons battalion to reach Vietnam, arriving in November 1966. It was to become one of the most decorated artillery units in history. Upon its arrival, the battalion was assigned to support the 3rd Marine Division in Northern I Corps. First-44th established its headquarters at Dong Ha Combat Base near the junction of National Highway 1·and Route 9, approximately 10 miles south of the DMZ. The battalion's fire units were deployed from Phu Bai in the south to Giolinh and Conthien in the north and Khe Sanh in the west. The battalion participated in Operation Pegasus, which broke the siege of Khe Sanh. C Battery led the Pegasus task force into Khe Sanh on April 15, 1968. First-44th was awarded the Presidential Unit Citation and the Valorous Unit Citation for its defense of Quang Tri during the Tet Offensive of 1968. The battalion became part of XXIV Corps Artillery and moved to Da Nang in 1970. It took part in Operation Lam Son 719, 720 and 810. The battalion came under control of the Da Nang Support Command just prior to its departure from Vietnam in 1971.

After Vietnam, the Army mothballed the quad .50s and searchlights and turned the Dusters over to the Army National Guard in the early 1970s. The last National Guard Duster-crewman graduated from the U.S. Army Training Center at Fort Bliss, Texas, in October 1988.

"You're part of history, there will be no more after you," Lt. Col. Daniel Ruiz, a training battalion commander told them. The last Duster firing took place in 1993 when the South Carolina guardsmen conducted their last annual service practice with Duster.

The automatic weapons battalions and the air defense artillerymen who served on them won't be forgotten by the field artillerymen who watched a quad .50 stop a sapper attack in the wire, by the cavalry platoon leader who rallied his platoon while Vulcans stood off an enemy ambush or by the infantrymen who embraced the Duster leader who broke through to the infantry position early one morning.

The automatic weapons battalions fired more than four million rounds of Duster ammunition and more than 10 million rounds of quad .50 ammunition. They participated in every major American campaign during the conflict in Southeast Asia. Some reached the outskirts of Phnom Penh.

Each battalion won either a Presidential or Meritorious Unit Citation. The Soldiers who served in them won more than 450 medals for valor and earned more than 1,000 Purple Hearts.

But they were never able to stop the flow of communist replacements down the Ho Chi Minh Trail, make front page news as often as the peace demonstrators, convince people back home that Vietnam might be worth the price they paid, or make South Vietnam over in the image of America.

Attention to orders!

The President of the United States of America, authorized by Act of Congress, July 8, 1918 (amended by act of July 25, 1963), takes pleasure in presenting the **Silver Star** to **Sergeant Robert H. Lauver** (ASN: RA-13894587), United States Army, for gallantry in connection with military operations against an opposing armed force in the Republic of Vietnam. Lauver distinguished himself by exceptionally valorous actions on Jan. 31, 1968, as the squad leader of a multiple machine gun mount of **Battery G, 65th Artillery Regiment, 108th Artillery Group,** during a combat operation with two Marine companies in the city of Hue. When a Marine tank was hit by a rocket, Lauver ran through intense enemy sniper and automatic weapons fire to pull the seriously wounded driver to safety. He then returned to his gun and personally directed its fire, eliminating several enemy machine gun positions. After his squad fought its way to the Perfume River, Lauver deployed his weapon on the south bank to support the Marines as they crossed a bridge. As the lead elements reached the north bank, they were pinned down by a massive wall of enemy fire. Realizing that they needed immediate heavy fire support, Lauver led his squad across the bridge, delivering a devastating volume of accurate fire which destroyed most of the primary enemy positions. Through wounded in the leg by fragments of an enemy grenade which exploded nearby, he refused medical aid and assisted medics in the evacuation of the dead and the treatment of the wounded. Lauver's gallantry in action was in keeping with the highest traditions of the military service and reflects great credit upon himself, his unit, and the United States Army.

General Orders: Headquarters, U.S. Army, Vietnam, General Orders No. 3710 (Aug. 1, 1968)

Attention to orders!

The President of the United States of America, in the name of Congress, takes pride in presenting the Medal of Honor (Posthumously) to **Sergeant Mitchell William Stout**, United States Army, for conspicuous gallantry and intrepidity at the risk of his life above and beyond the call of duty while serving with **Battery C, 1st Battalion (Automatic Weapons) (Self Propelled), 44th Artillery Regiment, 108th Artillery Group,** in action against enemy aggressor forces in the Republic of Vietnam, on March 12, 1970. Stout distinguished himself during an attack by a North Vietnamese Army Sapper company on his unit's firing position at Khe Gio Bridge. Stout was in a bunker with members of a searchlight crew when the position came under heavy enemy mortar fire and ground attack. When the intensity of the mortar attack subsided, an enemy grenade was thrown into the bunker. Displaying great courage, Stout ran to the grenade, picked it up, and started out of the bunker. As he reached the door, the grenade exploded. By holding the grenade close to his body and shielding its blast, he protected his fellow Soldiers in the bunker from further injury or death. Stout's conspicuous gallantry and intrepidity in action, at the cost of his own life, are in keeping with the highest traditions of the military service and reflect great credit upon him, his unit and the United States Army.

General Orders: Department of the Army, General Orders No. 42 (Sept. 12, 1974)

Attention to orders!

The President of the United States of America, authorized by Act of Congress, July 8, 1918 (amended by act of July 25, 1963), takes pleasure in presenting the **Silver Star** to **Captain (Artillery) Vincent J. Tedesco, Jr.** (ASN: OF-101185), United States Army, for gallantry in action while engaged in military operations involving conflict with an armed hostile force, while serving with the **1st Battalion (Automatic Weapons) (Self Propelled), 44th Artillery Regiment, 108th Artillery Group,** in the Republic of Vietnam. Tedesco distinguished himself by exceptionally valorous actions on Jan. 24, 1968, as commander of a Battalion Reaction Force dispatched to relieve an ambushed convoy near Camp J. J. Carroll. When he arrived at the scene of the battle, Tedesco found that the savage enemy fire had inflicted many casualties on the convoy's troops, including all the officers. Immediately taking charge of the situation, he moved throughout the ambush site, heedless of withering hostile fire, and organized the remaining men into a highly effective fighting force. Shouting words of encouragement, Tedesco directed devastating machine gun and cannon fire on the enemy positions. He then helped administer first aid to the casualties and quickly organized a detail to move the more seriously wounded away from the ambush area. As the enemy fusillade intensified, Tedesco returned to the midst of the raging battle and continued to inspire his troops' fierce fighting. His fearless and determined leadership in the face of a numerically superior hostile force enabled his men to overcome the enemy's heavy fire, break contact and extract the ambushed convoy. Tedesco's gallantry in action was in keeping with the highest traditions of the military service and reflects great credit upon himself, his unit, and the United States Army.

General Orders: Headquarters, U.S. Army, Vietnam, General Orders No. 2132 (May 8, 1968)

A Patriot Weapon System stands ready near Camp Doha, Kuwait, Oct. 26, 1994. (U.S. National Archives)

The story of Patriot

By Maj. Paul Weeks

This article was published in the Air Defense Artillery Yearbook 1993.

During Operation Desert Storm, as the nation proudly followed the accomplishments of our men and women in arms, a special, albeit small, number of those folks smiled with deep satisfaction at the achievements of the world's first anti-tactical missile (ATM) defense system - Patriot. That group watched intently as Patriot showed its supporters and detractors alike that when you couple our industry's top technical "know-how" with the foresight of the military's materiel development community, you can put a highly sophisticated weapon system in the hands of Soldiers. When these Soldiers are well-trained and motivated, the Army then has all the ingredients that spell SUCCESS. The engagements in Southwest Asia were likened to a bullet hitting a bullet, with the combined velocities reaching several kilometers per second; where computer decisions must be made with split-second accuracy; and where skilled operators quickly learned that doctrine and tactics are not cast in stone, but must remain flexible to adjust to the moment. As those many hundreds of military and civilian people beamed with pride, a few looked back and felt some-

what vindicated ... the system, the process, worked. The trials of those early years in development were all worthwhile.

Patriot's ATM capability was not achieved overnight. The intricate development process began with bona-fide requirements from the combat developer or user and proceeded through a technical phase that demonstrated that what was being proposed to meet those requirements was in fact possible. It was followed by a test and evaluation phase that provided the user with an analysis of how adequately the proposed systems or upgrades met those requirements. Then, years later, it was married up with Soldiers who, equipped with the tools to effectively use the new capability (i.e. doctrine and tactics, field manuals, etc.), became the well-trained warriors of Operations Desert Shield and Storm. Without a doubt many similarities exist between those experiences of the early years of the Patriot Advanced Capability (PAC) program (simply named PAC-1 and PAC-2) and what we must now go through when we look ahead to achieving the required operational requirements of the more advanced Patriot Advanced Capability program called PAC-3. The similarities include justifying the need (What is the threat?), working a solution (What does it take to defeat this threat? What are the missions?), testing the technical theories (What confidence level can we give the Soldier that this will work? How well does it meet the requirements?) And, finally, putting a program together that is feasible in the near-term, all the while having to defeat barriers erected by nay-sayers. The differences between the old and the new PAC programs, aside from the obvious (advances in the threat and changes in mission), generally center around the environment within which the programs are pursued. Today this environment consists of world political realities, national priorities and the budget!

The "bible" of the operational requirements behind Patriot's initial development was published in 1972 as the MN(ED), or Material Need (Engineering Development) document. It remains today the foundation of Patriot's requirements. It is the basis for the follow-on 1989 ATM required operational capability document and 1992 PAC-3 operational requirements document (ORD). The MN(ED) authors initially saw a need for Patriot to be able to protect itself against long-range free rocket over ground (FROG) missiles. However, the requirement was dropped when experts determined that the accuracy of the FROGS was such that the threat to Patriot was minimal. Patriot development continued concentrating on countering the air-breathing threat (ABT), its primary mission being defined in the scope of countering large numbers of ABB in Central Europe. This NATO mission for Patriot was to be one of attrition while deployed in the "belt" defense forward along the inner German border, and point defense of high value assets in the rear. What happened to cause this shift in focus? In 1976, when initial production for Patriot was approved, the Soviets stood up and took notice.

The continued success of the Patriot program, demonstrating a formidable ABT capability, resulted in the Soviets' realization that their original estimates of relatively insignificant aircraft losses in a Central European scenario were no longer valid. Patriot's deployment meant these losses would increase dramatically, resulting in unacceptable attack force ratios. Word came through intelligence sources that the Soviets were working hard to significantly improve the short-range tactical ballistic missile accuracy against high value assets - Patriot being on or near the top of the list. The deployment of the more accurate SS-21, SS-23 and follow-on SS-23 missiles in the late 1970s and early 1980s would result in more effective counter-Patriot operations.

A "skull session" one Saturday morning in the spring of 1983, pre-sided over by Brig. Gen. Max Bunyard, Patriot project manager (PM), with his replacement, Brig. Gen. Donald Infante, tackled the questions, "What could Patriot do to combat this growing ballistic missile threat?" and "How quickly could it be done?"

The outcome of this session was the PAC-1 and PAC-2 programs. PAC-1 consisted of a software-only modification that provided Patriot with a limited self-defense capability against one class of tactical ballistic missiles (TBMs). This was followed by PAC-2, an upgrade whose centerpiece was a new missile warhead and an upgraded dual fuse with appropriate software changes to improve Patriot's accuracy through interceptor trajectory shaping. PAC-2 brought about an improved self-defense capability while offering collateral defense to vital assets within Patriot's footprint. In addition, Patriot performed these missions against an expanded target set that included the treaty-compliant short-range threat TBMs.

The new Patriot warhead would have to defeat ABl3 and the threat's high explosive TBM warhead. As the size of the PAC-2 warhead was to remain relatively the same as the original Patriot standard munition, the improvements focused on the size of the fragments and the velocity and spray pattern needed for a high lethality kill. Light (helium) gas gun tests (propelling a fragment at the target) and arena tests (exploding a scaled-down device to measure fragment velocity, energy and spray pattern) helped the developer choose the warhead. Methodical engineering and testing convinced the Patriot Project Office that PAC-2 would do the job. But the Patriot ATM program detractors were picking up steam, resulting in the contracting of independent analysts to check on the PPO's work. Initially, these independents were unanimous in their condemnation of the program. The entire program came close to being canceled. However, in 1987, the ATM Panel, another independent group working out of the prestigious Johns Hopkins University Applied Physics Laboratory, concluded that PAC-2 would work. This key evaluation and the PPO's "above-board" approach to sharing available data convinced the Army to move ahead with procurement of the PAC-2 capability in January 1988.

Not long after this the Patriot PM, Col. Bruce Garnett, made an innovative program decision that was directly responsible for Patriot's success in Desert Storm and its subsequent key role in the revitalization of Strategic Defense Initiative (SDI) Global Protection Against Limited Strikes (GPALS) programs. Realizing that the first unit equipped with the PAC-2 missile was scheduled to occur at least six months after the deployment of its enabling software package (post deployment [software] build, or PDBI-3), Garnett pushed Raytheon to compress the missile production ramp-up schedule, accelerating the full capability deployment date to January 1991. As a result, when Operation Desert Shield began, vendor material was already in the pipeline, making possible the acceleration of the assembly process. The rest is history: Patriot defeated Iraq's Scuds using the best missile available.

While Patriot's success in the Gulf War transpired more than two years ago, its legacy remains: the process works. Identify the problem, determine what is required to meet the needs, put together a program and task the best to bring it to reality. But today the environment surrounding this new effort has changed significantly: the Cold War is over, the defense budget and

the size of the armed forces are shrinking, and the tenor of the threat has changed. No longer are we to defeat, with greatly superior technology, a numerically advantaged force. We are now faced with the prospect of coming up against despots who will rely increasingly on alternative means to gain political objectives. As Lt. Gen. Donald Lionetti, commanding general, U.S. Army Space and Strategic Defense Command, frequently points out, "The missile genie is out of the bottle."

Saddam Hussein demonstrated the relative ease of converting a relatively unsophisticated weapon into an instrument of geopolitical purpose. Within this contract, a world apart from the original PAC program, the PAC-3 requirements were born and upgrade programs defined. The process has begun anew with the PAC-3 program.

The need

First, establish the operational need. The PAC-3 operational requirements were developed by an exceptional team of Air Defense Artillery School professionals supported by knowledgeable air defense experts, some of whom participated in the writing of the original MN(ED). Under the guidance of (then) Brig. Gen. John H. Little, a special working group, headed by Cols. Men Hasbrouck and Jeffrey Ellis, considered the primary ORD drivers as the increased capabilities of the "new" threat, Patriot's new missions in support of air defense artillery's contribution to the evolving Air Land Operations doctrine, and finally, but perhaps most importantly, the lessons learned from Desert Storm.

The threat

The threat's technological advances have affected Patriot's missions to defeat both TBM and ABT targets. Through dedicated efforts by all concerned, all the capability possible was squeezed out of the hardware and software package that is today's Patriot. It was this system that did combat against the Desert Storm Iraqi-modified Scuds. But Patriot PAC-2 was and is at the edge of its performance envelope. The fielding of Quick Response Program upgrade will greatly improve Patriot's capability against modified Scuds. But the threat is not standing still either. Today, exports of longer range (and therefore higher velocity) TBMs continue, and their use in any future conflict is almost assured. World interest in cruise missiles and stealthy air-frames is growing thanks to the U.N. coalition forces' demonstrated success of these weapons. The new PAC-3 requirements recognize the changes in this threat: lower radar cross section targets, travel at greater velocities (TBMs) and lower altitudes (cruise missiles), unconventional warheads in the presence of debris or penetration aids (TBMs) and sophisticated jamming environments (ABTS). The requirements reflect the philosophy that Patriot must expand its protective ATM footprint in both dimensions while buying back the ABT capability required by previous documents but now reduced by threat advancements.

The mission

Patriot's Desert Shield and Storm deployment signaled a shift in the weapon system's mission requirements. It would not be deployed just to protect the commander's vital assets. Patriot would be called upon to defend what is now referred to as theater-strategic geopolitical assets (such as cities). Recent redeployments to Southwest Asia illustrate Patriot's attractiveness as a purely defensive system to demonstrate the United States' resolve and support of its allies. This mission drives the requirement to expand the TBM defensive footprint — protecting larger and more numerous vital assets from longer range TBMs and engaging them farther out and higher up to better protect those assets from the effects of more deadly unconventional weapons.

Lessons learned

Extensive debriefings of all Desert Storm Patriot and Hawk crews played the major role in highlighting lessons learned, the solutions to which must be incorporated in the Patriot upgrade program. In addition to highlighting the need to protect assets within a larger area, the defense planner must have the flexibility to tailor the brigade's or battalion's response to the anticipated threat, a response that may even have to be implemented in near real time to adjust to battlefield realities. A Patriot battery arriving in theater without an information and coordination central (ICC) must be given a better capability to integrate into the theater air defense architecture. The amount of strategic airlift requiring overcommitted C-5As must be reduced and the launcher reload times improved. Patriot needs an embedded data recording and organic analysis capability that will assist in post-mission after action reviews and in identifying possible improvements and will facilitate realistic training. Communications must be improved to aid in Patriot's interoperability, especially over longer distances. These are just a sampling of what the Soldiers told us Patriot needed.

At the heart of all these requirements are three stark realities. First, Patriot's Weapons Control Computer (WCC) must be expanded. The new enhanced WCC, together with optical disks to replace current data storage devices, will be applied in 1995. Patriot must then take the next step and unleash itself from the track via missile constraints on its firepower response. The answer: a missile with an active seeker, not requiring the radar's illumination waveform. Two missiles are currently being considered. Each one represents a different design approach: Raytheon Company's Multi-mode Missile (about the same size as Patriot PAC-2, with a substantial hit-to-kill zone, long range and an extended warhead proximity kill zone) and Loral-Vought's Extended Range Interceptor (much smaller than Patriot so there are more missiles per launcher, with shorter range, designed to hit-to-kill). Third, and the real key to the PAC-3 program, the radar's multifunction capability must be increased to enable Patriot to accomplish its additional missions against the more sophisticated threat. As the demands on the radar grow, especially in the area of more complex waveforms transmitted over larger surveillance sectors, its "radar time" budget must be increased to ensure all tasks are accomplished in the time required to protect its assets and survive. The proposed PAC-3 Phase III radar's dual traveling wave tube will provide a faster, more responsive radar capable of defeating the threat.

Other improvements in various stages of development include a PAC-2 missile upgrade (guidance enhanced missile) to improve effectiveness against the current TBM target set, software enhancements to improve survivability against an anti-radiation missile, and a relay node capable of supporting communications with a battery's launcher "farm" many kilometers away while enabling sharing of these farms between batteries. An improved communications processor will be the heart of the communications upgrades that include the incorporation of Joint Tactical Information Distribution System and mobile subscriber equipment into the battalion and battery. Improvements to the battalion tactical operations center (BTOC) will make it re-

A partially camouflaged M-109 launching station for the MIM-104 Patriot missile stands ready for use near Jubail, Saudi Arabai, during Operation Desert Shield, January 1, 1990. (U.S. National Archives)

sponsive to the automated defense design demands as well as the management of all battalion assets. In addition, plans are now being made to export portions of the BTOC capabilities down to the battery as an automated battery command post.

But what about the operational environment? How is Patriot going to fit into the theater air defense picture? Recognizing the synergy between the Army air defense systems and the U.S. Air Force, the future high-to-medium-altitude air defense systems' doctrine and tactics will focus on theater missile defense as well as the new ABT, the cruise missile against which our U.S. Air Force has little capability. Patriot will operate within a protective "enclave" of high value assets with Terminal High Altitude Area Defense (THAAD). Patriot, the baseline in defining theater tactical missile defense requirements, will be the lower tier in what is now referred to as a "near leak-proof" two-tier defense. With PAC-3 operational requirements taking Patriot to its cost-effective limits, THAAD, the upper tier, defends the enclave against the medium-range TBMs while maintaining a substantial overlap with the Patriot target set to achieve the requisite defense effectiveness. Interoperability between the two complementary systems will be achieved initially with improvements to the Patriot ICC and BTOC software, then through fielding of the air defense TOC. This future command and control node will be a hardware and software package that can be reconfigured to accomplish applicable force and engagement operations tasks (regardless of weapon system) at each echelon from brigade to battery.

In addition to PAC-2 upgrades, a new high- to medium-altitude common launcher, designed to accommodate future systems such as THAAD and Corps Surface-to-Air Missile as well as Patriot, is being considered. The new launcher will improve Patriot's transportability and mobility and allow it to fit aboard C-141 Starlifters. It also fits Oshkosh Truck Corporation's M-1704 palletized loading system truck, allowing automated loading while its all-wheel drive improves mobility.

These advances will permit the U.S. Army to enjoy unmatched air defense superiority into the next century. The pieces of the puzzle are falling into place just like they did in the late '70s: the threat has been defined, the operational need has been substantiated and the weapon systems are being developed to counter that threat. Refined operational concepts will produce new doctrine and tactics, and experts are determining training and support requirements. In 1995 and 1996, we will field the first set of Patriot upgrades (Configuration l) and testing Configuration 2, with its crucial PDB-4 software package. Next we will test and field the initial THAAD capability called THAAD User Operational Evaluation System. Right now, agencies throughout the ADA community are planning for these events. Lessons from the past have taught us that to be effective against tomorrow's threat, the process must begin today.

Maj. Paul Weeks, retired, was assigned to TSM- Global Protection Against Limited Strikes, U.S. Army Air Defense Artillery School, Fort Bliss, Texas.

Strategic rotation

Patriot's role in Persian Gulf War

By Lt Col. David E. Neely and Maj. Marc J. Romanych

One would have to have had his head buried in the sand not to be aware of Patriot's strategic and tactical roles in the Persian Gulf War. The saga of the accelerated production and rushed deployment of Patriot Advanced Capability (PAC) 2 missiles, the task force from 8th Battalion, 43rd Air Defense Artillery's left hook with VII Corps and the Scud launches into Israel and Saudi Arabia are well chronicled.

Almost forgotten in this high drama, however, is that less than three years ago, the men and women who manned air defense artillery's high- to medium-altitude air defense (HIMAD) systems were patronizingly referred to as "concrete Soldiers." This dubious title was, of course, bestowed upon them by their divisional combat arms counterparts who felt obligated to constantly remind them of the dirty nature of real Soldiering.

Granted, both Hawk and Patriot were designed to be mobile, and HIMAD units were occasionally evaluated on their ability to shoot, move and communicate. For the most part, however, the daily maintenance and training routines were conducted on fixed concrete sites. If the Gulf War itself didn't change this stereotype forever, then perhaps the little-publicized Patriot deployments since the war will.

Beginning in September 1991, after the majority of U.S. ground forces had been withdrawn from the Southwest Asian theater, Patriot units began a series of no-notice deployments and strategic rotations that could last well through 1996. At least three times, Patriot fire units and controlling headquarters from U.S. Army-Europe have literally deployed on a moment's notice while both Forces Command and U.S. Army-Europe units have been involved in continuous strategic rotations or reliefs-in-place. These deployments completely shattered the norms of yesteryear regarding HIMAD fixed-site operations.

From Jan. 19 through Feb. 5, 1992, the 10th Air Defense Artillery Brigade successfully deployed two battalions and a brigade headquarters from Germany to Saudi Arabia and conducted a predominantly personnel-only relief-in-place of the 94th Air Defense Artillery Brigade which had, without advance notice, deployed both personnel and equipment in September 1991. For the next five months, 2nd Battalion, 43rd Air Defense Artillery, 10th ADA Brigade, provided tactical ballistic missile

A MIM-104 Patriot anti-aircraft missile is fired during a 6th Training Brigade exercise. (Courtesy photo)

"The Gulf War was a limited objective war. If it had not been, we would be ruling Baghdad today - at unpardonable expense in terms of money, lives lost and ruined regional relationships. The Gulf War was also a limited means war - we did not use every means at our disposal to eject the Iraqi Anny from Kuwait. But we did use overwhelming force quickly and decisively. This, I believe, is why some have characterized that war as an "all-out" war. It was strictly speaking no such thing."

- Gen. Colin Powell, former Chairman, U.S. Joint Chiefs of Staff

coverage for the Dhahran area while 4th Battalion, 43rd Air Defense Artillery, 10th ADA Brigade, provided coverage around the capital city of Riyadh. The brigade's successful deployment and mission assumption were possible mostly because of thorough pre-deployment planning. This article details how 4-43rd ADA planned for this strategic rotation with a view toward providing a general construct for the way other units might deal with similar mission requirements.

Four-43rd ADA received notification of deployment in early October 1991, with mission assumption scheduled for early February 1992. With approximately 120 days to plan, prepare and execute the deployment, the battalion had sufficient time to develop and execute a detailed deployment plan. The planning process used to prepare for the mission was simple and followed established doctrine. With one notable exception, to be discussed shortly, the deployment was to the strategic level of war what a deliberate attack is to the tactical level of war.

Initially, the battalion continued to operate and train according to its approved quarterly training plan while the staff began its analysis of the new mission. Realizing that the 94th ADA Brigade had already developed the tactical plan and support base to a reasonably mature level, the 10th ADA Brigade was free to concentrate its efforts on the administrative and logistical aspects of deployment, Soldier and crew training, and perhaps most importantly, planning and building a rear detachment that could sustain itself and support the deployed battalion. Unlike no-notice deployments where much of the mission analysis must be devoted to the future area of operations, a planned strategic rotation allows a more balanced focus on the administrative, logistical and operational requirements of the unit's forward deployed and rear garrison elements.

While the battalion executive officer developed the battalion deployment plan and designed the rear detachment, the battalion operations officer (S-3) concentrated their efforts on the new area of operations and the selection of the advance party. As the battalion staff began to collectively refine mission requirements, future training plans (i.e., for the next training quarter) were modified to focus on those tasks that supported preparing the battalion for the new theater of operations and executing the deployment. As always, even though the mission was well understood, the staff had to plan with imperfect and incomplete information and, therefore, modify its estimate of the situation as changes occurred.

By early December 1991, approximately 60 days after notification and 60 days before mission assumption, the staff finalized the battalion deployment plan. Then a small quartering party, under the leadership of the S-3, made a site visit to the 94th ADA Brigade's area of operation to conduct a terrain walk, finalize the rotation timeline and coordinate the mechanics of the battle handover. During the 30 days prior to deployment, the battalion concentrated on preparing Soldiers for the rotation (personal readiness, weapons qualification, nuclear, biological and chemical proficiency), finalizing the composition of the rear detachment, structuring family support groups, taking inventory, and transferring modified table of organization and equipment (MTOE) and installation property to rear detachment representatives for administrative storage.

The battalion's deployment commenced with the departure of a large advance party comprised of the S-3; senior representatives from the S-1, S-2, S-4, signal officer and electronic missile maintenance officer sections; and battery and direct support maintenance company commanders with their supply sergeants and all primary hand receipt holders. Upon arrival in Saudi Arabia via a combination of military and chartered aircraft, the advance party members paired up with their counterparts from the outgoing battalions. Approximately one week was allotted to inventory and transfer all property before the battalion's main body arrived. To speed the equipment transfer process, inventorying was conducted between hand receipt holders and supervised by battery and company commanders who only inventoried major equipment end items. Component inventories were conducted by the primary hand receipt holders.

The battalion main body maintained battery and company integrity as it departed Germany over approximately eight days. As 4-43rd ADA's main body arrived in Saudi Arabia over the next three days, advance party representatives processed Soldiers in and oriented them on equipment and battle positions.

The incoming and outgoing batteries conducted a battle handover on the fourth day the battalion main body was in country. The handover was complete once a

"Although Western export controls have slowed the spread of crucial technologies, a second generation of far more capable TBNs is on the verge of deployment in over a dozen countries. Situated in the volatile Middle East and North Africa region, some of these TBMs would have the ability to reach major European cities … This increase in offensive capability is in turn placing heavy demands on current and next generation air defense systems."

- Clifford Beal, International Defense Review

manning crew from each firing battery and the fire distribution section passed a system validation on their site's equipment, and 4-43rd ADA became responsible for the air defense mission on the applicable site.

Although many of the planning considerations for 4-43rd ADA's strategic rotation were the same as those for a no-notice deployment, the planned rotation had certain differences that warrant further explanation.

Tactical versus administrative/ logistics planning

Because the mission and its execution parameters were already well defined by the 94th ADA Brigade, tactical planning was narrowed to training the battalion for the new mission and executing the air movement from Germany to Saudi Arabia. Thus, the battalion staff concentrated primarily on administrative and logistics matters.

Identifying and preparing equipment for deployment

Although the brigade was directed to leave most of its MTOE property in theater, some Patriot end items and ancillary equipment accompanied 4-43rd ADA Soldiers on the rotation. Most noteworthy were weapons (individual and crew-served), NBC equipment, office computers, facsimile machines, secure telephones, photocopiers and communications security equipment, Patriot and doctrinal publications.

Personnel replacement system

During the battalion's rotation, new Soldiers continued to arrive at the rear detachment in Germany. A system had to be developed to receive, prepare and forward Soldiers to the battalion in Saudi Arabia. Newly assigned Soldiers were in-processed by the rear detachment and community, telephonically slotted by the forward deployed command sergeant major and S-1 and, if necessary, allotted time to settle their families. The Soldiers were then formed into small groups under the charge of a deploying non-commissioned officer. They were then systematically issued all Southwest Asia-peculiar clothing (desert camouflage) and equipment, certified on weapons and NBC qualifications, and finally deployed on either dedicated flights or routine "channel flights."

Property accountability, storage, security

Most of the battalion's MTOE property did not deploy. Property transfer from the deploying battery commanders to rear detachment hand receipt holders was conducted before the deployment. These inventories were essentially treated as change of command inventories. All property belonging to a given battery or company was hand receipted to one senior NCO who would remain until the unit returned. There were no sub-hand receipt holders because most of the rear detachments consisted of transient personnel (Soldiers who were changing station, leaving the service or undergoing chapter eliminations and arrivals ultimately programmed for rotation to Southwest Asia). After all the Patriot and most conventional equipment was inventoried, it was winterized and placed in administrative storage. Unit areas and facilities not used by the rear detachment were secured.

Class IX repair parts flow

The rear detachment had to continue the pickup of Class IX parts and other supplies that had been ordered prior to the battalion's departure. This meant leaving behind knowledgeable maintenance and supply personnel who could have been of great value to the main body in Southwest Asia. A storage area was designated where parts could be segregated and stored until after the rotation.

Advance party composition

Unlike the advance party for a no-notice deployment, which is frequently oriented toward battalion-level operations and staff coordination, the advance party for a strategic rotation is weighted toward unit-level logistics and property accountability. Each battalion staff section sent representatives to work and coordinate with the outgoing battalion staff. However, most of the per-

"I am also proposing as well new steps to thwart the proliferation of ballistic missiles ... Now we will seek to strengthen the principles of the Missile Technology Control Regime by transforming it from an agreement on technology transfer among just 23 nations to a set of rules that can command universal adherence.

We will also reform our own system of export controls in the United States to reflect the realities of the post-Cold War world ... As we work to keep the world's most destructive weapons out of conflicts, we must also strengthen the international community's ability to address those conflicts themselves."

- U.S. President Bill Clinton,
United Nations, September 1993

There is an artificial quality to the new report [the Clinton administration study of defense needs].The dangers to national security that it describes, and on which it is based, are necessarily more felt than sighted. Most people understand that it's a dangerous world, and that it would be wrong to disarm to the incautious extent the country did between World War I and World War II. But right now the threat has to be to some extent envisioned and projected. The report, with its talk of having to fight two possible major regional conflicts more or less at once - the scenario is that one breaks out on the Korean Peninsula Just as another Is breaking out In the Mideast - does this. Critics will pick at it and possibly even mock it, but now they won't be able to say just that the budget is bloated. They will have to say, this is the danger we are dismissing in the nation's name, this is the capability we propose to fore go - and sign their names. That's a harder step.

- Washington Post, Sept 3, 1993

sonnel assigned to the advance party were unit supply sergeants and NCOs designated to become hand receipt holders.

Rear detachment mission, composition

The rear detachment was to maintain and secure the battalion's property and facilities, conduct replacement operations and support the battalion during its deployment. To accomplish this, the rear detachment had to be carefully manned with a few quality officers, NCOs and Soldiers with the needed skills and retainability to execute the mission. This was a tough decision because the caliber of the required personnel was such that, under battle-ready circumstances, they would have been essential to the deploying battalion. Only the battalion rear detachment commander, a major, was provided from outside the battalion to provide some horsepower and a field grade Uniform Code of Military Justice authority for rear detachment personnel. All other rear detachment Soldiers came from the deploying batteries and were consolidated under one rear detachment battery commander, a captain.

Unit DODAACs

As stated earlier, although the battalion's Soldiers deployed, the majority of its equipment was left at the home station with open requisitions for repair parts. To maintain the equipment's readiness, the pre-deployment Department of Defense activity address codes (DODAACs) had to remain active with the rear detachment. Likewise, the DODAACs supporting the outgoing units in the new theater remained active in the theater and were carried over to the relieving battalion. This meant that DODAACs should remain with equipment sets, not with units during relief-inplace operations.

Personnel actions

Needless to say, the deployment did not put personnel actions on hold. Soldiers continued to be promoted, personnel actions were still submitted for consideration, Uniform Code of Military Justice authority was still administered in the theater of deployment and awards continued to be recommended and presented. Accordingly, we had to leave one or two strong personnel clerks with the rear detachment. Furthermore, the supporting personnel services company had to be fully apprised of the battalion's situation prior to the deployment and their active assistance in processing transactions was absolutely essential to the battalion's success. Mail delivery and handling procedures, along with finance support in both the rear detachment and the theater of deployment, also had to be coordinated. An especially critical and volatile personnel issue was an unequivocal statement of emergency leave policy. The policy had to be understood by every Soldier and family member prior to deployment and the chain of command had to repeatedly advertise that it would not consider exceptions that would open a Pandora's Box of raw emotions. This seemingly harsh and impersonal policy was absolutely key to strength preservation during the deployment. Personnel management is an extremely tough area to make sacrifices in when it comes to leaving quality personnel behind, but not doing so would mean months of playing catchup when we returned.

Obviously, the aforementioned considerations are neither all-inclusive nor exhaustive. For example, personnel readiness processing alone encompassed such matters as privately owned vehicle storage and personal property inventories and storage, not to mention the myriad other actions normally encountered in pre-deployment processing. However, major areas addressed in this article highlight where detailed planning is needed to preclude disaster. Four-43rd ADA's detailed plans for all of these areas easily consumed 200 to 250 pages, much of which may or may not be applicable to units that may engage in the same type of deployment in the future. As stated earlier, these areas are offered only as a construct for the development of detailed and tailored deployment checklists.

Perhaps the most significant challenge we are collectively confronted with is that institutionalization of these planning considerations will surely become an absolute requirement for all of us in the future, especially as our national military strategy evolves to one of predominantly force projection. Let there be no doubt that contingency planning is the wave of the future!

At the time this article was written:

Lt. Col. David E. Neely was the battalion commander, 4-43rd ADA.

Maj. Marc J. Romanych was the battalion S-3 until April 1993.

Attention to orders!

The President of the United States of America, authorized by Act of Congress July 9, 1918 (amended by an act of July 25, 1963), takes pleasure in presenting the **Silver Star** to **Captain (Air Defense Artillery) Charles Earnel Branson**, United States Army, for conspicuous gallantry and intrepidity in action in connection with military operations against a hostile force in Iraq in support of Operation Iraqi Freedom. Branson distinguished himself while serving as the commander of **Alpha Battery, 1st Battalion, 3rd Air Defense Artillery,** in direct support of the **First Brigade Combat Team of the 3rd Infantry Division (Mechanized)** during the Battle for Objective Jenkins from March 24 to 29, 2003. The First Brigade commander issued Branson a tactical mission order to secure a bridge in the vicinity of the village of Al Kifal to enable the brigade to continue its attack in Karbala. For this mission, in addition to his two Bradley Linebacker platoons, Branson received a tank platoon from 3-69th Armor as a reserve, a Combat Observation Lasing Team, and a Long-Range Acquisition System team. An air defense battery commander leading a Bradley and tank company team in an attack was unprecedented. Just after midnight on March 25, 2003, Branson's company team reached the service road leading to the bridge and immediately began receiving heavy rocket-propelled grenades and small arms and mortar fire from a hostile force well established in prepared defensive positions on the near side of the bridge. Branson pulled his forces back to a rally point and called in artillery fire to suppress the enemy fire. He rallied his forces and continued the attack, only to receive additional heavy fire. For the next eight hours, Branson maintained the momentum of the attack, calling for artillery Fires on three separate occasions and requesting the commitment of the reserve tank platoon, which arrived at 8 a.m. on the morning of March 25, 2003. In a last-ditch effort to halt Branson's unrelenting assault, the Iraqis attempted to blow the bridge. A portion of the bridge collapsed, but that did not stop the attack as Branson aggressively ordered his tanks to cross the weakened structure. This action turned the tide of the battle. Following additional fire and maneuver, Branson's force secured the bridgehead, but fierce fighting continued for the next 36 hours. Later that day, the remainder of Task Force 3-69th Armor was committed to the fight. On March 26, 2003, Task Force 2-69th Armor relieved Task Force 3-69th Armor to continue the lodgment expansion on the far side of the bridgehead. Branson and his company team were ultimately relieved on March 29, 2003. The enemy battle damage assessment for this operation included more than 200 enemy killed in action, 20 "technical" vehicles destroyed and the capture of numerous weapons caches. Branson's personal bravery, expert coordination of artillery fire and ground attack and exemplary devotion to duty were in keeping with the highest traditions of the military service and reflected great credit upon himself, the "Rock of the Marne" Division and the United States Army.

General Orders: Department of the Army, General Orders No. 42 (Sept. 12, 1974)

Nimble Titan promotes multi-national cooperation in missile defense

By Jason Cutshaw

The Nimble Titan logo. (Courtesy illustration)

Twenty-two participating nations, two observing nations and three international organizations convened March 11-16 to experiment collectively with policy and operational concepts with a shared objective to expand international relationships, develop regional layered defenses, and strengthen deterrence for participating nations and organizations.

The Nimble Titan 18 Conflict Event is the culmination of a two-year global integrated air and missile defense campaign of experimentation. In this event, participants respond to scenarios involving mock air and missile threats from notional countries 10 years in the future. Collectively, the multinational players produce concepts and solutions that can be used to influence real-world policy and military responses.

As Nimble Titan began, the leader of the Joint Functional Component Command for Integrated Missile Defense, or JFCC IMD, U.S. Strategic Command's lead proponent for missile defense, emphasized the importance of cooperation amongst the various nations and organizations.

"Make no mistake about it, we face some difficult challenges," said Lt. Gen. James H. Dickinson, JFCC IMD commander. "We share common adversaries that are growing their missile forces, in both capability and capacity. Many of these threats are transregional, with multidomain reach. These weapons pose a threat in each region of the globe. No one nation can keep pace to defeat all the current and emerging threats; our multilateral integration and cooperation are imperative."

USSTRATCOM is one of nine unified commands in the Department of Defense and is designated as the global coordinating authority for missile defense. In support of this mission, JFCC IMD, under the command of Dickinson, ensures available missile defense resources are used efficiently and effectively to support the Warfighter.

"As our missile defense capabilities increase, we are now able to see and engage beyond our geographic boundaries, but that is not enough," Dickinson said. "To deal with the evolving threat, we need to strengthen and exercise our allied and partner relationships. We must become more integrated, and develop interoperable, agile layered defenses.

"Nimble Titan is where that begins," he added. "What you do here directly impacts not only national policies; it also enables a future that encourages international cooperation from the senior levels all the way to the warfighters."

Nimble Titan has grown from six nations in 2008 to 24 nations and four international organizations from the Asia-Pacific, Europe, Middle East and North America regions currently. As participants became active during the wargame, they spoke of the virtues of working together to defend each other if the need arises.

"There are several important aspects to Nimble Titan," said Col. Adel Bin Sanqoor, United Arab Emirates national lead. "You get to look to the future and learn from other coalition partners and their experiences and challenges. Nimble Titan is the only event in the world that gets people together to expose them to multiple threats and experiment without any risks. Everyone is standing shoulder to shoulder with each other and learning how to be prepared for future threats."

Participants spoke about their role is as they worked together during the event. They also spoke of how Nimble Titan is beneficial to each nation and how they are focused not only on their own defense but also the safety of their neighbors.

"Nimble Titan is one of the experiments that brings together the higher leadership of nations who are not normally into the nuts and bolts of missile defense," said the Assistant Director of the Joint Air Power Competence Centre Madelein Spit. "The important thing with Nimble Titan is it is not the warfighters only who talk about missile defense, but it is the political leadership as well. The decisions that have to be taken before the war starts – those are the political ones, and this is an event where that comes out in the open for everyone to understand how to work together."

Stinger/MANPADS Knowledge Center

The Stinger/MANPADS Knowledge Center is a consolidated resource that provides you access to Doctrine, TMs, Crew Drills and tutorial videos. (C.A.C. card required)

Visit the ADA Multimedia Library on the Fires Knowledge Network:

https://go.usa.gov/xQQNr

ADA modernization team seeks 'quick wins' on goals

By Mitch Meador

Two of the six modernization priorities that Army Chief of Staff Gen. Mark A. Milley set forth last October directly affect Fort Sill and the Fires Center of Excellence.

No. 1 is long-range precision fire support capability, and that's the field artillery branch. No. 5 calls for better defenses against missiles and drones, and that's air defense artillery.

When Brig. Gen. Stephen Maranian was asked in a recent interview how it felt for his branch to top the list, he replied that any one of the six could have been No. 1.

His ADA counterpart, Brig. Gen. Randall McIntire, said he "absolutely would agree with that."

McIntire said it's less about the order and more about having a combined arms approach to the future.

"It's a total package … Everybody has a piece of the pie here to make it work, from a combined arms approach," he explained.

"All six priorities are critical in our ability to win in a near-peer adversary fight," said the ADA School commandant and chief of the ADA branch. "We have spent the last 15-plus years focused on fighting wars of insurgency and terrorism while our adversaries have made improvements in their own capabilities. This has resulted in loss of significant overmatch that we had long maintained since World War II.

"To regain that dominance the Army chose to focus on the six priorities," McIntire said.

"I think it's fantastic that Fort Sill's got two of the six priorities, and I often remind myself, 'how would you like to not be one of the priorities?' Because it is a big Army," he pointed out.

When Milley first laid out his priorities, he stressed the importance of the first four, but when he came to the fifth, he said, "All that doesn't matter if you're dead. And that's why we need air defense."

McIntire and Maranian have each been named directors of cross-functional teams (CFTs) for their respective branches. The goal of these teams is to speed up the Army acquisition process and get new technologies from the development stage into the hands of Soldiers as fast as possible.

"Really, what we're all about, from a mission standpoint … we use the word 'drive.' 'The Air Missile Defense CFT will drive the Army's modernization priorities by rapidly integrating and synchronizing the requirements, the development process, the acquisition process and the resources to deliver capabilities into the hands of the warfighter.' That's what we're about," McIntire said.

Within weeks after Milley's rollout of the priorities at the Association of the United States Army's Eisenhower Luncheon, the CFT directors met with senior Army leaders to learn their intent and get some guidance on how to proceed. They formulated what their approach would be and what the expectations were before bringing in the rest of the CFT members.

Although there are six priorities, there are actually eight cross-functional teams dealing with Army modernizations. That's because two categories were subdivided. There's a core team of sorts working with all eight. McIntire said core team members range from programming to contracting to testing.

"And the beauty of the core members is the reach-back capability they have into their parent organizations, but I've had great team members that come from all across the Army," he said.

His CFT spent a few days reviewing the entire air and missile defense portfolio.

"Our approach was, what can we do to get some quick wins? While still looking out at the future, but there are certainly things that needed to get jump-started, that needed a little bit more hands-on work to them," McIntire said.

Each CFT is a little bit different. Some are looking 10-12 years out. The Air and Missile Defense CFT is too, but it's also a pilot program.

"So our expectations were, what can you do in 6-8 months in a pilot program? We chose to fix a couple of things that were just on the verge of needing a little extra attention," he said.

The first one was to develop an initial capability to provide short-range air defense to support the maneuver force. The branch was already leaning toward taking that path, but this was the perfect opportunity to get the requirement, said McIntire. It will definitely use the Stryker platform because

As director of the Army's Air and Missile Defense Cross Functional Team, Brig. Gen. Randall McIntire is exploring two options to help air defenders confront a near-peer adversary, short-range air defense to support the maneuver force and integration of two existing systems, Terminal High Altitude Air Defense and Patriot. (Mike Pope/Lawton Constitution)

it has the needed size, weight and power, but the CFT is still working on the "ornaments" — the missile and the effectors that will be on top. Members are shopping around, observing demonstrations of what defense contractors have to offer. Hellfire and Stinger are among the possibilities.

"Those are existing things that we're able to get our hands on quickly and build the capability with the intent that over the next several years we'll figure out how to grow and (put) new and improved things on it," the general said.

The three Maneuver Fires Integration Exercises conducted at Fort Sill's Electric Fires Range not only got industry involved but actually fit right into what the CFT is all about, he noted.

Another quick win for the team would be to make existing systems less "stovepiped." They work great, but they work by themselves. The ADA team seeks better integration of the Terminal High Altitude Air Defense (THAAD) and Patriot missile systems. The Army just finished fielding its seventh THAAD battery and it has 15 Patriot battalions. Now the CFT wants to accelerate integration between these upper and lower tiers of air defense, so that they work side by side.

"What that does for us is, it gives us a lot more opportunity to be more efficient. If we do it right, it'll also allow us to defend more assets. It'll allow us to spread out and do more things. It'll allow us to pick the best shooter for the situation, if we're able to have these two systems talking together," McIntire said.

Priority No. 5 also calls for ADA to address the threat posed by hostile drones. At the outset, the CFT looked at what was possible in 6-8 months for the counter-UAS (unmanned aerial system) mission set.

"It's pretty big and it's pretty complex" was what they found. There are programs already at work. McIntire thought at the time that it was bigger than what the nascent CFT could handle.

"There's enough people working on that today that I was comfortable we didn't necessarily need to jump on that one," McIntire said. However, if the CFTs prove to be long-lived, his team will revisit what's next.

What will ADA look like five years from now?

"I think we're going to continue to grow our capabilities. I think we're going to start to see a transition from having gun-missile mixes today, which is our primary intercept capability, to having directed energy lasers. And that'll take time, but it'll be a natural evolution," McIntire said.

Today, guns and missiles are used on a 50/50 basis. The general thinks the gun-missile mix will eventually be two-thirds and directed energy one-third of what ADA brings to the fight. Ten years and beyond, the technology may have matured to the point that directed energy weapons become half to two-thirds.

The ADA chief believes there will always have to be a mix because the threats are different and every threat requires a slightly different tool to defeat it.

In the meantime, he also believes the Army will grow the ADA branch by adding four battalions of maneuver short-range air defense capability. The first two are already programmed and approved, with the goal that every division, both active duty and National Guard, will eventually have one such battalion.

"We're adding capability, both in Europe and the Pacific. I think we're in a good position for the branch to continue to grow, which is really good for Fort Sill and the Lawton community, as all of the training will have to come through here as we start to build those units."

Mitch Meador covers Fort Sill stories for the Lawton Constitution and has had the military beat for more than 20 years.

Soldiers from 173rd Airborne Brigade practice target engagement with a Stinger Missile weapon system. Instructors from the Air Defense Artillery Center and School at Fort Sill, Okla., taught maneuver Soldiers how to conduct short-range air defense operations at the 7th Army Training Command's Grafenwoehr Training Area, Germany, from July 31 to Sept. 1, 2017.

Paratroopers train to jump with Stinger missiles, defend against air threats

By Maj. Thomas Cieslak

FORT BRAGG, N.C. – Conducting static-line airborne operations with non-typical weapons systems requires specialized training and equipment due to their large size. Paratroopers accustomed to the size and weight of a weapons case carrying an M4 or M249 must learn how to pack, move with and exit an aircraft with the bulkier equipment.

Paratroopers of the 3rd Brigade Combat Team, 82nd Airborne Division have been training to perform airborne insertions with the Stinger Missile Jump Pack, a Man-Portable Air-Defense System capable of defending drop zones from hostile unmanned aerial vehicles (UAS) and rotary wing aircraft.

"Operational environments the Army has operated in were mainly focused on countering insurgencies and air defense's focus centered around protection from Inter-Continental Ballistic Missiles," said Capt. Herman Wu, 3rd BCT air defense officer. "It wasn't until near-peer threats to paratroopers became apparent that the Army recognized a capability gap exists in short-range air defense on the drop zone."

The weapon's capability to defend against air threats on the drop zone makes it an essential component in future airborne operations.

"As an airborne unit, the Stinger Missile Jump Pack greatly increases our ability to defend against enemy UAS and rotary-wing threats," said Wu. "It is likely our next drop zone will be beyond the range of any friendly air defense assets and air superiority does not guarantee safety from enemy air threats.

"It could likely be our only defense against air threats in the initial stages of an airborne operation as the enemy tries to take advantage of our re-organization," he added.

Training to jump with the Stinger Missile Jump Pack on Fort Bragg consisted of several events intended to familiarize the 3rd BCT paratroopers with the bulkiness of the equipment when exiting an aircraft. It also helped increase their knowledge about the system's employment.

Classroom instruction, practical exercise at the United States Army Advanced Airborne School's 34-foot tower and virtual-reality training at the Fort Bragg Virtual Stinger Missile Dome conducted throughout March with the 108th Air Defense Artillery Brigade developed the paratroopers' knowledge about jumping with the system and employing it on the ground.

"Through this training, paratroopers are gaining confidence in their ability to successfully conduct a static-line airborne operation with the Stinger Missile Jump Pack," said Wu. "Their presence on the drop zone provides an extremely effective countermeasure to enemy air threats."

Maj. Thomas Cieslak is the 3rd Brigade Combat Team, 82nd Airborne Division Public Affairs Officer.

A paratrooper from 3rd Brigade Combat Team, 82nd Airborne Division exits the 34-foot tower at the Army Advanced Airborne School on Fort Bragg, N.C., with a Stinger Missile Jump Pack, March 14. Conducting static-line airborne operations with the weapons systems requires specialized training and equipment due to its bulky size. (Spc. Nathaniel Phelps/U.S. Army)

Soldiers from to E Battery, 3rd Battalion, 4th Air Defense Artillery conduct Stinger missile training using the Virtual Stinger Dome at Fort Bragg, N.C., Mar. 21. The dome is a new training system that uses virtual reality technology to immerse Soldiers into a digital world providing a more realistic Stinger team training. Third Brigade Combat Team, 82nd Airborne Division, owns one of five systems across the Army. (Spc. Houston Graham/U.S. Army)

Juniper Cobra 18 exercise fortifies US, Israeli bonds
https://go.usa.gov/xQna4

Revived Roving Sands exercise teaches air defense units mobility, expeditionary warfare
https://go.usa.gov/xQna8

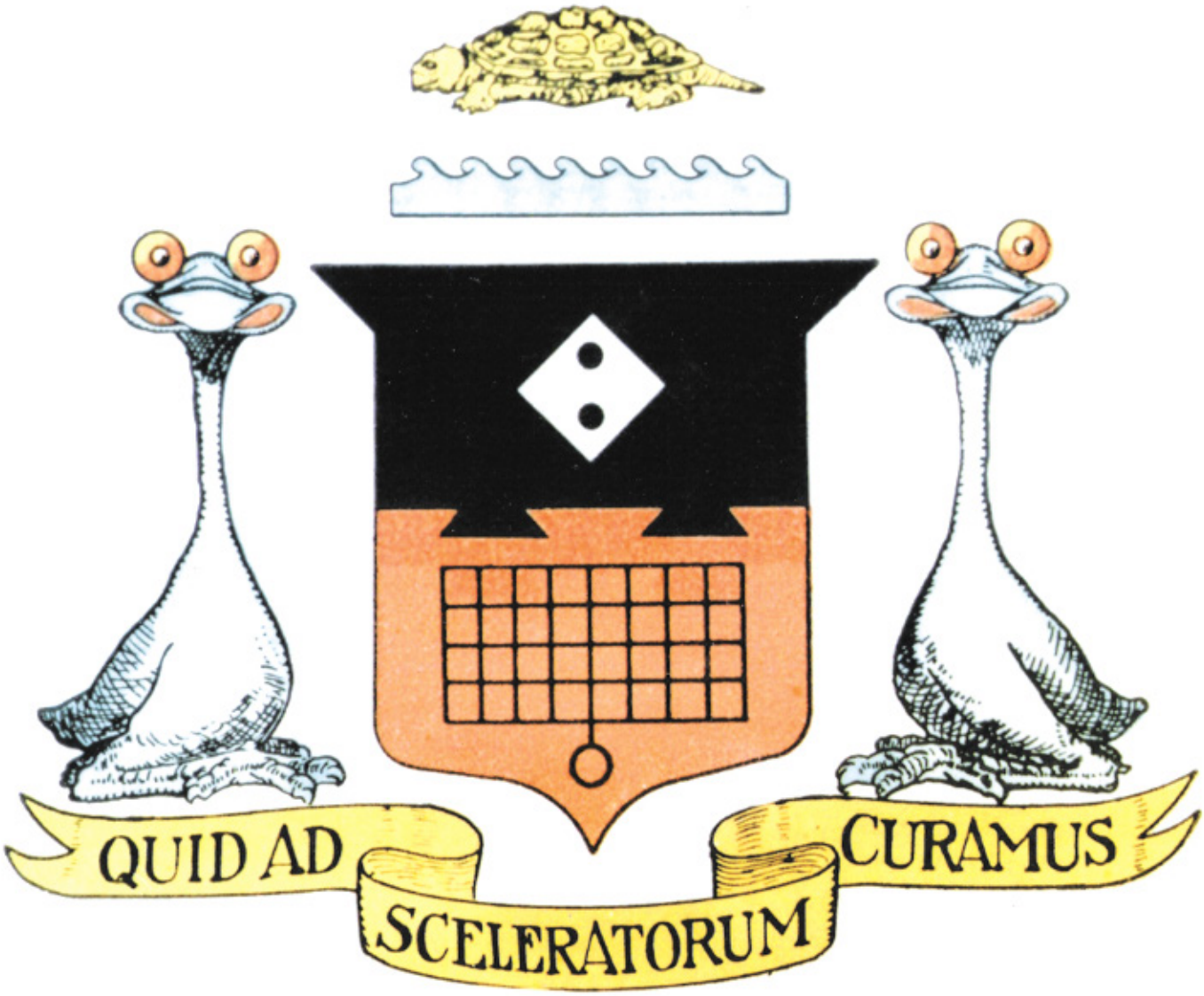
678th Air Defense Artillery Brigade uncases colors in Ansbach, Germany
https://go.usa.gov/xQna9

Ohio Air, Army National Guardsmen team up in Afghanistan
https://go.usa.gov/xQQNU

32nd Army Air and Missile Defense Command Roving Sands 2018 Wrap-Up
https://www.facebook.com/32ndAAMDC/videos/1646990265387915/

The curious case of the Oozlefinch

By 2nd Lt. George Myers and 2nd Lt. Mark Nassar



The chronicle of the Oozlefinch, air defense artillery's unofficial mascot, is simultaneously well documented and elusive. It has disappeared and reappeared more times than scandal-ridden celebrities on social media, an act for which he has become notorious.

While there are as many opinions on the Oozle, as there are air defenders in the Army, the relationship between air defense and the Oozlefinch goes back longer than that between Mickey Mouse and Disney.[1] On the 50th anniversary of the air defense artillery, a history of its esteemed mascot and guardian is in order. From humble beginnings to present day, the Oozlefinch has constantly evolved and adapted to fit the espirit de corps of each successive generation of air defenders.

There are several rumors about the origin of the Oozlefinch. The most popular account holds that he was first sighted during the early 1900s at Fort Monroe, Va., by Capt. H.M. Merriam, flying tail-forward across a bar patio.[2] The most distinguishing feature Merriam noted about the Oozlefinch were his eyes – bloodshot, gawking and without eyelids or eyebrows.

One proposed explanation for the Oozle's reverse-flight says that he does it to prevent dust and debris from lodging in his retinas. Another says it is because he cares more about where he has been than where

1 *Flynn, Ken (1998). "Mythical bird keeps both eyes on air defenders". El Paso Times*
2 *"History of the Oozlefinch"*

he is going.[3] Following Merriam's encounter, the legend of the Oozlefinch spread rapidly and became a hot topic of conversation among the Coast Artillery Corps. In 1905, a statue in his image took perch above the mantle in the Fort Monroe Officers' Club, where he watched over artillery board meetings, and countless raucous evenings of dice games, drinking parties and officer shenanigans.

In 1918, members of the Railway Artillery Reserve, American Expeditionary Force in France made the second recorded wild Oozlefinch sighting. These artillerymen-come-birdwatchers collaborated on an artistic recreation, depicting a single-feathered bird sporting a trench helmet, and a wristwatch on his left leg reading "7:30," the time RAR began its daily work.[4] When the commanding general of the RAR sent the image up to his boss, Chief of Coast Artillery Maj. Gen. Frank Coe, for permission to emblazon RAR vehicles with the Oozlefinch, Coe could not resist.

To nobody's surprise, the Military Intelligence Bureau had dumped an oversized portion of their budget into a dossier on the odd bird. It said that the Oozlefinch was nearly extinct, but wore his lone remaining feather with "great pride and gusto." He subsisted on "hopes" foraged from the rumor-mill and chatter among Soldiers, and had a characteristically hard time figuring out whether he was supposed to report at 7:30 a.m. or p.m. – an excuse which may sound all too familiar to the modern noncommissioned officer. His signature call of "gazook-gazoo," often heard ringing above the heads of artillerymen in the morning, roughly translated to "up yours!" Without reservation, Coe gave the Oozle his stamp of approval to represent the RAR.

Through the 1920s and 30s into the 40s, the Oozlefinch faded into relative obscurity, settling into premature retirement in 1948. During WWII, artillerymen fighting overseas remembered his legacy, and many carried his likeness as their sacred guardian. In these trying times, the Oozle's spirit delivered his flock to numerous victories in the European and Pacific Theaters.[5] Meanwhile, the original Oozlefinch statue was briefly moved from the Fort Monroe Officers' Club to the Artillery School at Fort Winfield Scott in San Francisco, then to the training grounds at Fort Bliss, Texas.[6] He spent the better part of these years as a recluse, turning his gaping eyes 180 degrees inward (a unique talent) meditating and reminiscing on his life, and the need for modernization of artillery.

It wasn't until 1956 when the Oozlefinch found a new lease on life. He awoke from his slumber, slapped on his helmet, tucked a Nike missile into the crook of his left leg, and emerged to become the proud guardian of every American missile man. Those years of solitude hardened the Oozle, giving him a more aggressive look, threatening enough to deter any communist who dared confront our air defenders.[7] The immortal bird was no longer the hapless doofus he once was. A new generation of air defenders imagined him with a steely gaze and a Russian fighter jet crushed inside his beak, with his left and right feet clenching and crushing two more enemy jets.

The new hardened Oozlefinch served valiantly through the Vietnam War into the 1980s, one weary eye constantly staring down the Soviet Union.[8] With a beefed-up budget courtesy of President Ronald Reagan, the air defense community sought to develop a new and improved self-propelled gun system. In 1985, the ill-fated Sgt. York project was ready for live-fire testing. Legend has it that when the York made its debut at the range, the targeting system locked on to what looked like a target, but in reality was the air vent to a port-o-potty.

When a special fire team went downrange to conduct their damage assessment, what did they discover? None other than our friend the Oozlefinch, sitting on the john, ADA magazine under wing, dazed and slightly irritated. The Oozle quickly regained his composure and reminded the air defenders that our business is technology-driven and built on the lessons we learn through failure.[9]

When the priorities of global security took the Oozlefinch to the Middle East in the 1990s, the Oozlefinch set aside the Communist aircraft to gear up for deployment with the 3rd Battalion, 43rd Air Defense Artillery. He traded his trench helmet in for a desert camouflaged kevlar and desert goggles to protect his unblinking eyes from heat and sandstorms, and slipped into a "We Won't Forget" Patriot Scudbuster T-shirt purchased from the gift shop at the Air Defense Museum.

During Operations Enduring Freedom and Iraqi Freedom, ADA Soldiers kept the Oozlefinch alive with a new illustration for a new era of warfare. Their Oozle looked fit to be fried – totally bald, and only eleven herbs and spices away from a meal. With supreme confidence in the competency and brilliance of the ADA, he felt safe taking his eyes off them long enough to hit the gym for two-a-days. He was noticeably beefed-up, rocking pectorals even the Hulk would covet. With an unflinching grin in the face of danger, large bulging eyes for advanced target acquisition and talons for destroying rotary- and fixed-wings alike – the Oozle was clearly adept to his strategic environment.

Today's Oozlefinch faces an uncertain future. As the last generation of air defenders is slowly overcome by the next, his memory gradually fades. He unquestionably deserves our appreciation for more than a century of loyal service as a symbol of our spirit and lineage. But will we carry his legacy, or will he retreat once more to wait for his inevitable rediscovery? He is the mascot that air defenders deserve, but will we realize he is the one we need? There are still those who mock the Oozle, who wish for his demise, but history shows that he can take it. Because he's not a hero. He's a silent guardian, a watchful protector… he is the Oozlefinch.

Second Lt. George Myers has a bachelor's in Political Science from Bethany College in West Virginia. Myers commissioned through Officer Candidate School in March 2018 and will start Air Defense Artillery Basic Officer Leader Course in June 2018.

Second Lt. Mark Nassar has a bachelor's in Political Science and a master's in Public Administration from Stephen F. Austin University in Texas. He commissioned through Officer Candidate School in January 2018 and will start Air Defense Artillery Basic Officer Leader Course in June 2018.

3 *Bird, Ima.(1983)*
4 *General William Chamberlaine. "Distinctive insignia for Railway Artillery Reserve, American E.F.," American Seacoast Defenses Reference Guide. (pp. 561)*
5 *"History of the Oozlefinch"*
6 *"The Missile Oozlefinch," American Seacoast Defenses Reference Guide. (pp. 567)*
7 *Byrd, Ima. (1983)*
8 *"The Missile Oozlefinch," American Seacoast Defenses Reference Guide. (pp. 568)*
9 *"The Oozledork."*

The Fires Bulletin Staff would like to congratulate the Air Defense Artillery Branch on their 50 years of achievements and service. What started as a specific mission for artillerymen, quickly grew into a vital component of the U.S. Army mission. The articles contained within these pages are just a few of the tremendous milestones of the Soldiers within the ADA ranks. We are proud to serve the Soldiers of the Air Defense Artillery Branch.

Please accept our congratulations on this anniversary and best wishes on another 50 years of success!

Sincerely,
The staff of
Fires