AIR DEFENSE

Trends

JANUARY - MARCH 1975

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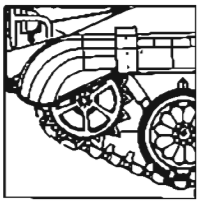

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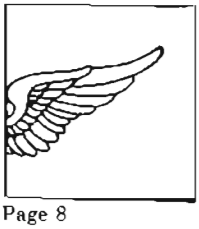

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Distribution will be made only within the School, except for distribution on a gratuitous basis to Army National Guard and USAR schools, Reserve component training and ROTC facilities, and as requested by other service schools, CONUS armies, Active Army units, major oversea commands, and military assistance advisory groups and missions.

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Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, 8 April 1974, in accordance with AR 310-1.

Articles and letters should be sent to: The Editor, Air Defense Trends, USAADS, Box 5600, Fort Bliss, Texas 79916.

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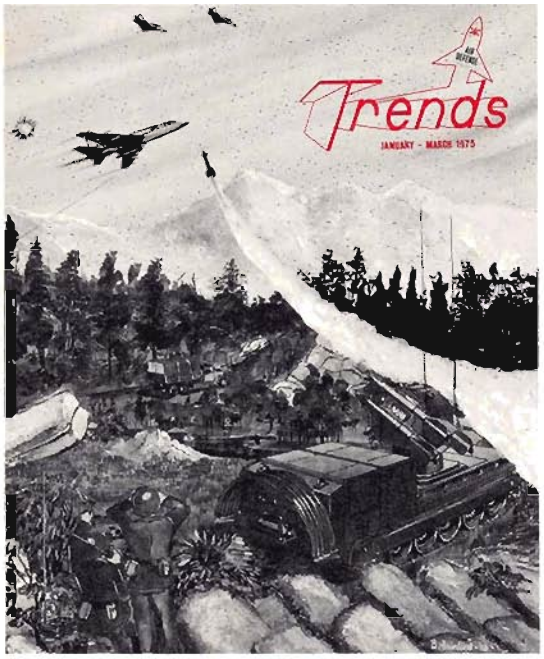

COVER: Portraying one aspect of the theme, "Air Defense of the Field Force," is this painting by Bill Hainline, who has been an illustrator on the *Air Defense Trends* staff for several years. It is planned that other aspects of this theme will be portrayed in some future issues of "Trends."

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Letters to the Editor

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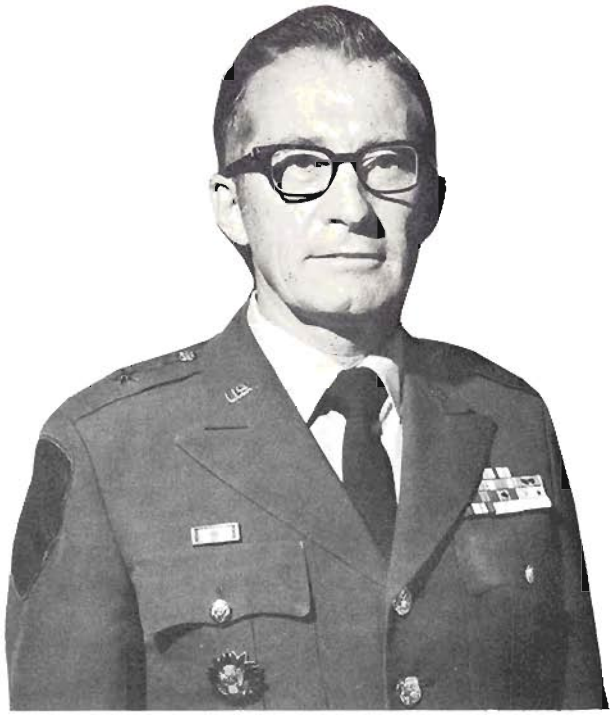


Brigadier General Ernst E. Roberts

Brigadier General Ernst E. Roberts retired on 1 October 1974 after completing nearly 30 years of military service.

General Roberts graduated from the US Military Academy in 1949 with a commission in Artillery. His military service included combat duty in Korea, followed by numerous important assignments such as Secretary of the General Staff at West Point; Chief of Plans and Activities Division, Office of the Assistant Chief of Staff for Force Development; and Commander, 38th Air Defense Artillery Brigade. During his military career, General Roberts completed courses of instruction at the Ground General School, Fort Riley, Kansas; Artillery Officers Basic Course, Fort Sill, Oklahoma; Artillery Officer Advanced Course, Fort Sill; Command and General Staff College; and the Air War College, where he was designated a distinguished graduate. He also acquired a Masters Degree in Business Administration from Xavier University and a Masters Degree in Mechanical Engineering from the University of Southern California.

A brigadier general since April 1972, General Roberts' awards and decorations include the Distinguished Service Medal, the Silver Star, Legion of Merit, Meritorious Service Medal, Army Commendation Medal with two Oak Leaf Clusters, the Presidential Unit Citation, and four service medals.

DANT CHANGEOVER

Brigadier General Robert J. Lunn

Brigadier General Robert J. Lunn assumed the position of Assistant Commandant, 27 September 1974, after serving 13 months as Deputy Commanding General, 32d Army Air Defense Command in Germany.

A native of Illinois, General Lunn graduated from the US Military Academy in 1950 and was commissioned a second lieutenant of Artillery. His air defense experience dates from that time and includes command assignments from battery through group level to his previous assignment. In 1961 he joined the US Army Artillery Board at Fort Sill, Oklahoma, as Chief of the Lance Missile Development Program. He also served 3 years in various Army General Staff assignments, including duty with the Office of Chief of Research and Development as Chief of the Missile Division and assistant to the Secretary of the Army.

Since graduating from West Point, General Lunn has attended the British School of Antiaircraft, Wales; the University of Arizona, where he received a Master's Degree in Aerospace Engineering; the Command and General Staff College; and the Army War College. His foreign service includes Korea and Germany. General Lunn's decorations and awards include the Legion of Merit with Oak Leaf Cluster, Army General Staff Badge, Army Commendation Medal with Oak Leaf Cluster, and five service medals.

Air Defense Mobility Versus Operational Area

Lieutenant Colonel Thomas E. Bearden
SAM-D Project Office
Redstone Arsenal, Alabama

The mobility required of an air defense system such as SAM-D continues to be questioned. There are conflicting opinions at almost all levels as to the mobility necessary. In an attempt to set an overview context for addressing considerations of mobility, codeployments, design requirements, deployment concepts, and employment concepts, an unusual matrix has been constructed contrasting mobility of air defense systems versus the operational areas they serve. Strong consideration has been given to the tactics, deployment philosophy, and system philosophy of the Soviet Union. Other recurring questions that fall within the purview of this matrix are the mobility requirements that should be impressed upon the design of an air defense system, the question of integrated systems/codeployment philosophies, decoy philosophy, hardening philosophy, frequency diversity, and tactical missions. A deliberate attempt has been made to avoid the more detailed individual considerations of mobility such as trafficability, climatological aspects, detailed terrain roughness, terrain type, etc. Instead, an attempt has been made to first set the overall strategical/tactical stage in which such problems should be discussed and addressed.

The military philosophy of the US can be divided into strategic and tactical warfare considerations. Occasionally, a gray third consideration called by various names such as communications zone and theater of operations is addressed, but essentially US plans divide sharply into strategic mobility and tactical mobility as a general way of division of mobility. Further, because of historical experience, the US considers its theater of operations (tactical) warfare will normally be conducted at a location physically distant from its strategic warfare, since it considers that its field forces will normally fight on a separate continent from heartland US.

The Soviet Union differs sharply in military philosophy. Its philosophy consists of three broad areas:

- Strategic Warfare
- Operational Warfare
- Tactical Warfare

Tactical warfare equates essentially to divisional warfare; operational warfare equates to operations of the Soviet front organization. However, the Soviet front specifically does not refer to the "up front" idea loosely used in American military speech. Loosely, Soviet frontal operations would correspond to operations of several US corps. Strategic warfare involves heartland Russia.

Historically, the Soviet Union has itself been located on the same continent in which its great wars were fought. Thus, the Soviets have not had the convenient option of sharply separating operational warfare from strategic warfare. From the time of Genghis Khan, large armies who broke through the Soviet front simply continued on across the Soviet heartland. The most recent experience of the Soviet Union (in World War II) again thoroughly reinforced this military philosophy. Today, for example, the Soviet Union continues to be contained by frontal confrontation with China and NATO, both of which are on the same continent as heartland Russia. Accordingly,

Soviet military philosophy integrates warfare at all three levels with no sharp separation between levels.

Since mobility terms are defined differently by almost everyone who uses them, the following mobility definitions and considerations are used:

- Nonmotorizable (fixed) System — This is a system that is fixed in position and primarily is deployed in a strategic role. It can be adapted for some parts of the deep rear of the operational area. A nonmotorizable system must be modularly designed, capable of being packaged for shipment by air, land, or sea, and capable of being installed into a fully constructed and prepared site and operated from there.
- Motorizable (Semifixed) (Semitransportable) System — This system that is originally designed to be transportable is self-contained with shelters etc., but lacks sufficient transport. The semifixed system can be moved and set up to operate in another location if the other location is prepared. The time required in dismantling and setting up may require 1 or 2 days. The semifixed system is capable of regaining a transportable configuration by assignment of the required additional transport.
- Motorized (Transportable) System — This system is motorized and self-contained (shelter, vehicles, etc.). Specifically, it is wheel-mobile in a nonspecialized fashion; that is, it uses standard trucks, trailers, and shelters. The system is primarily road bound although it has limited off-road capability. Most of the US mobile air defense systems are in the motorized category. The motorized system is not really a "shoot and scoot" system. Its march order and emplacement times may run from 30 minutes to 2 hours.
- Mechanized System — A mechanized system is designed to have equal mobility to the tank and personnel carrier. In addition, it must be designed for quick emplacement and march order — for example, 30 minutes or less to emplace and be ready to fire, and 15 minutes or less to march order. The mechanized system is designed for "shoot and scoot" operations. It must have self-contained power with no cabling limitations. Mechanized systems are required for the mission of accompanying moving armored and mechanized forces in either offense or defense. Mechanized systems are further separated into *mobile* and *highly mobile* subcategories. Mobile systems are designed for increased off-road capabilities but retain a wheeled configuration. Highly mobile systems are maximized for off-road trafficability and are essentially tracked vehicles. (Weapon systems mounted on ground effects vehicles for experimental use in the Delta in South Vietnam would be considered highly mobile systems although not on tracked vehicles.) (There can be some exception to this.)

From this breakdown, several interesting observations can be drawn. To accompany armor and mechanized infantry requires mechanized mobility; therefore, the vehicle design criterion for tactical warfare, or for the continuing air defense protection of the tactical division, is for mechanized mobility. The immediate conclusion is that a family of mechanized air defense systems is required to furnish air defense for rapidly moving armored and mechanized forces. Behind the mechanized forces, i.e., in the rear of the operational area (division and corps rear, and deeper), motorized systems are sufficient; therefore, this is a design requirement for the rear of the operational area. For the rear of the COMMZ and deep airfields, ports, and fixed installations, a fixed system may be employed.

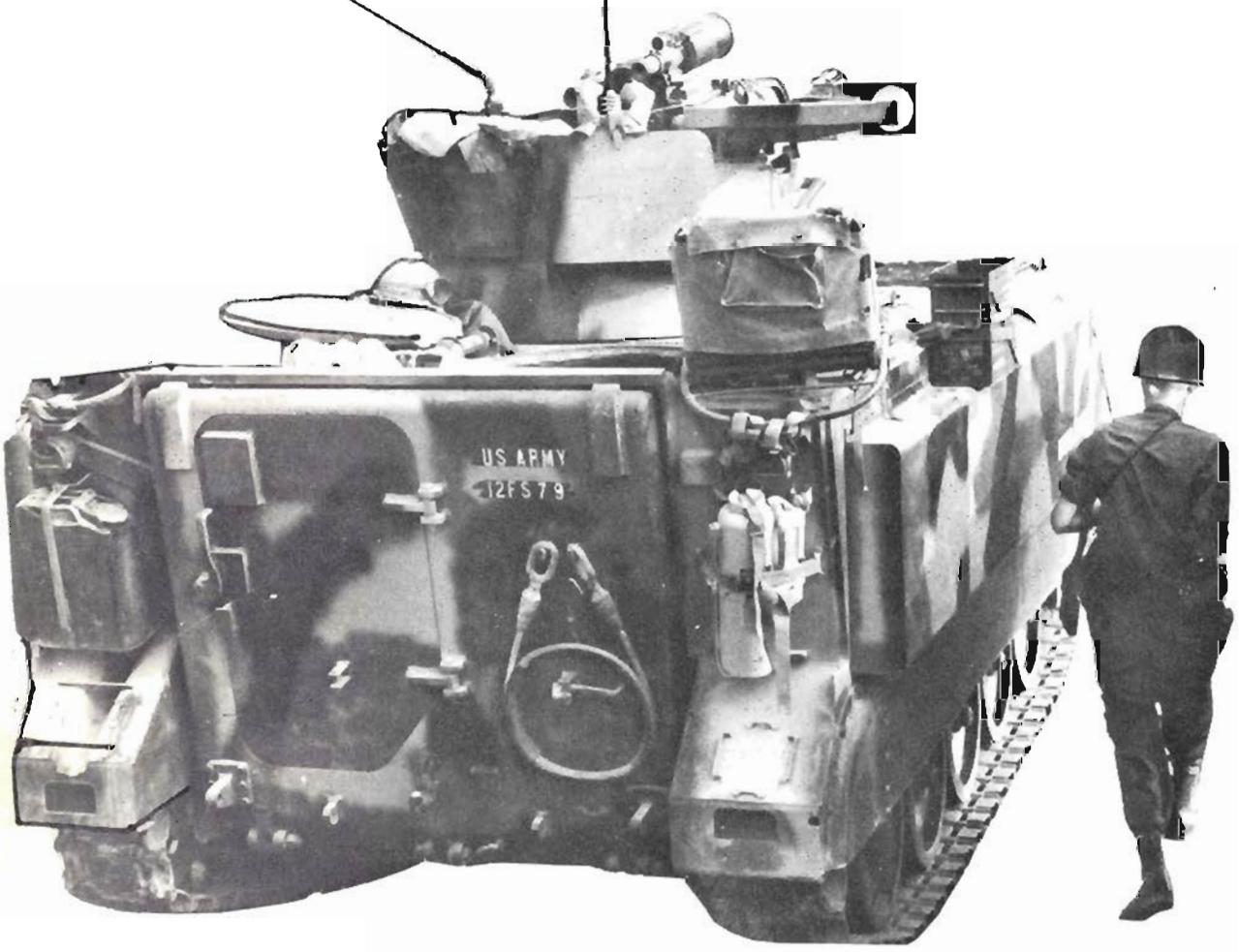
Another aspect immediately apparent is that a transportable system can be converted to a semifixed (motorizable) or fixed (nonmotorizable) configuration. The reverse is not necessarily true. A fixed design site cannot be converted to either semifixed or transportable configuration without almost total redesign. A semifixed (motorizable) system by definition is a system that has already been designed to be motorized and thus it can be converted to a fully motorized configuration by the addition of its designed transport.

Examination of Soviet systems reveals an almost perfect fit to this mobility breakout, particularly for the mechanized and the motorized design criteria. For the mechanized category, USSR has deliberately optimized to the highly mobile subcategory. The Soviets are deeply committed to massive, rapid, mechanized warfare, and they have a full air defense mechanized weapons family. It includes ZSU-23-4 and 57-2 radar-directed guns (mounted on highly mobile tank chassis); SHORADS consisting of an SA-9 (which is an SA-7-type system) reportedly mounted on the BRDM rough-terrain vehicle (mobile system); the hand-held SA-7, the SA-6 (tank chassis, highly mobile, deliberately designed to be both a SHORADS and a medium-range SAM); and a LORADS, which is the SA-4 GANEF (tank chassis, highly mobile. Thus, the Soviets have a totally mechanized air defense family capable of providing complete air defense protection over rapidly moving mechanized and armored forces. After an area has been secured by mechanized and armored forces, the motorized air defense systems (which are much cheaper to maintain and operate) can move forward and relieve the mechanized air defense forces. The mechanized air defense systems then move forward to continue their support of the rapidly moving ground offense.

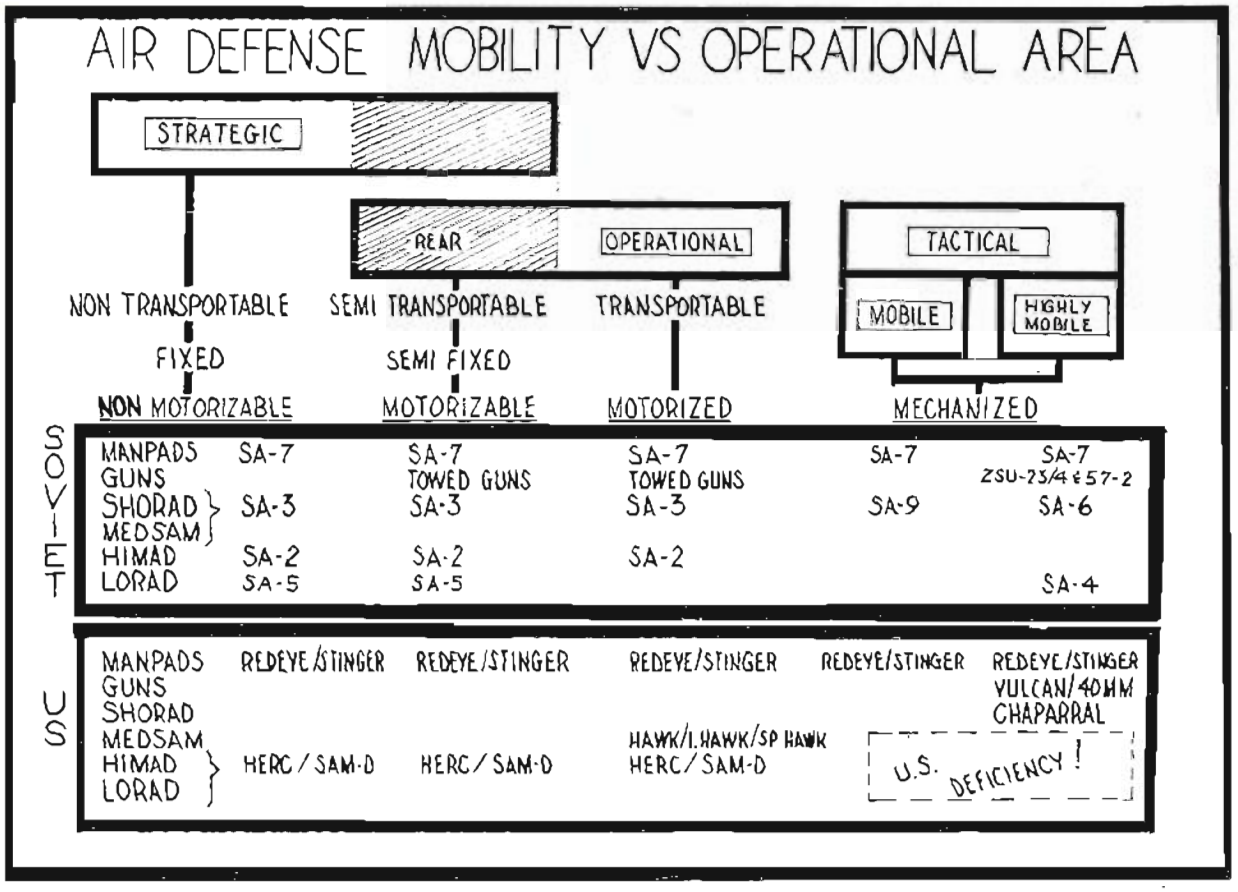
Semifixed and fixed systems are found behind the Soviet front and in the strategic area of the Soviet Union. Two systems, the Griffon and

Galsoh, are interesting from this mobility viewpoint. Both strategic systems appear to have been substantially designed originally for transportability to provide a very long-range air defense and a ballistic missile defense to the Soviet front, as well as to the Soviet strategic heartland. So far as is known, the radars with these two systems have not been designed in a transportable mode.

Fitting of US air defense systems to this mobility matrix is also interesting. We seem to have had the same type of concept intuitively without putting it into specific words and formalizing it. We also seem to have specifically failed at implementing our own attempts to fulfill the motorized and mechanized design criteria. Ajax, Hercules, and Hawk were all designed to fit the motorized (transportable) criterion. Ajax and Hercules could, of course, each be reduced in mobility to semitransportable or to the fixed site configuration. The primary limitations of the Hawk system, that make it motorized rather than mechanized, are its standard wheeled vehicles and the large number of cables necessary to use the system. The self-propelled Hawk system represented an attempt to obtain a mechanized highly mobile air defense system; however, the cabling problems prevented SP Hawk from actually fulfilling the requirements.



The original SAM-D concept called for tracked vehicles, automatic data links, and self-contained power. In that configuration SAM-D was a mechanized (highly mobile) long-range system. Due to costs and sizing problems, the system was revised to a motorized version on standard Army



wheeled vehicles. The motorized system can, of course, be further reduced to a semifixed system (by deletion of substantial transport and mounting equipment in more prepared sites) or to a fixed system.

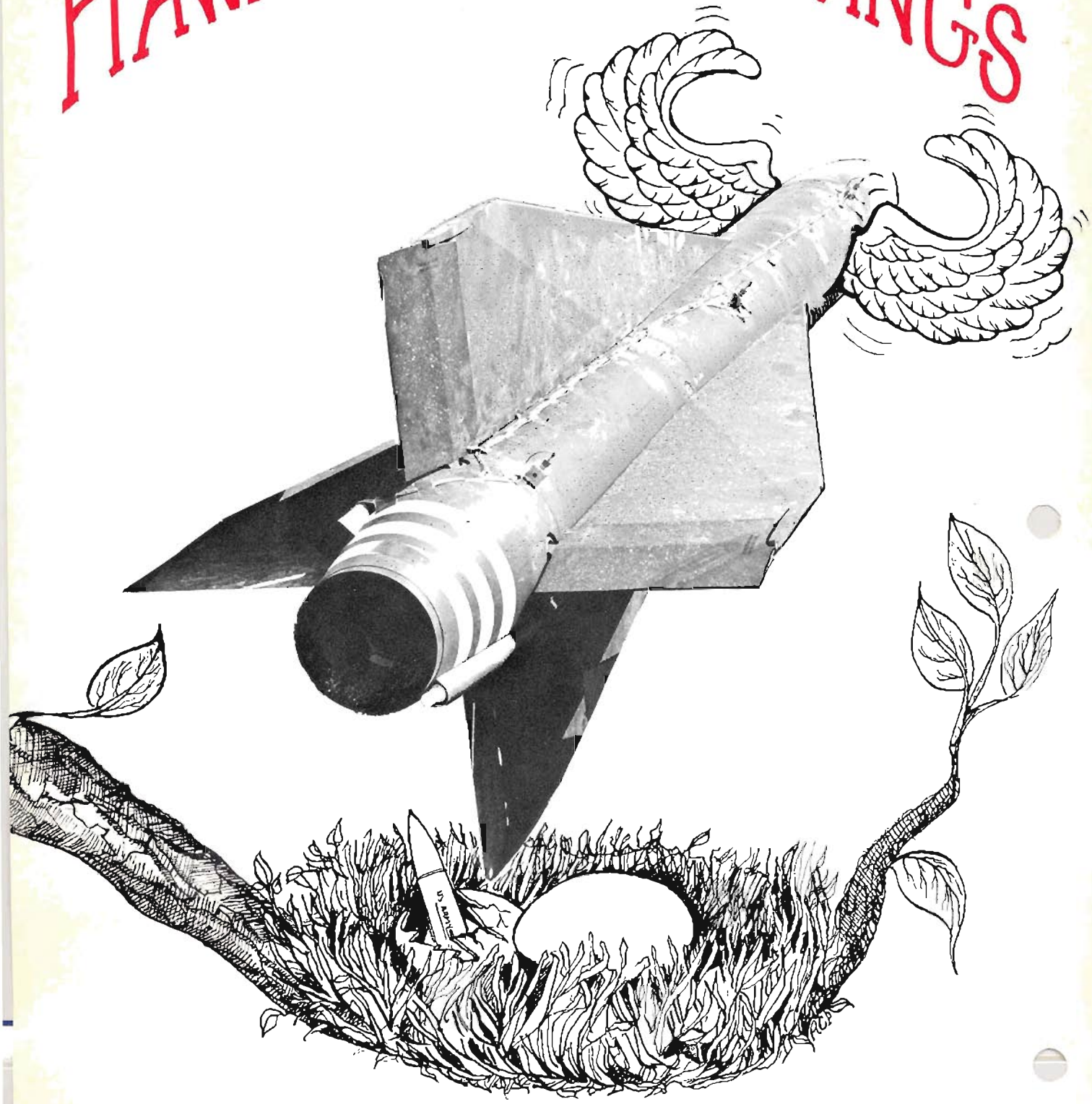
The Chaparral/Vulcan and the 40-mm gun systems provide the only mechanized air defense systems in the US Army today. (Redeye, of course, can be carried along by mechanized and armored forces.) Procurement of a new SHORAD system may add a mechanized SHORADS to the US inventory in the future. Because of the limited number of US air defense systems available, it is not possible to provide total air defense for all priorities that might be desired. In the face of the increasing Soviet emphasis on tactical close air support strike aircraft, this represents a weakness in the US Army's capability to wage successful offensive combat or to employ a mobile defense.

In my opinion, the need can be seen for two versions of medium- and long-range air defense, one a motorized, highly capable system comparable to our present military need statement and the second a lighter, mechanized version on a wheeled, rough-terrain vehicle, such as the DRAGON wagon, would seem preferrable for the mechanized role.

This is a totally qualitative and rough look at the overall ground mobility requirements for air defense systems. The almost exact fit of the Soviet systems into the defined matrix lends credibility to it.

Lieutenant Colonel Bearden is Chief of the Evaluation Branch, Military Studies Division, SAM-D Missile Project, Redstone Arsenal, Alabama. In addition to having attended several high-level air defense courses and the Command and General Staff College, he holds a Master of Science degree in nuclear engineering from Georgia Institute of Technology. He has also authored numerous writings in the field of parapsychology.

HAWK SPROUTS WINGS



. . .Brigadier General John J. Koehler, Jr.
Commander, 38th ADA Bde

The Hawk missile system is now truly air mobile because of pioneering efforts in Korea by the 38th Air Defense Artillery Brigade. Although Hawk equipment has been moved by helicopter in the past, some components required separation from their trailers which dictated extensive premovement preparation. Seizing on recent technological advances in aviation airlift capabilities, and applying some innovative rigging techniques, units of the 38th Brigade, for the first time, have moved all the Hawk battery components by air in their normal configuration.

The breakthrough has tremendous significance on the role of Air Defense Artillery both in support of the Army in the field and for area defense missions. Moving by echelon, an augmented assault fire unit (AAFU) located north of Seoul was displaced a distance of 42 kilometers by air to a relatively inaccessible location and placed into full operation in 1 hour and 20 minutes. A conventional move by road through the heavy traffic of the city of Seoul would have taken more than 6 hours. The following day, the second fire unit, the Battery minus, which remained operational and continued the mission during the AAFU move, was displaced by air. The Battery minus move was completed and the unit achieved operational status in 1 hour and 40 minutes. The impact of this increased flexibility further authenticates the capability of Hawk to provide direct, continuous support to the ground-gaining arms.

Why the Breakthrough

The deployment innovation was made possible by two engineering design improvements: the increased lift capacity of the CH-47 (Chinook) C model aircraft and the improved capability of new sling equipment. Where the older A model Chinook could manage a maximum load of only 7,500 pounds, the C model can tote some 14,000 pounds. New slings, with increased tensile strength and greater length, allow simplified rigging. Recognizing that these improvements made many procedures listed in 1965 technical manuals obsolete, the 38th Brigade took a new look at the airmobility possibilities for Hawk. These improvements meant it was no longer necessary to separate the tracking radar, the high power illuminator radar (HIPIR), and the supporting 45-kw generator from their trailers. Airlift of these loads previously required complicated sling rigging of two separate loads. Now the equipment is march ordered much as if for a road move, quickly fitted with four-point slings, and whisked away by the twin-rotor, workhorse choppers.

The 2d Battalion, 71st Air Defense Artillery, the northernmost US Hawk battalion in the 38th Brigade, was tapped to blaze the airmobile trail. This unit, because of mission and location, would most likely have first need for an airmobility capability in case of hostilities.

Phasing of the Move

The airlift move was divided into three phases: planning, preparation, and execution. For a first of its kind operation like this one, planning was necessarily extensive.

Personnel required training in the new movement technique. They first learned the aircraft capabilities, including a thorough indoctrination on safety. Next, they were taught modifications to conventional march order procedures. Emphasis was placed on the concept of equipment prepositioning. Aircraft control teams and hook-up teams were thoroughly trained.

Simultaneously, new rigging techniques were worked out. Proper slings were selected and inspected and sling load kits were fabricated. Load testing was accomplished utilizing the unit's organic 5-ton wrecker. All rigged loads were lifted by the wrecker while personnel checked to insure that the loads rode level were balanced and that the straps made contact with the load only between attaching points and hook-up points.

In a final familiarization before actual deployment, a CH-47 aircraft was flown to the site. Unit personnel became acquainted with aircraft characteristics — winds up to 80 knots and noise level were significant factors. Aircraft safety and emergency procedures were stressed. A practical exercise was conducted with both external and internal loads.

The preparation phase began with the assembly of sling kits. To insure rapid deployment, the sling kits were made in advance and were ready to attach to their respective items of equipment. Next, auxilliary equipment was procured, which included goggles and work gloves for all personnel, distinctive outer garments for wear by pick-up and landing zone crews, smoke grenades, Conex containers and back-packs, and vehicle-mounted radios. As preparation neared completion, a date was set for the move and aircraft were scheduled. Finally came the last step of the preparation phase: equipment march order and rigging of loads for air movement. Sling kits were attached to the loads at the four attaching points and the first load inspection was conducted.

Use of at least two pick-up points speeds execution of the airmobile deployment. While one load is being lifted, another can be prepositioned. Final load inspections were conducted for proper march order configuration and rigging. Air traffic controllers on the ground bring the choppers into the pick-up zones at 5-minute intervals. The

hookup teams designate the next item to be picked up and attach the sling to the helicopter hook, while standing on the load. We selected men who like adventure for our hook-up teams. These teams stay with the load until it breaks ground, to insure the slings remain free of the load.

Equipment Placement

At the landing zone the receiving crew designates positions for the equipment, marking the designated set-down point with smoke as the loads approach. The team insures that the item is in the right place and facing in the right direction prior to touchdown. Straps tied to the load are used to turn the equipment when it is a few feet off the ground, thus allowing all personnel to remain clear of the load.

Achieving an operational status with the fire unit is done following standard emplacement and equipment check-out procedures. Proper load sequencing allows the fire unit to become operational with one launcher in minimum time. Using six Chinook aircraft, AAFU fire units have been ready to fire within 30 minutes of the first load touching down in the new position. Times for the Battery minus fire unit have been as short as 40 minutes.

Where We Stand Now

To date, 20 airmobile Hawk moves have been successfully conducted by the men of the 2d Bn, 71st ADA. Sling equipment for the other Hawk battalions in the Brigade has been received and training in airmobility operations is underway. These troops are becoming as proficient in air moves as they are in road moves. We have submitted recommended changes to technical manuals to pass on to our sister units throughout the world the knowledge gained by our efforts.

In short, Hawk has sprouted wings. This increased rapid deployment capability further insures successful mission accomplishment of our Hawk units and improved support to the ground-gaining elements of the combat arms. Hawk has moved into the airmobile era.

Brigadier General Koehler's work in making Hawk a truly airmobile system is in keeping with his long experience in research, analysis, and systems development.

Realism In Air Defense Artillery Training

Colonel J. Hollis V. McCrea, Jr.

One of the real challenges to a commander in training his unit is striving for realism. The matter is particularly aggravating to commanders of divisional ADA units. There are two outstanding reasons for this.

First, in ADA field training exercises in which aircraft participate there are unique problems in visual aircraft recognition (since US aircraft are used for both sides). Even after proper identification, the attrition game is difficult to play and often reduces itself to differing opinions of "Who shot whom."

The second reason, and the one addressed first in this article, is the difficulty in providing realistic targets for live-fire exercises. If we were designing a realistic target, characteristics we would look for are availability, low cost, ease of operation, all-weather capability, reliability, and productivity. We have no such target in our inventory today. However, it might stimulate our thinking to discuss why these characteristics are desirable and how we may relate them to certain of the targets that are available to us.

• *Availability and Cost.* To have maximum flexibility in training his unit, a commander should have targets available when he needs them in the sequence of his training. If a Vulcan battery commander had a readily available target which would allow him to conduct worthwhile live-fire exercises on a schedule of his choosing, then decentralized training could be practiced. Cost is an important factor, especially where the target is expendable. The ideal target must be inexpensive and in sufficient quantity to train the entire unit.

• *Ease of Operation.* The ideal target must be safe, simple enough to be operated by unit personnel, and usable in training areas readily available to the unit. If the unit commander has the capability of scheduling his live-fire exercises whenever he chooses and the targets can be operated and maintained by his unit personnel, then improved training is assured.

• *All Weather Capability.* All weather capability is essential in an ideal target; however, if we are to be realistic in our live-type exercises, we must not be entirely dependent on visual acquisition and engagement of the target.

• *Reliability.* The ideal target system will be ready to operate when needed, will not suffer repeated malfunctions, and will not require elaborate safety measures which in some cases all but eliminate realistic training. The reliable target will not cause the "hurry-up-and-wait" so often experienced during training exercises.

• *Productivity.* An important quality the target system must possess is productivity. Productivity involves two general areas — realism and gunner (or crew) satisfaction. The target must provide the

The ballistic aerial target system (BATS) has several of the attributes of the ideal target system.

proper elements of surprise, speed, and attack angle, and the same vulnerability as attack aircraft in the inventory of any potential adversary. The target must challenge the entire unit to acquire, identify, engage, and destroy it. Its construction should leave no doubt in the minds of the crew that they have succeeded (or failed) and for what reasons.

What we have discussed would amount to an air defense commander's dream in target systems for practice firing. But we know that no such systems are available, nor are any on the horizon. So the task at hand is to maximize the good qualities of the target systems that *are* available to reduce any shortcomings through sensible planning.

Let's begin with the ballistic aerial target system (BATS). BATS is primarily used for divisional ADA weapons — Chaparral, Vulcan, and Redeye. BATS is boosted by 2.75-inch folding-fin aircraft rockets and is sustained in flight by a commercial jet engine starter cartridge. It has a variety of selectable velocities ranging from 275 to 550 knots, and selectable altitudes from 300 to 6,700 feet. Maximum range of the target is in excess of 4 miles — which provides a flight time of up to 43 seconds. BATS has several of the attributes of the desired target system. It is easy to operate and has proved to be highly reliable. The launchers are an item of issue to the divisional ADA battalion, and the rockets are available and stored with division training ammunition. The ability of the unit to fire when it pleases may be hampered somewhat by availability of ranges — otherwise, it is well within the unit operational capability. BATS has an all-weather capability, although from a safety standpoint it is not particularly desirable during an electrical storm. The target is relatively inexpensive. Its principal shortcoming is its lack of productivity, particularly for the Vulcan system, and to some extent for Chaparral and Redeye. It

does not test the crew's proficiency at acquisition and identification, since the launch point is usually visible, or at least will be known after the first launch. Also, it does not give a complete test of the gunner's proficiency, since the course is entirely ballistic; hence, the target does not maneuver. The velocity and time of presentation are quite realistic, and from these viewpoints provide excellent training. The principal disadvantage for the Vulcan system is the lack of crew and gunner satisfaction. The 20-mm round will rarely deter the target from its ballistic course unless a fin is knocked off. A trained observer or umpire, armed with binoculars, can usually determine the hits and misses. However, there is no substitute for real-life attrition of the target. This is not a problem for Chaparral or Redeye. BATS presents a splendid IR source and is extremely vulnerable to these two systems.

Another target system, used primarily for Chaparral and Redeye, is the Firebee/Towbee. The Firebee is a high-speed (just slightly subsonic), remotely controlled target. It has been configured to pull tow targets (Towbees) which are sequentially released, one being mounted on each wing tip. This system realistically portrays a high-performance threat. It requires quite extensive range areas; therefore, it is not conducive to decentralized training. The Firebee is expensive, recoverable, and not to be used as a target. The Towbees provide an excellent IR source and are a challenging target for Chaparral and Redeye.

A target being tested that is readily available and inexpensive is the radio-controlled model airplane. Tests were run with a 1/10 scale model aircraft (5- to 6-feet wing span) with speeds ranging from 90 to 125 mph. The cost per unit ranges from $100 to $200. Tests showed good tracking, good maneuverability, and a rather realistic portrayal of a high-performance aircraft (with reduction in size compensating for slower speeds). If the system proves to be feasible, it would have many of the ideal advantages of the commander's dream target mentioned earlier. Limitations might be in the areas of all-weather operation and realism from the standpoints of surprise and performance.

The other major problem in engendering realistic ADA training is encountered in field training exercises because there is no live firing. And, as mentioned previously, difficulties arise from the use of US aircraft by both sides, as well as determining attrition of the attacker or the defender.

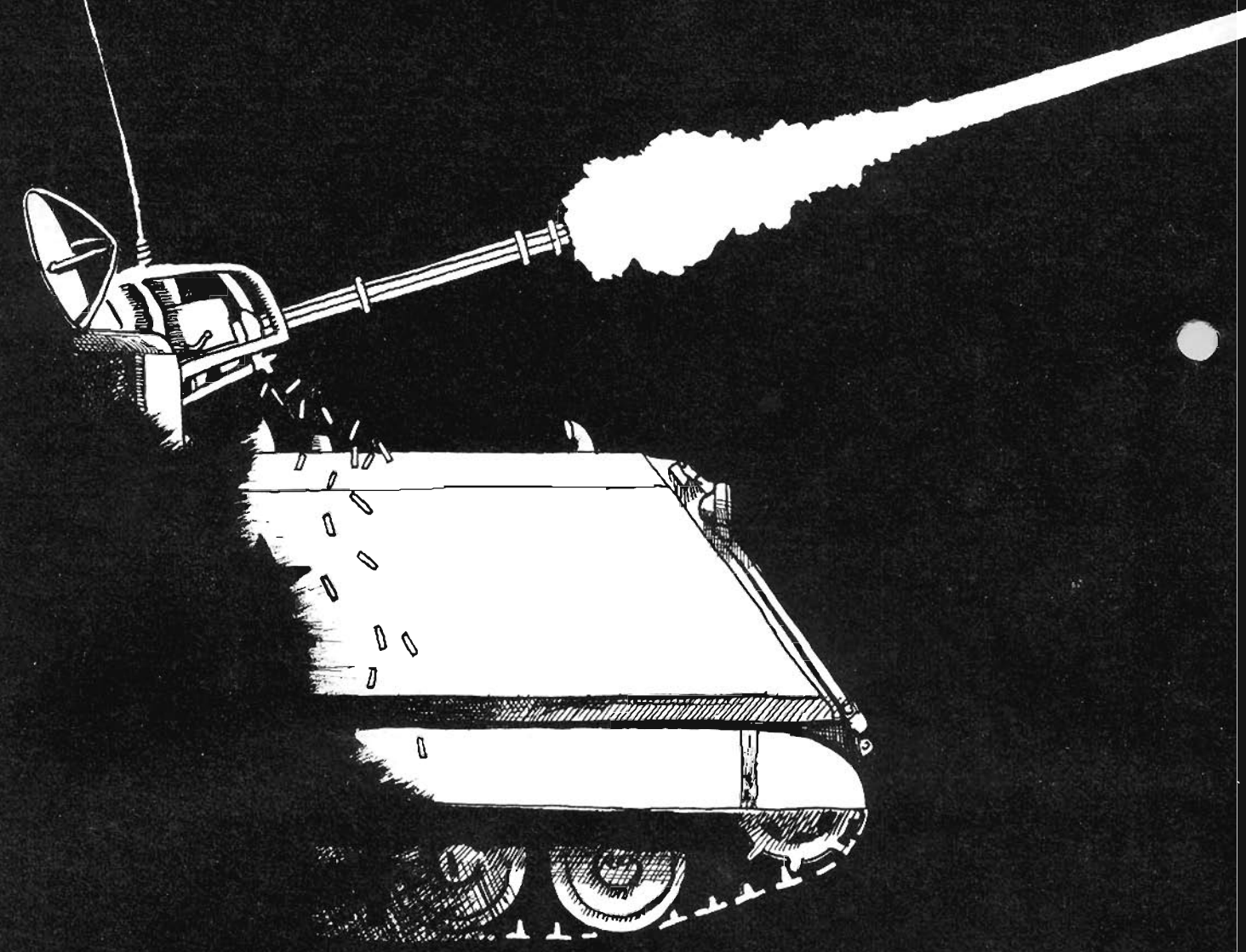
A number of factors impinge upon this problem that are not easily solved. First, airspace control is a sizable consideration even in a training exercise, and the proliferation of airborne exercise controllers and evaluators only complicates matters. Real-time event recording is also difficult when the matter of who killed whom first is a question of only seconds.

A new development which shows great promise in this area (i.e., that of playing attrition) is the use of laser transmitters and receivers that can be set up to indicate the results of a successfully simulated engagement. Such a system has long been needed for ADA.

In summary, there is a pressing demand for target systems and control devices that will assist commanders in conducting realistic and challenging training, whether it be in live-fire exercises or in maneuvers with the division. The time for the first realistic assessment of the crew's capability is not after a conflict begins. Realism in practice exercises using the tremendous ADA power will pay dividends in actual combat.

Colonel McCrea is Deputy Director of Studies and Concepts Department, Directorate of Combat Developments, US Army Air Defense School. He holds a Masters Degree in Nuclear Engineering and is a graduate of the Army War College. He has combat experience in both the Korean and Vietnam conflicts.

NIGHT



FIRING

OF HAWK AND VULCAN

Except for highly specialized small units, US Army elements have for many years shown considerable room for improvement in night operations. In the Pacific during World War II, and in Korea and Vietnam, the enemy was better able to operate in darkness than were US forces.

Modern enemy aircraft are capable of attacking ground forces at night, therefore, air defense unit commanders must direct commensurate attention to this aspect of battle. Until operating in darkness becomes natural to him, the soldier's effectiveness in combat is impaired. Before we are really combat ready, each air defenseman and his weapon must be as efficient at night as possible.

With this concept in mind, USAADS units are now conducting more nighttime firing of their air defense weapons. Recently, the 5th Battalion, 57th Air Defense Artillery, conducted its first tactical, night firing of the Hawk. Likewise, the 3d Battalion (C/V), 6th Air Defense Artillery, engaged in night firing of Vulcan. Reports of these exercises follow. The experiences described are offered as information to unit commanders who plan nighttime firing exercises. The units involved may be contacted for further details.

Hawk

Night firing of two Hawk missiles was conducted by B Battery, 5th Battalion, 57th ADA, to observe battery personnel in a night tactical engagement and to record the range at which the Hawk signature is visible at night.

The exercise was conducted essentially as a normal Hawk firing. The unit assumed battle stations at 2030, and the Firebee/Towbee was launched at 2100. The target made one calibration run and was fired upon during its second circuit. The first missile burst prematurely, apparently due to electrical power unit failure. The battery engaged and destroyed the second Firebee on its first inbound course.

Problems encountered and lessons learned.

- At night and in clear weather, the signature of the missile is clearly visible at the maximum engagement range. This signature could provide an enemy pilot ample warning of missile launch and allow time for him to turn (if necessary) and outrun the missile. Generally, if the enemy tactic is to try to outrun the missile after observing a launch, then Hawk engagements should be attempted at closer than maximum ranges.

• Information on the best range to fire Hawk at night is being determined. It will be provided in a classified document.

• From the tactical engagement standpoint, no significant problems could be attributed to employing Hawk at night. As was expected, crew drill was slower. The use of flashlights to set and check dial settings and to double-check crew performance for safety contributed to slower crew drill.

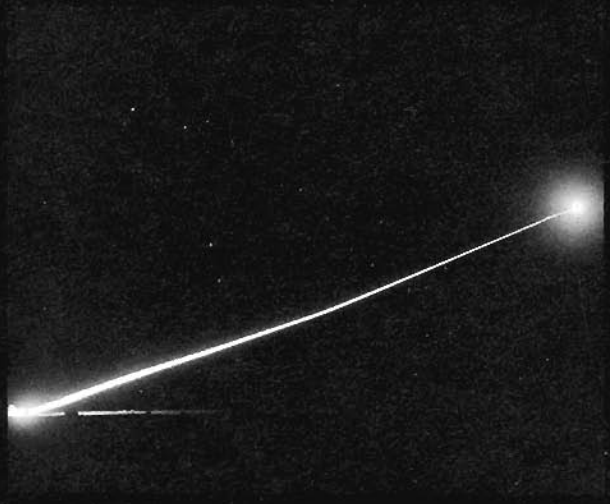
• From a system maintenance standpoint, it was learned that troubleshooting during darkness is easier using covered trouble lights or lamps rather than flashlights.

• Other difficulties encountered were primarily those associated with timing. Checkpoints had to be established and illuminated for rapid identification by aircraft.

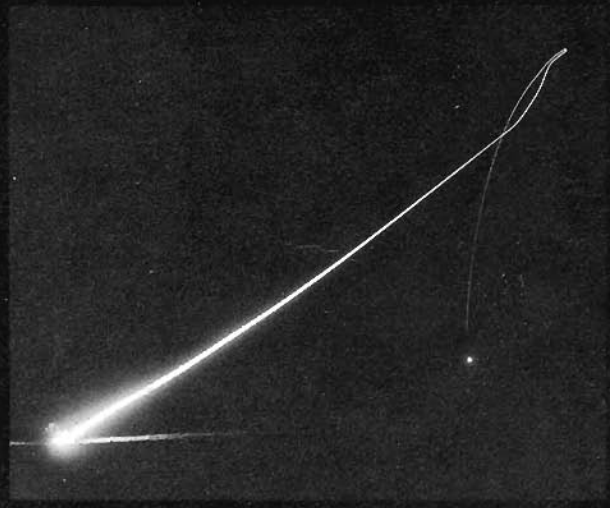
The battery commander and team chief conducted the engagement countdown in the battery control central. Rates of closure on the target were determined and aircraft safety corridors were established. Special identification, friend or foe, (radar) codes were used.

The mission was successfully accomplished. It provided the data necessary to make an initial determination on the visibility of a Hawk launched at night. In addition, it allowed a Hawk missile crew to conduct a night engagement and comment on problems encountered.

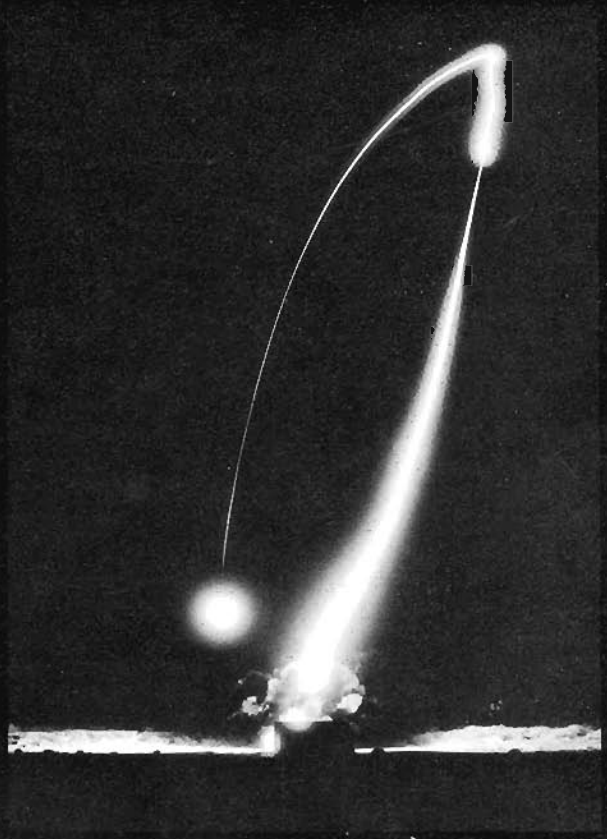
Following are scenes from different positions at various stages of the firing exercise.



Boost phase and burst of first missile, looking from the right side.



Complete trajectory of the second missile, viewed from the right side.



Trajectory of second missile recorded on infrared film. Shows relative IR signature of missile during launch, boost sustainer, and rocket-motor burnout.

Vulcan

To determine how well Vulcan and Chaparral gunners could perform at night, the men of the 3d Battalion (C/V), 6th ADA, recently conducted night-firing exercises with Vulcan and tracking exercises with Chaparral.

The battalion employed three self-propelled (SP) and three towed Vulcan systems, along with two Chaparral systems. Actual firing involved two SP and two towed Vulcan systems. It was a moonless night.

Objectives of the exercise were to:

- Determine the capabilities of Chaparral and Vulcan crews to engage during hours of darkness.
- Determine the most effective firing mode for the Vulcan.
- Determine the maximum and minimum requirements of target presentations for Chaparral and Vulcan gunners and crews to effectively engage.
- Identify safety requirements for night firings.

Six ballistic aerial target systems (BATS) and one radio-controlled aerial target (RCAT) were provided as targets. Various target speeds and trajectories were used. The manual, ground, and radar modes were tested with burst settings of 30, 60, and 100 rounds.

The tracking exercise for Chaparral included the use of trainer missiles with guidance sections attached. Targets (BATS) were fired at various angles with different charges. "Weapons Free" conditions were authorized during the hours of darkness.

All systems were prepared and emplaced on the firing line before darkness to preclude unnecessary movement. Flashlights were taped to the left and right firing limit stakes for each fire unit. Red lights and white lights were alternated to preclude confusion. Each system had a Range Safety Officer. Primary means of communications were TA 312's. Prearranged flashlight signals were used, in addition to TA 312's, to denote ready for action.

Problems encountered and lessons learned.

Vulcan —

- Loading of 600 rounds of the SP Vulcan ammunition took approximately 8 minutes. Firing effectiveness was initially poor but improved as the gunners became accustomed to the peculiarities of the targets and night-firing conditions.
- Units should not attempt to fire at BATS launched from a position 50 meters distant and at an angle of 30 degrees from the firing line with launch angles of 37 and 45 degrees. These conditions cause the target missile to fly too high and too close for Vulcan gunners to track.
- The RCAT was easily tracked prior to firing. However, once firing commenced, smooth tracking became a problem because tracer illumination made it difficult to accurately determine target position.
- Most gunners initially tracked the BATS exhaust cone. This was overcome by estimating the actual target position and tracking that same distance ahead of the exhaust cone.
- Tracer sensing from observers stationed down range assisted the gunners in making lead corrections for the next BATS presentation.
- Gunners firing at BATS had ample time to achieve two 60-round or two 30-round bursts. Only one complete 100-round burst could be achieved.
- The maximum time that Vulcan gunners had to acquire, track, and fire on the target was 10-12 seconds. The variance in time was due to different range safety limits assigned.
- Based on the characteristics of the two types of targets used and the range safety constraints, the gunners preferred the 60-round burst for the BATS (high speed) and the 30-round burst for the RCAT (low speed). The two BATS fired at 29° elevation were the most suitable.

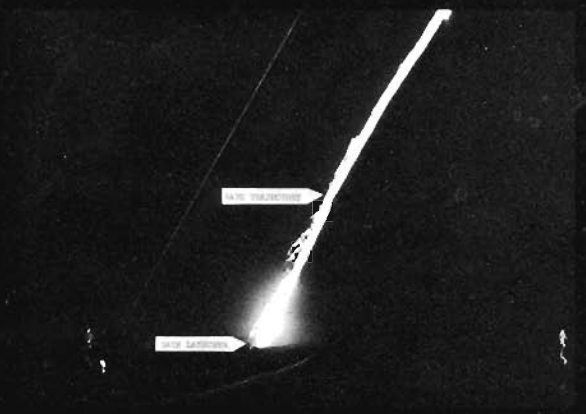
Chaparral —

- When tracking the BATS, all Chaparral crews achieved a missile tone within 10 seconds after launch. When tracking RCAT's, Chaparral gunners were able to receive IR tone on 2 out of 10 passes. Estimated altitude of the RCAT's was 200-250 meters. The BATS with the M2540 infrared POT gave the best missile tone.

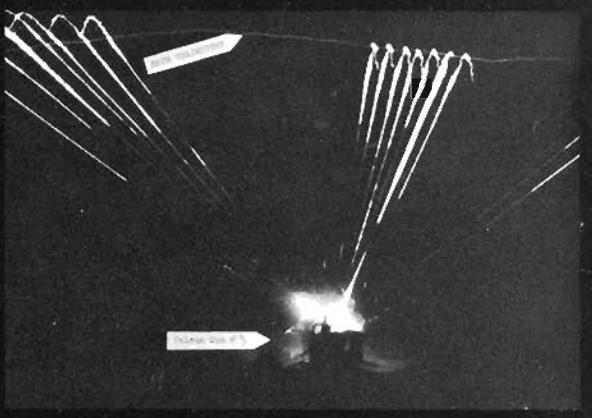
Following are some recommendations for units that will be conducting night firing exercises:

- All portions of crew drill, from emplacement to firing, should be practiced during darkness.
- Consider launching BATS from positions down range and on a course diagonally toward the firing line. This would provide training in engaging incoming targets.
- Use firing limits of at least 1,800 mils to enable a gunner to effectively use the radar mode for high-speed targets on a crossover trajectory. This, together with moving the BATS launch point down range (approximately 150 meters and from 35° to 40° from the firing line), would provide time to achieve acquisition time delay and fire at least two 60-round bursts.
- When more than one type of target is used, the RCAT should be launched first. Should malfunctions occur, the more reliable BATS could be launched while repairs are made on the RCAT. Thus, available green time would be used and waiting time for the crew would be reduced.

Following are pictures taken during the Vulcan firing exercise.

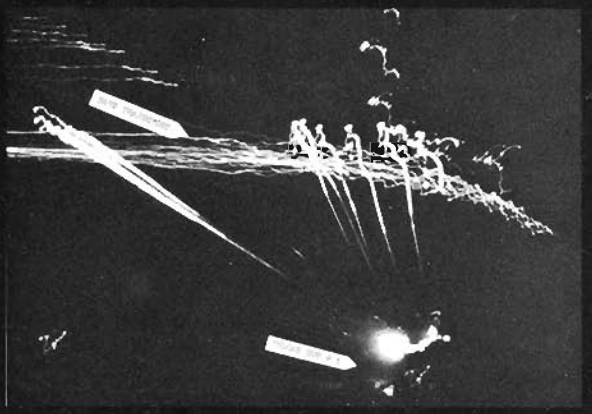


BATS launched at 45° with midsustainer and two boosters. Maximum altitude during flight — 522.3 meters. Average speed — 320.8 knots. Range — 3,363 meters with a time of flight of 22.5 seconds. ID sources — one MARK 28 and W112B infrared flare.

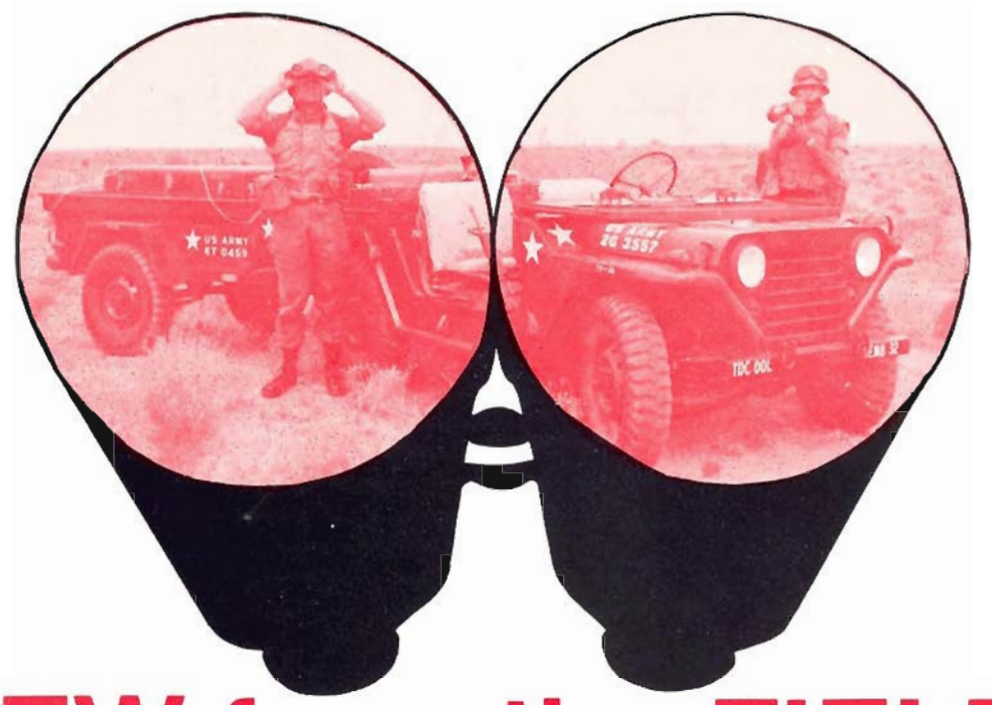


Towed Vulcan, with dual-wheeled conversion kit installed, firing two complete 60-round bursts and a partial burst at a BATS launched at 37°. BATS launched with a mid-sustainer and two boosters. Altitude of target is approximately 285 meters with an average speed of 324K. The IR sources on the target consist of an M2540 IR POT and a W112B infrared flare.

Towed Vulcan #5 firing a complete 100-round burst and Towed Vulcan #6 firing a partial 60-round burst at BATS launched at 29°. BATS launched with three boosters. Altitude of the target during firing is approximately 295 meters. Average speed — 401.2 knots. ID source — W112B infrared flare.



Towed Vulcan #6 firing two 60-round bursts at BATS launched at 37°. BATS launched with mid-sustainer and two boosters. Approximate altitude is 260 meters. Average velocity is 324 knots. ID sources consist of M2540 IR POT and W112B infrared flare.



VIEW from the FIELD

Comments from Colonel Bobbie J. Brashear, Commandant, 4/56th US Army Reserve School, Tulsa, Oklahoma.

The article "Redeye MOS Study" in the June issue of *Air Defense Trends* has brought to a focal point the one significant deficiency in the Redeye program.

The basic issue, as presented by Captain Childress, was perceived by myself and others who were involved in the early 1972 program which introduced Redeye into the Reserve Components. It was our judgment then, and mine now, that the ultimate success of Redeye and its successors must be insured by the personnel being integrated into the air defense career programs with a definite MOS series assigned.

So long as the present system of adding the R6 designator to a soldier's primary MOS is followed, we will continue to see our Redeye-trained personnel disappear into the career systems of their basic arm. Further, while in Redeye assignments, the personnel become automatic nominees for extra duties and details in the unit which degrade their proficiency through lack of time for training.

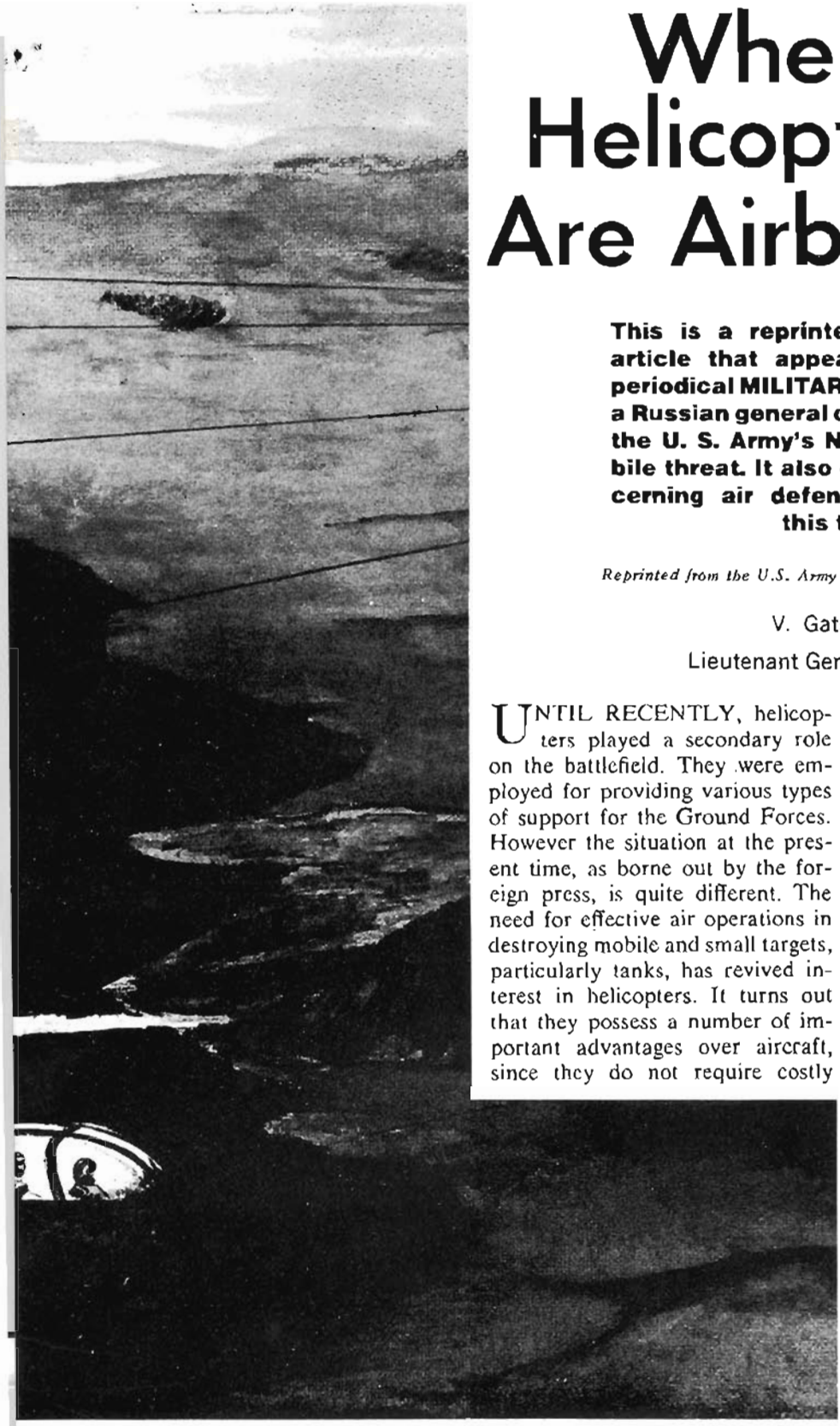
The current fixed allocation of Redeye personnel by unit TO presumes to a certain extent, that an equal requirement for low-altitude air defense will exist in all areas of a combat zone. To my knowledge, this has never occurred in any previous conflict where the enemy had a viable tactical air capability.

Our earlier "war-gaming" with Redeye envisioned the Redeye personnel as being Air Defense Branch and placed in direct support of units, much the same as conventional air defense support.

I have just concluded reading FORSCOM letter, dated 5 July 1974, subject: Training Guidelines, FY 1975, in which training shortcomings in both Active army and RC units are discussed. One such area is Redeye.

This writer was involved in the Counter-Mortar Radar (CMR) program in its early days. It took the Korean War to convince a lot of commanders that CMR had a job to perform that was vital to the overall mission. Similarly, I was involved in the defense of the old counter-fire platoon of the infantry regiment which was almost wiped out because of alleged ineffectiveness. This argument was squelched when it became apparent that the platoon leaders were kept busy as mess officers and any other additional duties they could find. The principal NCO personnel were likewise given other duties. As a consequence, the counter-fire platoons were not trained and were marginal to ineffective.

Let us hope it doesn't take a war to put Redeye into its proper total perspective.



When Helicopters Are Airborne

This is a reprinted translation of an article that appeared in the Russian periodical MILITARY HERALD. It reflects a Russian general officer's evaluation of the U. S. Army's NOE helicopter airmobile threat. It also covers thoughts concerning air defense tactics to offset this threat

Reprinted from the U.S. Army Aviation Digest, September 1974.

V. Gatsolayev
Lieutenant General of Artillery

UNTIL RECENTLY, helicopters played a secondary role on the battlefield. They were employed for providing various types of support for the Ground Forces. However the situation at the present time, as borne out by the foreign press, is quite different. The need for effective air operations in destroying mobile and small targets, particularly tanks, has revived interest in helicopters. It turns out that they possess a number of important advantages over aircraft, since they do not require costly airfields and they are able to change their flight altitude and speed very quickly and extensively. Moreover their high cargo carrying capability enables them to transport various types of guns, instruments and fire control equipment.

These and other factors serve to define the future for helicopters, which at the present time are serving as a powerful means for destroying various ground targets.

Helicopters at the present time constitute an absolute majority of all of the piloted aviation vehicles being employed for military purposes. Using data obtained from the foreign press, let us examine some of their tactical-technical characteristics.

The flight range for helicopters is 500-1,500 kilometers. In addition to maneuvering successfully above a battlefield and furnishing fire support for ground subunits, they can also conduct reconnaissance of an enemy's forces and communications, ferry in airborne

troops and diversionary-reconnaissance groups and carry out strikes against various targets in the immediate rear and [also those] located at a great depth from the front line. In particular, they are able to attack tactical airfields, command posts, troops on the march, crossings, bases and warehouses.

The flight speed of helicopters may change drastically from zero to 300 kilometers per hour and more. If in this sense we view a helicopter as a target for antiaircraft gunners, then its low speed, compared to that of an aircraft, is considered to be a shortcoming since it will remain longer in the zone of fire of air defense weapons than, for example, a fighter-bomber. In addition, the accuracy of the antiaircraft gunners will increase under such conditions. With regard to the effective carrying out of combat and particularly gunnery tasks, these vehicles also possess certain positive qualities: comparatively low speeds, the ability to hover while aiming and firing at small mobile targets, etc.

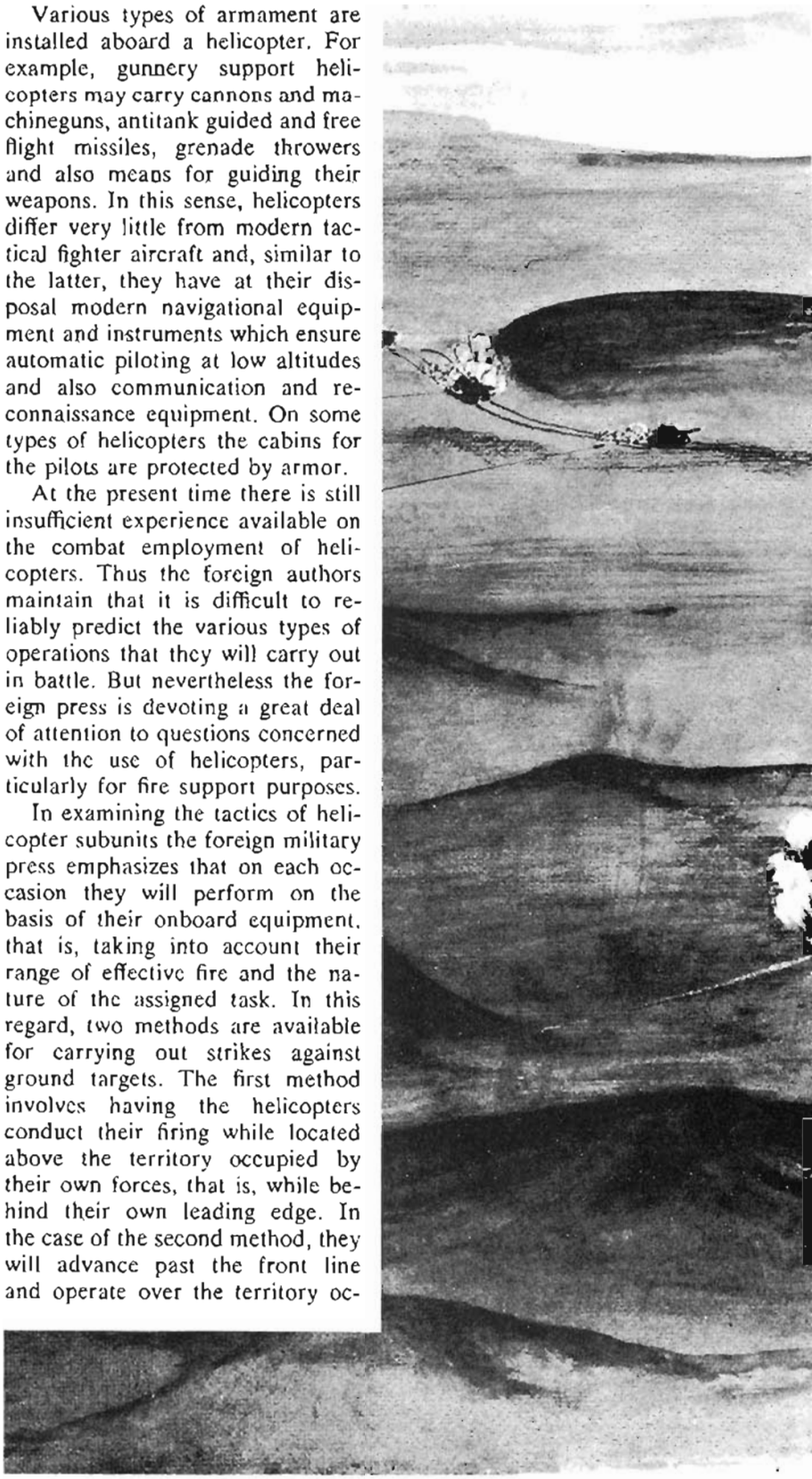
An important combat characteristic of helicopters is their rate of climb—8-18 meters per second. This means that within a matter of just several seconds a helicopter can surprise an enemy by suddenly taking off from a shelter and rising to an altitude that will enable it to observe the battlefield, select a target, destroy it and thereafter depart the area of shelling.

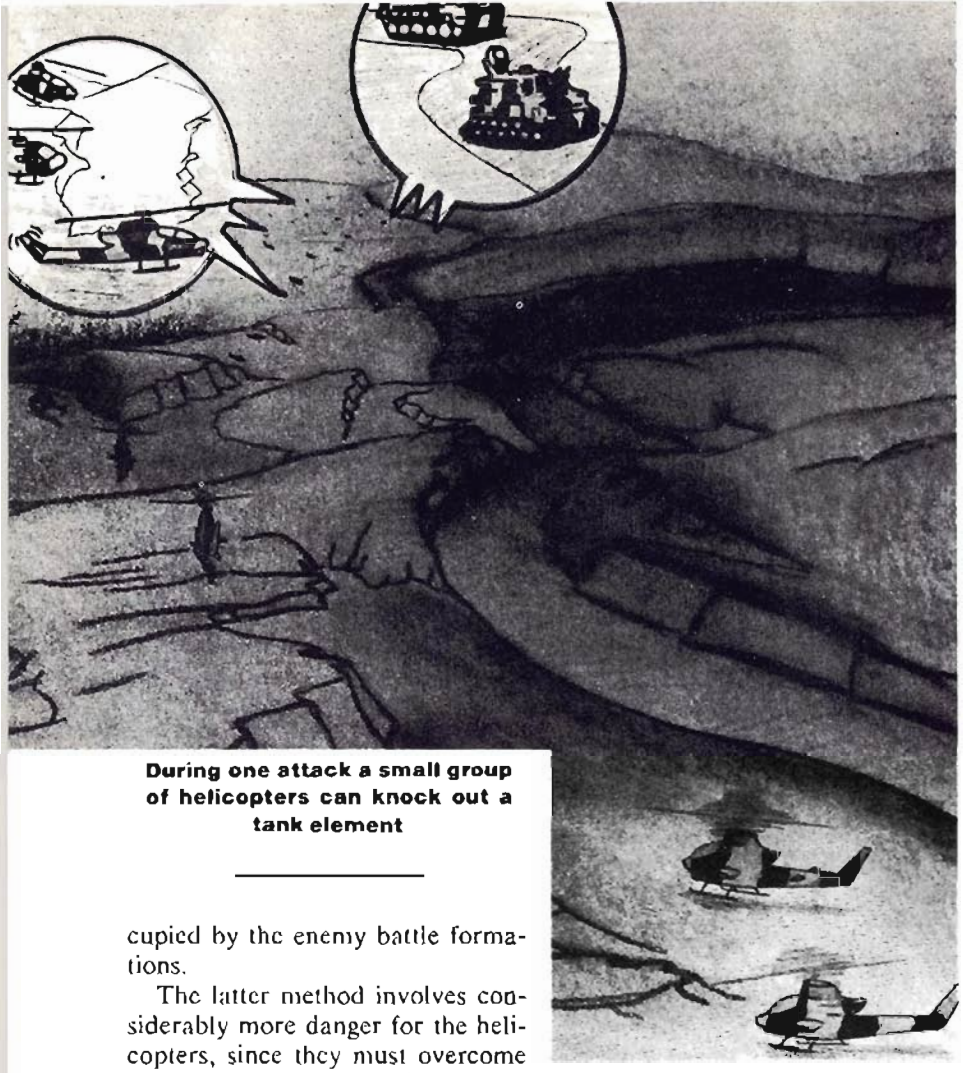
The practical ceiling of helicopters is 3,000-5,000 meters. But their maximum altitudes, as borne out by the foreign press, are rarely used, since their flight safety is related more to low altitudes where they are more difficult to detect by means of radar. Helicopters are able to approach the line at which they are to carry out a gunnery task in a secretive manner, taking advantage of the folds in the terrain.

Various types of armament are installed aboard a helicopter. For example, gunnery support helicopters may carry cannons and machineguns, antitank guided and free flight missiles, grenade throwers and also means for guiding their weapons. In this sense, helicopters differ very little from modern tactical fighter aircraft and, similar to the latter, they have at their disposal modern navigational equipment and instruments which ensure automatic piloting at low altitudes and also communication and reconnaissance equipment. On some types of helicopters the cabins for the pilots are protected by armor.

At the present time there is still insufficient experience available on the combat employment of helicopters. Thus the foreign authors maintain that it is difficult to reliably predict the various types of operations that they will carry out in battle. But nevertheless the foreign press is devoting a great deal of attention to questions concerned with the use of helicopters, particularly for fire support purposes.

In examining the tactics of helicopter subunits the foreign military press emphasizes that on each occasion they will perform on the basis of their onboard equipment, that is, taking into account their range of effective fire and the nature of the assigned task. In this regard, two methods are available for carrying out strikes against ground targets. The first method involves having the helicopters conduct their firing while located above the territory occupied by their own forces, that is, while behind their own leading edge. In the case of the second method, they will advance past the front line and operate over the territory oc-





During one attack a small group of helicopters can knock out a tank element

cupied by the enemy battle formations.

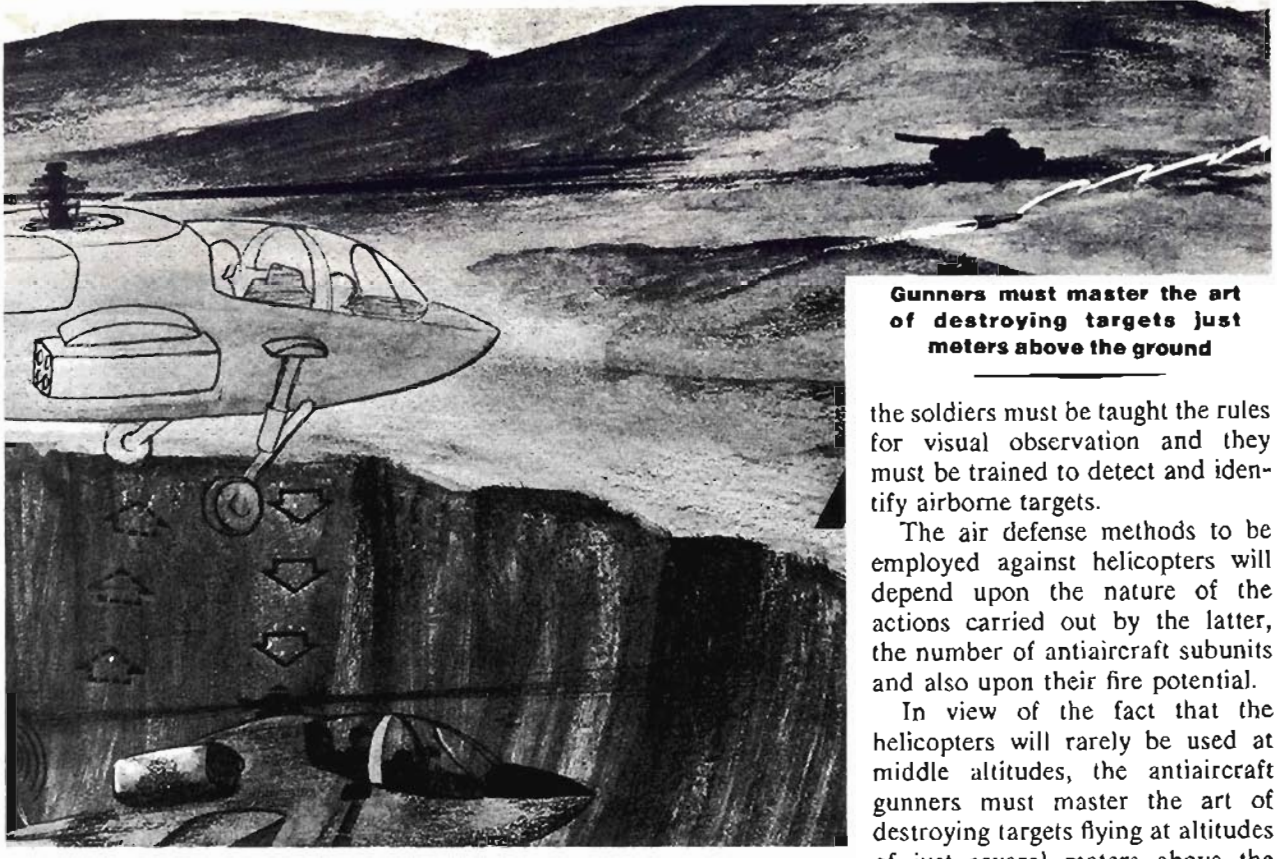
The latter method involves considerably more danger for the helicopters, since they must overcome the zone of fire of air defense weapons. Thus, when planning an operation in which helicopters are required to penetrate a territory occupied by the enemy for the purpose of conducting reconnaissance, ferrying in airborne forces or diversionary-reconnaissance groups or carrying out strikes against targets in the enemy's rear, full consideration must be given to the nature of the PVO [air defense] forces and the opportunities available for neutralizing them. Certainly, the foreign authors maintain that when deciding upon the flight sectors for helicopter subunits a preference should be shown for those sectors in which the PVO forces are weak and where conditions favor concealed flight operations at a low altitude.

What actions will be carried out by helicopters located above the territory occupied by their own forces? The foreign military specialists believe that under such conditions the firing will be conducted against various targets and particularly against the enemy tanks attacking along the leading edge of defense. Towards this end the helicopters will approach the line of contact between their own forces and the enemy and remained concealed behind natural or specially installed screens. At the moment of the attack, the crews, acting upon a signal issued by the combined-arms commander, will go aloft in their helicopters, approach the planned firing lines at a low altitude, occupy an advantageous position for firing and carry out their strike. It is obvious that the line for the timely landing of the helicopters (starting line) will be located at a distance from the leading edge such that losses caused by the artillery fire of the attacking enemy will be minimal and the firing line will be located where there are fewer antiaircraft weapons and where, prior to ascending for the purpose of firing, the helicopters will be able to conceal themselves behind local objects and conduct observation of the enemy actions.

Certainly, the foreign press has stated that the tactics of such mobile subunits as helicopter elements must be distinguished by special flexibility. For example, in order to force an enemy into dispersing the fire from his antiaircraft weapons, the helicopters may appear on a mass basis from various directions and carry out strikes both along the front and on the flanks. Nor can one exclude the possibility of a large number of helicopters being employed in the form of small groups.

In examining the possible actions that can be carried out by helicopters, the authors of the articles which appeared in the foreign military journals devoted a great amount of attention to their use in combating leading detachments and enemy advance guards. They maintain that fire support helicopter subunits can prevent the latter from carrying out their assigned tasks and in this manner they can sharply reduce the tempo of the offensive. This is particularly important during those instances when it is impossible to delay the advance of a strong enemy forward detachment through maneuvers being carried out by ground subunits.

Naturally, the point is emphasized in the articles that fire support helicopters must carry out a strike against a forward detachment prior to the latter being able to carry out its assigned task. In order to accomplish this, the direction of [helicopter] movement should be reconnoitered in advance . . . After



Gunners must master the art of destroying targets just meters above the ground

having selected an area in which maneuvering will be very difficult and also the organization of an effective air defense and deployment of tanks and other vehicles, a surprise strike should be carried out against the forward detachment.

It is by no means easy to repel such an airborne attack since helicopters can operate, as mentioned above, at low altitudes (down to 10 meters) and they are located in the zone of fire of antiaircraft gunners for 25-35 seconds in all, that is, for as long as is necessary to guide an antitank guided missile to its target. During this period of time the air defense subunit must detect the helicopter, turn its gun (launcher) in the direction of the target, lock onto it and remain prepared to fire as many projectiles as possible. Hence, every attempt must be made to reduce the amount of time required to detect the target and to make the required preparations for firing. In order to accomplish this, improvements must be realized in the system employed by platoons and batteries for reconnoitering an airborne enemy. In addition to a reconnaissance scout at a battery or platoon command post, all personnel must concern themselves with visually searching for the helicopters. Upon occupying a gun (launch) position, each gun crew must determine the sectors of observation, particularly in the direction of the front and flanks, where for the launch range of antitank guided missiles there are natural screens of the type usually employed by helicopters for concealment purposes.

The operators of radar sets, upon proceeding to reconnoiter the airborne targets, must first of all study well the locations and the nature of the signals being received from local objects, such that at any moment they will be able to distinguish their blips from those representing the airborne target flying at a low altitude. Naturally the officers, sergeants and soldiers must know the silhouettes of the fire support helicopters and possess the skill required to identify them in a rapid manner. Thus during specialized training exercises and drills the soldiers must be taught the rules for visual observation and they must be trained to detect and identify airborne targets.

The air defense methods to be employed against helicopters will depend upon the nature of the actions carried out by the latter, the number of antiaircraft subunits and also upon their fire potential.

In view of the fact that the helicopters will rarely be used at middle altitudes, the antiaircraft gunners must master the art of destroying targets flying at altitudes of just several meters above the ground. Here a considerable amount of importance is attached to anticipating the course to be followed by the helicopters and the targets of their strikes. If it is determined that the deployment of the antiaircraft subunits is not in keeping with the interests of air defense, then the deployment should be changed to ensure that the helicopters will appear within the range of effective fire of the PVO weapons.

Here a very important role will be played by antiaircraft ambushes, wherein a portion of the guns and launchers will be carefully concealed in the immediate vicinity of the anticipated helicopter course. Naturally one acquires the ability to predict the development of events only by persistently studying the tactics of helicopter subunits.

A very complicated task is that of combating helicopters which are firing antitank guided missiles while located above their own territory. In order to reduce to the maximum possible degree the time which elapses between detecting an airborne target and opening fire

against it, it is recommended that, once a position has been occupied, each gun or launcher be assigned a principal axis for firing in a manner such that it will divide the observation sector into two equal parts and pass through the point of probable appearance of the helicopter. After receiving his task the gun commander must determine the azimuth, the angle of sight of this point and the corresponding settings for the sight. In such a case the natural screens that could be used by the helicopters for concealment purposes, will be kept under constant observation.

During an attack against an enemy's leading edge of defense the constant support antiaircraft subunits must follow directly after the battle line of tanks and remain ready to immediately open fire against the helicopters and their commanders must be familiar with the direction of constant observation, that is, that local object where the airborne enemy may possibly appear.

When planning a change of position for antiaircraft subunits which usually fire from stationary positions, one should bear in mind that they should be "brought up" in a manner such that, during the period of artillery preparation, they change their positions and remain as close as possible to the line from which the helicopters are most apt to open fire with antitank guided missiles. Certainly, the routes for such movements and the gun positions must be located beyond the zone of fire of the enemy's direct firing weapons. In order to ensure that the degree of readiness of the antiaircraft subunits is not lowered too drastically, the movement to the new positions should in some cases be carried out on a gun-to-gun basis.

When organizing an air defense system for motorized rifle, tank and artillery subunits, it should be borne in mind that a small group of helicopters is capable, during just one attack, of knocking a tank element out of action and even a forward detachment. Thus, in the interest of protecting the latter, one should assign highly mobile antiaircraft subunits that are capable of firing at airborne targets while moving or during very brief halts. In the process the antiaircraft units should ideally be distributed in a manner such that a portion of them are located at the head and the remaining portion in the middle of the column.

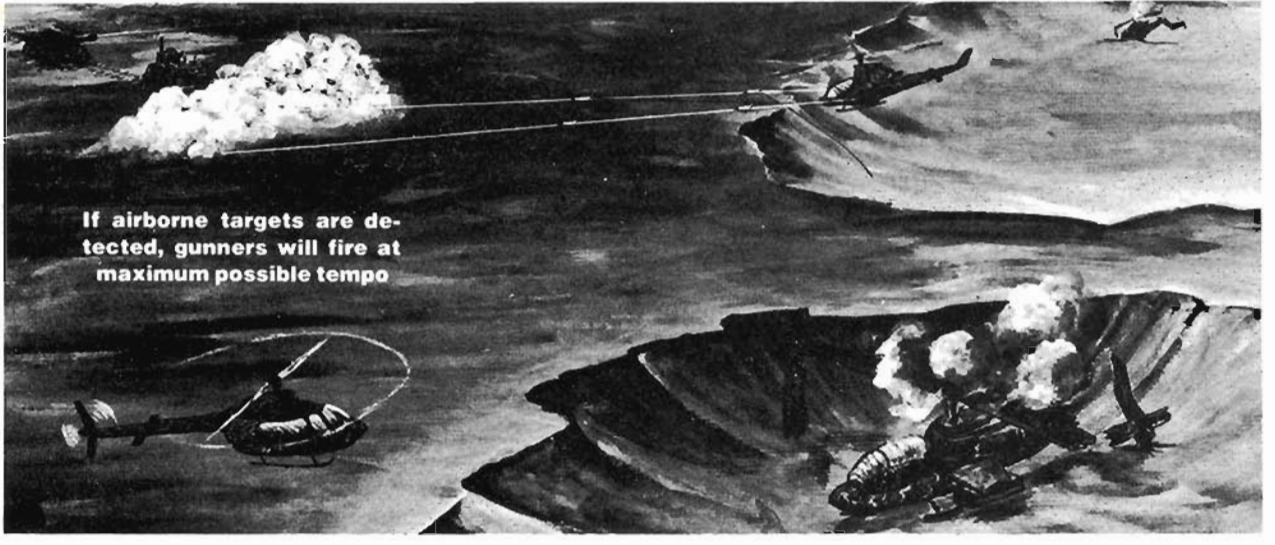
The distances between the antiaircraft units and other vehicles must not be less than 50 meters. This ensures freedom of action for the antiaircraft personnel when firing at low-flying targets. The right to open fire against the helicopters belongs to the commander of a unit. Thus he is responsible for the timely detection and identification of the airborne enemy. In this regard he must assign the march task in an efficient manner and indicate the sector for observation and firing relative to the column's movement (to the right, to the left, forward, backwards). In this manner he will be able to organize correctly a search for the targets and display initiative during a complicated situation.

When protected forces are required to transit narrow areas along a route (bridges, defiles, crossings, etc.), all units must remain in readiness to immediately open fire in their sectors and their commanders must maintain constant observation of the airspace.

If airborne targets are detected (helicopters), the antiaircraft gunners will fire at their maximum possible tempo. Interludes in the firing will be tolerated only in those instances where the gunners have lost their targets and such interludes will then be used for introducing firing corrections.

The same holds true for the missile personnel. During the period that a helicopter is searching for its target on a battlefield and aiming its antitank guided missiles, the missile personnel will be able to launch from one to several missiles. When the probability of destruction of a helicopter with just one missile is low, the subunits, depending upon the situation, may simultaneously launch several missiles without waiting upon the results of the first launches. This is particularly important in those instances where the airborne targets are operating at low altitudes and a complicated radio jamming situation has developed. Where favorable firing conditions are available and also in those instances where a need exists for simultaneously shell-

Fire support helicopters can sharply reduce the tempo of enemy advance detachments


If airborne targets are detected, gunners will fire at maximum possible tempo

ing several helicopters, each target should be destroyed using one missile.

It should be borne in mind that helicopters can operate simultaneously with tactical aviation and carry out strikes "on the sly" against troops and antiaircraft subunits, immobilized by firing at aircraft. Thus during all battles against tactical aviation, one must always anticipate the possibility of having to transfer the fire of a portion of the units (guns) against helicopters. This task should be assigned to the best trained crews.

A brief signal ("above the first helicopter") should be established for shifting fire. In response to this signal the designated units (guns) will commence independently to carry out the combat task. The shifting of fire from aircraft to helicopters up until the end of the firing (with the exception of cases involving self-defense) is hardly advisable.

Tank antiaircraft machineguns and also rifle weapons can be employed effectively against helicopters. Certainly, it will be difficult for the crews of tanks that are constantly engaged in battle against ground forces to detect a helicopter in a timely manner and yet they are obligated to maintain aerial observation.

The waging of battle against an airborne enemy requires that the antiaircraft gunners display a high degree of combat expertise and the ability to employ their weapons with the maximum degree of effectiveness. The knowledge and skills required for combating helicopters are usually acquired during the course of exercises, drills and firing practice. Thus conditions must be created during these exercises and drills that will enable the personnel to master the means and methods to be employed when firing against such targets. Firing against helicopters must occupy an important place among the combat and training gunnery tasks usually carried out by antiaircraft gunners, tank personnel and motorized riflemen.

The personnel must be taught to fire against such targets both while stationary and while moving and they must devote particular attention to questions concerned with target detection and identification, target acquisition, rotating a gun (unit) 90 and 360 degrees, loading, locking-on the target and commencement, conduct and termination of firing. Particular importance is attached to evaluating the speed and accuracy with which these operations are carried out and ensuring that a reduction occurs in the amount of time required to do so. The effectiveness of firing should be evaluated not on the basis of grouping the traces to the target, but rather according to the number of direct hits, that is, a positive grade is assigned only if bullet holes are observed.

Naturally, in order to work out questions concerned with firing at helicopters and carrying out field firing against them, an appropriate training equipment base must be created. The units have accumulated a considerable amount of experience in this regard. At some antiaircraft polygons, in the regions of moving target gunnery ranges for ground targets, some rather simple devices have been prepared for raising targets which, in terms of their configurations and dimensions, correspond with the silhouettes of helicopters. The firing at such targets is not as simple as it might seem at first glance. The principal difficulty is that very little time is available for carrying out the gunnery task—only as much as would be available in actual battle. Only well trained subunits can successfully overcome this difficulty. Obviously, firing against helicopters will in the future become a component part of a multitheme gunnery task. Hence, in order to achieve success during such firing, the personnel of antiaircraft subunits must master all firing methods, to include those used against both aircraft and helicopters. In order to accomplish this, the exercises and drills should involve the participation not only of "enemy" fighter-bombers but also helicopters.

The problem of combating helicopters has many facets and problems that are still awaiting solutions. It is to be hoped that the discussion raised on these pages will be continued in subsequent issues of the journal.

In this installment we see an account of air defense action during Eastern Mediterranean operations (1940-41), describing the defeats suffered by England because of inadequate air defense assets.

On 10 June 1940, Italy entered World War II as an Axis partner of Germany. On 14 September 1940, Italian forces from Libya invaded Egypt; on 28 October, Italian forces from Albania invaded Greece and British forces occupied the island of Crete; the British reacted to the Italian invasion of Egypt and the battle of Libya began. By 11 December 1940, the British had retaken Sidi Barrani and, on 15 December, moved into Libya. By early February 1941, the British held most of Libya and the Italians had retired.

After the defeat of the Italians in Libya became apparent, the British prepared for the invasion of other lands, principally Greece. For this purpose, they withdrew part of the ground forces in Libya and all of the RAF fighters that could be spared. The remaining British forces were seriously weakened. These actions set the stage for four important battles: Libya, Greece, Crete, and the siege of Tobruk.

Libya

The Germans launched an unexpected offensive against the seriously weakened British forces on 12 February 1941, and on the 24th the first clash between German and British armor occurred. The German drive pushed the British forces back into Egypt; Rommel almost reached Alexandria before he was stopped. The British left a garrison in the fortress of Tobruk, which was promptly invested by the Germans.

Until the end of October 1940, the only heavy antiaircraft artillery in the western desert had been a battery of AA guns at Mersa Matruh. Light antiaircraft weapons consisted only of light AA machineguns. Thereafter, the antiaircraft forces were gradually built up. Before the British retreat to Tobruk, five 75-mm Italian guns and sixteen 3.7-inch, twenty 40-mm, forty-four 20-mm, and one 37-mm British guns along with ten searchlights were with the British forces. One fighter squadron covered Benghasi and the forward area and another covered Tobruk.

The result of German air superiority, coupled with the British lack of adequate fighter antiaircraft defenses, was decisive and drastic. By the third week of February 1941, Benghasi as a port became useless to the British. In the face of repeated German air attacks, the long British lines of communication were hopeless, and adequate supplies could not be brought up to the field forces. The German dive bomber/tank attack team was highly developed and closely coordinated, with the result that the British could not operate and had to retreat. The lack of adequate fighter aircraft and antiaircraft defense gave the German Air Force unquestioned control of the air and made the defeat of the British inevitable.

Greece

After the easy conquest of Italian-held Libya, the British moved into Greece to drive out the Italian forces. As in Libya, the Germans interceded and invaded Greece on 6 April. The British lines of communication in the Greece action were some 300 miles long. The disparity between numbers of German and British aircraft was greater than in Libya. Some 80 British aircraft were pitted against roughly 800 German and 210 Italian aircraft. The British ground forces were protected by one AA gun and two automatic weapons batteries, while one AA gun and two automatic weapons batteries were providing airfield defense.

The enemy air action which began immediately was directed first against ports, quays, and sea communications. After gaining air superiority, it was directed against motor transport parks, petrol dumps, supply dumps, and the interdiction of lines of communication. Night movement and operations by the British became imperative.

The RAF suffered heavy casualities and was unable to contribute to the existing meager air defense. On 15 April 1941, 14 Hurricanes and all of

its 16 Blenheims were destroyed by the Luftwaffe. The local early warning (Greek) proved ineffective, and the only radar, a gun-laying radar, also was ineffective due to heavy iron deposits in nearby mountains. By 20 April, British evacuation of Greece became necessary.

Four AA guns were sent back to cover the vital bridge over the canal at Corinth, and 12 automatic weapons were sent to the Argos airdrome to protect the remaining Hurricanes. The planes, however, landed on the wrong field and, on the 23d, were destroyed by the Luftwaffe. On the 26th, the only bridge on the escape route was attacked by some 20 to 30 Ju-87's and 80 to 100 Me-110's. The attack lasted about 30 minutes and the antiaircraft defenses were silenced. The German Air Force, already vastly superior in numbers, systematically gained air superiority by crippling lines of communications and destroying RAF fighters. Once air superiority was gained, the British antiaircraft defenses were utterly inadequate even to deter the German air offensive.

Crete

In the case of Crete, the antiaircraft defense was different. It was obvious that if Greece should fall, the British base on Crete would be within easy bombing range. The accepted requirements for Crete, under the operations planned, were 56 AA guns, 48 automatic weapons, and 72 searchlights. Actually, at the time of the evacuation from Greece, there were only 16 AA guns, 36 automatic weapons, and 24 searchlights on Crete. Hastily, sixteen 3-inch AA fixed guns were added. These weapons had to be divided among three harbors and two airfields. The majority of the AA guns, and all of the searchlights, were concentrated for the defense of the Suda Bay area.

Reliance for early warning again rested on the existing Greek system and one GL radar, and again it failed. The enemy air offensive against Crete started on 14 May, aimed mainly at the British antiaircraft positions and RAF fighter aircraft. By 19 May, the RAF in Crete had been reduced to four Hurricanes and three Gladiators, essentially a complete lack of fighter forces, and the entire air defense responsibility fell upon the antiaircraft.

Shipping losses and disruption of supplies at Suda Bay were heavy, and resort was made to an antiaircraft umbrella barrage over the harbor and the limiting of ships in the harbor to two at any particular time. Thereafter, German dive bomber attacks on the harbor failed to achieve any measure of success. The main German assault upon Crete began at 0700 on 20 May, with a heavy air attack upon the Suda Bay-Maleme airport area and Heraklion airfield, primarily against antiaircraft positions, rendering the antiaircraft defenses ineffective. With German paratroop forces on Maleme, loss of that airfield was decisive. The Germans used it to build up their forces on the ground and quickly forced the evacuation of Crete.

In all three of these campaigns — Libya, Greece, and Crete — the Germans had first gained air superiority and, thereafter, utilized their air forces as harassing and antiaircraft-neutralizing forces with decisive results. In each case, the British had entered or been forced into the action with insufficient aircraft for continued operation and inadequate antiaircraft defenses. The disparity of forces, in both areas, was so great that technological differences and tactics produced no major effect upon the outcome. The British were overwhelmed by force of numbers alone. In the case of Libya, the offensive dive bomber/tank attack team, working under a condition of German air superiority, as well as very efficient and close coordination, quickly and decisively defeated (almost annihilated) the British forces.

Tobruk

The Libyan campaign set up an operation wherein technological advances and tactical differences did produce a decisive effect. The British, when they retreated to the east, left a garrison force at Tobruk which promptly was invested by the Germans: this was the beginning of "the siege of Tobruk." In addition to certain ground troops for perimeter defense, the British had four Italian 102-mm AA guns, twenty-four 3.7-inch guns, eighteen 40-mm Bofors, forty-two Bredas (captured Italian 20-mm automatic weapons), and ten searchlights.

The air defense was divided into two areas, the harbor and the field artillery areas around the perimeter defense. Early warning consisted of a GCI radar and two GL-2 radars. Both GL's were modified to feed data to directors, but only one director had been modified to receive the data. Dive bombers prevented the daytime use of the GL (which had limited elevation coverage), so the GL's were used mainly to control predicted barrages. At night, two mobile 3.7-inch AA guns were moved into position by the one director that could receive the GL data, to permit normal unseen target action.

Perimeter defenses were provided by three 40-mm Bofors and thirty-two Bredas. Positions were prepared so that mobile 3.7-inch AA guns could be moved ito the perimeter defense if needed. With this general disposition, the siege of Tobruk began, continuing until November 1941.

The defense of Tobruk is the story of the defeat of the German dive bomber and the nullification of the high-level bombing attacks. The antiaircraft defenses were almost as inadequate as were those

in Greece and at Suda Bay; however, the results were different. The Germans started their dive-bombing attacks on 11 April, and by 30 April, a total of 21 dive-bombing attacks had been launched against shipping in the harbor and antiaircraft units.

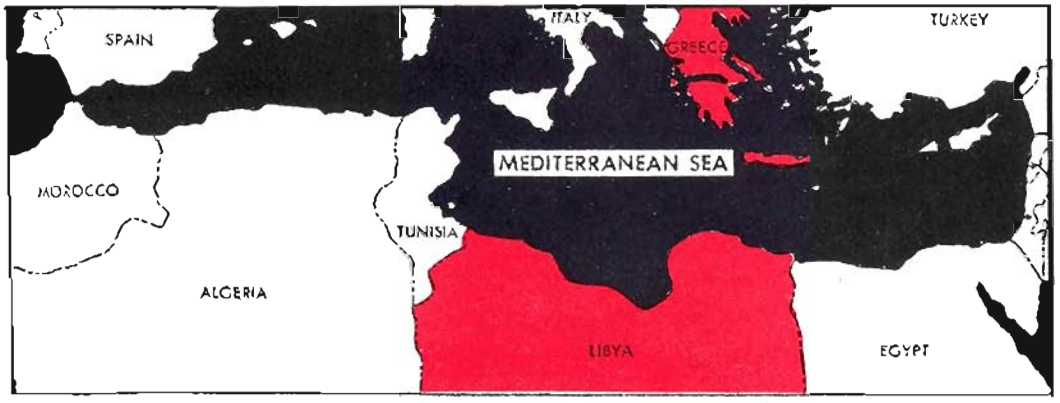
Immediate tactical measures were taken in the form of a standing barrage over the harbor. When the dive bombers started diving under or around it, provision was made to swing the barrage back and forth across the harbor to make the edges of the barrage indeterminate. Coupled with visual control of the barrage and direct observation of the attacking Stukas, the barrage could be and was moved to follow the attack if directed at some other area.

Twelve 40-mm automatic weapons were deployed around the harbor. When dive-bombing attacks started, the weapons nearest the attack would open fire at maximum range to put up a wall of fire through which the planes had to fly. The weapons on the opposite side of the harbor opened fire at maximum range, using fire control directors to increase the chances of kill. The Germans soon became discouraged and started to attack antiaircraft positions from several directions simultaneously. Thus was born what came to be known as the porcupine defense. The 40-mm weapons normally faced out from the vital area to engage attacks from those directions. The Breda 20-mm weapons all faced the center of the defended area to engage planes coming through the defenses. Antiaircraft gun batteries engaged targets with only three guns; the fourth gun remained ready to engage attackers with fuses precut to 2 seconds. In addition, all positions were well dug in so as to survive 1,000-pound bomb hits within 10 yards. By August, dive bombing began to taper off due to high losses. High-altitude bombing had been increased by July.

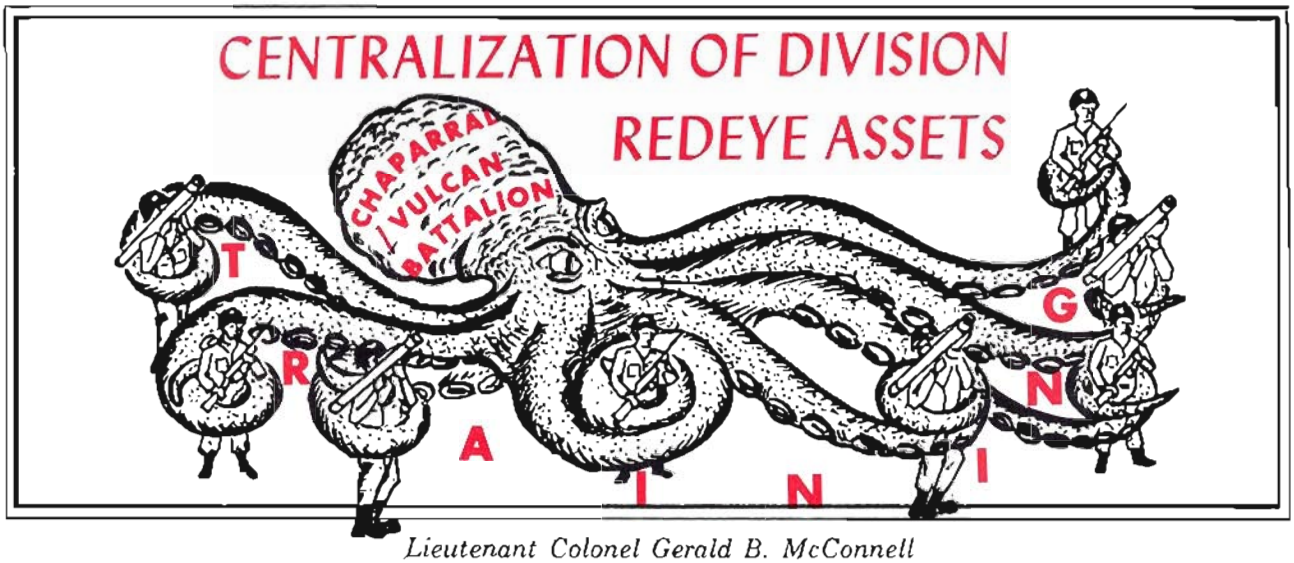
High-altitude attacks were from 18,000 to 25,000 feet. The combination of bright sunlight and desert haze made optical tracking very difficult, but it was no obstacle to the bombers whose crews had clear vision looking downward. As a result, the AA guns were forced into the use of controlled and predicted barrages. By the end of October, even the high-altitude attacks dwindled to the extent that small ships could be unloaded during daylight hours.

From April until November 1941, when the British linked up with Tobruk, antiaircraft engaged 4,105 aircraft, with 374 destroyed, probably destroyed, and damaged. Although the score is not impressive, testimony to the defense is the fact that the British stayed at Tobruk and the harbor remained in operation.

German air superiority and a weak Allied air defense spelled disaster for the British in Lybia, Greece, and Crete.



CENTRALIZATION OF DIVISION REDEYE ASSETS



Lieutenant Colonel Gerald B. McConnell

It was recently reported that Redeye assets of the 82d Airborne Division had been centralized for training, deployment, and command and control under the 3d Battalion, 4th Air Defense Artillery, 82d Airborne Division. The following article by LTC Gerald McConnell, Commanding Officer, 3d Bn, 4th ADA, 82d Airborne Division, describes how the centralization is accomplished and how this method facilitates ADA support for division assets. This article describes the experience of one organization.

The varied and unique missions of the 82d were the main impetus to centralize all division Redeye assets under the ADA battalion. Under the centralized concept, the battalion is composed of a headquarters and headquarters battery, 4 towed Vulcan batteries, and 54 Redeye teams. To support the division in a tactical situation, the air defense assets are normally assigned the following missions:

- A, B, and C batteries, each with 12 Vulcan squads/fire units and 15 Redeye teams, normally support the 1st, 2d, and 3d brigades respectively. Twelve of the 15 Redeye teams are provided to the brigade's infantry battalions while the remaining 3 Redeye teams are used to support each brigade's direct support artillery battalion.
- D battery, normally assigned a general support mission, has 12 Vulcan squads/fire units and 9 Redeye teams. The Redeye teams are used to support the armored cavalry squadron and the armor battalion.

Under the foregoing organization, the division ADA battalion commander assumes the responsibility for training, maintenance, and command and control of all Redeye assets. Field exercises and training tests have shown that the total air defense support is more cohesive and responsive under the centralized method than when two different units (e.g., ADA Bn and Infantry Bn) are controlling Vulcan and Redeye assets.

The centralization of Redeye assets has provided the following advantages:

- Adequate training time and priority are given to training Redeye personnel and maintaining proficiency.
- Allows the maneuver battalion commander to concentrate on the ground aspects of his battalion mission.
- Provides for a more flexible use of ADA assets and insures unity of command when employed to defend division assets.

The disadvantages are in the maintenance and personnel areas. The addition of 68 ¼-ton Redeye vehicles to the numerous wheeled vehicles found in a towed Vulcan battalion greatly increases the ADA Battalion's maintenance requirements. In addition, the inclusion of Redeye personnel into the battalion has increased administrative requirements. However, neither the maintenance nor administrative problems are insurmountable.

The consensus of the maneuver battalion commanders is that the centralized concept is providing them with better-qualified Redeye sections and is relieving them of a training responsibility for which they possess little expertise. During the approximately 2 years that the organization has been in effect, evaluations, to include visual aircraft recognition testing, show that the Redeye sections are better prepared to accomplish their AD mission, and that command and control from the air defense battalion substantially increased the effectiveness of the Redeye weapon system to support the 82d Airborne Division. This positive method of control exercised by the air defense batteries over Redeye, as well as the Vulcan system, makes air defense artillery more responsive and flexible to the many tactical situations the 82d Airborne Division may encounter.

Anti-aircraft Employment

On a Battlefield in South Vietnam

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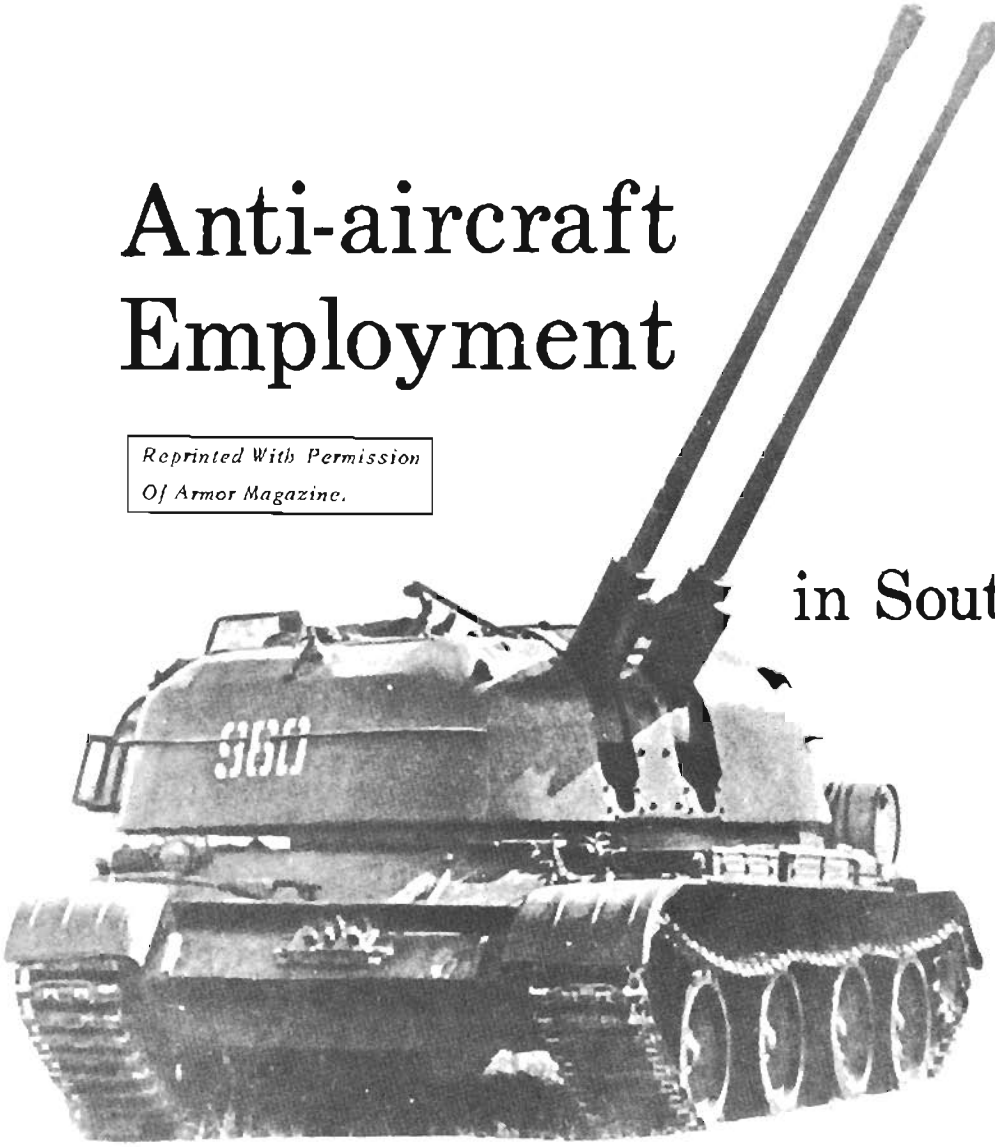


by Colonel (P.) Walter F. Ulmer Jr.

Background

The North Vietnamese invasion of South Vietnam which started in early April 1972 produced, in some locations, a scenario of mid-intensity warfare. Artillery, tanks and antiaircraft weaponry were employed in sufficient numbers and with sufficient regularity by the North Vietnamese Army to provide some noteworthy lessons for the future.

One of these lessons has to do with the offensive and defensive roles of antiaircraft artillery. Enemy maneuvering of antiaircraft weapons played a key role in several battles in Vietnam in the spring and early summer of 1972.

This discussion describes the impact which antiaircraft weaponry made on the campaign in Binh Long Province of South Vietnam in April-June of 1972. Some of the impact continued until, and after, the January 1973 cease-fire, with ground-to-air fire remaining a consideration in airmobile operations, in aerial resupply from fixed-wing aircraft, and in both rotary and fixed-wing close air support.

A Non-Typical Battlefield

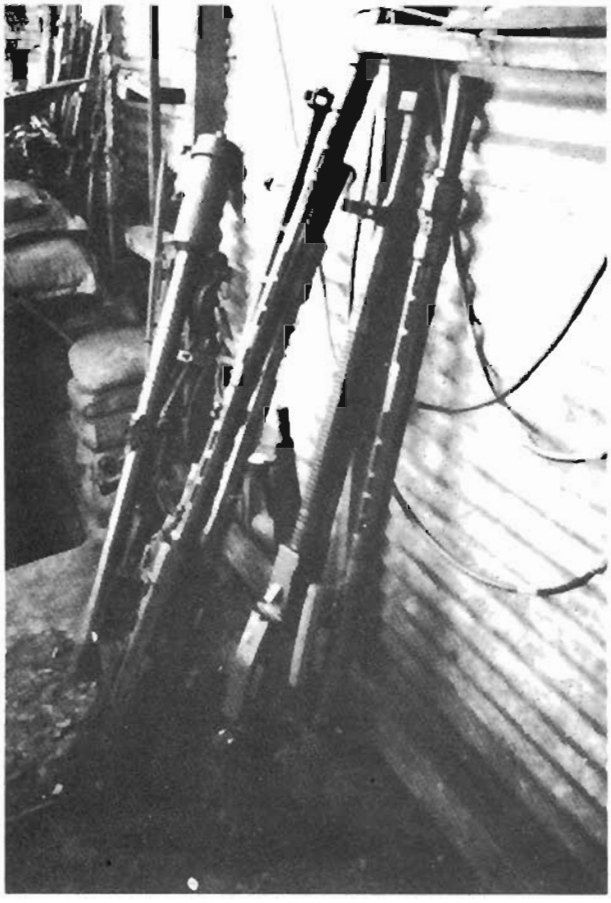
The degree of disruption caused by antiaircraft weaponry is of course dependent upon a number of classic variables of the battlefield: mission, terrain, available resources, relative state of training of the combatants, relation and importance of the local tactical situation of the larger strategic picture, the tactical acumen of the opposing commanders, and so forth.

The 1972 campaign in Binh Long Province did not represent a typical disposition of US forces in any commonly used scenario. Major US ground elements had withdrawn or were withdrawing; Army aviation assets were not available for massive assaults, and those present were possibly constrained in employment by policy considerations

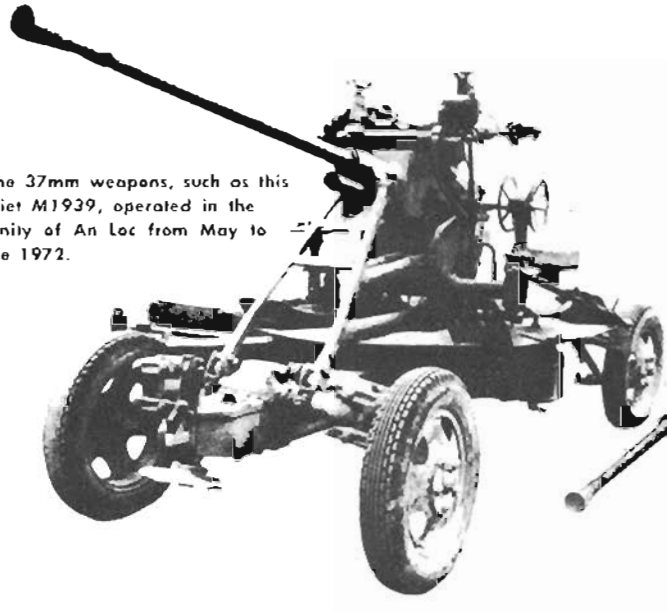
unknown to us who saw the battle from a bunker perspective. Friendly artillery support was almost non-existent. Tactical air support was generally plentiful (more than 100 sorties of fixed-wing during daylight hours in the immediate vicinity of An Loc on some days), backed up by *B52* strikes (almost one close-support mission per hour on a couple of days), with nearly continuous *C130* gunship coverage plus intermittent radar-controlled night-fighter strikes during darkness. Extrapolation of lessons from Binh Long to some future time and place must be done with caution. But whether the Middle East or Western Europe be the scene for conjecture, there seems little doubt that analysis of enemy antiaircraft capability should be serious business.

The antiaircraft picture developed rapidly in northern Binh Long Province. During the battle for Loc Ninh, 4-8 April, ground-to-air fire became so intense that resupply or evacuation missions could not be flown above the city. Caliber .51 machine guns were particularly effective.

Antiaircraft began appearing in strength around



Anti-aircraft weapons (12.7mm and 14.5mm) are included in this equipment captured by the 7th ARVN Infantry Regiment at An Loc in June 1972.



Some 37mm weapons, such as this Soviet M1939, operated in the vicinity of An Loc from May to June 1972.

An Loc on 16-17 April, and by nightfall on 17 April that town was ringed on three sides. There were .51 caliber, 23mm and 37mm weapons in evidence. On 9 May the first *SA-7* was observed, and several were fired during the second major attack against An Loc on 11-15 May. Guns and missiles were usually employed singly, with the pieces being displayed frequently. They used an erratic firing schedule, rarely using more than one weapon at a time. At the height of the battle, there were probably a dozen weapons in use around An Loc — within a few kilometers of town — with one or two additional emplacements in the enemy-held northern part of the town itself. Even though friendly air superiority was complete, and massive air support was available, each of the operations listed below was significantly affected by antiaircraft employment.

Reduction in FAC Effectiveness

As antiaircraft fire increased, the US Air Force forward air controllers (FAC) took the defensive measure of moving to higher altitudes. From nearly two miles above the terrain, they were still capable of marking and putting the fighters on targets with considerable accuracy. But FAC efficiency decreased. Locating targets took more time. Their visual reconnaissance was less effective.

Reduction in Close Air Support Effectiveness

Both rotary-wing and fixed-wing aircraft were shot down over An Loc. Active antiaircraft weapons became prime targets for fighters, thereby diverting firepower from other lucrative targets. Further, there were both approach paths and altitudes which were particularly hazardous. Under-

standable concern regarding antiaircraft capabilities distracted the pilots, or at least complicated their operation. Certain types of ordnance, such as napalm, were rarely carried in external loads when antiaircraft fire was intense. The *C130 Spectre* aircraft moved up to higher altitudes and was still able to give excellent support, but the *C119 Stinger* could not function well at the altitude necessary to give it reasonable survivability. *Cobras* were forced upward until some were releasing ordnance above 3,000 feet, with their accuracy markedly reduced at that altitude. There is no doubt that a mid-intensity antiaircraft environment can degrade significantly the effectiveness of helicopter gunship support, although there is still obviously a valid role for those vehicles in such an environment.

Complication of Aerial Resupply Operations

An Loc was cut off from ground resupply in early April 1972 and at the time of this writing (January 1974) was still being provisioned by air. During the early days, 16 April-4 May, over 60 per cent of the air-dropped supplies missed the drop zone. Low-altitude drops were being used during that period at a cost of three *C130s* shot down, with a considerable number of the *C130s* which overflew the town being damaged from antiaircraft fire. Subsequently, beginning on 5 May, a high altitude, high velocity technique was employed, with increasingly good results. Until late June 1972 when enemy fires decreased, helicopter resupply was too risky for routine use, with *CH47s* having a particularly low probability of completing a successful mission. One or two slick ships could run the gauntlet with *nap-of-earth flying*, but the combination of antiaircraft along the approaches into the town plus the artillery incoming on the landing zone made routine resupply or medevac an impossibility.

Complication of Intelligence Requirements

Targeting enemy artillery positions and antiaircraft emplacements was a never-ending task during the Binh Long Campaign. An effective method was never achieved. Recording, compiling, guessing, transmitting and striking probable locations became an important and time-consuming task.

Reduction of Command and Control Missions

Commanders could not linger at useful altitudes over the Binh Long battlefield. There was surely some blessing as well as some inconvenience in this situation. But much helpful overwatching typical of many battles in Vietnam could not be accomplished routinely with Command and Control ships having to fly on the periphery or at altitudes well over a mile high.

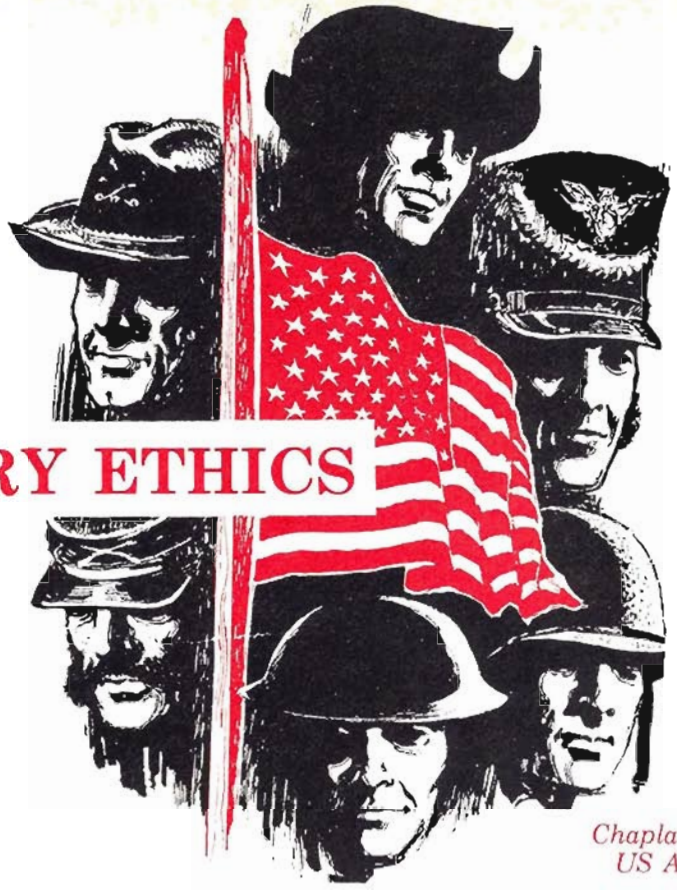
Complication of Airspace Coordination

Useful flight paths were limited, and as helicopter operations began increasing as the enemy firepower dwindled, the task of directing air traffic became complicated. Even two or three active antiaircraft weapons added sufficient obstacles to those already in being from terrain peculiarities and changing troop dispositions to significantly increase the difficulty of coordinating the use of the airspace over and near the battlefield.

What Lessons Learned?

Both the 1972 North Vietnamese attack and the 1973 Middle East War offer fertile ground for serious study, with the more recent Middle East operation possibly being the more relevant to conventional mid-intensity problems. But there is no doubt that aggressive employment of antiaircraft weapons in the forward battle area adds a new dimension of hostility. A few antiaircraft weapons can raise hell with a wide range of activities. We shouldn't be dissuaded from developing and exploiting all sorts of vehicles and tactics merely because — in an odd tactical circumstance in a distant land — some antiaircraft gunners entered the picture. However, it seems that once again we need to take a hard look at the realities of the battlefield. We need to examine our own antiaircraft doctrine. We must pay close attention to enemy antiaircraft capability.

COLONEL (P.) WALTER F. ULMER JR., commissioned from the US Military Academy, commands the 194th Armored Brigade at Fort Knox. His previous commands have included a regimental tank company, a heavy tank company in a divisional tank battalion, an amphibious tractor company and a divisional cavalry squadron. He served as senior advisor to a Vietnamese infantry regiment in 1964 and as senior advisor to a Vietnamese infantry division in 1972.



Duty, Honor, Country

MILITARY ETHICS

— Yes or No?

Chaplain (Major) Jerry D. Autry
US Army Air Defense School

When we begin to think about ethics, probably the first thing we'd have to say is that the subject is relevant. In fact, for the last several months, due to the Watergate hearings, the country has been bombarded with various interpretations of ethical codes. All of them have said essentially that we must have ethics in a democratic system, etc., etc., etc.

However, it has been a personal observation of mine, as a teacher of professional ethics in a formal classroom setting, that it is much easier to talk about the various "Watergates" than it is to personalize individual ethical systems. The "Watergates" become something that is way out there. The issues have some kind of effect upon those other people.

Making of Ethical Decisions.

How do you make your ethical decisions? As a parent you say to your son, "You cannot attend an X-rated movie;" and yet you have no reservation about his watching violence on TV. Does being in the home change the circumstances? You don't report a neighbor cheating on his income tax because you do it yourself.

Are your decisions based on values, experience, situations, or what? Or maybe you don't think about them. Maybe they are too "heavy" and you had just as soon let nature take its course. This idea might work OK until the son comes home and tells you that he's involved in a hit-and-run accident.

Situation Ethics.

One popular way to view ethical decision making is one based on situational ethics popularized by Joseph Fletcher in several books on the subject. Situation ethics would say that ethical decision making is wrapped around doing what one considers right in the particular situation that exists now. This doesn't mean that it may be right tomorrow or next week; but the decision maker sees it as right at the present time.

Fletcher illustrates this point by a story of a cab driver making conversation with a passenger while taking the passenger to a political convention. The cab driver says, "My grandfather and his father's father before him have always voted a Democratic ticket (the story could easily have been Republican) and so did my father." The passenger says, "Well, I suppose you are going to vote a Democratic ticket?" The cab driver said, "Oh, no, there comes a time when one has to put aside principle and do what's right."

One of the big problems with situational ethics would seem to be where or what are the absolutes, if one has to decide based on the situation. Is it appropriate to say that there are never any absolutes: no rights and no wrongs? This, of course,

produces its peculiar kind of problem. For instance, if a person believes that he is right, is he? Hitler apparently believed that he was right. Albert Schweitzer believed that he was right. One sought to save lives and the other was responsible for the decision that led to the annihilation of thousands of lives. Obviously, both cannot be right.

My strong personal feeling is that there must be absolutes. We might call the absolutes laws, codes, creeds, or whatever. This does not say that the same absolutes exist for all; but based on our own personal value system, there is a morality that exists which enables us to say this is right and this is wrong.

In our culture, right and wrong are basically built around the Judeo-Christian model of ethics. After all, we do call ourselves "a Christian nation."

The Military and Ethics.

American military ethics have been built around the motto, "Duty, Honor, Country." It has upheld the military from its earliest days of the Republic and there is no reason to think that it's going to stop now. Maybe the rules need some sort of redefining.

Who knows what relevance the prestige of the military might mean in the days ahead. Of course, this is a subject all its own, but regardless, the ethics of the military, both individually and collectively, will always reflect upon this prestige. Therefore, it seems reasonable to say that professional ethics in the military must reflect the highest form.

The course that I would set for the military in today's society would be to talk in terms of absolutes. There can be no double standard based on the situation. In vital national interests which may involve our country's future, the military must deal in terms of absolutes, where moral courage is the standard and not the exception. Ethical considerations such as truth in reporting, monetary responsibility, and mutual trust must become areas of second nature to the professional military man.

Idealism in the military should be an area from which we start and not toward which we work. A young officer said to me not long ago, "If I'm intellectually honest, it will kill my career." The ideal position in response to that question is, "So be it." Better to have killed a career than become a moral coward.

Conclusion.

I have intentionally created a military position of professional ethics that is uncompromising. At this point in our history, I feel that we have no choice. The other alternatives are totally unacceptable. Unrealistic platitudes? Hardly — moral courage toward true professionalism rooted in ethics.

Recently in a class, a young officer said, "The people who need to hear this lecture are the high-ranking officers, not we peons." My response then is the same as now. The individual choice makes up the collective society. The military leads the way. We, as a nation, are in the throes of a moral crisis. "Duty, Honor, Country" is not a choice. In the military, it must become a way of life.

Chaplain Autry holds bachelors degrees in Psychology and Theology from Furman University and the Reform Presbyterian Seminary, respectively. He also holds masters degrees in Pastoral Care, Counselling, and Sociology. For the past year, he has served as a counselling instructor in the US Army Air Defense School's Tactics Department.

Air Defense Briefs

SAM-D Missile Tests Successful

Successful completion of a 9-month test program of the Army's SAM-D missile was marked recently by the launch of the 10th controlled-test vehicle (CTV) at White Sands Missile Range, New Mexico.

Brigadier General Charles Means, SAM-D Project Manager at Redstone Arsenal, said the outstanding results of the CTV program complete a major milestone in SAM-D engineering development and are a tribute to the Government-industry development team. The 10-missile CTV program verified SAM-D's onboard control system and response to commands, tested the aerodynamic and structural design of the missile, and demonstrated inflight acquisition and tracking by the SAM-D ground-based fire control group, which boasts an advanced design phased-array radar. All planned test objectives of the CTV program were accomplished.

CTV missiles are guided by an onboard programer, while the TVM guidance scheme employs a phased-array radar and ground-based digital computers to track, guide, and command the SAM-D missile in flight. It provides a substantial increase in air defense performance against multiple and maneuvering targets in an electronic countermeasure environment.

CTV missiles of full-scale tactical configuration, except for guidance and warhead components, were tested beyond limits of prescribed system performance at White Sands during a full-flight envelope. Missiles were subjected to high acceleration and extremely tight initial turns in preparation for defense against "pop-up" targets that appear suddenly in a tactical system's range.

Another major objective completed successfully was a dynamic plume experiment — to evaluate effects of the missile plume on radiofrequency signals transmitted from the missile to ground support equipment.

Reorganization of BMD Defense Activities

Army is realining its ballistic missile defense (BMD) activities. The current BMD program, structured in three coordinated parts working together toward BMD objectives, is as follows:

Safeguard deployment near Grand Forks, North Dakota, will protect a portion of the United States' land-based Minuteman deterrent force plus provide valuable experience in the test and operation of a deployed tactical BMD system. The site defense prototype is scheduled for demonstration by 1977, when the Interim Offensive Agreement is scheduled to expire.

The advanced technology program encompasses all components and functional technology of BMD. This program provides the base for future systems' efforts, guards against technological surprise, provides the vehicle for upgrading the Army's BMD system, and assists in design and evaluation of United States' strategic offensive systems. The overall BMD program strengthens the United States deterrent by maintaining and capitalizing on United States technological superiority and by providing a United States capability to deploy improved BMD if necessary.

On 26 March 1974, the Deputy Secretary of Defense provided guidelines for reorganizing the Army's BMD effort. This reorganization is designed to maintain the technological program, reduce management overhead, and combine the agencies involved in the BMD effort into a single organization, reporting to the BMD Program Manager (BMDPM). The BMDPM has responsibility for determining requirements, establishing priorities, evaluating new concepts, and planning for the overall BMD program. The new BMD organization includes the following changes:

- All BMD activities will be placed under the BMDPM who reports to the Army Chief of Staff.

- The Advanced Ballistic Missile Defense Agency (ABMDA), currently under the Chief of Research and Development (CRD), and the US Army Safeguard System Command (SAFSCOM), currently commanded by the Safeguard System Manager (SAFSM), will be the subordinate organizations under command of the BMDPM. ABMDA will be redesignated as the Ballistic Missile Defense Advanced Technology Center (BMDATC). SAFSCOM will be redesignated as the Ballistic Missile Defense System Command (BMDSCOM).

• General staff supervision of Kwajalein Missile Range will be transferred from the CRD to the BMDPM.

• The position of the Deputy Assistant Secretary of the Army (R&D) for BMD will be eliminated.

• The Safeguard System Evaluation Agency (SAFSEA) at White Sands Missile Range, New Mexico, will be transferred to the Training and Doctrine Command (TRADOC).

Complete reorganization is expected to be accomplished by 30 June 1975.

TEC Accelerates Learning

High-quality instruction is being prepared for the soldier in the field in a ready-to-use audio-visual (AV) format that reduces preparation time and accelerates learning. The Training Extension Course (TEC) activity at the US Army Air Defense School (USAADS) is currently developing this instruction for ADA MOS 16P and 16R. The AV format is applicable for both individual (self-paced) and small group study.

TEC programing consists of identifying a subject area, reducing it to a series of tasks, validating them, and producing lessons that teach objectives only: eliminating all unessential information. The validation program includes testing each lesson with AD soldiers in divisional units to make sure the material does in fact teach. Several lessons have been completed and released to the field. There is a total of 144 individual lessons being prepared by USAADS to cover such subjects as Chaparral and Vulcan Maintenance; Crew Drill and Tactics; Administration and Supply; First Aid; Wheeled Vehicles; Personal Hygiene; Aircraft Recognition; Air Defense Fundamentals and Systems; and a series of lessons on TADDS and FAAR. All lessons will be viewed on a Beseler Cue/See teaching machine (automatic issue to units). The student, on his own or in small groups, can learn the essentials of a particular subject in 30 to 40 minutes. A series of these lessons constitutes a complete course of instruction on a subject.

Transition to Hawk

Many NCO's (grades E-5 through E-7) recently have been transferred by Department of the Army out of overcrowded career specialties into the Improved Hawk program. To facilitate this transition and provide the best training possible for these NCO's, the US Army Air Defense School has developed a series of Hawk maintenance supervisory courses. NCO's being reclassified to Hawk will first complete an entry level course designed to teach the basic skills required of one of the three Improved Hawk Maintenance MOS. Following this, the NCO student will take one of three supervisory courses which corresponds to the entry level course he has just completed. These specially designed supervisory courses, each lasting 6 weeks and 3 days, will prepare the newly reclassified NCO to serve in the Improved Hawk maintenance supervisory positions in one of the following MOS:

• MOS 24C, Improved Hawk Firing Section Maintenance.

• MOS24E, Improved Hawk Fire Control Maintenance.

• MOS 24G, Improved Hawk Information Coordination Center Maintenance.

23 For 23

An Air Defense Artillery battery in the 1st Armored Division chalked up 23 hits in 23 tries recently during its annual USAREUR Chaparral battalion tests at the Crete firing range. According to their battalion Sergeant Major, James Van Der Raay, this high score raised the overall battalion score significantly. "Last year, our battalion percentage was in the low 70's," he said. "This year we averaged out at around 89 percent. That's a gratifying improvement. I think we've really given the other Chaparral battalions something to shoot at. The battalion average was higher than any recorded during the USAREUR tests last year."

Improved Hawk Unit Fires Perfect Score

Battery C, 2d Battalion, 62d Air Defense Artillery, recently earned 2,000 points to become the first Improved Hawk battery to achieve a perfect score during annual service practice. It was the first tactical Hawk battalion to convert to Improved Hawk. As part of the 32d Army Air Defense Command, the battalion provides air defense for elements of the Seventh US Army and the US Army Europe.

Motor Officer Course

Recently, emphasis has been placed on the value of sending company-grade officers to the Motor Officer Course 8C-0600, conducted at the Armor School. The course would be particularly beneficial to ADA officers assigned to high-density vehicle units such as Chaparral/Vulcan battalions. The course lasts 8 weeks and includes management of maintenance resources and all facets of planning, organizing, directing, coordinating, and controlling the organizational maintenance program. Applicants must be commissioned officers in the grade of captain or below who are assigned, or are under orders for assignment, to a position to supervise maintenance of conventional materiel.

The emphasis of the course is on management, supervision of maintenance, and increased hands-on training. This training will build the officer's confidence in his abilities, both in maintenance and management.

Course subject areas of special interest to attendees are:

Maintenance Management and Supervision: The Army maintenance system, maintenance publications, operations records, maintenance service records, equipment logbook, materiel readiness and equipment serviceability criteria, repair parts supply, maintenance records evaluation, management of maintenance resources, the maintenance program, management responsibility, and maintenance management evaluation.

Engine and Electrical: Principles of automotive engines, fuel systems, and electricity; low-voltage circuit tester, malfunction diagrams, and powerplant servicing and troubleshooting.

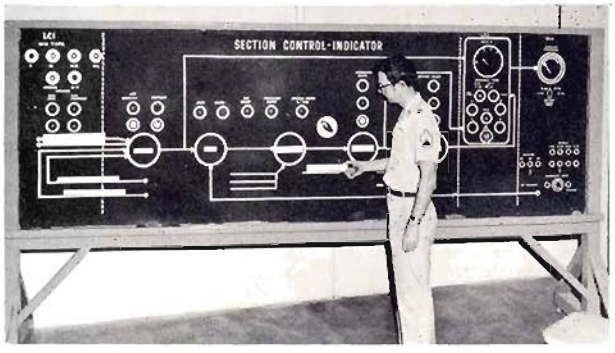
Periodic Services: Safety, tools and test equipment, wheeled and track vehicle components and services, and auxiliary equipment.

Ground Mobility: Vehicle operation and recovery.

Leadership: Introduction to management, work improvement techniques, procedure and layout charts, work measurement and quality assurance. The course is considered to present post-graduate material in maintenance of vehicles and weapon systems and will enhance the professional development program of the young ADA officer.

By agreement between the Air Defense School and the Air Defense Artillery Branch, Office of Personnel Operations (OPO), Department of the Army, an increased number of company grade officers will be selected by OPO in FY 75 to attend the Armor School Motor Officer Course. ADA field commanders are encouraged to seek TDY quotas for attendees from their unit.

New Instructional Training Aid Devised



This 12- by 4-foot portable, chalkboard-mounted, instructional training aid is effectively being used in the Systems Branch, Nike Systems Division, General Support Materiel Department, US Army Air Defense School. The new training aid electrically simulates (from standby to ready-to-fire) the complex set of sequences and interactions among the launcher control-indicator, section control-indicator, and launcher control console, and the inputs from the battery control area. Training time in the sequence of operation has now been cut from 4 to 2 hours.

Military Personnel Notes

Activation Of Three Combat Brigades

Secretary of the Army Howard H. Callaway has announced plans to increase combat forces by the equivalent of one division by June 1975. One brigade from each of three former active divisions will be reactivated beginning this fall. The brigades will form the base on which the Army will build three new active divisions.

The units being activated are:

- 1st Brigade, 5th Infantry Division (Mechanized), at Fort Polk, LA.
- 1st Brigade, 7th Infantry Division, and the Division Base (Minus) at Fort Ord, CA.
- 1st Brigade, 24th Infantry Division, at Fort Stewart, GA.

The announcement follows closely those made recently concerning reductions in headquarters and support activities. These decisions are moving the Army toward its goal of a 16-division force using manpower and dollars reallocated from the reductions.

EER Scores And Weighted Averages

MILPERCEN's Enlisted Classification and Evaluation Branch has released the point values assigned to the ratings in Parts IIB and IIC of the Enlisted Efficiency Report (EER). In Part IIB, the point values assigned to each of the six characteristic blocks (Adaptability, Attitude, Initiative, Leadership, Responsibility, and Duty Performance) are:

Outstanding	16.6
Excellent	13.3
Above Average	10.0
Average	6.7
Below Average	3.4
Unsatisfactory	ZERO

In part IIC, the point values assigned to the appropriate block of the advancement potential rating are:

Block One	25.0
Block Two	21.5
Block Three	18.0
Block Four	14.5
Block Five	11.0
Block Six	7.5
Block Seven	4.0
Block Eight	ZERO

By totaling these ratings on his EER, the soldier can figure his overall EER score. Using that score and the guidelines in DA Pam 611-8, he can determine the impact it will have on his Enlisted Efficiency Report Weighted Average (EERWA).

Personnel Assistance Points

Soldiers en route to or returning from oversea assignments get more attention now that the MILPERCEN Personnel Assistance Points (PAP) are operating. Fort Dix, Fort Jackson, and Oakland Army Base and the Returnee-Reassignment Stations (Travis AFB, McGuire AFB, and Charleston ARF) were reorganized and converted into Personnel Assistance Points.

These PAP's give soldiers a direct point of contact with MILPERCEN while they are traveling to or from oversea duty stations. The offices are open 24 hours a day, 7 days a week, and are staffed with well-qualified people.

About 30,000 soldiers pass through these terminals each month, and, until the idea of PAP's evolved, they had no way of contacting MILPERCEN on a timely basis and vice versa. The PAP's have been designed to counteract the problem.

PAP officials not only have the authority to coordinate directly with enlisted assignment managers and compassionate review and policy offices at MILPERCEN; they also verify assignments, administratively amend orders, extend emergency leave, help with compassionate problems, and offer personal advice to those in a travel status.

Officers Assignment And Education Preference

Revised DA Pamphlet 600-3, Officer Professional Development and Utilization, provides instructions for all commissioned officers except those of the Judge Advocate General Corps, Chaplains Branch, and Army Medical Department to complete a professional development plan (DA Form 419OR). The plan should indicate long-range preferences as to the types of assignments and education they desire to be considered for under the new Officer Personnel Management System (OPMS).

MILPERCEN's Officer Personnel Directorate reminds officers that the form should not be completed until they receive their designated specialties. During the interim, they may indicate their preferences for related assignments and schooling on the officer's assignment preference statement (DA Form 483). The milestone dates that were established for specialty designations are as follows:

- Primary and alternate specialty — Sep 74

designation for LTC and MAJ(P), except those with a mandatory retirement date prior to December 31, 1974.

- Primary and alternate specialty designation for MAJ and CPT(P). — Mar 75
- Primary and alternate specialty designation for CPT with more than 7 years commissioned service and primary specialty designation for CPT with less than 7 years commissioned service. — Sep 75
- Primary specialty designation for all LT's. — Dec 75

Officer Files Trimmed

The US Army Military Personnel Center (MILPERCEN) maintains two separate personnel files on commissioned officers' military service. One is the official military personnel file (OMPF). This file is maintained by the Personnel Actions and Records Directorate (PARD) of MILPERCEN and is used by DA Selection Boards to select officers for promotion, military and civil schooling, Regular Army appointment, retention, elimination, and recall to Active duty. The second is the officer's career branch individual file (CBIF) which is maintained within the Officer Personnel Directorate (OPD) and used by career branch managers in managing officer assignments, professional development, and other personnel actions.

Accurately maintaining these two separate files has required a sizeable staff of administrative support personnel. Based on a recently conducted MILPERCEN study to determine where duplicative filing between PARD and OPD could be reduced, filing procedures have been revised to eliminate all nonessential documents and information from the CBIF. Effective immediately, only the following documents will be filed in the CBIF:

- Officer Preference Statement
- Photographs
- Civil School Transcripts
- College Transcripts
- Individual Flight Records (most recent)
- Officer Record Brief
- Officer Evaluation and Academic Reports with related official correspondence.
- Records of punishment under Article 15, UCMJ, and Courts-Martial, and similar documents filed under the provisions of AR 600-37 (Unfavorable Information).

Original copies of letters of appreciation and commendation and copies of citations for awards and decorations are being transferred to PARD for inclusion in the OMPF. Other documents which duplicate those filed in the OMPF are being destroyed. These revised filing procedures do not result in a change to documents filed in the OMPF. An officer's OMPF still provides a historical record of his service, while the CBIF will now contain only those documents needed by the officer's career branch personnel management officers.

Army Drill Sergeants Needed

MILPERCEN's Enlisted Personnel Directorate is currently seeking high caliber NCO's to fill key cadre positions as drill sergeants at Army training centers. As in the past, only the most professionally qualified and highly motivated NCO's will be selected to participate in the Army's drill sergeant program. The role of the drill sergeant, as the Army's primary representative during the formative stages of the individual soldier's training, is taking on even greater significance in today's volunteer Army environment.

Male applicants must be NCO's serving in pay grades E5-E7, attain a score of at least 300 on a basic physical fitness test not earlier than 30 days prior to entering the 6-week drill sergeant school, demonstrate leadership ability and display good military bearing, and have no speech impediment or record of emotional instability. Additionally, prospective drill sergeants should be high school graduates, or possess a GED equivalent, and have General Technical (GT) Apptitude Area scores of 100 or above. Female applicants must be in the grades E4-E7 and meet the criteria listed in column 16, Table 11-3, AR 614-200.

Applicants selected will serve in stabilized assignments for 24 months (with the approval of the commander, extension up to 36 months is authorized), be eligible to receive special duty assignment (proficiency) pay, be issued supplemental uniforms which would be laundered and cleaned free, and be authorized to wear the distinctive drill sergeant hat and badge. Additional details are contained in Section XV of

AR 614-200 (Assignment, Control, and Transfer of Volunteers for Assignment as Drill Sergeant).

Applications from male personnel should be accompanied by three assignment preferences from among the following Army training center sites: Forts Knox, Jackson, Gordon, Dix, Riley, Bliss, Ord, Polk, or Leonard Wood. Female applicants should cite their preferences between either Fort Jackson or Fort McClellan. All applications should be submitted to HQ MILPERCEN, DAPC-EPC-CI, 2461 Eisenhower Avenue, Alexandria, VA 22331.

Vietnam Era Veterans' Benefits Increased

Congress recently enacted an increase in educational benefits for Vietnam era veterans and here are the provisions that affect active duty personnel.

The act provides nine months of additional entitlement for certain veterans to use in pursuing a standard undergraduate degree. The new law increases benefits by 18.2 percent for veterans who are receiving institutional training on less than half-time basis, flight, PREP, or correspondence courses. The 18.2 percent increase also applied to active duty personnel pursuing an education program and to wives, widows and children pursuing cooperative courses, or receiving apprentice or on-the-job training. A smaller increase applies to wives and widows pursuing full-time restorative courses.

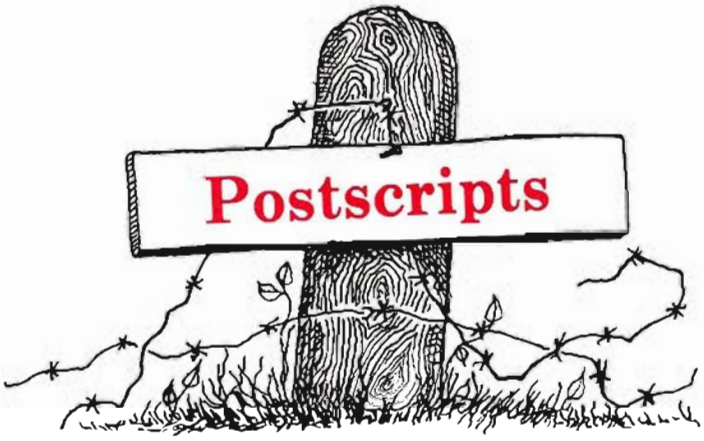
The Act also authorizes loans up to $600 per academic year to veterans and eligible wives, widows and children pursuing courses on a half-time or more basis at colleges and certain below college level institutions.

The tutorial assistance program for veterans and active duty members has been liberalized, increasing the monthly rate to $60 and the number of months available to 12.

For full details, contact your local VA office or representative.

Column I	Column II	Column III	Column IV	Column V
Type of Program	No dependents	One dependent	Two dependent	More than two dependents
				The amount in column IV, plus the following for each dependent in excess of two:
Institutional:				
Full-time	$270	$321	$366	$22
Three-quarter-time	203	240	275	17
Half-time	135	160	182	11
Cooperative	217	255	289	17

New benefits effective 1 Jan 75.

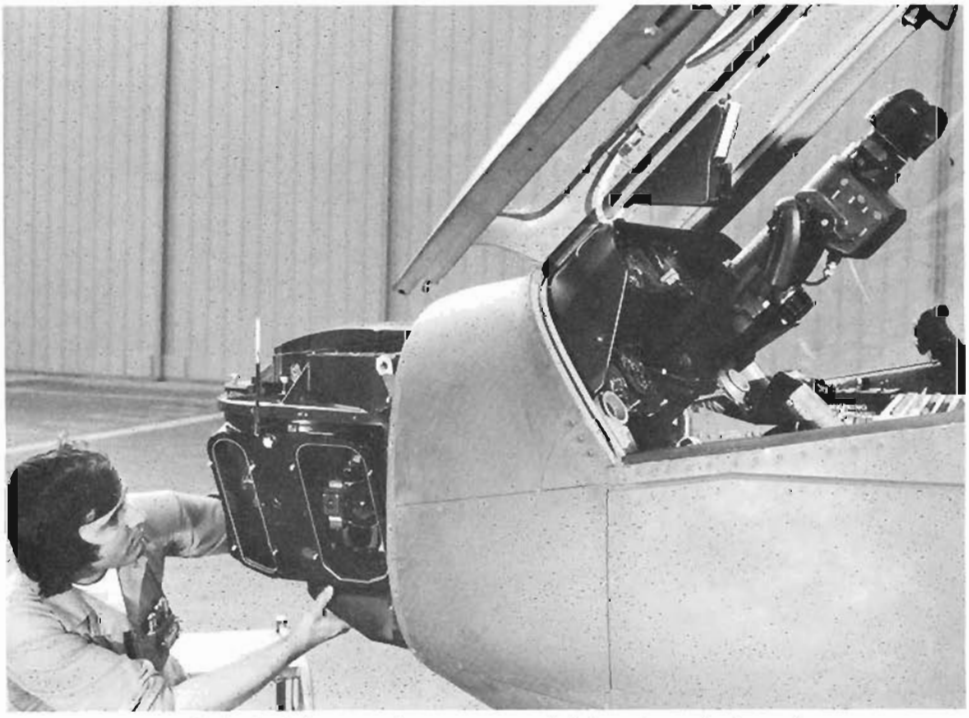


101 Cobras To Be Armed With TOW Missiles

The Army is procuring 101 TOW systems and will install them on the Huey Cobra. The TOW helicopter system consists of a telescopic gyro-stabilized sight, guidance and control equipment, cockpit displays and controls for the gunner and pilot, and four two-round missile launchers, providing capability for carrying eight TOW missiles.

The TOW system enables air crews to launch the wire-guided TOW missile from helicopters at standoff ranges against tanks, trucks, and ground installations. In extensive tests and in combat in Vietnam, the helicopter-fired TOW missiles displayed devastating accuracy and effectiveness. In Vietnam only two UH-1B helicopters armed with TOW were available. In the first month of combat, they destroyed 47 targets, 24 of which were tanks.

When the TOW helicopter system is in operation, the gunner locates his target in the stabilized sight (which is isolated from helicopter vibration), fixes his crosshair on the target, and launches the missile. He then holds the sight crosshair on the target, and the missile is automatically guided to impact on the spot where the gunner is sighting, receiving steering signals through two fine wires it unreels in flight. The helicopter pilot may fly at any speed, fly a zig-zag



A technician works on a new sight system designed to guide the TOW missile to its target.

course, or make a sharp-turning maneuver without affecting the missile's flight. Maximum range of the missile is 3,000 meters.

The US Army will be first to equip its forces with TOW-armed helicopters. TOW ground systems have been ordered by, or are being considered for use by, more than a dozen countries around the world.

Dragon Missile Going To Combat Units

Dragon, the Army's newest antitank weapon, is scheduled for delivery to combat units beginning this year. The Dragon missile system is a platoon-level, man-portable weapon that can knock out enemy armored vehicles at ranges up to 1,000 meters.

The complete system weighs 31 pounds and includes a nonexpendable tracking unit and a 24.4-pound round. The round comprises a prepackaged, expendable launcher and missile. The launcher includes a power source for the tracking unit.

To operate the system, the gunner attaches the tracking unit to the round, aims, and fires, then optically tracks the target until missile impact. The tracking unit senses target error and sends corrections to the missile by wire link.

The Dragon replaces the 90-mm recoilless rifle, currently the standard antitank weapon in the infantry rifle platoon.

Night Vision Goggles

It was recently announced that US Army-developed night goggles, designed to take the cover of darkness from the concealment advantage of the enemy, now hold the promise of giving sight tomorrow to many who are blind today.

Application of the technology of the night vision goggles (NVG) to aid those afflicted with the night-blinding disease, retinitis pigmentosa (RP) was reported by the US Army Night Vision Laboratory — several thousands are estimated to be afflicted with this disease throughout the United States. "Goggles therapy" feasibility tests conducted at the Massachusetts Eye and Ear Infirmary in Boston proved that by using NVG's, many RP patients could enjoy greater night mobility.

Further information on RP may be obtained by contacting the National Retinitis Pigmentosa Foundation, Rolling Park Building, 8331 Mindale Circle, Baltimore, Maryland 21207.

Brazo Missile Successful In First Test

Recently, the nation's first air-to-air antiradiation missile, the Brazo, successfully intercepted a jet drone target in its first test firing. The Brazo, launched from an F-4D Phantom, intercepted a BQM-34 drone in a "lookdown" tail attack at Holloman Air Force Base, NM. The Brazo (Spanish word for "arm") is designed to intercept an enemy aircraft by homing on its fire control radar. The Brazo uses a Sparrow missile airframe and employs a broadband frequency receiver.

Trash As A Fuel Source

Paper trash and wastes from the local garbage dump could be the source of automotive fuel, plastic products, and industrial chemicals as a result of a recent Army discovery.

US Army Natick Laboratories (NLABS) scientists have combined over 25 years of basic research, mountains of trash, and modern technology to make an economically competitive fuel. As a result, NLABS has become a leader in helping to solve the nation's two biggest ecological nightmares — waste disposal and the fuel shortage.

According to Dr. Leo Spano, Pollution Abatement Program Manager at NLABS, "We've found a way to make good use of the cellulosic part of the endless supply of trash by converting it into a glucose sugar. The glucose can then be further processed into ethanol or used in the production of chemicals and plastics now made from petroleum.

"Ethanol is a low emission fuel. When blended with gasoline, it could help power automobiles and other internal combustion engines with minimal, if any, change to the carburetor."

Natick has set up its own prepilot plant to be used in establishing the engineering and economic data required for the design of a large scale process. This prepilot unit is capable of converting 1,000 pounds of cellulose material per month to 500 pounds of glucose.

"We are convinced this vast quantity of waste should be exploited as a source of energy and food. The breakdown of this material to glucose is technically feasible and practically achievable on a very large scale by 1980."

Ground Troops To Have Laser Guidance Device

A device enabling ground troops to home special laser-guided missiles, bombs, or artillery shells to their targets is being developed. It is called a Ground Laser Locator Designator (GLLD). The system, lightweight and tripod-mounted, consists of a laser, a range-finder, a telescopic sight, and a tracking unit integrated into a single black box. It can be moved easily into forward battlefield position by two men. Once set up, a single operator will scan the area for "hard" targets, such as tanks or bunkers, using GLLD's (pronounced "glid") telescopic sight. When a target is sighted, the operator uses GLLD's laser rangefinder to determine the distance and bearing. He then focuses a narrow-beam, high-intensity laser on the precise spot he wants the laser-homing weapon to strike. A special viscose fluid damper in the tracking unit allows smooth, accurate tracking of even distant moving targets. Meanwhile, remote aircraft or artillery units alerted to the target's approximate location have launched or fired a laser-homing weapon. The weapon's sensor locks on GLLD's laser beam being reflected from the target and the weapon homes in for a hit. The wavelength and periodic pulsation of the laser beam allow the weapon to differentiate the correct target from others designated by different GLLD units. GLLD will allow artillery and aircraft to stay distant from their targets yet bring their weapons to bear with an extraordinary degree of accuracy.

Protecting Electronic Instruments

A new shipping container for electronics instruments that can save millions of dollars in shipping damage.

A new line of reusable shipping containers has been perfected which can eliminate millions of dollars in shipping damage done to electronic instruments and other delicate equipment each year. Called Isopods, the containers also cut present packing time by two-thirds or more and, over its 10-year lifespan, each can save thousands of dollars in packaging material costs alone. For example, Isopods are expected to save $850,000 in shipping fire control systems for the Navy F-14 and Air Force F-15 fighters over the life of the program. No tools are required to pack and unpack the containers, and engineers say the Isopods are far safer than the short-life, custom-built crates they replace. Drop tests, creating an external impact on Isopods in excess of 365 times the force of gravity, showed impact of less than 20 G's on the 350 pounds of equipment inside, an 18-to-1 reduction.

Engineers began working on the Isopod system 2½ years ago. They started with a strong aluminum box, added airtight doors for two-way access, relief valves for depressurization, and a "floating" inner framework separated from the box walls by shock-absorbing wire coils.

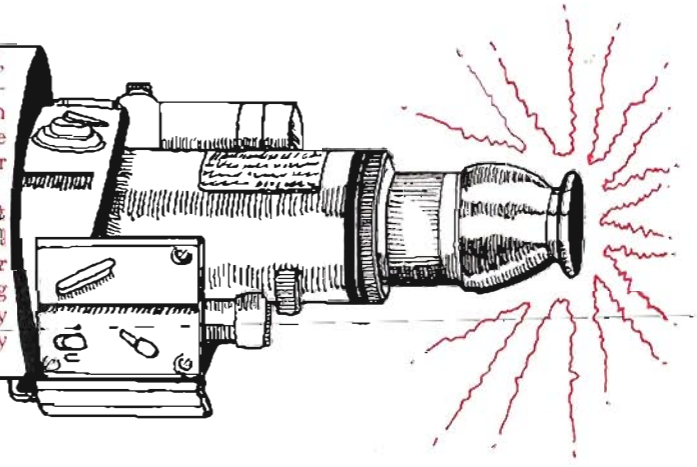
Key to the system is a unique quick-locking nylon strap assembly mated to slots running the length of aluminum shelving attached to the inner framework.

Only straps and vinyl shelf padding touch the equipment, and not one of the hundreds of Isopods in use has failed.

Night Vision Radiation Hazard

Units issued night vision devices AN/PVS-2, AN/PVS-2A, AN/PVS-3, AN/VPX-3A, AN/TVS-2, and AN/TVS-2A are warned that a radiation hazard to the user's eyes may occur unless the device has been modified by the protection adapter ring, FSN 5855-00-165-3093.

Users should inspect the device to insure that the eyepiece assemblies are marked with green foil tape. The tape indicates they are radiation free or have been modified by the above adapter ring assembly. Devices not meeting these safety requirements must be turned in for necessary modifications.



US ARMY AIR DEFENSE SCHOOL
Directorate of Training Developments
Fort Bliss, Texas 79916

ATSA-TD-TLS 1 January 1975

READERSHIP SURVEY

We are conducting a readership survey of *Air Defense Trends* and request your assistance. Please cut out this form letter, complete the information requested below, fold and staple the letter with return address visible, and mail. NO ENVELOPE IS NECESSARY.

a. Your organization: _____

b. Your address: _____

_____

c. Did you receive the September 1974 issue of *Air Defense Trends?*

☐ (Yes) ☐ (No)

d. Number of copies of *Air Defense Trends* you currently receive. ____

e. Number of copies of *Air Defense Trends* you desire to receive. ____

f. What is your opinion of *Air Defense Trends?*

(1) Well received ☐ (Yes) ☐ (No)

(2) Effectiveness _____

(3) Value to ADA _____

(4) No opinion _____

Additionally, comments you may have to improve *Air Defense Trends* are solicited.

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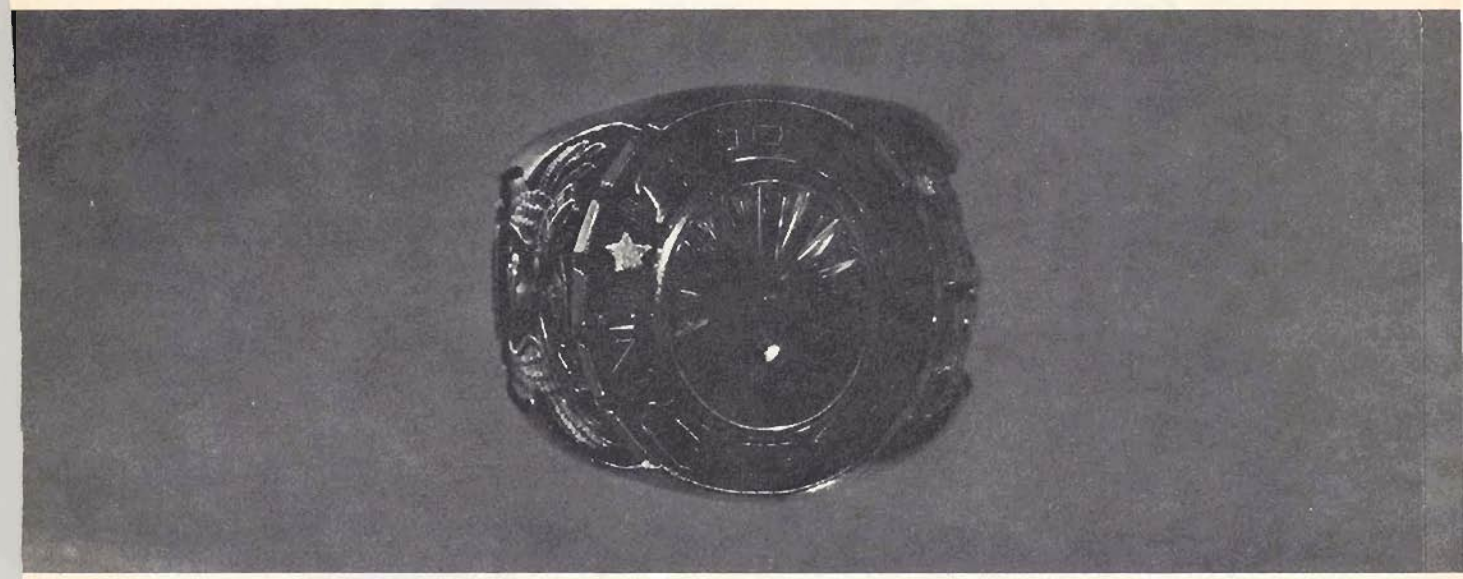
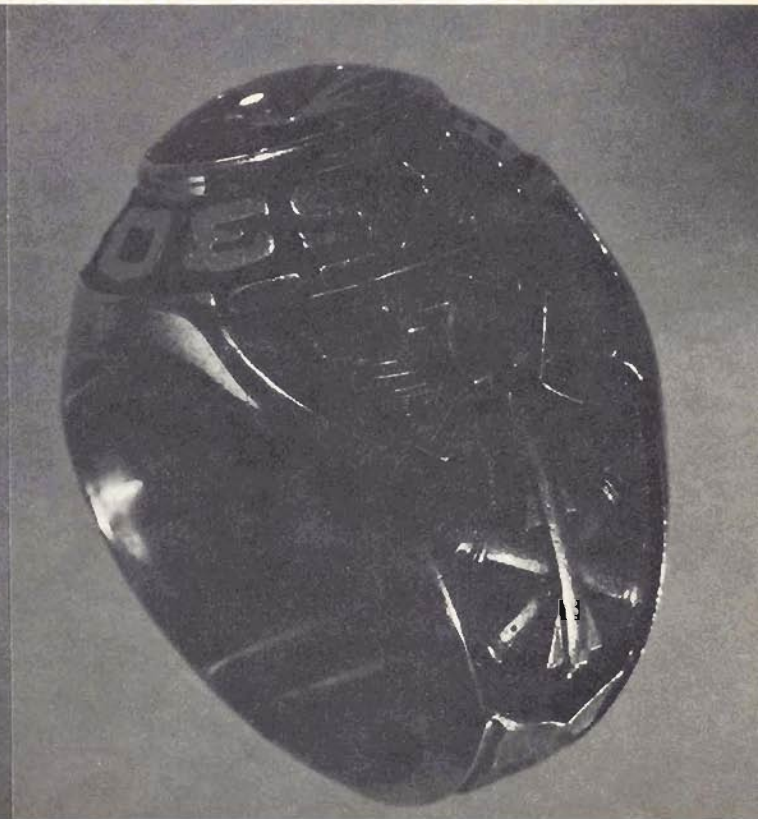
ADA-NCOES RING



This Air Defense Artillery Noncommissioned Officers' Education System graduation ring has been perfected and is now available to graduates of the course. It is intended to identify those noncommissioned officers whose scholastic achievement and proven leadership qualities deserve visible recognition. The ring was designed by Command Sergeant Major Johnnie L. Jones (CSM of the US Army Air Defense Center and Fort Bliss) and Sergeant Major Richard E. Roberts (Chief of the Air Defense Artillery Noncommissioned Officers Education System).



"Your suggestions get adequate exposure in Air Defense Trends. Example: Some ideas in the September issue on Chaparral Maintenance by Captains Paul McCarthy, Elmer Amacker, Sheldon Gerron, and Al Beaton are being acted upon by DCSLOG and Army Logistics Center. How about your ideas? Pick up your pen, open up your brain, and let's see what spills out."

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