AIR DEFENSE MAGAZINE

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C/V TACTICAL EMPLOYMENT

in the 8th infantry division

AIR DEFENSE MAGAZINE

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ABOUT THE COVER: Both the front and back covers place emphasis on certain activities of the 1st Battalion, 59th Air Defense Artillery in its support of the 8th Infantry Division during combat training. A full report on these and other activities is contained in the article, "C/V TACTICAL EMPLOYMENT IN THE 8TH INFANTRY DIVISION," beginning on page 6.

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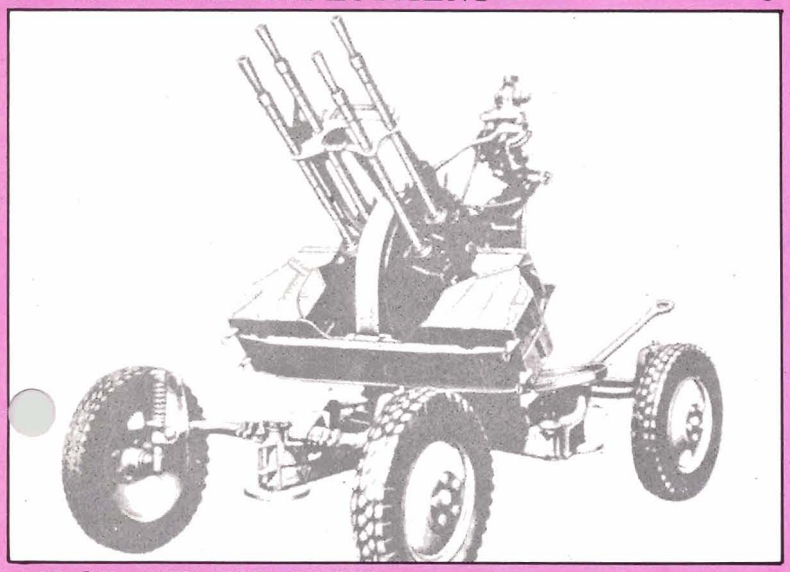

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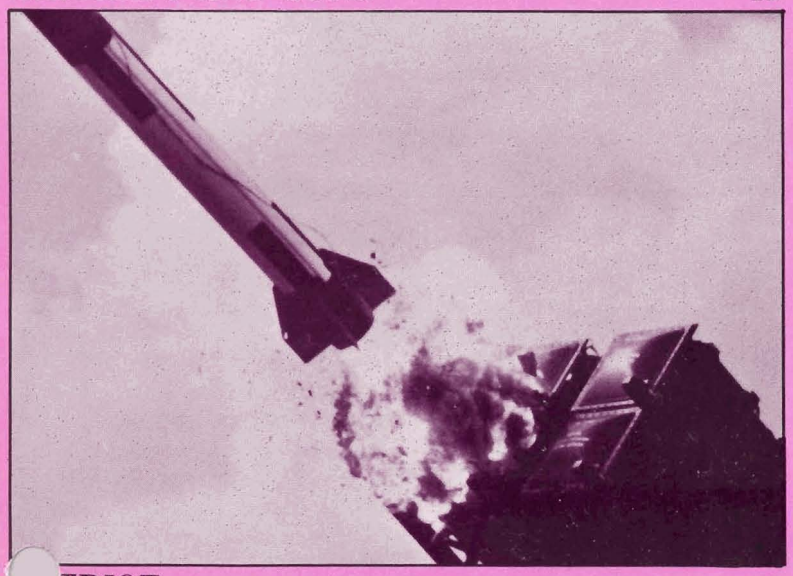

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INTERCEPT P

MAJOR GENERAL ROBERT J. LUNN

Air defense personnel in MOS 16P and 16R are eligible to attend a new course that has recently been instituted at noncommissioned officers academies (NCOAs) Army wide. The course, titled *Basic* NCO Course/Combat Arms (BNCOC/CA), is for those of you who are serving in squad or section leader positions. Previously, the very successful *Primary* NCO Course/Combat Arms (PNCOC/CA) has provided E-4s with apprentice supervisor skills. Now the BNCOC/CA further develops those skills and fully prepares graduates for leadership duties relevant to their MOS. Both courses train soldiers in the skills they need to perform their jobs.

The basic course is designed specifically for soldiers in skill level 3 (SL3) duty positions of squad or section leader. It teaches specific SL3 MOS duties from the Soldier's Manual task list. Equipment support is extensive and equipment is the same type as that of the units from which the students come. The core program of instruction covers the in-depth skills required to perform duties involving your type of unit and equipment; for example, towed or SP Vulcan. Training is both group-paced and individual-paced. Performance training is collective in nature and proceeds at the rate of the student group.

Pretesting is employed to determine where remedial training is required due to individual deficiencies. Training Extension Course (TEC) materials are the base for remedial instruction. Both TEC and remedial training are based on individual needs and rate of learning.

The size of student groups is the same as TOE squad strength, and groups are formed according to MOS and squad size. Thus, 16Ps are placed in five-man groups, which is the Chaparral squad size, and 16Rs in four-man groups, which is the Vulcan squad size.

The purpose of the BNCOC/CA is to help you develop into weapon system/equipment experts so that you can supervise and train your subordinates to maintain, operate, and employ their weapon/equipment. It also develops your skill as an NCO, enabling you to train and lead your subordinates in the proper application of cover, concealment, suppression, and teamwork. In addition, it will qualify you to give, and supervise the execution of, the necessary orders or instructions so that your squad or section will perform its ARTEP mission effectively.

The BNCOC/CA is appropriate training both for you who are actually assigned to an SL3 duty position and for you who are preparing for assignment to an SL3 duty position.

Priority for attendance is: first — SP4s, CPLs, SP5s, SGTs, and SSGs serving in E-6 duty positions who have not graduated from an accredited basic or advance course in their MOS, and second — SP5s and SGTs who are career motivated and have career potential.

Although the BNCOC/CA, as with the PNCOC/CA, is fielded for training in noncommissioned

officers academies worldwide, it is not programed for implementation in Korea.

Following is a list of the academies that conduct training in the BNCOC/CA for the two air defense MOS, along with stations that supply the students for each academy.

Academy	Installation for Student Input	MOS 16P	MOS 16R
Fort Bliss	Fort Bliss	x	x
	Alaska		x
	Fort Benning	x	x
	Fort Bragg	x	
	Fort Campbell	x	
	Canal Zone	x	
	Fort Knox	x	
	Fort Leonard Wood		x
	Fort Lewis		x
	Fort Ord		x
	Fort Sill	x	x
Fort Bragg	Fort Bragg		x
	Fort Dix		x
	Fort Jackson		x
Fort Campbell	Fort Campbell		x
Fort Carson	Fort Carson	x	x
	Fort Riley	x	
Hawaii	Hawaii	x	x
Fort Hood	Fort Hood	x	x
Fort Lewis	Fort Lewis	x	
	Alaska	x	
USAREUR	USAREUR	x	x

Student inputs are coordinated at installation level. For example, a soldier in MOS 16P at Fort Campbell would be programed for attendance at Fort Bliss and coordinated at post level by both installations. This tight control is necessary to insure that only the correct number of students are scheduled for a given class. The course is structured for a specific size class, and overages or shortfalls would reduce the benefits of the instruction.

A word to unit commanders:

Students selected to attend should be in squad or section leader positions and after graduation must be allowed the latitude, authority, and responsibility for training and leading their squads or sections in their units. Proper use of the improved competencies of BNCOC/CA graduates can lead to improved unit training, better field exercises, higher ARTEP results, much higher SQT scores, and superior readiness ratings.

Robert J. Lunn

ENGAGEMENT ZONE

letters to the editor

SOVIET AA GUNS

Dear Sir:

Recently, drawings of Soviet SAMs and antiaircraft guns appeared in an *Astronautics and Aeronautics* magazine article by Mr. Terrell E. Green entitled "TAC Air in the Defense of NATO." Credit for the drawings was given by Mr. Green to AIR DEFENSE Magazine.

I am currently writing a thesis for the US Army Command and General Staff College and, if given your permission, I would like to reproduce for my thesis the drawings presented by Mr. Green or from your Soviet Air Defense poster.

Any consideration you can give me in this matter will be most appreciated.

Before closing I must say as an Air Force student at the College that I've found your magazine most informative and enjoyable. In the future, it will continue to be on my list of "must read" publications.

GARRY A. SCHNELZER
MAJ, USAF

ON AD PRIORITIES, etc.

Dear Sir:

I have read with interest the many issues of AIR DEFENSE Magazine that you've been publishing. It seems the article I wrote some time ago about standard tactical missions (not published) could still be of value, particularly when you read the new FM 44-1. This book seems to be fine for division operations except for a weak link that is present. Here I'm speaking about the decision-making process for the selection of air defense priorities. This was treated adequately in the old FM 44-1, but now it is totally deleted. I think it belongs in FM 44-1 even though it may appear in some other FM. This particular subject involves the teaching of the air defense estimate of the situation and is a tough question to answer. In fact, Army commanders (not just air defenders) are the ones that have to answer the question. Historically, the air defense officer has been the individual to recommend the priorities to the commander.

Well, in keeping with the TRADOC concept of training platoon leaders and battery commanders, the Air Defense School has gone along with "How to create mental cripples" by the deletion of this material. You can see the handwriting on the wall that if the Army does not generate the requirements for AD protection, then nobody will do it. In this vein, the Army should designate Hawk as a SHORAD and area defense weapon.

Command and control is another Army area that needs attention. The Army short-range systems will never be really integrated until communications are made available to the individual Redeye, Chaparral, and Vulcan or their follow-on replacements. Why is integration important? If you ever want to fire or declare WEAPONS FREE, then you need integration. Plus, we must stop trading off IFF in the early stages of a weapon's development as being too expensive. In the first place, people (AF) do not "trust" other people (Army); however, if the Army guy has a "gadget," his credibility is established since they have a common problem (operation of the "gadget").

I think these are valid points that must be constantly assessed or the Air Defense Branch may not operate the systems of the future.

JAMES E. WILSON
LTC, ADA
HQ, CENTAG

SQT SCHEDULING

Dear Sir:

Your January-March 1977 AIR DEFENSE Magazine contained numerous enlightening articles for the Air Defender. However, the article, "SQT Unveiling," on page 46, was incomplete. It should have stressed that CMF 16 SQTs to be administered for record during the July to December time frame are SQT 2 and 3 16B; 2 16C; 2, 3, and 4 16D; 2, 3, and 4 16E; 2 16H; 2, 3, and 4 16J; 2, 3, and 4 16P; 2, 3, and 4 16R. All MOS in CMF 16 will be tested in CY 1978.

CHARLES L. REED
CPT, ADA
Branch Chief, ITA, DTD
(ADA SQT Development Branch)
Fort Bliss, TX

RESEARCH REPORT

Dear Sir:

During research in which I engaged while on a recent tour of active duty, I analyzed several after-action reports covering field training exercises. A number of problem areas confronting battalion staffs, maintenance units, and firing units was surfaced in the reports that I think should be brought to the attention of your readers to assist in planning future field exercises. Accordingly, I have codified them as to general areas of responsibility and they are submitted herewith for your consideration. Courses of action are recommended where possible to help solve the problem in the future.

JAMES F. BELL
LTC, ADA
USAR

STAFF LEVEL COMMENTS:

• *There was insufficient S1 play.* Planners must consider the essentiality of S1 play to realism in all exercises of battalion strength and above.

• *Division courier procedures were a problem in that the distance between various battalion staffs and division was such that courier runs were almost worthless.* Courier runs should be scheduled so that each unit is visited at least twice a day.

• *In Chaparral and Vulcan units, the S3 had difficulty in assessing kills of enemy aircraft because the "killed" aircraft were used immediately to attack again.* This was a drawback in evaluating effective ADA operations.

• *The number of "enemy" helicopter flights against Chaparral and Vulcan units was not entirely realistic.* The intent, no doubt, was to give the units a lot of engagement practice; however, in actual combat there would be very little rotary wing aircraft activity because of these weapons.

• *In airspace management there is an evident lack of training in the areas of coordinating, integrating, and regulating flights.* Training may need to be increased considerably to tie in the entire structure of the proper management of airspace control. Personnel must use the same language so that there is no question as to what a particular word or term means.

• *There was a problem of ADA weapons integration into the defense structure because of communications trouble involving the automatic data processing equipment.*

• *Traffic control problems developed due to the close proximity of S4, medics, and battalion maintenance operations.* Plans should provide for adequate dispersion to allow these units to function properly.

• *Communication was degraded because of too many antennas being located close together.* The present TOE does not provide enough radio equipment in the S3 section or a 292 antenna. Action should be initiated to have the TOE changed to meet the need of more radio equipment and provide a 292 antenna.

• *Ration resupply runs were excessive.* This problem could be ameliorated by a consolidation of ration breakdown.

• *Line batteries failed to notify S2 of their redeployment moves.* The number of personnel in the S2 section does not allow for 24-hour manning. There should be a minimum of two people on duty in this section at all times.

BATTERY LEVEL COMMENTS:

• *Early warning at battalion level from Hawk AADCAP sometimes is interrupted.* A backup system should be considered.

• *After Hawk simulated engagements were scrubbed, the previously engaged targets continued to fly over fire units without any EW updates.* New EW information should be provided to affected units when a "destroyed" aircraft immediately assumes the role of a new target.

• *Units that were supported by ADA units too often failed to recognize the role of the ADA support.* In one instance, the company commander of a tank unit failed to deploy or integrate a Vulcan unit that was there in support into his night defense or convoys. Other supported units failed to tie in ADA operations with their unit's operations. Supported units generally lacked understanding on how ADA hostile aircraft determination and engagement rules are developed. Supported units must be thoroughly schooled on the role of ADA in support.

• *There were instances of lack of markings (or even friendly markings) on "enemy" aircraft.* In one instance it was noted only 1 of 14 aircraft was showing hostile markings on DISCOM assault. There was confusion on the changing of the hostile aircraft list during and prior to the actual exercise.

• *If there is no EW radar, the operation of an EW net on a 24-hour basis is a useless drill during the hours of darkness.* Radar coverage for EW is necessary at all hours.

• *The direct exchange of deadlined system components with S4 causes problems to the supported unit.* The general support element should coordinate and supervise all logistical functions.

• *Some communication problems were experienced.* One that arose was with the AN/GRC-106. The radio historically has had questionable reliability. This can be overcome to some extent by better operator training, but in general the radio needs to be improved. The keying devices on the TSEC/KY-8 may function poorly due to age and heavy equipment usage. Operators should be taught to watch for and, where possible, correct the difficulty. Operator training on the AN/VRC 46/47 (FM radio equipment) needs to be increased. This was shown by the significant down time. Another common difficulty was noted when the KW-7 crypto device in the AN/GRC 122 (RATT) malfunctioned due to heat.

• *Local calls through the switchboard (SB-86) were delayed on several occasions because of operator difficulty.* It would be wise to increase operator training on use of the SB-86 switchboard. Other SB-86 difficulties arose because of heavy traffic in the HHB area. Training in quick repair and tagging of wire can be most helpful for quick repair.

• *A significant difficulty was encountered when fuel tank carriers from the batteries carried two-thirds diesel fuel to one-third MOGAS.* The exact opposite should be the case because the MOGAS fuel demands are much higher. The diesel vehicles, once moved to position, used relatively little. The gasoline-driven vehicles are constantly in use.

• *Some difficulty was experienced due to an inadequate flow of information.* In several instances, battalion personnel in HHB were not briefed as to the location of the battalion staffs or medical facility. A medical section had not been briefed as to the location of the field hospital. A personnel section failed to show for an initial briefing, except for three people. Providing a backup to getting the word out seems indicated.

C/V TACTICAL EMPLOYMENT

in the 8th infantry division

Captain John Costello

During the past year, the men of the 1st Battalion, 59th Air Defense Artillery, the divisional air defense battalion for the 8th Infantry (Pathfinder) Division, have blazed new trails with their participation in tactical concepts within the Army's ARTEP procedures. The training began with air defense elements being integrated into the Division's annual company tests. From support of those tests through continued operation during the Division's battalion ARTEPs, Chaparral/Vulcan elements have played a key role as an integral part of the combined arms concept.

Each new concept and lesson learned from both groups of tests were emphasized during the battalion's own squad ARTEPs held in preparation for the culmination of training efforts during Reforger 1976.

The purpose of this article is to describe how air defense is being employed within a divisional training program that is based on a real-life and real-time threat and involves the development of new tactics using the ARTEP as a training vehicle. In particular, the growing importance of the role of Chaparral, which does not have the dual role capability of Vulcan, will be shown, especially in its close integration with maneuver elements.

8th Infantry Division Company ARTEPs

Company tests held in 1976 emphasized small unit tactics and integration of the Vulcan into the general scheme of maneuver. Vulcan platoon missions ranged from protection of battalion command posts to movement with the overwatch element during the attack phase. Chaparral, meanwhile, played a general support role, requiring air defense commanders and maneuver unit commanders to closely coordinate movement and to place emphasis on mutual planning. Although not fully integrated into the problem because of the size of the units being tested, the weeks spent in support of the tests provided leaders both at Chaparral platoon and squad level a close look at armor and infantry combined arms teams. This set the stage for future liaison during the battalion ARTEPs held later in the year.

In the interim between the company and battalion tests, the air defenders of 1/59 participated in two no-notice, alert river-crossing operations. On one such operation a Chaparral and a Vulcan platoon, given 45 minutes notice, departed the battalion cantonment area, conducted a convoy linkup with a battalion task force, road marched 35 kilometers to a crossing site on the Rhine River, and provided air defense for the bridgehead—all within an hour after their departure.

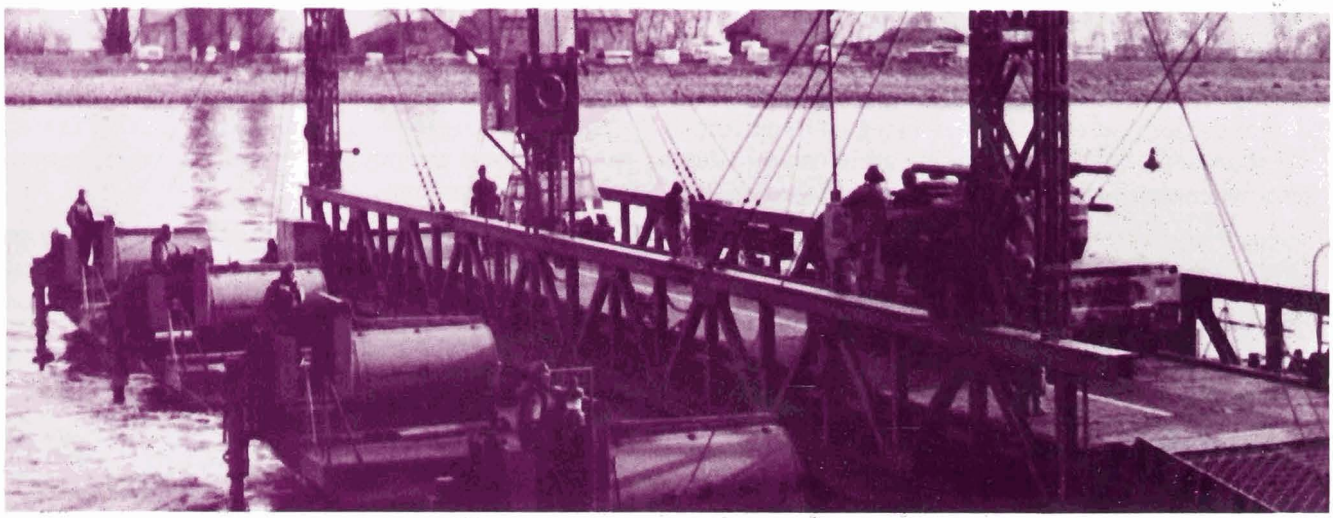
The bridgehead was secured by a German security company and the crossing conducted by a raft company of the Bundeswher. Air defense elements were deployed on both sides of the crossing site; some air defense elements had crossed to the far side with the lead elements of the security detachment. Such training once again emphasized the necessity of close coordination between both maneuver elements and their support, and provided an example of continuing emphasis on interoperability with our Allies.

8th Infantry Division Battalion ARTEPs

The 8th Infantry Division battalion ARTEPs marked the Army's first full-scale implementation of the ARTEP at this level. Repetition of various problems pitted a two-battalion task force size element against the Division's armored cavalry squadron, buttressed by British armored reconnaissance elements. Throughout the problem, the "enemy" simulated Soviet tactics, which consisted of a movement to contact, threat-oriented defense or active defense, and an attack phase. Air defense was integrated closely into each phase, the initial linkup being made during the D-2 through D-1 time frame with movement of the battery headquarters into the brigade tactical operations center (TOC) and coordination and movement conducted by both Vulcan and Chaparral platoon leaders. The task organization consisted of one Vulcan platoon in operational control (OPCON) of each maneuver battalion with a Chaparral battery in direct support of brigade. The air defense battery commander thus became the brigade air defense officer and was responsible for information dissemination and integration of Vulcan, Redeye, and Chaparral.

Located inside the brigade tactical operations center, the air defense battery's representative had easy access to the brigade S3, fire support officer (FSO), and air liaison officer (ALO). Maintaining FM communication with the five platoons in the problem (two Vulcan and three Chaparral) and with the air defense battalion headquarters, the brigade air defense officer (ADO) acted as a focal point for air defense coordination, early warning information, weapons control statuses, and friendly flight information. This point of contact also provided backup air defense information for the brigade's Redeye teams along with updated information on forward area alerting radar (FAAR) frequencies and locations. By plotting Redeye locations on an air defense situation map, the brigade air defense adviser was able to provide the commander with a clear picture of the total air defense deployment. From this picture, adjustments were made and a better balance provided among Redeye, Vulcan, and Chaparral.

During the movement-to-contact phase, Vulcan platoons displaced forward with their respective task forces while the Chaparral platoons occupied positions relative to their priorities of brigade and battalion TOCs, trains areas, and field artillery locations. Chaparral was echeloned as far forward as possible, while at the same time providing coverage for the assigned priorities. Alternate and supplementary positions were reconned and occupied



River crossing operation in progress.

by all squads to avoid having their positions located by air reconnaissance. This constant varying of positions, coupled with movement at night and effective camouflage, prevented the squads from being detected. It also led to enemy airmobile operations being planned around positions that were reconned a few hours before but were no longer occupied when the attack occurred. When a major airmobile operation occurred at 0430 on D+2, the air defenses were prepared in new positions to counter the threat.

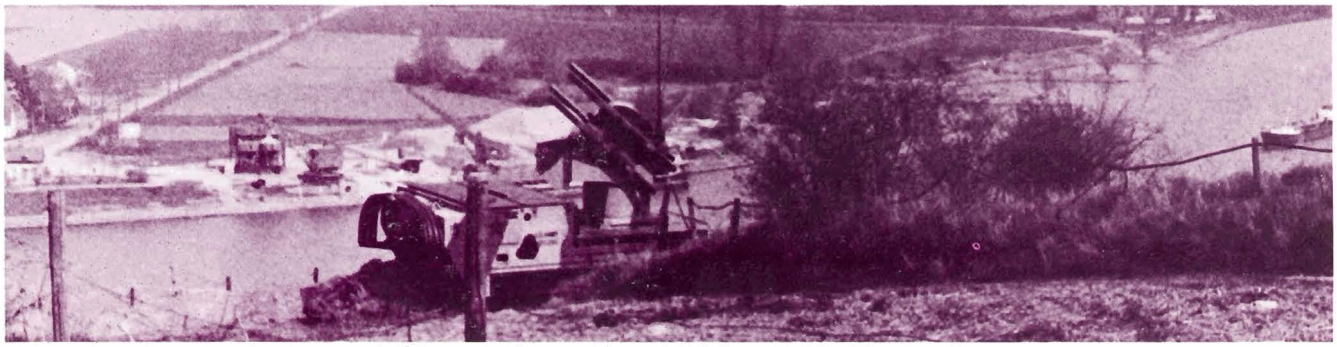
Lessons learned in countering airmobile operations proved extremely valuable months later during Reforger '76. A key factor was the positioning of air defense elements in areas to counter nap-of-the-earth (NOE) flights. Such positioning requires a good appreciation of the mission, threat, and RSOP procedures since positions that are good against a NOE threat are not necessarily adequate for a high-performance, low-altitude threat. The commander is forced to have a firm grasp of the terrain through map and ground reconnaissance to insure a balance when both threats exist. Even when a decision to emplace a system is made, the problem is not solved; coordination with the ground forces remains critical. The air defense platoon leader or battery commander often finds himself competing for valuable terrain with crew-served weapons, tanks, or TOWs of the maneuver forces. Hence, terrain appreciation and continuous coordination as a member of the team remain essential to success.

Once contact was made with the enemy and the friendly advance halted, air defense elements moved into more static positions, Vulcans still far forward with the lead elements of the task forces. A counter-attack by the enemy using mass armor assaults of more than 50 vehicles forced both Vulcan and Chaparral elements to redeploy and move into support of the active defense. This defensive strategy, which is of critical importance since our NATO forces plan to meet a superior armored force, demands that not only the maneuver element commander but also the supporting unit commander closely plan and coordinate all actions. Based on the concept of massing all available fires within a particular area or avenue of approach (engagement area), the active defense requires the close attention of air defense commanders at all levels. More often than not, critical areas as designated by the active defense are also probable avenues of enemy approach; hence, planning for Vulcan and Chaparral positions takes on great importance.

During the problem, Vulcan was positioned with the maneuver elements around engagement areas in such a manner that air and ground fire could be effectively delivered into the zone. Chaparral, on the other hand, provided coverage over and usually behind the zone. Again, critical in planning was the competition for key ground between tank, TOW, mortar, and Chaparral, because many of the characteristics of a good position were similar for each weapon. Foremost in the air defense commander's mind, of course, is to provide air defense for designated priorities. However, ground tactical considerations and concealment of positions often dictated that the nice-to-have position was just out of the question.

During the active defense, the air defense commander must have a constant awareness of the fluidity of the battlefield and each leader down to squad level must be specifically aware of unit, number, mission, etc., down to the smallest detail. Without this information, air defense elements are subject to being overrun, captured, or destroyed by friendly forces because they might be positioned in an engagement area.

To preclude such circumstances, the air defense battery commander was read in on the tactical situations early during the planning stage. During the critical portions of the problem, coordination meetings were conducted personally by the brigade commander with his S3, ADO, FSO, and ALO. During these sessions, the defense and attack plans were firmed and finalized, questions asked and answered, and final conditions made. During the attack, the brigade commander, S3, ADO, FSO, and ALO formed the jump TOC and observed the battle from key locations.



A Chaparral provides air defense at bridgehead.

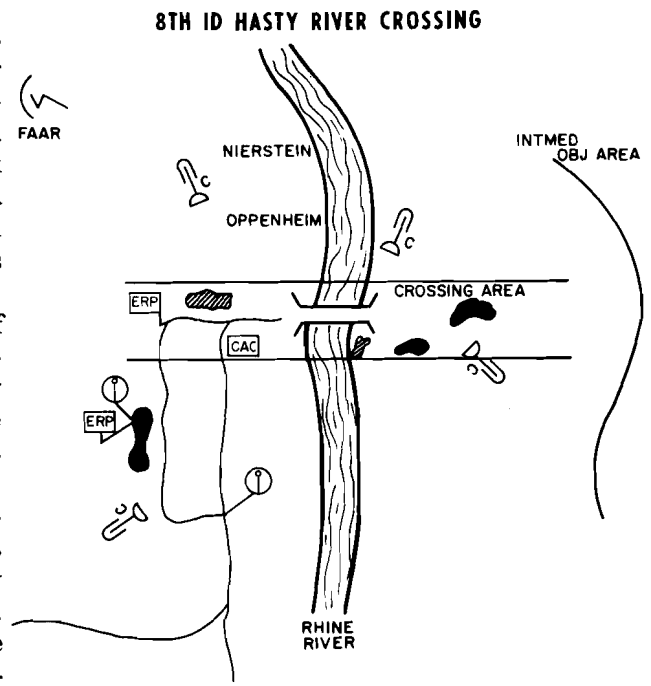
The conduct of the attack demonstrated the value of such close coordination. Preceded by live close air and field artillery fire, the battalion task forces crossed the line of departure (LD) with Vulcan well forward. Chaparral had been prepositioned behind the LD to provide coverage for the advancing forces. This had to be done with extreme care so as not to give away the attack. Once all the maneuver elements crossed the LD, Chaparral followed, displacing on command to preplanned positions along the axis of advance. Control of the Chaparral elements was closely exercised to prevent degradation of air defense coverage, but at the same time providing coverage to those elements in the attack. As the TF commanders called in the phase line crossings to the brigade jump TOC, the air defense commander, on the spot, through use of prearranged code words could control the forward or rearward motion of Chaparral. By using this system and by squad training in quick action drills, RSOP, and camouflage, more than adequate air defense was provided.

Because of the success of close coordination and integration of air defense during the division ARTEPs, the challenge of Reforger '76 was optimistically anticipated. Prior to the Reforger exercise, continued effort was placed on squad proficiency through the ARTEP vehicle. Emphasis on making the squad leader aware of his responsibilities was exercised through prescribed standards for movement, communications, map reading, and target engagement. With the approach of Reforger, the air defense artillery was both well-trained and well-maintained.

Reforger '76

The air defenders of 1/59 played a key role in the Reforger '76 exercise as the air defense battalion of the 8th Infantry Division (Orange Forces) facing both high-performance and helicopter threats. Helicopters were from the 101st Airborne Division. The activities of the Chaparrals of Battery D, 1/59, in GS of the 8th Infantry Division present an example of typical activities plus special missions the air defense battery must be prepared to perform.

The air defense priorities for Battery D were the Division TOC and Division Support Command (DISCOM). Once deployed on D-Day, the battery was positioned in a protective belt approximately 40 km wide to the rear of the maneuver elements (with their air defense in the form of DS ADA batteries), and from 3 to 8 km in front of the areas containing the assets to be protected. Deployed along the low-altitude avenues of approach, modified mutual support was possible in those areas deemed exceptionally critical. Employment covered both high-performance routes of approach and those low-lying areas suitable for NOE flying techniques. Key coordination was effected with the DS Hawk unit to insure that dead areas deemed critical were provided air defense coverage. Hawk coverage diagrams were used in constructing the defense, and Chaparral/Vulcan positions were made available to Hawk through the Division Airspace Management Element.



There was little air activity on D-Day as the Orange Forces (8th Infantry Division) pushed south. Emphasis was placed on concealment, communications, preventive maintenance, and observation and detection through visual sightings and through the TADDS/FAAR link.

D+2 saw some high-performance aircraft attack friendly positions. Engagement reports were confirmed by on-the-spot umpire computations. Squads continued to vary their locations within their assigned areas; OR rate remained 100 percent. Between 2300 and 0130, an attack was made on the Division headquarters by a small sortie of helicopters. Chaparral squads provided early warning, but did not engage due to fire criteria restrictions.

On D+3, the Orange Forces met stiffer resistance and preparations for a possible airmobile counterattack were made. Because of the increasing threat of an airmobile operation, a rear area protection (RAP) mission was assigned to segments of the Division to secure the extended lines of communications resulting from the rapid mechanized advance

made by the Orange Forces. As part of the RAP mission headed by the DISCOM commander, the engineers, armored cavalry, rangers, and GS ADA were consolidated into a RAP CP. D Battery train was divided with the combat element moving to the DISCOM TOC and the field element collocated with an armored cavalry platoon, remaining slightly more forward to provide continual support for the Chaparral platoons.

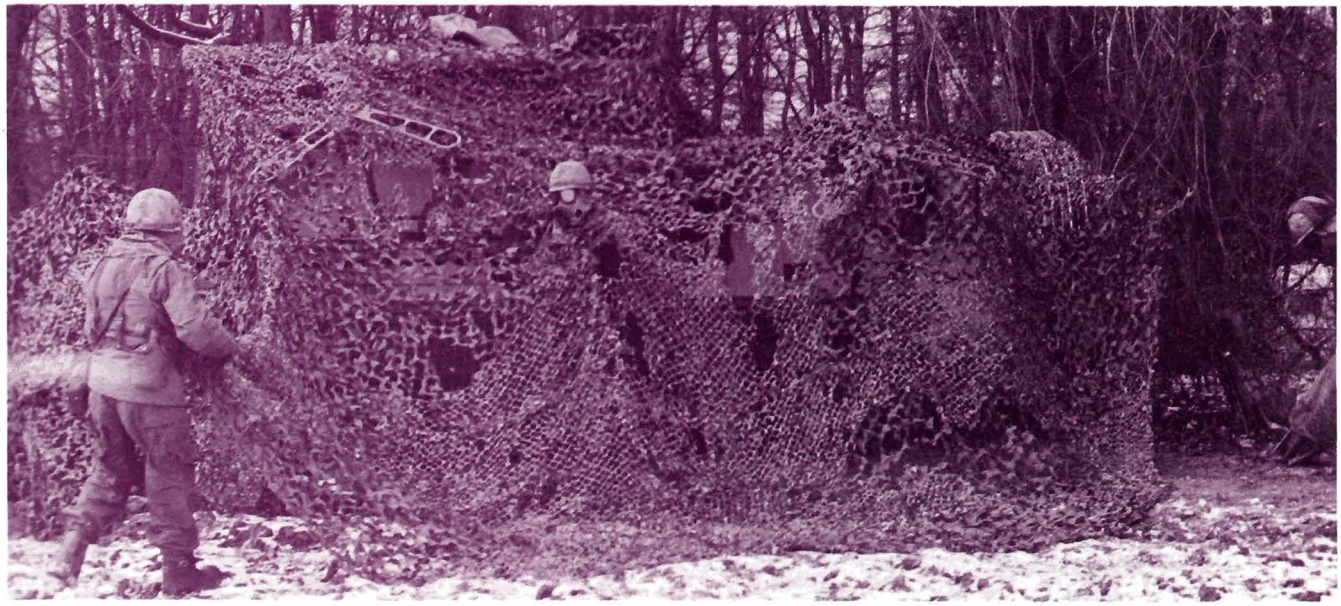
At 1530 D+3, during the displacement of the battery TOC to the RAP headquarters, the first major air assault took place. Both FAAR and visual spottings confirmed large groups of helicopters moving northward. After-action engagements flowed quickly and those confirmed were passed to higher headquarters as soon as possible by the now very mobile battery TOC. The air activity became so intense that all radio nets were cleared to allow for only early warning information, using a grid identification system designed for the exercise (Spectrum X). The termination of the assault saw a large number of confirmed aircraft kills and no successful insertions. The FAAR/TAADS data link proved invaluable as information reached the squads quickly. This was reinforced through backup information on the command net when multiple targets were spotted by the radars.

The Battery TOC closed with the RAP CP at approximately 1730. Initial coordination was made. Air defense briefings were presented to the RAP staff and the 1st Battalion, 75th Rangers, assigned as a quick reaction force after their successful attack behind enemy lines the day before. Critical to the air defense mission was not only the destruction of hostile aircraft but also the relaying of early warning and sightings to the RAP TOC so that any trend of aircraft approach could be determined. Through visual sighting, FAAR, and Spectrum X reporting, each major attacking force was to be pinpointed and rear area forces alerted. It was important not only to attrition, but to spot troop insertions and to distinguish whether they were real or false.

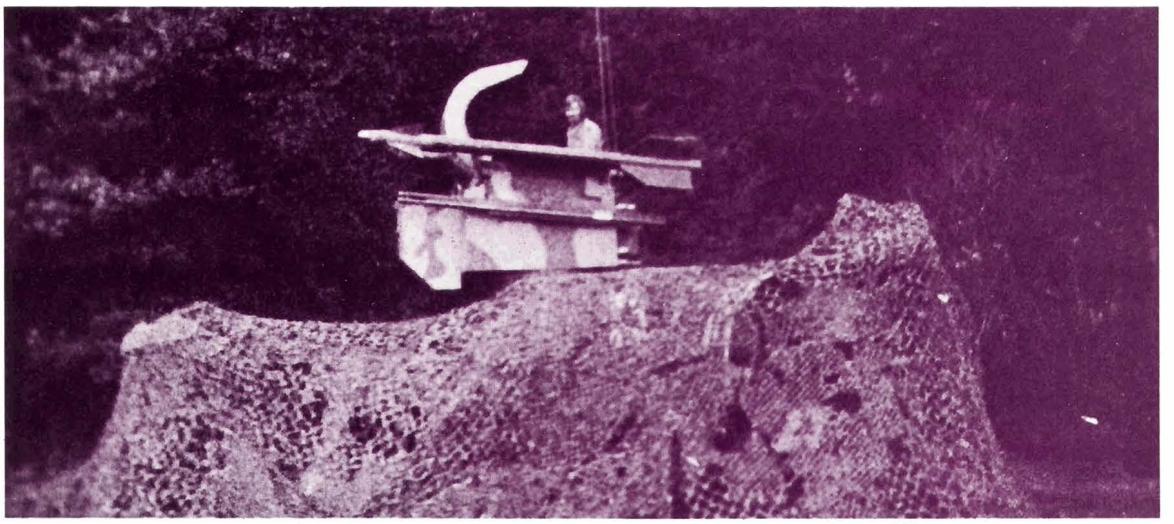
The main attack came the following morning (D+4) and began with a trickle of FAAR data increasing to multiple data, then to visual sightings and engagement reports. The single approach, rally point, and movement to the objective of enemy air became apparent. Because of this information, the cavalry and rangers were alerted and moved to LZs so quickly that they often formed the greeting party for lead elements. Some assaults were greeted by rangers, others by cavalry, and still others by self-propelled 155s in a direct-fire role.

The Chaparral squads, meanwhile, continued to engage at a hectic pace. At the end of the attack, a phenomenal number of kills was confirmed, based on actual engagement sequences, missile reload time, and missile resupply. Some squads did expend their basic loads plus the available supply rate that had been drawn and distributed daily. Simulated and timed ammunition cross leveling, inter- and intrabattery, did occur to insure that critical positions did not run dry.

One of the main approach avenues used by the 101st became known to the air defenders as the Neukirchen Gap Trap and provided a good example



A Chaparral squad operating in "Nuclear, biological, chemical environment."



On full alert

of the effectiveness of air defense and the value of good, sound RSOP techniques. Both Chaparral and Vulcan were strategically positioned along this approach. Camouflaged, using natural terrain and shadows, located on rear slopes and the edges of treelines and in shoulder-high bushes in open fields, the squads were not spotted from the air until it was too late. Helicopter sorties actually landed within a few meters of Chaparral positions without knowing of their existence.

The squads positioned in this Gap accounted for more than 50 confirmed aircraft engagements out of the numerous aircraft tracked. What is important, however, is the proof that by using good camouflage techniques and taking advantage of the terrain through detailed planning, the supposed shortcomings of the Chaparral system can be overcome and Chaparral will work in an extremely effective manner. The Neukirchen Gap further demonstrated the value of mass, some mutual support, early engagement, and defense in depth. As the helicopter forces approached their major objective, it was estimated that over 50 percent of their force had already been destroyed. Those aircraft not engaged by air defense artillery on the way in were targets on the way out.

Of course, one must temper any overly optimistic feeling of success with a consideration of the unrealities of a training exercise. Both sides operated in a bullet-free environment and both sides lost and gained by the necessary exercise programed controls. However, the Reforger experience showed that forward area air defense can survive on the battlefield through camouflage, concealment, fire distribution, and RSOP of alternate and supplementary positions. Through the proper positioning and massing of weapons, Vulcan and Chaparral can counter the NOE antitank helicopter. Reforger '76 and the entire training year proved that air defense artillery, especially Chaparral, can move about, can communicate, and can be an active participant in combined arms actions.

Captain Costello received a Bachelor of Arts Degree from the Citadel and a Master of Arts Degree from the University of Virginia. In addition, he is a graduate of the Air Defense Artillery and Armor Officers Advanced Courses. He has commanded a towed Vulcan battery in the 82d Airborne Division and served as an adviser in Vietnam. Presently he is commanding Btry D (Chap), 1st Bn, 59th ADA, 8th Infantry Division, in Germany.

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A battery of Bofors 40/70 mm automatic guns in action.

aircraft and guns: the everlasting duel

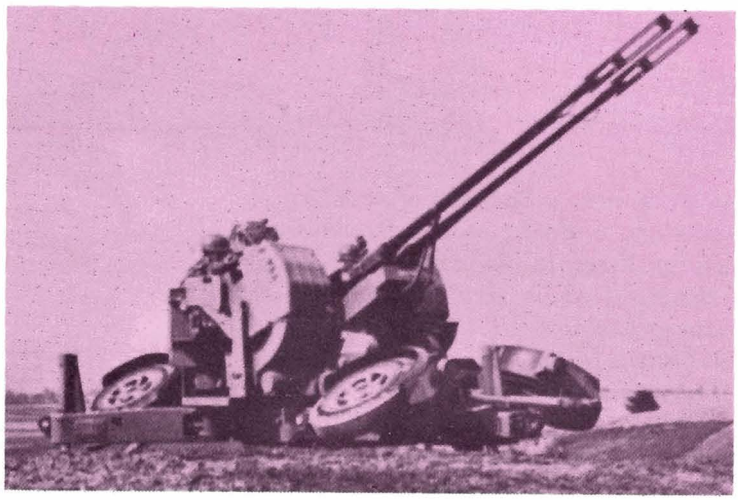
MASSIMO FERRARI

In the Fifties, when Western general staffs were hastening to replace traditional AA weapons (artillery and machineguns) with missiles and non-guided rockets, the general opinion was that the days of AA artillery were numbered and its operational credibility minimal. The exaggerated faith in guided weapons had relegated artillery development to a position of little importance, since it was felt that it was inevitably destined for elimination. Events have proved this attitude to be mistaken, and have shown that traditional AA artillery, appropriately up-dated, is an indispensible weapon against attacking aircraft, even in this era of great progress in missiles - especially the individual type employed by the infantry - and in aviation technology.

As far as the Eastern bloc nations, led by the Soviet Union, are concerned, they have never abandoned the idea that modern and efficient traditional AA artillery is a necessity, and the fruits of their longsightedness are apparent today in their excellent AA artillery pieces, and their efficient and flexible AA forces. The Western countries on the other hand are less well-covered in this particular sector; those which traditionally or through military alliance use American equipment, find themselves today equipped with guns which are largely outdated, since the United States is only now trying to make up for lost time, and is engaged in developing weapons systems in which the traditional artillery component is integrated with a missile system.

Interesting projects are, however, under way in Western Germany, France, and some of the neutral countries, such as Sweden and Switzerland, where manufacturers for some time now have taken the initiative in facing up to this problem.

Against high and medium level attack, missile systems have shown themselves superior to any other type of weapon, thanks to the great range of their search equipment and the precision of their guidance systems. Their effectiveness is such that attacking aircract are now virtually obliged to adopt low-flying tactics, where they can use ground features in the hope of escaping discovery. In this particular context, automatic control and navigation systems are being perfected which allow the aircraft to approach at a programmed altitude, following the ground contours and minimising the danger of long-range discovery. It is against this type of attack, which at present comes in at a maximum altitude of about 600 m, but which could in the near future be reduced to under 200 m, that conventional AA artillery has shown itself to be irreplaceable. Even when used alongside the latest missile systems, specially designed to combat low-level attack, with which it forms a complex capable of meeting any requirements, the decisive role is still that of the traditional artillery.



The Oerlikon GDF-001 twin 35/90 mm AA gun (already known under the designation 2ZLa/353), which is without doubt one of the best weapons of its type.

In keeping with its role, the calibre of these weapons is obviously not large: the range is, in fact, between 20 and 57 mm, but recent tendencies are

The American M-163 self-propelled AA system made up of a VADS complex, using the well-known M-61 A-1 VULCAN 20 mm revolving barrel gun mounted on the hull of an M-113 A-1.

The French Panhard AML S-530 light AA vehicle, equipped with a SAMM turret armed with two M-621 20 mm machineguns.

narrowing the range even further to between 20 and 40 mm.

GENERAL OPERATIONAL CONCEPTS

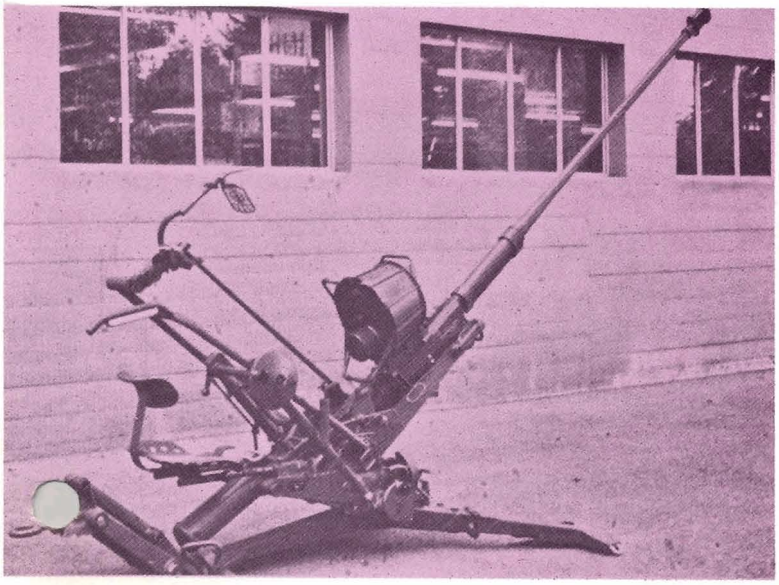
Having handed over to the missiles the role of defending large urban areas and industrial complexes, and the task of defending against strategic bombers, today's artillery has the essentially tactical task of providing point defence for military installations and positions, airports, and troops on the move. Since, as we have said, its main adversary will be the strike or bomber aircraft flying low to avoid radar, then it must be capable of putting up dense and accurate fire, so that those aircraft which do succeed in avoiding the missile screen must fall to its fire, or at the very least be disturbed to the extent where they are unable to successfully carry out their strike mission.

Under a separate heading come the armoured column AA defences, made up mainly of artillery pieces mounted on tank or other armoured vehicle hulls, served by mobile search radar.

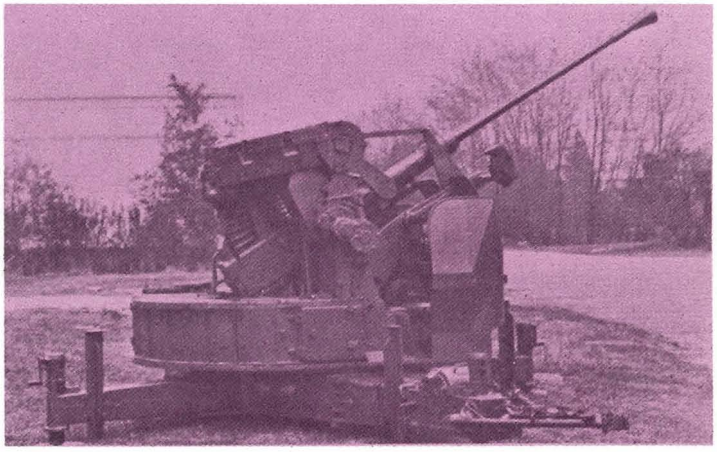
There are examples galore of this particular philosophy in the more recent world conflicts. In Vietnam it was shown how an army with little air cover — or at least very much inferior to that of the enemy — can drastically reduce the effectiveness of air support through the operation of an effective and powerful AA network served by efficient radar and visual surveillance. Wars such as that in Vietnam, and the recent Arab/Israeli war of 1973, have confirmed the validity of traditional AA weapons, and have opened up new horizons of technical and operational development in this sector. Having established the principles behind this new-found importance of traditional AA artillery, we shall go on to look at the most outstanding characteristics of the main types currently in service throughout the world.

SOVIET UNION AND WARSAW PACT COUNTRIES

As we have previously said, the Soviet Army and those of the WARSAW PACT countries are currently the strongest in the world as far as AA artillery is concerned. The largest calibre gun used has been the 130 mm M-55 (KS-30). This weapon, at the time of its first appearance, had a reasonably acceptable performance, with a vertical range of about 16 kms., a rate of fire of 10-12 rounds/min, and a muzzle velocity of around 945 m/sec. It has since been replaced in its country of origin by missile batteries, but is still in service in a number of countries militarily assisted by the Soviet Union.



The Oerlikon KAB (ex-5TG) 20 mm machinegun with a barrel of 120 calibres on a GA1 (ex-101-La) infantry AA mount.



The widely-used Bofors 40/70 mm automatic cannon modernised with a Breda 144-round automatic loading system. The modernised version, which is in service with the West German armed forces amongst others, can now attain a theoretical rate of fire of 300 rounds/min.

Also in the process of being replaced is the 100/45 mm M-49 (KS-19), although it still has a very acceptable performance and capability, thanks to its exceptional mobility. It weighs around 19.5 tons, can fire a 15 kg projectile to a height of 13-14,000 metres, and has a rate of fire of 15-20 rounds/min. It is normally used in conjunction with a SOM-9 or SOM-9A radar, similar to the American SCR-584, and a PUAZO-6/19 aiming system of entirely Soviet production. In addition to the Soviet Union and the WARSAW PACT countries, the M-49 is also in service with a number of other countries including North Vietnam, Cambodia, and Egypt.

No longer in service in the Soviet Army, and in process of being progressively replaced or relegated to a secondary role in the smaller Communist countries, are the 85/35 mm M-39 (KS-12) and M-44 (KS-18) guns, which for a long time formed the backbone of Soviet AA defence.

Designed before the Second World War, and extensively used during it, they had a vertical range of around 8,300 m. A modified version was produced by Czechoslovakia, which had a longer barrel and a T-shaped muzzle brake, but its firing characteristics were virtually identical to those of the original model.

Among other pieces which have been superseded in the Soviet Army but are still in service in countries allied to or dependent upon the Soviet Union for military supplies, there is the 37 mm M-39/39 gun which was extensively used during the war in Vietnam. This is the Soviet version of the well-known Bofors 40/56 mm gun, whose theoretical rate of fire (around 180 rounds/min.) make it still a reasonably valid weapon — especially at ranges of between 1,100 and 1,400 m. It was slightly modified by the Chinese, who gave it the designation M-55. In addition to the normal version there is a less widely used twin version in service in a number of countries, including Egypt, Algeria, and China.

The present first line Eastern bloc AA artillery is, however, based on the 57 mm S-60 and the twin 23/80 mm ZU-23.

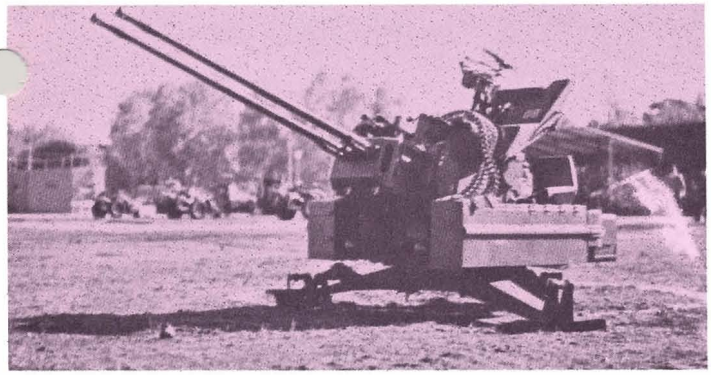
The first of these two first came to the attention of Western observers in 1950, and it very soon became apparent that this was a more powerful version of the German 55 mm Gerat 58 L670-7 automatic cannon, which had still not gone into production when the war ended and whose plans had been captured intact by the Soviet occupation forces. As far as is known in the West, this is an extremely robust and reliable weapon, with a muzzle velocity of around 1,000 m/sec. The projectiles, which are highly destructive and fitted with proximity fuses, are loaded from the left in 4-round clips. The working principle is based on the direct exploitation of recoil forces. A battery of six guns uses SON-9 or SON-9A search radar and PUAZO-6-60 central fire control. It is also used with a new fire control radar known ad FIRE-CAN in NATO code, and operating in the S Band. The whole complex is mounted on a 4-wheel carriage with four hand-operated jacks to establish a level platform. Unlike most Western guns of similar calibre, the wheels are not removed for firing, but raised clear of the ground. The whole complex weighs about four and a half tons. Elevation is from -5 to +58 degrees, and in the horizontal plane it, naturally, covers the full 360 degrees. Range is between 14 and 15 kilometres, with a theoretical rate of fire of 120-140 rounds/min, and a practical rate of fire of 70 rounds/min. firing HE or APHE ammunition. The gun usually requires a crew of 7, and is towed by either a Ural 375 (6x6) or a Zil-157 (6x6).

The 57/73 mm S-60 on a twin mounting in a roofless turret is the artillery piece of the excellent self-propelled ZSU-57-2, which for many years now has provided the mobile AA defence for Soviet armoured and mechanised divisions, as well as those of many other Communist bloc countries. The chassis on which it is mounted is derived from the very well-known T-54/55 main battle tank; since the armour has been

A battery of Soviet ZU-23 twin 23/80 mm machineguns. Derived from an aircraft weapon, it has proved to be very effective.

The French AMX-30 self-propelled AA system equipped with a SAMM S-401 A turret armed with two HSS-831 L 30 mm cannon (now called the KCB by Oerlikon).

The standard version of the classic Bofors 40/70 mm automatic cannon.



The Rheinmetall Mk-20 Rh-202 twin 20 mm in service with the West German and Norwegian armies. It has a theoretical rate of fire of 2,000 rounds/min.

The GEPARD self-propelled AA system, the most sophisticated of its type, equipped with an Oerlikon GDP-B03 turret armed with two KDA 35/90 mm machineguns. The model in the photograph is the one selected by the Bundeswehr.

The British Vickers FALCON self-propelled AA system with two HSS-831 L (now known as the KCB by Oerlikon) 30 mm cannon.

The Israeli twin 20 mm on a Half Track. This gun uses the American Maxton mount and probably the Swiss HSS-804 gun.

reduced, and therefore also the weight, it only has 4 bogies instead of the usual 5.

The twin 23/80 mm ZU-23 is also a standard weapon in the Soviet Army, with the specific role of defence against low and very low air attack. Their particular task is to put up heavy fire against attacking aircraft when they have reduced altitude to assure maximum precision, and are therefore at the most delicate and crucial point of their mission. They have replaced in this role the older 14.5 mm ZPU-4 in many units of the WARSAW PACT armies.

The ZU-23 has easily replaceable barrels, each capable of a theoretical rate of fire of about 1,000 rounds/min. The 23 mm gun has been developed from a model used in combat aircraft, and is gas-operated with vertical sliding bock. Each barrel, which is 2.01 m long, has a large flame suppressor. The ammunition, which includes HEI and API, is similar to that used in Soviet aircraft, and is in 50-round magazines fixed on the outer side of each gun.

The whole is mounted on a light (about 1 ton) two-wheel carriage with jacks front and back, which are lowered for firing, and the wheels can be displaced to facilitate magazine changing. Elevation is from -10 to +90 degrees and the effective range is between 1,500 and 1,800 m.

It is also mounted on an armoured chassis, when it becomes the well-known and effective ZSU-23-4 self-propelled AA weapons system with quadruple 23 mm guns (see ARMIES & WEAPONS No. 22).

The twin carriage is normally towed by a 4x4 Gaz-69 truck, and is air-transportable, and can be dropped by parachute. It is operated by a battery of the artillery battalion supporting a motorised infantry regiment, for which it provides the necessary light AA defence. As far as its effectiveness, and that of the quadruple self-propelled version, is concerned, American and Israeli statistics confirm that in Vietnam and Sinai the 23 mm AA guns produced as good, or better, results than missiles, at lower cost.

Finally, to complete the array of Soviet AA guns, there is the 14.5 mm Vladimirov (KPV) heavy machinegun, in its quadruple (ZPU-4), twin (ZPU-2), and single (ZPU-1) versions, which is also employed on point defence against low-level air attack.

While the ZPU-1 is in process of being withdrawn

The French M-693 M.le F-2 gun on the new 53 T-2 AA mount for the infantry.

from service, the twin version is still in service with Soviet units, and in any event the gun is still in very widespread use in the armies of the smaller Communsit countries. Originally designed to use the ammunition produced for the PTRS (Simonov) and PTRD (Degtjarev) anti-tank rifles, it is belt-fed, has a theoretical rate of fire of 600 rounds/min. (the practical rate is between 150 and 200), and a practical range of about 1,400 m.

Before ending our piece on Eastern bloc AA weapons, it is worthwhile mentioning the Czech 30 mm M-53 gun, which has a theoretical rate of fire of about 500 rounds/min and comes in a twin mechanically towed version as well as a self-propelled version mounted on a Proga V35 armoured truck.

UNITED STATES AND NATO COUNTRIES

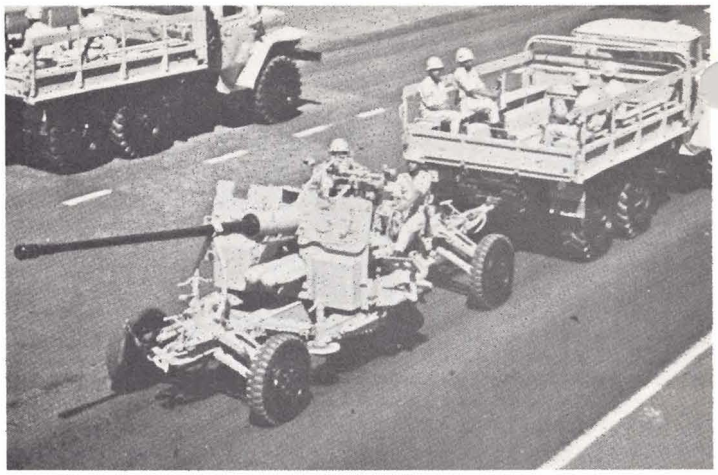
The only traditional type AA weapon currently in service with United Stated forces is the M-61 A-1 VULCAN multi-barrel 20 mm gun, exactly the same as that installed in United States combat aircraft.

After having undergone extensive testing during 1964 and 1965, the VULCAN Air Defence System was chosen by the US Army to equip its AA defence battalions. This is produced in two versions, the M-167 on a wheeled carriage towed by a 4x4 M-37 truck, and the M-163 mounted on an M-113A1 APC, designed and built by General Electric of Burlington, Vermont.

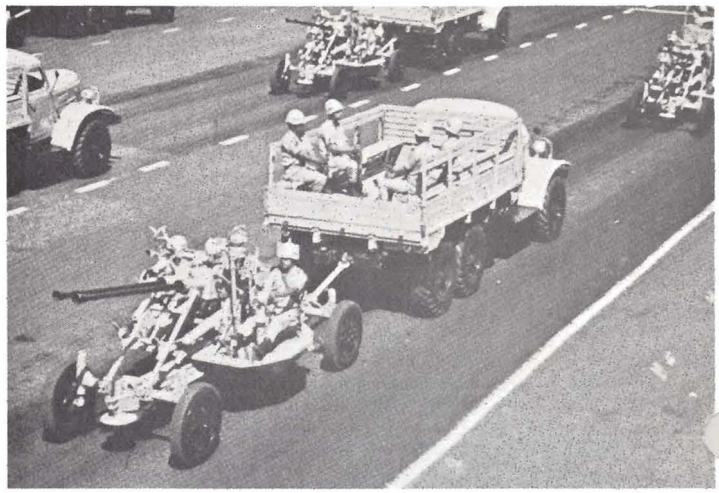
The system consists of a 20 mm M-61 A-1 gun with six revolving barrels, an ammunition container situated on the left-hand side, and a fire control system.

The entire complex is installed in an electrically operated turret, which rotates through 360 degrees and has an elevation of from -5 to +80 degrees. The towed system has an electric generator mounted on the chassis, which assures the complete working of the system. The fire control and aiming system consists of gyro-stabilised sighting equipment connected to an electronic data processing system, a Lockheed coherent pulse Doppler rangefinding radar, and an electric generator for the sights. The layer follows the target with his sights, the radar passes the necessary information on the range and closing speed of the target to the sights generator, which converts them into electrical impulses. When the target comes within the gun's range a green light appears in the sight, and the layer can then open fire, leaving the target with little hope of escaping damage.

There are two different rates of fire; 3,000 rounds/min for use against subsonic aircraft, and 1,000 rounds/min for use against ground targets such as infantry or armoured vehicles. According to the target to be engaged, the gunner has a choice of a large range of projectiles, including tracer, armour-piercing incendiary, and HE in a number of combinations. The VULCAN is employed as a ground AA defence weapon in conjunction with the CHAPARRAL missile batteries, and as such is a valid tactical weapon destined to remain in service for a good many years to come. In addition to the US Army it is also in service with the Israeli Army, and the Belgian Air Force who use it in an airport defence role;

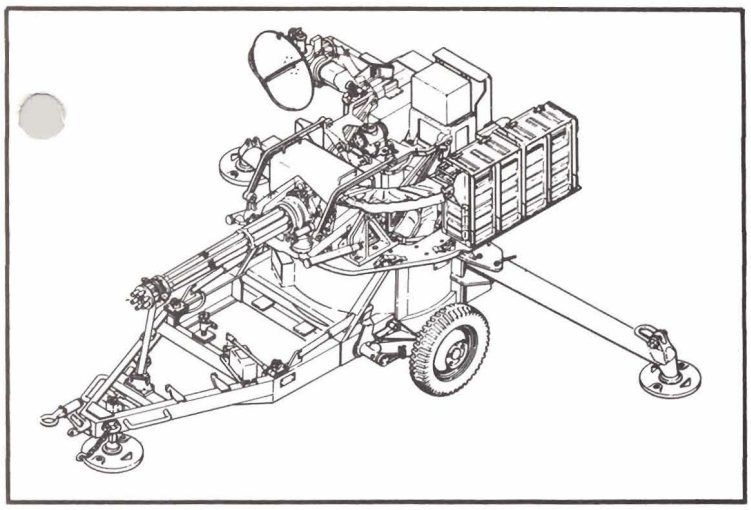


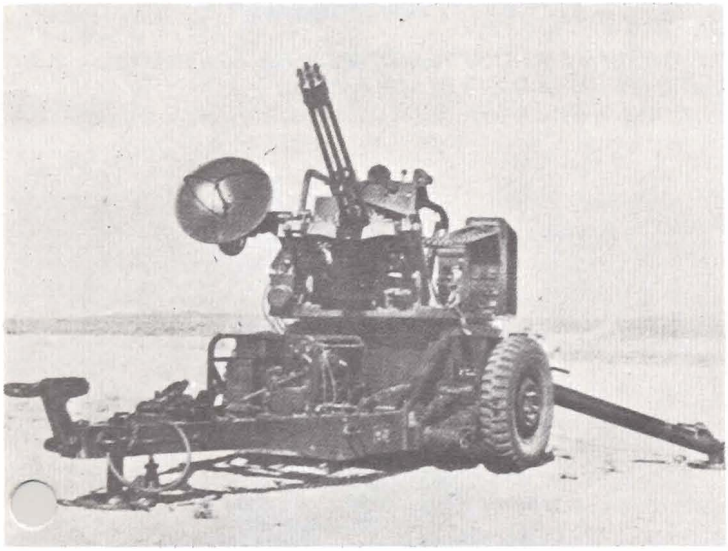
The Russian S-60 57/73 mm automatic cannon.



The Russian twin 37 mm.

The French Panhard M-3/VDA light AA AFV with the TA-20 turret (built in cooperation with Electronique Marcel Dassault, Galileo and CNMP/Berthiez) armed with two HSS-820 (now KAD-B) 20 mm cannon and equipped with a search radar.





The M-167 version of the Vulcan Air Defence System on a wheeled mount.

it is also expected to be adopted before long by Jordan.

Some of the smaller nations, such as Spain, Greece and Turkey, still have in service the 90/50 mm M-117 and M-118 guns on two and four-wheeled carriages respectively, drawn either by 4x4 M-4 trucks or by artillery tractors. These have a rate of fire of 22-28 rounds/min, a vertical range of about 17 kms, and can be elevated and traversed either manually or automatically. The M-117 weighs 8 tons and the M-118 14 tons.

Greece, Israel, Turkey and Japan also use the 75 mm M-51, also known as the SKYSWEEPER. This weapon was developed toward the end of the Second World War, and in addition to the gun itself there is an M-38 fire control system using a search radar mounted on the left-hand side, with a range of about 22 km. For use against ground targets there are conventional optical sights. It is mounted on a 4-wheel carriage drawn by an M-8A1 tractor. The M-51 can fire 45 rounds/min — a rate of fire chich makes it a still-valid weapon — using two circular drum magazines installed at the rear of the mount, and an automatic loading system.

Also in widespread use, although of only relative efficiency, is the 40/56 mm M-1 automatic cannon, an American edition of the well-known Bofors weapon, which the Americans produced during the Second World War under licence from the famous Swedish company. The M-1 has a rate of fire of 140 rounds/min and is still in service, in a secondary role, in many countries allied to the United States. There have also been a great many self-propelled versions, including the M-19 and M-42, still in service in many armies, and much used in Vietnam.

Among multi-barrel guns there is the 12.7 mm Browning M-2 HB M-55 on a Maxton carriage, which is now outdated but still in service in many armed forces, including the Italian, in which it should soon — we hope — be replaced by a more modern weapon.

Also in widespread use in NATO or Western bloc countries, as well as a number of neutral and Third World countries is the 40/70 mm automatic cannon, designed by Bofors but built under licence in a number of countries, including Italy where it is produced by the Breda company (see ARMIES & WEAPONS No. 13). This gun is still the backbone of the light AA defences of Great Britain, France, Italy, Spain, India, Austria and naturally, Sweden.

The Federal German army and air force on the other hand are just bringing into service the excellent twin 20 mm Rheinmetall Mk-20 Rh-202, which is undoubtedly a big step forward (see ARMIES & WEAPONS No. 4). The precision, flexibility, and high rate of fire (800-1000 rounds/min per barrel) of this weapon make it a truly valid and reliable AA system which many countries are actively interested in adopting — Norway already having done so.

France is also particularly active in the 20 mm field and has produced two cannon of this calibre, both double feed and both gas-operated. The first of the two, the M-621, was produced to meet the joint specification of the French Army and Air Force, and uses electrically-fired ammunition. The second, the M-693, uses more powerful mechanically-fired ammunition, and has been described in ARMIES & WEAPONS No. 2. For this gun there has recently been put into production the 53 T-2 light infantry AA carriage.

In the self-propelled AA field, which has been little developed in the West, there is the French AMX-13 D.C.A. 30, which consists of two 30 mm HSS-931L automatic cannon on the hull of an AMX-13 light tank. Going into service in 1965, it was virtually the only modern system of this type to be found in Western armies. A series of lighter systems of this type have also been produced in France, including twin 20 mm's in an adapted SAMM S-530 turret mounted on wheeled armoured vehicles, mainly the Panhard AML. The gun used in this turret is the previously mentioned M-621.

The SAMM TG-522 is still in the prototype stage, but results so far appear to be very promising; this consists of twin M-693 (Model F-1) 20 mm's, with a rate of fire of 700 rounds/min per barrel. This twin turret will be series-produced and will be fitted to light armoured vehicles.

In the same category as the preceding two is the Electronique Marcel Dassault TA-20, with Galileo surveillance and observation radar, using two 20 mm HSS-820 automatic cannon. Mounted on a Panhard M-3 armoured car, this system has already been ordered by at least two countries.

To close on self-propelleds, we shall conclude with the GEPARD, the AA version of the LEOPARD 1 armed with two 30 mm automatic cannon, which is currently in production for Germany, which has ordered 420, and Holland, which has ordered 95. This particular system, which must be considered one of the best of its type, has aroused the interest of both the Belgian and Italian armies, whose joint requirements should amount to about 130 units. The GEPARD mounts the excellent 35/90 mm Oerlikon KDA, which has a rate of fire of 500 rounds/min, with the German version using a Siemens radar for the fire control system, and the Dutch version an integrated HSA system. Since the number of rounds carried is limited (238) there is an electronic system which pre-selects the length of burst necessary to knock-out each particular type of target, thus reducing waste of ammunition.

SWEDEN AND SWITZERLAND

These two countries, although neutral, are the homes of two of the biggest names in the armaments industry, Bofors and Oerlikon. In the AA sector particularly, these two companies have always produced high-performance weapons,

which have been largely exported outside their country of origin, and which have always been in the vanguard of technological progress.

Bofors, in addition to their well-known 40/70 mm, also produce the 57/60 mm m/54, which is in service with the Swedish and Belgian armies. This is a gun with a practical range of about 4 kms and a rate of fire of 160 rounds/min. Recognisable by its large shield, it is mounted on a 4-wheel carriage drawn by a Volvo 3154 6x6 or other tractors of similar type and power. Although not the latest of guns, it is still a valid weapon, which explains why it is still in service. Bofors also produced the very famous 40/56 mm m/36, which was produced before the Second World War and is still today — in the up-dated version produced by the Swedish company — in service in many Third World countries and those not politically aligned with one of the super powers. Although decisively superseded in performance, it still retains a certain operational credibilty by virtue of its simplicity, robustness, and flexibility.

In Switzerland, Oerlikon produces a range of small calibre AA guns which must be considered one of the best and most complete to be found anywhere. The range of guns, which currently includes cannon of 20, 25, 30 and 35 mm, has been enlarged by the takeover, a few years ago, of Hispano-Suiza of Geneva.

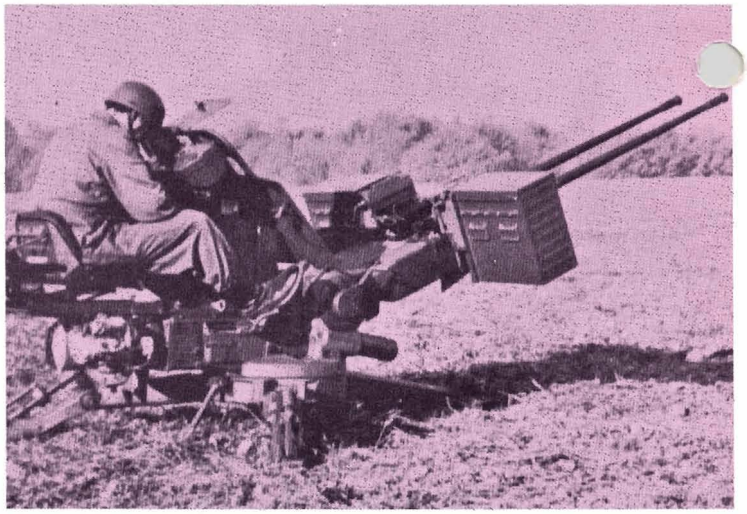
The 20 mm range, which all use the same type of ammunition and are all gas-operated, includes three different models: the 5TG (now KAPB), the 204 GK (now KAA), and the HSS-820 (now KAD-B). The 5TG (now KAB), which has a barrel 120 calibres long, is magazine-fed (drum magazines of 40 or 50 rounds may be used, or straight 8-round clips), and has a theoretical rate of fire of 1000 rounds/min. Developed by Oerlikon at the beginning of the Fifties, it was adopted by the Swiss (who designated it K-54) and Spanish armies, and was mounted either on a 61La wheeled single mount for infantry, or on a 72ZSLa twin mount for fixed emplacements. The carriage currently in production is the 101La, which has been renamed GAI.

The 204 GK (now KAA) was also developed by Oerlikon at the beginning of the Fifties. This has a barrel 85 calibres long, a muzzle velocity. of 1,050 m/sec., is belt fed, and was specifically designed for installation in vehicles. It is particularly used in armoured vehicle turrets (GAD-AOA for example) and on a GAM-BO1 naval mount.

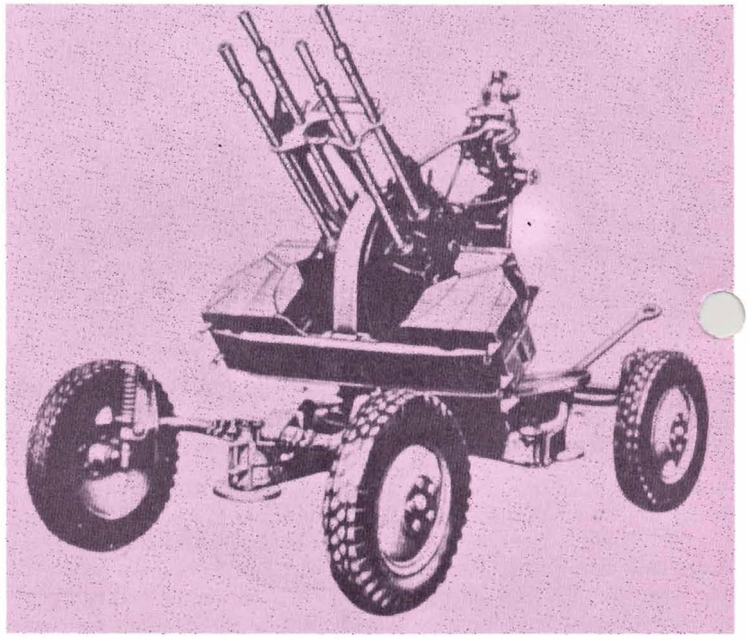
The well-known HSS-820 is a Hispano-Suiza automatic cannon which has been adopted by a great many armies, including the US Army who have given it the designation M-139, and the German Army. It can be either belt or magazine fed, and has a theoretical rate of fire which can be regulated between 800 and 1,050 rounds/min. It has been installed on mounts and in turrets too numerous to mention, but Oerlikon more often than not recommend either the single HS-639 B4 (now GAI-CO2) or twin HS-666 (now FAI-D01) infantry carriage.

Regarding the 25 mm KBA, which was the first automatic cannon to be designed right from the start with double feed in mind, we shall refer readers to ARMIES & WEAPONS No. 6. Although designed essentially for ground use, it was installed in GBD-B20 and GBD-A-5 armoured vehicle turrets as well as being mounted on the GBI infantry carriage. Effective against aircraft at up to 1,500 m range, it has been adopted by the Dutch Army, as well as taking part in the US Army's BUSHMASTER programme.

In 30 mm calibre Oelikon produces the well-known HSS-831 SLM (now KCB-B), with a rate of fire of 650 rounds/min and a muzzle velocity of 1,080 m/sec. Designed by Hispano-Suiza for use in twin turrets on self-propelled AA vehicles (French systems on AMX-13 and AMX-30 hulls, British FALCON, the experimental German MATADOR,etc.), A-32 twin naval mount, or on the HS-661 infantry carriage with hydraulic loading and Officine Galileo P-36 aiming system.



The Oerlikon GA1-DO1 (ex.HS-666) twin complex using two KAD-B (ex-HSS-820 SL) 20 mm cannon.



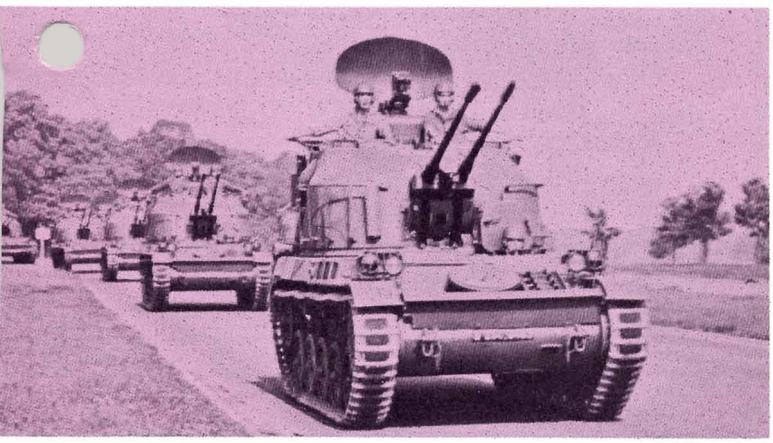
The Russian ZPU-4 quadruple 14.5 mm.

In 35 mm calibre there is the KDB (originally the 533 MK) automatic cannon with magazine feed, and the more recent KDA with belt feed. Both guns are gas operated, have a theoretical rate of fire of about 550 rounds/min., barrels 90 calibres long, and are about the best of their type to be found anywhere in the world.

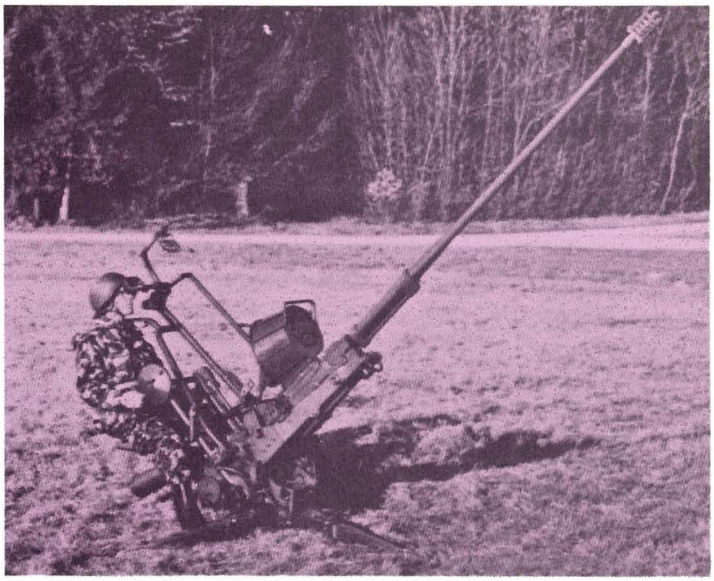
The KDB is the piece used in the GDF-001 (ex 2ZLa/353) twin mount and its GDM-A naval version, both of which are in service with about ten countries. The naval version is used in the GDP turret of the GEPARD AA armoured vehicle, while the GDM-C naval version is produced in collaboration with OTO Melara of La Spezia, Italy. For more detailed information on this weapon we would refer readers to ARMIES & WEAPONS No. 15.

CONCLUSIONS

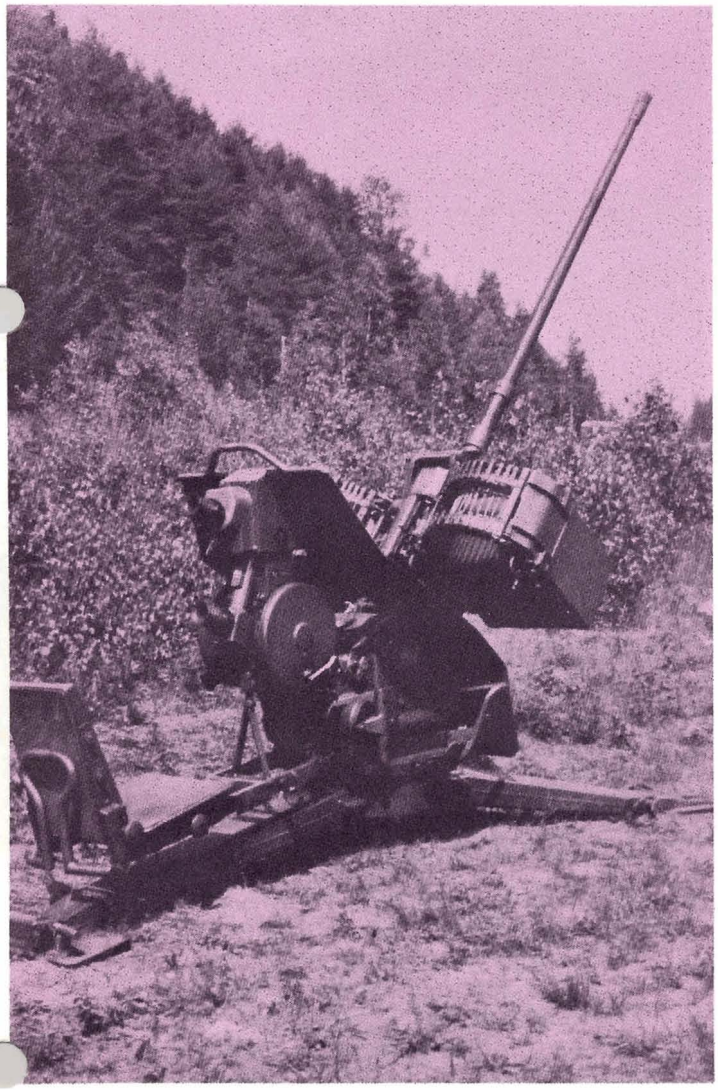
Having reviewed the AA



French AMX-13 self-propelled AA systems equipped with SAMM S-401 turrets armed with two HSS-831 L (now KCB) 30 mm cannon. These vehicles first went into service with the Armee de Terre in 1966.



The Oerlikon 5TG (now KAB) 20/120 mm cannon on a GA1-BO1 (ex-101La) infantry AA mount.



The German Rheinmetall Mk-20 Rh-202 20 mm cannon on the HS-660N infantry AA mount.

weapons currently in most widespread use, a number of interesting conclusions can be arrived at.

The first, and we should think the most obvious, is that manufacturers, both Eastern and Western, are tending more and more toward small calibre guns with very high rates of fire. This would appear to us to be the logical consequence of the new role of AA artillery, whose function is now complementary to that of the missile batteries, compared to which they are more mobile, cost less per round fired, and are just as accurate against low-level air attack. We believe, therefore, that the future of this type of AA artillery is well defined and assured, and it can be further said that both manufacturers and the various general staffs are showing increasing interest in this particular component of their air defences, especially — and we feel this is worth repeating — after the experiences of Vietnam and the Yom Kippur War.

From the commercial point of view too, the development of this type of weapons system is extremely promising. The vast market represented by those countries not politically or militarily aligned with the United States or the Soviet Union needs an AA component which is efficient, costs little, and is simple to operate.

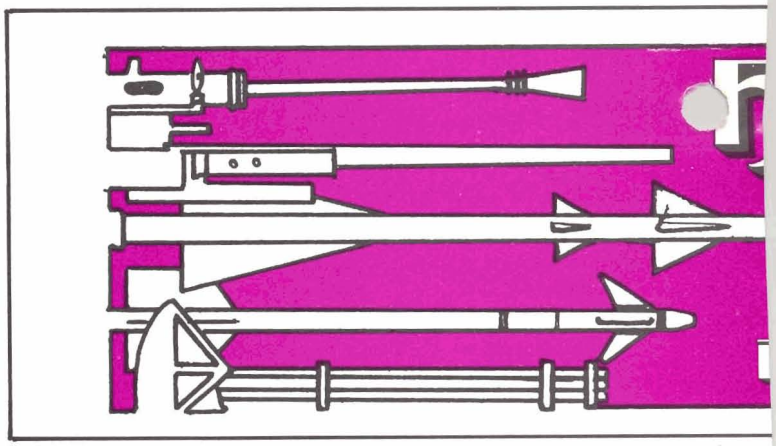
If it is also considered that this particular type of weapon can be adapted for use against lightly protected ground targets, infantry, and APC's or ICV's, then the advantages in cost and operational flexibility become even more apparent.

From another point of view, the current situation would appear to indicate that Western industry has made up the ground lost to the Soviet Union and is, in fact, now producing equipment which is superior in quality, although perhaps more expensive, and when the GEPARD type self-propelleds come into service then the disparity in this sector also will have been largely eliminated.

As far as the calibres of these weapons are concerned, it can be pretty well taken that these will remain between 20 mm and 40 mm without going any higher, since this would appear to be about the limit to which one can go without losing the fundamental virtues of a high rate of fire, lightness, and mobility.

One final observation which could be made is that, looking at the most modern AA cannon, one cannot but be struck by their similarity in performance to those which have been in use for some time in ground attack aircraft (the ground version of the VULCAN, for example, is the same as that which for some time now has been produced to air force specification); it might almost be said that the aircraft's own weapons are being turned against it.

The previous installment of "History of Air Defense" described the antiaircraft buildup at the Remagen Bridgehead in Germany near the end of World War II. This installment describes the Allied antiaircraft tactics at Remagen and the results achieved.

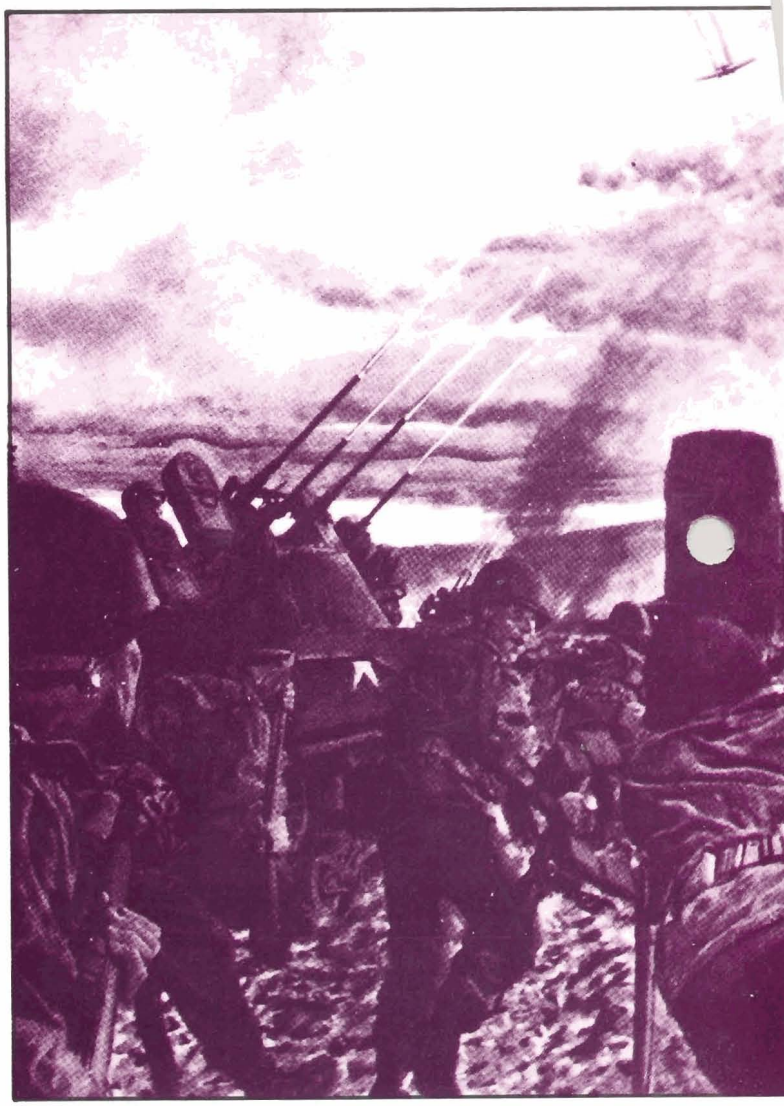


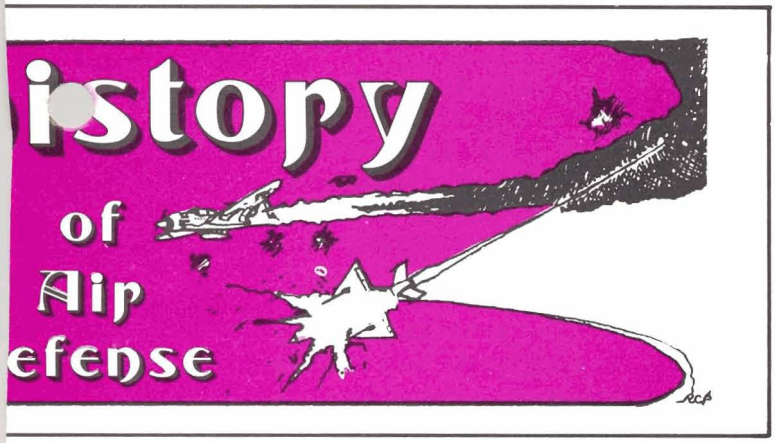
The nature of the target at Remagen was of the pin-point variety, and one well-aimed bomb could have caused a most serious bottleneck. Antiaircraft commanders in the area believed that the only means of protecting the two bridges at night was to keep enemy aircraft completely out of the area, and it was decided that an umbrella-type night barrage, fired over each bridge by automatic weapons, would accomplish this purpose. The number of automatic weapons in the vicinity of the bridge could put such a volume of fire into the air at one time that even the most fanatic Luftwaffe pilot could hardly be expected to face it. This was proven to be true and no aircraft penetrated any of the barrages fired.

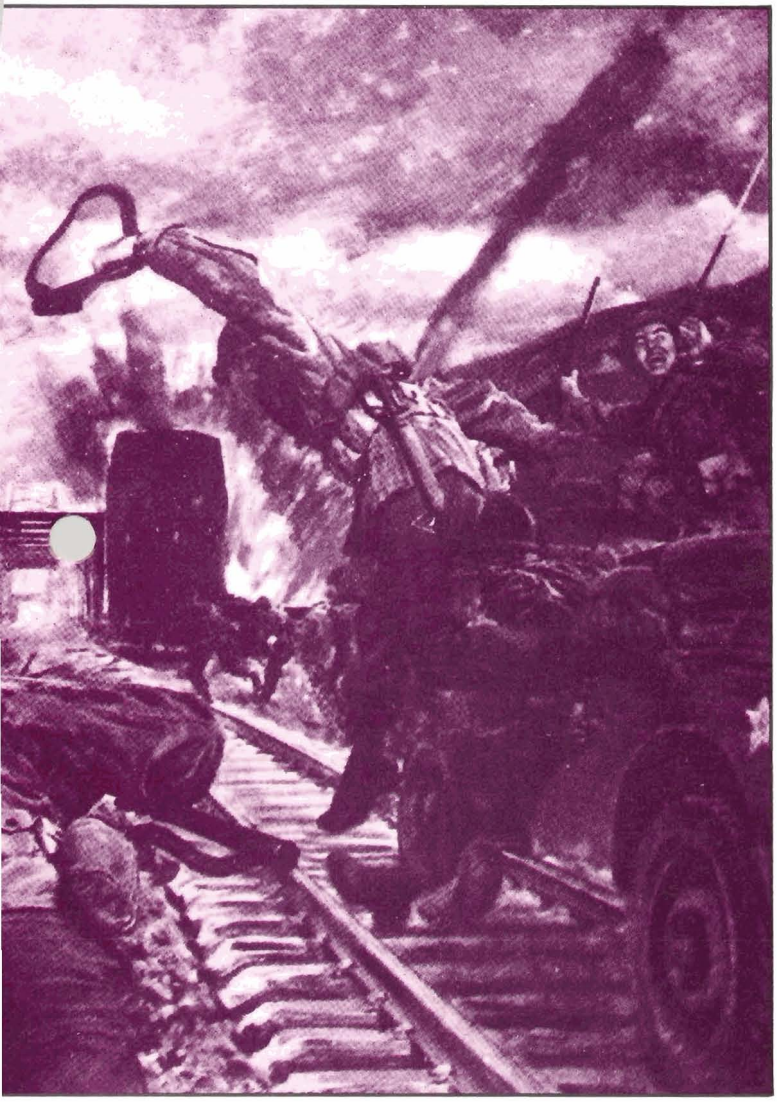
A line running northeast and southwest was projected to separate the bridges in the area and to segregate fire units into two umbrella sectors. All units northwest of this line fired at the azimuth of the bridge in the southeast sector. A high barrage was used when aircraft attacked above 6,000 feet, and a low barrage was used upon aircraft below 6,000 feet. For either barrage, circles with radii of 1,000, 2,000, and 3,000 yards were drawn about each bridge. During the low barrage, all 40-mm or 37-mm guns within the 1,000-yard circles fired at a quadrant elevation of 20°. All 40-mm or 37-mm guns between the 1,000-yard and 2,000-yard circles fired at a quadrant elevation of 25°, and all 40-mm or 37-mm guns between the 2,000-yard and 3,000-yard circles fired at a quadrant elevation of 30°. Caliber .50 quad mounts within each of these radii fired 5° higher than the 40-mm or 37-mm guns. The high barrage was similar except that all guns fired 20° higher than the lower barrage.

During the firing of either barrage, the elevation and azimuth trackers of the 40-mm and 37-mm guns slowly rotated their hand wheels one turn in either direction of the center point, and the caliber .50 quad mounts varied azimuth and elevation 5° in each direction of the designated point.

An automatic weapons officer was stationed at a 90-mm gun battery SCR-584 radar to give warning and commands to fire to automatic weapon units by radio. When an enemy aircraft was tracked to within 10,000 yards of either bridge, he ordered a standby for either low barrage or high barrage, depending upon the altitude of the aircraft. If the aircraft was below 4,000 feet, the officer gave the command to fire when the enemy plane approached to within 5,000 yards of either bridge site; or if above 4,000 feet, he gave the command to fire when the aircraft approached to within 6,000 yards. The barrage was limited to only 10 seconds of fire and, if







the aircraft should again attempt to attack, the barrage was repeated. When the aircraft left the area, the officer waited 5 minutes and then gave orders to resume a normal alert status.

This automatic weapons barrage was fired on 5 nights, and on 3 nights it was fired three times. The average ammunition expenditure per night was 320 to 400 rounds of 40-mm and 20,000 rounds of caliber .50 ammunition per battalion. Six casualties to troops resulted from the barrage, and 20 balloons were destroyed. All antiaircraft commanders were of the opinion that the automatic weapons barrage had accomplished its purpose, for enemy aircraft, after seeing the umbrella of fire above the vital areas, failed to press home their attacks. Promiscuous antiaircraft fire did not occur, since there was no automatic weapons fire permitted at night other than this barrage fire. One especially meritorious point in favor of the barrage was the fact that it gave all-round protection and could engage an attack from several directions at the same time. The barrage fire effectively protected the bridge during the most critical period of the bridgehead operation.

The first attack against the Ludendorf bridge was delivered on the afternoon of 8 March (24 hours after capture) by 11 Ju-87s and 1 Me-109. The 482d AAA AW Battalion (SP), as a result of a remarkable antiaircraft action, claimed all 12 of these aircraft as destroyed and seen to crash. After a quiet night, 17 enemy aircraft appeared over the area, singly or in pairs, at daylight on 9 March. These aircraft, showing more caution than their ill-fated predecessors, took violent evasive action and flew at lower altitudes than those of the previous day. All attacks were repulsed, and claims for the day were 12 enemy aircraft destroyed, including He-111, Me-109, and FW-190 types.

On 10 and 11 March, the weather was unfavorable, but scattered attacks by single aircraft on the area were maintained. These again consisted of Me-109s, FW-190s, and Ju-87s. Both high- and low-level bombing was attempted, accompanied by violent evasive action. No damage was done and claims for the 2 days amounted to 29 destroyed and 7 probables. There was no activity at night.

Improvement in the weather on 12 March coincided with an increase to 84 aircraft in the scale of attack during the day. In addition to types previously employed, one Me-262 was seen. No formation bombing was attempted and most raids were from a low level. Notwithstanding the enemy's use of cloud cover, claims were 31 destroyed and 8 probably destroyed. There also was slight activity by night which resulted in four claims attributed to 90-mm guns.

On 13 March, activity increased to 97 aircraft, but there was no change in tactics and the enemy continued to be unwilling to risk deliberate bombing runs, without which hits on a pinpoint target were extremely unlikely. The employment of four Ar-234 jets on reconnaissance marked the first appearance of this aircraft over the bridgehead. Claims on this day were 31 destroyed and 13 probables.

On 14 March, the enemy dispatched 80 raiders by day and 14 by night. Of this force, no less than 67 were recognized as jets, indicating a complete change of tactics. These aircraft made bombing runs at great speeds and usually at altitudes of between 1,000 and 2,000 feet. Again, single aircraft and small flights were employed. That jet speeds proved a severe test for the antiaircraft defenses is indicated by a proportionate reduction in antiaircraft claims, which totalled only 5 destroyed and 13 probables by day and 6 destroyed and 1 probable by night. On the other hand, the reluctance of the jet pilots to reduce speed on the bombing run was without doubt a primary cause of their inaccurate aim.

The 14th of March marked the climax of the enemy effort. Thereafter, the Germans abandoned the jet assault and committed only 12 aircraft on the 15th, 1 on the 16th, and 12 on the 18th, of which 6 were at night. The AA guns took considerable toll of these attacking planes and on the 19th, 20th, and 21st, the enemy ventured to attack only at night. This, however, also proved to be expensive, as total claims were 12 out of 20 and 6 out of 15 destroyed. After the 20th, attacks against the Remagen bridge ceased.

Antiaircraft defenses in the Remagen area contributed tremendously to the success of the initial Rhine bridgehead. The German Air Force, with 442 sorties, had been unable to cut the flow of troops and supplies which were continually crossing the Remagen bridges. After 3 weeks, the Luftwaffe virtually gave up and ceased to enter the area. The units at Remagen had accomplished their mission.

On the basis of confirmed claims, antiaircraft inflicted a 26.6 percent loss rate on the raiders during the period 8-14 March. The highest attrition rate was 59 percent on 9 March and the lowest was 7 percent against the jets on 14 March.

On 24 March, additional crossings of the Rhine were effected by both the 21st Army Group and the Third US Army, forcing the enemy to divert his attention from the once all-important Remagen area.

Wesel Airborne Operation

An Allied airborne operation in the vicinity of Wesel, Germany, was staged on 24 March 1945, in support of the Rhine River crossing by the Ninth US Army. The objective was to place strong airborne elements of two airborne divisions to the rear of Germany army forces opposing Rhine River bridgeheads.

The airborne operation was conducted in three phases: phase 1 was a parachute drop to secure drop zones and landing zones; phase 2 was a glider assault landing to bring in additional troops, vehicles, equipment, and guns; and phase 3 was a resupply drop to the parachute and glider units landed in phases 1 and 2.

A 3-day air interdiction in the vicinity of drop zones preceded the operation. This interdiction included communications and movement centers and assisted in neutralization of local antiaircraft defenses. During the 3 days prior to the operation, 8,506 tons of bombs were dropped on flak defenses in 3,741 sorties.

Phase 1 included 242 C-47 transports carrying about 3,900 troops from England and 72 C-46 transports carrying troops from continental bases. No air opposition was encountered. Troops and supplies were dropped with great accuracy. Flak was light during the drop; however, planes encountered intense flak shortly after they cleared the drop zone and while turning onto their route to home bases. Of the 242 troop carriers from England, 20 were shot down and about 100 were damaged, 70 severely. Of the 72 C-46s used, 19 were shot down and 38 damaged.

Phase 2 included 296 C-47s towing 592 Waco gliders. Due to the glider tow, the planes were flying at about 110 mph, somewhat slower than normal. Twelve C-47s were shot down and about 140 damaged. Heaviest flak was encountered at the landing zone and at the turn beyond the zone after release. Of a British force of about 400 gliders, 10 were shot down and 284 damaged by flak.

Phase 3 consisted of 237 B-24s that reached the drop zones and dropped supplies. Fifteen were shot down and 104 damaged, with most casualties occurring shortly after the drop. Loss rate was about seven times higher than for a flight of C-47s which preceded them by only a few minutes, because the higher speed of the B-24s carried them closer to German flak concentrations during their turn away from the drop zone.

The following statistics cover the entire operation:

	Effective A/C	A/C Losses	% Losses
Total airlift	1,556	52	3.28
Supply mission	129	16	6.66

Antiaircraft was not a significant factor in this operation in terms of percentage of planes downed. In this, as in other World War II airborne operations, planes were routed away from points defended heavily by antiaircraft and thus avoided all but incidental fire and such light antiaircraft and small arms fire as was in the drop and landing zones. Allied air superiority and operations to neutralize the Luftwaffe eliminated any interference by enemy aircraft. The preoperation flak suppression missions served to hold Allied losses down, although the loss of 68 planes and the gliders included a sizeable number of personnel.

STINGER organization

JOE FRIES

We have all become accustomed to the Redeye "all-arms" organizational concept — a concept that is cursed by some and praised by others. Should the Redeye organizational concept be carried forward into the Stinger era? This article says NO!

The organizational concept for Stinger's predecessor (Redeye) was developed in the late 1950s and early 1960s and approved in 1965. The first Redeye teams were fielded in 1967. The concept allocated one 2-man firing team per company-size combat unit, organized a combat battalion's/squadron's allocation into a section, and made the section organic to the battalion/squadron. The section is, therefore, the highest level of Redeye organization (fig. 1). The concept is simple and economical. It is attractive because it provides combat battalions their "own" air defense.

Why Change?

The current concept for organization of Stinger is the same as the Redeye organizational concept. According to a recent USAADS study, this approach is invalidated in 1977 by —

Changing division tactics. New tactics emphasize rapid massing of forces at the point of decision to defeat a numerically superior enemy. Division air defense priorities will change rapidly. The Redeye organization, because it allocates a fixed amount of air defense to certain units regardless of need, hinders the massing of air defense resources at the point of decision.

Increasing air threat. Redeploying forces will be vulnerable to air attack by improved jet aircraft and by modern helicopters carrying antitank guided missiles. The capabilities of each air defense weapon must, therefore, be exploited to the fullest. The current Redeye organization, applied to Stinger, does not make effective use of weapon capabilities because it does not place the weapons where most needed in each situation. Training quality is also a problem.

Stinger capabilities. Stinger's advanced capabilities mean that Stinger can make a significant contribution to the overall division air battle, especially if it is in the right place at the right time. Conversely, those same capabilities mean Stinger could be extremely dangerous to friendly aircraft if gunners are not well trained. The Redeye organization is not consistent with Stinger capabilities.

Preferred weapon roles. Each air defense weapon performs certain tasks best. Task assignment should depend on defense needs, the tactical environment, and weapon characteristics. These factors, considered collectively, favor weapon tasking as follows:

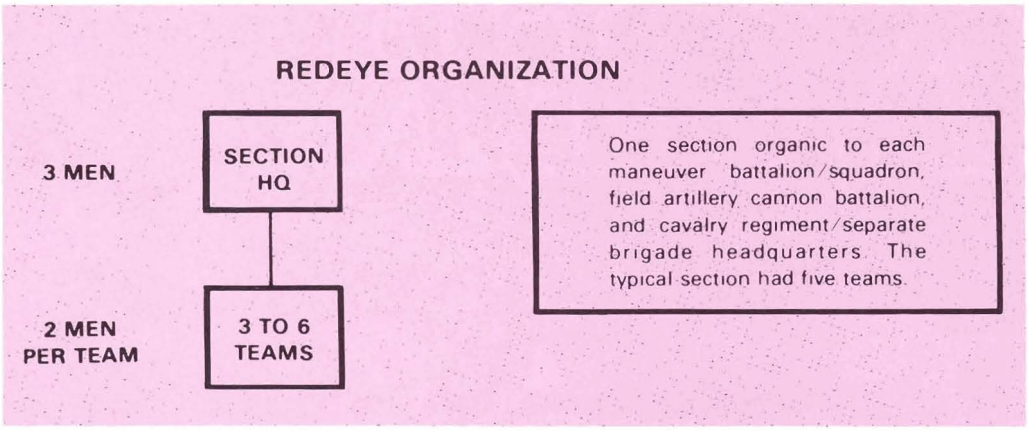


Figure 1

■ **Self-propelled ADA guns:** defend high-priority mobile forces on the march, in the covering force, and in the attack.

■ **Roland or Chaparral:** defend high-priority critical assets in brigade rear and division rear.

■ **Stinger:** defend high-priority maneuver and field artillery battalions in position *and also* defend high-priority critical assets (e.g., CP, trains, ASP, POL) for which no ADA guns or Roland/Chaparral are available. Additionally, defend mobile maneuver forces when ADA guns are not available. Complement ADA guns when priorities and the situation permit. The Redeye-type organization would assign Stinger only one task (maneuver/field artillery battalion defense) — a task assignment that is not always the best for the division situation.

Lessons learned. Ten years of Redeye field experience seem to show, in retrospect, that:

■ The amount and difficulty of air defense training needed by Redeye teams were underestimated in the early 1960s.

■ The ability of non-ADA units to conduct specialized Redeye air defense training was overestimated.

■ The extent of the pressure on non-ADA commanders to use Redeye personnel in other than Redeye duties was not foreseen.

■ Career pattern and personnel management problems inherent in the Redeye organizational concept were not sufficiently appreciated in the early 1960s.

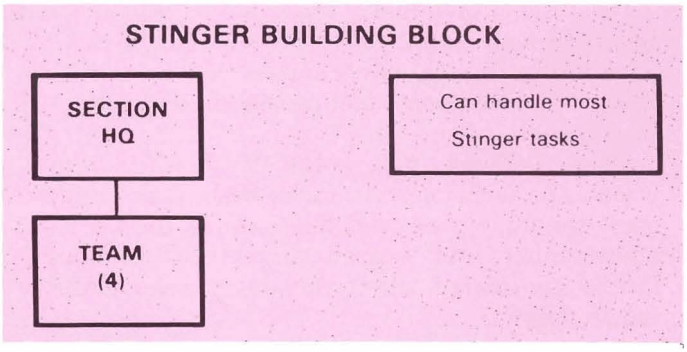


Figure 2

The foregoing, considered as a whole, indicates a need for change. We could, of course, continue "tweaking" the Redeye concept with small fixes as has been done in the past. However, fundamental organizational change seems appropriate.

What Organization is Needed?

If we are going to reorganize Stinger for more than just "tweaking" purposes, we must start at the beginning. The first question is "What is the basic organizational building block?" Analysis shows that four 2-man teams can effectively accomplish most tasks that would logically be assigned to Stinger. The four-team *section* is, therefore, the basic organizational building block (fig. 2). So far, we see little difference from Redeye; only that a Redeye section is comprised of one team per company-size unit (a fixed allocation) whereas the four-team Stinger section is based on task analysis.

The next question is, "How many Stinger sections do we need in a division?"

There are at least three answers:

■ Provide one per maneuver and field artillery battalion, *a la* Redeye. Too inflexible.

■ Provide enough for division *area* coverage. Too expensive; impractical.

■ Provide enough so that Stinger, in conjunction with the other ADA weapons, will insure that the division commander's priorities can be accommodated. This is the preferred approach. Analysis, based on use of this "prioritizing" scheme, suggests that the armored or mechanized infantry division should be allocated 18 Stinger sections (72 teams). By coincidence, this allocation is almost identical to the current Redeye allocation for an armored division.

The next question is, "How should we organize the 18 sections?" Use of a priority allocation scheme demands an organization that is more centralized than the current Redeye fixed organization. Therefore, the 18 sections must be packaged as parts of a larger ADA unit. Organizing the division's Stinger allocation into four platoons would provide flexibility while insuring a reasonable span of control.

One of the potential pitfalls in a consolidated Stinger organization is that Stinger sections may lose their familiarity with maneuver unit tactics and methods of operation. Accordingly, each section should have one "home" maneuver or field artillery

battalion with which it will normally work *if* it is given a battalion defense mission in exercises and in combat. Similarly, a platoon will usually work with a particular ADA gun battery which, in turn, usually works with a particular brigade.

The highest Stinger echelon (battery) (fig 3) is intended primarily for management and support. It is part of the division ADA structure. The combat service support personnel (cooks and vehicle and generator mechanics) may be organic to the Stinger battery or may be included in other supporting combat service support units.

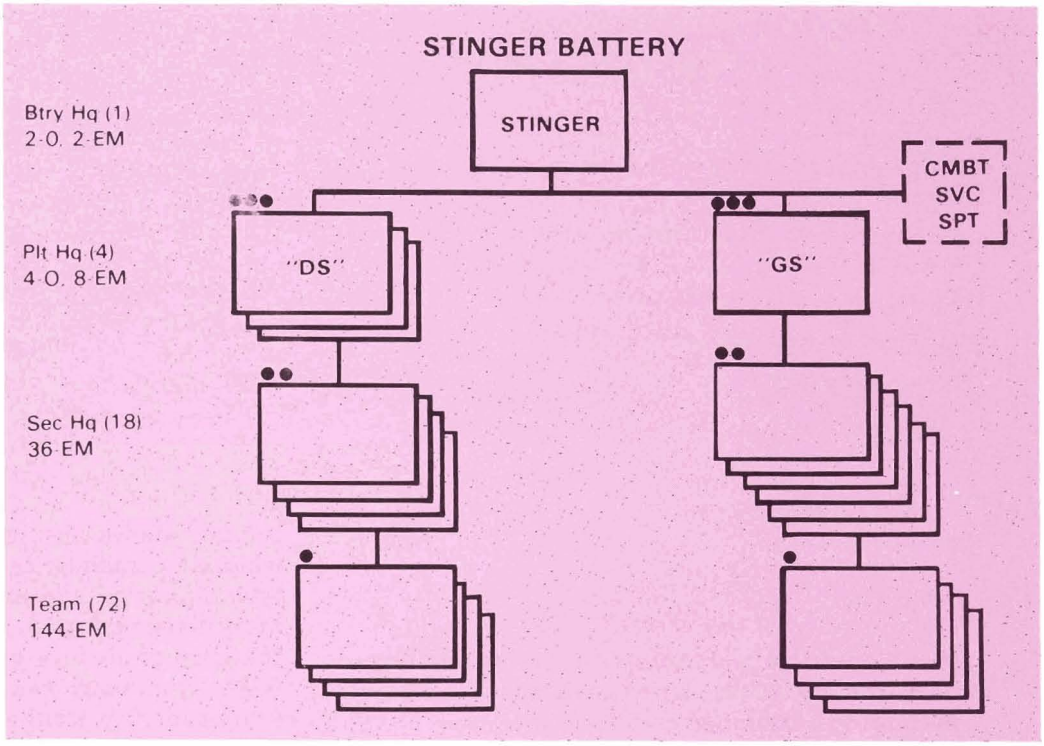


Figure 3

The battery would rarely, if ever, fight as a full battery. This is part of the reason for the small battery headquarters. Platoons would usually be attached to other ADA units. However, any platoons given DS or GS tactical missions would remain under battery control. A type organization for combat might be that depicted in figure 4.

Stinger section tasks include defense of maneuver and field artillery units in position, defense of critical assets such as CPs and trains, and defense of redeploying/attacking units for which no guns are available.

As can be seen, adding a Stinger battery to the division ADA organization further aggravates the ADA battalion commander's already severe span of control problems. This is part of one of several considerations behind the DIVADA concept discussed by LTC Infante on pages 24-27 of the January-March issue of AIR DEFENSE.

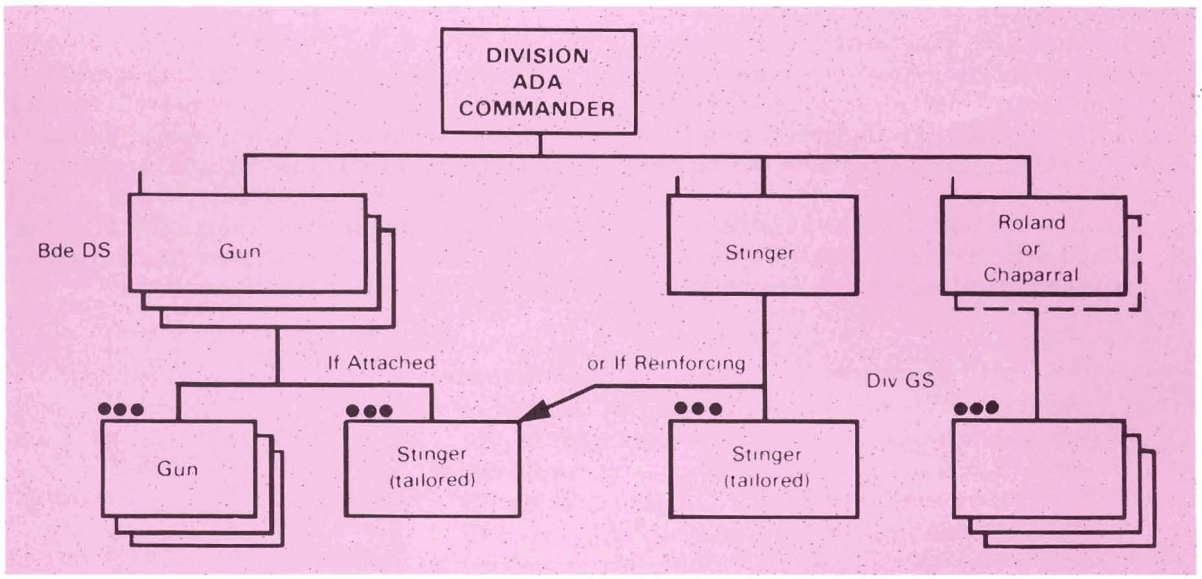


Figure 4

COMPARISON OF ALLOCATION SCHEMES	FLEXIBLE ALLOCATION	FIXED ALLOCATION
High Priority Assets Provided Tailored Defense	84%	16%
Low Priority Assets Intentionally Provided Area Cover Only	16%	4%
High Priority Assets Not Defended		*20%
High Priority Assets "Underdefended"		*5%
Assets "Overdefended"		*55%

*Maldistribution

Figure 5

So What?

What does the reorganization buy us? It buys increased effectiveness for two reasons —

- Improved training.
- Increased flexibility.

Field experience shows that Redeye consolidation results in better training. One means of training effectiveness is ARTEP ratings. The 9th Infantry Division Redeye sections went from 37 percent satisfactory ARTEPs under the old concept to over 80 percent satisfactory under a Redeye battery organization. This should pay off in improved effectiveness against enemy aircraft and improved safety for friendly aircraft.

Increased flexibility also pays off in increased air defense effectiveness by insuring that Stinger is placed where and when needed most. This point is illustrated by some data generated during study of the Stinger consolidation issue. For example, consider Stinger missions. Under the suggested organization, three offensive and three defensive scenarios were analyzed. Stinger missions broke out on the average as follows:

- Defend maneuver battalions = 54 percent.
- Defend field artillery battalions — 11 percent.
- Defend other critical assets = 35 percent.

Compare this with the current concept which would always place 100 percent of the Stinger with the maneuver and field artillery forces, thus preventing allocation flexibility. The above numbers demonstrate flexibility in task assignment, but that in itself proves little. The flexibility must be for a reason. The reason is shown in figure 5; again using six scenario averages.

The left column shows the results of flexible allocation of all ADA resources against the division priority list. The right column shows the maldistribution of resources when a commander cannot "touch" a fixed Redeye-type allocation and must work with only the primary divisional ADA. This is the normal case under the current Redeye concept. There is no way an ADA commander can properly cover the division commander's priorities of the moment if he is burdened with the fixed-Redeye-type allocation (fig 5).

Why Wait for Stinger?

Much of what has been said also applies to Redeye. Actually, the current Redeye organizational problems are a driving force behind the thinking favoring change of the Stinger organization. A considerable segment of air defense community opinion thinks we should consolidate Redeye *now* and not wait for Stinger to do it. Consolidating Redeye now would improve Redeye training and operations and would prepare the division for Stinger.

Status

The foregoing concept is finding considerable acceptance. TRADOC has approved it for testing. Two divisions are using a Redeye consolidation variant and others are thinking along similar lines. FORSCOM endorses the Redeye consolidation concept. The logic is good, especially with the more capable Stinger. Stinger consolidation is probably part of the future ADA organization.

Joe Fries retired from the Army as a Chief Warrant Officer in 1960 and has since served in the field of combat developments as a project officer. He graduated from the Command and General Staff College as a civilian and holds a Bachelor's Degree in Political Science from the University of Texas at El Paso where he is pursuing a Master's Degree. Several of his articles on air defense have been published in past issues of the magazine.

CE for Air Defense

1LT Michael L. Helferd

"Track: Blue 2, 4."
"Three helicopters landing: Black 4, 7."
"Track with tail: Red 3, 7."

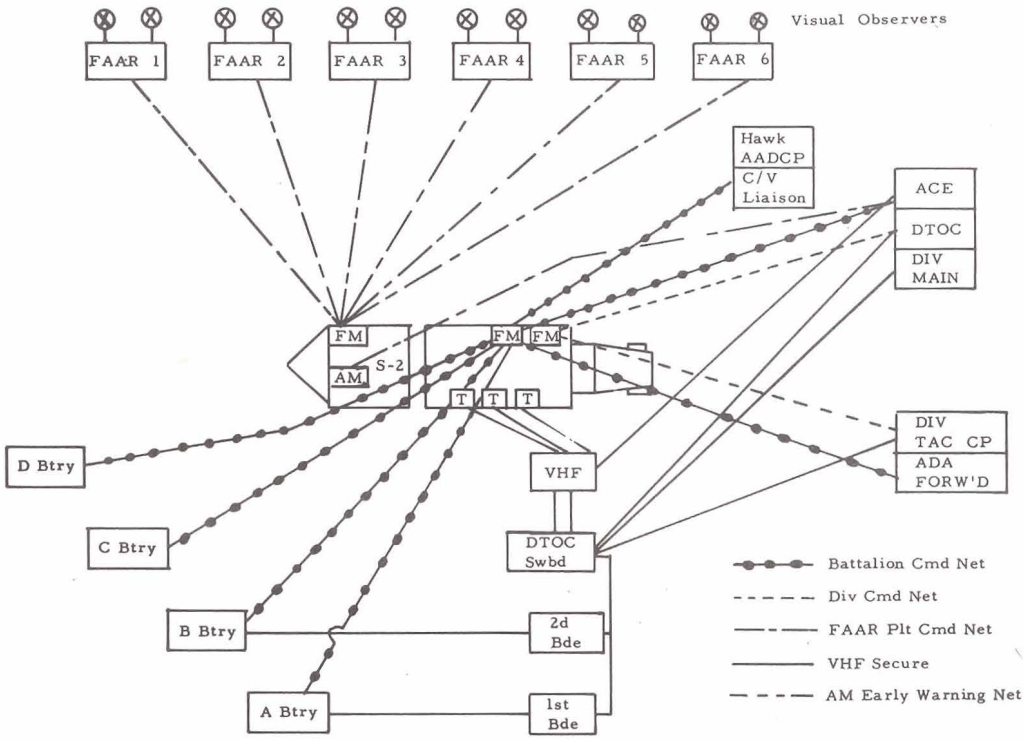
These words culminated several months of C-E planning as the 1st Battalion, 59th Air Defense Artillery (Chaparral/Vulcan) prepared to play the role of the air defense of an aggressor division for REFORGER '76. The communications arrangements helped the battalion successfully defend airspace of the 8th Infantry Division (Mechanized) during last year's 4-day maneuver.

Both radio and wire communications were used, but the wide dispersal of fire units and frequent moves made FM radio the primary means. REFORGER '76 marked the first occasion that 1-59 ADA was provided the multichannel terminal equipment called for by doctrine. Formerly all communications, except internal command post wire, had been by courier and FM radio.

The addition of secure VHF circuits allowed entry into the division tactical operations center (DTOC) switchboard and provided the battalion rapid telephonic communications to the airspace control element (ACE), the G3, and the brigades. (Secure voice, due to limited quantities of COMSEC equipment, had previously been limited to ACE's and battalion S3 stations in the division intelligence net.) Secure VHF also allowed the first use of the battalion's land-line teletype capability since the unit deployed to Europe in 1969.

The battalion is also authorized four AN/GRC-106 AM radios. Three of these radios are TOE-designated as stations in an air defense liaison net between the ACE, the Chaparral/Vulcan (C/V) battalion S3, and a supporting Hawk battalion. The fourth radio gives the battalion commander access to the division tactical operations center single sideband (TOC SSB) net. Other capabilities provided the battalion by TOE are two AN/GRC-142 radio teletype sets (one for each of the division admin/log and ops/intel nets), an AN/GSQ-80 message center (with the TCC-29 land-line equipment), and an SB-86/PT switchboard (1-59 is issued an SB-3082 in lieu of the SB-86). Total authorized communications assets include more than 100 FM radios and 2 FM retransmission stations.

Another asset of the battalion is the forward area alert radar (FAAR) platoon. This platoon is authorized eight radar sets, and six of these were operational throughout REFORGER. The platoon is an important part of the division's early warning efforts. Information obtained from the radar is disseminated through the division area by the target alert data display set (TAADS). The TAADS is the



receiver for a one-way digital link from the individual FAAR's to each C/V fire unit and divisional Redeye team.

Although these radios were designed by TOE to be used as shown in FM 11-50, numerous exercises and various requirements made it necessary to operate in a manner somewhat different from "the book" (see figure).

One of the changes that took place before the exercise was the designation of the TOC SSB net as an early warning net both for air defense and for nuclear, biological, and chemical information. This requirement made necessary a rearrangement of the AN/GRC-106's within the battalion. The battalion operations/intelligence section (S3/2) used one radio on the new net to disseminate spot reports received from ACE (collected from throughout the division area and passed up through the brigades and division support command), the FAAR platoon, the Hawk battalion's Army air defense command post, and the battalion fire units. The ACE also maintained a station on this net, as did the Hawk battalion. The necessity of maintaining spare radios on this important net forced the air defense liaison section to communicate on the battalion command net (FM).

Spot reports were called in by the division's Spectrum X (read X as ten) system. This method of locating aircraft within a kilometer grid square was designed by the ADA battalion S3 as a simple means of allowing all members of the division to render quick, accurate reports in a common, easily understood manner. Each 10-km grid square was named with a color. To call in a spotting, the user merely counted the number of 1-km squares right and the number of squares up. Thus, "Black 2, 7" meant there was an aircraft in Black square at 2 km over and 7 km up. Authentication of spottings was required only if the report was of enemy troop landings or pickups.

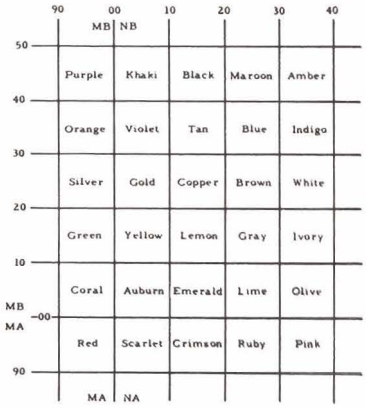
The system, which is much quicker than finding and transmitting grid coordinates, worked to perfection. Collected reports from FAAR, Hawk radar, battalion fire units, and other divisional elements totalled over 8,000 in the 2 days of 101st Airmobile Division participation. The centralized plotting of the spot reports gave the division ample warning of airmobile assault targets prior to each attempted attack. Throughout the exercise, 8th Infantry units were responding to airmobile insertions well before the lead helicopter had landed.

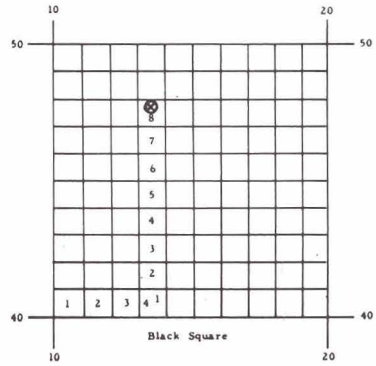
There were two communications concepts tried during REFORGER '76 that are worthy of note: (1) the idea of a "hot loop" telephone circuit with the tactical command post, S3, 1-59 ADA, G3, ACE, division artillery, and each brigade as simultaneous users of a single patched circuit; and (2) the testing of a modified commercial transisitor radio used to receive early warning transmissions from organic AN/GRC-106's.

The need for rapid, secure communications of air threat information to and from other divisional elements was the spark behind the idea of a "hot loop" circuit. Use of this line allows a single telephone call to suffice in passing along any information of interest to any of the elements having access to the loop. The designation of the circuit as an air defense system also allows the battalion TOC the means of talking secure to battery level, at least to those batteries in direct support of a brigade. Although the circuit functioned workably during CPX's prior to REFORGER, it did not function satisfactorily during the exercise itself. Due to the large number of subscribers on the line, the distance between stations, and the fluidity of the situation, degradation of signal strength through the many patchings was an insurmountable obstacle. Future exercises will modify the concept to provide sole-user circuits from each element to the ACE, located at Division Main, where they will be run in to an SB-22/PT and strapped over. The resulting conference call will be the "hot loop." Although this approach has not yet been tried, signal losses should be significantly reduced, making understandable communication possible.

The concept of the modified pocket AC radio arose from the need for rapid dissemination of weapons control status, spot reports, and similar information down to fire unit/Redeye team level. A small inexpensive receiver capable of netting with organic AM broadcast equipment would solve the problem cheaply and reliably, while the earplug of such a radio would leave a gunner free to carry on his duties with hands unencumbered. The 28 modified radios tested in REFORGER did not function as well as earlier tests had indicated they would. More accurately, they hardly functioned at all: readable reception occurred only within a 10-km radius of the transmitter. Here the problem appears to be with the antenna system in the receiver (an internal and unmatched coil). Future work will be aimed at impedance, matching the antenna with the timing circuitry, or simply designing a radio receiver that will meet the requirements.

REFORGER '76 proved the flexibility of communications in the air defense battalion, and, indeed, in the entire division. The exercise also showed that the 1st Battalion, 59th Air Defense Artillery, with thorough planning and training, could successfully defend the division's airspace against a helicopter threat.





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VIEW from the FIELD

JOINT SERVICES AIR DEFENSE TRAINING PAYS DIVIDENDS

MAJOR ROBERT C. BURGETT
and
CAPTAIN WALLACE E. SMITH, JR.

A problem that has historically haunted personnel responsible for training Army air defense units is the nonavailability of aircraft to fly realistic missions against our weapons. Air defense units in CONUS, Korea, and Europe track and simulate engagements of targets of opportunity that may happen to fly through their defended areas. But being proficient in this type of engagement is hardly the same as being capable of effectively engaging a formation of high-performance aircraft flying tactical maneuvers while using electronic counter-countermeasures and infrared suppression devices. The problem, of course, is that the Army cannot afford the high dollar cost of having tactical fighters and bombers fly against our defenses frequently enough for us to develop and maintain our desired crew proficiency.

For divisional air defense units, the problem is compounded by the lack of sophisticated simulators presently available for Hawk and Hercules units and by the lack of understanding of some commanders and staff officers of the difficulties involved in gaining and maintaining air defense crew proficiency. The present budget for an air defense artillery battalion is probably larger than for any other comparable size element in the division except aviation, and it is unrealistic to ask for the additional funds required to obtain sufficient tactical aircraft sorties over the training area to adequately train the air defense artillery crewmen.

The present solution to this training problem is for Chaparral and Vulcan platoon leaders and Redeye section leaders to take their weapons and personnel to the local aviation section and park them near the runway to track helicopters and light aircraft that are taking off and landing. This solution is not only boring to the crews but may also be detrimental in that it offers very little challenge and may develop a false sense of security in assessing the crews' combat readiness. Enemy aircraft will not attack us flying straight and level patterns, with flaps down, at speeds less than 100 miles per hour.

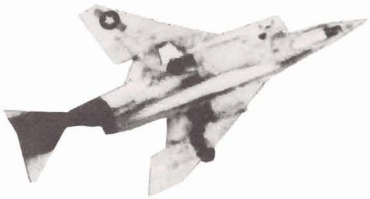
When high-performance aircraft are scheduled to fly maneuvers near a unit's location, they are seldom in the area more than 2 hours at a time. The platoon has probably been in position for half a day

to be sure it doesn't miss the opportunity, and for various reasons such as weather, aircraft maintenance, and mission changes, these aircraft usually arrive only 50 percent of the time. Even then, the platoon leader has no communications with the pilots to request various attack patterns, and it is almost impossible to arrange for some type of debriefing session with the pilots to discuss learning points that may be advantageous to both the air defense personnel and the pilot.

In the 7th Infantry Division at Fort Ord, California, a solution to this problem has been found. At Fallon Naval Air Station in Fallon, Nevada, air groups from the Navy's aircraft carriers periodically conduct intensified live-ordnance training exercises. The Air Group will consist of three or four complete squadrons, and for 2 weeks on four nearby ranges they fly actual bombing and strafing attacks, ECCM missions, and close air support missions. Approximately 350 sorties are flown daily using F4s, A-6s, A-7s, and various other types of Naval aircraft.

Six of the Division's 10 Redeye sections have been sent to Fallon Naval Air Station to train jointly with these Naval air groups. The training program was organized, coordinated by the Division's ADA battalion (1st Bn, 51st ADA), and did not require any extravagant intraservice agreements or transfers of funds. Commercial bus transportation is used in moving the units from Fort Ord to Fallon. The Nevada National Guard provides tactical vehicles for the sections to use during the training. The Navy provides billeting, meals, storage for trainers, POL, and use of their ranges. The program has been a great success, mutually benefiting both pilots and ADA gunners. Plans to train all Redeye sections and platoons of the Division's C/V Battalion (1st Bn, 51st ADA) on an annual basis are now in effect.

Not only is there an excellent density of air traffic at Fallon, but the birds fly actual bombing and strafing attacks 1,000 to 2,000 meters from the gunners' positions. The 7th Division air defenders have the unique experience of seeing tactical aircraft using various approach and delivery methods: high- and low-level strafing and rocket attacks, high- and low-angle dive bombing, pop-up attacks, and laydown and standoff bombing techniques with various pull-out patterns. To make the maximum use of this training opportunity, the Redeye sections take 7 to 10 of the Division's tracking head trainers and each team member tracks approximately 35 sorties per day. Initial reaction time for each section



that has trained at Fallon averaged 20-30 seconds the first day and improved to 4-8 seconds by the end of the second week. Successful engagements also improved from approximately 70 percent to 95 percent. In addition to this intensified tracking practice, the gunners work under a variety of weather conditions and learn a real appreciation of the capabilities and limitations of their weapons. The soldiers encounter dry, hot, cloudy, overcast, rain, cold, windy weather as well as severe dust conditions.

After observing the accurate fire power an aircraft can deliver, and after participating in joint exercises in which the jets escorting helicopters in search and rescue missions simulated engaging their defensive positions, the teams have a new appreciation for air power, the importance of their job, and the importance of preparing better tactical positions.

This type of training, where 7th Division air defensemen observe, track, and simulate engaging targets just as they would in combat, is invaluable in making the Division truly combat ready. Additionally, the Navy pilots have expressed a great deal of interest in our weapons, and the dialog between pilots and gunners has proved beneficial to both services. The Redeye section leaders brief the Navy officers on the Redeye and SA-7 capabilities and point out the best evasive techniques from the standpoint of the gunners. This joint training program obviously enhances the combat readiness for both units concerned and involves no red tape. Hopefully, this program can be duplicated since it has proved to be highly effective and aids both services in understanding the problems to be overcome on the modern battlefield.

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Captain Smith was commissioned in 1970 after graduation from Florida State University. A graduate of the Air Defense Artillery Officer Advanced Course, he has served with Headquarters, ARADCOM; 31st ADA Bde; 2d Bn (C/V), 61st ADA in Korea; and is currently Cdr, Btry A, 1st Bn (V), 51st ADA, 9th Inf Div.

Redeye sections of the 1st Battalion, 51st Air Defense Artillery, assigned to the 7th Infantry Division, "shoot down" assorted high-performance naval aircraft flying actual bombing and strafing missions.

ECM Immunity

High Altitude Attack

CAPTAIN ROGER E. ANDERSON

High g's Target

The PATRIOT Army air defense system's heritage may date back to the Civil War when lighter-than-air vehicles were being used for reconnaissance; however, the first generation Army air defense system was not fielded until the latter stages of World War I when airplanes were introduced into the military inventory.

Since 1917 when the 100 mph FOKKER Dr.1 with its twin syncronized 7.92mm guns and 396 pound payload* inspired the enemy's respect, there have been tremendous advances in threat severity. Today's technology measures an aircraft's speed by mach number, its payload by tons, its altitude by tens of thousands of feet, and its range by hundreds or thousands of miles. Ordnance and ordnance delivery systems have also become more sophisticated, as have the electronic warfare and navigation equipment used as air defense penetration aids. The growth in threat severity necessitated a corresponding advancement in air defense capability. The expansion of technology gives us the means by which to achieve the required level of air defense and allows the planners to determine the most effective air defense weapons mix.

In 1917 the antiaircraft guns were enough. The 1940s saw a requirement for larger caliber and longer range guns as well as guns with more firepower, but with the introduction of long-range jet bombers and more sophisticated fighter aircraft in the 1950s came an air defense requirement that could only be met with high-performance guided missiles. The Nike Ajax, Nike Hercules, and Hawk missile systems countered that threat. Then, in the mid-60s, the Chaparral, Vulcan, and Redeye short range air defense (SHORAD) systems were fielded in response to the growing Soviet inventory of new low-altitude capable fighter aircraft and the increased emphasis on using these aircraft in ground support roles. It was also observed in the 1960s that the growth in the threat was beginning to outdistance the capabilities of our high-to-medium-altitude air defense (HIMAD) systems. As a result, several air defense studies were conducted that determined that Nike Hercules and Hawk needed to be replaced by a new technology HIMAD system. The need was for high firepower, electronic countermeasures (ECM) resistance, high kill capability against maneuvering aircraft and aircraft in formation, low manning requirements, minimum logistics burden, and a growth potential that would allow it to counter an increasing threat.

Based on the findings of these studies, system concept/tradeoff studies were conducted in 1965 to define the system alternatives that would support a decision to develop a specific system designed to close the gap. The current PATRIOT system configuration is an evolutionary product of the system concept defined in 1965, and has been verified by cost and operational effectiveness studies conducted in 1974 and 1975 as the most cost-effective solution to the HIMAD requirements for the post 1980s.

PATRIOT is a mobile all-weather Army air defense weapon system designed to counter saturation level attacks of advanced types of maneuvering aircraft at low, medium, and high altitudes in an intense electronic countermeasures environment.

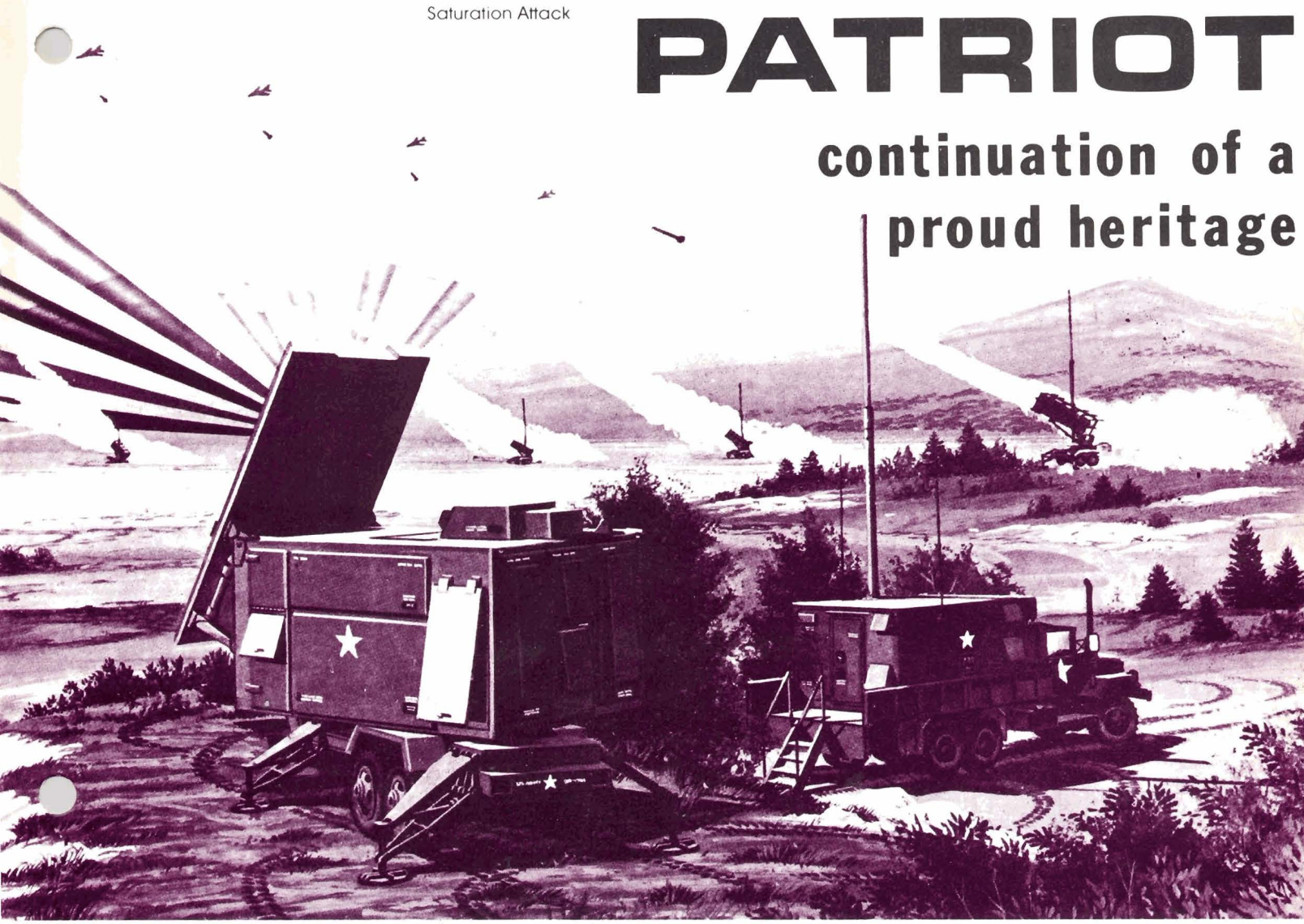
Organizationally, the basic element of the PATRIOT weapon system is the firing platoon. There are six platoons per battalion (two per battery) with each platoon consisting of an engagement control station, a radar set, an electric power plant, and five launching stations with a capability of controlling up to three additional launching stations.

The engagement control station (ECS) is the operational control center of the system. It provides for the man/machine interface and contains the weapon control computer and various data and voice communications facilities. The ECS shelter is mounted on a standard Army 5-ton cargo truck and provides a climate controlled environment for the three-man crew (two fire control operators and a fire control officer), as well as protection devices for use in chemical, biological and nuclear (electromagnetic pulse) environments.

The weapon control computer gives the system the capability of fully automated operation with human override. It is a militarized computer organized in a multiprocessor configuration, which allows it to monitor data from and deliver data to the radar and launchers and to exchange digital data messages with adjacent and battalion level systems. The computer appraises the threat and selects the appropriate responses, to include:

- Transmitter waveforms, power and timing.
- Receiver modes and circuitry.
- Track classification.
- Engagement priorities.
- Launcher selection.
- Prelaunch instructions.
- In-flight missile guidance.

*Giorgio Apostolo and Giorgio Begnozzi, *Color Profiles of World War I Combat Planes*, (New York: Crescent Books, 1974), pp. 57-64.



PATRIOT

continuation of a proud heritage

Other computer actions include automated equipment monitoring with diagnostic software routines that provide built-in test and fault isolation.

Another key element in the PATRIOT system is the radar set (RS), which consists of a multifunction, phased-array radar mounted on a modified semitrailer that is towed by a standard Army 5-ton tractor. The status and functions of the radar are monitored and controlled by the ECS via shielded cable, which protects against electromagnetic interference. The radar is unmanned during operation; however, it contains a network of built-in test equipment that periodically reports the complete radar status to the ECS. The fire control operators can also implement special radar diagnostic checks and can remotely activate and deactivate the transmitter and set "no look" cutout zones for the shelter-mounted antenna. The phased-array antenna does not rotate but instead consists of approximately 5,000 phase-shifting elements that allow instantaneous electronic positioning of the beam in space. The electronic beam scanning under computer control gives the radar the capability of simultaneously performing all the tactical functions that currently require nine separate radars in the Hercules and Hawk systems. The tactical functions are:

- High- and low-altitude surveillance.
- Target acquisition.
- Target identification.
- Target track.
- Missile track.
- Missile guidance.

Due to the nature of a flatfaced, nonrotating, array antenna providing sector coverage, the radar has been given a rapid retrain capability. The radar trainability can be controlled remotely from the ECS or locally at the radar, thus giving the commander the capability of covering a new primary target line without relocating the RS.

Electrical power for the ECS and RS is provided by the electric power plant (EPP). The EPP consists of four 60-kw, 400-Hz turbine generators mounted on a standard Army 5-ton cargo truck. A 24-hour fuel supply is provided by two palletized fuel cells that lie flat in the truck bed, and an auxiliary fuel trailer. Cabling from the EPP includes four power cables and one control cable. During emplacement, the control cable and one of the power cables are run to the ECS and the remaining three power cables are run to the RS. The control cable gives the fire control operators emergency shutdown control of the power supply to the ECS and RS, as well as the capability to monitor the number of generators on line, the low fuel warning signal and the quality and amount of power being furnished. Three generators are required to be on line during full operation and can be controlled from a local/remote unit (LRU) control box.

The PATRIOT launching station (LS) is a remotely operated, fully self-contained unit that provides a trainable and stable missile launch platform for up to four missile rounds. The LS consists of the launcher mechanical assembly, launcher electronics assembly, and a 15-kw diesel generator set (which provides the launcher with its own integral electric power) mounted on a semitrailer similar to the RS. After emplacement by the three-man crew, the operation of the LS is placed under the control of the ECS via digital data link, thus eliminating cabling constraints and allowing considerable distance separation from the ECS. In prelaunch operation, the launcher electronics serve as an interface between the missile and the ECS, performing the necessary functions of preparing and launching the missile as directed by the ECS. The LS is not required to be aimed prior to launch, however, it is remotely trainable in azimuth from the ECS so that it can be pointed in the direction of the threat. As with the RS, the LS has built-in test equipment that automatically monitors the launcher and missile status and provides it to the ECS upon command.

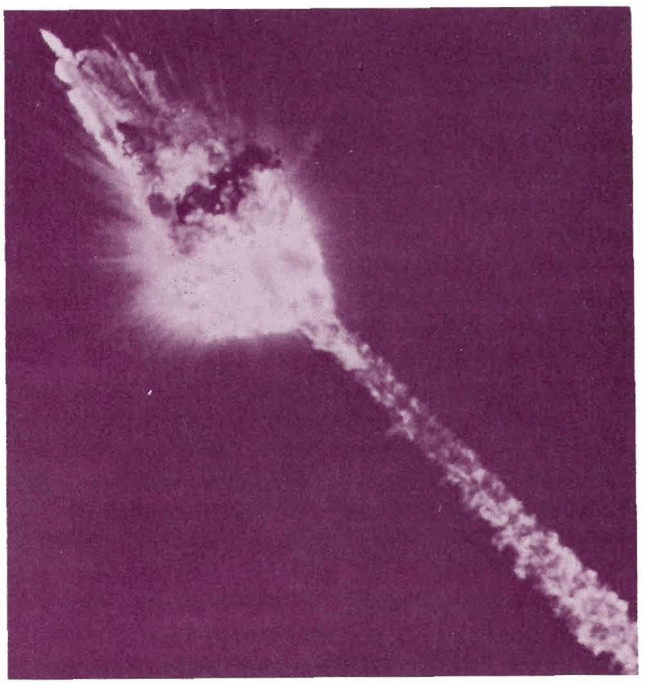
The PATRIOT missile round consists of a missile and a missile canister. The canister serves as a shipping and storage container as well as a launch tube. The missile is a certified round and will be sealed in its canister at the time of manufacture

and, while in the field, will not be removed from its canister until it is fired. Status monitoring, preheating, and launching functions will be via a single umbilical cable interface between the launcher and the missile canisters. The missile itself is a state-of-the-art vehicle that provides high performance against the entire threat spectrum. It is a wingless missile with four tail control surfaces and is propelled by a single-stage, all-boost, solid propellant rocket motor.

In addition to the missile being wingless, it has a unique guidance system that gives it a capability of much reduced miss distances. The guidance commands actually commence during prelaunch when initial turn data is computed by the ECS weapon control computer and stored in the missile memory. Once the fire command is given, and for a few seconds after launch, the missile flies by memory to a point where it is electronically captured in flight by the radar. After capture, it is command guided through mid-course to an appropriate point in space just prior to intercept. When the ECS weapon control computer determines that the missile is at this point, it commands the system to go into its terminal guidance mode, which is called Track-via-Missile, or TVM. When the system enters TVM, the radar sends out a special TVM waveform that illuminates the target, and it sends an uplink message to the missile that commands the missile to open its receiver for detection of the TVM waveform energy reflected from the target. The missile then determines boresight error, encodes the error, and sends it via downlink message to a special TVM receiver on the radar. Guidance computations are then made by the ECS weapon control computer and sent back through the radar to the missile via uplink message, thereby completing the guidance loop. This process continues until intercept. The reason that TVM guidance provides greater accuracy than other types of guidance is that the inputs to the guidance computations are based on what the missile sees rather than what the radar sees, and since the missile is so much closer to the target, the input data are more precise.

The equipment and the related functions that have been discussed have the capability of being operated autonomously at the firing platoon level; however, during normal operations the six firing platoons will be controlled by the command and control group located at the battalion.

The command and control group (CCG) serves as the nerve center for the PATRIOT battalion. It contains the necessary communications facilities and control consoles to provide a center for the coordination of PATRIOT's firepower with other users of the airspace. The command and data networks extend from the CCG to the group level Army air defense command post (AADCP) and to adjacent CCGs as well as the ECSs at the platoons.



F-102 Intercept.

To give the battalion radio links the required range over difficult terrain and in ECM environments, 3 communications relay groups (CRG) and 10 antenna mast groups are planned for each battalion. The CRGs contain VHF and UHF radio terminal sets that are similar to those used in the CCG and ECSs. The antenna mast groups are collocated with each CRG, CCG, and ECS and round out a full complement of PATRIOT-peculiar communications equipment that provides the battalion with multiple communications paths. This interlocking network of communications maximizes the probability of timely command and data exchange, and gives the battalion commander the flexibility to relocate subordinate units or CRGs without losing communication with other subordinate units, adjacent battalions, or the group AADCP.

The technological base on which PATRIOT is being built is manifested not only in its equipment design and operational and communications concepts but also in its logistics, maintenance, and training concepts. The use of standardized microminiature electronics modules throughout the system substantially reduces the number and types of repair parts, the time to repair a fault, and the skill level requirement of the organizational repairman. The standardization of repair parts, along with the extensive use of built-in test equipment and fewer system-peculiar major end items, is one of the primary reasons for not having a direct support (DS) repair capability for system-peculiar equipment within the battalion. The only DS maintenance at battalion level will be for selected engineer and signal equipment with automotive DS being performed on an area basis. The first level of mainte-

Fire control section (emplaced).

nance for system-peculiar equipment above the organizational level will be general support (GS).

The PATRIOT support equipment located within the battalion consists of: shelters mounted on standard Army 5-ton cargo trucks which serve as maintenance work centers and small repair parts transporters at the firing platoons; a lowbed semitrailer for transport and storage of firing platoon large repair parts; a 5-ton tractor-wrecker which provides the lift capability for the large repair parts and the prime mover for the large repair parts transporter; a semitrailer van for the transport and storage of battalion level small repair parts; and six 5-ton tractor-wrecker, semitrailer combinations which are used for the storage, resupply, and reload of missile rounds.

The PATRIOT GS equipment and personnel will be located at theater or corps level and will be capable of testing and repairing selected system-peculiar subassemblies, as well as providing backup contact team support for repairs beyond the organizational maintenance capabilities.

Developmentally, the PATRIOT system has entered its final phase of engineering development and testing before it enters into initial production. During this phase, the system will be subjected to full system field and laboratory tests under the environments of temperature, weather, mobility, and ECM.

The present schedule calls for the completion of development in the early 1980s and will culminate with the developmental and operational testing in the 1979-1980 time frame. Upon the completion of testing, PATRIOT will be produced and fielded with the first units replacing Nike Hercules. Once the Hercules replacement has been completed, Hawk will be replaced.

After 12 years in concept formulation, advanced development, and engineering development, the PATRIOT air defense missile system has proved that it is fully capable of continuing the proud heritage of air defense and that it will close the gap between the present air defense capabilities and the threat of the 1980s.

GLOSSARY

AADCP	Army Air Defense Command Post
CCG	Command and Control Group
CRG	Communications Relay Group
DS	Direct Support
ECM	Electronic Countermeasures
ECS	Engagement Control Station
EPP	Electric Power Plant
GS	General Support
HIMAD	High-to-Medium-Altitude Air Defense
LRU	Local/Remote Unit
LS	Launching Station
RS	Radar Set
SHORAD	Short Range Air Defense

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the Air force connection

This is the first of a series of articles by Air Force personnel for AIR DEFENSE Magazine. The purpose is to provide a forum for enhancing communications between the Air Force and Air Defense communities. The Air Force Representatives office at the US Army Air Defense School invites suggestions for future topics or inquiries that might be discussed on an individual basis.

There are four air situations that confront the ground commander. The first is the strategic threat of the ICBM and the sea-launched ballistic missile (SLBM) which is beyond the scope of this discussion of theater warfare. The remaining three conditions are tactical in nature. The initial tactical condition is one where the enemy has air superiority. This is the most hazardous and it gravely limits options available to commanders. They cannot move, observe, and act while simultaneously keeping their heads down. An example is the situation facing the commanders in North Korea on their thrusts to the south during the Korean War.

A second tactical environment is the one in which there is partial control of the sky by friendly forces. In this situation, some air assets may be dedicated to the direct support of the ground commander. The portion of assets that may be allocated to direct support is, of course, directly dependent upon the extent of air superiority enjoyed. The greater the air superiority, the fewer sorties required for counter-air missions (air-to-air intercepts and air defense suppression) and the more that can be released to close air support and interdiction.

It is doubtful that we will ever enjoy the "luxury" of total superiority (air supremacy), but this is the objective of air power and ADA. It is the final and most desirable tactical air environment. The advantages of air supremacy are numerous, but the problem is how to attain it. We want to minimize losses of friendly aircraft to friendly ADA (shoot 'em down and sort 'em out on the ground) and of friendly ADA to our air defense suppression missions (if you shoot at me I'm going to shoot at you).

To achieve this objective, every commander (ground, ADA, and Air Force) must completely understand the total mission and its associated elements. He must communicate with his counterparts and know their capabilities and limitations. The ground commander must know his ADA capabilities and properly deploy his weapon systems if he expects to achieve the flexibility he needs to win the ground battle. The ADA commander must know his responsibilities, as well as his capabilities and limitations, if he is to make his contribution. The Air Force commander must know his weapon systems and how they may best be employed to assist the ground and ADA commanders. These objectives can be accomplished only if each commander understands and appreciates the importance of the related missions.

The tactical air control system (TACS) provides an organizational framework designed to effect communications, coordination, and the optimum deployment of ADA and tactical air power. TACS is the means by which we put the missile up the enemy's tail pipe and the bombs on target. Included in TACS is the new airborne warning and control system (AWACS) aircraft, which will bring an entirely new aspect to theater warfare. But all of these exotic weapons and communications systems are for naught unless we understand each other.

This means that we not only need to comprehend our own capabilities and limitations, but we also need to accurately perceive the other fellow's mission. Communication is the name of the game. This is one primary reason for Air Force representation at the US Army Air Defense School — to facilitate mutual understanding and appreciation. The organization for command and control exists, but to be effective it must have clear purpose and meaning. Only through precise communications are we able to achieve meaningful command and control. Communication is the one factor that will provide the insurance necessary for victory.

The Air Force Representatives' office at USAADS is in business to serve the Air Defense community. A meaningful dialogue will benefit both services. We solicit your comments and desires to help us develop a rationale for future discussions. Please forward your comments to SAFR/USAADS, Box 5188, Fort Bliss, TX 79916.

EPMS

Officers' Road Map

Brigadier General Charles K. Heinden, Director of Enlisted Personnel, US Army Military Personnel Center, has said that the success of EPMS is largely dependent upon an informed Army and that Officers must be thoroughly knowledgeable of EPMS and know where they fit into the system so as to give it unqualified support.

Despite a major publicity effort accompanying the implementation of EPMS, the constant turnover of personnel results in soldiers who are confused as to what EPMS is all about.

This article was written by a member of the EPMS Task Force to assist the officer corps in understanding EPMS, and it is published at BG Heinden's request to serve as a current guide and future reference for all concerned.

If someone were to ask you what you know about the new enlisted personnel management system (EPMS), what would your answer be? Do you really understand what EPMS is all about?

These questions have been asked of many of your fellow officers. Most have been well informed, but some are still confused about EPMS. Either they lack sufficient knowledge of the subject or they perceive EPMS as strictly an enlisted matter. They don't understand where they fit into the picture. This situation is a matter of concern. Years have been spent developing a system that benefits the individual soldier and at the same time enhances the professional status of the entire Army. EPMS is a good program, but its success is largely dependent on the active participation of the officer corps. This article is designed to tell you what every officer should know about EPMS.

The old system served us well for a number of years, but times have changed and the Army has had to change with them. It was recognized early that to have a truly professional force we would have to develop a different system for the management, training, and evaluation of our enlisted soldiers. The EPMS Task Force was formed at MILPERCEN and TRADOC to work on this problem. They spent 18 months seeking the counsel, ideas, and opinions of about 20,000 soldiers to develop the framework for EPMS.

During group interviews, statements like these were frequently heard: "I'm in a dead-end MOS;" "I'm an E9—been in the Army 27 years; AIT was the last formal school I had the opportunity to attend;" "I can't get promoted as long as I stay in my MOS, and the Army won't let me reclassify into a new MOS;" "I'm a deep-sea diver, and the Army sent me to NCOES in a transportation MOS; it just doesn't make sense;" "My job is boring and I'll probably get out after this (first) hitch;" "Last month I graduated tops in my Advanced NCOES course, and my current job has nothing to do with my MOS;" "The green machine has had me, I can't get there (grade E8) from here (grade E6)."

Unfortunately, many of these were valid comments. They describe some real-world soldier problems with the old enlisted personnel and education system. Clearly, a better system was needed if the Army hoped to maintain a volunteer Army of qualified, professional soldiers. A system that was not people oriented as well as mission oriented was just not going to do the job.

The causes of much dissatisfaction and many problems were found in what is known as the personnel management subsystems. These subsystems (training, evaluation, classification, and promotion) tended to operate independently and were not mutually supportive of one another. Soldiers were promoted to a higher grade and then evaluated to determine their ability to perform in that grade. In other instances, soldiers who had been performing well in a job for several years were then sent to school to learn the same job. After reviewing situations like these, the objectives of EPMS started to come into focus.

- Every soldier needed logical job progression from grade E-1 through grade E-9.
- A system of career-long training that prepared the soldier to assume duties at the next higher grade

had to be developed.

■ Fair and reasonable promotion opportunity had to be developed.

■ The soldier needed a meaningful, challenging job at every level of his career.

In general, the attitude of the enlisted corps was that officers already had those elements built into their personnel system. "Why wasn't there the same concern for enlisted personnel?"

Getting There From Here

In 1972 the Army adopted a system to group Military Occupational Specialties (MOS) that were related, manageable from a personnel and manpower standpoint, and provided visible and logical progression from grade E-1 to E-9. These groupings are called Career Management Fields (CMF).

It was a good step but only the first. The next move was to further refine the career management fields to achieve the objectives of EPMS and provide a total system for enlisted professional development. Understanding how this is done in each CMF will assist later in understanding why specific changes were made.

It usually takes at least a year to develop a prototype career management field. First, information found in the automated data banks and surveys filled out by soldiers are studied. Tasks and duties performed at each grade in an MOS are analyzed. Soldiers who serve in the MOS are interviewed to gain further insight into the tasks they perform, their problems, attitudes, and recommendations. Do meaningful jobs exist at each grade level? Should the MOS be consolidated with another MOS or merged with another at the grade where the problem exists? What effect will new equipment have on the soldier's job? Is the reenlistment rate low? If so, why?

In this probing manner, each MOS is carefully examined. This results in the development of several prototype career fields. The prototypes are then analyzed by career managers, trainers, doctrine developers, and users. The most feasible receive further study: Logical job progression? MOS in the proper career field? Can it be supported with a realistic career-long training program? Job challenge? Are promotion opportunities reasonable?

Let's pause at this point to discuss promotion opportunity because promotions are a prime motivator in career development. Soldiers tend to avoid an MOS in which there is little chance for advancement. What causes promotion bottlenecks? How can they be resolved?

MOS 13B, Cannon Crewman, is a good example, Job progression was logical and visible (Fig. 1), but there was a promotion bottleneck in going from grade E-6 to E-7. This caused many soldiers to move to other MOS to get promoted. To see this clearly one had to look at the job positions found in the authorization (MTOE/TDA) documents. The number of positions available (authorizations) impacts on how many soldiers can be promoted in a specific MOS.

The left column of figure 2 shows the worldwide profile of job positions at grades E-6 and E-7 and the grade E-8 positions from the capper MOS which supports promotion flow within the career field. There were not enough 13B positions at grade E-7 to support adequate promotion opportunity within the MOS. The underlying cause was the basic organization of the Field Artillery battery. In each battery there were six grade E-6, Chiefs of Section; one grade E-6, Ammunition Sergeant; but only one grade E-7, Chief of Firing Battery. The effect was a ratio of seven soldiers competing for promotion to one position. Solving this problem involved reconfiguring battery organization, evaluating job positions, and upgrading the jobs that justified a higher grade. Upgrading jobs is not always the best solution, but in this case it was. The MOS bottleneck was broken as shown in the right column of the chart. The advantage of being able to keep highly

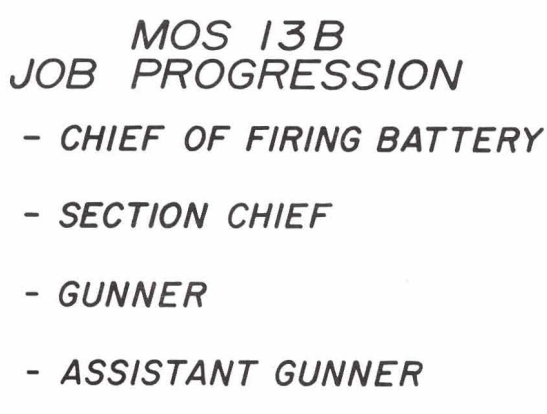


Figure 1

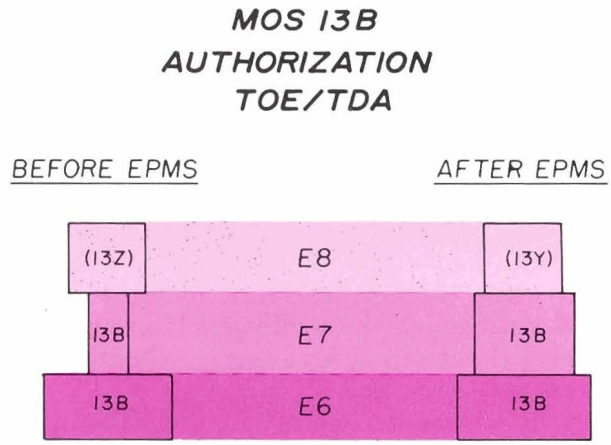


Figure 2

qualified cannon crewmen in their jobs rather than moving them for promotion purposes is obvious.

Now let's return to the development of a CMF. The prototype CMF is wargamed by a group of qualified soldiers experienced in the MOS involved. The end product of this process is the EPMS recommended career management field.

Each career management field is then formally coordinated with the training commands, major field commands, and the DA staff. When that coordination is completed and disagreements have been resolved, the CMF is presented to a steering committee of general officers representing the DA staff, major field commands, and TRADOC. The Sergeant Major of the Army is also a member of the committee. During this meeting, any issues that may still exist within a CMF are ironed out, decisions are made, and the CMF is approved or disapproved for implementation.

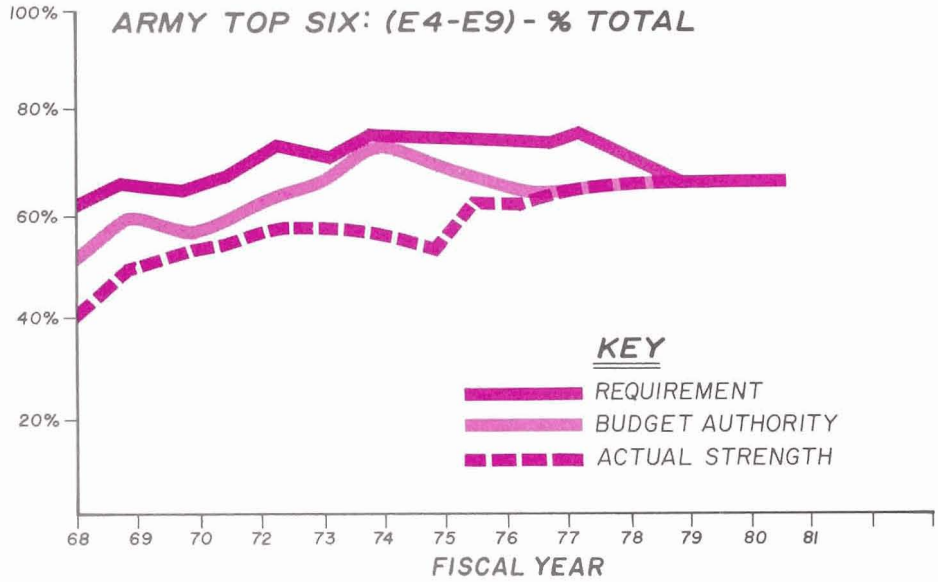


Figure 3

Developing a CMF is a lengthy, painstaking process involving a lot of highly qualified, conscientious people. This is what it takes for a soldier to be able to say, "I *can* get there from here."

Consolidating several MOS into one and merging others at a higher grade have been the source of much discussion. Some believe this process causes a loss of expertise, while others argue that it provides the soldier with greater challenge and more variety in assignments. The EPMS Task Force had to come to grips with this problem when it began to examine the MOS structure. Some MOS had few authorized spaces, were extremely limited in scope, and offered little opportunity for advancement. A "quick fix" solution would have been to eliminate or consolidate any MOS with fewer than 150 positions. This was ruled out, because a lot of good soldiers' careers would have been hurt. Some MOS had to be broadened at the entry level to provide both challenge and opportunity so that the soldier would want to stay in the Service. The reason was obvious. The Army cannot afford the cost involved in training new people to completely refill a MOS every 2 or 3 years. Further, it is the reenlistee who eventually provides the experience and expertise that every MOS needs to survive.

Merging of some soldiers' MOS at the leader and supervisory levels also became necessary because some were in "dead end" MOS. CMF 11, Maneuver Combat Arms, is an example. A very large share of the promotions to grade E-9 and Command Sergeant Major selections was coming from a relatively few of the MOS in the career field. Soldiers in the other MOS were stymied. A number of highly qualified soldiers were not being given a chance to compete for the Army's highest enlisted grade. To correct this, all E-9 jobs in CMF 11 were consolidated into a single MOS. The results were increased competition and more equitable opportunity for promotion, a variety of assignment opportunities, and more broadly experienced enlisted supervisors.

It has been asked if there is a conflict between more generalization under EPMS and increased specialization under the Officer Personnel Management System (OPMS). The answer lies in perspective. Before EPMS and OPMS, enlisted soldiers and officers were at opposite ends of a spectrum. Some enlisted soldiers were too specialized and some officers were overly generalized. Under EPMS and OPMS, the two are now moving toward the center of the spectrum to provide a more balanced, responsive force. It should be noted that EPMS was not an outgrowth of OPMS. The systems were developed separately.

Slower Promotions?

Since 1968, all of the services have been under increasing pressure from Congress and Department of Defense to halt grade creep and bring the grade structure into alinement with budgetary constraints. Some people interpret this as a forerunner to slower promotions and maybe even a promotion freeze, which is not true.

Grades E-4 through E-9 are commonly referred to as the "TOP SIX" of the enlisted grade structure.

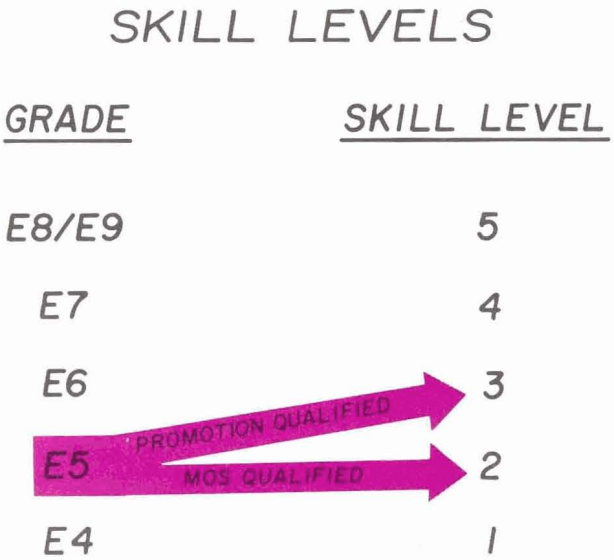


Figure 4

Figure 3 plots the TOP SIX as a percentage of the total number of soldiers. The upper line represents the Army's requirement for combat organization (total authorized enlisted strength as determined by totaling all of the TOE and TDA documents for the entire Army). This is called the required force. The middle line represents the Congressional budgetary authorization for the TOP SIX. In other words, the number of TOP SIX soldiers for which Congress will pay. The dashed line represents the percentages of soldiers who actually have one of the TOP SIX ranks on their sleeves. When a unit commander looks at his authorization document (upper line), he perceives an NCO shortage. In reality the Army does not have the money to promote the number of soldiers stated in these documents (middle line). At first glance it would appear that this would cause a general slow down or a promotion freeze. Prior to FY 75, we rarely spent all of the money Congress authorized for promotion into the TOP SIX (dashed line). The EPMS Task Force was given the mission to relook at our grade structure and to bring what the Army says it needs down to a level that Congress will fund. At the same time, EPMS is trying to adjust CMF and MOS so that every soldier has a greater opportunity for promotion. By 1978 the Army expects these three lines to be in close alinement. What does all this mean? To begin with, no one is going to lose stripes. On the contrary, as EPMS is fully implemented and promotion bottlenecks are reduced, more soldiers will have better opportunities for promotion. Commanders may not be authorized a grade structure as high as before, but the Army will be better able to fill by grade what is authorized. Perfection is not promised, but progress has been made. The commander will have a more realistic picture of his organization and what he will have available to complete his mission. The days of promising champagne on a beer budget are coming to an end.

From what has been said, it might appear that EPMS has provided a means of ensuring that the Army will have a soldier in the proper grade for each requirement. This assumption is not entirely true. Other factors impact on promotions that militate against perfection. We said before that authorizations drive promotions, which is true, but authorizations don't stand still for very long. They are changed to meet requirements. The authorization for a given MOS will go up or down as the Army's force structure is changed. A good example of this was the decision to go to a 16 division force. Adjustments had to be made in a large number of MOS to allow for this expansion. As a result of such changes, commanders experienced grade shortages in some MOS and overages in others. To correct this, soldiers were transferred from overage to shortage MOS (reclassified).

Since the Army bases promotions on future projections, this will minimize the shortage problem. Keep in mind that the success of this program is dependent upon the timely submission of document

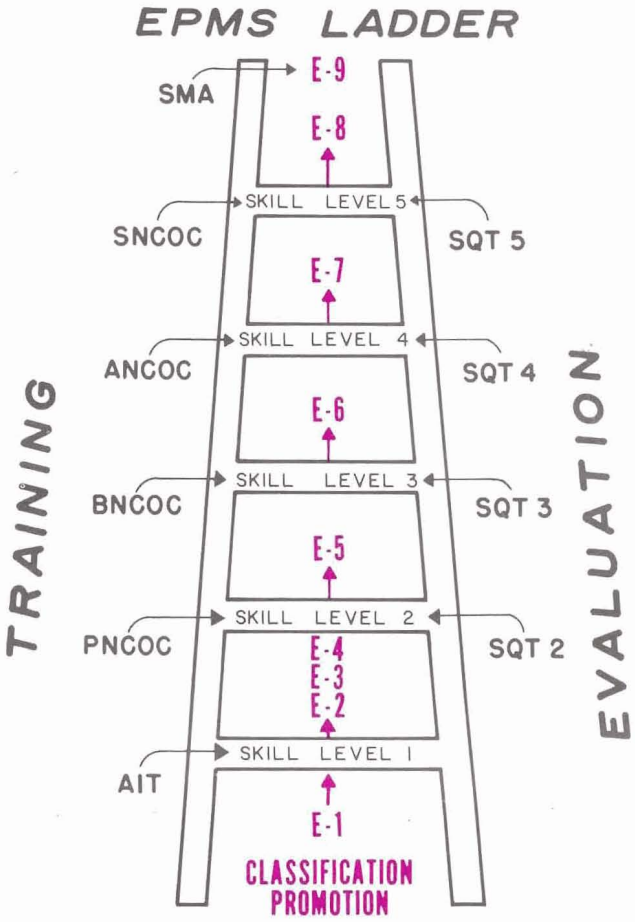


Figure 5

(force structure) changes. The personnel system must have time to react.

EPMS — Leaders/Commanders Responsibility

"He is one of my best NCOs, and I can't understand why he wasn't promoted." More often than not, we blame the system when a deserving soldier is not promoted on time. Well, it will continue to happen until officers learn *how* to get their soldiers promoted. They *must* understand EPMS and *assume* their role in managing enlisted careers. EPMS places more emphasis on the commander's role in the professional development of his enlisted soldiers.

Skill Level

Skill level, that's the *key*. It's the glue that holds EPMS together. There are five skill levels associated with MOS. They are found in the fourth character of the enlisted MOS code — 11B20, 76Y30, 63C40. Figure 4 depicts the new relationship between grade and skill level that is standard for all MOS.

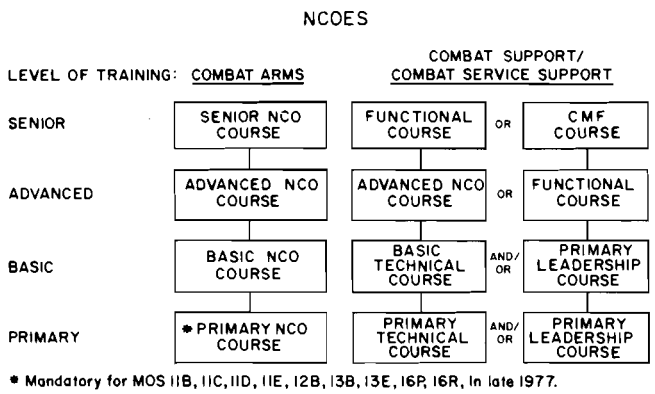


Figure 6

What is a skill level? Under EPMS, it reflects the skills typically required for successful performance at the grade with which the skill level is associated. What else must commanders know about the skill level? A soldier must possess the skill level of the next higher grade to compete for promotion to that grade. As an example, a SGT/SP5 must hold skill level 3 — 11B30 — to compete for grade E-6. This provides a stimulus for professional development and precludes a soldier from being promoted beyond his current capabilities.

Getting the Skill Level — Training

There are two ways to complete the training requirement for the next higher skill level. The first is by learning the higher skills while serving on the job. It is called on-the-job experience (OJE). The second is to complete the designated school course (NCOES). They are equal. Completing the training requirement is what is important, not the route used. This subject will be discussed later.

Counseling — EPMS

SGT Smith has arrived in his new unit. The First Sergeant has obtained a printout of SGT Smith's record, and the Commander is reviewing it: Single. Second enlistment. Three years, 2 months of service. Grade E-5. Promoted to current grade 6 months ago. Previous commander appointed him to corporal; filled an E-5 slot. "Must be a front-runner. Nice to get good men." MOS 12B20. "Whoa there! With maximum waivers on time in grade and time in service, Smith could start competing for E-6 in about 10 months. But first he needs the E-6 skill level — 3. I'll discuss that with him . . .

"SGT Smith, that about winds up this interview except for one thing — your professional development. Since the start of EPMS, it is one thing that I personally monitor. Your record looks great, but you need that next higher skill level within 8 months. Here's what we can do to get you there. The first step is to locate you, grade E-5, on the EPMS ladder (Fig. 5). This EPMS thing is like a track meet, and you have two hurdles to cross. First, complete either OJE or the basic NCO course. I just happen to have a quota for the basic course that starts next month, and you're going. Your basic course is taught over at the Division NCO Academy, so there's no TDY problem. The second hurdle is the Skill Qualification Test (SQT). You have to get that higher passing on SQT 3 to be awarded skill level 3, and we have about 8 months to get you ready for the test. Do you have the E-6 Soldiers' Manual that covers all the critical skills you must be able to do to pass the SQT? Good! I'll be getting reports on your progress through the chain of command. You're going to find that the unit training program will help you gain proficiency in some of those critical skills. In others, it will take some effort on your part."

Training and Evaluation

Let's refer to chart 5 again and review the significant features of the EPMS ladder. AIT normally results in the award of skill level 1. The primary, basic, advance, and senior courses teach the skills of the next higher grade level. SP4 attends the primary level to learn grade E-5 duties, SGT E-5 attends the basic level to learn grade E-6 duties, and so on. Each soldier is administered the SQT of the next higher level. SP4 takes SQT 2, SGT takes SQT 3, and so on up the ladder. When the training and SQT requirements are successfully completed, the higher skill level is awarded. The USA Sergeants Major Academy (USASMA) will continue

to be the top level of NCO training. Note that under the old NCOES there were only basic and advanced levels and the USASMA. Under EPMS two additional levels, primary and senior, have been added. These successive levels of training are the cornerstones for maintaining and increasing the proficiency and expertise of the NCO corps. But don't forget, OJE also is an equal and totally acceptable route to the development of professional qualifications.

A number of new course names such as Primary Technical Course, Primary Leadership Course, and Basic Technical Course are entering our training vocabulary. What are they? How do they fit into the NCOES under EPMS?

Essentially they are new, more descriptive names for the Combat Support NCOES courses (Fig. 6). This figure does not mean that every support MOS will have a course available at every level of training. Availability will depend on the technical requirements of each job. For example, MOS 95B, Military Police, will have both a primary and basic course at the lower levels and some type of course at the advanced and senior levels. MOS 34H, ADMSE Repairman, will have a primary course, some type of advanced and senior level course, but no basic course. If a support MOS requires leadership duties at grades E-5 or E-6, a primary leadership course will be available as appropriate.

Our road map is almost complete. As mentioned earlier, OJE is the route to a higher skill level when there is no school course at a level of training or if the soldier does not attend the school course (Fig. 7).

Successful completion of OJE is judged by the commander. A minimum of 6-months service for award of skill levels 2 and 3 and 12-months service for award of skill levels 4 and 5 are the prerequisites. This service must be in a job calling for the soldier's primary MOS at the current or next higher grade. OJE service does not have to be continuous. Part could be completed in one unit and the remainder in another.

To ensure that OJE and school courses are given equal weight, promotion boards will be given very specific guidance on this point. It is a real-world fact that the OJE route will require more individual application and initiative. At the same time, the soldier will usually contribute a full day to his unit. OJE will be given due recognition under the EPMS promotion system.

On the Way

When all of this will happen can be an article by itself, but a broad-brush overview is appropriate. Following is a chronological list of key events along the implementation trail:

- CMF approved
- Start EPMS NCOES
- Convert soldiers to new MOS
- Convert TOE/TDA
- Administer SQT
- Start award of higher skill level (DA announcement)
- Start new promotion system (DA announcement)

April 1977 was the scheduled date to start administering the first SQT to soldiers in CMF 11, Maneuver Combat Arms. That provides a perspective as to where the overall implementation project stands. It is envisioned that award of the higher skill level will begin shortly after SQT is administered to all soldiers in an MOS. Late 1977 is the projected test completion date for CMF 11. At about that time, DA will announce the start of the EPMS promotion system. Finally, according to the current schedule, all MOS should be under the EPMS promotion system by late 1979.

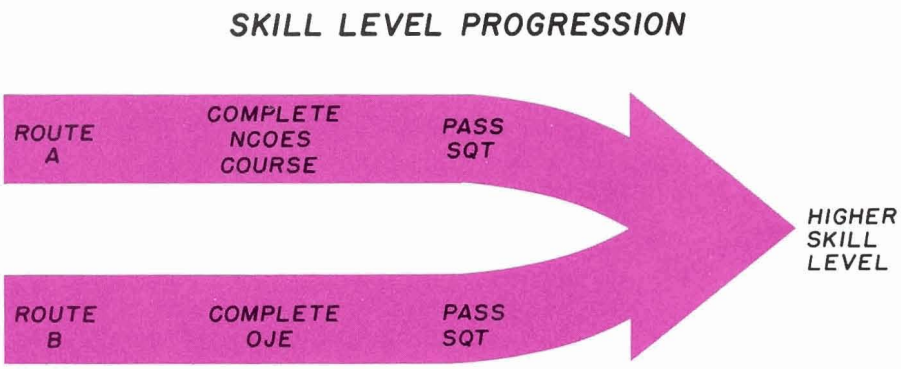


Figure 7

Possible Mission

No one doubts the complexity of the personnel management business. This is especially true in the Army. In the past, many commanders were confused and somewhat mystified as to where they fit into the picture. Times have changed. The success of EPMS depends upon the commander's understanding and involvement in the system. Under EPMS the role of the commander has been well defined. The key is knowing how to assist the soldier in obtaining the next higher skill level. For the soldier this means greater proficiency, job satisfaction, and promotion. For the commander this means a better soldier, a better unit, and increased combat readiness. That's what EPMS is all about.

WHAT DO YOU DO NOW,

LIEUTENANT?

Prepared by Tactics Department, USAADS

SITUATION:

You are the platoon leader of __ Platoon, Battery __ (Chaparral), ADA, Mechanized Infantry Division. Your platoon is providing air defense coverage at checkpoint #4 along the main supply route which runs from the DISCOM area in the division rear to the 1st Brigade trains. The division commander wants to prevent resupply vehicles from coming under enemy air attack if they get bogged down at this checkpoint (fig 1).

MiG-23-Flogger-Ds have been attacking targets in the division and brigade rear areas. Allied aircraft, consisting mainly of Jaguars, have been sighted in the areas as they return from close air support (CAS) missions in the covering force and division forward areas. The previous day, your Chaparrals came under air attack. Two Chaparrals from your platoon suffered damages by Jaguars as they were conducting a CAS mission in the vicinity of the defined area. The Jaguars attacked your position after they had been fired upon by one of your systems.

Maintenance personnel were able to repair one of your Chaparrals; however, the other system must be evacuated (first squad) and a float is not available at this time.

Resupply convoys continue to pass through the area and intelligence reports indicate that enemy air attacks are expected to continue with the primary avenue of approach being from the northeast. You are directed to continue to provide air defense

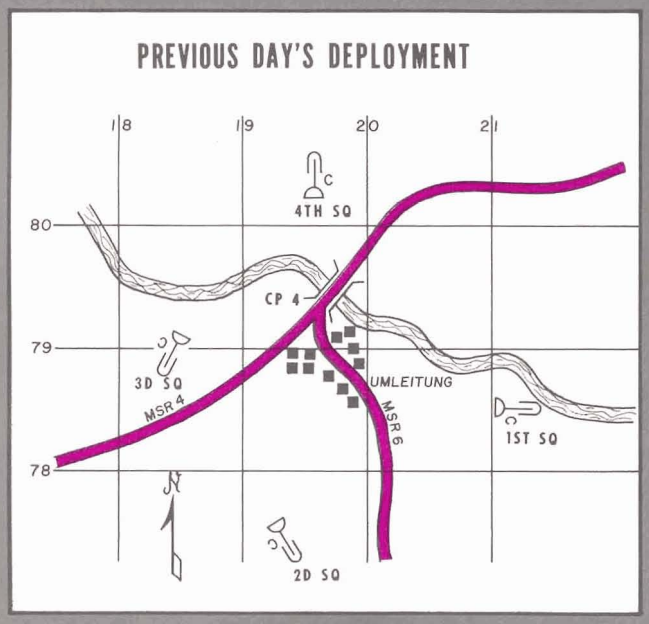


Figure 1

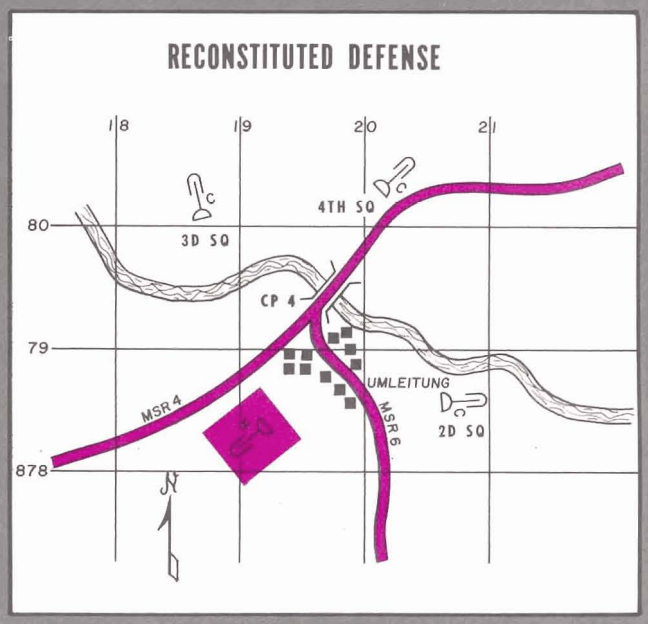
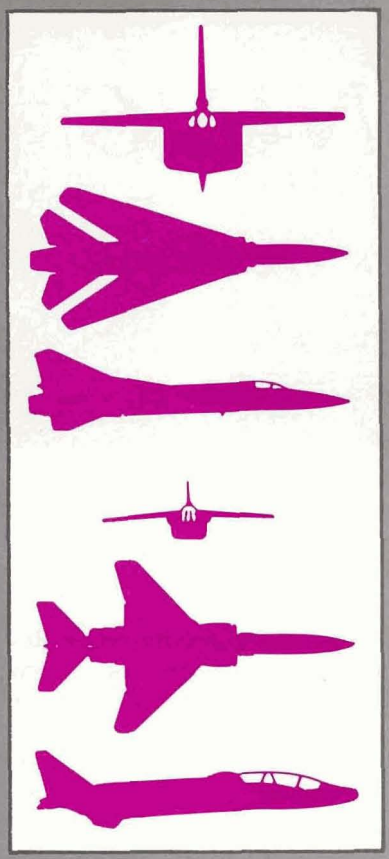


Figure 2



FLOGGER MiG-23 single-seat swing-wing supersonic fighter operated by the Soviet Air Force and has been observed in countries outside the Warsaw Pact. Two-seat version for advanced training. Span variation 29½-50 feet.

JAGUAR SEPECAT twin-engined, two-seat operational trainer in RAF service as Jaguar E. External weapons points on single-seat version, but one 30-mm cannon to two of GR1 and A versions. Span 28 feet. and A versions. Span 28 feet.

Figure 3

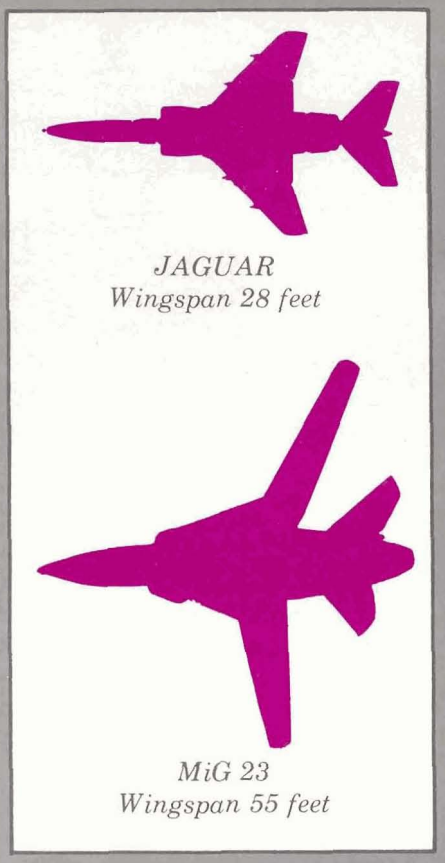


Figure 4

coverage at the "checkpoint" (fig 1). Your weapons control status is WEAPONS TIGHT and the air defense warning is RED.

What Do You Do Now, Lieutenant?

As the platoon leader, you should review the employment guidelines to redesign your defense to determine how you provide air defense protection for this checkpoint. You also need to consider a visual aircraft recognition (VAR) review based on the previous day's activities and intelligence.

First, you should think about your defense design. Most of the enemy aircraft have been coming from the northeast and east, although they can attack from any direction. You probably would consider moving your 3d squad north of the river, then utilize the personnel from the 1st squad, whose weapon was evacuated, to form a Redeye team with the Redeye equipment you have in your platoon headquarters and position them in the zone that was previously assigned to the 2d squad. Finally position the 2d squad near the 1st squad's original position (fig 2).

By utilizing the Redeye team in this situation, you have helped maintain a balanced, all-around defense, some early engagement capability, and overlapping coverage. Remember, Chaparral should be employed no farther than 2 km apart. If you didn't have the Redeye equipment in your platoon, you would have been forced to redesign your defense in such a way that maintaining overlapping coverage would have caused you to "close in" your defense. This would have also degraded the defense design principles of balance and early engagement.

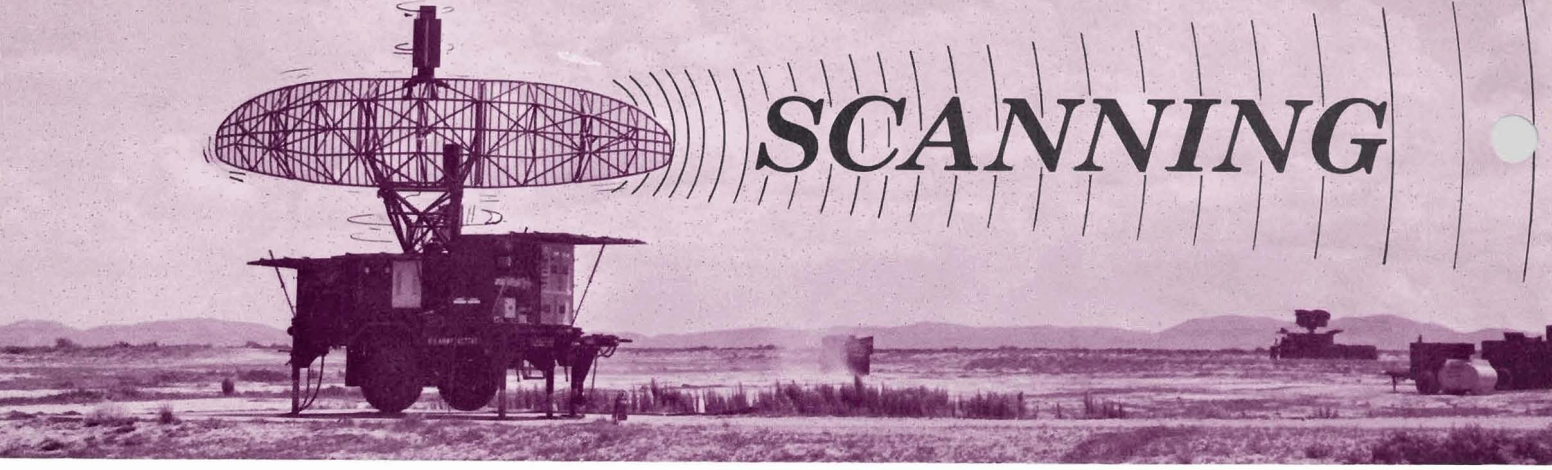
The next consideration is visual aircraft recognition. Since intelligence sources have informed you that MiG-23-Flogger-Ds and Jaguars are operating in your area, you should concentrate on those two aircraft during refresher training of your squads (fig 3). You need to point out the difference in the Jaguar and the Flogger-D, especially the Flogger with its wings extended.

The Jaguar has a larger canopy and a smaller wing span. Note the difference in the wings of the Jaguar and the MiG-23 in the extended position (fig 4). If the Flogger had its wings swept, it would be much easier to identify (fig 3).

You must also remind your squads that they are at WEAPONS TIGHT, which means they can fire only at aircraft positively identified as hostile, but also remind them that the right of self-defense is never denied.

Even though you are at the same checkpoint, you should move your squads after each air battle or after being reconnoitered by air. Camouflage is also important for your platoon's survivability.

With the use of intelligence information in your aircraft recognition refresher training and the proper deployment of your assets using the guidelines of balance, mutual support, and early engagement, you can enhance the successful accomplishment of your platoon's mission. Don't forget, however, the necessity for frequent movement and camouflage.



U.S. ROLAND PROGRESS

Hughes Aircraft Company hosted the first U.S. Roland Executive Program Review as more than 150 representatives from the US Army, Hughes Aircraft Company, Boeing Aerospace Company, and 16 major subcontractors met recently at Culver City, California. The review covered everything that has been accomplished over the past 2 years. Some of the major facts and accomplishments involving the U.S. Roland are discussed briefly in this report.

NATO Implications. Roland's capabilities have been proven in Europe, and the system is already helping to strengthen North Atlantic Treaty Organization forces and to reinforce our close ties with our European Allies.

Guidance Unit. An all-American guidance unit was recently given a last checkout prior to installation in the missile airframe.

Optical Sight. The first electro-optical sight has been demonstrated. It will be used by the system gunner for tracking high-speed, low-level attackers in daylight and clear weather. It provides precision target tracking, even in an intense electromagnetic countermeasures environment.

In daylight action, with good visibility, when Roland's optical sight may be used (after the search radar spots a bogey), and the interrogator, friend or foe (IFF), unit establishes that it is an unfriendly aircraft, the gunner can slew the sight to the speeding target.

Warhead. The warhead section has been certified, allowing assembly of complete missiles and subsequent test firings. Certification was preceded by stringent testing, including detonation of warheads to prove out fragmentation and explosive characteristics. The warhead explosive is identical to that used in the European Roland missile. Warheads tested were detonated by the New Mexico Institute of Mining and Technology, at Socorro, New Mexico.

Fire Unit. The first domestic-built fire unit is scheduled to be completed later this year, with initial firing tests scheduled for early 1978.

U.S. Roland is more than a missile, more than a radar, more than a fire control system. It is all these

Representatives of the Army and Industry assembled for the first US Roland Program Review.

More than a missile

things and more. It is designed to defend troops and high-value emplacements, such as airfields and supply depots, against attack by jet aircraft flying very fast and very low — a tactic designed to avoid radar detection until it is too late.

U.S. Roland will counter this tactic with a combination of:

■ A powerful pulse-doppler search radar to pick up attackers low on the horizon.

■ A pulse-doppler track radar to instantly lock on an Aggressor, freeing the search radar to scan for other bogeys.

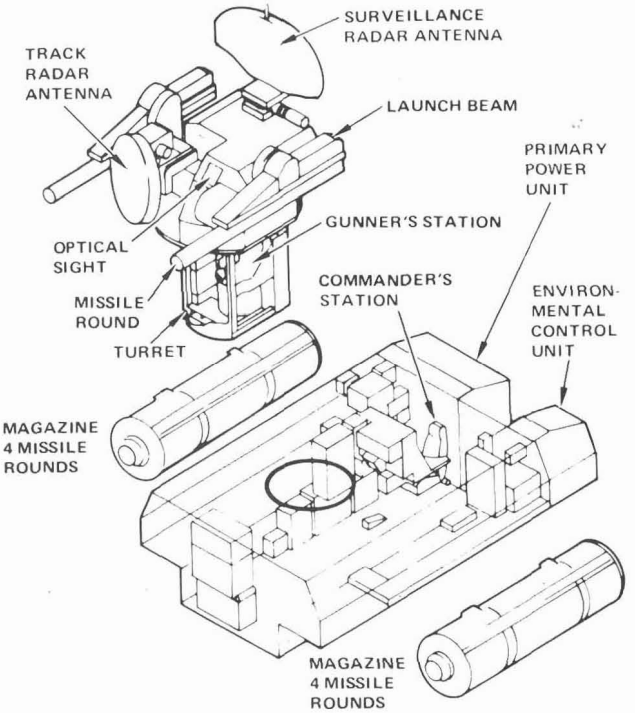
■ A supersonic, quick-reacting ground-to-air intercept missile to knock the attacker from the sky.

U.S. Roland mounts all equipment in one self-contained fire unit. The integrated system may be mounted on a wheeled or tracked vehicle to protect moving columns of men or machines. The Army will use the tank-like M-109 vehicle as primary U.S. Roland carrier. It also can be set directly on the ground to protect fixed installations. In any configuration, it is equally ready to tap its own power supply and swing into action.

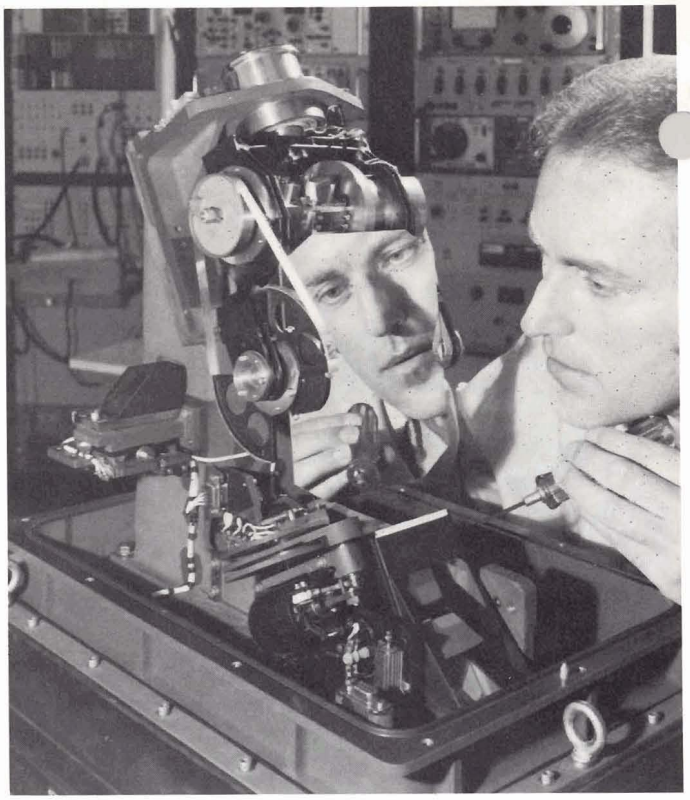
A Roland missile, sealed in a combination carrying/launch tube at the factory, is at the ready on a launching arm. Optical sight lock-on is established, the rocket engine is ignited, and the missile streaks skyward.

The gunner keeps his sight on the target, automatically generating a steady stream of position information for the system computer. At the same time, an infrared source on the back of the missile is being watched by the system's infrared tracker, automatically keeping the computer aware of the missile's course. The computer continually weighs this data, generating course corrections beamed to the missile's guidance electronics.

In darkness or in bad weather, the system's automatic track radar/intercept mode is used. The engagement sequence is the same except the track radar performs the functions of the optical sight and gunner, keeping the target dead center and the computer aware of its location. The rest is automatic and final.



BG Frank Ragano, Project Manager of the US Roland system, uses electro-optical sight.

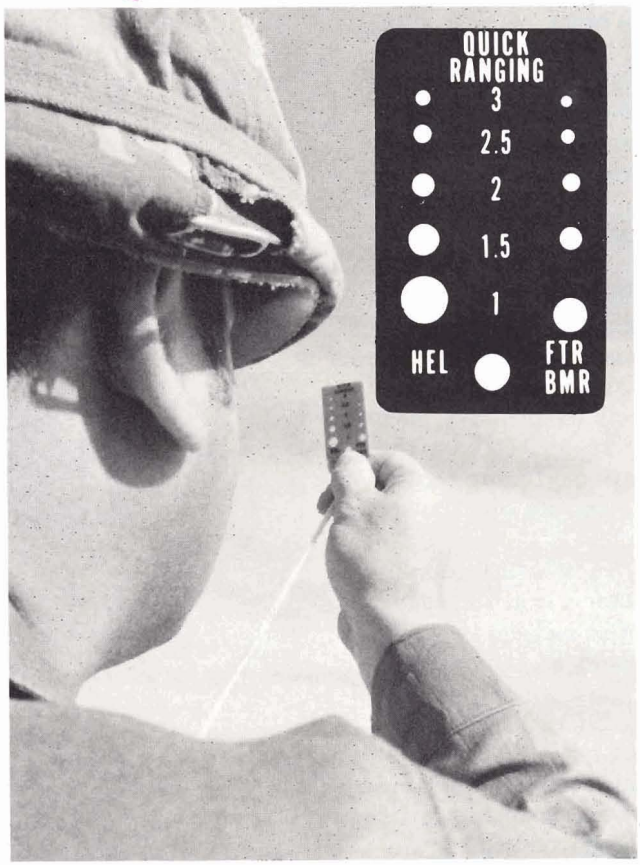


The optical sight gets a check before installation in the American-built sighting system.

QUICK-RANGING DEVICE

With the increased speeds of today's high-performance aircraft, the requirement for rapid detection and identification becomes more important. After detection and identification have been accomplished, the need for accurate ranging is an absolute prerequisite for a successful engagement. To aid SHORAD crewmen, a simple, quick-ranging device has been designed by the US Army Air Defense School.

The device, "Quick Ranging (Test)," consists of a piece of plastic (with lettering on one side) about the size and shape of an identification tag with precision holes drilled through it to achieve ranging from 1,000 meters to 3,000 meters in 500-meter increments. Its design incorporates ranging capabilities for both attack helicopters and fighter-bombers. The graduated holes are placed in two lines with helicopter ranging on the left and fighter-bombers on the right. In designing the device, an average attack helicopter was considered to be 20-meters long and a fighter-bomber 15 meters.



A soldier demonstrates the method of using the quick-ranging device, shown inset in full size.
Photo by SGT David R. Craig, Jr.

The ranging device is attached to a string and worn around the neck to make it ready for quick use. The string is of such length that, when the device is held up it is exactly 12 inches from the eyes. The SHORAD crewmen, when detecting an inbound lateral crossing target from his position, determines the type of aircraft; i.e., rotary or fixed wing. He then "eyeballs" the target through the ranging device and determines which hole the target fills. He then reads the range (in kilometers) which is the number nearest the hole.

The device was provided in limited numbers to the 1st Bn, 55th ADA, during its participation in a CONUS field training exercise in Louisiana. Test results from both FORSCOM and TRADOC units will be studied and a determination of the value and future use of the training aid will follow. Should test results prove favorable, the quick-ranging device will be identified as a graphic training aid (GTA) and will be supplied to field units through local TASOs.

ENLISTED CAREER NEWS

NOW HEAR THIS

Prolonged activity in a noisy area can lead to loss of hearing. A 1971 study at a major military training center showed hearing loss in only 2.4 percent of the new recruits, but by the end of basic training the figure had tripled. By the end of AIT, it stood at 13 percent. Officials at Walter Reed Army Medical Center estimate that over half the soldiers who have spent more than 10 years in combat arms suffer significant hearing loss.

This and other studies led to command interest in hearing conservation. More than 50 audiologists were commissioned and assigned to Army posts to set up programs, identify noise hazards, and provide hearing tests for soldiers.

Hearing loss can be prevented. Properly fitted ear plugs can be a definite help. But cotton has no effect, and cigarette butts plugged into the ear can be harmful. Medical authorities warn that soldiers should have their hearing checked frequently, the same as their eyes, teeth, etc. If you think you have a hearing problem, have your hearing checked. Deafness is preventable if caught in time. Once hearing loss occurs, it cannot be regained.

PORT CALLS — TOLL FREE

The Military Traffic Management Command has set up a toll-free telephone number for quick and easy port-call service. Now, soldiers home on emergency leave or TDY need not leave home to arrange their port calls. Soldiers are requested to call during normal duty hours and are encouraged to request port calls as early as possible. A soldier requesting a port call with less than 48 hours leave remaining will be advised to report to the APOE where his status will be changed to "duty."

The toll-free number for port calls is 800-336-0223, and can be used by group movements and recruits. If you do not have or don't remember the number, group movement leaders can obtain the number from the local transportation officer. Recruits will be furnished the number by the Armed Forces Examining and Entrance Station.

SERGEANTS MAJOR ACADEMY ACCREDITED

Senior NCOs can receive up to 18 semester hours of college credit when they complete the nonresident course of the Army Sergeants Major Academy. A recent decision by the American Council on Education (ACE) makes it possible. The ACE recommends that nonresident course graduates receive the credit in the upper division of the Baccalaureate Degree Program. This brings the nonresident course credits to the same level as the resident course. The ACE recommendation is retroactive and affects all graduates after July 1974. In addition, the Academy is accredited by the Southern Association of Colleges. Many colleges and universities recognize the credits in certain degree programs.

Sergeants Major Academy graduates are encouraged to check into this new ruling and have the credit posted to their personnel records. The enhancement to your career makes it well worth the effort. Since you have earned it, claim it.

SOLDIER'S MANUALS AND SQTs

The Soldier's Manual doesn't replace the soldier's rifle; however, it is every bit as important. You cannot perform your job successfully without knowing its contents. There will be a Soldier's Manual for every MOS and skill level. A personal copy is being printed for each soldier's personal use. If you have not received your copy start asking for it. Start with your installation Test Control Officer. In the meantime, don't twiddle your thumbs. Instead, go to your Military Occupational Specialty (MOS) Library or education center. They have reference copies of all the Soldier's Manuals published.

The Soldier's Manual is probably the most important book you own. It will definitely help you do a better job and be able to pass the new skill qualification test. It describes all the critical skills required to do your job. It also gives detailed guidance on where you can get more information about a particular skill you may need to brush up on.

If you are in one of the following MOS and have not received a personal copy of your Soldier's Manual, speak up before it's too late for you to prepare for that next promotion:

16B, 16C, 16D, 16E, 16H, 16J, 16P, and 16R.

■■ DA has approved a revised skill qualification test (SQT) schedule to allow all combat arms commanders the flexibility of scheduling the new test within a 6-month period. The change affects all Active and Reserve Component combat arms soldiers.

The extended time insures soldiers have the necessary 6 months to train with their Soldier's Manuals prior to taking the new SQT. Soldiers in Career Management Field (CMF) 16 will be tested within the July to December period. Testing of Reserve Component personnel will commence approximately 12 months after the Active Army.

Major commands have the option of scheduling SQT within the designated 6-month period. They will consider the amount of time their soldiers have worked with the Soldier's Manual (which outlines the critical tasks required to perform on the job) and the SQT.

The SQT will test only those tasks identified and announced in the SQT notice, which soldiers will receive at least 60 days prior to the beginning of the 6-month test "window."

■■ Soldiers graduating from certain AIT courses are receiving Soldier's Manuals before reporting to their new units, in accordance with current TRADOC policy. Graduates of such courses as the Maneuver Combat Arms, Military Police, certain air defense MOS-producing courses, and other specialties within Enlisted Personnel Management Group I are already receiving the manuals. As more of the manuals are completed, the AIT distribution method will be extended to include all AIT graduates.

The manuals are the soldier's personal guidebooks to job proficiency. They describe all the critical skills necessary to perform his job. Each manual also includes detailed information on standards of performance, as well as complete reference data on where more information can be obtained.

Once issued to the individual, each soldier is responsible for maintaining his personal copy and must have it with him when signing into his new unit.

■■ Inquiries continue to be received from the field requesting information as to which MOS are to be tested and when. "When will I take my SQT?" is a common question.

All MOS will eventually be tested. However, the following MOS are scheduled to be tested within the 6-month periods from April to September and July to December:

April-September	July-December	
MOS	MOS	
11B	16B	16P
11C	16C	16R
11D	16D	95B
11E	16E	95C
	16H	95D
	16J	

OVERSTRENGTH MOS REUPS

Some soldiers are not reenlisting in overstrength MOS because they have heard they can't, but that just isn't true. There is no MOS that is completely closed to first-term soldiers who want to reenlist in FY 77.

If you are in an overstrength primary MOS (PMOS), you are still encouraged to apply for reenlistment but you should be aware that you may be subject to retraining and reclassification. If the PMOS they want is in an overstrength category, soldiers should list three or more shortage MOS for which they are qualified and in which they will accept retraining and reclassification. Soldiers should know this before reenlisting in their PMOS or one of the other choices. No one is bound in any way to accept an MOS other than his or her PMOS. If you decide not to accept the MOS at reenlistment, you may leave the Army by expiration of term of service.

No action will be taken to retrain and reclassify a careerist at the time of reenlistment, but careerists are encouraged to apply for retraining and reclassification from an overstrength MOS in which they have reenlisted to a shortage MOS.

DA Circular 611-56 lists the status of all MOS. Soldiers should check the circular carefully before making any reenlistment plans.

BARS to STARS

OPMD UPDATE

FROM THE ADA LIEUTENANT COLONELS DIVISION

Command. Thirty OPMS centralized command positions have been ticketed for ADA LTCs during FY 78. These include 24 ADA battalions and 6 training commands that will become vacant between 1 Oct 77 and 30 Sep 78. The 2-year command tour in Europe reduced the number of available commands by four.

Assignments. ADA 05s stateside can expect to stay at their current locations for 36 months. Six to nine months before completion of 36 months, stateside officers should submit a preference statement indicating their assignment desires. Completion of 36 months at the same installation does not mean that an officer will move; it only means that he is available for move, depending upon the requirements.

Promotion. Two factors that receive too little attention from officers are their officer record brief (ORB) and official photo. Prior to any selection boards, ORBs should be reviewed for accuracy and photos should be updated as required. Photos should portray the officer in the best possible light; ADA bars should be worn, shoes polished, uniform properly fitted, including *authorized* decorations.

FROM THE ADA MAJORS DIVISION

Assignments. Several factors affect each assignment action. For example, the current strength of Air Defense officers in the grade of major is approximately 580. There are presently 326 spaces worldwide (of which approximately 35 percent are in oversea commands) designated for majors with Specialty Code 14 (Air Defense). The average utilization rate for Air Defense majors is 64 percent. Although the desired CONUS tour length goal is 36 months, the foregoing dictates that for Air Defense majors this goal cannot always be met. Assignment actions are based on the needs of the Army, professional or career development of the individual and, finally, on personal desires of the officer. This may sound harsh, but we *must* meet Army requirements. Our aim is to satisfy these requirements and also assign you where you would like to go and to a position that is professionally appropriate. Please keep the Majors Division informed of your "druthers" by timely submission of DA Form 483, Officer Preference Statement. You can amplify your assignment with a phone call to Majors Division at least 8 or 9 months prior to your date of availability for assignment, especially if you are oversea vulnerable. Our policy for officers serving in a CONUS assignment is to call you prior to making any assignment action. For those of you in oversea commands, this procedure cannot always be accomplished; therefore, the Officer Preference Statement is a vital document in the slating of your next CONUS assignment.

Command and General Staff College (CGSC). Everyone in the zone of consideration for CGSC level schooling (CPT (P) through school year group 1964) should insure that a current official photo is in his file. Also, update your Officer Record Brief if you have not done so in the past year. Don't wait until the last week. The prescreen board is scheduled to meet in mid-July with the final selection board to convene in the early fall. If you are in year group 1964 or 1965 and have not already been selected for CGSC level schooling, you should enroll in the nonresident instruction program. This action will not preclude your selection for the resident course.

Officer Personnel Management System. Many of you have wondered what the "mechanics" are in making an assignment now that we are no longer organized as a branch. In Majors Division, there are at least four officers involved in each assignment. Data in the computer have each of you projected into

either your primary or alternate specialty for your next assignment. This will appear in your orders as your projected specialty. Approximately 6 to 9 months prior to your date of availability (completion of a normal tour), the specialty manager of the specialty to which you are projected will review your file and slate you for an assignment based on the needs of the Army, your career development, and your personal desires. After the specialty manager has firmed up what he feels is correct, your file is routed to your other specialty manager for concurrence. If there is a disagreement, they attempt to resolve it at that point. Your file then goes to the professional development officer for his concurrence. If he feels the assignment is not appropriate, he tries to resolve it with the two specialty managers. Your file then goes to the Chief of Assignments for final resolution. After his approval, a request for orders is prepared directing the assignment.

FROM THE COMPANY GRADE OFFICERS DIVISION

Advanced Civil School Outlook – FY 77/78. The Company Grade Combat Arms Division received 85 advanced civil school (fully funded) quotas for FY 77 and is programed to receive 80 for FY 78. Air Defense Branch has normally received a high percentage of graduate quotas in the technical and hard science disciplines. This year and FY 78 are no exception. To date, we have 44 officers either in school or on orders. There are some good prospects for the remaining quotas, but we need more. The disciplines still available in FY 77 are as follows:

Journalism	ORSA (Business)
Comptroller	ADPS (Business)
Management Research	Engineering Aeronautical
Engineering	Electronics
Guided Missile Engineering	Engineering Nuclear Effects
Engineering Physics	Engineering ADPS
ORSA (Engineering)	Nuclear Physics
Area Studies	Education Audio Visual Aids
Psychology Social	Psychology Applied

Did you say "WOW?" Those officers considering graduate study should prepare by taking the Graduate Record Examination or Graduate Management Admission Test, inquiring about schools' prerequisites for acceptance, etc. Selection for advanced civil schooling requires three essential elements: an academic background sufficient to gain graduate school acceptance, an exceptional to outstanding performance record, and availability. Advanced civil school applications are accepted at any time and remain active in your branch file until you are selected or are found ineligible.

Want to Make a Good Impression? In just about every case when your Official Military Personnel File or your Career Management Branch File is reviewed for a personnel action, the first item looked at is your photograph. As you can imagine, this is the best method (other than appearing in person) that the board of officers reviewing your record has of knowing you. Do your two files have a photograph that is up-to-date? Are you wearing all your awards and decorations? Is your uniform well-fitting and neat? Are you well-groomed? Is your posture correct? Are you overweight? These are just some of the questions you should ask yourself when you prepare to have your picture taken. Ask them again before you submit the photographs for inclusion in your files. For further details consult AR 640-30 and interim change to AR 640-30 contained in DA message 151430Z, Apr 77. You cannot be present to represent yourself in every personnel action, but you can provide a photograph that you are confident will represent you well.

Preference Statement Use. "Why bother filling out a preference statement, they never read it anyway." NEWS FLASH!!! They *do* read it. In fact, *every time* you are being considered for reassignment, the preference statement is considered. Unfortunately, many of you do not have a current preference statement in your file, or if it is current, it is unrealistic; i.e., we have no assignments in the Bahamas, Samoa, or the Virgin Islands. If returning from an oversea assignment, submit a preference statement 6 to 9 months prior to the date you are eligible to return from overseas and insure that you give three or four choices. Also, list your eligibility date so we know just when you are scheduled to return. If you are in CONUS, submit your preference statement after being on-station approximately 6 months, and insure that you list choices for both long and short tour areas. Any special consideration should be listed; in fact, anything you believe we should be aware of should be noted on the form. Considerable thought should be given when completing your preference statement so that you, in fact, do desire to go to the locations or to the positions you list. So, get a current preference statement to us and give some thought when completing it. This is one of *your* personnel management tools that can influence your career pattern.

Company Grade Reassignment Procedures. Am I

being considered for oversea orders? Currently, AD captains and lieutenants are being considered for oversea assignments after approximately 24 months time-on-station. So far, officers serving on stabilized assignments (command, ROTC, AERB) are not being considered until the completion of the normal required tour. Validated oversea requisitions are received in the Branch approximately 8 months prior to the required reporting date in the oversea command. Officers' records are then reviewed for availability for oversea assignments based on the amount of time at their present duty station. Individuals with no previous oversea assignments are normally considered the most immediately available. After officers are identified as available, their records are thoroughly reviewed for qualifications, past performance, professional development needs, and personal preferences. Qualified officers are then assigned against the validated requisitions. If training is required, and a course is available prior to or when the individual must report to the oversea command, TDY enroute will be authorized. After your assignment is determined, a request for orders (RFO) is made and sent to your unit. A copy of the RFO is also mailed directly to you. If all goes well, you should know 6 to 7 months prior to your oversea reporting date.

RESERVE COMPONENTS ADOPT OPMS

The Active Army's Officer Personnel Management System (OPMS) has been conceptually adopted by the Reserve Components, and both the Army National Guard and the Army Reserve are conducting test implementation in New Jersey and Pennsylvania. The Reserve, after completing tests with some 1,500 officers, plans to expand the effort shortly with Readiness Region VI, composed of four states: Indiana, Kentucky, Michigan, and Ohio.

The desired goal to be achieved is a Reserve Component officer whose career development will parallel his active counterpart so that, in the event of mobilization, his abilities and functions will be compatible with total force requirements.

PHOTOGRAPHS OF RESERVE OFFICERS

Photographs are now required for each eligible officer being considered by a Reserve promotion selection board. The photo need not be professionally taken, may be black and white or color, and should be at least 3½x3½ inches, not to exceed 8x10 inches. The specifics reference uniform, pose, and other submission requirements were published in Change 3 to AR 135-155, effective 1 Nov 76.

Reserve officers on active duty, as well as Regular Army officers, should already have a photograph in their Official Military Personnel File if they are complying with the requirements of AR 640-30.

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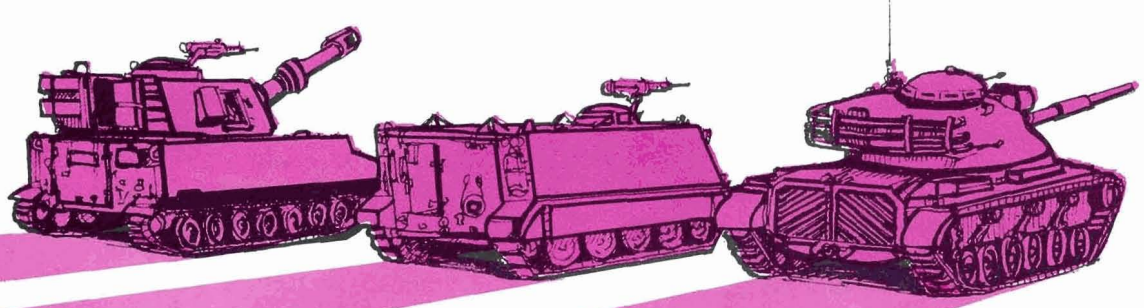


COPPERHEAD TEST SUCCESSFUL

Testing of the Army's "Copperhead" (formerly called CLGP) antitank projectile moved into a new phase recently at White Sands Missile Range with the first firing of a prototype of the projectile in its engineering development (ED) configuration.

The test, conducted for trajectory evaluation only, was successful. The projectile was fired from a standard Army 155-mm field artillery Howitzer and was guided by an airborne laser, but no specific target was used.

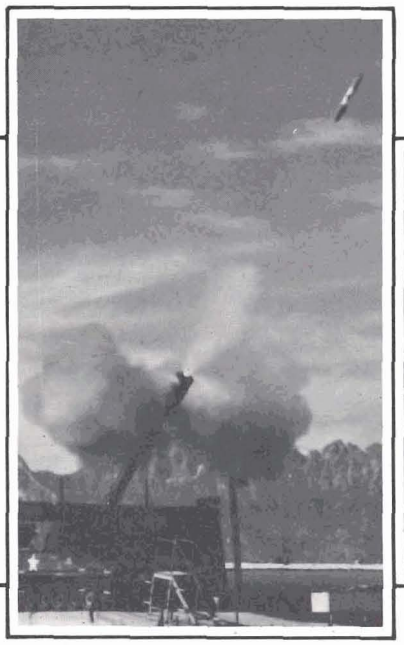
The firing was the first of two scheduled trajectory evaluation tests, termed "aerodynamic rounds" by the contractor, the Martin Marietta Aerospace Corporation of Orlando, FL.

A similar test was conducted in December, and the Copperhead program will now move into full-scale engineering development testing.

The Copperhead program will now move into full-scale engineering development testing.
Cannon Artillery Weapon Systems, headquartered at Picatinny Arsenal, Dover, NJ. The New Jersey headquarters is an element of the US Army Materiel Development and Readiness Command (DARCOM).

At White Sands the project is in the Direct Support Antitank Branch of the Land Combat Material Test Division.

Preparing to load the Copperhead missile.



Copperhead launched from a 155-mm Howitzer.

Airborne laser carried by remotely piloted vehicle.

(Photos provided by White Sands Missile Range)

COMMAND AND CONTROL TRAINING VEHICLE

Recreative Industries vehicle.

The CCTV project is a comparative evaluation of three candidate command and control training vehicles to determine which, if any, meets the US Army Training Device Requirements for a simulated tracked combat vehicle to be used for leader training where maneuver damage, space limitations, and fuel conservation preclude training with actual combat vehicles. Two commercial models, the Hustler and the Recreative Industries vehicles, and one military model, a modified M-151A ¼-ton truck, are being used for comparison with standard tracked vehicles. Each vehicle is to accumulate 2,000 miles to develop data for a reliability and maintainability (RAM), safety, and human factors engineering evaluation.

— ARMOR

COMBAT SIMULATION

The next-generation engagement system, known as the Multiple Integrated Laser Engagement Simulation (MILES), is currently being developed. This system involves development of laser adapters to various weapons such as rifles, machineguns, and antitank weapons, along with laser detectors that are worn by the infantrymen. These devices permit effective, simulated, two-sided combat training in which a soldier can safely "fire" his weapon (i.e., transmit a low-energy laser beam) at his simulated "enemy" in the opposing infantry company. If his aim is accurate, the laser signal is picked up by the detectors worn by his opposing infantryman and a signal is generated which tells the infantryman that he is a "casualty."

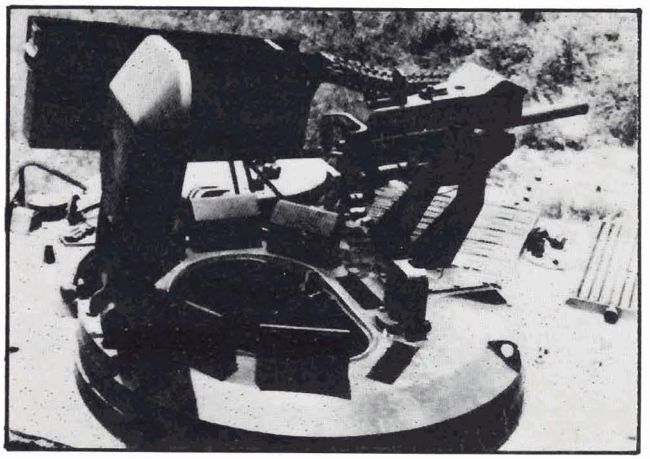
The devices required for this simulated training are inexpensive insofar as initial procurement and maintenance are concerned, the fidelity of the training is extremely high, and tactics at the company and battalion level can be verified. Most important, however, the training is received with enthusiasm by the individual soldiers, thus significantly increasing their combat effectiveness. The technique is now being adapted to other types of weapon systems and Army combat organizations.

Another technique that has had an immediate payoff in reduced training costs is the substitution of lower-caliber ammunition in training with high-caliber weapons. For example, a common .22 caliber rim fire adapter has been developed for the M16 rifle and a .50 caliber adapter has been developed for the 90-mm and 105-mm guns. These lower-cost rounds permit "live" marksmanship training for individual soldiers and various combat crews without expenditure of the higher-cost round.

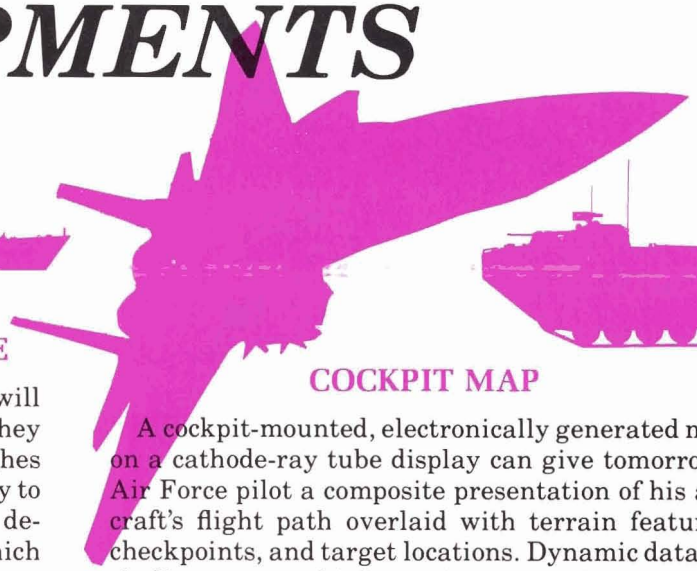
John L. Allen
— Defense Management Journal

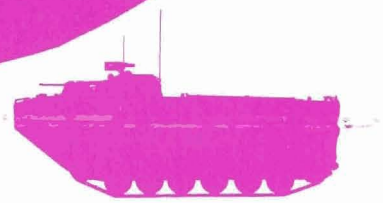
COMMANDER'S WEAPON STATION VEHICLE

A recent test of interest was the special study of the vehicle commander's weapon station for 40-mm, high-velocity grenade launcher (HVGL) to evaluate the effectiveness of the launcher in terms of time to adjust fire onto a target and accuracy when used in the role of the tactical control weapon. The 40-mm HVGL is being considered for use at the commander's station for the XM-1 tanks and the armored cavalry scout vehicle.



DEVELOPMENTS





SCANNING OPTICAL MICROSCOPE

The first scanning optical microscope that will inspect large-scale integrated circuits while they are being operated has been developed by Hughes Aircraft Company. It has demonstrated its ability to detect, localize, and identify flaws in complex devices. Unlike other scanning microscopes, which scan only one logic state at a time, this microscope will effectively superimpose many logic states at one time to "characterize" or inspect the microcircuit. The completely nondestructive instrument scans with a modulated laser and was specifically designed under sponsorship of NASA's Marshall Space Flight Center to meet the high throughput requirements of manufacturers of high reliability microcircuits. The instrument is a significant scientific step forward, and it is expected to become extremely valuable in multiservice usage.

COCKPIT MAP

A cockpit-mounted, electronically generated map on a cathode-ray tube display can give tomorrow's Air Force pilot a composite presentation of his aircraft's flight path overlaid with terrain features, checkpoints, and target locations. Dynamic data including command information or warnings can also be added to the map display. Geographic information for the map is stored in a magnetic-disc data base and retrieved according to the aircraft's position. The electronic map is part of the controls and displays being developed for the USAF Avionics Laboratory's Digital Avionics Information System (DAIS) program. DAIS is bringing advanced, integrated digital processing to aircraft avionics design, with modular, standardized equipment used to handle all avionics subsystem functions.

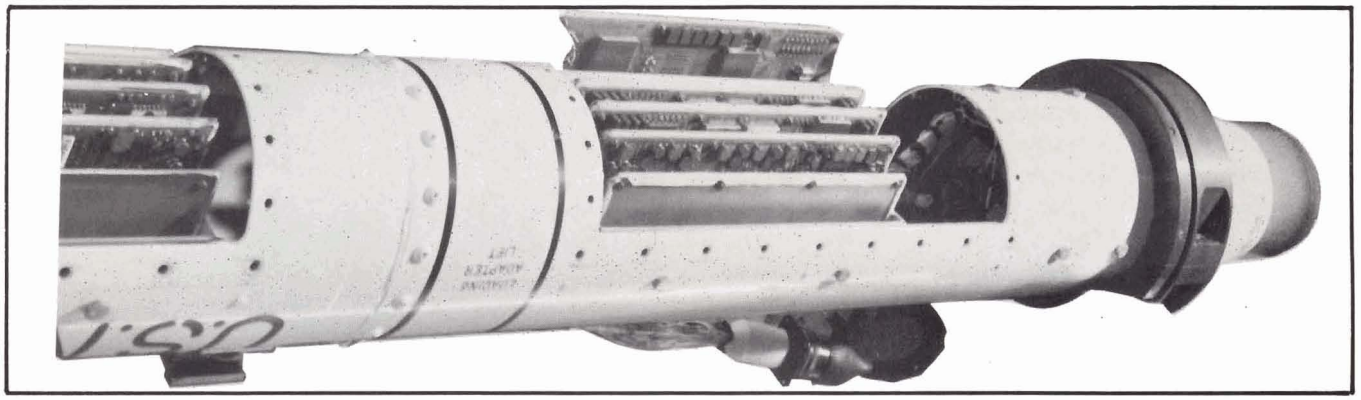
DOGFIGHT IR SEEKERS

Advanced infrared dogfight missile seekers are undergoing a series of performance definition flight tests at Nellis Air Force Base, NV. Ten sets of flight test hardware for the joint Air Force/Navy Air Intercept Missile Evaluation (AIMVAL) program were built.

The seekers, a second new seeker type, and the AIM-9L seeker are carried on the weapons racks of Navy F-14 Tomcats and Air Force F-15 fighters in air combat maneuver engagements against F-5s simulating high-performance targets.

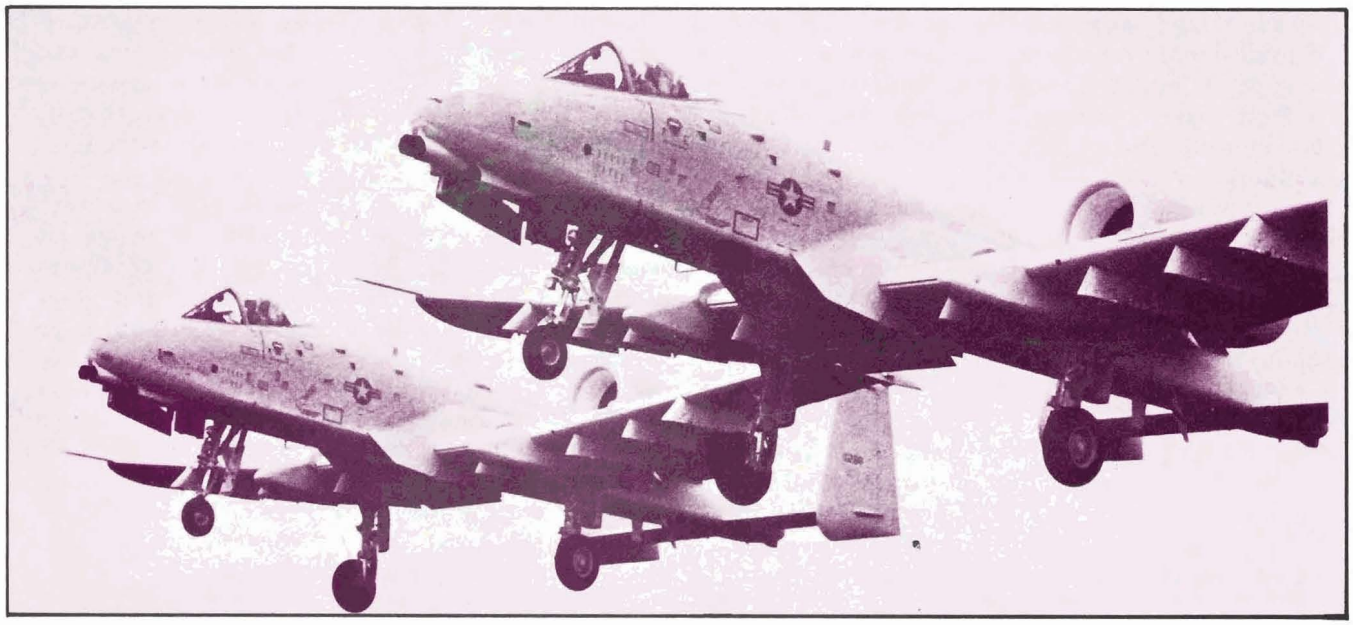
The goal of AIMVAL is to determine the seeker performance requirements for a new generation of short-range, air-to-air missiles to be compatible with the Air Force F-15 and F-16 and Navy F-14 and F-18 aircraft.

The seekers are mounted in 8-foot captive test units with associated electronics. Operation of the units after more than 140 qualification flight hours continues to be successful.



Advanced infrared seeker unit.

DUAL DELIVERY



The first delivery flight of two A-10s on the same day are shown in formation as they take off for Davis-Monthan AFB via Tactical Air Command Headquarters at Langley AFB, where they were seen by visiting media representatives from the NATO nations of Europe.

AIR CUSHION RESUPPLY CRAFT TESTED

The Army has begun developmental testing of a new air cushion vehicle at Aberdeen Proving Ground, MD. The vehicle, Lighter Amphibious Air Cushion Vehicle (LACV-30), will replace the Army's most commonly used amphibious resupply crafts, the LARC-5 and the LARC-15, neither of which works on the air cushion principle.

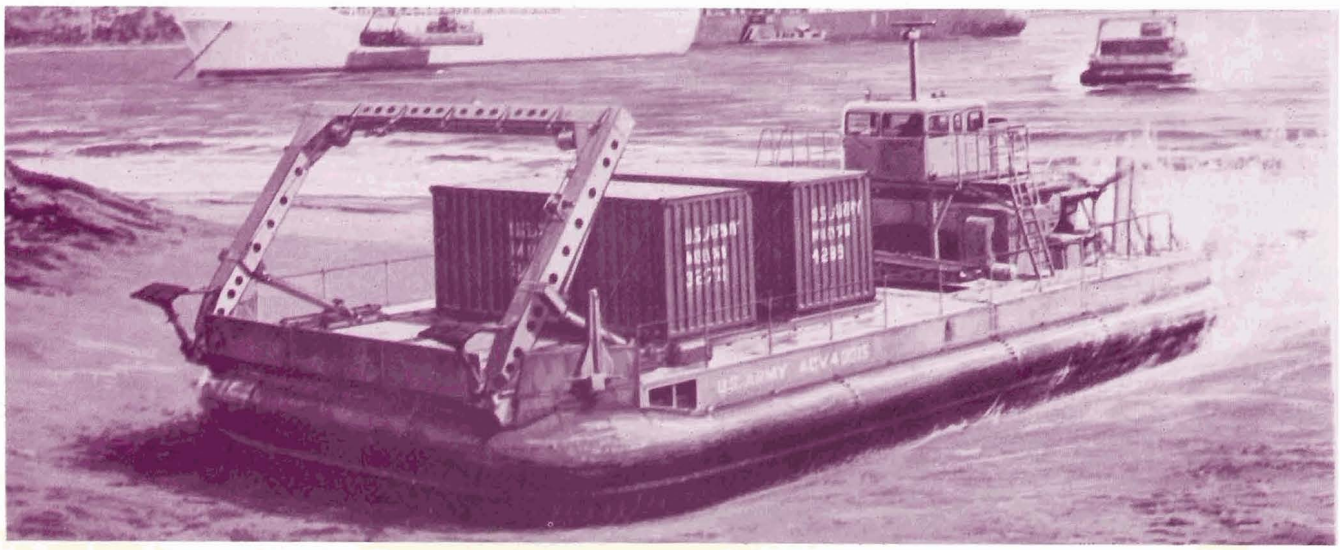
The LACV-30 has an unusual shape. The vehicle is 80-feet long, 40-feet wide, and weighs about 58,000 pounds. The craft will be tested at speeds up to 40 knots. With its size, LACV-30 will need a 500-yard turning radius at high speeds.

The LACV-30 is designed to carry cargo weighing up to 30 tons. The vehicle will be able to transport cargo on both land and water, riding on a cushion of air forced out of the bottom of the craft.

On land the LACV-30 has the ability to move over obstacles up to 3 feet in height, and skim across ditches from 6- to 12-feet wide. In addition to its capability of operating over a variety of land and sea conditions, the Army prototype will also be expected to be operable in cold climates with temperatures as low as 40° below zero.

After testing at Aberdeen and Fort Story, VA, the vehicle will be shipped to Panama City, FL, for further testing.

Current Army plans call for complete conversion to the LACV-30 by 1980.



ARMY/AIR FORCE JOINT LASER TESTS

Army and Air Force laser equipment is compatible and performed successfully in close air support tests recently concluded at Gila Bend, Arizona. The Army's 14-pound laser target designator (LTD) was used to designate targets for the Air Force's A-10 close support fighter. The A-10 is equipped with a Pave Penny laser seeker which enables the pilot to detect, identify, and engage targets illuminated by laser energy.

During 2 weeks of joint tests in the Arizona desert, Army and Air Force personnel designated parked aircraft, trucks, antiaircraft guns, and tanks on a simulated airfield. The A-10s, flying at altitudes from 50 to 5,000 feet, made a variety of runs dropping practice smoke bombs, 500-pound laser-guided bombs and strafing runs using the aircrafts' 30-mm cannon.

Several night missions were conducted during which the planes engaged and hit targets invisible to the pilots. Since the LTD did not have a night sight, the A-10s dropped flares, enabling observers to see and designate targets. "Night missions were just about as successful as day," said MAJ Ray Benson, R&D coordinator for Precision Laser Designators who represented the Army for the tests. "Results were excellent. There was little or no reduction in night accuracy." On several runs, two designators were used to mark different targets for individual fighters. The equipment, operating on different codes, permitted each aircraft to engage a specific target with maximum effectiveness.

The Army LTD equipment in the tests was developed by the Electronics Command but subsequently transferred to the Research and Development Command, which has tri-service responsibility for development and management of all ground laser equipment. In addition to the LTD, the Laser Designators Office is developing the ground laser locator designator (GLLD) and unit for the Marines called modular universal laser equipment (MULE).

"Tests were highly successful," said COL John Reeve, Project Manager for Precision Laser Designators in the Army Missile Research and Development Command at Redstone.

CANINE MINE DETECTORS

The value of dogs to the Army continues to expand, and some things they are capable of are actually amazing. Now, another capability is being tested that may make man's best friend a valuable companion on the battlefield.

The US Army Mobility Equipment Research and Development Command (MERADCOM) is testing the use of dogs for mine and booby trap detection. At distances as great as 25 feet, a dog can detect a trip wire even though invisible to humans. The dog's ability to detect metallic mines equals that of conventional metal mine detectors and exceeds it in the detection of nonmetallic mines. A research physicist in charge of the project at MERADCOM said, "Dogs are remarkably proficient in the detection of booby trap wires, far exceeding any other practical or even experimental devices now available."

The exact mechanism a dog uses to detect mines and booby traps is not completely understood. It is known that a dog's extraordinary sense of smell is a major factor. Also, the dog's keen hearing may be important. It is believed that they may actually hear the vibrations of the booby trap trip wire.

The philosophy used during training is the principle of positive reinforcement, rewarding the canine with food tidbits and praise. Many of the same training techniques used for explosives and narcotic detection dogs were applied. German Shepherds and Labrador Retrievers of either sex undergo 8 months of booby trap and landmine detection training.

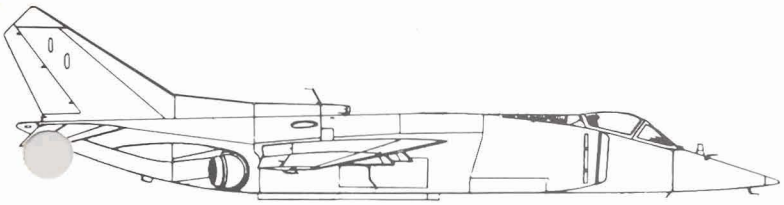
These dogs would be deployed with a handler for mine and booby trap clearing operations in support of troops in combat. They could be used to mark mine fields; clear trails, roadways, and helipads; and to search buildings, bridges, vehicles, and even persons for explosive devices.

NAVY'S AEGIS SUCCESSFUL

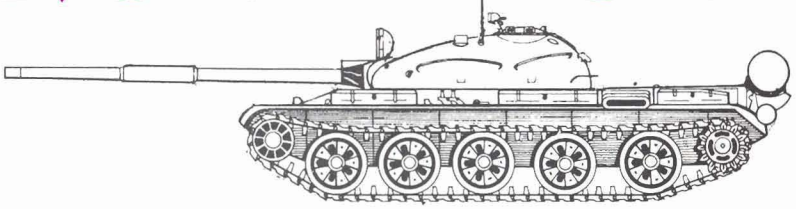
A major step in the development and improvement of Navy surface-to-air missiles has been reached with the successful firing of a Standard Missile Two (SM-2). Launched from the US Naval Ordnance Missile Test Facility's "Desert Ship," the test round successfully intercepted a high-operational-altitude drone at a range in excess of 50 miles. The purpose of the firing was to demonstrate the ability of the missile to intercept a crossing target at high altitude and extended range.

The missile (FTR-8) incorporates some of the latest Navy missile guidance techniques. It can be fired either surface-to-surface or surface-to-air. Both medium-range and extended-range versions are being developed. The medium-range version is scheduled to replace the Terrier/Tartar System while the extended-range version will replace Terrier and Talos.

The success is considered by Navy leaders to be a turning point in Naval warfare.



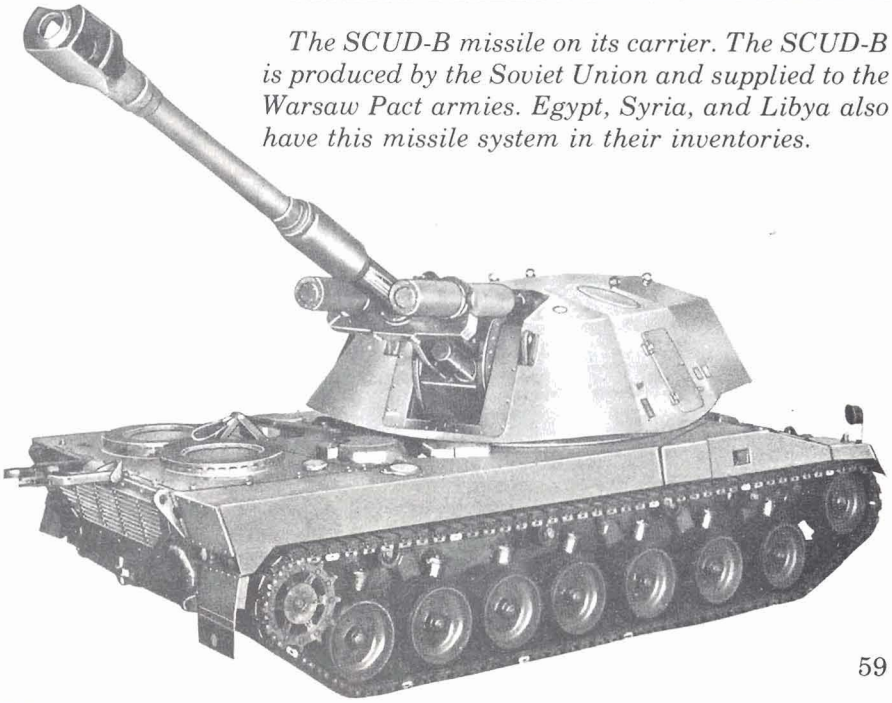
INTELLIGENCEWATCH



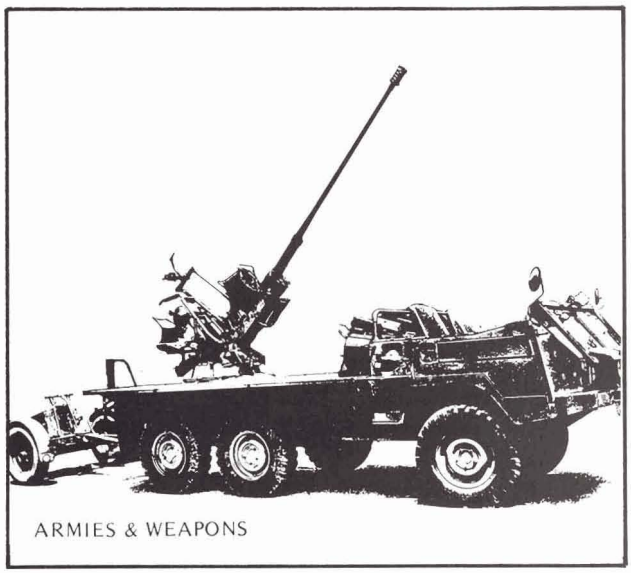
The Soviet IMR engineer tank has been in the Russian inventory for about 3 years and is used primarily for road building, as a snow-plow, and at times as a tank retriever. The tank is from the T-54/55 family of Russian tanks and weighs about 36 metric tons with a 510-HP engine.

The SCUD-B missile on its carrier. The SCUD-B is produced by the Soviet Union and supplied to the Warsaw Pact armies. Egypt, Syria, and Libya also have this missile system in their inventories.

West Germany, Italy, and Great Britain are jointly involved in the development of a new 155-1 Howitzer tank. A prototype of the tank was introduced on 25 January 1977. The testing program is expected to take several years to complete. The finished product is scheduled for the tri-country inventory about 1982.

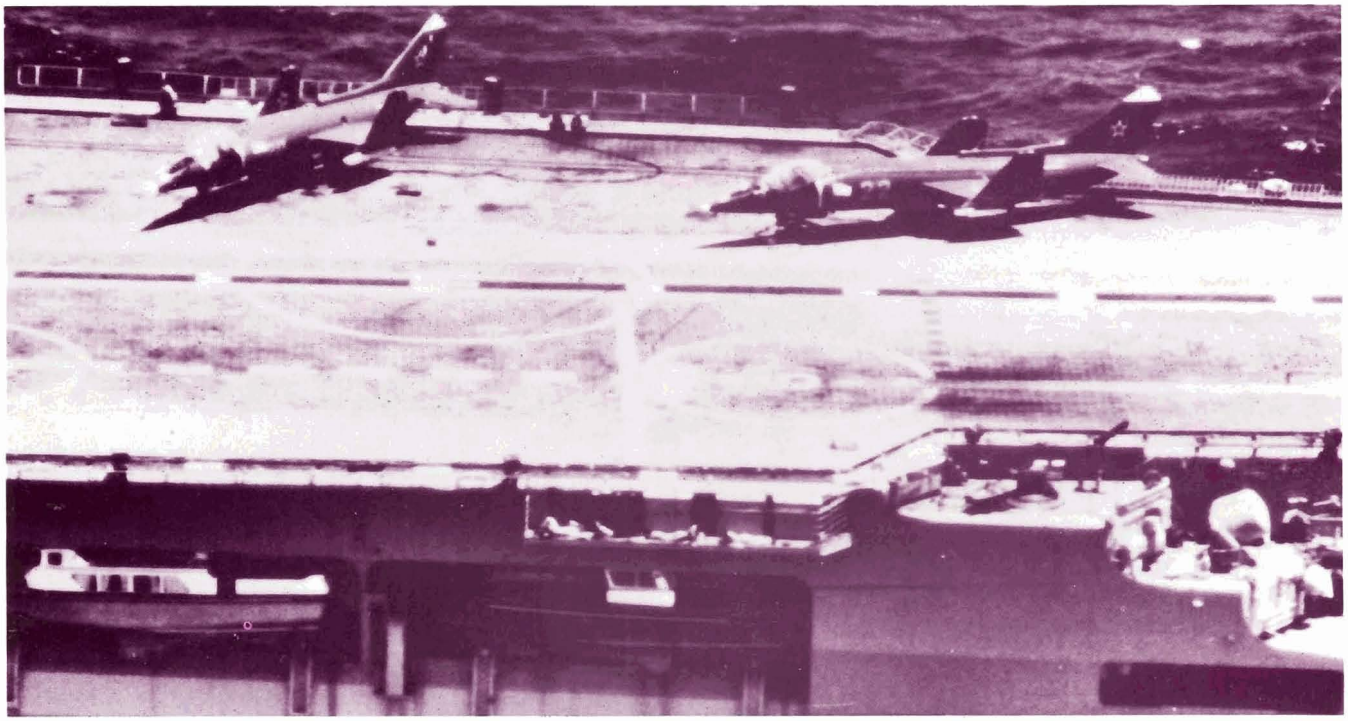


Photos curtesy of Soldat Und Technik.



The Austrian army is preparing to purchase about fifty 3.3-ton PINZGAUER 712, 6 x 6 trucks armed with 20-mm antiaircraft guns mounted on a truck platform. The Austrians say the 20-mm gun in this configuration becomes very mobile, can defend armored columns as well as men on the move, and has great cross-country capabilities. In addition to defending against low-level attack, the weapon is effective for interdiction against attack by parachute troops.

Jane's Fighting Ships confirms that there are at least three pocket-type, SX404 Italian-built submarines in the Taiwanese navy. Previous reports indicate that the SX404 has been seen with the Colombian and Pakistani navies as well. Cosmos, an Italian-based company, has been building the SX404 since 1955 and, to date, has completed about 60. The pocket-edition submarine carries a crew of 5, plus 8 frogmen, and attains a speed of 11 knots on surface and 6.5 knots submerged.



The Soviet Yak-36 vertical/short takeoff and landing (CV/STOL) fighters, shown above on the flight deck of the aircraft carrier, Kiev, are part of a larger force of these aircraft operating in the Mediterranean.

AIR DEFENSE
Book Review

PEACE ENDANGERED, The Reality of Détente, by R. J. Rummel; SAGE Productions, Beverly Hills, California; 189 pages, Illustrated, $10.00.

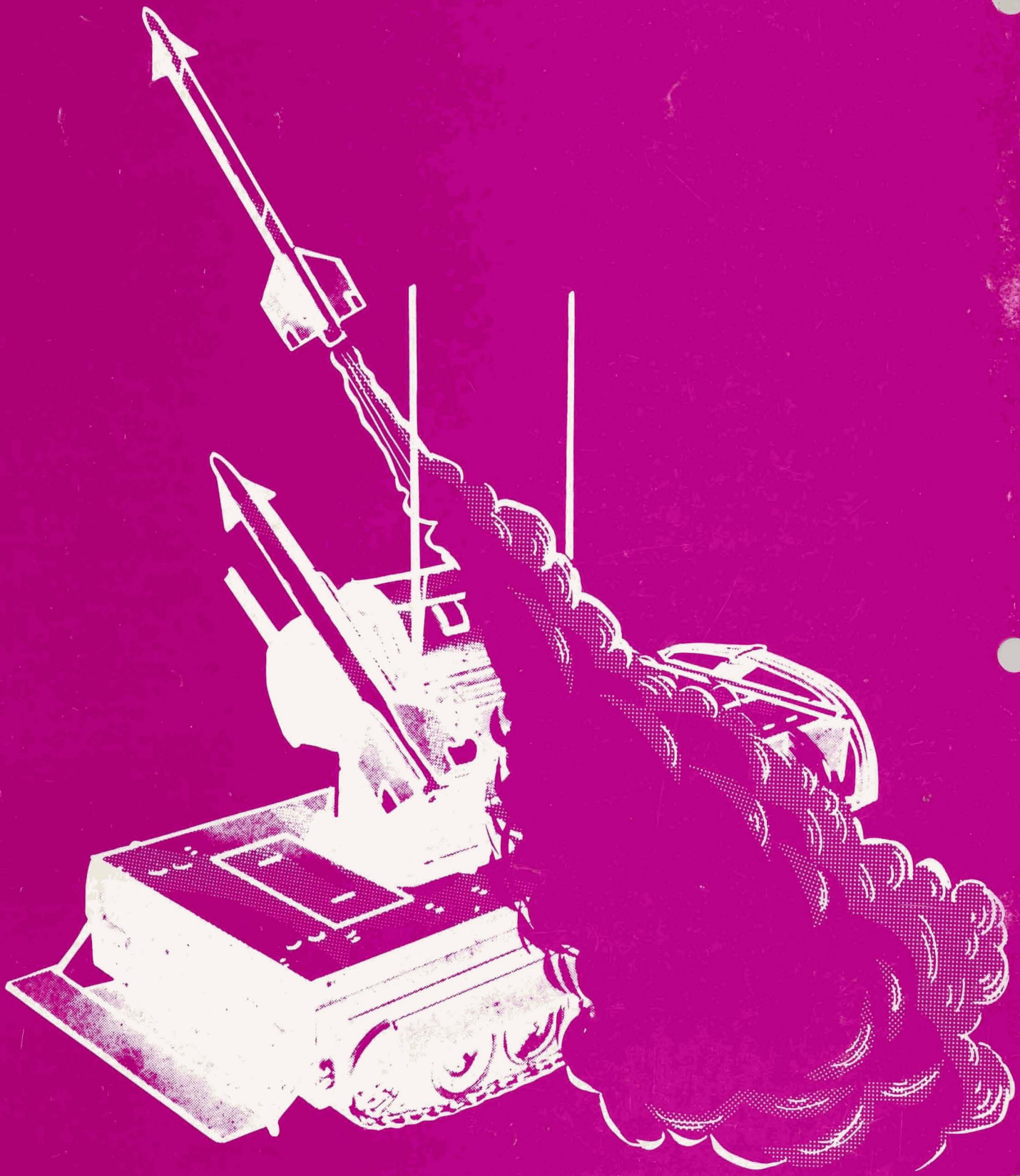
"Under détente . . . we are disarming our conventional forces and seriously deteriorating our nuclear retaliatory capability while increasingly relying on an incredible massive retaliation *threat*." So states the author in this hard-hitting, sobering report on his findings after exhaustive research and computer processing of facts surfaced by that research. Much of his concern focuses on actions by the United States that are contrary to the theory recognized by students of international conflict and deterrence: that nuclear stability — the condition of minimal risk of nuclear war—depends on a particular balance of strategic and conventional forces between major nuclear powers. The theory consists of three elements: each side must have a sufficient strategic force to ride out a nuclear attack and retaliate with unacceptable loss to the attacker; each must have military forces sufficient to cover all possible threats so that neither will be able to take advantage of weakness in the other's forces, which might motivate the weaker to resort to massive retaliation; and raising the threshold for the use of nuclear weapons, which enhances the stability of deterrence.

The author, who is a Professor of Political Science at the University of Hawaii and has an impressive list of credentials, including seven other books in fields related to international affairs, expresses his own pessimistic conclusions in this book. A strong and thought-provoking method of portraying his feelings (based on extensive research) is the scenario at the beginning of the book that covers a war (beginning in the Middle East) and following step-by-step developments to where, 2 months later, the United States has to choose between surrender to Russia or suffer destruction by nuclear attack a city at a time. The compelling logic of the scenario will give pause to even the most optimistic reader.

Rummel justifies the scenario with examples of what the world is facing as Russia widens her nuclear and conventional superiority, accompanied with intervention she has already started. Even back in the 1973 Mideast War, the USSR had the temerity to threaten unilateral intervention in a "savage" message to our President, causing an American world-wide nuclear alert at that time. As Rummel sees it, this expansion and fortitude, combined with Western Europe, the Middle East, and Northern Asia coming under control of militant leftists, would, in some future crisis, give us no choice but war or surrender.

What détente involving Russia and the United States appears to be and what it really is becomes the author's next issue. His frank statement of the numerous relative facts is that cooperation ("détente") is empirically separate from conflict. Two nations can pursue cooperation and conflict at the same time; therefore, détente is false. "Cooperative transactions do not buy peace. Not for the Soviet Union or China, or even America."

Rummel's 1976 hypothesis that the Mideast is the logical starting place for global conflict gains credence when in 1977, men of stature and weight of judgment have made the following observations:

The Middle East is and will continue to be a focal point of tension and instability. Actual and potential developments affect nearly every nation of the globe, thus dramatizing the impact of interdependence among nations. Despite the concessions agreed to and implemented by Egypt and Israel in the interim Sinai Agreement, the basic problems of Israeli occupation of former Arab lands and the Palestinian issue continue to make the Middle East an area of potential conflict. Opposing forces have increased their quantities of modern sophisticated weapons and have improved both defensive and offensive capabilities. A renewal of hostilities could conceivably set in motion a chain of events that might culminate in another Arab oil embargo. If the Soviets chose to increase their support to Arab forces or intervene directly, then a confrontation between the United States and the Soviet Union would be a distinct possibility.

POW: A DEFINITIVE HISTORY OF THE AMERICAN PRISONER-OF-WAR EXPERIENCE IN VIETNAM, 1964-1973, will be reviewed in the July-September 1977 issue of AIR DEFENSE MAGAZINE.