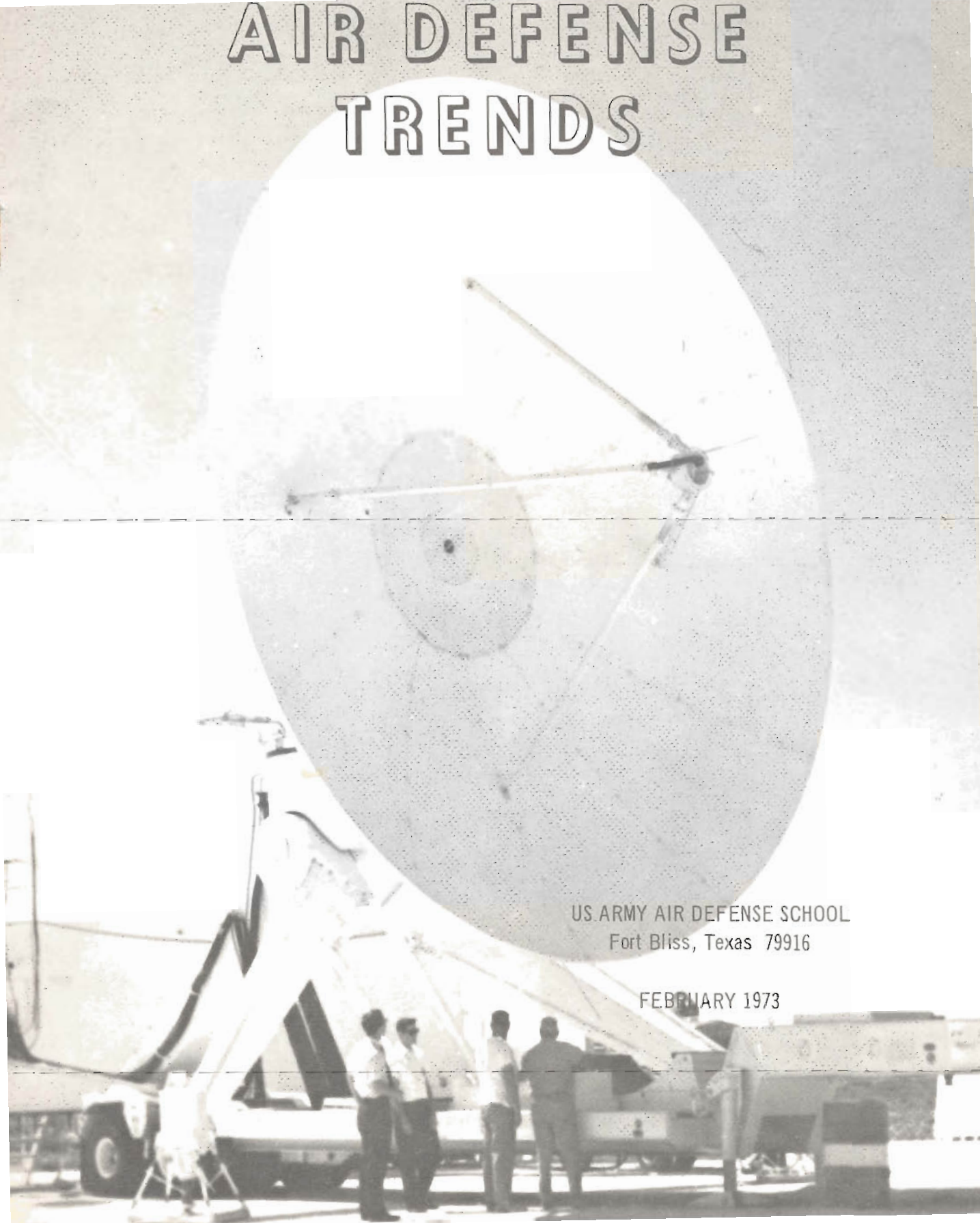
AIR DEFENSE TRENDS



US ARMY AIR DEFENSE SCHOOL
Fort Bliss, Texas 79916

FEBRUARY 1973

AIR DEFENSE TRENDS
US ARMY AIR DEFENSE SCHOOL
Fort Bliss, Texas 79916

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Air Defense Trends is an instructional aid of the United States Army Air Defense School; it is published when sufficient material of an instructional nature can be gathered.

We have had [our] programs examined and challenged time and again. We have been criticized both in public and private for over-optimism, poor management, and faulty estimating. Competition for resources has been fierce, but these challenges and criticisms are the natural concomitants of our business. Our purpose in life is to provide our soldiers the weapons and materiel that will give them the edge on the battlefield. To do so we must explore the boundaries of technology. If we stand still our soldiers will surely fail. Our mandate is clear. We will continue to endure and persist.

—General Henry A. Miley, Jr
Commanding General
United States Army Materiel Command

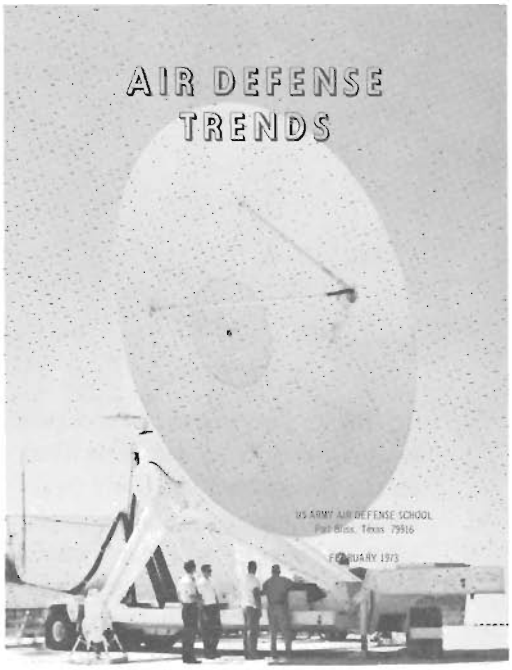
General Haines Welcomes First Class of USASMA to Sergeants Major Academy

General Ralph E. Haines, Jr, Commanding General, US Continental Army Command, presented the opening address at the opening ceremony for the Unites States Army Sergeants Major Academy at Fort Bliss on 12 January 1973.

Established on 1 July 1972, the Academy is the top level academic institution of the Noncommissioned Officers Educational System (NCOES).

Based on a curriculum covering four broad academic areas of human relations: military organization, operations, world affairs, and military management, the purpose of the Academy is to prepare select noncommissioned officers in the grades of first sergeant and master sergeant for duties as command sergeants major, with emphasis on the areas of leadership, discipline, human relations, and training management.

General Haines charged the 105 senior noncommissioned officers selected for the pilot course with the responsibility of maintaining the highest standards in military professionalism. He emphasized that it is of utmost importance that the noncommissioned officer strive toward excellence in education and job dedication. He said there is a misconception that peacetime military service is boring and lacks the necessary challenge. General Haines further emphasized that our noncommissioned officers are the backbone of the Army and must meet the challenges associated with peacetime operations.



COVER This is the Hard Point Demonstration Array Radar (HAPDAR) remote sensor antenna that will soon be used in electronic counter-countermeasure tests at White Sands Missile Range, New Mexico. It was previously used as part of the project RONDO system employed by Stanford Research Institute in reentry vehicle studies, which paved the way for its upcoming use in passive jammer location experiments. The RONDO antenna consists of a 30-foot diameter paraboloidal reflector mounted on an elevation-over-azimuth pedestal, a radiofrequency (RF) feed system, a control system, an operational console, and a tripod support structure attached to a flatbed trailer. It is used for the reception of RF energy in the range of 1280-1360 megahertz. The antenna is intended for use without the protection of a radome and is fully operational in winds up to 50 miles per hour. The system is capable of assembly, alinement, and disassembly on a 5-day cycle. The control console is located in a van within 100 feet of the antenna. A full report on recent and planned air defense tests involving HAPDAR appears on page 54 of this issue.

HEY THERE! Don't turn your back on progress. We'd like to publicize any ideas or innovations you have generated that would benefit the air defense family. Maintenance, supply, administration, and training are fertile areas for improvement. Send a report on what you are doing or thinking about to the Editor, Air Defense Trends, US Army Air Defense School, P.O. Box 5600, Fort Bliss, Texas 79916.

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AIR DEFENSE TRENDS

An instructional aid of the United States Army Air Defense School, Air Defense Trends is published when sufficient material of an instructional nature can be accumulated. It is designed to keep air defense artillerymen informed of unclassified tactical, technical, and doctrinal developments because it is essential to national defense that all levels of air defense command be kept aware of these developments and their effect on the air defense posture.

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

Qualified individuals may purchase copies of Air Defense Trends at 50 cents a copy from the Book Store, US Army Air Defense School, Fort Bliss, Texas 79916. The form below is printed for convenience in ordering.

When appropriate, names and organizations of authors are furnished to enable readers to contact authors directly when they have questions concerning an article.

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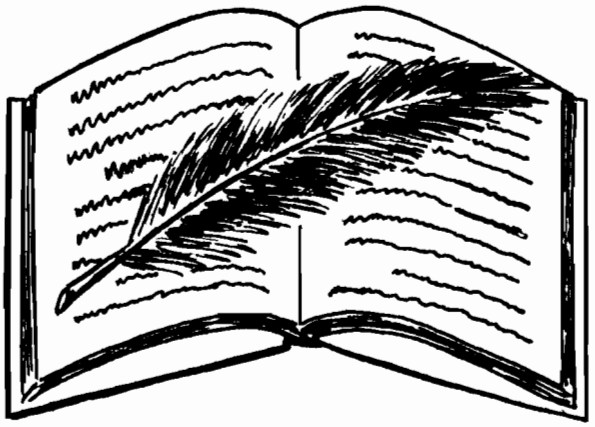


Air Defense Trends seeks your comments on any material published. A different viewpoint or a new line of reasoning may be published to stimulate the exchange of ideas. If you are an authority on a subject, we invite you to write an article and inform our other readers. If circumstances prevent you from writing an article, send in your idea and our editorial staff will assist in developing an acceptable article.

LETTERS

to the Editor

•Reference the Article on SAM-D which appears on page 65 of the March 1972 issue of Air Defense Trends. The overall impression that one receives from this article is that production of the SAM-D system is imminent; definitely not a fact.

Although engineering development is the next phase of the program, it is not the "final" step in developing the system to the point where it is ready to go into production. The engineering test, expanded service test, and intensified confirmatory troop test phases of the program follow engineering development; and from these phases, dependent upon successful system operation, comes the production go-ahead.

It is also to be noted that although the accomplishments singled out by Mr. H. Clay Johnson are indeed significant, they apply only to the unguided advanced development missiles. One cannot fault Mr. Johnson, Program Director, Martin-Marietta Corporation, Orlando Division (a subcontractor on the SAM-D system) for expounding on these accomplishments. However, the inference that the SAM-D missile has passed its final test and, therefore, that the system is well on its way to fielding, is misleading.

JOSEPH P. PEPE
Colonel, GS
Director, Army Missile Test and Evaluation
White Sands Missile Range

•Recently, I was referring to your October 1971 issue of Air Defense Trends and noticed a discrepancy in the article, "A New Look for Chaparral/Vulcan Battalions," on page 48. The article states that the headquarters and headquarters battery of each Chaparral/Vulcan battalion will have a FAAR platoon of eight sections. However, the accompanying headquarters and headquarters battery organization chart, labeled figure 2, shows only five

sections in the radar platoon. I am aware that there are actually eight sections. I mention the discrepancy only because it might be confusing to individuals less familiar with the FAAR system.

W. H. STEWARD
LTC, ADA (Ret)

• I am submitting this information on recharging the nickel-cadmium battery in target alert data display sets (TADDS) as an item of interest to readers who are involved with the Chaparral, Vulcan, and Redeye systems.

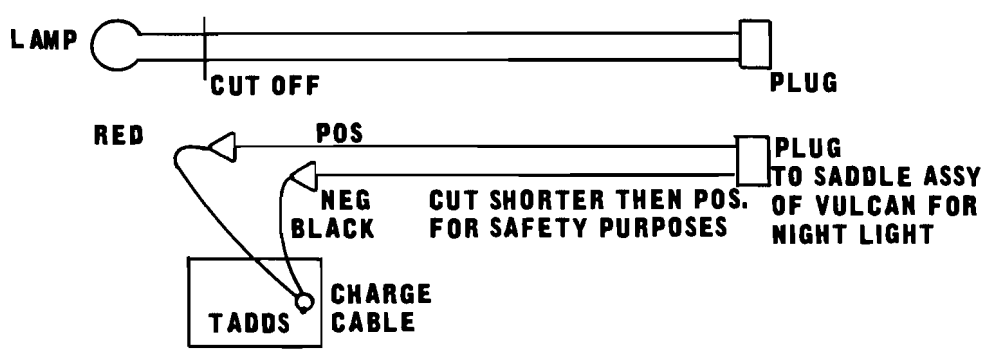
Located inside each TADDS is a $150 nickel-cadmium rechargeable battery. A fully charged battery will give about 24 to 30 hours of operation before recharging is required. When recharging is required, according to TM 9-1430-589-12 you should "Hook up to any 24-volt dc source." The time required for recharging the battery is approximately 14 hours. If the TADDS is in use while recharging, the charge time is increased by 20 minutes per hour. The operator is responsible for recharging the battery. The problem is, where does he find an available 24-volt source on the C/V systems or M151 used by the Redeye team without using the ignition switch or master power switches on track vehicles, which would further drain the vehicle batteries. The best solution when using the M163 self-propelled Vulcan or the M167 towed Vulcan is as follows:

1 - Remove the bulb end of the gunner's night light (FSN 6220-139-5276) located in the turret.

2 - Having obtained a cord (OPN 8437923) through battalion maintenance supply channels, make a pigtail on the cord.

3 - Attach a plug (FSN 5935-975-0963) (obtainable from the same source) to the cord.

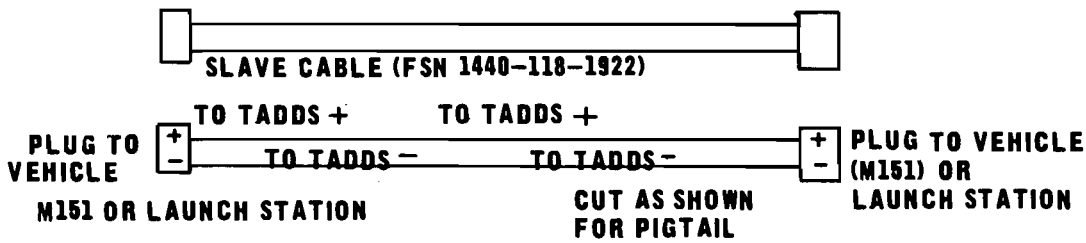
4 - Unplug the lamp and plug in the cord, and you have a 24-volt source for recharging the battery. Caution must be observed when hooking up the TADDS; if correct polarity is not observed, the TADDS charge lamp will not light and the battery will not charge. If polarity is correct, the charge lamp will light.



By using the foregoing procedure the battery can be recharged without the power switch on. While charging, the TADDS draws only 264 milliamperes of current. With this small amount of current being drawn from the system batteries, there will be no noticeable drain in a 14-hour period.

While using this procedure the TADDS should be placed in the gunner's turret so it will not be lost, misplaced, run over by the vehicle, or left behind during movement.

Now let's look at the Chaparral system. Located on the left side of the Chaparral launch station is a slave receptacle for starting the vehicle with the launch station batteries (TM 9-1440-585-12, fig 1-2). This outlet has 24 volts applied at all times. The slave cable, FSN 1440-118-1922, is supplied with the vehicle and can be used for charging the TADDS battery. A better solution, however, is for the maintenance personnel to use a salvaged slave cable cut in half. Two charging cables can be constructed from one slave cable. Use the method illustrated below and make a pigtail on one end.



This same method can be used for the Redeye teams in the various battalions of the division using the M151 with the slave receptacle.

In both cases the TADDS should be placed in the vehicle to prevent damage, loss, or misplacement.

CLIFTON F. EVERETT
CW2, USA
LAAD Dept, USAADS

• I am pleased to submit the inclosed report for possible publication in Air Defense Trends.

The article was written on behalf of Headquarters, US Army Europe (HQ USAREUR) by H. O. Johnson, Director Special Projects (Europe) for Braddock, Dunn and McDonald, Inc., currently under contract with the US Government.

I hope that the computerized radar coverage diagram capability that the article describes will be exploited by other interested commands. More detailed information may be obtained directly from Braddock, Dunn and McDonald, Inc., 6500 Convair, El Paso, Texas 79925, and I can provide data on our experience here. In the latter case, correspondence should be addressed to HQ, USAREUR, ATTN: H. O. Johnson, AEAGC-NAA, APO NY 09403.

DONALD D. BRIDENBAUGH
Colonel, GS
Chief, Artillery and Special Weapons Division

COMPUTERIZED RADAR COVERAGE DIAGRAMS

The 32d Army Air Defense Command (AADCOM) is now using computer generated radar coverage diagrams. Capability to produce such diagrams has, for a number of years, belonged solely to the air defense analyst and the study maker. Therefore, when IBM 360, type 40 computers were installed within USAREUR as part of its automated support system, the generation of radar coverage diagrams became a practical reality. With the initial assistance of Braddock, Dunn and McDonald, Inc. of El Paso, Texas, USAREUR developed an in-house capability to print such diagrams when required.

The key to printing radar coverage diagrams by automated means is the TACOS II air defense simulation model which was developed and is being used primarily by the US Army Combat Developments Command Air Defense Agency. Preparing the input for a typical computer "job" requires a careful map analysis of each radar site, entering the essential information in the blanks of an otherwise "standard" set of computer input cards, and turning the job request over to the computer systems support element. The job is run most often at night when computer time is more readily available. On the average, each coverage diagram requires from 5 to 8 minutes of computer time. Each diagram is printed to a selected scale, and the map coordinates are shown along the edge of the diagram.

The 32d AADCOM is evaluating all of its sites, using these coverage diagrams as an important analytic aid. Recently a large number of potential sites were evaluated to select the most suitable site for a group radar. For one potential site, a diagram was made to show what the coverage would be if the antenna tower were elevated an additional 10 meters. Costly construction can be supported, or avoided, by such diagrams.

Diagrams will gradually be made for all potential sites in the entire 32d AADCOM area. In time of war, real estate restrictions should be relaxed and units of the 32d would then have a decided advantage as they enter the maneuver phase of combat.

In addition to radar coverage diagrams, the 32d AADCOM uses the computer capability to print microwave communications line-of-sight maps. Because three altitude layers are normally represented in a printed coverage diagram, these three altitudes show how high (or where) the battery/battalion antenna must be to communicate with higher headquarters. In very special cases the 32d AADCOM has used the TACOS II capability to print out line-of-sight profiles. The 360/40 computer will print such a profile out to 100 kilometers in less than 1 minute.

The figure below depicts a short-range version of a radar coverage diagram. This diagram was used to examine a potential site for a FAAR radar.

LEGEND

Site Location:

Blank: Invisible at 300 meters and below
- : Visible at 300 meters and above
| : Visible at 100 meters and above
X: Visible at 40 meters and above

USAADS Notes

Hinman Hall

OFFICE OF DOCTRINE DEVELOPMENT, LITERATURE, AND PLANS

TERMINOLOGY

Because the term "command and control system" is defined in AR 310-25 and the name of the AN/TSQ-73 Missile Minder has been changed to command and control system, the US Army Air Defense School will use the terminology "command and control system" to describe the AN/MSG-4, AN/GSG-5, and AN/TSQ-51 systems. The terminology "command, control, and coordination system" will no longer be used in newly prepared or revised material. Printed instructional material now in use in the School, correspondence courses prepared by the School, and DA training literature for which the School is the proponent will not be revised solely to incorporate this change of terminology.

Department of the Army has directed that the term "airspace control" be used in all textual material in lieu of the term "airspace coordination" when describing Army airspace activities. Field manuals 44-1, 44-3, 44-10 (Test), and 101-5 have been, or are being, changed to reflect the directive. In line with this directive, the airspace coordination element (ACE) is now the airspace control element (ACE).

STINGER

General Dynamics Corporation has signed a contract for the engineering development of the air defense guided missile system XFIM-92A (Stinger). The development project will be managed by the Stinger Project Office located at Huntsville, Alabama, and headed by Colonel David Souser.

Stinger is the follow-on weapon for Redeye in the field army. Although similar to Redeye in operation, configuration, and physical appearance, Stinger has more capability than Redeye, to include forward aspect engagements and increased target speed capability. The Stinger system will be equipped with a lightweight Mark XII IFF system to aid the gunner in target identification. Current operational and organizational plans for Stinger are based on the concept of Stinger as an all-arms weapon replacing Redeye on a weapon-for-weapon and man-for-man basis.

A contract was recently awarded to North American Philips to produce a prototype night vision sight for the Stinger air defense guided missile system. The sight will provide a night detection/weapon aiming capability.

VULCAN AIR DEFENSE SYSTEM

USAADS has been informed by CONARC that the Vulcan air defense system, consisting of the items listed below, has been type reclassified from Limited Production-Urgent to Standard-A.

Gun, air defense artillery, self-propelled: 20-mm, M163
Gun, air defense artillery, towed: 20-mm, M167
Shop equipment, electronic test and repair, shelter mounted: DS/GS, AN/TSM-115
Radar antenna drive repair shop, truck mounted: DS/GS
Test set, radar: AN/TPM-23
Test set, air defense artillery: AN/MWM-2
Test set, radar: TS-2656/TPM-22

The following items have been type reclassified from Standard-A to Contingency and Training:

Gun, antiaircraft artillery, self-propelled: 40-mm, M42A1
Mount, machinegun: trailer mounted, multiple caliber .50, M55

DIRECTOR OF INSTRUCTION

REDEYE SECTION LEADER QUALIFICATIONS

In response to a Department of the Army requirement to fill Redeye section leader positions throughout the world with qualified personnel, the Air Defense School has included a 24-hour block of instruction in the Redeye missile system for officers attending the Air Defense Artillery Officer Basic Course. This instruction qualifies a lieutenant as a Redeye section leader; in fact, all graduates of the course since November 1971 have been qualified on the Redeye system.

NCOES BASIC COURSE

USAADS has received numerous queries from CONUS-based Chaparral/Vulcan (C/V) units about quotas for the ADA NCOES Career Development Basic Course. C/V units do not receive systematic quota allocations due to low density of MOS 16P, 16R, 24M, and 24N. Units must initiate requests for quotas through normal channels. CONARC has assured USAADS that quotas requested in this manner will be assigned regardless of MOS density.

Prerequisites:

- Active Army or Reserve component personnel in grade E4 or E5 (E3 only when selected for attendance at completion of AIT).

- Qualified in MOS 16B, 16C, 16D, 16E, 16F, 16H, 16J, 16K, 16P, 16R, 00G, 24B, 24C, 24D, 24E, 24F, 24G, 24M, 24N, 24P, 24Q, 24U, 25D, 25G, 25H, 25J, 25K, or 31R.

- MOS evaluation score of 100 or more.

- Ten months or more of active service remaining upon completion of course for MOS 16H, 16J, 16K, 00G, 31R, 25B, 25A, 25G, 25H, 25J, 25K, and 25E. Eleven months or more for all other MOS.

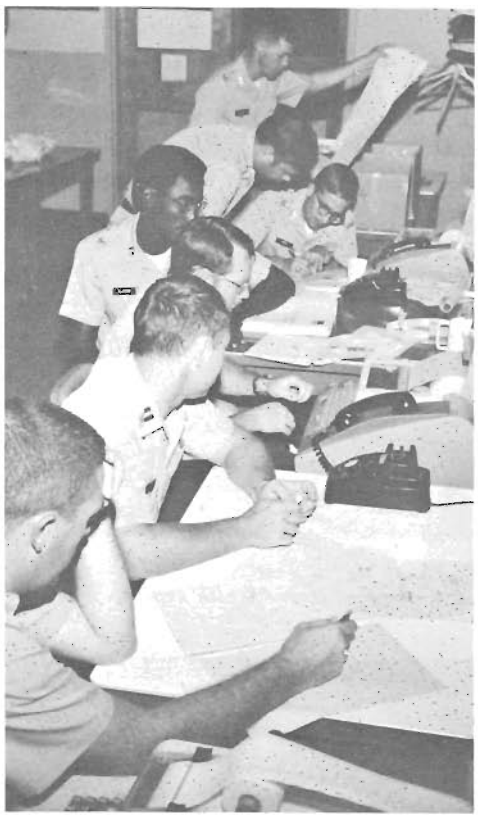
- Interim SECRET security clearance.

Course length by MOS:

MOS	Length
25B, 25D, 25G, 25H, 25J, 25K, and 25E	10 weeks, 1 day
16H, 16J, 16K, 00G, and 31R	11 weeks
16B, 16C, 16D, 16E, 16F, 16P, 16R, 25B, 24C, 24D, 24E, 24F, 24G, 24M, 24N, 24P, 24Q, and 24U	12 weeks

COMMAND AND STAFF DEPARTMENT

GUIDED MISSILE SYSTEMS OFFICER COURSE - 4F-1181

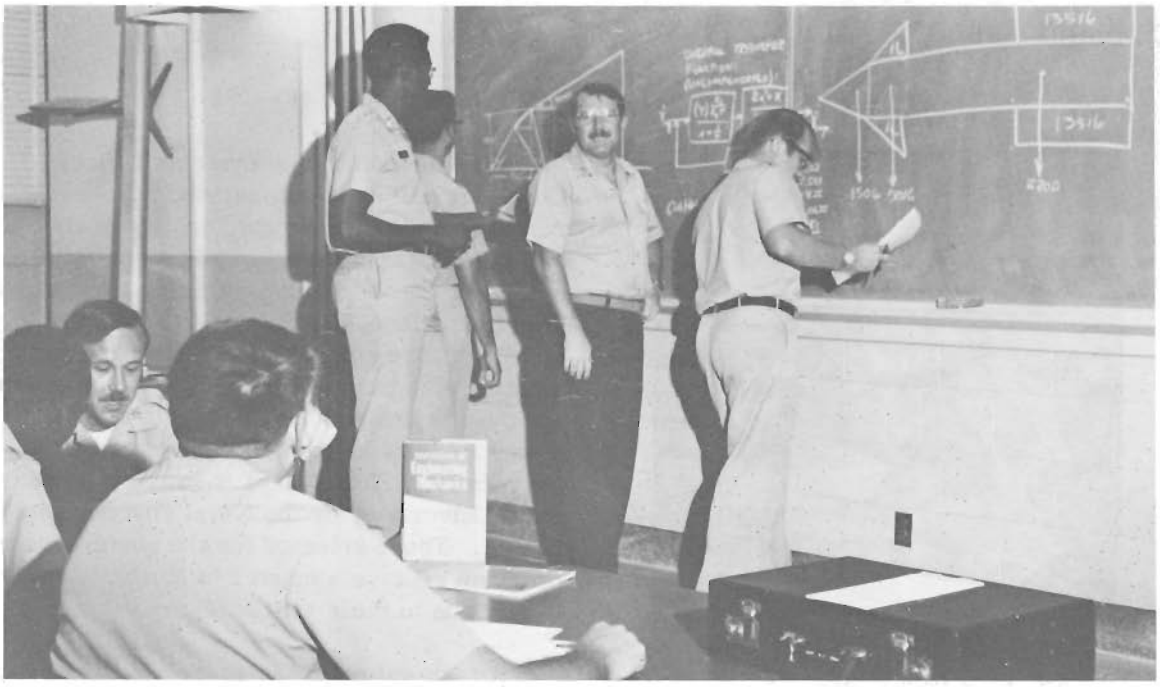


Class using computer in final calculations for design project.

The Guided Missile Systems Officer Course prepares commissioned officers for research and development, testing analysis, and military application of guided missile systems. Excellent opportunities are available for the course graduate to apply his training to the evaluation and comparison of existing and proposed missile systems in his subsequent assignments. Many graduates attend a follow-on graduate program at the University of Texas at El Paso, New Mexico State University, or the Naval Postgraduate School. Those selected for the postgraduate program receive a master of science degree in addition to their 1181 MOS.

An innovation to the course is the requirement that each class design a missile system. As an example, class No. 1-72 recently presented its final missile system design problem. Members of the class were divided into five groups designated to design the airframe, guidance, propulsion, control, and radar subsystems. This practical exercise in preliminary design of a missile summarizes and integrates all instructional material taught during the 33-week course with a major application in computer science. During the course students studied college level courses to obtain a fundamental understanding of physics; aeronautical, electrical, and mechanical engineering; operations research/systems analysis; and computer science. Computer science, a separate subject, is integrated with practical application in several other subjects. The computer facility available is the General Electric Mark II time-sharing system. This service has been available at USAADS since May 1971. The system is provided by contract with General Electric Corporation and consists of four teletype terminals and one cathode-ray-tube terminal. The actual computer, a GE 635, is located in Brook Park, Ohio.

Graduation ceremonies for Class No. 1-72 included an address by BG Joseph C. Fimiani, a former graduate of the course, who discussed the "stimulating and challenging career" of a guided missile systems officer. General Fimiani, project manager for Surface-to-Air Missile Development (SAM-D), stressed the need for more 4F-1181 graduates to meet the Army's requirements.



Students discussing trajectory, control theory, and strength of their missile design.

BG Joseph C. Fimiani presents Distinguished Graduate Award to CPT William R. Lynn.

Here are the prerequisites for the Guided Missile Systems Officer Course:

- Must be a commissioned officer in the grade of first lieutenant or higher.
- Must have credit for college courses in integral and differential calculus.
- Must have one semester of a college physical science.
- Must have SECRET (final) security clearance.

Two classes are offered each year. Can you meet the challenge?

Those officers desiring further information may direct their correspondence to:

Commandant
US Army Air Defense School
ATTN: ATSAD-CS-MS
Fort Bliss, Texas 79916

AIR DEFENSE ARTILLERY OFFICERS ADVANCED COURSE 4-72

DISTINGUISHED GRADUATE - CPT Richard S. Jones

HONOR GRADUATES - CPT's Robert L. Bailey, William F. Gerard, Jr, and Daniel L. Montgomery

COMMANDANT'S LIST - CPT's John J. Bussa, Jerry D. Peek, John W. Reynolds, and Donald F. Wantuck

GUIDED MISSILE SYSTEMS OFFICERS COURSE (1181) 2-72

DISTINGUISHED GRADUATE - CPT John L. Hitchcock

HONOR GRADUATE - CPT Daniel S. Petrosky

AIR DEFENSE ARTILLERY OFFICERS BASIC COURSE 5-73

DISTINGUISHED GRADUATE - 2LT Gregory K. Anerino

HONOR GRADUATES - 1LT John S. Greenlees; 2LT's George B. Caldwell, David C. Christian, Thomas J. Graf, and John A. Opiola

COMMANDANT's LIST - 1LT's James R. Doyle and Albert G. Vasser; 2LT's Douglas R. Beal, Dale R. Crider, Thomas E. Davis, John C. Heinemann, Jr, Charles V. Huddleston, Steven B. Hunt, James L. Keely, Bobby J. King, Jr, David W. Matthewson, James M. Seedorf, Steven M. Shelton, Donald B. Simpson, Jr, James S. Sutherland, Kenneth B. Thornton, and David A. Tupa

NONRESIDENT INSTRUCTION DEPARTMENT

A NEW LOOK

As our military posture shifts from a wartime footing to a peacetime environment, manpower and budgetary restrictions become more imposing. CONARC's training philosophy is changing to overcome these limitations. The philosophy that at one time placed primary emphasis on resident instruction is now swinging to emphasize the nonresident instruction programs. To meet this new challenge, the Nonresident Instruction Department is taking another look at the instructional material being prepared. The question that must be answered is how to provide the soldier in the field with imaginative and interesting instructional material.

This question was addressed by the Board for Dynamic Training that met at Fort Benning in late 1971. The Board concluded in part that the effort in Air Defense Artillery (ADA) training should begin with and be centered on the US Army Air Defense School with a substantial effort directed toward developing new techniques for tactical unit training. However, for this effort to be productive, field units must provide their service schools with substantive and timely feedback concerning the effectiveness of the instructional material currently available, and state the improvements they believe necessary.

Many areas are currently being investigated to assist the unit commander in preparing a truly dynamic training program that will, in turn, make the individual soldier more proficient. Such things as self-paced individualized instruction and programed instruction (both multimedia supported); stress on OJT "hands on" training; group study to assist advanced individual training (AIT) in units; and improved courses for individual study are only a sample of what is being examined. Some progress has been made, and a few items are available to unit commanders now. More will be forthcoming. As new material becomes available, units will be notified. If progress appears slow, it's due to our effort to build quality into our product.

Group study enrollment for the 16-series MOS career development courses is already in effect. This can be a vital tool in unit AIT programs. Group study, using the same material used in individual correspondence course study, involves the designation of a group study leader by the unit commander. The group study leader, using the procedures described in the Non-resident Instruction Department (NRI) Correspondence Courses Catalog, enrolls the members of his group. He himself may enroll as a student. All correspondence subcourse material less the examination, in sufficient quantities for each student, is sent to the group leader. Upon satisfactory completion of all lessons in the subcourse by the students, the examination is forwarded. The advantages of group study are: provides an effective unit training tool; overcomes individual inertia through regular study; and provides group interaction in a learning process.

To add reality and interest to correspondence courses, to afford an opportunity for soldiers to acquire skills as well as knowledges, and to provide an additional training tool for the unit commander, NRI Department is developing OJT or "hands-on" supplements and

subcourses to the existing 16-series MOS career development courses. Employing OJT subcourse material and referenced duties from TM's and FM's, the student performs specified tasks under the observation of a unit administrator. Once the administrator and unit commander attest to the satisfactory performance of the student, a certificate of completion is issued for the subcourse. Currently, OJT supplements for MOS 16R20, Towed and Self-Propelled Vulcan, have been prepared.

A staff or unit training catalog has been distributed to Active Army units down to battalion level, as well as to Reserve components, to assist the commander in the conduct of unit training. It includes listings of instructional material pertaining to 97 resident classes that are appropriate for use in unit training programs. Use of the material relieves unit instructor personnel of the burden of continually preparing instructional material and visual aids for many classes.

A course on unit administration is now available to help unit officers gain expertise in battery administration. It consists of subjects covering dining facility operations, supply procedures, records management, organizational maintenance, officer efficiency reports, military justice, and personnel management. Look for it in the correspondence courses catalog under the title, Battery Officers' Unit Administration.

A programed text subcourse on World Geographic Reference System (GEOREF) became available for distribution in December 1972. The programed format adds a new element of interest to correspondence course work, provides immediate learning feedback to the student, and reduces the amount of required reading.

Notes From
US Army Air Defense Center and Fort Bliss

MISSILE COMMAND INITIATES NIKE HERCULES MODIFICATION

Initiation of a major modification program on Nike Hercules that will enable the air defense system to meet more sophisticated threats during the 1970's was announced recently by Headquarters, US Army Missile Command, Redstone Arsenal, Alabama.

Nike Hercules was deployed nearly 14 years ago but is still the United States' primary high-altitude air defense weapon.

Improvements will make the missile more maneuverable and better able to counter targets operating in an electronic countermeasures environment.

Known as SAMCAP (Surface-to-Air Missile Capability), the modification program is being done initially by Western Electric Co., the Nike Hercules prime contractor. Army depot teams will accomplish follow-on installation to update old equipment. Modified hardware has been undergoing tests and evaluation at White Sands Missile Range.

The Nike Hercules system has proved effective against targets traveling at more than 2,100 miles per hour, at ranges greater than 75 miles, and at altitudes in excess of 100,000 feet, with a capability of destroying an entire formation of hostile aircraft.

The program is under the Air Defense Special Items Management Office headed by Colonel Morris W. Pettit.

SAM-D ENTERS ENGINEERING DEVELOPMENT STAGE

The Army recently awarded Raytheon Company an increment on a contract totaling approximately $558 million to begin engineering development of the SAM-D air defense system. The fiscal year 1972 increment awarded to Raytheon was $84 million. The balance of the contract will be funded over the 5-year program.

During engineering development, prototypes of the tactical SAM-D system will be fabricated, tested, and evaluated at White Sands Missile Range. This stage of development normally precedes production and deployment of any Army system.

Most of the work under the contract will be done at Raytheon's facility at Bedford, Massachusetts, and at Martin Marietta, Orlando, Florida. Martin is the principal subcontractor for the missile, and Thiokol Chemical is a subcontractor to Martin for the propulsion system.

Engineering development of SAM-D follows an advanced development program that built and tested key components of the weapon system. The SAM-D missile has passed a series of launch-eject, propulsion, and control system flight tests. Also, the missile guidance

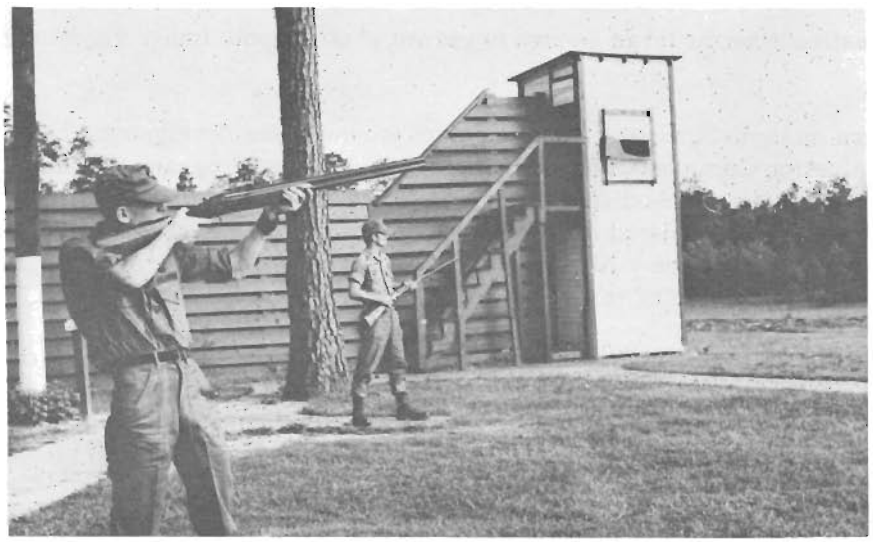
scheme has been demonstrated along with the system's phased-array radar, a sophisticated, unit that performs all the functions requiring several radars in other systems.

SAM-D's multifunction radar will detect, identify, and track targets, and issue guidance commands to missiles in flight. It will be capable of handling several targets simultaneously.

SAM-D is being developed for air defense against high-performance aircraft and is intended to replace the Hawk and Nike Hercules missile systems that are now deployed worldwide.

Plans to proceed with development of the highly mobile battlefield air defense system were announced by the SAM-D project office that manages the program for the Army at Redstone Arsenal, Alabama. Brigadier General Joseph C. Fimiani is project manager, and Mr. Charles Cockrell is his deputy.

REDEYE SHOTGUNNERS



Redeye gunners of the 7th Battalion Airborne (Vulcan), 60th Air Defense Artillery, 82d Airborne Division, take to the skeet range to improve their aircraft engagement technique. As the clay pigeons fly across the range, each Redeye gunner, armed with a shotgun instead of a missile, tracks, engages, and successfully destroys the targets. The course and the various directions of flight give a real appreciation of aircraft flight patterns to the gunners and enable them to gain experience in attacking a moving aerial target.

MISS DISTANCE RADAR SYSTEM

A continuous search within the Department of Defense has been made for ways to reduce the time and cost of developing new weapon systems. Substantial savings can be made during the test and evaluation phases by improvements in instrumentation facilities and methods. The miss distance (MIDI) radar is one example.

During the development of air defense weapons, both guns and guided missiles, the measurement of vector miss distance is necessary. This stems from the need to obtain detailed performance data on aiming, guidance, and fuzing subsystems during the development, testing, and technical evaluation phases. This has led to rather complex, sometimes redundant, scoring devices. Historically, vector miss distance information has been collected by optical instrumentation, which has these inherent limitations:

- Sophisticated test range facilities are required to support the effort.
- Excessive time is required for the reduction and analysis of photographic data.
- The rate of fire capability is considerably below that required for existing weapons.
- Testing is limited to fair weather daylight hours.
- Gun testing is limited to tracer ammunition only.
- Missiles must be large enough to permit photographic image recording at extended ranges.

A modern miss distance measuring system is now under development by the US Army Test and Evaluation Command Instrumentation Development Program, US Army Materiel Command. The system embodies a ground-based radar system that offsets the limitation of optical instrumentation listed in the preceding paragraph. The feasibility for the concept was developed by the US Army Air Defense Board, demonstrated during 1970, and culminated in a series of live firing tests at Fort Bliss, Texas.

Scheduled for delivery in January 1973, the MIDI radar will provide test data previously unattainable. Performance specifications include the round-by-round vector determination of miss distance when firing 20-mm nontracered ammunition at rates of fire up to 3,600 rounds per minute. The MIDI radar will measure miss distance up to 50 meters.

The anticipated improvements in shortening the research and development cycle for new air defense guns and missiles are based primarily on the near-real-time data reduction capability of the MIDI radar as compared with the lengthy data reduction time required when using optical/photographic instrumentation. A comparison between the two methods shows an improved data output of 100:1 and a personnel requirement reduction of 20:1. The cost savings possible through use of the MIDI radar have been estimated at $800,000 a year.

ARMY AIRSPACE CONTROL EXPERIMENTATION

Army airspace control experimentation is being conducted by Modern Army Selected Systems Test Evaluation and Review (MASSTER) elements at Fort Hood, Texas, in conjunction with personnel from Combat Developments Command (CDC) agencies and CONARC schools. The overall objective of the experimentation is to test current doctrine and procedures and recommend changes where necessary. A program of evaluation was jointly prepared by CDC and MASSTER. Phase I of the experimentation, a 3-week workshop, was

conducted during August 1972. The workshop involved a computer-assisted, two-sided, free-play wargame. Data obtained from the workshop were used to assist in the design of a CPX (Phase II) conducted in October and November 1972. An FTX is tentatively scheduled to begin in March 1973. A final report concerning the experimentation is anticipated in June 1973.

REDESIGNATION OF ADA UNITS

Department of the Army approval of a study on the priority of Army unit designations, 15 June 1972, has resulted in redesignation of the following ADA units, effective 13 September 1972.

Old Designation	New Designation	Station
7th Bn, 60th ADA	3d Bn, 4th ADA	Ft Bragg, NC
5th Bn, 67th ADA	3d Bn, 6th ADA	Ft Bliss, TX
5th Bn, 562d ADA	1st Bn, 3d ADA	Ft Bliss, TX
8th Bn, 7th ADA	1st Bn, 7th ADA	Ft Bliss, TX
6th Bn, 61st ADA	2d Bn, 55th ADA	Ft Bliss, TX
8th Bn, 60th ADA	2d Bn, 5th ADA	Ft Hood, TX
6th Bn, 68th ADA	1st Bn, 68th ADA	Ft Hood, TX
6th Bn, 67th ADA	2d Bn, 67th ADA	Germany
8th Bn, 67th ADA	1st Bn, 67th ADA	Ft Bliss, TX
8th Bn, 61st ADA	2d Bn, 61st ADA	Korea
7th Bn, 67th ADA	3d Bn, 67th ADA	Germany
6th Bn, 562d ADA	1st Bn, 1st ADA	Germany
5th Bn, 1st ADA	2d Bn, 1st ADA	Germany
7th Bn, 2d ADA	1st Bn, 2d ADA	Korea
6th Bn, 517th ADA	2d Bn, 2d ADA	Germany
3d Bn, 517th ADA	2d Bn, 3d ADA	Selfridge AFB, MI
3d Bn, 5th ADA	1st Bn, 5th ADA	Coventry, RI
4th Bn, 43d ADA	1st Bn, 43d ADA	Ft Richardson, AK
4th Bn, 44th ADA	2d Bn, 44th ADA	Korea
3d Bn, 51st ADA	1st Bn, 51st ADA	Highlands Station, NJ
7th Bn, 61st ADA	6th Bn, 56th ADA	Germany
4th Bn, 57th ADA	2d Bn, 57th ADA	Germany
6th Bn, 59th ADA	3d Bn, 59th ADA	Germany
6th Bn, 60th ADA	3d Bn, 60th ADA	Germany
6th Bn, 62d ADA	2d Bn, 62d ADA	Germany
6th Bn, 65th ADA	1st Bn, 65th ADA	Key West, FL
4th Bn, 65th ADA	2d Bn, 65th ADA	Van Nuys, CA
4th Bn, 4th ADA	1st Bn, 4th ADA	Ft Lewis, WA
6th Bn, 44th ADA	1st Bn, 44th ADA	Korea

Notes From the US Army Air Defense Board

AN/TPX-46 GENERAL PURPOSE INTERROGATOR

Chief Warrant Officer Earl L. Jarvis
US Army Air Defense Board

"Shoot 'em down, then sort 'em out on the ground."

This method of distinguishing friend from foe is positive, but it won't be appreciated by Allied aircrews or by YOU en route as a passenger to your new oversea assignment.

The decision to fire on suspected foe aircraft has plagued air defense artillerymen since World War I. "Is that a Spad or a Fokker?" "A Spitfire or a Stuka?" "An F-4H Phantom or a Mig-21 Fishbed?" Visual identification is very difficult with today's high-performance aircraft, and this situation points up the urgent need for a rapid, positive, and secure means of friendly aircraft identification.

Early attempts to remedy this shortcoming included the installation of corner reflectors on friendly aircraft to amplify the radar echo, as well as the use of reflective and absorbing coatings on propellers to provide a "signature" variation. Identification, friend or foe (IFF), systems have been used with radar since the start of World War II to help identify detected aircraft. For two decades the Mark X IFF system with the selective identification feature (SIF) has helped answer the question "Is he friend or foe?"

Today's threat of advanced high-performance aircraft dictates that identification be rapid, positive, and secure so an enemy cannot possibly pose as a friend. This requirement cannot be met by the Mark X with SIF because it is too slow and relatively easy to deceive.

To counter today's threat, Department of Defense has directed a TRI-SERVICE program to develop the Mark XII IFF system. It will improve air traffic control in CONUS as well as overseas and provide cryptographic coding of mode 4 for positive identification.

Most of the Army ground interrogators will be replaced by the universal AN/TPX-46 general purpose interrogator system. The basic security of its mode 4, random-pulse, cryptographic coding and daily code key changes makes it impractical for an enemy to pose as a friend, even with the use of captured, intact Mark XII equipment. Only friendly transponders containing the correct code key of the day can return a specified minimum number

of correct responses thus enabling the Mark XII to pick out enemy targets with extraordinary accuracy.

The AN/TPX-46 system will be tested by the US Army Air Defense Board under AR 70-10 as an expanded service test with opportunities for participation by all Air Defense Center Team members. The newly designed equipment is presently being tested at the contractor's factory, and delivery to the Air Defense Board for test was scheduled for late 1972.

The Mark XII offers the best available means of satisfying the operational requirements for a positive, secure, rapid, and reliable identification system.

MOBILE CINETHEODOLITES

Mobile cinetheodolites (fig 1) currently in use by the US Army Air Defense Board provide one of the primary methods of recording target or missile position in space. This one is employed by the instrumentation section when air defense weapon systems such as the Chaparral, Vulcan, Redeye, and Hawk are undergoing service testing at the Dona Ana maneuver area of Fort Bliss. Mobile cinetheodolites are emplaced at previously surveyed positions to provide maximum instrumentation coverage for the particular air defense weapon system undergoing service testing.

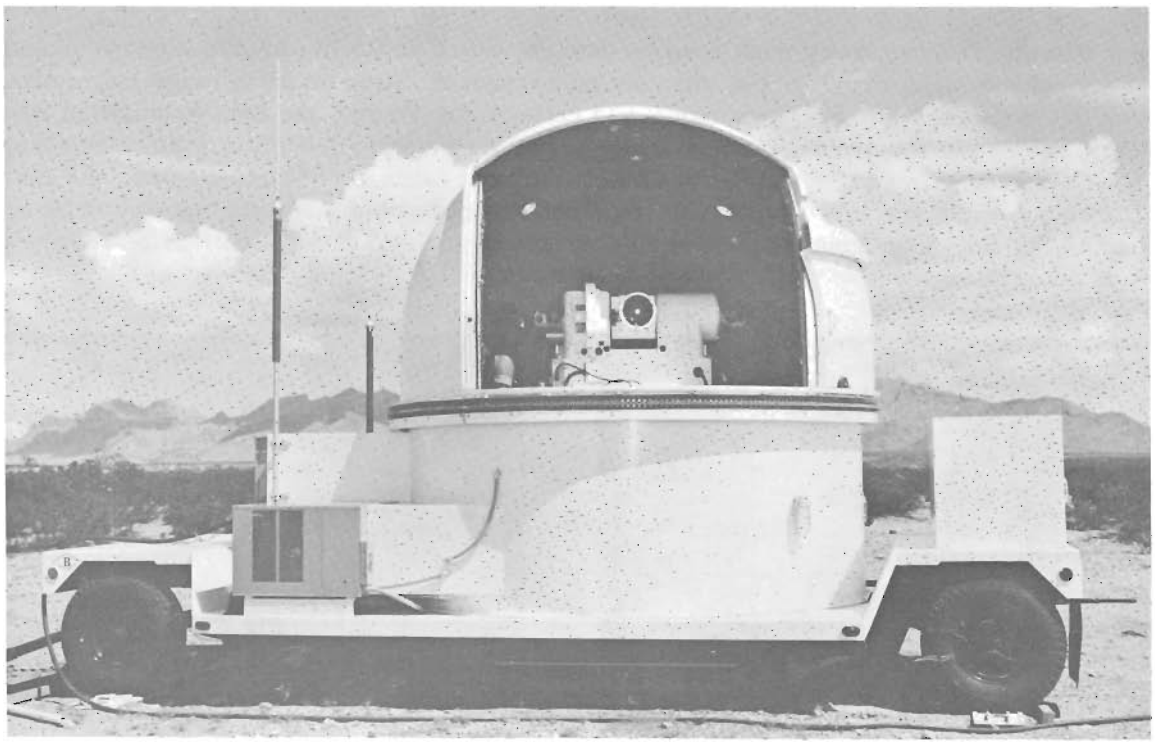


Figure 1. The cinetheodolite records the position of a target or missile in space.

The Air Defense Board presently has four electronic optical tracking Model F digital mobile cinetheodolites which are used for the purpose of recording precise target and missile

position on 35-mm film. This provides Board personnel with the capability to establish the trajectory of the target and/or missile and determine miss distance by means of triangulation.

Mobile cinetheodolites provide a means for the operator to select a frame rate of 5, 10, 20, or 30 frames per second for recording on film the azimuth and elevation angle data of the target and/or missile with a resolution of less than 5 seconds of arc error. The developed film is delivered to the automatic data processing complex (ADPC) of the Air Defense Board, where it is read and the information transferred to cards for computer processing.

Greenwich mean (Zulu) time and the synchronization pulses required for the mobile cinetheodolite timing system are derived for this purpose from the interrange instrumentation group time code B format, which is then transmitted to the mobile cinetheodolites via radio and/or wire for registration on the film. This method enables the ADPC to determine the precise time of all events of importance, such as missile or projectile intercept with the target. The data and information derived from the mobile cinetheodolite film during the conduct of a service test are a primary source of information to provide the project test officer with a basis for equipment evaluation. Thus cinetheodolites play an important role in the Army's program to insure that any new air defense equipment procured for issue to field troops is effective, dependable, and safe to operate.

AUTOMATED DATA ACQUISITION SYSTEMS

The Air Defense Board must keep its data collection capability in step with the evolution of air defense weaponry. Part of this continuing modernization effort in range instrumentation is the recent addition of two major data collection systems: the Data Acquisition System (DAS) (fig 2) and Electronic Warfare Data Acquisition System (EWDAS) (fig 3). The systems were designed primarily for high-speed, high-accuracy data recording, display, and analysis. The output of the systems is recorded on computer-compatible magnetic tape ready for entry into an IBM 360-30 computer, thus making the entire cycle of data collection and reduction fully automated.

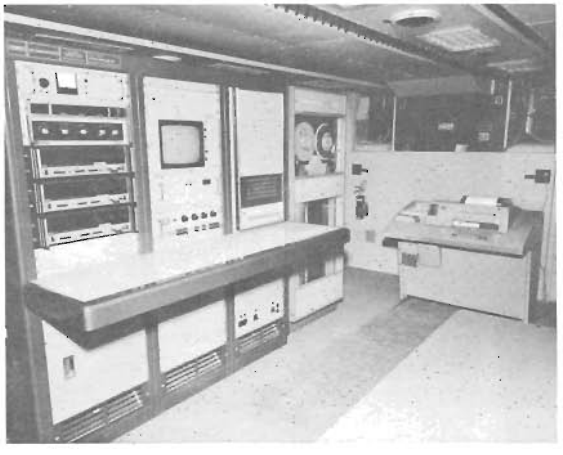


Figure 2. The data acquisition system.

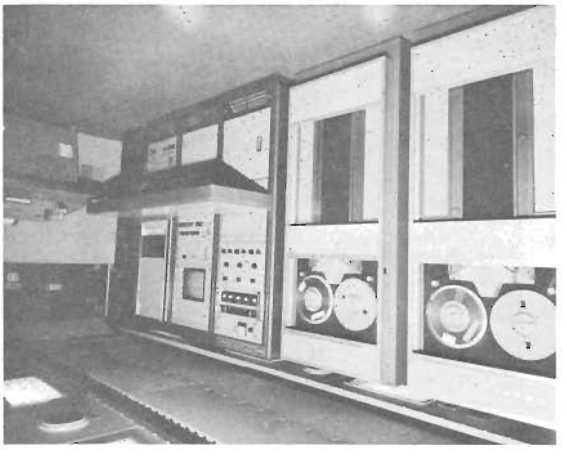


Figure 3. The electronic warfare data acquisition system.

The DAS is an entirely self-contained computer-controlled data acquisition, calibration, conversion, and recording system. It accepts as inputs discrete digital data, analog data, and three multipurpose signals. The multimeter section of the DAS accepts the three multipurpose input signals and performs a precision measurement of the three signals in either ac volts, dc volts, or ohms, as selected by the operator. The DAS provides teletype, TV monitor, and magnetic tape outputs that are compatible with the Air Defense Board IBM 360 Model 30 processing system. The DAS also produces a MODEM-compatible output for high-speed (40,800 binary digits per second) data transmission.

The EWDAS measures the effectiveness of an electronic jammer on a radar. It measures and records the jammer power level entering the front of the radar. The radar processor of the EWDAS accepts three radar intermediate frequency input channels and provides multiplexing, log conversion, sample and hold, analog-to-digital conversion, and video gating. In addition to the three jammer power inputs, the EWDAS has 24 analog and 32 discrete on-off inputs similar to the DAS. The EWDAS also produces a MODEM-compatible output for real-time data transmission.

The systems are installed in individual semi-vans and each requires regular 60-Hz power. These characteristics make the systems mobile and highly versatile.

Notes From the Human Resources Research Organization

The Army's principal training research and development agency, The Human Resources Research Organization (HumRRO), was organized as The Human Resources Research Office by George Washington University in 1951. In September 1969 HumRRO left the University system and became a private, nonprofit corporation. HumRRO seeks to improve human performance in organizational settings through behavioral and social science research, development, consultation, and instruction. Principal efforts for the Army have centered around the areas of training, motivation, and leadership. Since 1969 research has also been conducted for other Department of Defense agencies as well as a number of outside activities.

HumRRO scientists at Fort Bliss have undertaken three new major efforts in FY 1973. One of these, called ATC-PERFORM, involved HumRRO personnel in helping to install new instructional techniques at the Army Training Center for Field Artillery. These techniques, the most prominent of which was peer instruction, were developed and tested by HumRRO in connection with the Modern Volunteer Army Program. A brochure describing peer instruction, as well as other aspects of the program, is available from the Fort Bliss HumRRO office.

Another effort, titled CLASSROOM, is an outgrowth of exploratory research conducted in FY 1972. In this program HumRRO personnel are attempting to develop new methods of training and evaluating Army instructors. Details on results will be published when the project is completed.

The third major effort is being performed for the Combined Arms Training Board (CATB). HumRRO scientists are working with US Army Air Defense School personnel to complete task analyses of MOS 16R (Vulcan Crewman) and 16P (Chaparral Crewman). These analyses will be compared with similar data from MOS's in other combat arms. Common tasks will be determined, and a handbook outlining the common tasks of a soldier will be published. Lists of MOS-specific tasks will be employed locally to modify and improve training.

A 40-hour workshop in performance counseling has also been developed as a part of HumRRO's technical advisory service. The aim of the workshop is to develop skills in group problem-solving and participative management as additions to the leadership skills already possessed by Army officers and noncommissioned officers.

AMC Night Vision Lab Develops Thermoviewer With Potential for Many Military, Civilian Uses

Development of a new Thermoviewer as one of the U.S. Army's growing family of devices to detect the enemy at night as well as during the day, announced in mid-January by the Army Materiel Command, is expected to yield many civilian applications.

The AMC Night Vision Laboratory, a Fort Belvoir, Va., element of the Electronics Command, Fort Monmouth, N.J., is credited with development of the Thermoviewer. Its potential for civilian applications has been demonstrated initially by successful use to detect loose rock that might cause mine cave-ins; also, to study earth surface temperatures in geological surveys.

Other potential uses of the hand-held device include detection and mapping of thermal pollution in water and a variety of medical applications, such as detecting cancerous tissue beneath the skin and studying burned tissue.

Unlike previous image intensification devices, such as the Starlight Scope, the Thermoviewer can work in absolute darkness.

Since it detects only differences in temperature, it can be used in either darkness or daylight to indicate a person or vehicle, partly shielded by foliage or camouflage. It also can be used to see through light fog or haze because it works at a larger wavelength than that of visible light.

All objects with temperatures above absolute zero emit thermal radiation, or heat. In the visible wavelength, these waves can be seen, for example, as flames or the glowing red of heated iron. In other wavelengths, a detector is necessary.

The Thermoviewer has a detector array of lead selenide, thermoelectrically cooled to almost 160° F. below zero. The array is scanned electronically to create an image on a phosphor screen visible through the eyepiece.

Weighing only six pounds, it can be handled as easily as a pair of binoculars. It is powered by a belt-mounted, 5-pound, 6-volt rechargeable battery pack capable of 12 hours of continuous operation.

The principle of operation is not new, but previous equipment was heavy, bulky, and took 20 minutes to create a visible image. The Thermoviwer requires no outside illumination whatsoever.

The U.S. Bureau of Mines, testing the device in conjunction with the Night Vision Laboratory, found that it detected hazardous loose rock behind apparently solid mine walls and in supporting pillars.

The bureau discovered that the temperature of the air space around concealed loose rock was affected to a greater degree by mine temperatures than the solid rock surrounding it — a heat difference easily spotted by the Thermoviewer.

Since rock falls in mines cause more than 100 fatal accidents in coal mining operations annually, the location of undetected weaknesses in apparently solid walls and pillars could save many lives.

The device also could be used to locate underground mine fires, combustion in waste dumps, and underground water courses.

The Remote Sensing Geophysics Group of the U.S. Geological Survey mounted the Thermoviewer in an aircraft for flights over the Survey's Oklahoma test site. It proved valuable in making a detailed study of conditions which affect surface temperatures of the earth.

Similarly, thermal pollution of lakes, rivers and streams could easily be seen through the Thermoviewer carried in an aircraft.

Suggested also is that the device might be a valuable aid in nighttime sea rescue work, since it could detect the difference between seawater temperature and that of anyone in the water, or in a boat. This would be similar to the military application of detecting swimming infiltrators attempting to approach friendly locations.

Creative concepts are expected to lead to numerous other innovative civilian applications for the Thermoviewer.

CIVILIAN APPLICATION of Thermoviewer includes detection of loose rock that might cause serious mine cave-ins.

MAN IN FOLIAGE as viewed by the human eye is shown in photo at left, and as viewed in the same surroundings, at right, without added light, through the Thermoviewer.

Thermoviewer (AN/PAS-7)

Assistant Chief of Staff for Force Development Air Defense Directorate

Lieutenant Colonel Stanislaus T. Hoey
Executive, Air Defense Directorate

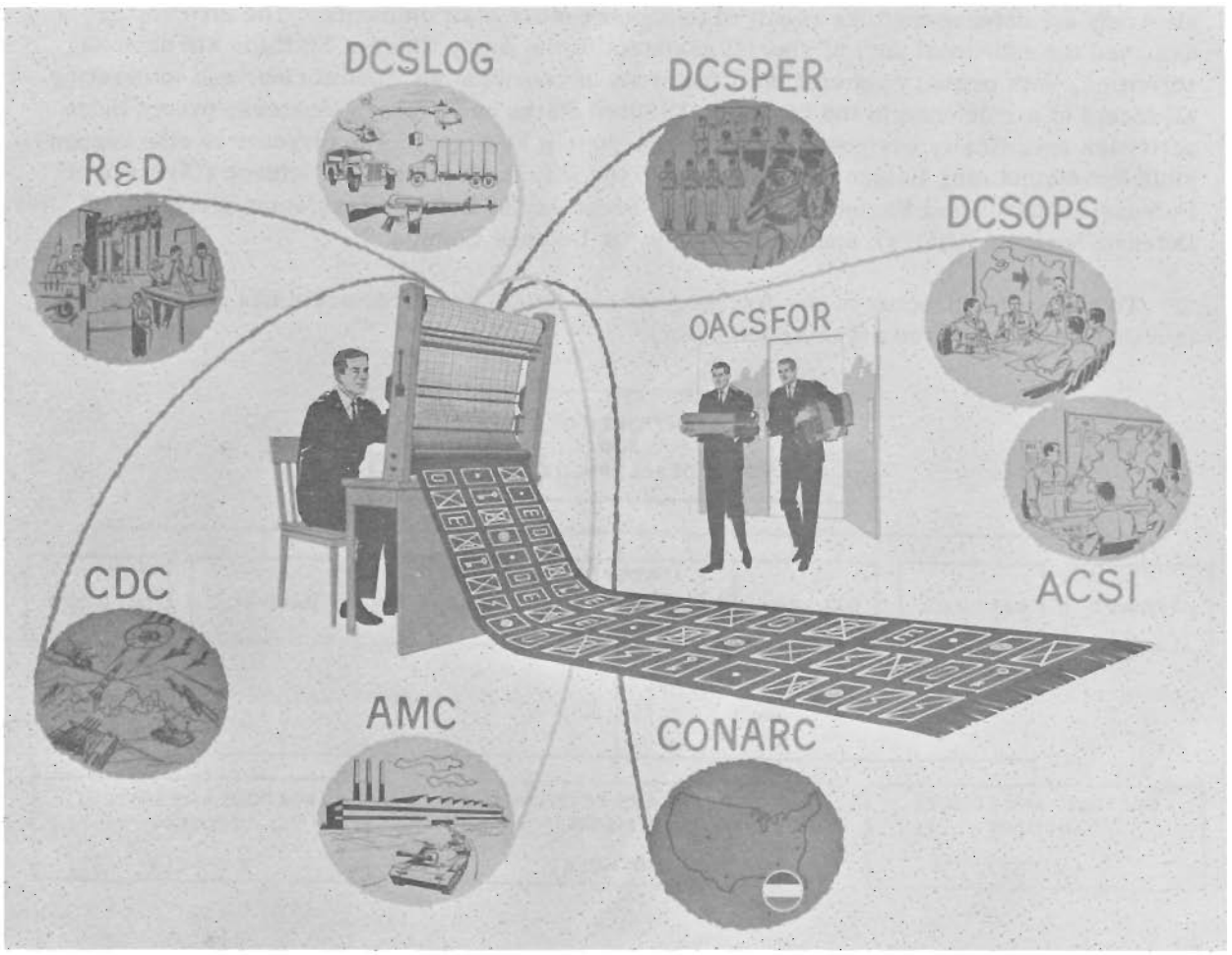
The purpose of this article is to acquaint air defensemen with the Air Defense Directorate, an element of the Office, Assistant Chief of Staff for Force Development. However, a look at the latter and its staff responsibilities seems in order before proceeding with a detailed discussion of the organization and functions of the Directorate.

The Office, Assistant Chief of Staff for Force Development, is a relatively new organization on the Army staff. It was created in 1963 when a Department of the Army staff agency was required to look closely at the force structure in the day-to-day management of the Army as well as projection of force development requirements for the future. This staff agency was subsequently organized and designated the Assistant Chief of Staff for Force Development (ACSFOR) and charged with the Army staff responsibility for the development of Army forces. Specifically, it has the responsibility for organization, unit training, manpower and force levels, system development, doctrine, and evaluations (operational test and evaluation (OTE)) for the Army. The ACSFOR office has been referred to as the Army's weaver, and the picture on the following page illustrates it. In describing the picture, ACSFOR is represented by the officer operating the loom in the middle. This means that ACSFOR operates in the middle of the entire Army staff.

The job of ACSFOR is to determine the force requirement for things and for people to man the force structure. How does this come about? The Deputy Chief of Staff for Military Operations (DCSOPS), working closely with the Assistant Chief of Staff for Intelligence, along with the day-to-day relation that he has with the Chief of Staff operating in the Joint Arena, establishes the strategic concept. This determines the major units required to carry out the joint strategy. ACSFOR rounds out the force structure in the Army Force Development Plan (AFDP), which is represented by the Army scarf (being woven) and the symbols you are familiar with.

Once ACSFOR identifies the composition of the force, the Deputy Chief of Staff for Personnel gets the men and, with US Continental Army Command, is responsible for their training.

The Deputy Chief of Staff for Logistics, with the US Army Materiel Command, procures the equipment. The Assistant Chief of Staff for Communications-Electronics sets the policy and standards for Army communications. The Combat Developments Command works with the Office, Chief of Research and Development, in looking to the future. ACSFOR is responsible for bringing this effort together. Organization, equipment development and issue, doctrine, and training must be synchronized to produce a ready unit at the time DCSOPS is ready to deploy it into a command. Essentially for all air defense units, the Air Defense Directorate performs the functions for ACSFOR in coordinating this effort to ready a unit.

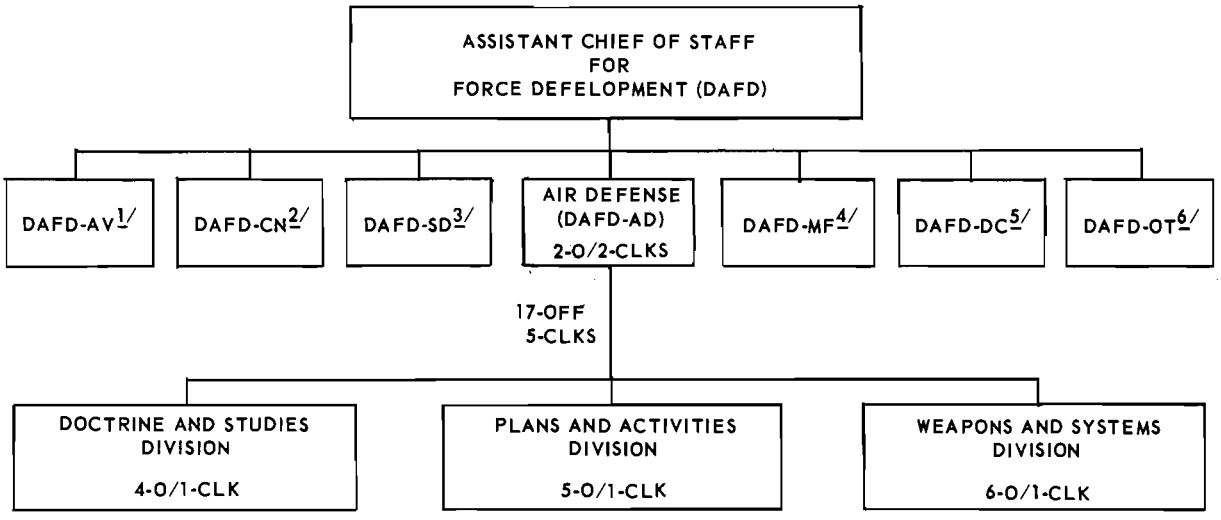


Shortly after ACSFOR was organized, it became apparent that with the growth and complexity of air defense systems a single manager would be required to monitor and coordinate air defense activities. However, it was not until 1966 that action was taken to centralize the coordination of air defense matters. In August 1966 planning began to remove the air defense element from the Office, DCSOPS, and to concentrate the ACSFOR/DCSOPS elements into a separate Air Defense Directorate in ACSFOR to coordinate Army air defense matters. The ACSFOR plan for the reorganization and structure of the Air Defense Directorate was submitted to, and approved by, the Army Chief of Staff in December 1966. Since many of the personnel were already in ACSFOR, the directorate was immediately functional and, on 31 December 1966, LTG Richard T. Cassidy (then Major General) was assigned as the first Director of Air Defense. Lieutenant General Cassidy is now Commanding General, US Army Air Defense Command. Other directors following General Cassidy were MG C. J. Le Van, now Commanding General, 32d Army Air Defense Command, US Army Europe; MG S. L. Reid (Retired); BG J. C. Fimiani, now SAM-D Project Manager; BG (Designate) Syldon E. Salter, the incumbent director. COL E. H. Church is Deputy Director.

The functions of the Air Defense Directorate are the same today as they were when the directorate was formed. They are to provide advice, assistance, and recommendations on

all Army air defense matters required to support other staff elements. The director is assigned the additional duty of special assistant to the Army Chief of Staff for air defense activities, with primary general staff functions of coordinating, monitoring, and integrating all facets of air defense in the continental United States and oversea theaters, except those activities specifically assigned the Safeguard System Manager. The director is also responsible for maintaining liaison and contact with the Office, Secretary of Defense (Director of Defense Research and Engineering); Office, Secretary of Defense (Assistant Secretary of Defense/Security Affairs); and the US Army Air Defense Command.

To assist the director in the discharge of his duties, the directorate has been organized into three divisions (see organization chart).



NOTES:

1/ Aviation Directorate

2/ Chemical Nuclear Operations Directorate

3/ Systems Directorate

4/ Manpower and Forces Directorate

5/ Doctrine, Evaluations, and Command Systems Directorate

6/ Organization and Unit Training Directorate

Not Illustrated under DAFD are the following offices:

1. Signal Security Managers Office
2. International Standardization Office
3. Information and Data Systems Office
4. Office of the Scientific Advisor

The Doctrine and Studies Division, headed by COL Avon R. Omps, is responsible for preparing, coordinating, and analyzing air defense studies. The threat and friendly systems' effectiveness and capability are analyzed to assess the impact on present and future

air defense doctrine, weapon system development, and force and structure requirements. Two major air defense studies were recently conducted under the sponsorship of the Air Defense Directorate: the Field Army Air Defense Systems (FAADS) Study and the SAM-D Nuclear and Antimissile Capability Study. Both were scheduled for completion by the end of September 1972.

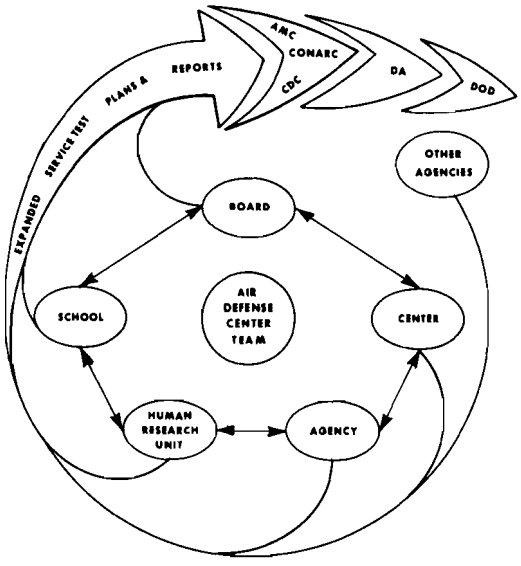
The Plans and Activities Division, headed by COL Robert H. Elliott, is responsible for monitoring and coordinating activities of Army air defense units worldwide. Specifically, the division assists in determining air defense force size and manpower requirements. These data are then used to update Joint and Army strategic plans and assist in budget development; i.e., for Procurement of Equipment and Missiles, Army; Operation and Maintenance, Army; and Military Construction, Army, funding air defense activities. In addition, the division monitors unit training and operational readiness of deployed air defense units and serves as ACSFOR point of contact for Safeguard matters.

The Weapons and Systems Division, headed by COL Ashley M. Foote, has primary responsibility for monitoring and managing air defense hardware from development to phase-out. Department of the Army system staff officers (DASSO's) are assigned to this division. These officers are responsible for fulfilling the directorate responsibility for life cycle management of equipment by integrating the many facets of system development, testing, budgeting, deployment planning, and monitoring individual and unit training. This is done for new equipment being introduced as well as product improvements necessary to counter the advancing enemy air threat.

Air defense weaponry under the managership of this division are Nike Hercules, Hawk, Improved Hawk, Chaparral, Vulcan, Redeye, Stinger, SAM-D, and targets (drones and BATS).

The Air Defense Directorate is the Army's focal point for coordinating and monitoring air defense activities. Let us serve you.

EXPANDED SERVICE TEST



--means greater involvement by interested agencies in testing items for the Army. It's one of the new concepts outlined in the latest AR 70-10. The regulation places emphasis on improved methods and procedures to develop, test, evaluate, and acquire materiel. The major thrust in this area has been to integrate operational considerations in testing as soon as practicable. The expanded service test (EST) has thus become one of the most important tests in the development cycle. Major activities and commands representing the developer, user, trainer, supporter, and tester are given the opportunity to participate in test planning, conduct, and reporting. The materiel to be tested determines the participants, but with air defense related weaponry, members of the Air Defense Center Team share the action as established in their memorandum of agreement. The development of the detailed plan of test revolves around the initial efforts of the Air Defense Center Team.

The Air Defense Board has overall responsibility to formulate the test plan, develop support requirements, direct and control the test, coordinate with the Center Team for accomplishment of test objectives, and prepare the test report. The Air Defense School develops the plan to test the training package, provides observers at the test site, and collects and develops results for inclusion in the test report.

The Air Defense Center coordinates the provision of additional resources for support of the test, and the School develops the center commander's independent evaluation of the report for US Continental Army Command.

The Air Defense Agency develops the doctrine, organization, and tactics input for the plan, provides observers, collects and develops results for inclusion in the report, and performs an independent evaluation of the report for US Army Combat Developments Command.

The Air Defense Human Research Unit analyzes the training package and provides human factor evaluations for the plan, provides observers, collects and evaluates data, develops results for inclusion in the report, and contributes to the Center Commander's evaluation as required.

The expanded service test concept depends upon vigorous participation and interaction of developer, user, and other agencies responsible for materiel decisions. The flow of decision information from an EST reaches the highest levels of the Department of Defense.

AIR DEFENSE CENTER TEAM MINUTES

Editor's Note:

The Air Defense Center Team normally meets each month to discuss significant topics of broad interest to air defense artillery in particular and to the Army in general. Other services also become involved. Therefore, unclassified information relative to Center Team activities for the period March 1972 to August 1972 is published in the form of abridged Air Defense Center Team Minutes to make the information readily available to interested commands.

Requests for additional information should be addressed to Commandant, US Army Air Defense School, ATTN: ATSAD-DL-D, Fort Bliss, Texas 79916. Point of contact is the Air Defense Center Team Coordinator, AUTOVON 978-5003/2481.

AIRSPACE COORDINATION ELEMENT (From minutes of 23 Mar 72)

The briefing on air defense operations and airspace coordination within the 82d Airborne Division was presented by a three-man team. Presentations included the following salient points: The 7th Bn (Abn), 60th ADA, was activated 29 June 1970 at Fort Bliss as a three-battery battalion (headquarters battery and two firing batteries). (Editor's Note: The 7th Bn, 60th ADA, has since been redesignated the 3d Bn, 4th ADA. Recently the term "airspace coordination" was officially changed to "airspace control.")

After completing basic and advanced training, and a successful ATT and maintenance inspection, the battalion moved to Fort Bragg on 17 December 1970 and was declared combat ready on 15 February 1971.

The accomplishments of the ADA battalion resulted in the 82d Airborne Division becoming more air defense conscious. Shortly after arrival, the battalion demonstrated the versatility of the towed 20-mm Vulcan. The Vulcan was airlifted by a Huey helicopter, dropped from a C5A, and then successfully test fired. Initial range restrictions at Fort Bragg were relaxed by adjusting the range fans and the ADA battalion was allowed to fire at aerial targets, including R-CATS and the ballistic aerial target system. Night firings at aerial and ground targets using high-explosive, incendiary, self-destruct ammunition followed.

Two additional Vulcan batteries were activated on 1 July 1971. Subsequently, the battalions were tasked with the development of techniques to integrate all divisional air defense resources into a highly effective anti-air package, to include the use of airspace over the division area of operations.

Initial action was the assignment of all division Redeye assets to the 7th Bn for intensive training. After gaining field experience the present organization was formed. It consists of a battalion headquarters, headquarters and headquarters battery, and four Vulcan/Redeye batteries, with a brigade airspace coordination element (BACE) in each brigade tactical operations center.

In accordance with the practice of deploying a brigade size task force, three brigade anti-air packages were organized, one for each of the three infantry brigades. A fourth anti-air package was provided for general support of the division installations or to operate as a brigade anti-air package in support of a separate or additional brigade.

The Vulcan/Redeye battery is the basic brigade anti-air package. Each battery has three platoons consisting of a platoon headquarters, four Vulcan squads, and three sections of four Redeye teams each. Within a particular brigade, the anti-air package is available to that brigade commander for all mission training and is immediately responsive for tactical deployment. The Vulcan/Redeye battery commander is also the adviser to the brigade commander in all air defense matters and is responsible for the operation of the BACE. Command and control is executed from section leaders all the way to the battalion operations center, and it includes control of the Redeye missile.

Major equipment changes proposed in the Redeye reorganization include substitution of the AN/VRC-47 for the AN/GRC-160, which is unreliable for air defense command and control, and the addition of the AN/GRR-5 to provide a voice early warning net.

Prior to the reorganization, Redeye assets were an unknown quantity to the ground commander who lacked the knowledge and expertise to effectively train and employ them. Under the present organization, all resources are centralized for training, deployment, and command and control. The Redeye teams are used to partially fill the air defense gap that exists because the 82d Airborne Division does not possess the Chaparral air defense system.

The division airspace coordination element (DACE) and the BACE act as communications monitoring elements capable of receiving, plotting, and resolving conflicts between users of the division's airspace. The DACE/BACE system was organized into six functional areas; i.e., chief coordinator, tactical air support, air defense artillery, Army aviation, indirect fire support, and naval gunfire. The DACE/BACE system operates from a small general-purpose tent and is attached to the tactical operations centers of the division or brigade it is supporting. Data recorded on a backlighted clear plexiglass board by two plotters include ADA fire unit positions, artillery positions, operations overlays, boundaries, corridors, landing zones, and air defense intelligence data. Each functional element of the DACE/BACE has specific tasks. The chief coordinator monitors all plotted airspace activities, resolves conflicts through appropriate authority, and keeps the G3/S3 advised of appropriate air defense intelligence and hostile air activities.

Initial opposition to the 82d Airborne Division's plan for airspace coordination, specifically by USAF elements, has declined since experience has shown that the DACE/BACE concept is effective and does not infringe upon Air Force responsibilities. The Air Force does not have the capability to coordinate airspace usage at this level.

AIR DEFENSE ARTILLERY MATERIEL DEVELOPMENT PLAN (ADAMDEP) (From minutes of 3 Aug 72)

The Director of the Air Defense Center Team opened the meeting, stating that a Center Team committee under the chairmanship of USACDCADA has revised and updated ADAMDEP for FY 74. Approval of the list for priority ordering of materiel, with supporting rationale, was requested prior to being presented at the Air Defense System Program Review.

The Commanding Officer, USACDCADA, stated that in addition to the items mentioned, requirements and their development with a summary of ADAMDEP FY 74 would be included in the briefing and in the presentation of ADAMDEP to the Air Defense System Program Review. The chairman of the ADAMDEP Center Team committee was introduced, and he reported that ADAMDEP FY 74 is in two sections. Section I deals with air defense of the field army, and section II, developed by ARADCOM, deals with air defense of CONUS. The arms limitations talks have delayed ARADCOM's section, but it is expected in final form for publication with section I.

Major topics covered in both sections of the ADAMDEP document are:

- ADA system cycle.
- Threat.
- Priorities.
- System descriptions.
- Rationale for priority ordering.
- Funding.

The new priority ordering for development of air defense materiel was accomplished, keeping in mind the "Family of ADA Weapons" concept.

In addition to an overall priority listing, the priority list is broken out by funding category (RDT&E and PEMA) which provides flexibility to DA (ACSFOR) in managing the ADA portion of the budget.

Discussion resulted in changes to priorities and rationale for priority ordering. These changes will be finalized and presented to the Air Defense Center Team for approval.

UPDATE ON SAM-D (From minutes of 9 Aug 72)

Brigadier General Joseph C. Fimiani, SAM-D Project Manager, presented a briefing in two parts.

Part I covered the current status of the SAM-D program and the ongoing efforts to sustain the SAM-D program.

• A system engineering cost reduction contract is being used to make the SAM-D program more cost effective.

• Contracts awarded will have less overrun cost due to improved wording in requirements.

• An updated engineering development plan and the presently envisioned SAM-D system were presented.

Part II included real and representative problems and solicited the assistance of the Air Defense Center Team in providing solutions to them.

During the discussion following the briefing it was agreed that the Air Defense Center Team, within the confines of available resources and assigned responsibilities, would study problem areas specifically identified by the SAM-D project managers' office. The Director of the Air Defense Center Team will be the point of contact and will designate appropriate representatives to study specific problems.

STINGER MISSILE DEVELOPMENT (From minutes of 10 Aug 72)

The current and projected threat, which justifies the Stinger system, and Stinger capabilities were reviewed.

Reasons for the Defense System Acquisition Review Council decision to replace Redeye were summarized.

Following a brief review of the Stinger system description, the status of the Stinger development program, including major milestones, was presented.

The briefing was concluded after discussions on the reliability, availability, and maintainability of the Stinger system.

Educational Television at the US Army Air Defense School

Lucius Casillas
TV Production Specialist
US Army Air Defense School

Educational technology is experiencing unprecedented and profound changes. The old image of an instructor standing beside a blackboard with chalk in hand has all but disappeared in a world of multimedia audio-visual devices. The Department of Defense and, in particular, the US Army Air Defense School (USAADS), have kept pace with innovations in the vast field of educational technology. The School is a main forerunner of accelerated training methods and techniques.

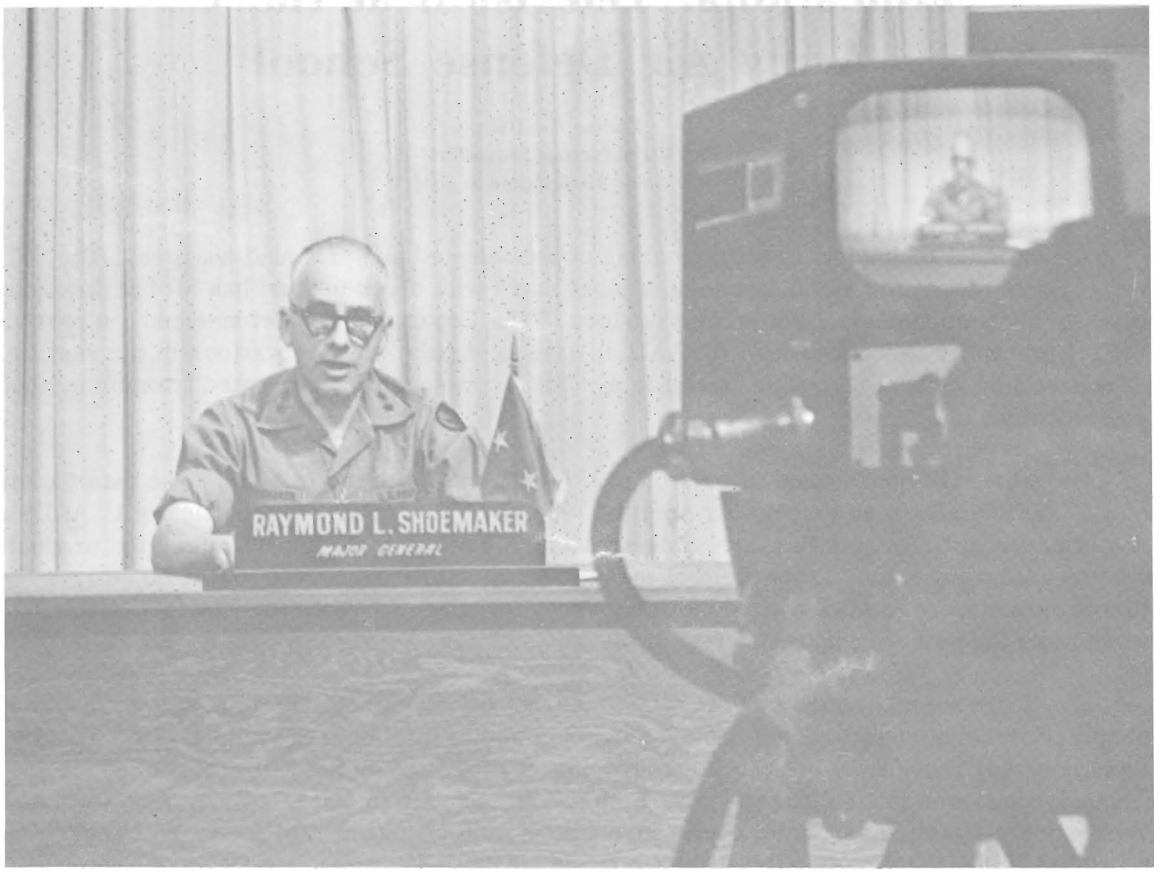
Integration of educational television at USAADS was initiated in 1957. The establishment of a CONARC television network in April of 1966 and the concurrent selection of USAADS as one of seven initial and major Army installations for a regional support television production center, was a milestone in the field of many innovative changes. The major objectives for this program were to assist in maintaining and improving the quality of instruction and to economize the use of educational resources.

The Television Division at Fort Bliss has been expanded continually since 1957. Equipment and mission changes have been constant. From a minimum of equipment for live transmissions over one channel to three classrooms in 1957, the facility has expanded to 8 channels that transmit 8 different programs simultaneously to 500 television monitors in approximately 200 classrooms, conference rooms, and offices in 50 different buildings. Once a limited USAADS television facility, it now supports all US Army Air Defense Center and Fort Bliss agencies and an expanded television production program which includes Fort Huachuca, Arizona; Fort Hood, Texas; and Fort Sam Houston, Texas.

The capability to perform remote or field production work is made possible by the use of a mobile television van. From a start of 3 mobile video productions in 1968, the annual production increased to 39 mobile video productions during fiscal year 1972, to include 8 Department of the Army training film projects (kinescope recordings converted to 16-mm film from video tape).

The Television Division's studio possesses all the capabilities of any large broadcast television station, and the facilities are of the highest broadcast quality. Included are a three-camera studio, control room (complete with professional switching, special effects generator, and master audio control) and master control room (with video controls, master video tape recorder, and video tape playback area with four video tape recorders, film chain, and master program switching console). During fiscal year 1972, 160 studio productions were completed, to include multiple daily newscasts.

The Television Division serves the School and the Air Defense Center with a true "open door policy." This policy fosters a creative working climate between the educational television facility and the instructor. Only two constraints are placed on each prospective program: the instructor must help with production and it must be done in good taste.



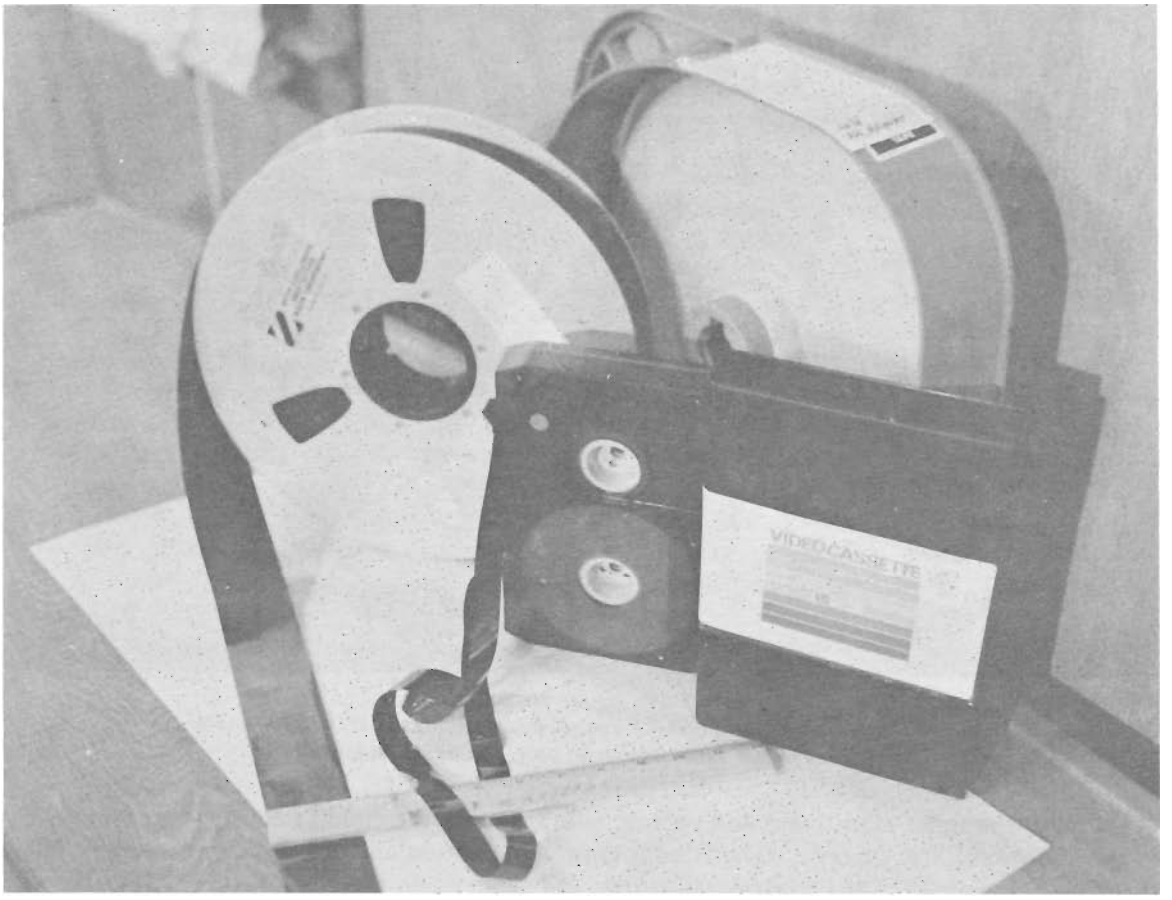
The Commanding General, US Army Air Defense Center and Fort Bliss, frequently uses closed circuit television to carry command information to thousands of interested persons.

The mobile television van provides the capability to perform remote or field production work.

The video tape master playback control board enables operators to monitor the video and audio quality of programs being transmitted.

One of the most significant and recent innovations in the field of educational technology is the videocassette system, scheduled for implementation and use during the second quarter of fiscal year 1973 at USAADS. The impact of the videocassette system will generate various ramifications: first, enormous savings will be realized in the conversion from the expensive 2-inch quadruplex system to the 3/4-inch helical scan system (at approximately one-tenth the cost), placing the use of educational television within the budgetary range of most agencies involved in educational television. Second, units in the field or in remote areas, lacking access to a closed-circuit distribution system, will now be able to easily transport the small, portable videocassette units and use television at any desired location where normal household-type electric power can be made available. Third, the videocassette is a color system, an important characteristic. The limitations characteristic of the black and white system have now been overcome, and US Continental Army Command (CONARC) has initiated a 5-year color conversion plan for its network system.

The videocassette system consists of small portable recorders and playback units designed for the use of instructors. This is a breakthrough for self-paced instructional techniques that affords the instructor and the student control of video-tape playbacks without prior scheduling. The videocassettes consist of compact, self-contained, sealed video-tape units that hold a reel of 3/4-inch video tape (up to 1,200 feet) and a takeup reel. It is about the size and weight of a regular hard-cover book and is capable of playing 10- to 60-minute tapes in either black and white or color.



The 60-minute videocassette (foreground) weighs only 1.2 pounds while the 2-inch video tape reel (background) weighs 11 pounds.

The Television Division is a part of a CONARC network exchange system. This system provides for an exchange of all video-taped programs produced by any of the existing 14 regional television production centers within the CONARC network to any service school or television division. The operation of this vast video tape library system is similar to the Army's Audio-Visual Support System in that a system for stocking, reproducing, exchanging, cataloging, and utilization reporting is available and within reach of all production and playback centers. CONARC publishes and distributes an "Educational Video Tape Catalog Master Index" (CONARC Pamphlet 350-34) which lists all available educational television video tapes for use throughout the Department of the Army. In addition, the Television Division at Fort Bliss publishes and constantly updates its own video tape catalog.

In the US Army Air Defense School the use of audio-visual communications, with its ability to motivate and educate, is vital. Production of educational television video tapes and training films is only one facet of the multiple audio-visual support functions available in the fast-growing arsenal of training aids used to increase the quality of military instruction. With increased standards of communication, less resources and manpower are required to provide faster and better learning methods for the students. Effectively used, educational television is a potent teaching tool in the instructor's hands. At Fort Bliss, educational television is a growing training medium that has definitely changed and updated instructional techniques and provided a new and challenging dimension in the field of educational technology.

Did You Know?

Watch this space in each issue of Air Defense Trends for information emanating from the Air Defense Artillery Branch, Military Personnel Center, Department of the Army. Questions may be directed to the appropriate action officer where names and telephone numbers appear at the end of the related topic.

The information herein is the Air Defense Artillery Branch interpretation of current policies and programs. It is not an official Department of the Army publication.

—Ed.

OFFICER ASSIGNMENTS

A Change for Aviators. A recent change has been made at the branch in the method of assigning aviators. In the past, all aviators were assigned by a single action officer—who was an aviator. This was necessary because oversea requirements for aviators were heavy and the pace was fast. Now aviators are assigned by action officers according to rank, with each assignment being coordinated with the aviation officer in the Branch. As an example, a lieutenant colonel returning from overseas is now assigned his CONUS duty station by Lieutenant Colonel Beck; and assignments of captains are handled by Major Williams. We have been able to make this change as a result of drawdowns in Vietnam, and we believe it is desirable in the overall career development of our officers. (Major Jernigan, OX3-1052)

Greater Stability for Captains. Although minor fluctuations occur, the trend toward increased stability for captains continues. Those most recently assigned to their second involuntary unaccompanied tour have enjoyed a minimum of 36 months back from their first short tour. The goal continues to be "send first those officers who have had no unaccompanied tours before anyone is returned a second time." Therefore, those captains who have yet to serve in an unaccompanied status can anticipate a short tour on completion of their current assignment. Requests for extensions in oversea long-tour areas for captains in this category are being approved only in exceptional cases. In this way we hope to increase the short-tour turnaround time and insure that everyone shares the burden of family separation equitably. (Major Williams, OX3-1177)

OFFICER EDUCATION

Senior Service College Selections. Although the number of eligible air defenders has remained fairly constant during the years we have been a separate branch, the number of selectees for senior service college has steadily increased each year. In 1969 (our first year) we had seven attend. In 1970 the number increased to 13, and in 1971 to 16. At least 22 Air Defense Artillery officers were selected to attend senior service college-level schools during FY 73. Three of these are colonels. One officer is a deferred principal from last year. The following statistical summary is based on the remaining 18 lieutenant colonels who were being managed by the Air Defense Artillery Branch at time of selection.

- Command. All selectees have commanded a battalion, nine have commanded in combat, two have had repetitive battalion command, and one has served in three command positions authorized a lieutenant colonel.

• Combat. All have completed at least one combat tour in Vietnam, and three have had two combat tours (one a second tour in Vietnam and two served in combat in Korea).

• Decorations. Decorations held by the selectees include one Silver Star, one Distinguished Flying Cross with cluster, and 15 Legions of Merit (three with cluster).

• Specialists. Among the air defenders selected are two aviators and four members of other specialist programs.

• Military education. Fifteen of the selectees are graduates of the Regular Command and General Staff College (CGSC) course, one attended the associate course, one graduated from Armed Forces Staff College (AFC), and one graduated from the Air Force Command and Staff course. One officer graduated from both the CGSC and AFSC.

• Civilian education. Seven selectees hold Master degrees and one is in graduate school. The remainder have Bachelor degrees.

• Year group distribution. Two selectees are from year group 52, 12 from 53, one from 55, and two from 56.

• Source of commission. United States Military Academy, 3; Reserve Officers' Training Corps, 13; Officer Candidate School, 2. (Lieutenant Colonel Myers, OX3-1375)

Transition Course for Warrant Officers. A 10-week course of instruction has been established at the US Army Air Defense School, Fort Bliss, Texas, to provide Air Defense Missile Assembly Technicians (MOS 221B) selected for transition to the Ordnance Corps support structure in MOS 251B with a working knowledge of Nike Hercules radars, computer, and related components. Graduates of this course will further attend an Ordnance school at Redstone Arsenal for qualification in MOS 251B. Missile assembly technicians interested in MOS reclassification to 251B should submit requests to the Air Defense Artillery Branch, OPD, in accordance with AR 611-112. (CW4 Vaughn, OX3-1336)

A New Look at Civil Schooling. In December 1972, Department of the Army announced an expansion of the civil schooling program. The keystone of the plan for the period FY 72-83 was recently expressed by the Army Chief of Staff:

"To provide the Army with the degree of expertise needed to meet its requirements and to perform a variety of missions, personnel will require increasing civil education. This is in consonance with advances in technology and the ever increasing need for communications and cooperation with the civilian elements of Government and with industry. For some members of the Army, civil education will be of equal or greater importance than advanced military schooling."

To provide direction to the civil schooling program, revised educational goals for military personnel were approved as follows:

• All career warrant officers will have associate degrees before they reach 15 years service.

- All commissioned officers will have baccalaureate degrees.

- Twenty percent of all career commissioned officers will have graduate degrees.

Changes in Degree Completion Program (AR 621-5). In recognition of the expansion of the Army civil schooling program, the degree completion program (Bootstrap) has been expanded to provide increased opportunities for officers to participate in full time college work at the undergraduate and graduate levels. The new time limits for schooling are:

Warrant officers	Months
Associate Degree	12
Baccalaureate Degree	18
Advanced Degree	18
Commissioned Officers	
Baccalaureate Degree	18
Advanced degree	
Degree of functional value to the Army	12
Degree for which ADA has validated requirements (immediate utilization)	18
Degree with subsequent assignment to ROTC	24

Advanced Civil Schooling (AR 621-1). The allocation of schooling quotas for the fully funded advanced degree program has been received by ADA Branch for FY 73. This training is to fill validated Army Educational Requirements Board (AERB) positions requiring graduate education. Quotas and disciplines are:

Journalism	1	Aeronautical Engineering	1
Operations Research		Electrical Engineering	2
Systems Analysis (Business)	2	Electronics Engineering	6
Comptroller	1	Guided Missile Engineering	4
ADPS - Business	1	ADPS - Engineering	1
International Relations	2	Operations Research Systems	
Social Psychology	1	Analysis - Engineering	7
Applied Psychology	1	Industrial Engineering	1
		Nuclear Physics	1
		Total	32

These quotas represent a 17 percent increase over FY 72 and reflect a moderate shift toward hard sciences. Selection for these quotas will be on a best qualified basis. All officers interested in the advanced degree program (AR 621-5) should forward an application to Branch. Applications previously submitted remain active. (Lieutenant Colonel Drisko, OX3-1390)

Undergraduate Schooling for Warrant Officers. One of the most frequent questions asked by warrant officers is, "What discipline can I apply for that would be of functional value to Air Defense Artillery?" There are quite a few disciplines in which you may apply. Those

disciplines for which the Air Defense Artillery Branch has particular interest are listed below. The ones marked with an asterisk are areas of prime consideration for warrant officers applying for an associate degree under the provisions of AR 621-1.

Air Defense Artillery Branch Subject Areas

Arts
Journalism

Physical Science
Science, General*
Mathematics, General*
Physics, General*
Physics, Nuclear

Engineering
General*
Aeronautical
Electrical*
Electronics*
Mechanical*
Guided Missiles*
Nuclear
Nuclear Effects
Physics*
Industrial*
ORSA
Heating

Business
Administration, Business*
Commerce, Marketing, and Merchandising
ORSA
Comptrollership
ADPS
Personnel Management/Administration
Logistics Management*
Research Program Management

Social Science
Social Science, General
Economics, General
Education, General
Teaching and Administration
International Relations
Government, Civil
Psychology, Social
Psychology, Applied
Political Science
Sociology
Public Relations

Concerning the undergraduate degree program (UDP), before you apply, check AR 621-1 carefully. The time to be selected for this program is from your 2d to your 7th year of warrant officer service. Also remember this program is oriented toward the Regular Army warrant officer, although you need not be Regular Army to apply. If you are interested in an area not listed, call Branch and check it out. If you are not eligible for the UDP, check the degree completion program (Bootstrap). AR 621-5 governs this program.

(Miss Boyle, OX3-1390; CW4 Vaughn, OX3-1336)

Advanced Course. The FY 73 classes consist of two classes of about 60 students each. Class 1-73 started 11 August 1972 and Class 2-73 will start 14 March 1973. This year Air Defense Artillery is participating in the advanced course exchange program with the other combat arms. Officers will be selected to attend the Armor, Infantry, and Engineer advanced courses and the Marine Corps Amphibious Warfare School. Selections for these courses are based on an officer's past manner of performance, military experience, effect of the course on his future career, his potential contribution to the school, and his ability and personality traits to creditably represent the Air Defense Artillery Branch while at the school. This should be a very challenging and rewarding assignment for any officer selected. Anyone who is interested in attending one of these advanced courses, write to the branch or call and let your desires be known. We will be glad to consider you at the time selections are made. (Lieutenant Colonel Drisko, OX3-1390)

CGSC Nonresident Instruction. The main nonresident course offered is the Command and General Staff Officer Course, Nonresident/Resident (CGSC N/R). It generally parallels the resident CGSC course but includes only the hard core subjects presently taught in the resident course. The Command and General Staff Officer Course, Nonresident/Resident, can be taken in several ways. Generally, it is accomplished entirely by correspondence, except that the final 2 weeks of instruction must be taken in residence at Fort Leavenworth to qualify for a USACGSC diploma. This final 2 weeks is called Phase X (ten). An expanded schedule of 13 classes has been developed for Phase X instruction at Fort Leavenworth. The schedule is published in CONARC Circular 350-2, 19 November 1971. Although the bulk of the students for this instruction will be USAR officers, 253 spaces have been reserved for Active Army officers. Any officer who is eligible should consider this increased opportunity of obtaining a CGSC diploma and request a quota for Phase X through Branch.

(Lieutenant Colonel Drisko, OX3-1390)

OFFICER PERSONNEL ACTIONS

The Officer Efficiency Report. No doubt the officer efficiency report is one of the most important documents in any officer's file. Nevertheless, there is confusion and misunderstanding concerning this document. Hopefully, this article will lead to a better understanding of the report, its meaning, and its usefulness.

Recently, a letter was received from an officer who was confused about the bar graph in Part XIIb. His confusion typifies one of the most common misconceptions concerning DA Form 67-6; i.e., Part XIIb of the form is the focal point of the report. Part XIIb, while important, is only a portion of the overall evaluation. Its significance rests primarily in its compatibility with the remainder of the report. Quite frankly, we're more concerned about an officer's manner of performance and potential. Furthermore, we're concerned about the narrative or comments portion and whether it supports the evaluation throughout the report.

Another area of concern is the period covered by a report. A report covering 30 days will not normally have the impact on an officer's record that a report covering 6 months or a year will have. The significance of the entries in the parts related to personal qualities and performance of duty factors usually is not obvious. If any entry in these items is a 3 or a 4, you may be assured that we in OPD will give it a long, hard look. A report containing 4's will invariably trigger action, primarily in the form of a letter from the career branch. Depending on the circumstances involved and the overall quality of the efficiency report, 3's may or may not cause equally immediate action. However, repeated 3's in a series of efficiency reports will elicit career branch action. As far as 2's are concerned, immediate action is rarely required. However, a continuing series of 2's on several reports on the same items will tell a great deal about the officer.

Every efficiency report that arrives in the branch is reviewed. If a report is exceptionally good or bad, or if it contains a comment which warrants further evaluation, the file is completely reviewed to see if there is an upward or downward trend in performance, and if the officer should perhaps be contacted. Frankly, if you are a fine officer who receives a report that does not measure up to the rest of your record, it is unlikely that you will hear from Branch immediately, primarily because we will be waiting to see the next report before

reaching any conclusion. However, if the next report continues in the same vein, then further action may be required. The point is this: one or more less than average reports do detract from an officer's overall competitiveness, and herein lies their significance.

As you know, officer evaluation is based on the "whole man" concept. Education, experience, potential, training, assignments and level of responsibility, awards and decorations, and other factors are considered in conjunction with an officer's manner of performance. All of these are used as "discriminators" in comparing officers. If a report is recent, it assumes greater significance than if it were of older vintage. The more reports of good quality an officer acquires after a less favorable report, the more apparent it becomes that the unfavorable report does not accurately portray his current ability, knowledge, and performance. On the other hand, an unfavorable report can never be totally ignored simply because, no matter how old it may be, it does represent a portion of an officer's career, and must be considered whenever an evaluation is made. While it most likely may not, of itself, be the basis for an unfavorable decision, when the competition gets tough, such a report cannot help but detract from the officer's ability to compete with his contemporaries who do not have such a report.

Now let's turn to preparation and content of efficiency reports. Thousands of efficiency reports are received yearly and they range from those representing flawless performance to those representing the very worst. Normally, these reports have been carefully and thoroughly prepared and present a clear record of an officer's performance. Unfortunately, there have been others that left considerable room for improvement. Accurate and meaningful efficiency reporting is imperative. A good rule to remember: Take the same care in preparing a report that you would expect when yours is being prepared.

Don't be obtuse or sarcastic when preparing the comments portion of an efficiency report. Say what you mean; don't leave room for doubt, questions, or misunderstanding. Vague, meaningless comments designed solely to fill in the blanks are not only unjust to the rated officer but unfair to those of his contemporaries who are being evaluated in very precise terms. Tell the story like it is and don't try to hide or gloss over information.

Another critical area is the timeliness of reports. Key management decisions involving selections for schooling, assignments, and other areas are made daily based on information obtained from efficiency reports. The absence of a current report in an officer's file due to a delay in preparation is inexcusable and reflects unfavorably on rating officials. Timeliness of reports is critical, especially with decisions being made daily concerning an officer's career. Remember, the longer a report takes to reach DA, the longer it will be before it can become a part of the officer's file.

There are very few things more disturbing than to hear an officer say of a rating given to a junior officer, "I rated him low so he would have room for improvement." Such action is totally unjust to the rated officer and reflects a lack of knowledge on the part of the rater. After all, junior officers are rated against other officers of similar grade and experience. If they have done an outstanding job and demonstrated great potential, they have every right to expect efficiency reports reflecting that fact. To underrate them simply because they are junior officers is unrealistic and unfair. More importantly, that report will remain in that officer's file for as long as he is on active duty. An injustice in the early stages of his career could possibly do him serious harm.

A word on the reviewer seems appropriate. Too often, the reviewer, who is responsible for insuring that the efficiency report provides sufficient and accurate information concerning the rated officer's performance, fails to review. This is most obviously true when the reports contain inconsistencies between raters and indorsers that are not satisfactorily explained. It is, of course, the reviewer's duty to refer such reports back to the rater and indorser for comment, or to add any additional personal comments he desires. Ultimately, the reviewer's action determines the soundness and validity of the information in the efficiency report.

In the final analysis, the effectiveness of any OER system depends on how well the raters, indorsers, and reviewers do their jobs. The professional well-being of the officer corps demands that every officer in the rating scheme do his utmost to insure that OER are properly and fairly prepared. After all, evaluation of a year's work out of an officer's career deserves one's very best effort. (Lieutenant Colonel Forte, OX3-1375)

Definite Term Agreement. Recently, we advised officers who were approaching release from active duty and who desired to submit a Regular Army application to submit a request for a definite term agreement. This agreement would extend the officer on active duty and allow him sufficient time to process his application. Department of the Army message No. 261330Z January 1972, Subject: Processing of Regular Army Applications for Officers Scheduled for Early Release from Active Duty, announced that officers would no longer be extended on active duty pending processing of Regular Army applications. As a result of this message, definite term agreements are a thing of the past and can no longer be approved by the branch. DA Message 0820055Z February 1972, same subject, provides additional information.
(Lieutenant Colonel Forte, OX3-1375)

INTERESTING FACTS

- Approximately one-third of all ADA lieutenants are required in Germany.

- The overall promotion selection rate for warrant officers to CW4 in 1971 was 20 percentage points better than the Army rate.

- One out of every four lieutenants in Air Defense Artillery is a Regular Army officer.

- Air Defense units in Vietnam, no longer active, earned more than 500 individual awards for valor.

OFFICER STRENGTH

The latest officer strength of the Air Defense Artillery Branch is:

Colonels	236
Lieutenant colonels	742
Majors	813
Captains	1,404
Lieutenants	1,348
Warrant officers	837
TOTAL	5,380

FROM THE DIRECTOR OF ENLISTED PERSONNEL

Enlisted Evaluation System. The important role the enlisted evaluation system is playing in the career development of the soldier makes it imperative that both the MOS testing and EER programs operate successfully. The interrelationship of the programs in the development of meaningful MOS evaluation scores accentuates this requirement. Commanders are enjoined to give strong continuing support to their programs and insure that personnel officers check and double check the control and suspense systems they use to insure that all eligible personnel are scheduled for their written MOS tests in a timely manner, and that all required EER are correctly prepared and processed. Every one in the chain of command has a part to play in making the enlisted evaluation system work. When the system breaks down, someone, not something, more than likely is the cause.

Identification, Testing, and Reporting of Enlisted Linguists. If you are an enlisted man or woman who speaks, reads, or writes a foreign language, you will want to check the following items with your unit personnel officer to make sure that your records are up-to-date. Many who are qualified in a foreign language have never been awarded the special qualification identifier L or the language code as part of their MOS, as required by Section IX, Chapter 1, AR 600-200. Without the L, you will never be identified as a linguist and, as a result, will not be considered for a linguist assignment. A review of records at HQ DA reveals that many linguists are not being reevaluated in their language proficiency every 2 years as required by paragraph 2-3, AR 611-6. If you have not been tested recently, I suggest that you go to your unit personnel office and see when you are scheduled for the proficiency test. Failure to be reevaluated may result in your not being considered for assignment to a linguist position. HQ DA is receiving many language proficiency questionnaires (DA Form 330) that are incomplete or incorrect. Since this form is the only source of information for the enlisted linguist master tape record, it is imperative that it be complete and correct before it is forwarded. Check the copy of DA Form 330 in your 201 file. If it is incomplete or incorrect, have your personnel officer send in a revised one. If you do not have a copy of DA Form 330 in your records, I recommend you find out why it is not there.

Special Assignments. Are you interested in a special assignment such as to a MAAG/Mission, international or joint headquarters, or DA/DOD staff agency? If you are interested in a special assignment and meet the qualifications as outlined in tables 11-2 and 11-3, AR 614-200, we need your application. See your commanding officer for a DA Form 2550, Application or Nomination for Special Assignment. Special requisitions are filled from eligible applicants who apply for special assignment, and by selecting personnel for screening under the provisions of AR 614-200. An application (DA Form 2250) is maintained on file at DA for 1 year or until requirements occur that the individual may be applied against.

Challenges of the Chaparral/Vulcan Platoon Leader

Second Lieutenant Douglas C. Wagner
Battery A, 4th Battalion (C/V)(SP)
61st Air Defense Artillery
Fort Carson, Colorado

Chaparral/Vulcan (C/V) platoon leaders occupy a very important position in the air defense artillery officer corps. With the deployment of divisional C/V battalions, our branch of service has entered the mainstream of field army activity and, because of the close contact necessary between all combat arms within the division, we are viewed with a watchful eye. The Chaparral and Vulcan systems are quite conspicuous and even the most indifferent soldier cannot fail to question his buddy with, "Hey man, what was that?" when one of the weapons goes by. Consequently, we are in the spotlight. To merely project a good image is not enough; we must also be well-trained. Our entire branch may be judged solely by the performance of our C/V platoons.

The Army's recent emphasis on decentralized training provides the C/V platoon leader with an additional challenge. Under this concept the platoon leader is the key man in the training process. Strict guidance and supervision are no longer at his call, so he must have the initiative to plan, organize, and direct training at the platoon level. Often the platoon leader's patience is sorely tried when his men are in a flux between details and training. This requires that a subject be presented several times to insure that everyone has received the necessary training. Repetitious classes have little value to those who have already had the instruction. Furthermore, morale suffers and time is wasted when instruction must be repeated.

Trying to find a workable solution to the training challenge has occupied considerable time in my battery, and several teaching techniques have been tried. Teaching classes in the motor pool was one of the first ventures. Naturally, some classes, such as loading of the system and prefire checks, necessitate the use of the weapon system. Subjects dealing with the hardware are taught most successfully when the equipment is on the weapon. Although this method provided better instruction, it did not solve the problem of personnel commitments.

So far, the best method we have experienced is to teach in the field, down range, in the "boonies," or anywhere available that is away from the daily garrison routine. If the platoon leader plans and coordinates well, it can be arranged so that while one platoon is training, the other two are accomplishing all the details in garrison. In this manner the one platoon can go to the field as a unit. Virtually all personnel of the platoon will be present until the unit returns to the motor pool. Since all the men are present, the platoon leader will have his combat organization. A great deal of training can be accomplished when a squad leader has all of his crew and can train on his own weapon. The significant advantage of this training technique is that the platoon leader can train his men to function as a team.

In addition to helping alleviate personnel problems, training in the field has other positive aspects. Instruction presented in the field gives continuity and value to related military subjects. Although prefire checks, boresighting, making range cards, and operation of the auxiliary power unit or main power unit can be taught in garrison, and the soldier may become competent in each individual skill, unfortunately he may not understand how all of these tasks relate. These same subjects taught in the field will become more significant because the soldier can readily see how each skill is needed to put the weapon system in action. Non-school-trained troops will remember more of the instruction when they can see its immediate significance and its relation to other actions. Many of the men in the platoon may be school trained, but field type instruction is still beneficial to them. While all of the individual skills are a review to them, they still profit from putting the system in operation in the field because this type of practice is realistic. In addition, the knowledgeable troops get a sense of pride and accomplishment when they can show one of the "new guys" how to do something.

The overall results of teaching in the field are good instruction, development of squad leaders, and increased efficiency of the platoon as a fighting unit.

Teaching in the field is not a training panacea for the C/V platoon leader. Many problems are still present. At times it is impossible to plan and coordinate well enough in advance to insure the best training. Conversely, planning too far in advance may prove futile if large, unexpected commitments crop up. Equipment faults may preclude a squad leader's use of his own equipment but, considering all factors, teaching in the field will work well if given a try. The challenge of training is there. It is really a great opportunity to learn military skills and work closely with the men.

If you have other suggestions that will help, your comments will be welcome.

HAPDAR - An R&D Facility

Lieutenant Colonel Martin G. Olson

Successful operation of deployed air defense systems today is the direct result of effective research and development efforts initiated 5 to 10 years ago. The capability 5 to 10 years from now to defend successfully against sophisticated ballistic missile attacks will be a direct result of the effectiveness of today's research and development efforts.

R&D leading to effective ballistic missile defense is being pursued with vigor and imagination in widely varying areas. For example, investigations are presently underway in laboratories where specialized materials are being developed for solid-state radar components and hardened antenna elements; in computer facilities where system and subsystem designs are developed and analyzed; on ballistic test ranges where various reentry vehicle models are evaluated for flight and radar reflectivity characteristics; in atmospheric tests where full size reentry vehicles enter the atmosphere at tremendous velocities and the physics of reentry is studied at the same time that actual flight performance data of that vehicle design is obtained; and on field test ranges where developmental 350+ "g" missiles are flight tested and advanced phased-array radar concepts and applications are implemented and evaluated.

One important part of this R&D program is being accomplished at the HArd Point Demonstration Array Radar (HAPDAR) remote sensor facility (fig 1) at White Sands Missile Range, New Mexico. A comprehensive article describing the HAPDAR system was published in the October 1969 issue of Air Defense Trends together with some of the early test results. Since then, major system changes have been made and the aggressive test program has been continued. This article summarizes the HAPDAR system modifications and test activities since 1969 and provides an insight into some of the BMD R&D efforts that are underway and represent a portion of the wide range of activities supported by this test facility.

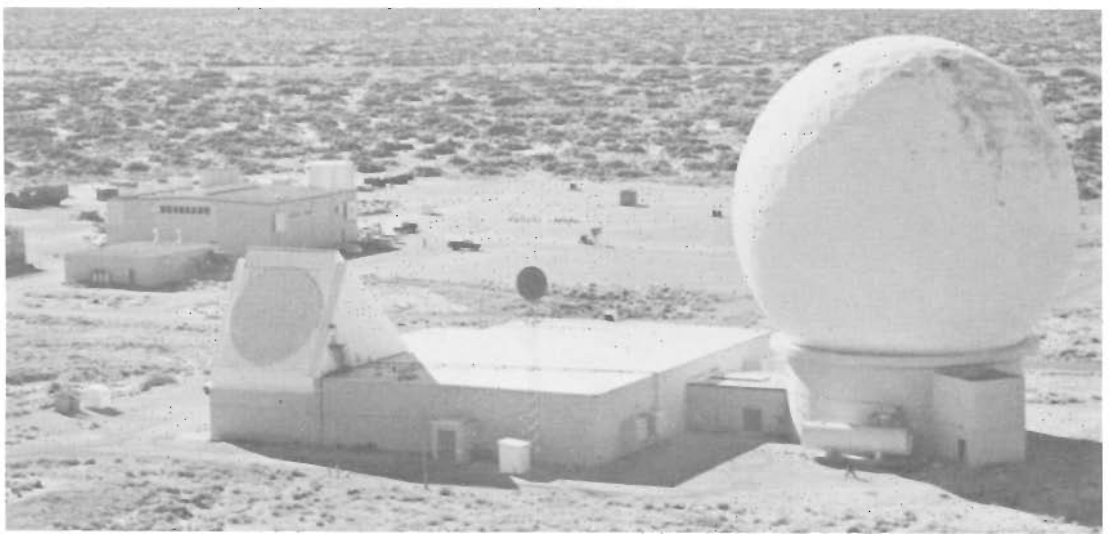


Figure 1. Hard point demonstration array radar facility.

The HAPDAR began as a radar development effort. It resulted from the realization in the late 1950's that radars employing mechanically steered antenna systems would never be able to cope with the cluttered target environments and extremely short response times associated with a ballistic missile attack. Electronic scanning techniques for fixed antennas were therefore considered mandatory developments. Early system concepts and designs of such antennas indicated that high initial costs in fabrication and continued high costs in the logistic support of systems employing these antennas would be major constraining factors in their deployment. Recognizing the need for reducing these costs without reducing system effectiveness, the Advanced Research Projects Agency (ARPA) competitively awarded the Sperry Gyroscope Division (SGD) of Sperry Rand Corporation a contract in June 1964 to demonstrate the feasibility of producing a low-cost, high performance, phased-array antenna and receiver system. SGD completed the design, development, construction, and testing of this system in January 1966. The system, known as HAPDAR, was at the time a passive, phased-array system controlled by a UNIVAC 1218 computer and capable of tracking a single target illuminated by the neighboring Nike Zeus discrimination radar.

In May 1966 the decision was made to make HAPDAR an active system by the addition of its own transmitter. SGD also won the competitive procurement to design, install, and test the transmitter. During the same period the target tracking capability was increased from a single target to five targets. This multitarget, active system was accepted by ARPA in October 1966. ARPA operated HAPDAR until mid-1968, evaluating the electrical characteristics and tracking performance of the antenna, investigating a variety of phased-array antenna technology areas, and beginning field test and evaluation of a new electronic counter-countermeasure (ECCM) technique. The HAPDAR and related programs were transferred from ARPA to the US Army Advanced Ballistic Missile Defense Agency (ABMDA) in mid-1968. ABMDA has operated HAPDAR since that time while continuing to increase the facility's testing capability.

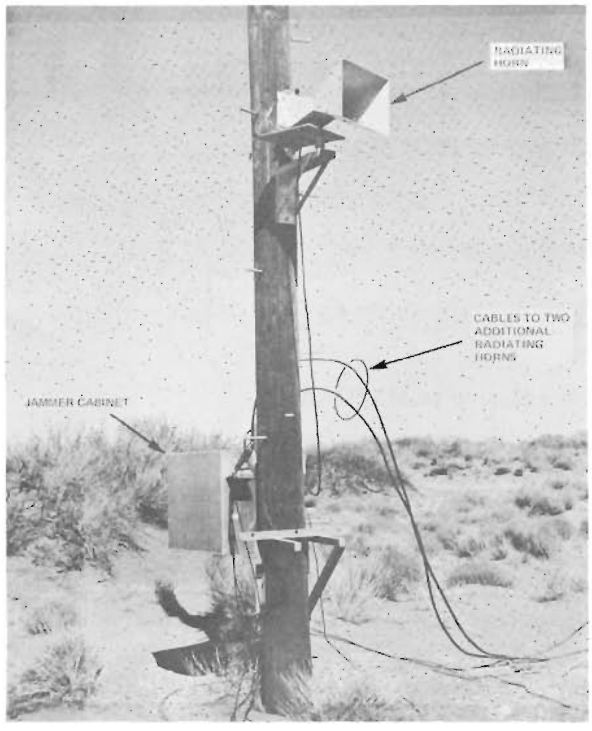


Figure 2. Pole-mounted jammer.

The HAPDAR facility has now been expanded well beyond its initial capability. The basic facility of 1969 consisted of the radar located in the Nike Zeus acquisition radar (ZAR) receiver building, and 16 pole-mounted jammer sources located in a 2,500-foot semicircle in front of the radar. Figure 2 shows one of the jammers and figure 3 shows their location relative to HAPDAR. The jammers are used to generate a wide variety of jamming environments required for evaluation of defensive countermeasures. Major additions to the basic radar facility include a high-capacity computer (IBM 360/65) installed in the ZAR receiver building and interfaced to control the radar, an integrated passive remote sensor for bistatic operation located 12 miles west of HAPDAR,

a new jammer complex located 14 miles in front of HAPDAR, and a dedicated data link with the ARPA measurement radar (AMRAD)—a range instrumentation sensor located 10 miles northeast of HAPDAR. The radar has also undergone several less conspicuous changes which have great impact on the facility's operational capabilities. Included in these changes was the replacement of the original, single-pulsewidth, soft-tube modulator supplying high-voltage pulses to an equally new klystron final power amplifier. The new modulator, when driven by a suitable waveform generator, is capable of producing a wide variety of transmitted waveforms for target discrimination and tracking tests, including monotone or coded pulses up to 30 microseconds wide, uniform bursts of from 2 to 16 monotone pulses, and short bursts consisting of monotone or coded pulse pairs of variable pulsewidth and pulse spacing. Modifications to the radar exciter resulted in a shift of the system center frequency to 1325 MHz and provided pulse-to-pulse frequency agility among eight crystal controlled frequencies located within a 100-MHz operating band. Frequency selection now can be accomplished manually from the console or automatically in one of two computer controlled modes—random or preprogramed.

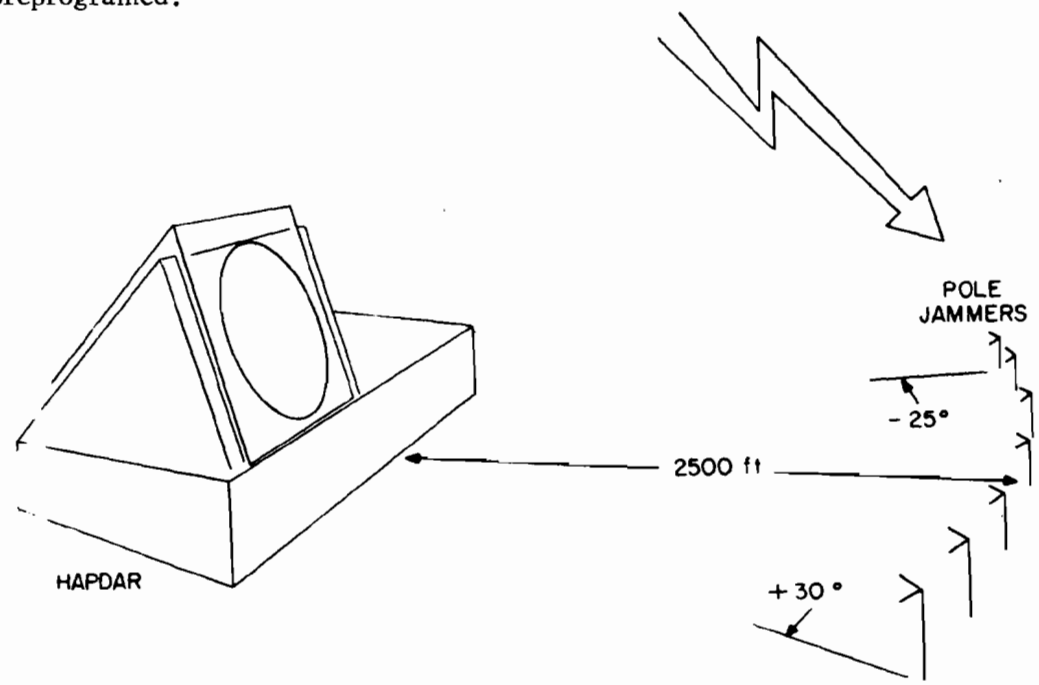


Figure 3. Jammer location relative to HAPDAR.

Additional changes included the replacement of the original video data processor (VDP). The new VDP, in conjunction with the radar-computer interface (RCI) group which integrates HAPDAR and the IBM 360/65 computer, provides the capability to acquire up to five targets on a single search pulse (previous capability was limited to one target per search pulse). The new VDP also provides computer control of the time of transmission, as well as the width and extent of the search and tracking gates. The RCI hardware contains a special feature which enhances the flexibility of the HAPDAR facility. It provides for the operation of HAPDAR by either the newly installed IBM 360/65 computer or the original UNIVAC 1218 computer while permitting the unselected computer to be available for use as a free-standing machine.

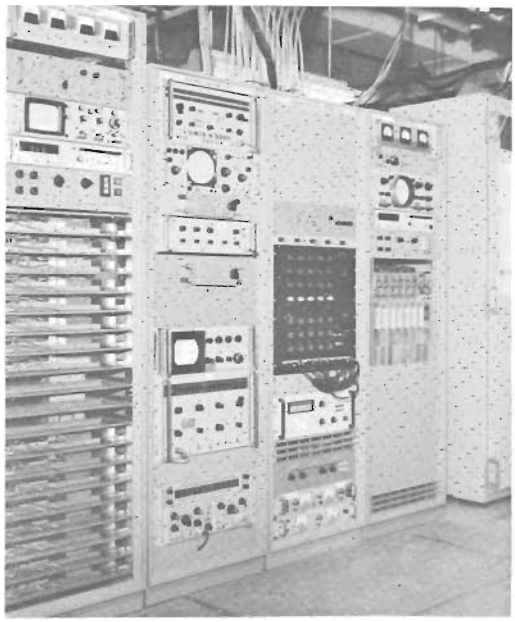


Figure 4. Advanced design multiple sidelobe canceller.

The test program at HAPDAR has been active and varied. The HAPDAR began its role as an R&D tool by supporting an ARPA ECCM program in the field testing of the multiple sidelobe canceller (MSLC) system developed by the Syracuse University Research Corporation (SURC). This MSLC technique development was initiated to offset the susceptibility of radar systems to sidelobe jamming. The MSLC program was transferred to ABMDA at the same time as the HAPDAR program. Testing of that initial MSLC design was in progress in 1969 and continued into 1970. As a result of the evaluation of data from these tests, the initial MSLC design was revised and an improved system was installed at HAPDAR in 1971 (fig 4). Comparison testing of the two designs was accomplished from 1969 through 1971 using jamming environments provided by the pole jammer complex.

In 1972 the first airborne jammers were used for testing. Initially a few aircraft-mounted jammers were employed; and later larger numbers of parachute supported jammers. The test and evaluation of this improved MSLC system was completed in 1972. As a result of the knowledge and experience gained in this program, as well as the performance demonstrated by the hardware design, MSLC systems are being installed on some US tactical, phased-array radars. Future radars, no doubt, will also include versions of the basic systems tested at HAPDAR.

A low angle tracking (LAT) program was initiated by ABMDA at HAPDAR in 1970. This two-phase development is directed at overcoming the difficulty encountered in accurately radar tracking targets within one or two beamwidths of the horizon using monopulse techniques. This difficulty results from the existence of multipath signals reflected from the earth into the antenna's mainbeam and, to a lesser extent, the major sidelobes. Successful accomplishment of this program will significantly extend radar coverage by allowing accurate tracking of targets at low elevation angles. The program, directed by Airborne Instruments Laboratory (AIL), a division of Cutler Hammer, Inc., began with a non-real time implementation of their LAT technique at HAPDAR. The first phase requirement was to demonstrate the feasibility of this technique over typical terrain since all their original LAT work had been done over water. This feasibility phase was successfully completed in 1971.

The second phase, now in progress, includes tracking tests to determine the tracking accuracy of the LAT system at HAPDAR. This second phase also includes a detailed design and cost determination for the implementation of a real time LAT system at HAPDAR.

Program success and predicted costs will certainly be key determinants in any forthcoming decision to undertake a real time system development.

A portion of HAPDAR's test activities address the problems reentry vehicles (RV) equipped with jammers pose for BMD. These vehicles create mainlobe jamming situations for air defenders in BMD just as jammer-equipped aircraft do for antiaircraft defense. Several years ago ABMDA began development of a technique to deal with mainlobe jammers in the BMD environment. This technique employs two sensors which passively track the jammers using the jammer's transmitted energy as beacons. The system, called the passive jammer location (PJL) system, was developed by SURC. It will resolve and track jammers with sufficient accuracy to allow the defense to intercept the jammers or take other appropriate action. A view of the PJL processor (during its construction) is shown in figure 5. The PJL system entered the field testing phase in the fall of 1972. One of the RONDO antennas (fig 6) from another ABMDA program has been integrated through microwave data links with HAPDAR for these tests. HAPDAR and RONDO will act as two passive sensors, and the IBM 360/65 computer will accomplish the required data processing. These tests will initially employ the new pole-mounted jammer test complex and later jammer-equipped military aircraft.

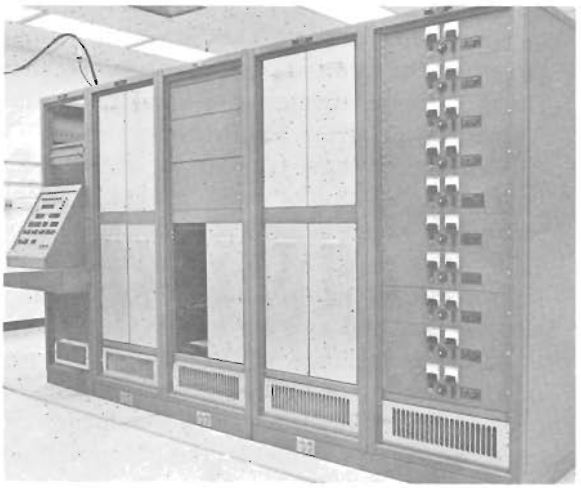


Figure 5. Passive jammer location processor (during construction).

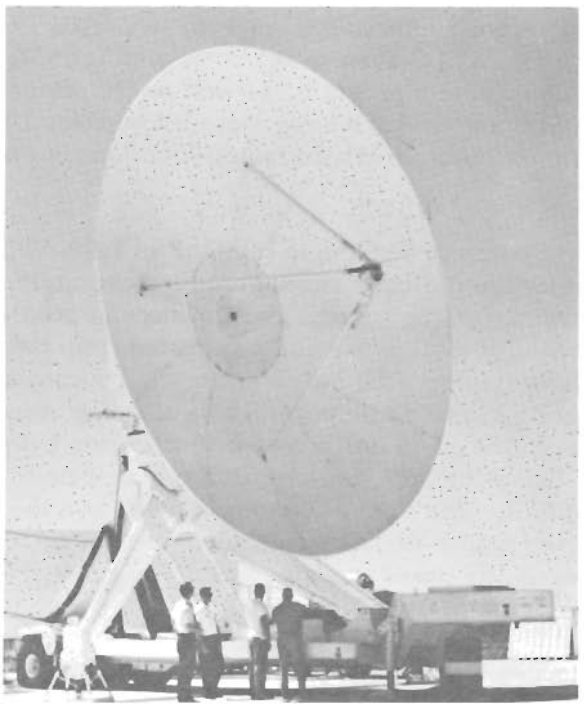


Figure 6. The RONDO antenna.

The solution to mainlobe jamming may lie in multiple sensor operation, but netted sensor operation may also provide other significant benefits for the defense. To investigate these potential benefits, HAPDAR now has a dedicated data link with a mechanically steered range instrumentation radar—AMRAD. This link allows AMRAD and HAPDAR to operate as netted sensors, and, in conjunction with Athena and Pershing missile flights into WSMR, investigations are conducted to develop and test effectiveness of target track handover techniques.

The cluttered, high-velocity target environments with which the BMD radar must cope

require highly organized and effective use of the radar's limited capabilities. Optimum use of these capabilities is realized through the implementation of efficient tracking algorithms and scheduling algorithms which allocate the radar's resources among the varied functions that the sensor must perform, such as search, discrimination, and track. The IBM 360/65 computer was brought to HAPDAR in 1971 to support tests in which a variety of such tracking and scheduling algorithms will be tested and evaluated in conjunction with Athena flights.

Although the test and evaluation effort at HAPDAR is predominantly BMD oriented, HAPDAR does support other development programs. In 1971 HAPDAR was employed to track fifty 105-mm howitzer projectiles fired cross-range in front of the radar. Most rounds were individually fired and tracked to obtain trajectory data. In several instances multiple rounds (as many as four) were fired in quick succession requiring the radar to independently track and obtain trajectory data on each projectile simultaneously. This work was done in support of the US Army Electronic Command, Fort Monmouth, NJ, and the resulting data contributed to the Army's program to develop counterbattery and countermortar radars. Also in support of ECOM, but for a different program, HAPDAR was used in 1971 to track 20-mm projectiles fired from a Vulcan gun. Single rounds, two-round bursts, and fifty-round bursts were successfully tracked.

Not all testing at HAPDAR is as system or action oriented. An investigation of the causes and modes of diode failure in the array phase shifters was initiated in 1970 and continued into 1971. Failed diodes and diodes that had not failed but had been in the array for some time were electrically and mechanically tested, sectioned by diamond saws, and microscopically examined. Data derived from this effort will lead to better diodes and improved phase-shifter reliability for future systems.

US ARMY AIR DEFENSE BOARD

U.S. ARMY TEST & EVALUATION COMMAND

FORT BLISS, TEXAS

Contribution to Air Defense

Major Donald J. Ulmer
US Army Air Defense Board
Fort Bliss, Texas

The air defense community is justifiably proud of its accomplishments in weapon development during the last two decades. The ability to actively destroy hostile aircraft has been an evolution from optically sighted guns of various caliber, through the incorporation of radar, to ever-advancing guided missile systems. Today's doctrine requires a family of weapons to defend our airspace: Redeye, Chaparral, Vulcan, Hawk, and Nike Hercules. Each has its role and complements the others. Eventually, still another achievement will be realized as Surface-to-Air-Missile Development (SAM-D) emerges on the scene.

Effective as these weapons systems are, some problem areas invariably surface as the systems undergo development and subsequent operation in the field. The proverbial concerns are: Will a gun jam if fired at maximum rate? Does a radar track effectively? Can

a missile stay together in a maximum maneuver? Do the climatic elements of extreme temperature, winds, terrain, etc., significantly detract from performance? Can the operator perform his intended functions in a capable manner without injury? One could add many more examples from operational reports and experience with deployed systems.

The US Army Air Defense Board (USARADBD) is and has been involved with these concerns. An element of the US Army Test and Evaluation Command (TECOM) with headquarters at Aberdeen Proving Ground, Maryland, the Board acts as an independent evaluator in the Army's materiel acquisition process and has the mission to:

- Plan, conduct, and report on expanded service tests, military potential tests, check tests, and initial production tests related to the suitability of air defense equipment for Army use.

- Participate in the planning and conduct of engineering tests and in the planning, supervising, and monitoring of confirmatory and troop tests as directed by Commanding General, TECOM.

- Advise proponent agencies and developers using data and information derived from test experience.

A historical sketch of the USARADBD reflects the Board's organizational character and lineage. As a direct descendent of artillery, a background can be traced to the Revolutionary War when Artillery, Engineer, and Ordnance were combined in one branch under Brigadier General Henry Knox, who was in reality the first Chief of Artillery. After the defeat of the Americans on Long Island in 1776, General Knox recommended, "That all matters respecting artillery and artillery stores be under the direction of a Board of Ordnance, whose business shall be the regulation and management of the affairs of this Department and to whom returns shall be made." This, in effect, was the first Artillery Board. However, it remained for General Order No. 6 in January 1866 to formally designate a permanent Artillery Board. Although this Board adjourned within the year, never to be reassembled, it had a far-reaching effect. The terminology of its contents remains evident today. This early Board was established to discuss and make recommendations on questions pertaining to the Artillery Arm of Service and was structured by a clause which stated, "The members shall sit on the Board, according to their rank in the Artillery, and the senior member shall be President." The Board's mission has not changed much in over a hundred years, and the title of President has remained to this day.

The documentary beginning of the existing Board occurred on 9 March 1942 when the Antiaircraft Artillery (AAA) Board was established at Fort Monroe, Virginia, from personnel and equipment furnished by the Coast Artillery Board. After 2 months in Virginia, the AAA Board moved to Camp Davis, North Carolina, and on 22 August 1944 was subsequently relocated at Fort Bliss, Texas, as a result of transfer of AAA responsibilities.

Fort Bliss has remained the home of the Board through many organizational title changes. It existed as an AAA Board until October 1945, when it was redesignated the Antiaircraft Service Test Section of an Army Ground Forces Board No. 1. With the establishment of the Antiaircraft Artillery and Guided Missile Center at Fort Bliss on 6 July 1946, another

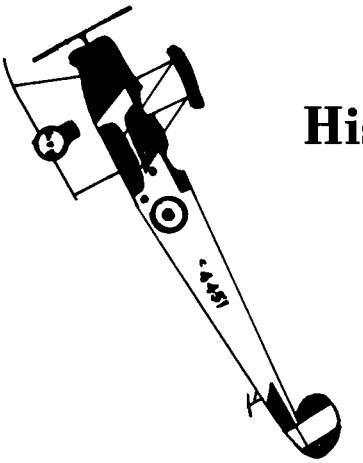
redesignation to Army Ground Forces Board No. 4 occurred. The present designation was established on 26 July 1972, when the organization became a Class II activity under TECOM.

During the period from post World War II to the Korean War, the Board was involved in a myriad of tests that depicted the air defense state of the art at that time. Examples of the testing effort included evaluations of the Mark X IFF system; various modification improvements to the twin 40-mm gun, such as the gun carriage M2A1 and winterizing kits; ammunition racks and sighting devices; mounts for the caliber .50 AA machinegun and 120-mm gun; and the modified AN/MPG-1 radar for use with the 90-mm and 120-mm armament.

The influence of the Korean Conflict and ongoing technology was evident in the decade of the 1950's. Tests continued on the twin 40-mm gun (improved turret controls; gun motor carriage T-141 and M4 gun mount modification) and on various components of the 75-mm Skysweeper and 90-mm gun. The significance of radar became apparent as tests were conducted on radar countermeasures, heating and cooling of radar/computer vans, high-altitude capability of AA radar, and UPS-1 and FPS-69 radars. Nike emergence into the air defense family of weapons became evident as projects included a surface-to-surface test of Nike, an informational test on the AN/FRC-15 in Nike I, a joint US-Canadian cold weather service test of Nike Hercules, an evaluation of Nike Hercules antijam display, various items of handling equipment, and the firing simulator and an Improved Nike Hercules inter-area communication system.

From the 1960's to the present, the US Army Air Defense Board has insured that new air defense materiel and modifications to existing systems are suitable for use in the field. Sometimes the items under test fail; sometimes they pass; and more often they get a tag stating, "Okay after deficiencies and other discrepancies are corrected." From 1962 to 1971, 108 classified test reports have been published and are on file in the Defense Document Center. Systems and components of Nike Hercules, Hawk, Vulcan, Chaparral, Redeye, interrogation equipment, fire distribution facilities, and various foreign weaponry have been viewed in various stages of test planning, conducting, and reporting.

Throughout its distinguished history, the US Army Air Defense Board has been characterized by technical proficiency and professional excellence. The members of the Air Defense Board, military and civilian, will continue to strive for the highest standards in test and evaluation so that the motto of Army Materiel Command, "Arsenal of the Brave," will be upheld and that it will be stockpiled with potent, capable air defense modifications, equipment, and weapon systems.



History of Air Defense

Editor's Note:

In this installment we see the beginning and development of a continental United States air defense system. As the system evolved, numerous problems arose that required joint service effort to solve. We also see how concepts and doctrine developed in building home air defense proved valuable in oversea deployment during World War II.

The United States did not keep pace with European countries in the early development of air defense. Although the Army Air Corps, Signal Corps, and Coast Artillery Corps had attempted to develop doctrine, procedures, and new equipment, the United States had not developed an air defense system as late as 1939. Based upon recommendations by General H. H. Arnold, the War Department, on 26 February 1940, authorized the activation of an Air Defense Command at Mitchell Field, New York, under the command of Brigadier General James E. Chaney.

This new command, with its small staff of Air Corps, Signal Corps, and Coast Artillery Corps officers, was charged with studying the entire air defense problem and exploring methods of defense for cities, bases, industrial areas, and armies in the field. Its first test came during the First Army maneuvers in 1940 when, for the first time, pursuit planes, antiaircraft artillery, and a warning service operated under one commander to defend a United States field army. In January 1941 the newly formed Air Defense Command conducted a test of air defenses in the northeastern urban area, including a warning service stretching from New York to Boston with more than 10,000 volunteer observers manning 700 observation posts. In both exercises new SCR-270 radars were used, and radar plots and spotter flashes were passed to information centers from which planes were alerted and vectored via high-frequency ground-to-air radio.

General Chaney was sent to England in the fall of 1940 to study the British air defense system then being used against German attacks. Although impressed by the British organization, techniques, and equipment, he recognized that such a single integrated system would not meet United States needs and recommended instead a number of independent defense networks to defend strategic areas. The Air Corps stressed that full responsibility for air defense should be concentrated under one command—an air command.

In February 1941 responsibility for air defense was assigned to GHQ Air Force, later redesignated Air Force Combat Command, which controlled the four continental air forces. A new interceptor command was established by each continental air force to take over the functions of the Air Defense Command, including control over aircraft warning services and antiaircraft units in its area. Shortages of personnel and equipment necessitated priority going to the coastal areas, and only the First Interceptor Command in the northeast and the Fourth Interceptor Command along the West Coast were given an operational air defense role. The Second and Third Interceptor Commands had only training missions.

The Air Corps and Coast Artillery could provide only a small increment of the planes and antiaircraft units required by these commands by the end of 1941. Progress was made in setting up the warning system which also served to alert the Civil Defense System, and work had begun on 15 information and 21 filter centers in priority regions along both coasts. By the end of 1941 only eight stations were fully operational: two on the east coast and six on the Pacific coast.

The Japanese attack on Pearl Harbor gave impetus to rapid expansion of the air defense systems and led to establishment of the Eastern and Western Defense Commands as theaters of operations, with control over the air organizations within their areas. The interceptor commands (redesignated fighter commands in May 1942) were further divided into regions, each of which was served by one information center of the aircraft warning service net. When fighter units were assigned, the commanding officer of the fighters became regional commander and chief controller of the three air defense elements: Air Corps planes, Signal Corps warning units, and Coast Artillery Corps antiaircraft units. He also regulated air traffic, blackouts, and radio silence.

Steps taken starting in 1942 laid the basis both for a strong continental air defense system and for an efficient system for controlling fighters in offensive combat operations. Research undertaken by the MIT Radiation Laboratory helped raise United States radar techniques to engineering and tactical levels unequaled by any other nation. Particularly significant was the development of microwave radar, which was operational by mid-1944 in time to assist in the invasion of Europe.

By early 1943 plans had been approved for a series of VHF fighter control areas along the entire west coast and along the Atlantic coast north of Norfolk. Under this plan, regions were subdivided into control areas and in each area a fighter control center maintained a separate operations board to direct interceptions. The area board displayed the warning data supplied by the aircraft warning service plus information on friendly planes supplied by the VHF net.

The principal fighting agents of air defense, fighter interceptors and antiaircraft artillery, were critically short when the United States entered the war. Antiaircraft units were organized into two antiaircraft artillery commands, one assigned to the Eastern Defense Command and one to the Western Defense Command. The antiaircraft commands were placed under the operational control of the interceptor commands, but were assigned to defense commands for training, tactical disposition, supply, and administration. The commands were subdivided into brigades (one per air defense region), which were subdivided into regiments and later converted into groups.

Effective coordination and control of guns and planes proved to be a difficult problem. By 1943, Army doctrine had accepted the tenet that operational control of antiaircraft artillery, when operating in the same CONUS area with aviation, should be given to an air commander responsible for the area to unify overall air defense efforts.

The continental air defense system performed valuable service as a testing ground and training ground for air defense concepts and doctrine which were employed successfully in oversea theaters and served as a basis for the system in use today.

From their entrance into the war, the United States air defense forces continued to benefit from the experience our British allies had gained during the Battle of Britain, defense of Malta, defeats in Greece and Crete, and African desert campaigns. Air defense doctrine, organization, and operational control reflected many adaptations of British experience.

Plans for the Allied invasion of North Africa charged task force commanders with air defense of their assault areas, other than for fighter defense. Antiaircraft defense was to be supplied by the antiaircraft battalions assigned to the assault divisions. Three aircraft warning battalions, to be landed with the assault troops, were to establish air warning nets for the Twelfth US Air Force and XII Air Support Command. The arrangement did not provide for central command authority over the various air defense elements.

The landings began on 8 November 1942 against meager opposition, and the few enemy air attacks caused little damage. As Allied forces moved inland, enemy air action soon increased and forward airbases received frequent bombings. Following completion of the assault phase an Antiaircraft and Coastal Defense Committee was formed to study and recommend allocation of fighter aircraft to ports and escort duty; antiaircraft to ports, airfields, and coastal regions; and needed detection and warning devices.

General Doolittle, Twelfth Air Force commander, continued to press for the assignment of all air defense weapons to the air defense wing in whose area the weapons were operating. The AAF strongly recommended that antiaircraft and fighter aircraft as weapons of air defense be under a single command. The AAF lost this round of the crusade for control, and antiaircraft units remained under the command of a ground force officer.

The Northwest African Coastal Air Force (NACAF) was the principal Allied agency for air defense—other than antiaircraft artillery—behind the combat zone. NACAF had major additional functions of air-sea reconnaissance, antisubmarine air operations, antishipping operations, and (in cooperation with naval authorities) air protection for friendly shipping. Thus, responsibility for air defense was divided between ground force and air force commanders, both of whom had other responsibilities.

As the Allied ground forces advanced, the area of responsibility of NACAF increased. RAF groups, because of their combat experience and mobility, normally were assigned to the forward sectors while the AAF operated in the quieter regions. By April 1943, the NACAF territory was divided into five areas. The RAF 323 and 242 Groups, with headquarters at Algiers and Souk Ahras in eastern Algeria, respectively, operated the two most exposed sectors. The 1st Air Defense Wing (Casablanca) and the 2d Air Defense Wing (Oran) remained in the original invasion areas, while the 3d Air Defense Wing operated

under XII Air Support Command with the II US Corps in central Tunisia. As the front moved forward, the two RAF groups advanced, turning over their old areas to the 1st and 2d Air Defense Wings.

In mid-May 1943, when organized Axis resistance in North Africa terminated, the area of responsibility of Coastal Air Force was extended to the Tunisia-Tripoli border. The 1st Air Defense Wing was moved up to the Sousse-Sfax area and the 2d Air Defense Wing took over the Algiers sector, both turning over their old areas to two newly-organized provisional commands, the 2688th and 2689th Air Defense Regions. The Coastal Air Force area of responsibility included the air defense of ports and assembly areas used to prepare the invasion force for assaults on Sicily and later Corsica, Sardinia, and Italy.

On 1 May 1943 the Allied Force Headquarters established uniform control of antiaircraft operations and provided rules of engagement to antiaircraft units (Air Defense Instruction 1, effective 2 July 1943). These instructions established restrictions covering fighters and antiaircraft fires over designated areas. Areas which could be defended best by antiaircraft were designated as inner artillery zones over which operations of friendly aircraft were prohibited and AA weapons were free to fire on all intruders. Less important areas protected primarily by AA guns were designated gun defended areas (which friendly aircraft should avoid but could overfly by identifying themselves) in which the AA guns were free to fire only on aircraft identified as hostile or committing hostile acts. For friendly airfields, the rules were similar to those of the gun defended area, with the airfield commander having responsibility to order withhold fire or cease fire, to prescribe the type fire to be used, and to prescribe flight instructions for friendly aircraft.

With the increase in Allied airpower and the consequent reduction in the strength and effectiveness of the German Air Force, reductions in antiaircraft in the Mediterranean became possible and were recommended by the Mediterranean Antiaircraft Advisory Committee, first on 11 April 1944 and again in June of that year. By January 1945 only two American gun battalions and three automatic weapons battalions were operating with the Fifth Army in Italy.

By August 1944 the danger of Axis air attacks on North African ports had disappeared and the threat to Corsica, Sardinia, and to Allied convoys in the Central Mediterranean was greatly reduced by the Allied landings in Southern France. Therefore, on 1 September 1944, all United States units were withdrawn from the Coastal Air Force. By November, the Mediterranean Allied Coastal Air Force, with all United States units withdrawn, was performing all air defense functions in the Mediterranean theater as well as defending Southern France from air attack to a line 40 miles north of the coast.

In the 2 years that United States forces had operated in the Mediterranean theater, USAAF pilots claimed 125 enemy aircraft destroyed, 31 probably destroyed, and 144 damaged. During the same period, United States antiaircraft gunners claimed 1,127 enemy aircraft destroyed and more than 253 probably destroyed. These figures do not indicate the number of enemy aircraft forced to jettison their bombs, abandon their targets, turn aside to secondary targets, or which failed to hit their targets due to antiaircraft fires and fighter actions.

The United States air defense operations in North Africa followed a normal pattern except where the particular nature of the operation forced changes. The ports where the units landed, and from which they proceeded inland, became vital points on their lines of communications. The airfields from which the fighters and bombers operated were focal points of German attack. Consequently, the major air defense efforts were at ports and airfields, defense against German reconnaissance aircraft, and defense of Allied convoys in the Mediterranean.

During hours of darkness the ports were defended solely by antiaircraft artillery supported by searchlights and barrage balloons. The main airfield defenses were the night fighters with airborne radar and controlled by ground radar, supplemented by some antiaircraft guns. When the Allied night fighters were brought up to strength, the airfield attacks diminished.

The radars and aircraft in the Mediterranean theater were using the British Mark III interrogator (IFF) for identification of radar plots. Due to the geographical layout and the sea area approaches, identification of the many radar plots became a critical factor. The system used was subject to much criticism, and the results obtained eventually caused its relegation to a status of nondependence. (The Thirteenth US Air Force at Morotai (SWPA), utilizing the US Mark IV IFF equipment which was very similar to the British Mark III, did make their equipment work.)

The convoys from Gibraltar, a necessity for the supply of Allied forces in the Mediterranean area, became a focal point of attack by the German Air Force. After being driven from North Africa the Luftwaffe continued attacks from Sardinia and Sicily. After these places fell, the Germans shifted their air force to southern France and continued the attacks on Allied convoys which were protected by the ships' antiaircraft and Allied fighters.

An Evaluation of the Air Defense Weapon Systems Qualification Program (Expert Missileman Examination)

The Air Defense Missileman Qualification Program has been frequently criticized, misunderstood, and misused; more often, it has simply been ignored. In contrast, other Army skill programs appear consistent in purpose, goals, and function. It is this inconsistency that provided the impetus for an evaluation of the program.[1] The expert missileman examination was evaluated because it encompasses the two lesser examinations (first class and second class). Three major questions were asked and the answers were evaluated:

1. Is the program used? (Do personnel participate, and if so, to what extent?)

2. Does the program reflect those skills that are actually used in accomplishing the air defense mission?

3. If the program works and if it is worthwhile, how can individuals be encouraged to participate?

The expert missileman examination is intended to test the soldier's overall knowledge of materiel and techniques in a particular air defense artillery weapon system, the individual's ability to exercise tactical control, and his ability as an instructor. This examination is open to persons assigned or attached to an air defense artillery unit, or to persons in training for, or anticipating, an air defense artillery assignment. The criteria for testing and evaluating candidates for the expert missileman qualification are based on the guidelines set forth in FM 44-19, Qualification Program—Air Defense Artillery Weapon Systems. Qualification is based on the attainment of 75 points out of 100 taken from the following tested areas: general subjects, maintenance and maintenance management, and technical subjects.

The examination allocates approximately 30 percent of its weight to common subjects that are applicable to all candidates; e.g., communications doctrine, internal wiring diagrams, map reading, and organization of air defense forces. Forty percent of the test is allotted to materiel and maintenance subjects. The maintenance questions are deep and all-encompassing, requiring detailed explanations and block diagrams in such areas as missile system components, warhead and guidance sections, radar functional diagrams, and proficiency in performing complex weekly system checks. The tactically oriented areas receive approximately 30 percent of the total remaining point value and stress tactical employment and tactical control ability. From the preponderance of technical questions and weighted point values in these areas, it appears that an Expert Missile Technician Badge should be substituted for the Expert Missileman Badge.

To determine the validity and applicability of this weighting system and the test as a whole, a survey was conducted to equate actual onsite involvement in the tested areas to

[1]Conducted by Captains Roger J. Cerne; James J. Cravens, Jr.; Donald A. Gibson; Raymond S. Stefanowicz; and Malcolm J. Symons of Air Defense Artillery Officers Advanced Course 2-44-C22, No. 6-71.

their assigned point values, and to determine the applicability of the test to the candidate's onsite functions.[2]

The survey indicated that of the average working day, 30 to 35 percent of the time is spent on non-air defense or non-mission essential tasks; e.g., site beautification, parades, inspections, etc. The remaining percentage of time is devoted to mission oriented pursuits in which the officer concentrates on tactics and tactical control and the enlisted man concerns himself with maintenance and maintenance training.

From these findings it was concluded that the average officer is not competitive with enlisted men in the field of detailed maintenance or maintenance management, while the average enlisted man is not as well versed or as proficient in the tactical control aspects of air defense weapon systems as are officers.

To amplify the survey, queries were made of air defense headquarters throughout CONUS concerning their percentage of qualified missilemen; however, these statistics were not available from a majority of commands. This lack of response supported the assumption that the missileman qualification program is not given sufficient emphasis and is not considered an integral part of air defense training or operations.

Based on the survey, other statistics, and group analysis, the following conclusions are made:

1. The Expert Missileman Qualification Program is functional, but participation is limited. Furthermore, the program is not adequately publicized nor uniformly administered, and its use is largely dependent upon command emphasis.

2. The program is realistic, but it is not designed for officers and senior grade NCO's. In addition, it is not familiar to the troops and it is not related to daily training and activities. In the case of officers, the examination gives extremely heavy weight to detailed maintenance procedures while the officers' assigned tasks as supervisors require maximum emphasis and skill in command and tactical areas.

3. There is low positive incentive in the program and little encouragement for individuals to increase skills via the program. Insignificant distinction between expert and other classes and lack of recognition in unit newspapers and ceremonies are prevalent.

Considering these weaknesses, the following recommendations are made:

1. The qualification program should be integrated into training. By its nature the qualification program readily measures training, yet is often strangely divorced from it. This is especially relevant in the case of a newly forming unit. An example is a case where several units undergo extensive training and then, as an afterthought, establish a qualification program. Why not qualify through training?

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[2]This survey was disseminated to members of the 11th Artillery Group (formerly 6th Artillery Group), 15th Artillery Group, and Air Defense Artillery Officers' Advanced Courses, 2-44-C22, No. 5-71 and No. 6-71, at Fort Bliss. Dissemination covered a varied spectrum of experience and time in service. Since the survey was restricted to qualified missilemen and because the sample was relatively small, there were recognizable limitations to its significance.

2. Separate point weights should be established for officers and enlisted men to provide a closer correlation between normal job performance goals and the defined goals of the qualification program.

3. At the commander's discretion, point credit should be given in those test areas where the individual has demonstrated excellence during other tests; e.g., proficiency pay, annual service practice, and operational readiness evaluations. This would allow the examination to recognize outstanding performance in the everyday environment. At present it is possible that an individual can attain the highest score on his proficiency pay test, assist in obtaining a near perfect annual service practice score, and excel in all tactical evaluations, training tests, and readiness evaluations and still not be rated an expert missileman. It is proposed that such demonstrated excellence be rewarded. For example, an NCO earning proficiency pay as a defense acquisition radar mechanic (MOS 24P) has performed exceptionally on a test requiring intense knowledge in emplacement and operation of acquisition systems, use of integrated equipment, maintenance of equipment, use of unit and functional schematics, and administration and supply. These well-defined areas can and should be correlated with similar areas on the expert examination.

4. Greater emphasis should be placed on positive incentives such as the awarding of promotion points and the creation of a truly distinctive badge. The current Army promotion system for E5's and E6's is composed of a total of 1,000 points. Awards and decorations, as a separate category, is allotted a maximum of 50 points. An example of some of the points allotted in this category are: Good Conduct Medal—4 points, and Army Commendation Medal—8 points. Because the Expert Missileman Badge requires a high degree of skill, expertise, and time to acquire, it should be included in the awards and decorations category and given a weight of 4 points. This weight would compare favorably with the Good Conduct Medal and is based on the requirements each holds for attainment. Furthermore, there is a definite need and precedent for a unique and recognizable Expert Missileman Badge. There is a readily identifiable badge for the Expert Infantryman, Expert Medic, and Expert Driver, but the Expert Missileman is but another bar for the basic trainee's rifle badge. Essentially, an afternoon at the rifle range is being equated with months of concentrated effort.

Each of these recommendations stands alone. Together, their implementation would increase participation in the program and create a corresponding increase in air defense knowledge and professionalism. This is the true value and need of the program.

Editor's Note:

The current FM 44-19 is strongly maintenance oriented but this inconsistency is being corrected by revisions now in process. Separate FM's are being written for each air defense system. Although FM 44-19-1, Air Defense Artillery Missileman Examinations (Nike Hercules), is basically oriented toward operators, it contains a sufficient depth of material that can be used to qualify officers and senior NCO's as basic, advance, and expert missilemen. Individuals can be encouraged to participate by requiring missileman qualification as a prerequisite for superior performance or specialty pay. AR 672-5-1 authorizes commanding officers to issue certificates of achievement. Suggestion for changing the AR, to include an expert missileman badge, should be submitted to Headquarters, Department of the Army, with a proposed design of the award.

The Deployment of FAAR in the Field Army Division Area

Editor's Note:

This article was written by a team of students from 2-44-C22 Course, class No. 2, 1972, consisting of Captains R. W. Feiszli, M. H. Kimmel, T. H. Payne, W. B. Raines, and W. J. Williams.

In the near future the forward area alerting radar (FAAR) will be fielded to provide early warning for forward area weapon units. The purpose of this article is to propose possible defensive deployment concepts for FAAR. Three methods of control (centralized, decentralized, and composite) are developed and the advantages and disadvantages of each were considered.

In determining the best radar employment for a given situation, the division air defense officer must consider many of the same factors that apply to air defense weapons: mission, air threat, ground threat, terrain, weather, communications, and the division commander's priorities. However, certain factors peculiar to FAAR must also be considered. These factors are constant and apply to each of the three employments. One is the FAAR platoon itself which is composed of only eight radars and is organic to the Chaparral/Vulcan (C/V)

battalion. Another is FAAR physical characteristics such as weight (4,413 pounds), which makes it capable of being air-lifted. There are also these technical considerations:

- The FAAR site location should be selected to insure radar coverage and accessibility and have no more than 10° incline.

- The location must have radio line-of-sight to the fire unit's target alert data display set (TADDS) that receives alerting information from the FAAR.

- Locally generated interference such as tactical generators must be avoided.

- The range of the FAAR for planning purposes is 19 kilometers.

- Prescribed maintenance will be required periodically and therefore must be planned.

In addition to the foregoing technical considerations are these tactical considerations:

- Current guidance is that the FAAR should be no closer than 2 kilometers to the forward edge of the battle area (FEBA) and yet as far forward as possible.

- Radar coverage should be overlapping to insure effective coverage. In this regard, systems placed no more than 17 kilometers from each other will achieve adequate area coverage.

- To enhance security, efforts should be made to choose defensible terrain and to use existing defense perimeters when possible.

- When applicable, FAAR coverage should be used to fill Hawk radar gaps.

- Alternate sites should be used, depending on the combat situation, because FAAR will be an inviting target.

- Alternate radar frequencies should be available and used to avoid jamming. FAAR has a 17-frequency capability.

At this point it is appropriate to state the following assumptions:

- The C/V assets will be primarily deployed, if consistent with the division commander's priorities, along low-altitude routes of approach into the division area.

- The average division front will be 30 kilometers.

- The priorities for the FAAR's mission will be as stated in FM 44-1, namely, C/V fire units and then Redeye.

- The system will be used only during those hours when the weapon systems it supports are in operation.

Under the concept of centralized control, the division C/V battalion deploys and controls all eight radars and associated maintenance equipment to provide area and/or sector coverage for the entire division.

Area coverage means placement of the radars to achieve overlapping coverage throughout the division area. Sector coverage, on the other hand, refers to coverage that is weighted primarily along low-altitude routes of approach or other such vital areas, with possible sacrifice of full area coverage. This type of coverage may be mandatory in areas of extremely rough terrain where terrain masking and requirements for low-altitude route coverage may render the achievement of full area coverage impossible.

To provide the early warning required, the battalion could deploy the radars singly. This would achieve the area coverage required to support Redeye fire units and Vulcan point defenses and still provide sector coverage support to the Chaparral units employed along low-altitude routes of approach. Priority of coverage would go to the C/V units, based on the division commander's air defense priorities. Radars not required to complete this coverage would be held in reserve as floats. These radars may then be used to replace deployed radars that malfunction or require other maintenance. They may also be used to relieve deployed radars that are displacing from one location to another. The locations and frequencies of all radars would be tabulated at battalion headquarters and distributed to all air defense fire units in the division to enable them to tie into the radar that could best support them.

Some problems inherent in this deployment can be foreseen. The time required to replace an out-of-action radar could be great, thus requiring that a deployed radar remain on the air at one location for considerable time. This would greatly increase that radar's vulnerability to attack by enemy air and indirect artillery fire. Additional difficulty may be encountered in meeting the minimum 6-kilometer noninterference distance due to the number of radars radiating simultaneously. These problems could be alleviated if the battalion deployed the radars in pairs. Only one radar per pair would radiate at a given time and while one radar was radiating, the other would be displacing to an alternate position for operator checks and maintenance. When the second radar began to radiate, the first radar would move.

The centralized method has several advantages. Balanced coverage of the division's air defense priorities is easier to achieve when coordinated at the divison level by the C/V battalion headquarters. The radar locations could be readily listed and all fire units, C/V and Redeye alike, could be quickly informed. Positive radiation emission control at this level would preclude interradar interference. Radar assets can be more readily conserved, thereby insuring that operational replacements are readily available. Continuous early warning during displacement can be assured, and frequent displacement required to avoid enemy detection, particularly near the FEBA, would be much more feasible. Finally, centralization of maintenance personnel is mandatory due to their few numbers. Under the centralized concept, this is accomplished with no alteration of the currently proposed organizational structure.

Decentralized employment of the FAAR in the defense of the field army division is not a totally new concept to military doctrine. The primary reason for this technique is to accomplish more fully the primary mission of FAAR—providing data to the Chaparral and Vulcan fire units.

Decentralizing the command and control of the FAAR simply means placing the radars at a command level lower than the C/V battalion. By collocating them with the fire units, better security would be possible.

The collocation or pairing of FAAR with Chaparral and Vulcan tracked vehicles would result in logistical and mechanical maintenance benefits.

When actual fielding of the FAAR is accomplished, these and many more advantages will be realized.

A third method of employment is the composite method. In the composite method two FAAR's would be located at the C/V battalion headquarters, along with their small maintenance capability as presently authorized in the FAAR TOE. Distribution of the other six radars would be: two per Chaparral battery and one per Vulcan battery. The composite method would require additional maintenance personnel and equipment upon deployment of FAAR in the field Army. With two FAAR's at the battalion headquarters, first priority would go to sector coverage in the division front primarily along low-altitude approaches into the division area. Second priority would be to supplement area coverage for the division front, particularly to extend radar coverage forward of the FEBA. Coverage to Redeye teams would also be included. Third priority would be to relegate the two FAARs to the role of C/V battalion floats. This priority enhances the maintenance capability of the system.

The composite method has the advantages of security and responsiveness because the two radars under battalion control are within its grasp of command. With two radars under its direct control, the battalion has a greater responsiveness than under the decentralized method.

Maintenance would also be more efficient under this system, keeping the expertise at battalion headquarters and sending out contact teams to maintain the other six radars.

In considering the centralized method it was found that battalion control allowed for a more coordinated air defense effort and generally would be preferred if the division commander desired complete radar coverage of his division area. In addition this method conserves radar assets and allows more than adequate backup radars and time for maintenance. However, this method tends to cause the fire units to adjust to and respond to positioning of the FAAR radar rather than the FAAR being responsive to the tactical needs of the fire units. Also, movement and positioning of FAAR's to react to changing battalion level coverage priorities would be on a FAAR section basis and would not allow for movement and emplacement security. In addition, typically only three or four of the eight radars would be in use at a time which appears to overconserve assets.

The composite method appears to somewhat solve the responsiveness question and also provides the battalion commander with resources to replace lost or inoperable radars or to respond to additional radar requirements imposed by the division commander. This second advantage is somewhat degraded by the time lag expected for replacement by floats and the need for the radar to proceed from point to point without any means of security.

The decentralized method, while not providing any reserve or float capability, seems to be the best method in terms of tactical, organizational, and support considerations and is recommended over the other two.

From a tactical point of view the decentralized method places FAAR assets where the FAAR can best accomplish its mission: at the fire unit. The battery commander can determine optimum sites for his weapons based on their function and then position FAAR to support them. Any moves required by FAAR will be made as a part of the Vulcan or Chaparral battery or one of its platoons, thus providing built-in security. Radar backup is provided to some extent at battery level. Organizationally, this plan eliminates the FAAR radar platoon at battalion level and provides radar sections at each battery. The only real drawback to decentralized control appears to be some maintenance considerations. Under current strength levels not enough maintenance personnel are assigned to provide a capability at each radar section. If additional personnel cannot be authorized, it is suggested that the battalion headquarters battery have a FAAR maintenance section that will provide organizational maintenance on a periodic and contact team basis to deployed batteries.

It is to be expected that with the maintenance capability at battalion headquarters level, some extended downtime periods will occur. However, it must be remembered that the radar is an adjunct to, rather than an integral part of, the weapon system. Radar downtime does not mean system downtime or air defense gaps; and in this light, while still critical, it is not an overriding factor. In addition this radar is assumed to operate only at those times during which the supported weapon systems operate.

Air Defense Artillery Officer Advanced Course Electives Program

Editor's Note:

Air Defense Artillery Officer Advanced Course students are now offered a challenging electives program designed to complement the long-range educational plan recently implemented by the Command and General Staff College. Electives include both military and college courses. Here is a complete description of the program, including a tentative list of electives.

The electives program within the 2-44-C22 course curriculum evolved as a direct result of the Haines Board study. The Board, established by the Department of the Army to review the curricula and operating procedures at service schools that conduct courses of instruction for officers, recommended the development and introduction of an electives program into all officer advanced courses.

Officer students at Army service schools vary widely in intellectual capacity, motivation, and experience. The elective program is designed, therefore, to enhance the professional competence and the intellectual development of the student.

The program encompasses two basic areas of study—military electives and college electives. Each student must participate in two military elective subjects and at least one college elective subject within the course curriculum.

Military electives are taught concurrently with the course curriculum. US Continental Army Command (CONARC) has designated certain military subjects as progressive, common, or local-type electives. The progressive electives are those successfully completed at the advanced course level and which can be pursued on a higher level at the Command and General Staff College. Elective subjects so classified are Automatic Data Processing and Operations Research/Systems Analysis. Common electives are developed by a proponent agency and are made available to schools that conduct advanced courses. Schools will determine the actual use of the common elective material. Common electives in the C22 course are Communicative Arts, Insurgent Warfare, and Logistics Management. Local electives are those subjects that further the mission of a particular school. Electronics is offered as a USAADS local elective.

Army Aviation is available to USAADS C22 students as a military out-of-course elective. It is offered through extension subcourses obtained from Fort Rucker, Alabama. This 54-hour course covers staff organization and procedures, Army Aviation in special operations, aviation maintenance and supply, communications, aeromedical evacuation and armed helicopter fire support, airmobile operations, aviation field exercises, aircraft accident prevention, and the Army air traffic regulation system.

College electives are offered as part of the advanced course curriculum. These courses allow the student to pursue specific areas of interest at the graduate and the undergraduate level. Tuition for college courses offered within the structure of the C22 course is paid by USAADS. (Students do not incur a service obligation.)

Students will be polled prior to their arrival at USAADS, and college electives will be scheduled according to the results of the poll. The process will be repeated for each new class.

Elective grades are not considered when academic standings in the advance course are computed; however, failure of an elective or attending a course on a no-credit basis will prevent a student from qualifying as the distinguished or honor graduate or from ranking on the commandant's list. A grade slip will be furnished upon completion of any elective subject in the program. Faculty advisers will be notified of the grade for counseling purposes. After a student completes all electives, a transcript will be forwarded to the Academic Records Division, Office of the Secretary, US Army Air Defense School, Fort Bliss, Texas 79916, for inclusion in the student's academic report to the Department of the Army.

A guidance board composed of qualified personnel provides career counseling for students. The purpose of the board is to approve or to determine the ability of each student to pursue elective studies based upon his career achievement goals and core curriculum proficiency. If a student's course work suffers because of an overload of electives, the board will determine whether the student should withdraw or continue in the program. In the event of a withdrawal, an appropriate remark will be entered in the student's academic report to the Department of the Army. The board also provides effective liaison between the student and the Air Defense Artillery Branch, Department of the Army Personnel Center (DAPC). Career counseling by the board and by DAPC representatives concerning future assignments and career goals and patterns will be accomplished during the student's residency at USAADS. Once an elective term starts, students cannot change courses without approval of the student guidance board.

New Mexico State University will award graduate or undergraduate credit to ADA advanced course students who successfully complete the elective courses, if the student meets all criteria for enrollment in the university.

Students who wish to pursue academic programs that cannot be satisfied through courses offered in the regular elective curriculum may, upon approval, enroll in courses at local colleges, such as the University of Texas at El Paso or New Mexico State University. Arrangements for such courses are the responsibility of the individual officer and there must be no conflict with scheduled advanced course activities. Fees and tuition costs are also the responsibility of the individual; however, tuition assistance may be requested through the local education center.

MILITARY ELECTIVES

Insurgent Warfare. Provides the student with a comprehensive background of the causes of insurgent warfare through study of selected countries that have experienced revolutions. The countries studied are Russia; Latin America, to include Cuba, Guatemala, and Venezuela; Africa; Asia, to include China, The Philippines, Malaya, and Vietnam; and any other country in which conditions indicate that revolution is imminent.

Logistics Management. Provides the logistic-oriented student with a progressive, in-depth knowledge of the CONUS wholesale logistics system and its relationship to the retail logistics

system by continuation of basic instruction presented in the regular curriculum. Provides the student with a general knowledge of logistics management to include management practices, procurement, inventory and stock control, maintenance management, and financial management.

Communicative Arts. A study of the basic principles of writing; organization of material; military research emphasizing the use of the library and reference filing systems; staff writing procedures, to include preparation of the staff study and preparation of speeches and briefings, including notes for oral presentations; fundamentals of speech and speaking techniques; and practical exercises in writing, briefing, and other oral presentations.

Automatic Data Processing. The student receives instruction on the purpose, generation, and use of internally stored instruction (program) governing the operation of general purpose digital computers. He also learns about the functional operation of the central processing unit (CPU), to include arithmetic logic, storage and control units operation, use of computer console, and machine and symbolic language programs; and a detailed discussion of formula translation (FORTRAN) programing, to include elementary concepts, input-output statements, binary functions, and subroutines for generation of FORTRAN programs. He also receives information on elements and procedures of beginners all-purpose symbolic instruction code (BASIC) language programing, to include formats and generation, compiling, testing, and debugging BASIC language programs for the Data 620 Computer.

Electronics. The student receives instruction on semiconductor materials; detailed operation of the common base (CB), common emitter (CE), and common collector (CC) amplifiers using PNP and NPN transistors; direction of current flow; polarity of voltage drop; phase relationship of input and output signals; and the purpose of all components in CE, CB, and CC amplifiers. He is required to determine voltage gain, current gain, power gain, and input and output resistance of CE, CB, and CC amplifiers. He also learns typical uses of and bias stabilization in CE, CB, and CC amplifiers; impedance and impedance matching devices; operation and characteristics of audio amplifiers; RF amplifiers and transistor power supplies; and class of operation and biasing of transistor oscillators. He receives instruction at a block diagram level on transmitters, to include modulation, and input, output and analysis of typical converters, detectors, and mixers. Also, he receives information on function and operation of transistorized superheterodyne receivers; operation of one-shot, bistable, and free-running multivibrators; and construction of semiconductor devices and integrated circuits.

Note. The student will have received the required preparatory annex that includes radar principles, circuits, standard test equipment, and fundamentals of vacuum tubes, which gives sufficient background training to enroll in this electronic elective.

Operations Research/Systems Analysis. This elective encompasses statistical analysis, including collection, organization, and representation of sample data; probability, to include set theory, Venn diagrams, and probability distributions normally encountered in OR/SA; statistical inference, to include confidence interval estimates and hypothesis testing; queuing theory solution to servicing times; use of models in OR/SA with emphasis on Monte Carlo simulations; game theory solutions to problems involving selection of optimum strategy in face of competition; linear programing solution to problems involving optimum allocation of limited resources; and elements involved in decision-making process and student practical application through case studies.

COLLEGE ELECTIVES

Principles of Guidance, 540 (graduate - 3 hours)
Educational, social, historical, philosophical, and psychological foundations of guidance in schools, colleges, and industry.

Edumetrics, 499 (graduate/undergraduate - 3 hours)
The rationable assumptions, theories, and techniques underlying descriptive and inferential statistics as applied to measurement and research.

Psychology of the Disadvantaged, 478 (graduate/undergraduate - 3 hours)
The basic principles of educational psychology, including learning theories of intelligence and intellectual development, growth and development, and motivation, specifically oriented to the disadvantaged.

Human Growth and Development, 340 (undergraduate - 3 hours)
Developmental changes through childhood and adolescence, and consideration of factors associated with development in personality, intellectual skills, social, and emotional responses.

Managerial Economics, 401 (undergraduate - 3 hours)
Application of economic theory to problems of business management: profit, demand, cost, competition, product line advertising, employment of factors of production, and capital budgeting.

Business and Government, 335 (undergraduate - 3 hours)
Relation of government to business through regulation, prohibitions, assistance and competition; political, legal, and social implications.

Economic Problems of Underdeveloped Countries, 324 (undergraduate - 3 hours)
Role of population size, social values and institutions, agriculture, industry, government, free market forces, international private investment, and government foreign aid in the process of economic development.

American Foreign Policy, 362 (undergraduate - 3 hours)
Formulation, content, and rationale of current foreign policies of the United States.

Industrial Organization and Public Policy, 475 (graduate/undergraduate - 3 hours)
An analysis on an empirical level of market structure, conduct, and performance and their interrelations in American industries, followed by an appraisal and critique of existing anti-trust laws and suggestions for possible revisions in these laws.

Government and Politics - Mexican and Central America, 372 (undergraduate - 3 hours)
Political structure and processes of Mexico and neighboring Latin American Republics.

The foregoing college courses are those selected for use when polling the students for their preferences. In the future, to eliminate the four courses scheduled being in the same relative discipline, five courses will be contracted, one in each of the major disciplines

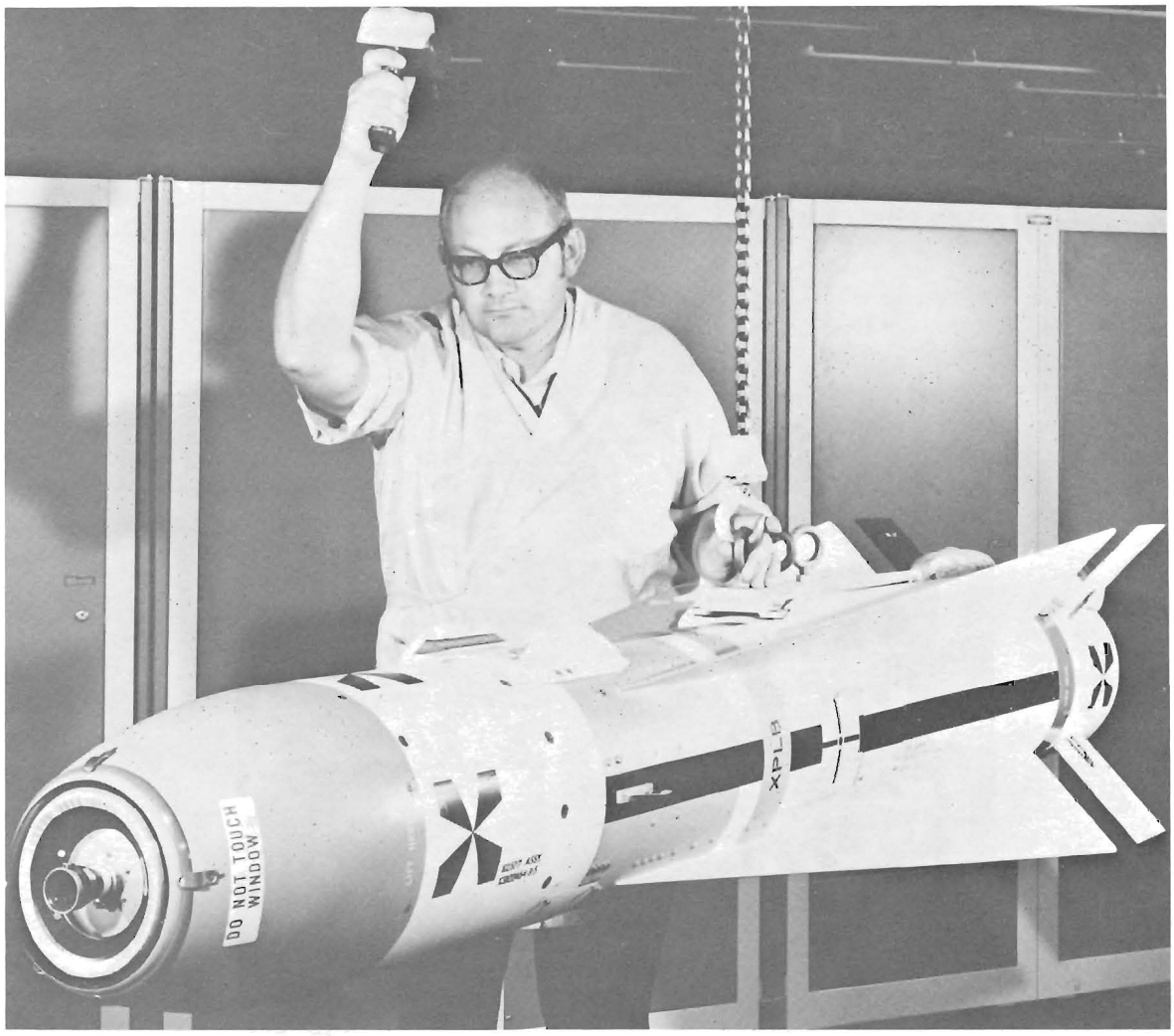
desired at Command and General Staff College. Students will be given the chance to select from three courses in each discipline. Disciplines are Business Administration, History, Education, Social Science, and Government (Political Science).

3D Battalion of 4th Air Defense Artillery Lineage Spans 186 Years

Private Leroy A. Briscoe, Baltimore, Maryland, Battery A, 3d Battalion Airborne (Vulcan), 4th Air Defense Artillery, an assistant gunner on the 20-mm Vulcan antiaircraft weapon in the background poses with a muzzle loading flintlock. The unit used this type of weapon when it was first organized on 20 October 1786 as Captain Burbeck's Artillery Company. The only airborne air defense artillery battalion in the US Army, the unit celebrated its organization day this year as a unit of the famed 82d Airborne Division at Fort Bragg, North Carolina.

Potpourri of Information

TV-GUIDED MISSILE



The new air-to-ground Maverick missile is shown above during production at Hughes Aircraft Company's Tucson, Arizona, plant. The missile is guided to the target by a tiny television camera installed in its nosecone. After selecting the target, the pilot "locks on" the Maverick's TV camera and launches the missile, which is automatically TV-guided to the target. During developmental flight tests the Maverick scored a success rate of better than 90 percent, thereby enabling the US Air Force to cancel 13 of 40 scheduled test shots and complete the test program 2 months earlier than originally planned. The Air Force maximum incentive award was presented to Hughes Aircraft Company in recognition of the outstanding performance of their missile.

SPACE WATCH

Deep underground within a Colorado mountain are large display screens that show what is going on in space. These screens in the North American Air Defense Command's (NORAD) Combat Operations Center (COC) can show the routes space satellites, such as the one charted here by a computer, will take as they circle the globe. By pushing buttons, the NORAD battle staff members can see the paths a satellite will follow for as many as 12 revolutions in the future. Built more than 1,400 feet below the granite top of Cheyenne Mountain near Colorado Springs, the COC is the hub of NORAD's air defense activities guarding the continent against air attack. The command also is responsible for keeping tabs on space objects orbiting the earth.

APOLLO 16 GUIDANCE AND NAVIGATION COMPUTER

Apollo 16 astronauts were provided both guidance and system malfunction detection by the Apollo guidance and navigation computer produced by Raytheon Company.

Throughout the Apollo program in both lunar and earth orbital missions, the spacecraft guidance and navigation computer has performed reliably and accurately under a wide variety of conditions.

The brain of the guidance and navigation system which includes inertial measurement and optical sighting subsystems is the computer, a small, general-purpose unit designed

specifically for space flight. Along with its associated display-keyboard, the computer is used in both the command and lunar modules for necessary guidance and navigation maneuvers.

During the Apollo 14 mission, the computer guided the command module to a near pinpoint splashdown less that 2 miles from the targeted point in the recovery area in the South Pacific.

In previous missions splashdown points have been well within programed limits; with Apollo 8, for example, only some 1,000 yards from the target point.

Also attesting to the accuracy of flight paths the computer sets into the lunar missions is the fact that many of the programed midcourse guidance maneuvers are not required. In the normal programing of a flight path to the moon and back, provisions are made for propulsion burns that keep the craft within prescribed course limits during the flight.

In addition to performing guidance functions, the computer monitors a number of systems and their inputs and checks for abnormal conditions. This includes data received from on-board radar, communications, and other avionic subsystems, as well as from the astronauts themselves.

It is programed to react to almost 90 different abnormal or alarm situations and, in turn, alert the astronauts and mission control on earth.

Because the computer flags attention to these problems, it may sometimes be criticized as the bearer of bad news, but it is only doing one of its designed and programed jobs.

Typical of this protection function of the computer was its performance prior to the lunar landing sequence in the Apollo 14 mission. At that time, the computer signaled, through the display-keyboard, an abort possibility before the scheduled descent to the moon's surface.

The possibility of aborting the landing sequence was caused by an alarm signal from the computer that indicated that something was not operating properly in a switch in another part of the instrument panel.

With the knowledge that information in the computer was based on a faulty input, programers at Massachusetts Institute of Technology's Charles Stark Draper Laboratory used the computer's flexibility and devised a series of programing steps and computer entries to allow it to bypass the automatic procedures that would normally follow such an abort signal, and a successful landing was carried out.

In other missions, this monitoring and protection function of the computer alerted those in control of a range of abnormalities so that corrective actions could be taken.

The computer and the display-keyboard are produced by Raytheon Company at its Equipment Division manufacturing facility in Waltham, Massachusetts, under contract to

Delco Electronics Division of General Motors Corporation, prime contractor to the National Aeronautics and Space Administration for the guidance and navigation system. The guidance and navigation system was designed and developed by MIT's Charles Stark Draper Laboratory.

INDIVIDUAL SHIP MISSILE DEFENSE

A target acquisition system (TAS), now in engineering development at Hughes Aircraft Company's ground systems group, will give individual ships of the US Navy a new means of defending themselves against surprise attack. A $2.8 million modification for this purpose was added to a $24.3 million contract awarded by the Naval Ordnance Systems Command in July 1972. The work will extend over a period of $3\frac{1}{2}$ years.

TAS will be integrated with the NATO Sea Sparrow Surface Missile System to form the Improved Point Defense Surface Missile System. Point defense provides individual ships with a complementary self-defense capability against threats that evade or leak through the umbrella-like fleet area defenses. TAS will speed the detection and identification of approaching targets so that each ship can quickly employ its own missile system to protect itself.

The Hughes TAS design integrates a short-range radar and infrared sensors (for surveillance and detection) with an IFF system that separates enemy targets from friendly aircraft. The sensor signals are automatically processed by a computer, providing rapid evaluation of the threat and designation of enemy targets to appropriate weapon systems in priority order. Two engineering development models will be produced under the current contract.

Because point defense systems must weight the value of a ship against the cost of the system required to defend it, a "full-up" TAS system has been designed for such high-value ships as aircraft carriers.

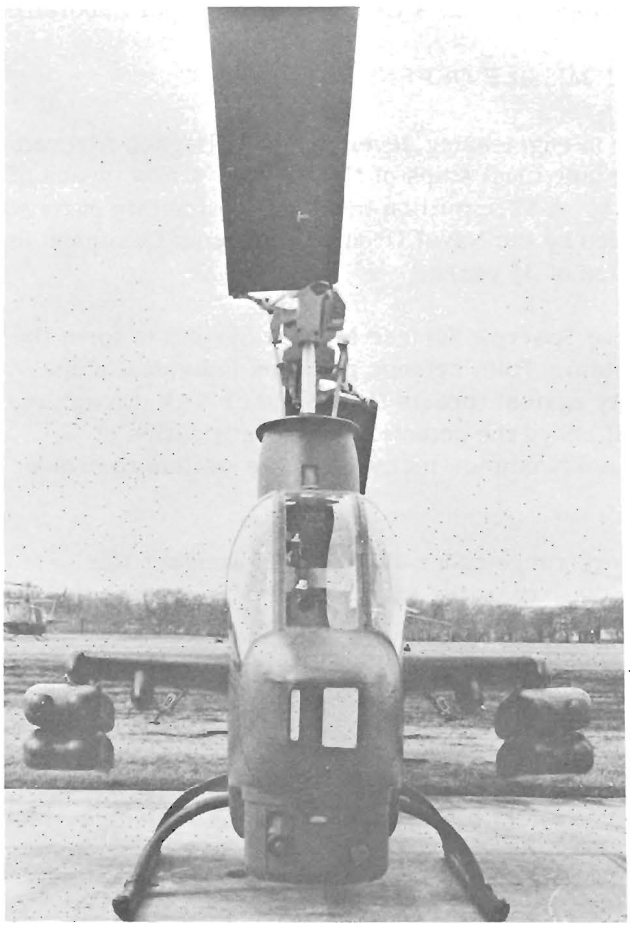
Derivative systems with lesser performance capability and lower costs will be available as options. These might be employed on vessels that require a level of self-defense appropriate to their value and mission, but would not be considered such prime targets as carriers. Options include signal sensors—radar only or infrared only—and either automatic or manual operation. The system will employ the latest techniques for canceling clutter or undesired radar reflections, thus enabling the sensors to detect targets under the worst of natural sea or shore backgrounds, man-made clutter, and electromagnetic interference. The clearer radar signals resulting from clutter rejection will assist ship operations in all-weather conditions and deployment close to shore, and they will permit automatic defensive operation from initial detection to identification and target designation.

Each development model, when completed, will go through an objective evaluation in a stringent shipboard demonstration and testing program.

JAPAN ORBITS SATELLITE

Japan recently put its fourth satellite into orbit. It weighed 165 pounds and was developed by the Institute of Space and Aeronautical Science of Tokyo University for radio exploration.

NEW STING FOR COBRA



Eight US Army Huey Cobra attack helicopters will be equipped with TOW antitank missiles and a fire control system developed by Hughes Aircraft Company under contract with Textron's Bell Helicopter Company. The TOW will give the Huey Cobra the capability of knocking out with a single round such targets as ground fortifications, either moving or stationary tanks, and armored vehicles at ranges up to 3,000 meters. The helicopter can carry either two or four missiles on each side in launcher pods shown here in mockup form.

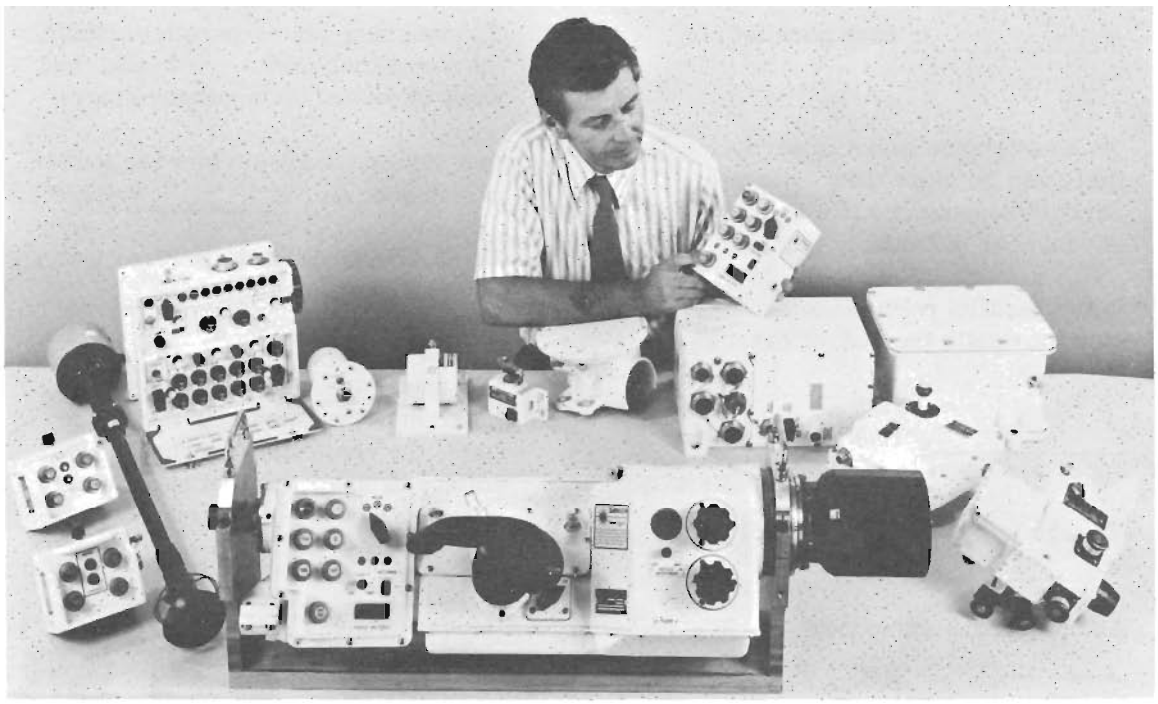
LASER RANGEFINDER

Hughes Aircraft Company will build prototype laser rangefinder and ballistic computer systems for the US Army's M60A1 improved main battle tank. The 18-month contract calls for the fabrication of 12 computers and nine laser systems together with supporting software for Chrysler Defense Engineering of Centerline, Michigan, the M60A1 prime vehicle contractor. During the past year Hughes has been working on a contract from the Army's Frankford Arsenal for development and fabrication of six computers and nine laser systems. These will also be delivered to Chrysler, along with the prototype units, for test and evaluation.

The newly-designed fire control system, which directs the firing of the tank's 105-mm gun, will increase the M60A1's first-round hit capability against both stationary and moving targets, and assure increased reliability. The laser rangefinder will provide, almost

instantaneously, accurate ranges at extended distances. This range information will be processed by the solid state computer, together with crosswind, powder grain temperature, gun trunnion cant, tube wear, air temperature, altitude, and tracking rate, to provide the correct azimuth and elevation in firing commands.

The computer will provide computation for nine ammunition types, enabling a commander to select that ammunition which best meets his battle situation. Both computer and laser units incorporate a self-test capability and provide for automatic fault isolation to minimize field maintenance.



The first-round hit capability of the US Army's M60A1 main battle tank will be markedly improved with the use of this laser rangefinder and ballistic computer fire control system being built by Hughes Aircraft Company. In the foreground is the laser transmitter/receiver and commander's control panel. In background are computer components and sensors. The engineer holds gunner's laser control unit.

Series-Parallel Circuits

Across

1. To find the resistance of the entire circuit, where resistance banks are in series, combine the parallel resistances in each bank and _____ the series resistance.

2. _____ in each parallel circuit branch is $\frac{E}{R}$.

4. With resistance banks in series, there can be more than _____ parallel resistances in a bank and any number of banks in series.

6. In the parallel portion, total _____ current equals the sum of branch currents.

8. _____ across series resistances are equal to IxR.

9. Voltage is the same across all parallel _____.

10. An open in any component in the _____ circuit causes the entire circuit to be open.

11. An open in one branch of the parallel circuit does not _____ current flow in other branches.

13. Total resistance in the parallel circuit must be less than the smallest branch _____.

Down

1. _____ voltage equals the sum of series IR drops.

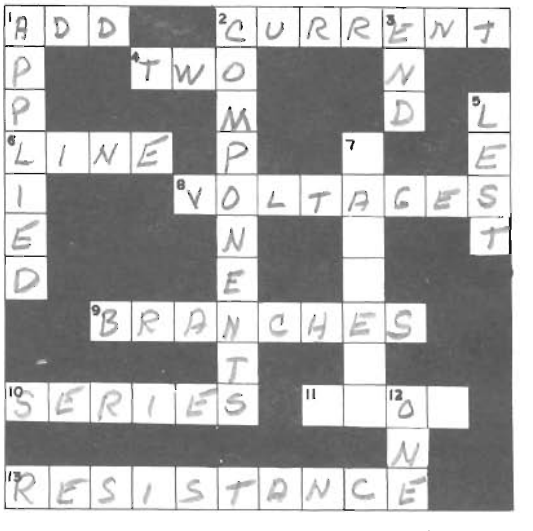
2. Current is the same across all series _____.

3. To analyze a series-parallel circuit, start reducing the _____ branch and work in toward the applied voltage.

5. In a series voltage divider the lowest resistance has the _____ voltage.

7. Total resistance in the series circuit must be more than the _____ individual resistance.

12. For any _____ resistance in a parallel string, the current in the string times the resistance equals the IR voltage drop across that particular resistance.



Answers on page 92.

Reader's Corner

CURRENT BOOKS AND ARTICLES OF MILITARY INTEREST

This list is published to draw attention to worthwhile and informative books and articles in other publications. We realize that not all items will be available to all readers. Our motive is to be helpful to as many readers as possible.

The content of these publications does not necessarily represent the opinion of the US Army Air Defense School.

—Editor

BOOKS

The World's Great Regiments by Vezio Melegari. Putnam, New York.
"This book is not intended as a treatise on uniforms nor is it intended as an organized summary of military history. Undoubtedly it is more evocative than scientific, more episodic than systematic."

Civil Rights; a Current Guide to the People, Organizations, and Events by A. John Adams. Bowker, New York.
"This work was planned simply as a practical aid to refresh memories on some of the principal persons, dates, and events of the struggle as it has developed over the last 15 years and as it is happening now."

Know Your Color-TV Test Equipment by Robert G. Middleton. H. W. Sams, Indianapolis.
"A complete volume on color-TV test instruments . . . how they operate and how to repair them."

Red Blueprint for the Conquest of America by Joseph H. Wherry. Naylor Co., San Antonio.
"Terrifying and irrefutable evidence that Communism is a real threat to the United States - not at some vague time in the future but right now, today."

Learning and Teaching, a Programmed Introduction by E. Stones. Wiley, New York.
"It is designed to form the basis of a course on learning and teaching taking up one term of an educational psychology course at colleges of education and universities and assumes no previous knowledge of psychology."

A Programmed Course in Basic Electricity by New York Institute of Technology. McGraw-Hill, New York.
"The programmed course in basic electricity contained in this book offers a tested procedure for taking the first step toward electronics specialization."

Fundamentals of Electric and Electronic Circuits by Matthew Mandl. Prentice-Hall, Englewood Cliffs, NJ.
"Here is a thorough exposition of the basics relating to dc and ac circuitry."

Computer Data Processing and Programming by Thomas R. Gildersleeve. Prentice-Hall, Englewood Cliffs, NJ.
"A self-teaching book, enabling an individual with no previous computer data processing experience to start writing RPG programs with a minimum of guidance."

How to Score High on the Scholastic Aptitude Test and Other College Entrance Tests by Albert J. Genua. J. F. Ryder, New York.
"To help you gain admission to the college of your choice: extensive practice test material, with answers; a vocabulary list of over 1600 words; vocabulary-building puzzles; a mathematical review, with examples; pertinent information about American colleges."

The Firearms Dictionary by R. A. Steindler. Stackpole Books, Harrisburg.
"Basic reference and illustrated encyclopedia of gun language and lore of sportsmen, collectors, gun-fixers, and their libraries, clubs, workshops."

A Glossary of Terms Used In Heraldry by James Parker. Gale Research Co., Detroit.
"This work, following the title of the older book, is called a glossary, the object being primarily to describe and explain the several terms connected with the study of Heraldry which a reader is likely to meet."

Palestine, the Arabs and Israel; the Search for Justice by Henry Cattan. Longmans, London. (International Publications Service, 303 Park Avenue, S. New York, NY).
"This book is the first of its kind. Henry Cattan, a Palestinian by birth and an established international lawyer, states the Arab case historically, legally, and in its present situation."

The Draft; a Handbook of Facts and Alternatives by Sol Tax, ed. University of Chicago Press, Chicago.
This book, containing articles by 26 people who have made a study of the draft, covers the problems of the draft, preceptives of the draft, and possible alternatives to it.

Drug Awareness by Richard E. Horman. Avon, New York.
"The distillation of over 2,000 articles and papers on drugs published in the last five years, DRUG AWARENESS is an important and revealing book for the general reader, as well as the student and specialist."

History of Rocketry and Space Travel by Wernher Von Braun. Thomas Y. Crowell Co., New York.
"Newly revised and expanded, this comprehensive history covers the most significant developments and discoveries in the history of space science, with emphasis on the Apollo Lunar landing."

ARTICLES

"Over the Threshold," Wm. Beecher, Army (July 1972), pp 17-20.
"Tactical nuclear weapons are once again being developed into a front-line deterrent in Europe after a decade in the doldrums when it was feared that their refinement would invite too-easy employment. The recent mutual limitations on strategic weapons have changed all that."

"Pay Today," Soldiers (July 1971), pp 12-14.
This timely article describes what is involved in the JUMPS program, which was underway in August in continental United States followed by Europe in October and the Pacific area in November.

"The Laser's Bright Future in Medicine," Business Week (July 15, 1972), pp 50-52.
"In the next two years, doctors expect to be able to filter dangerous bacteria out of the air, spot breast cancer almost as soon as it begins, and perhaps even discover how to prevent inherited diseases."

"Soviet Ground Force Logistics," Graham Turbiville, Army Logistician (July-August 1972), pp 18-21.
"Contrary to popular Western belief, the Soviets have developed a logistics system capable of supporting fast-moving mobile combat operations advocated by Soviet military planners."

"Inching Toward the Metric System," H. Allen Perry, The American Legion Magazine (July 1972), pp 18-22.
"We are now virtually the only nation not on the metric system. Here's a look at our probable switch in ten years or so."

"Education in the Military - Some Critical Comments," George C. S. Benson, Adult Leadership (June 1972), pp 47-49.
This article presents the status of educational attainment of officers and enlisted men in all the military services in the United States.

"Partners in Defense," Thomas V. Jones, Ordnance (July-August 1972), pp 40-42.
"Industry and the military must work together to reduce the cost of weapon systems and to put procurement on a sound business basis while concentrating on those areas which will give the best results."

"Early Retirement: Is it Worth the Price?" David Nesenholtz, Military Review (July 1972), pp 23-35.
"The conclusions in this article should be kept in mind while considering any new attempts to deal more effectively with the 'early' retirement problem."

"Air Defense School Provides Command with Top Technicians," Argus (June 1972), pp 8-11.
"Since the first Nike Hercules battalion became operational in 1958, the Air Defense School has graduated some 24,000 well-trained Hercules technicians of whom almost one-third studied the techniques of maintaining the fire control system."

"NCO Education System," Thomas P. Curtin, Infantry (May-June 1972), pp 42-43.
"Our Modern Volunteer Army needs supervisory personnel who are truly qualified in their duties. For the career enlisted soldier, the NCOES opens new, equitable opportunities for professional development."

"Why Chaparral-Vulcan? You Can't Buy Just a Little Air Defense," Argus (April 1972), pp 18-19.
This article attempts to explain that in spite of the fact that we already have the Redeye, we also need the Chaparral-Vulcan to protect us from battlefield disaster.

"RMV's in Aerial Warfare," Wm. B. Graham, Astronautics & Aeronautics (May 1972), pp 36-47.
"By every measure, Remotely Manned Vehicles (RMV's) will prove more versatile, more accurate, and much less costly than conventionally operated tactical aircraft - they mean a new era in air warfare."

"New Regiments New Divisions," John Pettit West III, Military Review (May 1972), pp 34-42.
"The proposed system - with its cross-trained regular battalions, with its well-trained Reserve and National Guard battalions and with its large number of mission-oriented division, corps, and field army headquarters - could provide a reduced military establishment capable of supporting a $1\frac{1}{2}$ war strategy."

"Taming a Paradox," Augustus Thomas, Army (May 1972), pp 10-19.
"Ruminations about the implications to the Now Generation of a completely volunteer Army and proposed changes that might give us a force of proficient, competent, determined, physically hardened professionals."

ANSWERS TO CROSSWORD PUZZLE

Across		Down	
1.	add	1.	Applied
2.	Current	2.	components
4.	two	3.	end
6.	line	5.	most
8.	Voltages	7.	largest
9.	branches	12.	one
10.	series		
11.	stop		
13.	resistance		

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An index of all issues of Air Defense Trends for the previous year will be published in the first issue annually. This index covers the year 1972.

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