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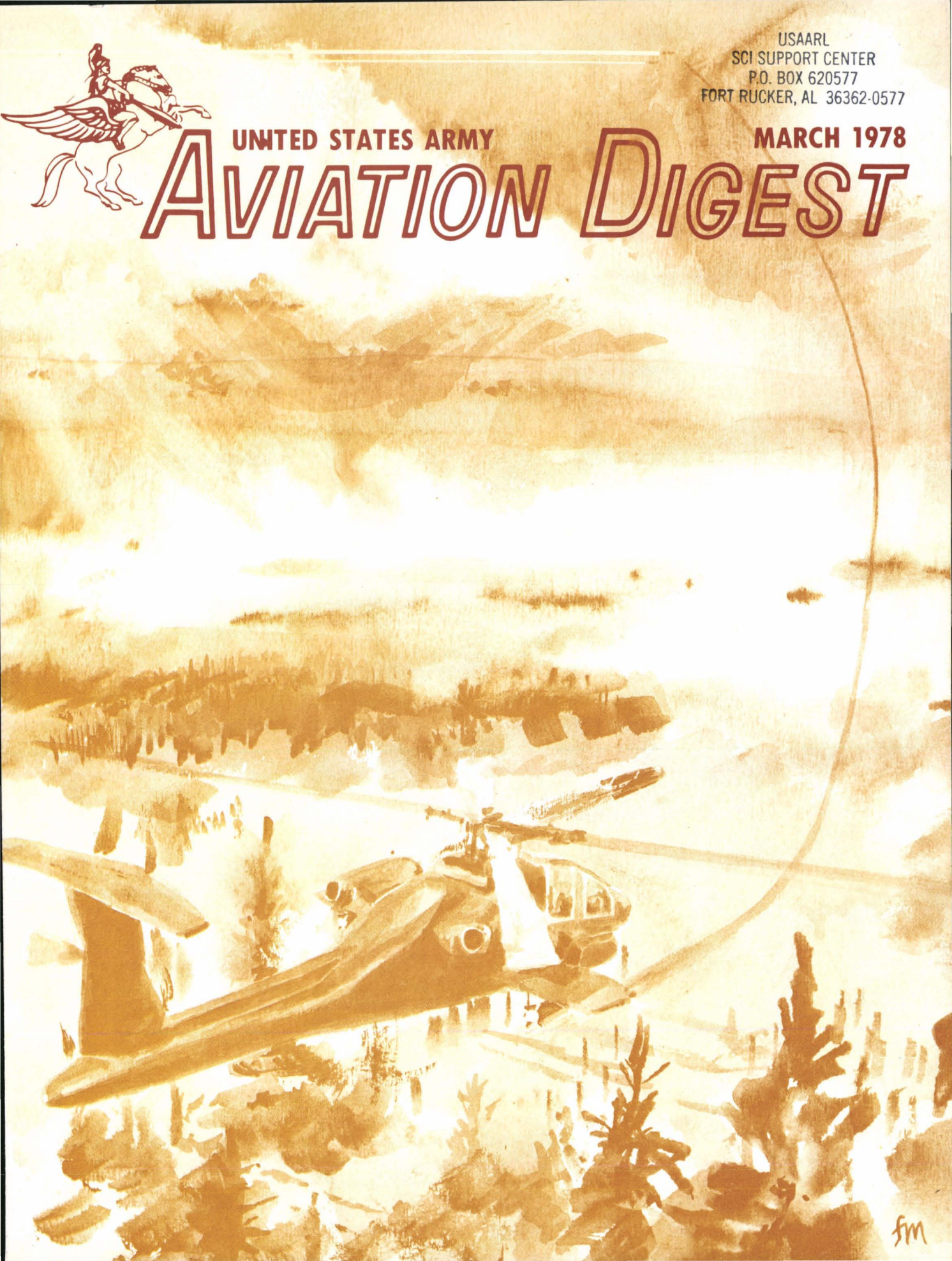
UNITED STATES ARMY

MARCH 1978

AVIATION DIGEST



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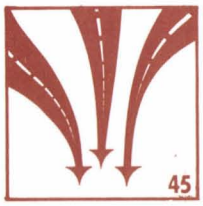

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ABOUT THE COVER

Airborne Air Defense Artillery article starts on page 2. Cover art by Fred Martin.

The mission of the *U.S. ARMY AVIATION DIGEST* is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

The *DIGEST* is an official Department of the Army periodical published monthly under the supervision of the Commanding General, U.S. Army Aviation Center. Views expressed herein are not necessarily those of the Department of the Army nor the U.S. Army Aviation Center. Photos are U.S. Army unless otherwise specified. Material may be reprinted provided credit is given to the *DIGEST* and to the author, unless otherwise indicated.

Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, *U.S. ARMY AVIATION DIGEST*, Fort Rucker, AL 36362.

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VIEWS FROM READERS

A Medical Specialists' Panel Symposium covering Operational Helicopter Aviation Medicine will be held from 1 to 5 May at Ft. Rucker, AL. It is sponsored by the NATO Advisory Group for Aerospace R&D and is being organized by the U.S. Army Aeromedical Research Laboratory. About 68 papers will be presented covering six major areas.

Persons desiring to attend the unclassified meeting must be a citizen of a NATO country. They should contact LTC G.S. Kush, USAF Office of the Surgeon General, HQ USAF (SGPR) Forrestal Bldg. Wash, DC 20314; AUTOVON 223-5944.

Sir:

In a recent issue of the *AVIATION DIGEST*, you requested input from old "L" pilots as background for an article you were contemplating.

Personnel Order No. 167, 26 August 1947, HQ Army Air Forces, came with my Liaison Pilot rating effective 5 September 1947.

I am assigned as Senior Army Advisor (SRAA) to the 102d U. S. Army Reserve Command in St. Louis, MO.

I will retire 30 November 1978 with 34+ years service ... and I have enjoyed every minute of it to date. There is no reason to believe that I won't enjoy the remaining 11+ months. I leave two sons in the Army: George, a 1975 Citadel graduate, a 1LT now serving in Germany; and Jim, a yearling at West Point.

Hope you can use the information.

COL George E. Thayer Jr.
Office of the Senior Army Advisor
102d U. S. Army Reserve Command
St. Louis, MO 63120

Sir:

Your article about the ZSU-23-4 in the November 1977 *AVIATION DIGEST* was very informative and definitely left some people in our unit thinking. I don't believe there should be an aviation unit in Germany that is unfamiliar with the capabilities/limitations of the ZSU-23-4, and if they are not familiar with this weapons system, they are not only letting themselves down, but anyone they happen to be flying in support of.

There are a couple of areas that I would like to address questions to and maybe stimulate some thinking on your part too. You mentioned that finding this particular weapon would probably fall to the aeroscout. (At least the article concentrated on this point.) The current doctrine we are training under and the guidance that was given to us in the C.A.B. was that the targets would be handed off to us from someone already in contact, be it another aeroscout or a ground scout of some type. Having 13 OH-58 helicopters and only 7 aeroscout pilots in our unit makes the aeroscout pilot a precious and guarded commodity. (When I use the term aeroscout I do not mean someone who has just received a scout transition and is boring holes in the skies; I mean one who has preferably more than 6 months of actual scouting in Germany.) Thus I can't see the rationale behind sending one of the few aeroscouts we have out to find his public enemy no. 1.

My second inquiry is about the AN/APR-39. I have never seen one and I know of no unit in Germany who has one, so us being able to "paint" his location sounds a bit ficticious at this time. Another point to keep in mind is that the OH-58 is a totally unarmed aircraft performing a most hazardous mission next to and forward of the FEBA. To think for a moment that even if I had the radar warning receiver that I would expose myself so I could find him is asking a lot. (In Vietnam everything was armed and it wasn't even a high threat environment like Europe.)

In conclusion, I found your article very enjoyable and would like to see some kind of series like this where you have a Warsaw Pact weapon and list its capabilities/limitations for our information.

CW2 Robert Fogel
B Co, 501st CAB
APO NY 09326

• With regard to use of the scout to locate the ZSU; you are probably correct in assuming that your initial target handoff will come from a ground unit or another attack helicopter team that is in contact with the threat force. Once that initial handoff is made the scout must locate targets for the attack helicopters in his team. You should not blunder around the battlefield until somebody shoots at you, a la Vietnam, but instead use the stealth and agility of the scout to locate the enemy. We know that the ZSU-23-4 normally is found in the lead elements of a threat armor force and that the gun dish radar gives the vehicle a unique physical appearance. Additionally, the AN/APR-39 Radar Warning Receiver, will give you a general azimuth and range to the ZSU location.

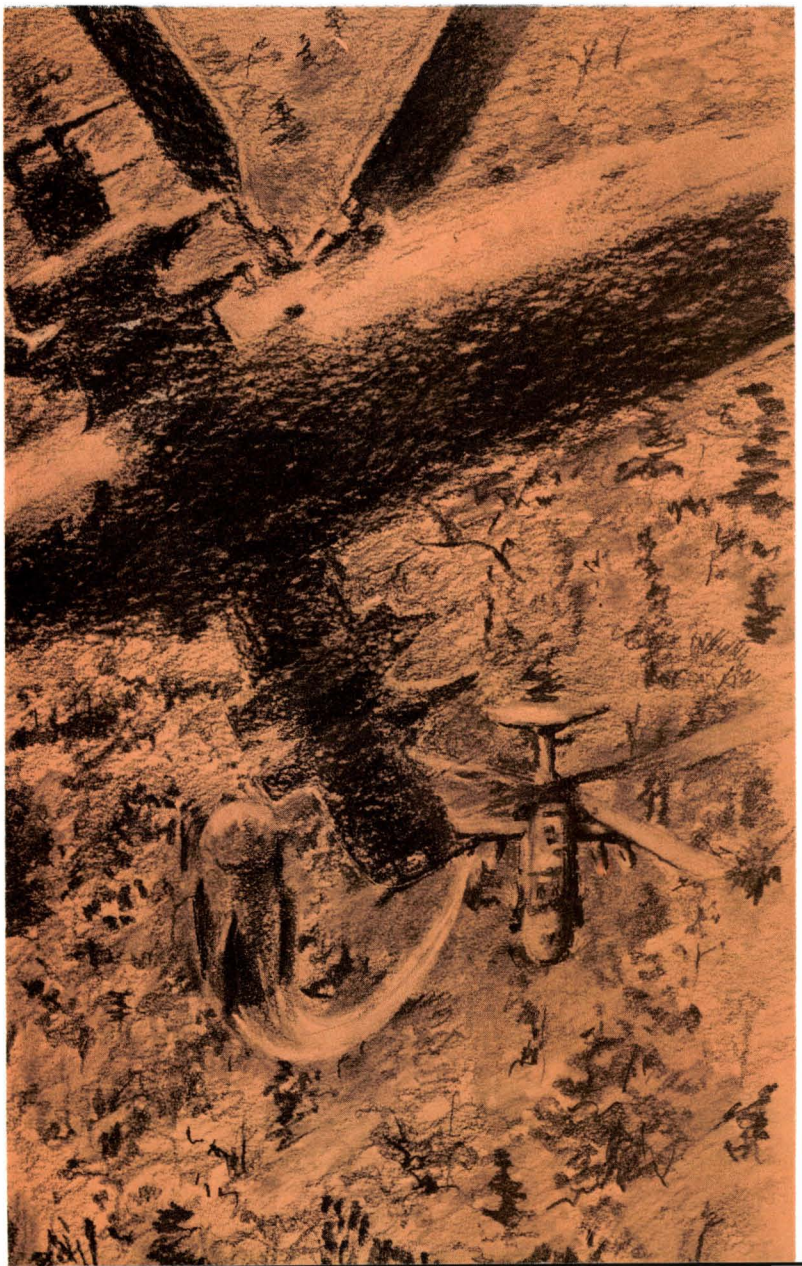
USAREUR is installing APR-39s at this time. We understand that the AH-1S and OH-58s in the attack helicopter units have been given priority for installation. When you receive your APR-39s you will soon

Continued on page 47

ANNUAL AWARD
Monthly Winner
CONTEST

Airborne Air Defense Artillery Weapons System

Captain Edward H. Littlejohn III
Training Management Division
Directorate of Training
U.S. Army Aviation Center



GLOSSARY

AAA	antiaircraft artillery
AD	air defense
ADA	air defense artillery
AM	amplitude modulated
ARM	antiradiation missile
ARTEP	Army Training and Evaluation Program
C&C	command & control
ECM	electronic countermeasures
EW	electronic warfare
FM	frequency modulated
HF	high frequency
JCS	Joint Chiefs of Staff
km	kilometers
NATO	North Atlantic Treaty Organization
NOE	nap-of-the-earth
SAM	surface-to-air missile
TRADOC	U.S. Army Training & Doctrine Command
UHF	ultrahigh frequency
USAADS	U.S. Army Air Defense School
USAF	United States Air Force
VHF	very high frequency
V/STOL	vertical/short takeoff & landing

CONSIDER THE military/political situation in Europe. Review the lessons learned concerning SAM and counter-SAM from the Vietnam war. Then think of the lessons still being learned from the 1973 Mideast War. An obviously common lesson to learn from all three is that there is an immediate need to

I propose the possibility of using organic Army aircraft as airborne air defense sites. Instruction in the Air Defense Artillery (ADA) Career Course emphasizes both mobility and countersuppression techniques for Army air defense units. The necessity for these actions is critical if today's Air Defense Artillery units are to perform successfully their missions and survive.

Mobility and countersuppression techniques create many problems for a landbased air defense unit: time; priority of terrain and routes of travel; logistics; degraded mission effectiveness due to time off the air and increased maintenance requirements; difficulties in camouflage, communications, coordination, ECM, etc. Yet, they are essential for survivability and for providing the best possible air defense for the supported unit.

By placing an appropriate air-to-air capability on a helicopter and dedicating it to the air defense mission, many problems can be substantially reduced. The airborne air defense system can move, shoot and communicate much better than any present ADA asset.

The data and opinions presented in this article are solely those of the author and in no way imply endorsement by the Department of Defense.

consider the requirement for Army Airborne Air Defense Artillery.

In the European theater, the U.S. Army and its Allies face an enemy vastly superior in numbers of aircraft, AD weapons, EW means, long-range artillery, tanks and personnel. In response, we possess the questionable advantages of an initial defensive posture (probably) and some technical superiority.

Army AD assets in Europe include:

- Nike Hercules units (for high altitude theater coverage).
- Basic and improved Hawk (for low/medium altitude coverage and direct support of maneuver divisions).
- Vulcan/Chaparral (for low altitude coverage organic to divisions and air base security).
- Redeye (for low altitude coverage organic to maneuver battalions).

Even in conjunction with Air Force tactical air the outlook is not encouraging. Additionally, Patriot (SAM D), Roland, DIVAD Gun and Stinger are some time away from being operational in the field, nor do they provide a final solution.

U.S. forces in Europe have adopted a doctrine of defense which will provide an enhanced probability for a first battle victory by the West.

The sum effect of the new defensive concept and superior numbers of Soviet aircraft, EW elements, and long-range artillery is that Allied air defense units are placed in a perilous predicament. Obviously, ADA units cannot accomplish their missions if they cannot survive on the battlefield.

ADA units *must* be highly mobile and effective. With the emerging *doctrine of defense*, the battlefield situation will be fluid with a maximum of decentralization. ADA units will be required to move frequently to meet changing situations and to avoid becoming targeted. This will result in a loss of time available to perform actual ADA missions. Road clearance and site selection become major problems as units of all types move more often and as ADA sites encounter specific terrain requirements.

The large covering force, within Hawk and Hercules coverage, needed under the new defensive doctrine will be a prime air and artillery target. ADA sites also will be high priority targets for the enemy. Today, Vulcan, Chaparral and Redeye are the only ADA weapons systems possessing the mobility to assist the covering force; and they are severely limited in range and acquisition capability.

Command and control (C&C) is a major difficulty in Europe. This is due not only to the fluid defense but (inherently for ADA) also to dispersal distances and a probable heavily jammed electromagnetic spectrum. The expected intensity of air battle demands rapid decentralization as high C&C echelons become inundated. The greatly increased division area of operations (up to about 60 km in width) will further aggravate the situation.

The Vietnam war in many respects proved to be a testing ground for U.S. Armed Forces. The Army developed airmobile and counterguerilla warfare tactics while the Air Force gained invaluable experience operating in high density SAM and AAA envelopes. The latter subject area is quite significant.

As the war in Vietnam continued, airways over North Vietnam, particularly Hanoi, became saturated with antiaircraft capability. This lethal environment was instrumental in speeding tactical and technological improvements which have irrevocably affected ADA.

The development of the an-

tiradiation missile (ARM) and its use against North Vietnam's Soviet SAM sites established a new, formidable threat for AD sites which emit electromagnetic energy. The North Vietnamese used elaborate countersuppression techniques with moderate success. Their stable defensive posture enabled the use of some actions which would not be practicable for use by our forces in Europe. Frequent moves, blinking of radars, dummy emissions and other methods require costly tradeoffs in mission capability versus survivability.

During the Vietnam conflict the Air Force introduced a practical application of laser technology. The employment of the "smart bomb" and other laser target designated ordnance necessitates a change in basic air defense doctrine for a critical asset. The asset to be defended now must be much larger due to the extended bomb release distance possible with "smart ordnance." This increased bomb release radius applies to high altitude bomb runs or low altitude bomb runs which "toss" the payload.

A last point to consider concerning Vietnam is that our experience largely was offensive. The enemy enjoys the benefits of combat experience gained from the point of view of the air defender.

The 1973 Mideast War yielded a vast amount of information and intelligence. The Army has used this as a guide to determine the array of weapons helicopters will have to face on the battlefield and as a baseline to measure the capabilities of Army aviation units and equipment. Further, a senior Army official noted that a complete family of modern air defense weapons and tactical fighter aircraft were used in this war; electronic warfare and weapons were effectively employed.

Without discussing classified material, the following assumptions can be made concerning the 1973 Mideast War:

- The Arabs displayed an extremely dense and varied arsenal of AD assets.
- Arab air defense forces, as well as other Arab combat arms, were employed using Soviet doctrine.
- Air defense proved itself to be an essential element of the modern battlefield.
- Soviet military planners demonstrated an awareness of the advantages of an ARM.
- Overlapping fire and mutual support by SAM sites proved tactically valid.

The surface-to-air missile weaponry of the Arabs effectively denied airspace to the Israeli Air Force for a period of time. As in Vietnam, the SAM envelope drove aircraft downward into the more lethal AAA gun range. The mere threat of an ARM attack by either side was effective in that it resulted in countersuppression actions which drastically reduced the SAM site's capabilities while increasing vulnerability.

Advantages. The fielding of an Army airborne ADA system would provide the answer to many of the aforementioned problems:

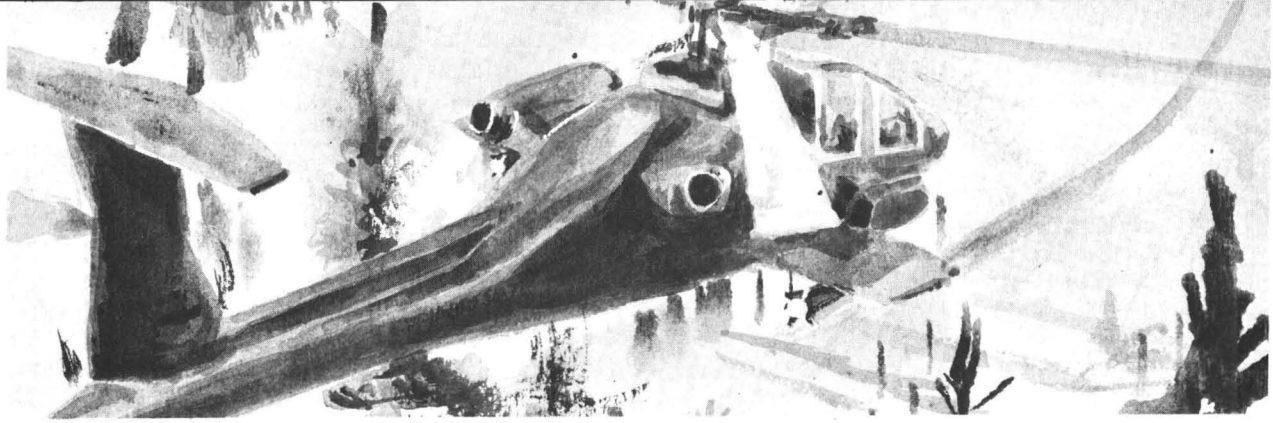
- Mobility is immensely improved, thus vastly reducing a multiple of problems while greatly improving flexibility, survivability and response to the field commander's needs.
- High performance aircraft and an ARM have more difficulty effectively acquiring and engaging a helicopter air defense platform (firing upward from a low altitude using NOE flight techniques) than a stationary ADA asset.
- Communications would be simplified.
- The relationship between Army aviation and ADA would be enhanced by the increased interoperability of the two.

A more indepth examination of these salient points proves most enlightening.

The heliborne air defense system provides obvious advantages as compared to today's air defense systems which rely on wheeled or tracked vehicles to deploy about the battlefield. The helicopter, without a doubt, is the most mobile vehicle available. It can takeoff and land in small, unimproved areas and is capable of rapid heading changes. Modern helicopters also have sufficient speed to deploy quickly over large areas and can operate NOE at night and during adverse weather conditions.

A heliborne air defense system could operate completely independently of jammed road networks and does not require the terrain that present air defense systems need. Helicopters in flight are unaffected by muddy roads, river crossings, minefields and impassable landscapes. Essentially, terrain would be of little concern in comparison with ground transportable AD systems.

The increased mobility of the airborne air defense artillery weapons system would enable AD assets to be deployed rapidly over large areas to meet the most imminent threat – thus providing a better means of fulfilling the ground commander's requirements. This weapons system would meet the challenges of the new defensive doctrine



and would provide AD for rapid displacement of critical assets and organizations during an exploit and pursuit, retrograde, coordinated offense, river crossing or other tactical maneuver.

The combined arms team no longer would be required to rely solely on the limited Vulcan, Chaparral and Redeye AD systems when using the traveling or bounding overwatch movement techniques. The heliborne air defense platform gives the commander the ability to fulfill the principles of AD (mix, mass, mobility and integration) in heretofore unconsidered ways. Flexibility can be a reality.

Countersuppression would not present as great a difficulty to the airborne air defense system as it does to ground-based systems. This is due primarily to mobility. Whereas a ground-based system must consider alternating radars in different frequency bands (blinking) or shutting down radar emissions completely to counter the ARM, the airborne system could maneuver rapidly in addition to these methods. Quick defensive maneuvers can provide cover and concealment from enemy ground or air threats.

Although employed in limited numbers, helicopters *did* survive in the 1973 Mideast War and could have been used on a larger scale. Exercises conducted by U.S. forces and its NATO Allies demonstrated that helicopters flying at low altitudes can be very difficult targets for fixed wing fighter aircraft. Invariably, the helicopters detected the high performance fighters before they themselves were spotted.

More recent testing at Nellis AFB, NV, has demonstrated the survivability of the helicopter versus the enemy air defense. Out of a significant number of engagements against the threat array, only 60 percent were even acquired and an even smaller number of engagements resulted from the acquisitions. For each single engagement by the air defense array, helicopters were able to engage ground threat forces 32 times.

The airborne air defense system has several other advantages. Aircraft have better fields of view than ground-based assets; terrain and vegetation masking are no longer detrimental considerations. Also, an airborne launcher provides a substantially higher engagement capability and greatly increases the probability of a successful first round hit.

Missile resupply would be simplified greatly for the airborne air defense asset. After firing its ordnance, the airborne AD system could quickly return to a central ammunition/supply point for reloading and refueling. Ground-based AD systems require an elaborate logistics network with trucks constantly moving to support missile resupply whereas the heliborne rearm system provides its own transport which is totally independent of road networks.

Both AD units and Army aircraft rely on line-of-sight communications. AD units use ultrahigh frequency (UHF), very high frequency (VHF) amplitude modulated (AM), and frequency modulated (FM) radios for communications of both voice and automatic data link. Today's Army helicopters have a variety of radios including UHF, VHF, HF, AM and FM. Further, aircraft can maneuver to maximize radio capabilities and minimize interference. This is a much more difficult job for the ground unit. Whereas radio line-of-sight is a deployment consideration for ground units, the airborne unit would have much more latitude. Helicopter communications systems are line-of-sight, but the Army would like an air-to-air and air-to-ground non-line-of-sight-system somewhere within a 65 km (40 mile) range.

As previously noted, communications will be a difficult task on the modern battlefield. The mobility of the helicopter can be used to maximize communications by minimizing the adverse effects of terrain and enemy jamming. Through radar vectoring, air defense battalion commanders can improve command and control by accurately positioning their airborne AD assets as they desire and exercising improved control in their repositioning and deployment during centralized operations.

Decentralized operations would be facilitated in that battery commanders can delegate responsibility to widely dispersed aircraft commanders as necessary. In addition, the air defense helicopter would be in

Airborne ADA

the early warning net and each helicopter, by virtue of its airmobility and search capabilities, would be an integral part of this net. Units could receive or handoff targets as well as detect, acquire and engage.

Feasibility of the concept. Because of the rapid buildup of helicopters by the threat forces, the U.S. Army is considering arming its gunships with air-to-air capability. The probability of armed helicopters engaging other aircraft on the battlefield is growing. Some Army planners already are thinking about air-to-air tactical concepts for helicopters. A manual for air-to-air tactics is being developed, and the U.S. Army Aviation Center, Ft. Rucker, AL, hosted an air-to-air symposium during October 1977.

On 18 June 1974, TRADOC replied to an inquiry from the Commanding General, Marine Corps Development and Education Command, Quantico, VA, about a proposal to mount a Stinger missile system on V/STOL (Vertical/short takeoff and landing) aircraft and armed helicopters:

It is believed that the attachment of the air-Stinger weapons systems to existing V/STOL aircraft and armed helicopters is feasible from a technical point of view. The additional capability ... is considered quite significant ...

In their role as helicopter escort vehicles and when air support cannot be provided by fixed wing aircraft because of nonavailability or adverse weather condition, V/STOL and helicopters should have an antiair capability.

The above is interesting insofar as the necessity and feasibility for arming helicopters where an air-to-air capability is concerned. *However, this proposal is sorely limited in that it is primarily addressing only a defensive capability for the helicopter.* By placing an appropriate air-to-air capability on a helicopter, we not only provide for the self-defense concept but we also add a lethal, long-range air defense system to the inventory.

Two families of missile systems must be considered: the radar guided missile and the infrared tracking missile. Each system has advantages and disadvantages. Since there are several plausible choices in each category (see figure 1), and because each has inherent advantages, it might be logical to use both for an Army airborne ADA system. Long-range acquisition for both systems could be done by either a conventional ground-based radar system communicating with the firing platform and/or by a heliborne acquisition capability (similar to an airborne ADA Battalion Army Air Defense Command Post or AWACS).

Since the military has air-to-air systems in its inventory (and under development) which are adaptable to mounting on Army helicopters and performing the envisioned mission, the technical questions of feasibility are not formidable.

Accepting the argument that the Army airborne ADA system is feasible, how would this unit be organized and trained?

Organization would be a major study in itself. A combination of ADA and aviation unit tables of organization and equipment would be required once numbers and types of equipment have been determined by proper authority.

Training on the other hand could be done effectively in a number of ways. ADA units today are familiar with the operational ready evaluation (ORE); combat readiness test (CRT); and annual service practice (ASP). Aviation units are well acquainted with the ARTEP and gunnery training. How would one give cost effective evaluations to an airborne air defense unit?

One possible answer is air combat maneuvering instrumentation (ACMI) being developed by the Air Force. This system provides quantitative and qualitative information for training; operational testing and evaluation; and research, development, training and evaluation. Real-time results of air-to-air scoring – multiple threats and command and control are available to airborne aircraft and for aircrew debriefing and review. This system is an extremely valuable training aid which covers both the tactical and technical areas of the airborne AD systems officer.

Expanding the already accepted feasibility of a limited air-to-air capability for Army helicopters to that of a true airborne air defense system is a necessary, logical step which must be taken. The step is feasible, tactically sound and economically viable. The U.S. Army Aviation Center could provide the tactics and basic instructions for air-to-air and training against an active ground threat array. A joint effort between USAAVNC and the U.S. Army Air Defense Center, Ft. Bliss, TX, would develop a superior airborne air defense system and greatly assist their interoperability on the modern battlefield.

Figure 1 – Possible Weapons Systems For Air Defense Use

1. AIM-4A Falcon
   Length: 77.8"
   Width: 6.4" (without fins)
   20.0" (with fins)
2. AIM-4C
   Length: 198 cm
   Diameter: 16.25 cm
   Wing Span: 50.8 cm
   Weight: 54.4 kg
   Missile is basically same as AIM-4A but uses infrared seeker with a rear aspect attack capability. 28
3. AIM-4D Falcon
   Length: 79.2"
   Width: 6.4" (without fins)
   20.0" (with fins)
   Weight: 134 pounds
   Kill Mechanism: Blast
   Warhead: 8.4 pounds high explosive
   Missile uses all aspect attack capability with improved infrared homing head. 29
4. AIM-4F Falcon
   Length: 86.365"
   Width: 6.64" (without fins)
   23.97" (with fins)
   Weight: 151.94 pounds
   Kill Mechanism: Blast
   Warhead: 5 pounds high explosive
   Missile uses improved radar guidance system for better electronic countermeasures. Missile uses semiactive radar homing. 30
5. AIM-4G Super Falcon
   Length: 82.5"
   Width: 6.64" (without fins)
   24" (with fins)
   Kill Mechanism: Blast
   Warhead: 8.6 pounds high explosive
   Missile is the infrared seeking counterpart of the AIM-4F. 31
6. AIM-7F Sparrow III
   Length: 144.5"
   Width: 8.03" (without fins)
   40.3" (with fins)
   Weight: 514 pounds
   Kill mechanism: Blast
   Missile uses proportional navigation, semiactive radar homing. 32
7. AIM-9B Sidewinder
   Length: 111.5"
   Width: 5" (without fins)
   22" (with fins)
   Weight: 164 pounds
   Kill mechanism: Blast
   Warhead: 12.5 pounds HE
   Missile uses infrared guidance system which requires no additional fire control equipment. 33
8. AIM-26B Falcon
   Length: 85.0"
   Width: 11.4" (without fins)
   24.5" (with fins)
   Weight: 258.62 pounds
   Kill Mechanism: Blast/Fragmentation
   This missile has head-on attack capability using semiactive radar homing guidance. Missile has larger warhead and an all-weather capability. 34
9. AIM-9L
   This missile "is the most sophisticated heat seeker yet developed....It has a cyrogenically cooled seeker which is proposed to provide an all-aspect detection and launch capability, optimized double delta fins for increased maneuverability, and guidance improvements to increase the launch envelope and ensure accurate guidance. It also has the new laser type fuse (active optical target detector) and a narrow beam, high velocity, warhead (annual blast fragmentation)." 35
10. Roland I and II
    Length: 2.4 mtrs
    Diameter: 16 cm (wing span is 50 cm)
    Weight: 63 kg
    Missile is tube launched
    Guidance: Roland I, is command to line-of-sight with optical aiming and automatic infrared tracking; Roland II is same with the addition of auto radar aiming.
11. Rapier
    Length: 2.206 mtrs
    Diameter: 12 cm
    Span: 36 cm
    Weight: 65 kg
    Missile follows optically established sightline to the target using computer calculations for course corrections via command link. 37
12. Agile
    Currently under development by United States Navy; Missile uses infrared guidance and vector control; Honeywell/Hughes helmet mounted sighting system is utilized. 38
13. Phoenix
    Length: 396 cm
    Diameter: 38 cm
    Wing Span: 91.4 cm
    Missile uses both radar acquisition/homing and infrared target detector/tracking system. Presently under development by U.S. Navy. 39
    Complete system breakdown (AN/AWG-9):
    Radar: 649 pounds
    Infrared: 66 pounds
    Computer: 167 pounds
    Control and Displays: 166 pounds
    Missile Auxiliaries: 93 pounds
    Secondary Power: 86 pounds
    Racks, Antennas: 94 pounds
    Total weight 1,321 pounds. 40

Figure 2 – Possible Army Aircraft For Air Defense Use

1. Bell Kiowa OH-58
   Empty Weight: 1,464 pounds
   Operating weight: 2,313 pounds
   Maximum gross weight: 2,768 pounds
   VNE: 120 knots
   Cruise max range: 102 knots
   Hover out of ground affect: 8,800 feet
   Hover out of ground affect at 3,000 pounds gross weight: 6,000 feet
   Max range at 3,000 pounds gross weight: 264 NM
   Endurance time: 3:30 hrs. 41
2. Bell Iriquois UH-1H
   Empty Weight: 4,667 pounds
   Max. gross weight: 9,500 pounds
   Operating weight: 5,557 pounds
   VNE: 120 knots
   Cruise max range: 110 knots
   Hover out of ground effect: 1,100 feet
   Range max: 276 NM
   Endurance time: 2:30 hrs. 42
3. Bell Cobra AH-1G
   Operating weight: 6,073 pounds
   VNE: 190 knots
   Mission weight: 9,407 pounds
   Max gross weight: 9,500 pounds
   Hover in ground affect: 9,900 feet
   Endurance time: 2:30 hrs. 43
4. Boeing Vertol CH-47 Chinook
   Empty weight: 20,547 pounds
   Payload max: 23,450 pounds
   Mission Radius: 115 miles
   VNE: 190 mph
   Hover out of ground affect: 14,750 feet. 44
5. Sikorsky Black Hawk UH-60A
   Presently being produced for the U.S. Army.
6. Hughes AH-64
   Presently under development for the U.S. Army.

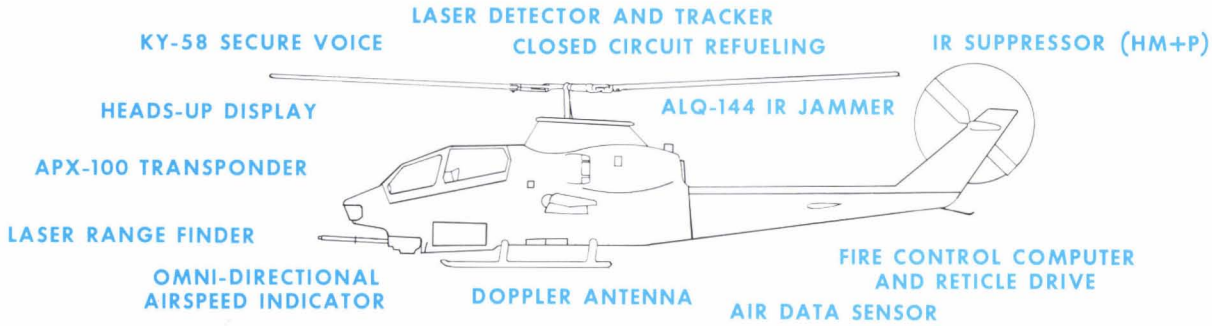


Figure 1 — Modernized AH-1S (199 -297) also see back cover.

MODERNIZED COBRA PART 3

Colonel Robert P. St. Louis
Project Manager, Cobra, TSARCOM
St. Louis, MO

DURING THE TWO previous series on the modernized Cobra, an overview of the total program and the weapons program have been presented. This article will address the fire control, airborne laser tracker and aircraft survivability equipment programs.

FIRE CONTROL

The fire control subsystem is the major effort of Phase II of the Enhanced Cobra Armament Program (ECAP) designed to upgun and modernize the Cobra attack helicopter. The featues of the new fire control subsystem include a pilot heads-up-display (HUD), fire control computer (FCC), air data subsystem (ADS) and laser rangefinder (LRF). The new fire control is scheduled to be installed on the aircraft to be delivered in November 1979.

Figure 1 shows the configuration changes for the 199th through 297th AH-1S aircraft which will complete the modernization of the Cobra TOW (tube-launched, optically-tracked, wire-guided) attack helicopter.

The HUD, being developed by Kaiser Electronics in Palo Alto, CA, will provide increased weapon delivery capability for both day and night operation. The primary purpose of the HUD is for aiming the aircraft to fire the TOW missile system and other aircraft weapons. It will aid the pilot in navigation and increase flight safety during nap-of-the-earth (NOE) flight. The HUD consists of two line replaceable units, a pilot's display unit and a symbol processor unit (SPU).

The pilot's display unit, shown in figure 2, is mounted on the pilot's instrument panel and presents flight, target acquisition, and weapon delivery information using a cathode ray tube (CRT)/optical display. All of the HUD symbology appears in the pilot's normal field of view.

Weapons systems, fire control, flight status and flight control information are displayed, including target acquisition reticles, aircraft boresight reference, and gunner's sighting cues. The fire control data displayed includes aiming and firing data for rockets, guns and TOW missiles and is based upon the weapon type selected by the crew. Also displayed are engine torque, radar altitude, magnetic heading and target range data information. Examples of this symbology are shown in figure 3.

The SPU, which receives and processes inputs from the fire control computer and other aircraft sensors and generates all of the symbology which is displayed on the HUD, is a compact, lightweight electronic unit which is mounted in the aft aircraft equipment compartment.

The fire control computer is being developed by Teledyne Systems Company in Northridge, CA and will provide the gunnery solutions for the turret and rocket weapon systems. It is a general purpose, digital computer which accepts inputs from the universal turret, air data subsystem, laser rangefinder, airborne laser tracker and telescopic sight unit and performs computations that enable the pilot and copilot to deliver accurately ordnance from the turret and rocket weapon systems. Figure 4 shows the computer which will be located in the aft fuselage compartment.

The air data subsystem is being developed by Marconi-Elliott Avionics in Rochester,

England and provides three dimension airspeed, downwash, static pressure and air temperature information to be used by the fire control computer to solve the gunnery problem for increased accuracy of the turret and rocket weapons. The swiveling pitot static probe shown in figure 5 is mounted on the top of the canopy extending out to the right side of the aircraft and is used to gather the data to be sent to the fire control computer.

The primary purpose for the addition of the laser rangefinder into the TOW Telescopic Sight Unit (TSU) is to enhance the ballistic weapons accuracy on the modernized Cobra and increase survivability from enemy fire by allowing the AH-1S to stand off to the maximum range of the TOW missile.

This program is an integration of an existing laser design which has been used in other Army laser systems such as the ground lightweight laser designator (GLLD), XM-1 tank fire control and the Army lightweight target designator (LTD). The TSU provides gunner aiming line of sight angles, rates and laser range to the fire control computer. Other inputs from the data computer and vertical gyro will be used by the fire control computer to compute the weapon lead angles required to minimize the aiming error.

Maintenance features include a laser built-in-test (BIT) which can be performed on the ground with the TSU window cover installed. Since the LRF fault isolation can be performed by BIT at aviation intermediate maintenance (AVUM) and aviation unit maintenance (AVIM), no changes are required to the M65 Test Set, Guided Missile System (TSGMS). Laser malfunctions will require replacement of the TSU.

The LRF can be a hazardous

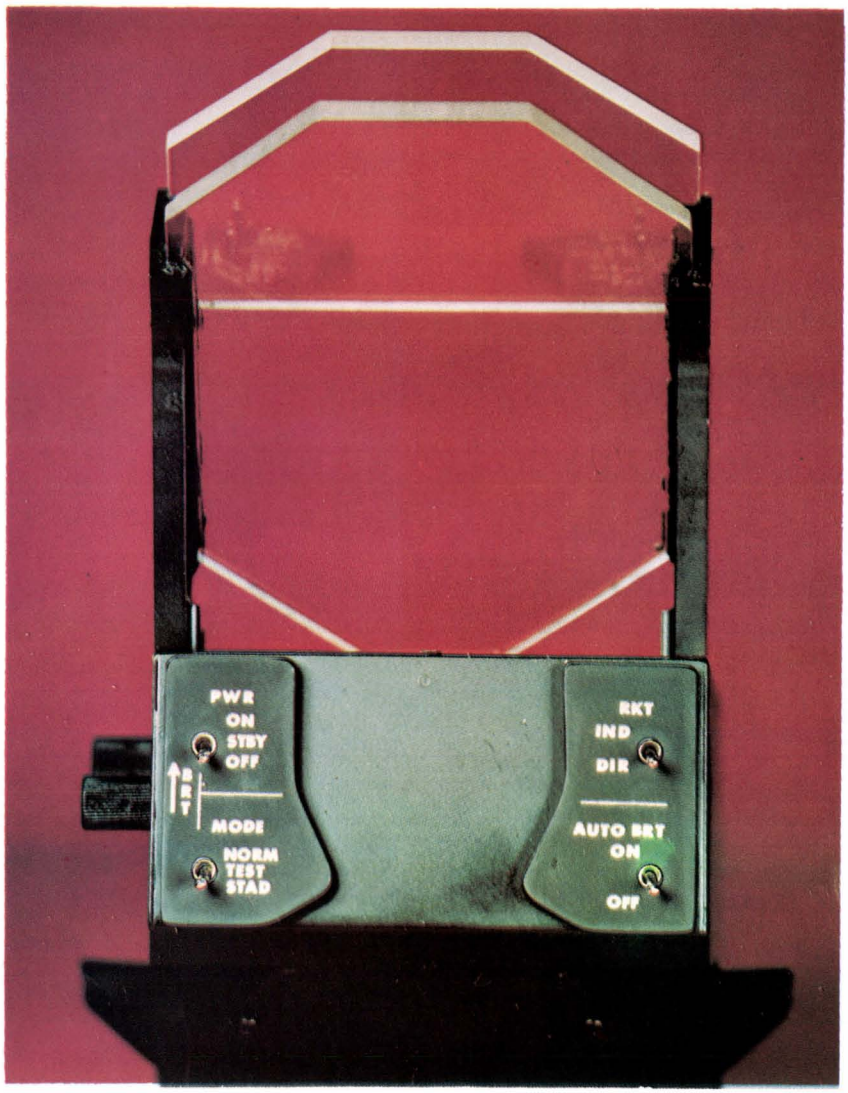


Figure 2 — Pilot's Display Unit

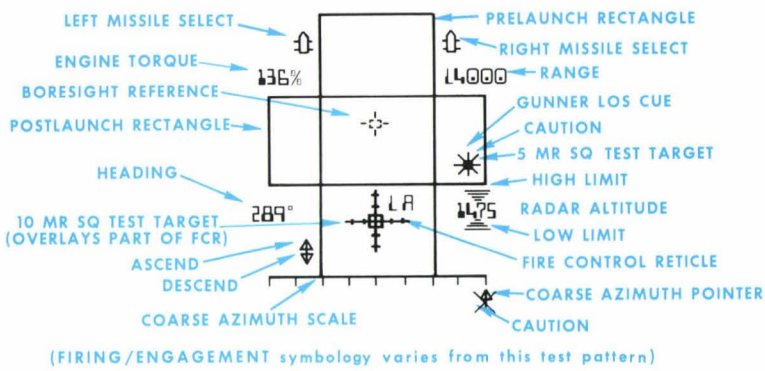


Figure 3 — HUD Test Mode Symbology

device if used indiscriminately on the ground or in the air. Safety features are included to minimize probability of injury to the aircraft crew and ground support maintenance personnel. As an example, the laser cannot be fired when the aircraft engine is not running and when the protective cover is not installed on the TSU window. However, when the protective cover is placed over the TSU window the laser can be fired to perform BIT. When airborne, the laser cannot be fired unless the TSU laser eye filter is switched in place and the laser is armed by both the pilot and the gunner. Figure 6 shows how the laser rangefinder will be installed in the M65 TSU, which will be accomplished by Hughes Aircraft Company.

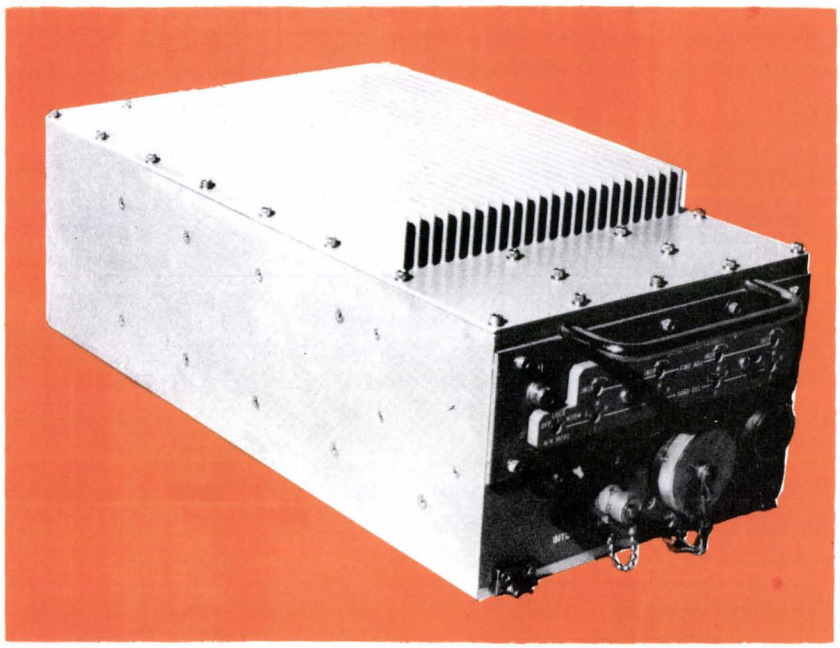


Figure 4 — Fire Control Ballistics Computer

AIRBORNE LASER TRACKER

The Airborne Laser Tracker (ALT) AN/AAS-32 is an aircraft mounted system designed to automatically search, acquire and track target reflected laser energy. The system was developed in conjunction with the laser target designator AN/PAG-1 (hand held) but is compatible with any laser designator of the same wavelength that employs the Tri-Service pulse repetition frequency (PRF) coding scheme. The AN/AAS-32 major components are shown in figure 7. The ALT will improve target acquisition and provide target hand-off capability for laser designated targets. It is scheduled to be installed on the aircraft in November 1979.

Figure 5 — Air Data Subsystem Components

AIRCRAFT SURVIVABILITY EQUIPMENT

The Cobra aircraft is one of the most important aircraft survivability equipment (ASE) customers of the present fleet of front line aircraft. In fact, since 1974 intensive programs in infrared (IR), optics, radar, and ballistics survivability have been underway to counter present and projected air defense threats. The results are now evident in the new look of the Cobra weapons platform. The IR suppressors and low reflectance IR paint, flat plate canopy, warning

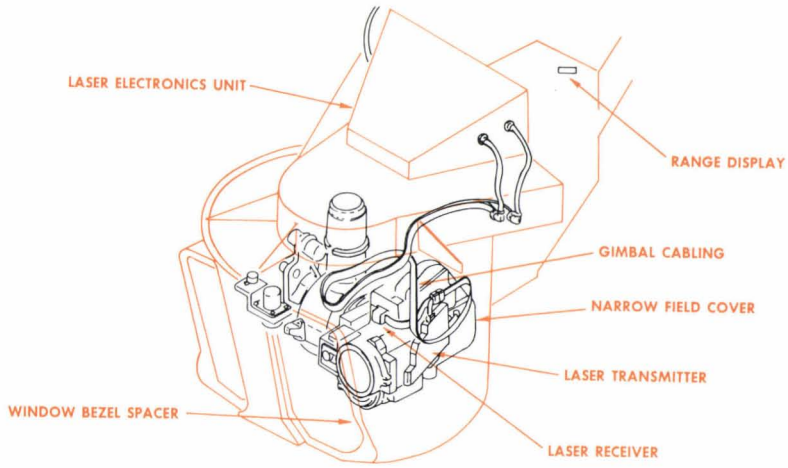


Figure 6 — Laser Rangefinder Installation

receiver antennae and jammers will complement the advanced weapons, fire control and navigation developments to transfigure the lean AH-1G to the higher powered modernized and survivable AH-1S.

In addition to these hardware improvements, tactics and doctrine have been developed to take advantage of the new weapons capability which will enhance the aviator's ability to survive in combat. Testing and improving of these tactics and doctrine during field exercises has established the credibility that Army helicopters can survive and operate effectively on the modern battlefield.

Infrared Survivability. IR suppressors and paint are used to reduce the AH-1S signature sufficiently to operate against the less sophisticated missiles. During 1976 and early 1977, the bell scoop IR suppressors and IR paint were applied to the Cobra/TOW helicopters in Europe, Continental United States, Hawaii and Korea. The scoop weighs 40 to 45 pounds and shields the hot metal parts from view of the IR missile. IR paint has been adapted as the standard Army paint and is being applied routinely on production, overhaul and modification lines. For advanced threats, an improved IR suppressor, which reduces hot metal plus plume (HM + P) signature is required. It reduces the effective range of the more sophisticated IR missiles and makes it feasible to employ an efficient IR jammer.

The AH-1S suppressor program is now in the latter stages of engineering development and scheduled for production in 1979. It is a cooled plug-type suppressor and the design uses large volumes of ambient air to cool the exposed metal surfaces and to dilute the exhaust gas to lower the plume signature. Figure 8 shows the present bell scoop IR suppressor while figure 9 shows the new hot metal plus plume IR suppressor.

ALQ-144 IR Jammer. The IR jammer is required to defeat the postulated air defense growth threat. The ALQ-144 weighs 25 to 30 pounds and is an active IR countermeasure which confuses the threat IR missile. Development and operational testing has been completed successfully and production is planned for 1979. The application of the ALQ-144 to the AH-1S will be accomplished along with the new hot metal plus plume suppressor.

RADAR SURVIVABILITY

The AN/APR-39 radar warning receiver (RWR) on the Cobra is a simple lightweight system consisting of five antennas, two receivers, a comparator and a cathode ray display and weighs about 10 pounds. For low level and NOE operations, the radar signal density will be low due to terrain masking, permitting the use of this proven system. The APR-39 provides the pilot with the advantage of being able to take evasive maneuvers before actually receiving fire from radar-directed weapons. The warning is provided to the pilot through an audio tone in the headset and a strobe on the cathode ray tube.

A laser warning receiver, adaptable to the APR-39, is now completing advanced development and is scheduled to enter full-scale engineering development in early fiscal year (FY) 79. It weighs about eight pounds and will display quadrant warning to the pilot that a laser designator or rangefinder is aimed at the aircraft.

The ALQ-136 radar jammer on the Cobra is an automatic radar jammer for attack helicopter use that is passive until illuminated by a threat radar which has locked onto the aircraft. The ALQ-136 automatically causes a breaklock on the threat radar, then returns to the passive mode. It can defeat two threats simultaneously. It is scheduled to be applied to the AH-1S in 1979. The M-130 chaff dispenser is the low cost radar countermeasure solution for the Cobra, pending availability of the ALQ-136 radar jammer. This system has proven its effectiveness, weighs about 30 pounds fully loaded with chaff cartridges and is in production. Provisions for the Cobra weigh 2 to 3 pounds.

OPTICAL SURVIVABILITY

Canopy glint, rotor blades and fuselage color were determined to be major contributions to the visual detection of NOE helicopters. All new production AH-1S have flat canopies and all other Cobras will receive the new canopy during future S model conversion programs. After extensive field testing it was determined that the dark green IR paint on the fuselage and flat black on blades was the optimum paint scheme for Central Europe and Asian theatres. This is now standard paint as described in the IR suppression discussion, above. A separate program to define the approximate type and color paint schemes for desert and arctic operations is underway. A late FY 78 recommendation is expected.

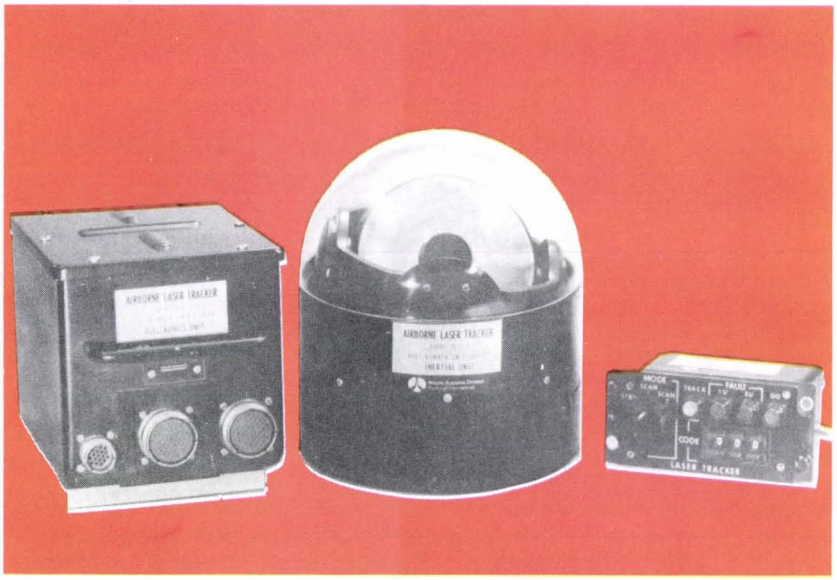


Figure 7 — Airborne Laser Tracker AN-AAS-32

BALLISTICS SURVIVABILITY

The AH-1S already has benefitted from vulnerability reduction or ballistics hardening efforts. The new AH-1S tailbooms have been designed to withstand ballistics damage from a 23 millimeter (mm) round. The improved tailbooms will be applied to all conversion Cobra aircraft. The new main rotor blade not only reduces the radar cross section but can withstand a 23 mm round ballistic damage and continue to fly. A new transmission is under development which will be capable of operating for 20 minutes without lubrication should it receive a ballistic hit.

Figure 8 — AH-1 with Bell IR Suppressor

The Cobra has the best aircraft survivability equipment presently available and active programs to meet the growth threat are being expedited and matched with the aircraft production to minimize cost and modification downtime. The new survivability equipment is being developed for ease of installation through kit design which provides the commander the flexibility to use only the ASE that is needed.

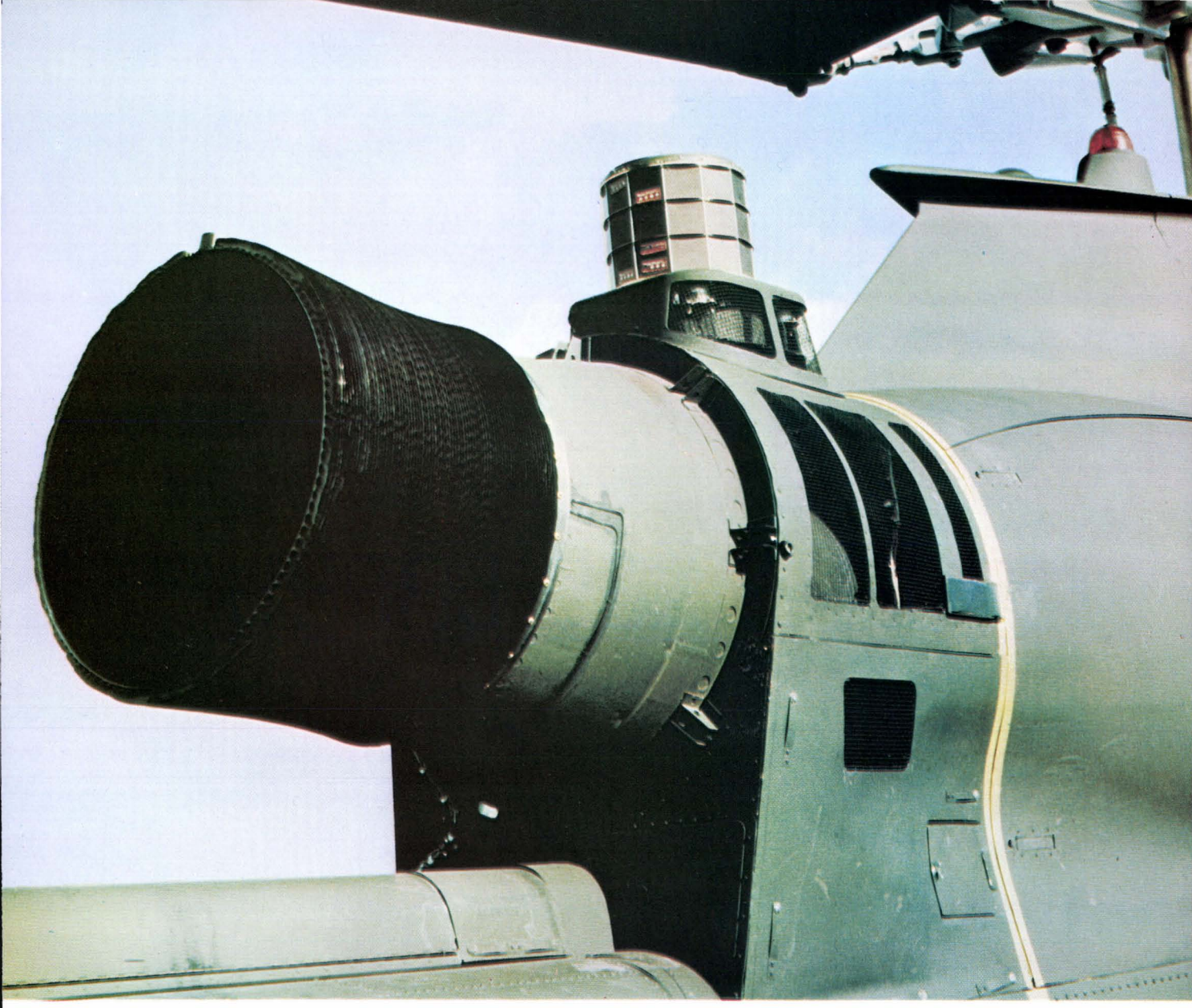


Figure 9 — New production AH-1S

TECHNOLOGICAL ADVANCES

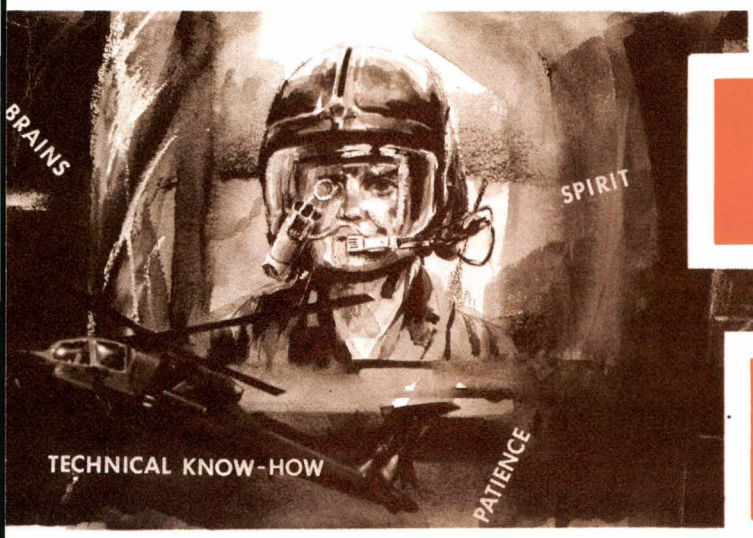
There are several technological improvements being developed which could enhance the AH-1S Cobra TOW navigation, target acquisition and communication capabilities.

A projected map display (PMD) for navigation, a FLIR augmented TOW Sight (FACTS) for high threat acquisition and recognition and a new group of NOE radios for communication with all battlefield elements are possible candidates for additions to the Cobra.

Also, an integrated avionics control system (IACS) which will provide for complete avionics, doppler navigation control and PMD interface. Efforts are underway to uprate the T53-L-703 engine from its present 1,800 shaft horsepower (SHP) to 2,000 SHP to meet the 4,000/95 degrees fahrenheit (F.) hover out of ground effect at max gross weight requirement.

A multiplex system is being investigated which will eliminate more than 100 pounds of wire bundle weight. These new candidates will increase reliability, save cockpit space, reduce pilot workloads and increase the efficiency of the overall Cobra weapon system.

These three articles have provided a look at the programs and type of equipment to be utilized to completely modernize the AH-1S Cobra TOW to meet the needs of the Army through the 1980s and 1990s.



Guts are Great but Brains are Better

Colonel John C. Bahnsen
TSM, Attack Helicopter
U.S. Army Aviation Center

THE TITLE OF this article might insinuate that "guts," bravery, audacity are not as important as brains in combat. But the fact is: *guts* have never been more important. The modern battlefield will be the most demanding the nation has ever faced.

If we accept the fact that we may be outnumbered it should put new vigor into our Soldier souls. To fight, survive and win certainly will require brave Soldiers with brains and physical stamina at the head of the qualification list. Brains are needed to orchestrate the modern battle—to *be able* to employ improved, more complex weapons systems. Physical stamina will be a driving force in view of our growing 24-hour-a-day capabilities.

In particular, the Army attack helicopter force (this includes scouts!) must develop a more determined *special spirit*. Attack and scout helicopters are not armored vehicles. They will not survive a shoot out with armored vehicles. This possibly dictates a somewhat different instinct than the demands of the battlefields of Vietnam.

Audacity in Vietnam quite often meant attacking troops with small arms, albeit brave bastards, in any one's Army. Attack helicopters on the next battlefield cannot get away with close-in, head-on attacks. We must work at long range from concealed positions. Our next battlefield most likely will be an armored fight. With this in mind rest assured that attack helicopters will have a key role in destruction of the enemy.

What kind of a Soldier will be the best in this environment? Are there some special characteristics of the aviators manning our scout and attack helicopters? Can we select the best before the fight? Will the same type that proved supereffective on our last battlefield be our future hero?

During World War II, German pilot Colonel Hans Rudel destroyed 519 Russian tanks. He flew a STUKA carrying two 37 mm cannons. His book. *STUKA Pilot* published in 1952, is a classic story of a dedicated, strong willed fighter. During recent interviews with Colonel Rudel by Air Force Captain Lonnie Ratley, Rudel cited that the most critical requirement of a close support tank killer is der Geist – *spirit or indomitable will!*

Rudel was shot down more than 30 times yet continually returned to the fight. This is an example of *the spirit* needed on any battlefield. In his book he related his experiences in surviving in a slow moving, poorly armored aircraft by knowing his equipment and the enemy. It is a story of intense dedication. It is a story of a modern day warrior that we would all like to emulate.

On the next battlefield *the spirit* of the Soldier is all important. We may fight the same people Rudel fought. Only in this day they are more sophisticated and infinitely better armed and trained. And, they are ready!

Today attack helicopter pilots must expose themselves to the enemy for their primary direct fire weapon TOW (tube-launched, optically-tracked, wire-guided) to be effective. The tactical fundamentals of maximum standoff distance and minimum exposure time are absolutely essential in doing this job successfully. Closing with the enemy appears brave and gutsy, but attack helicopter combat effectiveness is not increased appreciably. The primary idea must be to maximize tank killing, with low risk to the shooter. The enemy's artillery, air defense weapons, tank weapons, air forces and armed helicopters will provide sufficient threats to make the overall duel sporting.

Possibly the best Soldiers for this job are patient. They are Soldiers who will persevere and select their shooting positions carefully. They are not necessarily slow, but they have a certain coldness, calmness in their movements. These Soldiers are *not* easily stirred to emotional decisions. They have quick reflexes, are able to pick the right positions, select the right terrain with the right terrain masking on the first look. They can take incoming fire and not be worried that they ducked, knowing that eventually they'll get their shot. And in terms of results, that's what counts!

What other personal qualities might be important? In the case of Hans Rudel, he was a nonsmoker and nondrinker. He was in superb physical condition and normally ran 6 miles daily. He carried a discus, a 16-pound shot and a javelin in his cockpit in order to exercise during refueling and rearming stops.

Rudel stated that his physical conditioning program achieved two things – first, his reflexes and capabilities were maximized, and second, his physical conditioning proved to be profoundly effective psychological therapy which took his mind away from the hardships of the battlefield. Obviously, physical fitness is *required* in today's attack helicopter force.

In this light, I will make one observation about physical fitness. I recently have been closely associated with Air Force fighter pilots. From brigadier general to lieutenant, they are trim and physically fit. I envy their slim appearances and strive to match them. Unfortunately, that fighter pilot image does not fit the Army's attack unit commanders and attack helicopter aviators across the force.

During an "Air Antitank Seminar" held at Naval Postgraduate School, Monterey, CA in March 1977, several interesting observations concerning antitank pilots' characteristics were observed by attendees. Figure 1 partially summarizes the views of the various contingents attending. It is reproduced from "Air Antitank Seminar" report published by Naval Postgraduate School, Monterey, CA.

I believe the Army needs to more carefully select aviators for its small attack helicopter force. We have part of the mechanism to do this in operation today. We currently select our scout pilots based on set criteria during initial training. These criteria, although not all inclusive of what might be desired, should become the first step in selecting attack helicopter aviators.

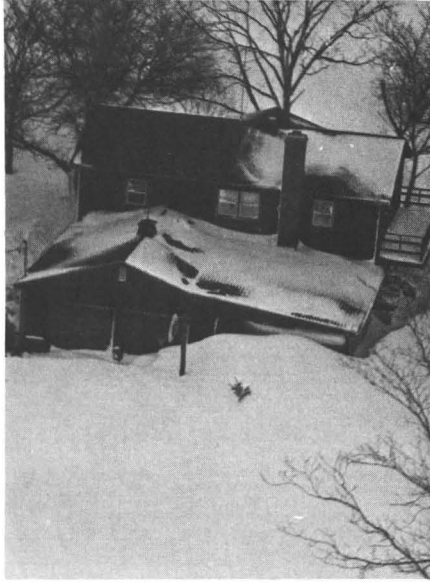
As scout pilots graduate and report to the field, unit commanders should be the next step in the selection process. From their groups of scout pilots, commanders should pick their best for further training in attack helicopters. They should not place a fixed number of flying hours or any other such arbitrary constraints on their selectees. Commanders should be able to evaluate the selectees based on personal knowledge of their brains, aggressiveness, competitiveness, performance under stress, physical fitness, physical stamina, and the key to the whole program – the *INDIVIDUAL DESIRE*. Commanders should vouch for their selectees as outlined above.

After a Soldier has been selected for attack helicopter training, that person becomes eligible to be designated an attack helicopter Battle Captain (or Team Leader). From this group of performers will spring our future crop of exceptional attack unit commanders.

Spirit, *Der Geist*, has never been more important to our Army and to Army aviation. We want our *best* pilots in the cockpit and behind the guns on the next battlefield. Anything less risks an enemy victory. We need aviators with guts *and* with brains. *We need the best!*

FIGURE 1 — Views from "Air Antitank Seminar" attendees

ATTENDEES	*DESIRED ANTITANK PILOT CHARACTERISTICS*
Air Force	Physical fitness greater than fighter pilots. Empathy with ground troops. Duty tour with Army.
Marine Corps	None. Tanks are just another target. Pilot empathy with troops already Marine hallmark.
Navy	None. Any Naval combat aircraft and pilot will do.
Army	Empathy with ground troops. Pilot ground indoctrination tour.
Industry (Aerojet)	Special eyesight.
Euroexperts	Acquired superior physical condition. Overall alertness. Competitiveness. Empathy with ground troops.



Activity continued day and night as helicopters supported Operation Snow Blow in northwestern Ohio in January of this year.

Support came primarily from Ohio National Guard helicopter units. AH-1 Cobras and UH-1 Hueys were used to evacuate people, deliver food and medicine, and to provide reconnaisance and transportation support for active Army and National Guard personnel involved in snow removal.

LTC Dwayne Lee commander, 27th Engineer Battalion, Ft. Bragg, NC, and commander of the active Army engineer task force in Snow Blow, used an OH-58 Kiowa for transportation and airborne command and control.

Ohio National Guard Support To Operation Snow Blow

HELICOPTER VIBRATIONS: Where We Are

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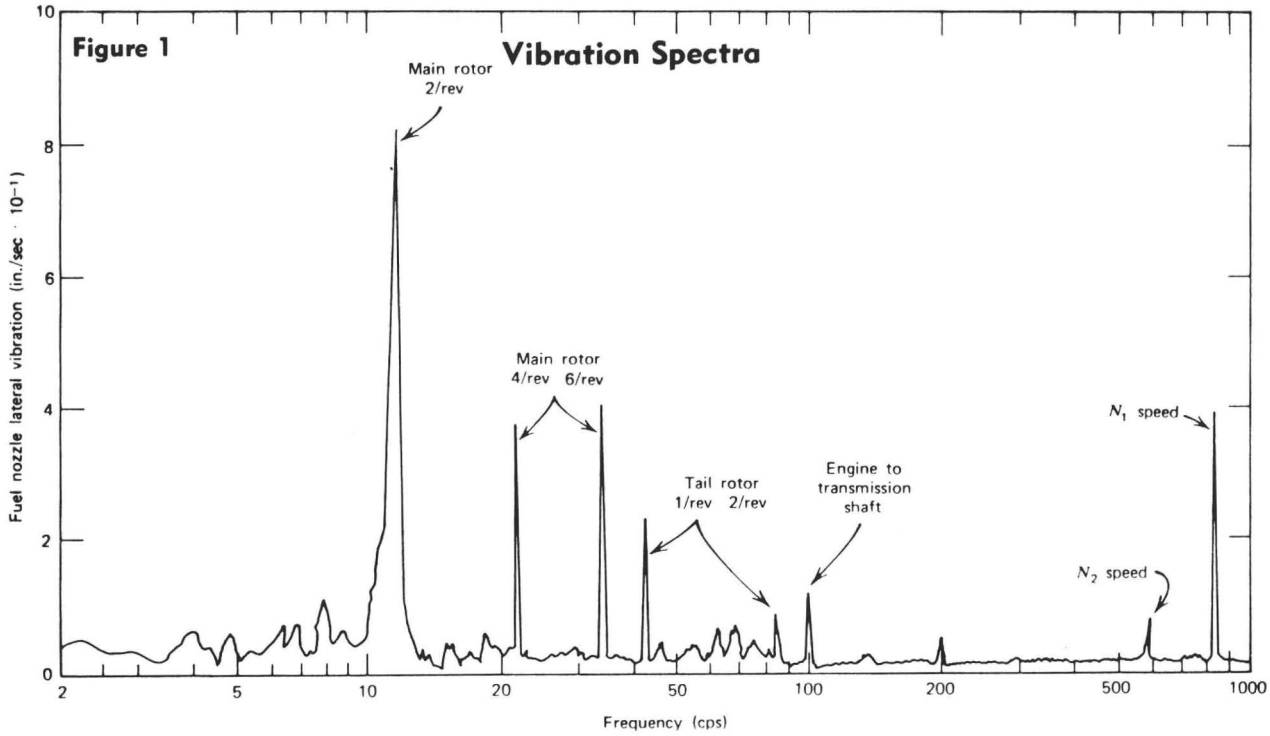
THE TWO WORDS "helicopter" and "vibration" always have been considered synonymous by Army aviators. Although significant strides in recent years have helped to alleviate the vibration problem, the theory required for its solution is still not completely understood.

As greater emphasis has been placed on reliability and maintainability and crew and passenger comfort, helicopter vibration requirements have become more stringent. UH-60 Black Hawk (utility tactical transport aircraft system) and AH-64 AAH (advanced attack helicopter) have been the first Army helicopters qualified under these new requirements.

How did they fare? What were the requirements? What problems were encountered by contractors attempting to meet the most stringent human factor vibration requirements a helicopter has ever had imposed on it?

Before answering these questions a brief review of the



sources of helicopter vibrations is in order. Figure 1 illustrates the vibration spectra of two-bladed light observation helicopter measured at one point. In this case the point was the fuel nozzle lateral vibration.

The importance of the main rotor as the primary source of vibration is clearly evident from figure 1. The first or fundamental blade passage frequency, 2/rev,* has by far the largest amplitude. This trend also is true for helicopters with more than two blades. The blade passage frequency and integral multiples of it are the primary sources of vibration throughout the airframe. Therefore, for a four-bladed helicopter the primary sources are 4/rev, 8/rev, etc.

While there are other sources of vibration, as can be seen from figure 1, their importance usually is more localized. In other words, equipment located near the engine or near the tail rotor or rotating shafts will receive a much larger portion from these sources. From a crew and passenger comfort consideration the main rotor, with its low frequency sources, is the major concern.

One main rotor source that hasn't been addressed and isn't distinctly illustrated in figure 1 is 1/rev. This source is a direct function of blade track and balance, and corresponds to an unbalanced automobile wheel or driveshaft. This source often is termed a "correctable" vibration since proper track and balancing methods and blade tooling can greatly reduce this source.

Figure 2 illustrates a comparison of the Black Hawk (UTTAS)/AAH human factor vibration requirements with past requirements. Also included in figure 2 are the results of recent human response to low frequency vibration tests, one of which has been incorporated in the military specification labeled "Human Engineering Design Criteria for Military Systems, Equipment and Facilities, 'MIL-STD-1472B'." The curve labeled, "Fatigue After 8 Hours," is taken from this specification.

For the sake of simplicity a four-bladed helicopter operating at a rotor speed of 300 rpm (revolutions per minute) is used in figure 2. This is necessary since the Black Hawk/AAH requirements state that a maximum vibration level of .05 g is permitted at the pilot, copilot and passenger stations during steady speed conditions for vibrations occurring at the n/rev blade passage frequency and below, where n is the number of blades. Therefore, for our example helicopter, the n/rev frequency is 4/rev at 20 hertz (Hz). Figure 2 verifies the validity of the more stringent Black Hawk/AAH requirement, especially in the frequency range from 4 to 10 Hz where the human body has natural frequencies that could be in resonance with the forcing frequencies.

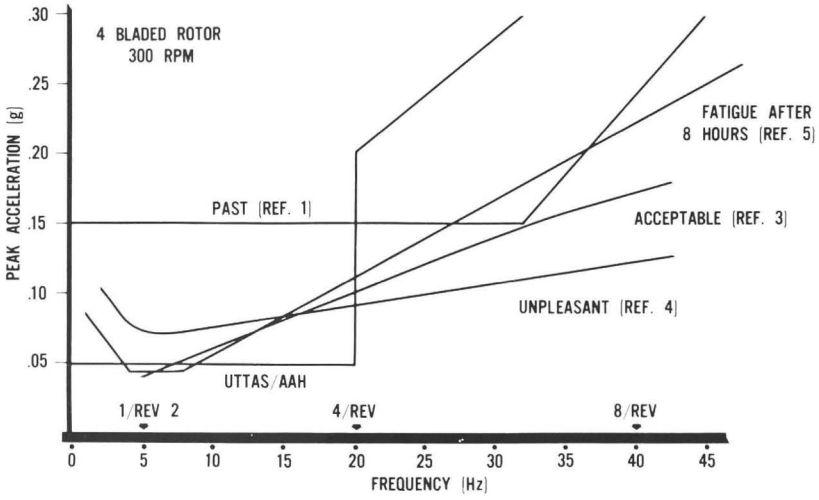
Also revealed in figure 2 is that the Black Hawk/AAH requirement may be too severe for a helicopter with more than two blades and is not stringent enough for the second blade passage harmonic, i.e. 8/rev for our example helicopter. It is evident from figure 2 that vibration requirements should be a function of frequency in the low frequency range, below 50 Hz. This can be accomplished by a simple formula such as g equals .004f/.01, where g is the vibration level in the acceleration unit, g, and f is the forcing frequency in Hz. For our example helicopter the formula would provide vibration limits of .03 g at 1/rev (5Hz); .05 g at 2/rev (10Hz); .09 g (20Hz); and .17 g at 8/rev (40Hz). These levels correlate well with the test results in figure 2.

None of the contractors

*2/rev is a system to measure the number of times each rotor blade passes a given point. Those interested in a more detailed explanation should contact the author.

Figure 2

Comparison Of Current And Past Human Factor Requirements For All Steady Speeds Up To V cruise

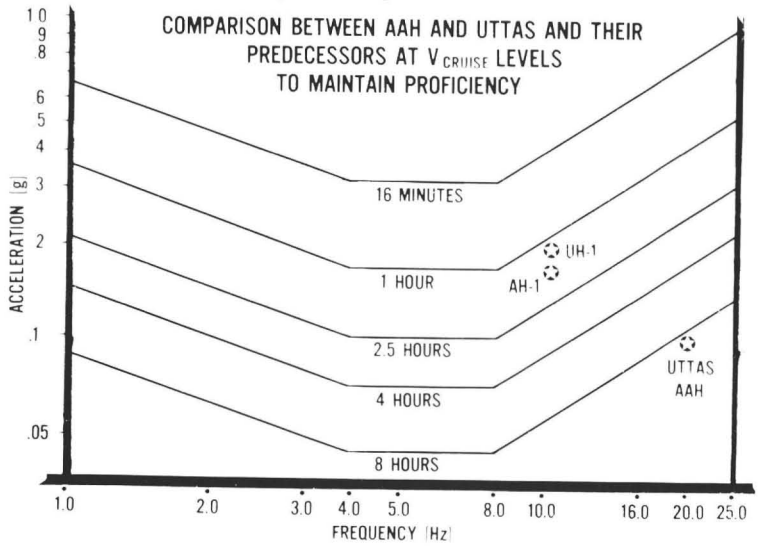


participating in the Black Hawk/AAH development programs could meet the .05 g human factor vibration requirement without paying an excessive weight penalty in vibration control devices. For this reason and those already discussed, an acceptable deviation of 0.10 g was allowed at the 4/rev rotor harmonic; however, the .05 g requirement remained in effect at frequencies below 4/rev. Even with the 0.10 g deviation the human factor vibration environments of the Black Hawk and AAH have improved considerably over their predecessors, the UH-1 Huey and AH-1 Huey Cobra. Illustrated in figure 3 is the vibration at cruise level (V-cruise) for the Black Hawk and AAH plotted along with their predecessors.

Using the vibration exposure criteria of MIL-STD-1472B the times listed are concerned with preservation of working efficiency called "fatigue, or decreased proficiency boundary." The "exposure limits" for health and safety reasons can be obtained by raising the working efficiency boundaries by a factor of 2. To obtain the "reduced comfort boundaries," the values of working efficiency boundaries must be divided by a factor of 3.15. In transportation vehicles the reduced comfort boundary is related to such functions as reading, writing and eating.

Another helicopter vibration concern is what effect will terrain flying, particularly nap-of-the-earth (NOE), have on crew proficiency and component reliability. Figure 4 is typical of the vibration characteristics of a helicopter in its different flight speed regimes. It is evident two regimes, low speed flight and high speed flight, produce critical vibration levels. It is in these regimes that analytical methods used to calculate hub forces and moments and predict airframe vibrations are most unreliable.

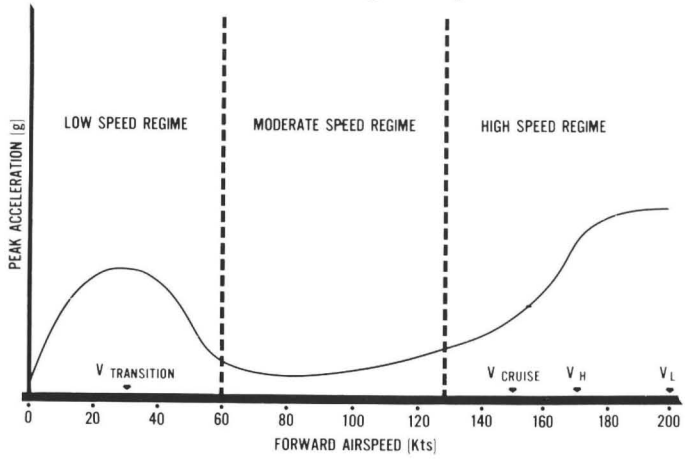
Figure 3
Vibration Exposure Criteria



The marked increase in vibration levels and variable stresses at low speeds can be attributed to the nonuniformity of the induced velocity field created in the flow through the rotor. This condition makes the aerodynamics representation in an analytical model to predict vibrations very complex and involves a rotor wake theory that is not completely understood.

In the high speed regime, the increase in vibration levels can be attributed to amplification of variable aerodynamic loads generated as a consequence of the dysymmetry of lift between the advancing and retreating blades. This results in blade stall on the retreating blade and compressibility (mach number) effects on

Figure 4
Typical Helicopter Vibration Characteristics With Increasing Airspeed



the advancing blade. Here again the aerodynamics representation necessary in the analytical model is complex and not completely understood. The critical nature of the high speed regime has been the major concern of helicopter design engineers in the past. The cruise speed generally has been used as the critical design point for vibrations.

The increasing emphasis on terrain flying and pop-up maneuvers as accepted doctrine requires a reassessment of helicopter vibration requirements. While the Black Hawk and AAH have greatly improved NOE flight characteristics, most of the design philosophy and flight spectrums were based on Vietnam experience where the majority of flight time was spent in level flight at not more than 1,500 feet. As shown in figure 4 the low speed regime also is critical and terrain flying as accepted doctrine makes reevaluation of vibration requirements in low speed maneuvering flight an *absolute necessity*.

It was difficult to achieve the vibration environment found in Black Hawk and AAH. Much time, effort and cost were involved throughout the development programs. Because much of the theory is still not understood many of the vibration problems were only solved through trial and error testing and previous experience.

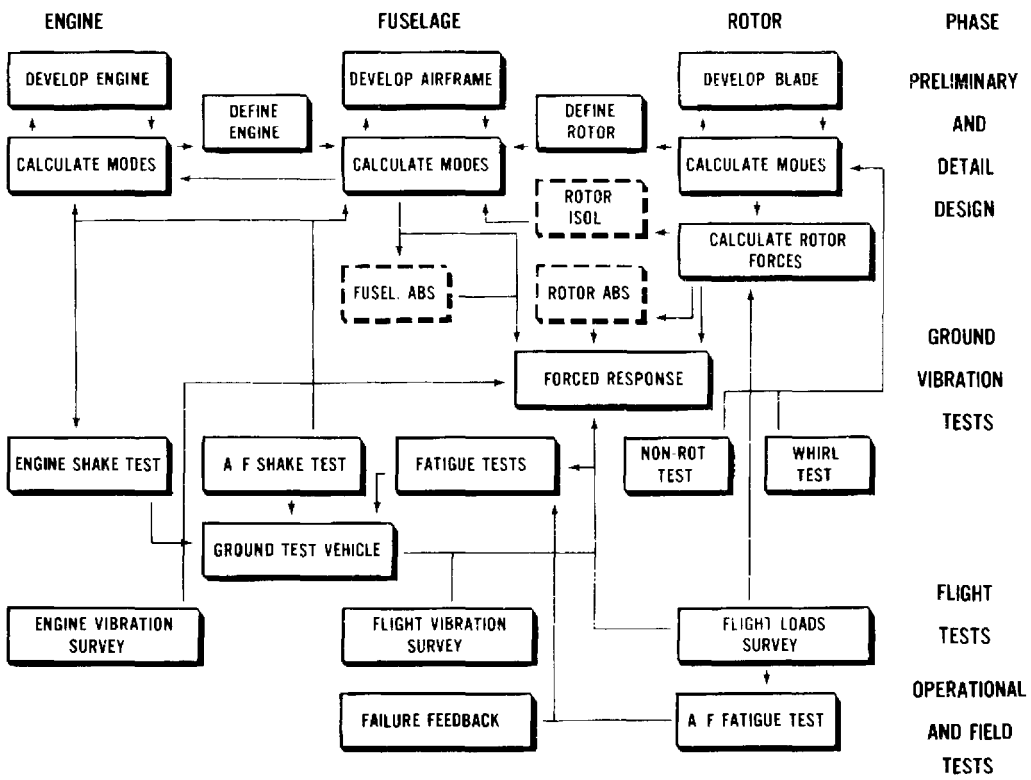
Figure 5 illustrates how the vibration problem was addressed through the development programs and the acceptable environments obtained. The complexity and interface between the systems (rotor, airframe and engine) can be seen clearly in figure 5. This problem must be addressed early in the design phase.

There will be surprises when flight testing is initiated, but these must be kept to a minimum. Previous experience and test data from successful helicopters must be used in conjunction with analytical methods if an acceptable environment is to be achieved.

Whether the helicopter can progress much beyond its current state of development is difficult to foretell. Unless a better understanding of the fundamentals of rotor dynamics and aerodynamics is obtained it is doubtful. Rotors will continue to be designed by extrapolation from previously successful designs without significantly extending the useful envelope of existing rotors in relation to loads and vibrations.

Figure 5

Flow Diagram Of The Helicopter Vibration Problem



Lightweight Doppler Navigation System (LDNS: AN/ASN-128)

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IN DECEMBER 1976 the U.S. Army awarded a $5.6 million production contract for 200 Lightweight Doppler Navigation Systems (LDNS). The Kearfott Division of the Singer Company was the recipient of the contract following an intense and highly competitive development program and evaluation between their system and a similar system. The contract includes an option for 600 additional systems.

Initially the LDNS is scheduled to be installed in the AH-1S Cobra, the UH-60A Black Hawk and the AH-64 AAH. Also under consideration for receiving the system is the CH-47 Chinook (figure 1).

Now that you know that we are getting them and in what aircraft they will initially be installed, you probably are wondering what exactly is a lightweight doppler navigation system and how does it work. Hopefully this article will answer these questions for you.

The LDNS is a lightweight (30 pounds), self-contained (it needs no signal from a ground reference point), low cost (about $25,000) and an extremely accurate navigational system.

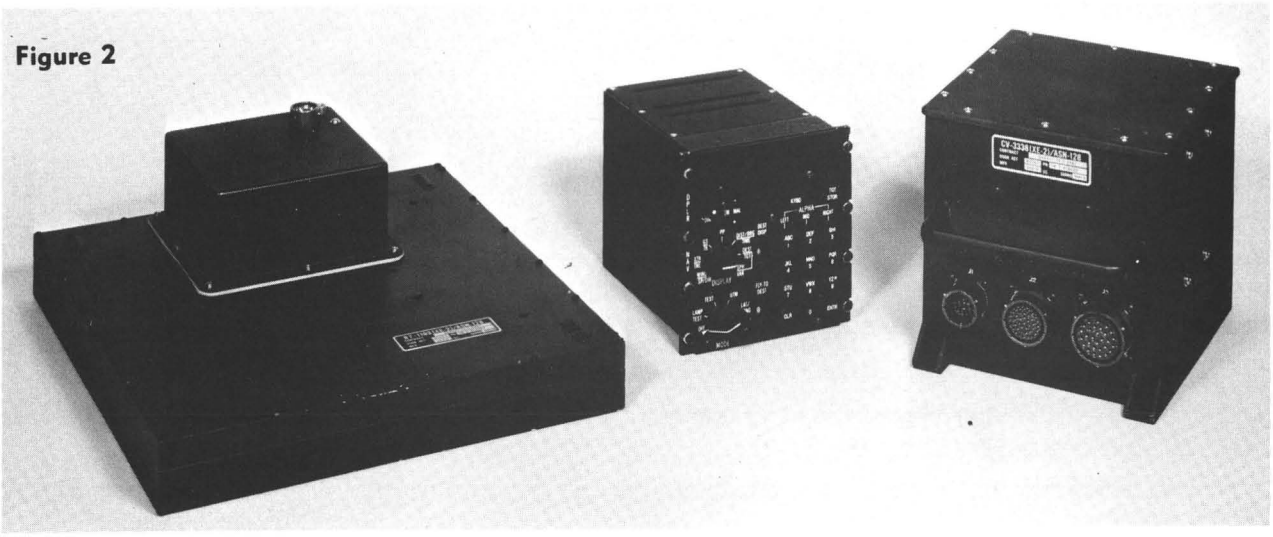
The system is designed to operate from zero to more than 14,000 feet in altitude: at ground

Figure 1

AN/ASN-128 Doppler Navigation Set
Aircraft Installations

Black Hawk	Mid-Calendar 1978
AH-1S	Calendar 1979
CH-47D	Calendar 1982
AAH	Calendar 1982

Figure 2



Left to right: Receiver/Transmitter; Computer Display Unit; Data Converter

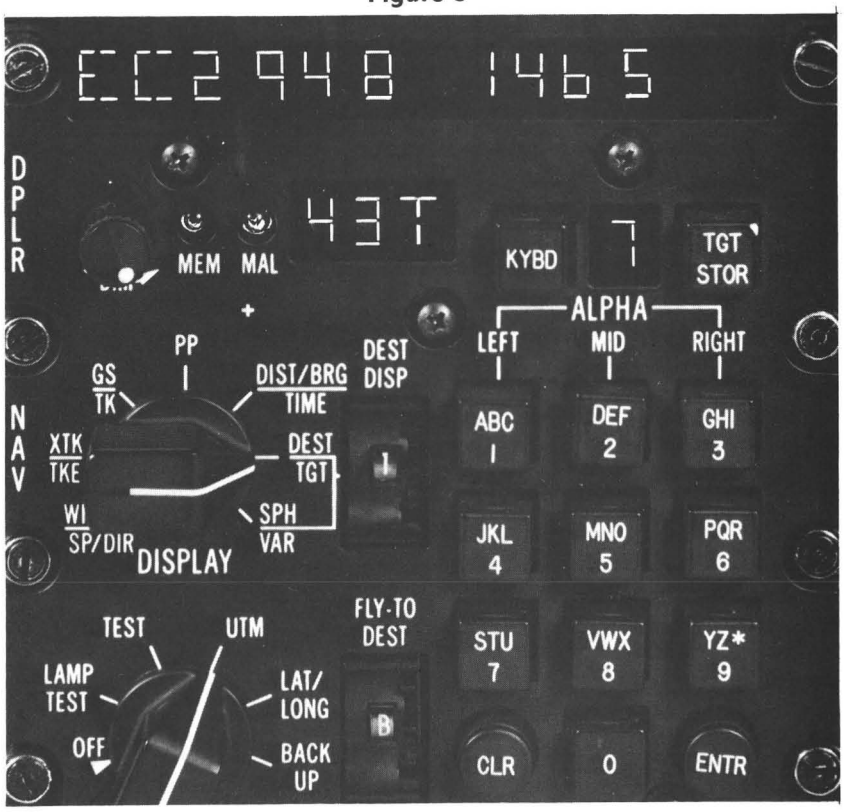
speeds of from -50 to +300 knots, and at attitudes of ±45 degrees pitch and ±30 degrees roll. As you can see, it is applicable to all types of Army missions – including nap-of-the-earth (NOE).

The LDNS consists of three separate units (figure 2): the radar receiver/transmitter antenna (RTA), the radar signal data converter, and the computer-display unit (CDU).

The CDU (figure 3) which is installed in the cockpit, controls everything that is entered into or computed by the system. As with all avionics systems being developed, the panel lighting and display's alpha-numeric lights are compatible with the night vision goggles (AN/PVS-5) as well as being visible in bright sunlight.

The information computed by the LDNS and how it is displayed on the CDU is shown in figure 4, while figure 5 gives a horizontal picture of the navigational problems solved by the system. To get all of this information, however, some data inputs into the

Figure 3



Glossary

fd = Doppler Frequency Shift
V = Velocity of helicopter relative to the ground
c = speed of propagation of the microwave energy (speed of light)
ft = Frequency of the transmitted energy
γ = Vertical angle from line of flight to the transmitted beam direction
XTK = Cross Track Error
TKE = Track Angle Error
Bpp = Bearing At Initial Point
B = Bearing To Destination
T = Track Made Good
R = Distance from Present Position to Fly-To-Destination
H = Heading

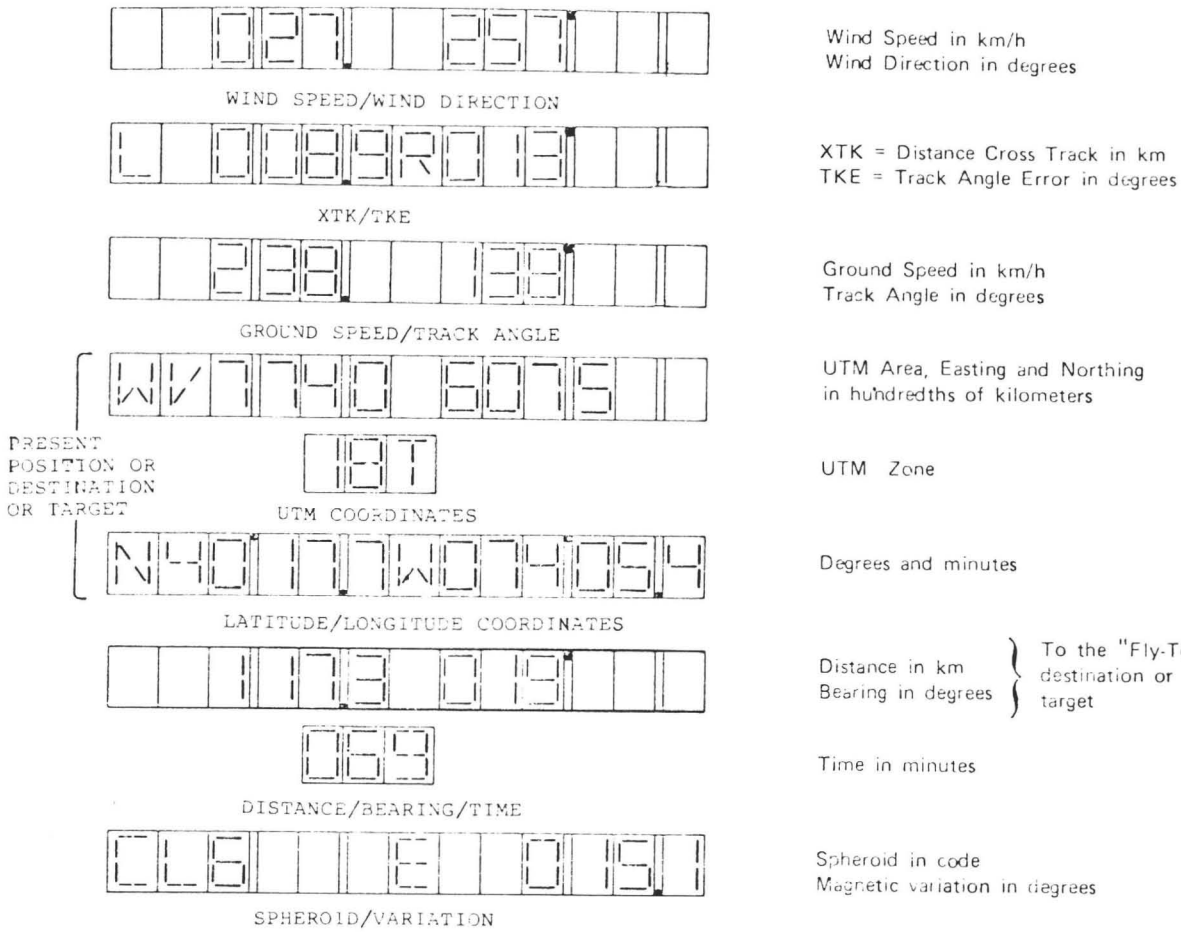


Figure 4

system are required. Much of this data is supplied automatically from the aircraft's other avionics sensors, but the following data must be entered into the system – via the keyboard on the CDU – by the pilot/navigator.

- Spheriod of operation – when using UTM (universal transverse mercator (grid)) coordinates
- Present position – 8-digit UTM or latitude/longitude coordinates
- Magnetic variation of present position and destinations – to nearest 1/10 of a degree
- Coordinates of desired destination/checkpoints – this is needed only if steering commands are desired. (The steering information can be used to drive other cockpit displays such as the horizontal situation display (HSD)).

A quick look at the legend section on your tactical map will provide you with the first and third required inputs while the second and fourth inputs can be obtained from the topographical portion of the map. Once this initial data from the pilot/navigator is entered, the system is ready to go. (The CDU also contains the built-in test equipment (BITE) that tells the pilot/navigator the system is functioning properly.)

As I think you can begin to see the lightweight doppler navigation system requires navigators to work a little harder while they're still on the ground but once the aircraft is airborne the LDNS drastically reduces the workload imposed by the navigational task. It should be made clear, though – once airborne the navigator *must still work* with the system.

To minimize the effect of the error rate the navigator may update the system ever so

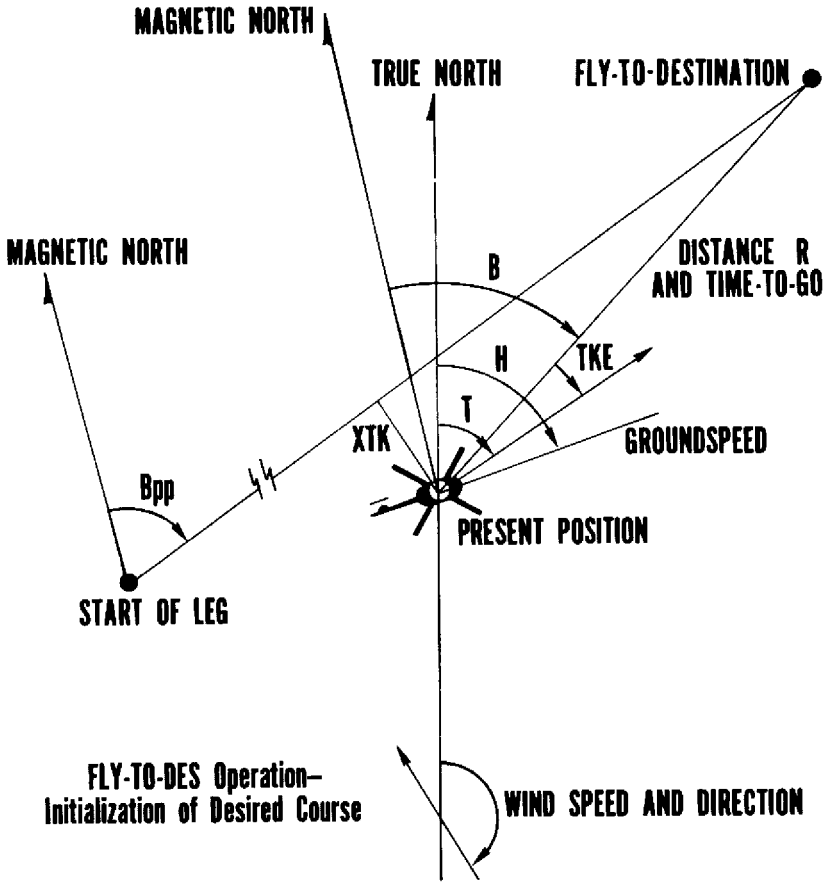
often – the rate being governed by the length of the flight route and the degree of accuracy desired at the final destination.

To update the system all you have to do is fly over a known set of coordinates – usually it will be one of the checkpoints you initially entered into the computer – and then press the enter button as you pass directly over that point. As pilots/navigators become more and more confident in the fact that the LDNS will do what it was designed to do, they'll be able to reduce the workload of the navigational tasks and direct this new found "free time" towards the accomplishment of the multitude of new tasks that our newer, more sophisticated aircraft are going to demand.

Now, to understand how the Doppler Navigation System works, let's return to Christian Doppler (1803-1853), an Austrian physicist, whose observance of the phenomenon known as Doppler effect is familiar to anyone who has noticed the change in pitch of a locomotive whistle as it passes a stationary point. His principle states that whenever a sound source or an observer moves, the frequency of the sound heard differs from the frequency of the source from which it regenerates.

This principle not only is applicable to sound, but also to electromagnetic radiation, including microwave energy. In the case of Doppler radar, the frequency shift in the microwave reflected signal is a measure of the relative motion of the observer and the reflecting medium. This brings us to the Doppler Equation, shown in figure 6.

Let me close by leaving you with this little reminder: "To be an effective member of the combined arms team on our next battlefield, we *must* know at all times where we are and where we are going."

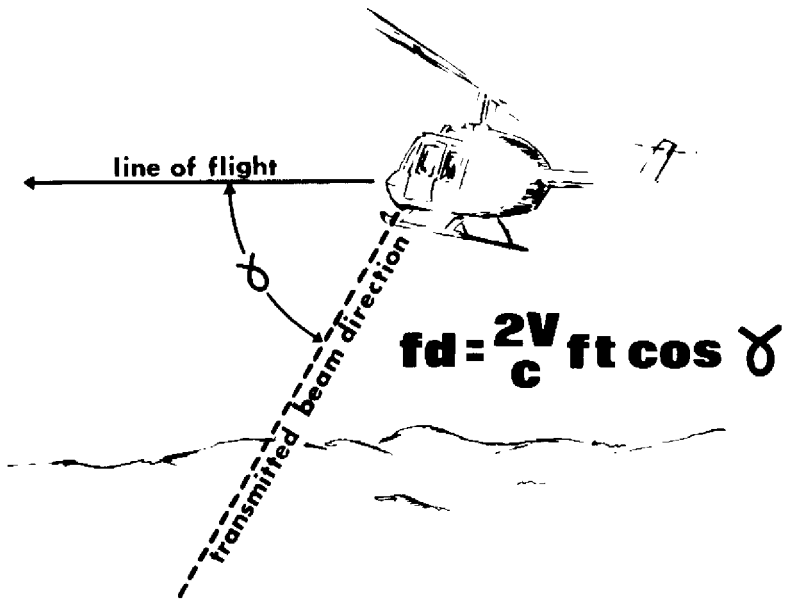


Navigational Problems Solved By The Computer

Figure 5

Figure 6

The Basic Doppler Equation



Wire strikes claimed an average of two Army aircraft every month during FY 1977, and this average has since increased to about 2.7 aircraft per month for the first quarter of FY 1978

WIRE STRIKES ON THE RISE

THE OH-58 WAS ready for flight back to its home station. It had been serviced and thoroughly preflighted. All cockpit and operational checks had been performed by the book; and the pilot, an experienced SIP, had accomplished every phase of planning with equal thoroughness. The route he selected was chosen because it provided more suitable landing areas in the event of an emergency and the flight would be made during daylight hours in VFR weather.

What more could anyone ask?

With two passengers on board, the pilot lifted the OH-58 off the ground and nosed it toward home. Scarcely 20 minutes later, the broken aircraft, its occupants dead, lay inverted in a river – victim of a wire strike.

How did an ideal flight situation turn into a catastrophe? This is how accident investigators pieced the events:

At some point after departure, the pilot elected to veer from his established course to follow a river. Then, in violation of his unit SOP, he chose to descend below the minimum authorized altitude of 500 feet agl. As the aircraft rounded a bend, wires seemingly appeared from nowhere. Whether or not the pilot saw them is not known; but if he did, he had no time to react. The aircraft crashed into the wires which severed the mast, then nosed inverted as it fell uncontrollably 140 feet into the river.

We will probably never know why the pilot deviated from his normal route or why he failed to follow published procedures to maintain a minimum altitude of 500 feet agl. But we do know from analysis of aircraft and engine components that no mechanical failure contributed to this accident. Ironically, had the pilot checked his map,

USAAAVS

Crash occurred after main rotor blade broke apart during continued flight over wooded terrain following wire strike. Two fatalities and one major injury.

Pilot deviated from course and was making unau flight down river. Aircraft struck cable (shown abov water. Three fatalities.

which was found folded to show his planned route, he would have seen that the wires were clearly marked.

This accident is "typical" in that most wire strikes do *not* occur during authorized NOE flight, despite its inherent dangers, but during the conduct of other types of missions.

During the 5-year period, FY 1973-1977, wire strikes resulted in destruction of 30 aircraft, major damage to 13, minor damage to 4, and incident damage to 54. In addition, they caused 23 precautionary landings. Collectively, they claimed 37 lives and cost more than $10½ million for damaged and destroyed equipment. Almost 90 percent of these mishaps happened outside the authorized NOE environment. This fact coincides with the concern voiced by Army aviation safety personnel early in FY 1973 when NOE training began to expand. The fear expressed was that as NOE and other forms of low-level flight became more commonplace, pilots might tend to become less cautious and more prone to fly low level outside the authorized training area. They pointed out that in a formal NOE training program, the risk of wire strikes is known to be a real and constant threat. Consequently, positive prevention measures have been taken.

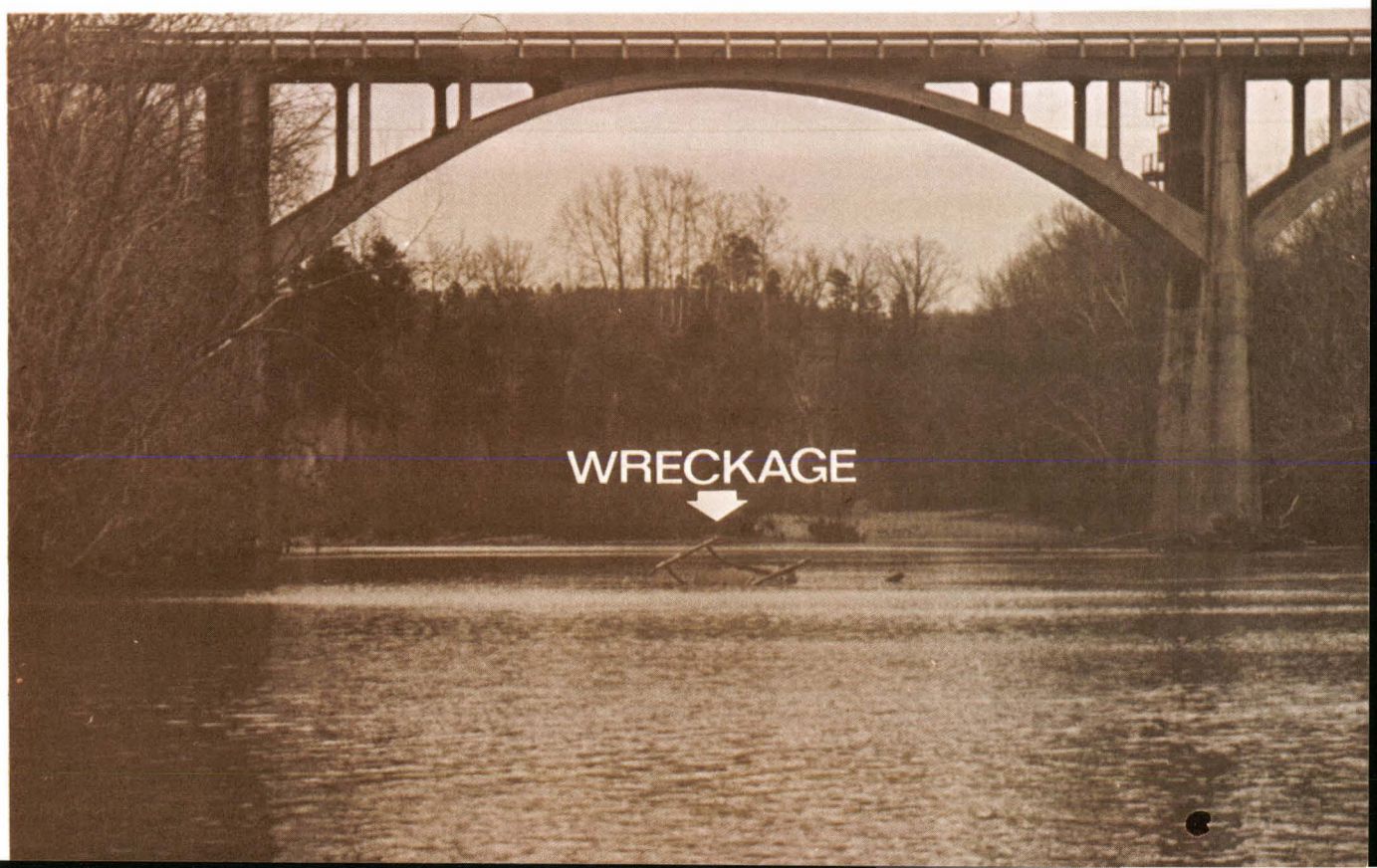
Since we do not provide the same degree of supervision and controls outside the NOE training environment where do we look for a solution?

Numerous agencies have become involved in the search for a solution. Radar and laser wire detectors have been developed. Wire cutting devices have been designed for use on the nose, hub shroud, and leading edges of rotor blades. Aircraft manufacturers have suggested curving the skids upward to a greater degree in an effort to reduce skid entanglement. But as yet, none of these systems or configurations has proved sufficiently practical for adoption.

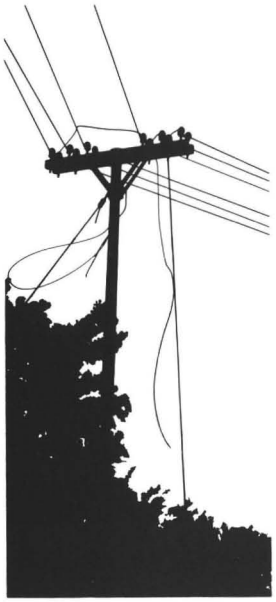
As the matter now stands, we must look to ourselves for the best means of avoiding wire strikes. And there is much we can do. The first step is to review what we already know.

Facts to consider

- Human error is almost always involved when wire strikes occur. Those rare mishaps that happen after some in-flight materiel-related emergency are generally the only exception.
- Most wire strikes occur below 50 feet agl, with few occurring above 150 feet and none at altitudes above 300 feet.
- Most wire strikes happen during cruise flight.
- An aerial reconnaissance over unfamiliar terrain is only partly effective in locating wires strung in the area. For all practical purposes, it is virtually impossible to ensure all wires are noted during such a reconnaissance.
- Wire strikes seldom occur at takeoff and landing points when surrounding wires are marked.
- Pilots in units with strong command supervision to enforce SOPs dealing with flight discipline are



low-level
mbled into



Copper wires supported by 20-foot poles snapped on contact with aircraft and severed one tail rotor blade, causing loss of entire tail rotor assembly and aircraft control.

WIRE STRIKES ON THE RISE

less likely to become involved in wire strike mishaps.

• Even though wires may not be seen, their presence should be expected along roads and railroad tracks; between hills, poles, structures; and between any pole and a structure. Even when only a single pole in open country is spotted, the possibility of wires exists.

• The position of the sun, types of wires, time of day and exising atmospheric conditions can drastically affect the pilot's ability to detect wires. A change in one or more of these variables can be a deciding factor as to whether wires can be readily spotted, seen with difficulty or not seen at all. Even large powerlines suspended by towers can sometimes be impossible to see even on a perfectly clear day. On one occasion, accident investigators being flown to the site of a wire strike accident could not see the powerlines from the air even though they knew exactly where the wires were located.

• Some types of wires such as those associated with missiles are impossible to see during flight. The danger posed by these is greatest during low-level flight over firing ranges and over trees and other

Right and below: Wreckage settled against tree after aircraft struck wires (shown by arrows) approximately 50 feet agl.

Aircraft came to rest on level ground after main rotor struck telephone wires, causing them to wrap around mast and sever push-pull tubes during attempted takeoff from hover.

foliage adjacent to such ranges.

• The more crewmembers actively engaged in spotting wire hazards on any given flight, the less the risk of wire strikes. Conversely, the possibility of a wire strike is greatest when the pilot is the sole aircraft occupant.

Actions to take. With what we know, we can take positive steps to prevent wire strikes. The following are recommended:

1. Review unit SOPs and directives related to low-level flying to make certain they reflect the safest procedures possible for the types of missions being flown.

2. Provide adequate supervision to ensure pilots adhere to established policies.

Recently, a pilot decided, on his own, to perform NOE flight at night. Not only did he embark on an unauthorized flight but, in addition, took with him an unauthorized passenger. The aircraft struck wires and crashed, killing both occupants and destroying the aircraft.

3. When low-level flights are required, provide aviators with current maps that show wire obstacles, and make certain crews receive thorough briefings.

4. Where possible, mark all wires around potential takeoff and landing sites on and off military reservations and airfields. In the absence of some device to help the pilot locate and identify wire obstructions, one of the best solutions lies in making wires more conspicuous. This means the use of wire markers – something we have been doing to a limited degree for years. Time and again such markers have proved their value. A pilot arriving at an airfield – even one new to him – knows to expect wires in the vicinity. In looking for them, his job is simplified by the markers.

5. Unless required by missions, avoid low-level flight over areas known to contain wires and over firing ranges where fine missile wire can pose a potential threat.

6. Use all crewmembers in searching for wire obstructions during all low-level flights, and ensure maximum coordination between them.

7. Keep in mind, the closer to the ground that low-level flight must be conducted, the slower the airspeed should be.

If two helicopters are approaching wires or some other obstruction and one is traveling at 80 knots while the other is flying at 40 knots, the pilot of the faster moving aircraft must spot the obstruction from a distance of more than 1,650 feet to have sufficient time to react and avoid

Final resting place of aircraft which struck and broke powerline suspended over canyon shown in photo below. Three fatalities.

striking it. On the other hand, the pilot of the slower moving aircraft could get slightly closer than 600 feet to the obstacle before detecting it and still have ample time to maneuver his aircraft to safety. (These figures have been approximated, allowing for a time delay that includes the period required for human perception, decision, control manipulation, and reaction of the aircraft to control input.) Since more obstacles of different types are likely to be encountered close to the ground and since the types of evasive maneuvers that can be safely made at extremely low level are limited, depending on terrain, vegetation, etc., it is more than just good common sense to slow down when flying near the ground.

The number of wire strike mishaps involving Army aircraft decreased from 38 in FY 1971 to a low of 17 in FY 1975. The trend then began to reverse itself and in FY 1976 the number of wire strikes rose to 22. In FY 1977 this figure reached 25. If the frequency of wire strike occurrences remains unchanged for the remainder of FY 1978, we can expect their number to reach 32. To stop this upward trend, positive action is a must; and the brunt of this responsibility rests on commanders and aviators alike.

SMOKING: Effects On Pilot Performance

Major William E. DeBree
Directorate for Plans, Operations, and Education
U.S. Army Agency for Aviation Safety

FOR NEARLY FOUR decades, people in aviation medicine have been aware of the special hazards smoking creates for aviators. In the early 1940s, a medical coordinator for one of the major airlines warned that in addition to the harmful effects of long-term smoking, an immediate hazard was created by the carbon monoxide (CO) in tobacco smoke. This has since been extensively tested, proven, and documented.

The CO produced in smoking as a result of incomplete combustion is the same as that emitted from automobile engines but in smaller quantities, of course. After being inhaled into the lungs, the CO mixes with the oxygen in the lungs which reduces the volume of oxygen available for use. The red blood cells contain hemoglobin for transporting oxygen from the lungs to the cells throughout the body. One study showed the CO to be 210 times as successful as oxygen in competing for a transport position on the hemoglobin contained in red blood cells. The hemoglobin and CO, when bound together, are called carboxyhemoglobin (COHb). COHb affects the respiration process by reducing the amount of oxygen available to the cells and it also impairs the hemoglobin's ability to release the oxygen it still carries to the cells. The effect is an oxygen deficiency or hypoxic condition.

Aviators, especially fixed wing pilots, should know the hazards of hypoxia. And smoking increases the probability of hypoxic conditions occurring in aviators. For the light (1-10 cigarettes per day) to moderate (11-20 cigarettes per day) smoker, his physiologic altitude with a COHb level just over 5 percent is 6,000 to 8,000 feet—*when on the ground!* A heavy smoker (20+ cigarettes per day) with a 10-percent COHb level experiences a physiologic altitude of over 14,000 feet. Consider that federal aviation regulations require the administration of pure oxygen at cabin altitudes of over 12,500 feet. Army Regulation 95-1 requires that aircraft not equipped with oxygen may be flown between 10,000 and 14,000 feet *pressure al-*

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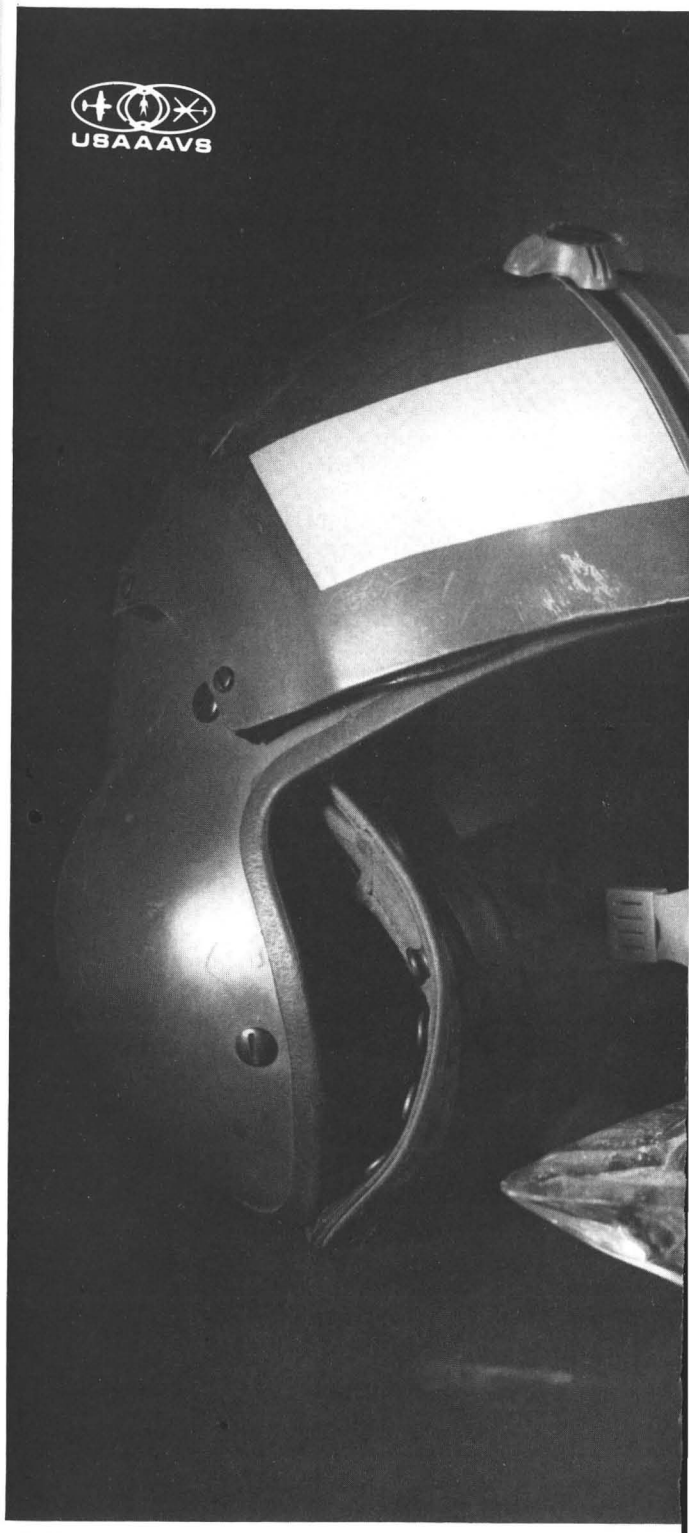
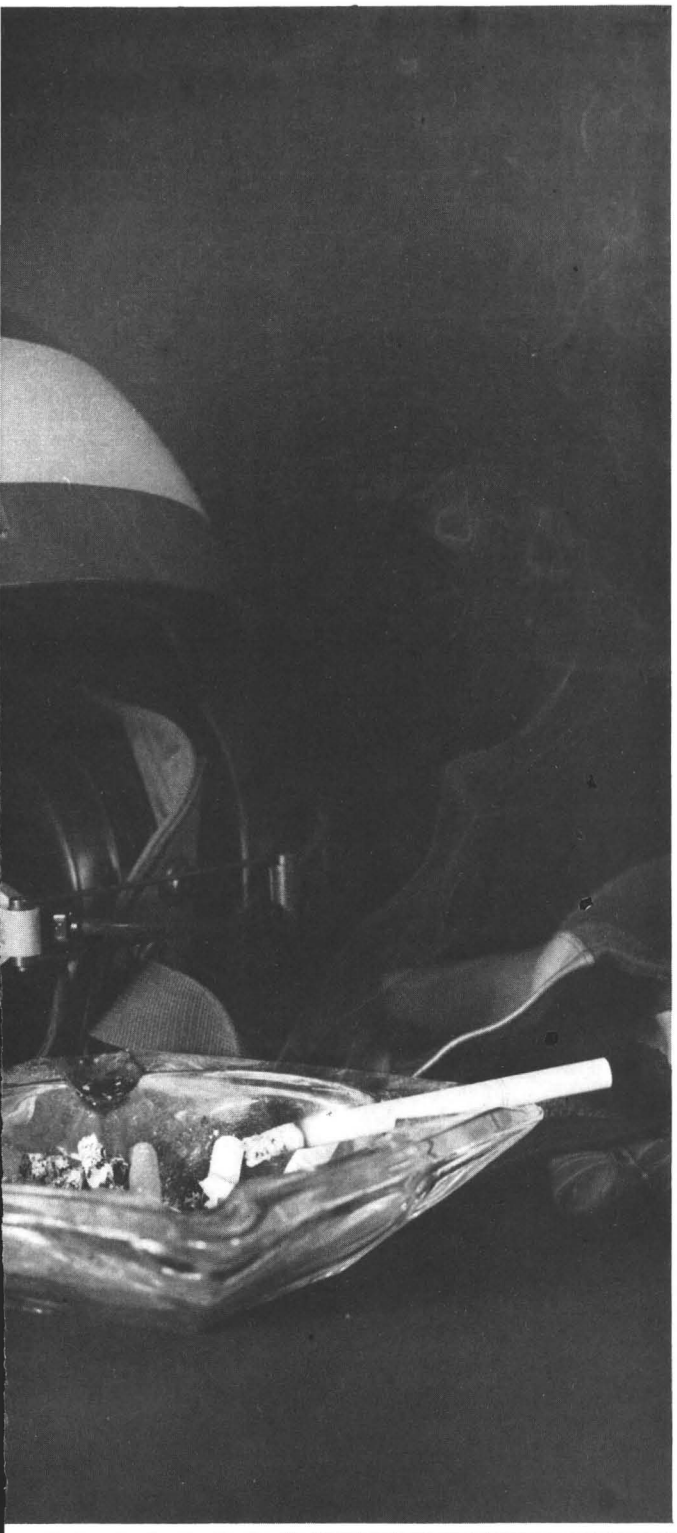




ME QUIT? HOW?

By this time, we are all aware that smoking is linked to cancer, emphysema, chronic bronchitis, and circulatory diseases. Some medics say that the smoker's smoke is a health hazard to nonsmokers in the vicinity. Research shows that nonsmokers are harmed by breathing others' smoke in smoke-saturated rooms. The heart beats faster. Blood pressure goes up, and so does the level of carbon monoxide in the blood.

As pilots and aircrewmen, you should know that smoking reduces your blood's ability to transport oxygen. This cuts down your night vision because your eyes are big oxygen consumers, and it limits your tolerance to hypoxia. (An aviator who is a heavy smoker can get carbon monoxide hemoglobin saturation high enough to cause measurable impairment of vision and altitude tolerance.)

And smoking while oxygen equipment is in use, although strictly forbidden by regulations, has been suspected in several oxygen mask fires and resulting fatalities.

We'll assume you are aware also that smoking costs money and that, far from being a super-sex-symbol when you take a deep drag on your weed, to a nonsmoking female type you probably don't smell so good.

If you've read this far, you're probably one who has considered quitting smoking.

How do you go about it?

The American Heart Association published a pamphlet outlining a specific program devised by a Dr. Donald T. Fredrickson, former director of the Smoking Control Program and Smoking Withdrawal Clinics in the New York City Department of Health. His ideas sound good to us.

"I am convinced beyond any shadow of a doubt that every cigarette smoker can stop smoking, and I mean *every* smoker," Dr. Fredrickson says. "This is true no matter how long or how much you have smoked, or how addicted you may think you are, how many times you have fallen off the wagon and tried to crawl back on, or how chained you may believe you are to your cigarettes. *Every single cigarette smoker has the ability to stop smoking.*"

Dr. Fredrickson almost guarantees that if you follow his program, let yourself go and hold nothing back, you can become a *permanent nonsmoker* during the next couple of weeks. It works this way:

Continued on page 32

Continued from page 30

SMOKING: EFFECTS ON PILOT PERFORMANCE

titude for no more than 1 hour, of which no more than 30 minutes will be above 12,000 feet only for the purpose of clearing high terrain or local weather. Our heavy smoking aviators are over this physiologic altitude on the ground.

Pilots who smoke initially experience a 20-percent night vision reduction at sea level which progresses until they begin to experience drowsiness, impaired efficiency and poor judgment at approximately 10,000 feet; while nonsmokers experience a 5-percent reduction in night vision at 6,000 feet but are otherwise generally unaffected up to 12,000 feet. This is because without pressurization, the lungs' ability to take in oxygen decreases with increases in altitude. A threshold is reached where oxygen is needed to preserve unimpaired functioning of the flight crew. Commercial aircraft are pressurized at 7,500 feet and military aircraft without oxygen are restricted to 10,000 feet unless specified circumstances are encountered.

What does it all mean? Substantial positive G forces and hyperventilation reduce the blood flow to the brain. These contribute to functional impairment—even in the absence of CO. Situations can arise unexpectedly which require immediate action and which tax the responsiveness and mental readiness of even the ablest aviator. Some of these situations cannot be properly dealt with by a hypoxic crewmember—one with an oxygen deficit induced by a COHb level of 5 to 10 percent.

The danger of hypoxia is usually associated with flying at altitude, but the lack of oxygen caused by the CO in tobacco smoke can be just as much, or maybe even more, of a hazard at low altitude, e.g., the terrain flying environment.

Low altitude is where it is happening in Army aviation and we cannot afford the handicap smoking imposes. Flying along at tree-top level requires continuous mental and physical alertness and there is no tolerance for hesitation.

Experimentation has demonstrated that manual dexterity decreases at a 7.25-percent blood COHb level. The equivalent of a few cigarettes per hour produces a deterioration of safe driving skills. A COHb level of 10 percent increases response time and impairs the ability of drivers to maintain a 200-foot separation from other vehicles. A key researcher summarized the findings: "It is highly possible that more complex psychological functions involving judgment and situational decisions and responses would be greatly affected by exposure to levels of CO which are sufficient to produce concentrations of COHb in the blood between 5 percent and 10 percent."

Test results conclusively indicated that the proportion of errors increases with the increase of COHb levels in such tasks as simple arithmetic, crossing of t's, form discrimination, color response, and plural noun recognition. At a 20-percent COHb level, errors increased tenfold. At such low levels as 2 to 5 percent, CO significantly impaired attentiveness to auditory stimuli. At the lower level, test subjects had reduced ability to judge between the durations of two sounds. At the upper level, they substantially lost their ability to estimate 30-second intervals in sounds. At the 2- to 5-percent range, slow responses to visual stimuli

Continued from page 31

ME QUIT? HOW?

STEP 1: FIRST WEEK

Before you begin a smoking withdrawal program, you should do some serious thinking about your sincerity or purpose and readiness to follow through. Here are some ground rules:

1. List several reasons for giving up smoking that are intensely personal, that have meaning for you.
2. Find someone who is interested in following the smoking withdrawal program with you and who is willing to compare notes with you as you follow the program.
3. Agree that you will follow all instructions in your program to the letter.
4. Determine that you will approach your smoking withdrawal in a positive way and not with grim determination.

If you are ready to work on this, continue with Step 1.

Instructions

1. Your first job is to build motivation. From your list of reasons for giving up smoking, select the most important one—that is, the one that will turn you on and keep you moving. *Write it down.*
2. Begin to think about how you should change your behavior if you wish to succeed. *Write these ideas down.*
3. Adopt a positive attitude. What has been your attitude before? *Describe. Indicate what attitude you are going to have now.*
4. Develop a *cigarette tally* of your smoking behavior. Using the model shown (figure 1), draw up a chart on an 8½ by 11-inch sheet of paper. This paper will be used for recording information about each cigarette you smoke during the day, including *Time*, *Occasion*, *Feeling*, and *Value* on a scale of 1 (most important) to 5 (least important).

- Fold the cigarette tally sheet lengthwise, wrap it around your cigarette pack, and secure the package with two rubber bands.
- Carry your pack where you normally do and continue smoking as you have done before.
- Every time you take a cigarette, unwrap the tally sheet and fill in the appropriate information.

STEP 2: SECOND WEEK

Have you cut down on your smoking as a result

were unmistakably proven. Visual acuity is an expression of the sharpness and clarity of vision. Experiments readily detect a 7½-percent impairment of visual acuity at a 3½-percent COHb level. COHb also induces a change in the ability to discriminate between differences in light intensity. At a COHb level of 15 percent, the brightness threshold increases 100 percent, which is to say 100 percent more light is needed to detect a flash of light. Generally speaking, COHb affects the responsiveness of the central nervous system to incoming stimuli. Put in an understandable frame of reference, for the smoker with a one- to two-pack per day habit, his signal identification performance is cut by almost one-third (28 percent).

Now let's take a few key phrases from the last two paragraphs and apply them to an aviator flying NOE at night – phrases like "decreased manual dexterity," "increased response time," "errors increase," "impaired attentiveness to auditory stimuli" and "slow responses to visual stimuli." These impairments add up to one thing – increased probability of a major mishap.

It should not come as a surprise to find that the problem is addressed in Army Regulation 40-8, Temporary Flying Restrictions Due to Exogenous Factors: "Aircrewmembers are discouraged from smoking tobacco at all times. They should especially refrain from smoking before flights at night and during all flights because smoking, with its increased carbon monoxide in the blood, results in greater detrimental physiological effects than would normally result from the altitude of the aircraft."

Here are some of the other physiological effects of smoking as they appear in national mortality statistics. If you smoke, your chances of dying from:

- lung cancer increase more than 1,000 percent;
- bronchitis or emphysema increase 610 percent;
- cancer of the larynx (throat) are 540 percent greater;
- cancer of the mouth are 410 percent greater;
- cancer of the esophagus are 340 percent greater; and
- peptic ulcers are 280 percent greater.

Heart attack increases significantly.

With side effects and statistics such as these, we have both medical and military reasons to reevaluate our approach to smoking in the aviation environment. Our current training and tactics are directed at preparing aviators for a very sophisticated combat environment. In such an environment Army aviators will be subject to demands for a higher level of judgment and decisionmaking.

Can we afford to give away the possible deciding edge in terms of visual and auditory acuity, reaction time and vigilance? I think not. Aviators should be encouraged to stop smoking and appropriate steps taken to insure that measures suggested in AR 40-8 are incorporated in all aviation unit SOPs.

References

S.A. Robinson and S.M. Wolfe, *Smoking: Its Adverse Effects on Airline Pilot Performance*, Health Research Group, Washington, DC, April 1976.

of the wrapping and recording procedure? Which cigarettes were most important to you?

Most people find that the wrapping technique makes it impossible for them to smoke automatically. In addition, tallying related activities helps people to see the powerful associations that they have linked with the smoking act. They then realize that smoking is not an addiction but a habit they have taught themselves by constantly associating actions with feelings and activities. Once they realize this, they can see their way clear to the conclusion that they can reverse the process they, themselves, began – they can retrain themselves.

Instructions:

1. Continue with your smoking record.
2. *Write down the important reasons why you want to stop smoking.*
3. Carry your cigarettes in a different place. If you normally carry them in one pocket, switch to another. But, whatever you do, make it a little more difficult to reach for your pack.
4. Never buy a carton of cigarettes from here on. Instead, buy one pack at a time.
5. Switch your brand at least twice during the week.
6. Do not carry matches or a lighter from now on.
7. Begin a gradual program of reduction.

- Each morning, *jot down the number of cigarettes you think you can manage on for the day.* At night, *write down how many cigarettes you actually smoked.*
- Reduce the number of cigarettes you smoke

CIGARETTE TALLY

DATE JULY 1

Time	Occasion	Feeling	Value
1. 0800	rising	depressed	1
2.			
3.			

FIGURE 1

each day in any way you wish. Aim for eliminating the most important cigarettes or the least important. It is up to you to decide what plan will work for you.

STEP 3: THIRD WEEK

Now you're going to take a smoker's test, but first look over the smoking record that you've been keeping for the past 2 weeks. Can you identify those circumstances under which you smoked heavily? Which were the most important cigarettes in your daily routine?

Some people find that if they go after the toughest cigarettes first, the others take care of themselves. Others prefer to go after the 3's, 4's, and 5's—those that aren't quite that important. Once they've eliminated those, they're ready to tackle the tough ones. No two smokers smoke for the same reasons. This is simply a reflection of the fact that no two people are quite alike. So, now let's find out some of the reasons why you smoke! (See figures 2 and 3.)

Instructions:

- Continue all earlier instructions.
- But now plan a 24-hour period when you will try to go without smoking entirely.
- Put your resolution into practice.
- *Write a description of what happened during your "no-smoking" period.*

STEP 4: FOURTH WEEK

What has been most helpful to you when the urge to smoke came upon you? As you continue your withdrawal program this week, here are some suggestions given by former smokers:

1. Walking or exercise helps. A change in activity patterns and an increase in physical exercise

SMOKER'S TEST

The test you are about to take will help you to identify the type of smoker you are and some of the important reasons why you continue to smoke. It was designed by Daniel Horn, Ph.D., Director of the National Clearinghouse for Smoking and Health, Public Health Service, and is based on a model developed by Silvan Tomkins, Ph.D.

WHY DO YOU SMOKE?

Important: Answer every question by circling one number for each statement.

	Always	Frequently	Occasionally	Seldom	Never
A. I smoke cigarettes to keep myself from slowing down.	5	4	3	2	1
B. Handling a cigarette is part of the enjoyment of smoking it.	5	4	3	2	1
C. Smoking cigarettes is pleasant and relaxing.	5	4	3	2	1
D. I light up a cigarette when I feel angry about something.	5	4	3	2	1
E. When I have run out of cigarettes, I find it almost unbearable until I can get them.	5	4	3	2	1
F. I smoke cigarettes automatically without even being aware of it.	5	4	3	2	1
G. I smoke cigarettes to stimulate me, to perk myself up.	5	4	3	2	1
H. Part of the enjoyment of smoking a cigarette comes from the steps I take to light up.	5	4	3	2	1
I. I find cigarettes pleasurable.	5	4	3	2	1
J. When I feel uncomfortable or upset about something, I light up a cigarette.	5	4	3	2	1
K. I am very much aware of the fact when I am not smoking a cigarette.	5	4	3	2	1
L. I light up a cigarette without realizing I still have one burning in the ashtray.	5	4	3	2	1
M. I smoke cigarettes to give me a "lift."	5	4	3	2	1
N. When I smoke a cigarette, part of the enjoyment is watching the smoke as I exhale it.	5	4	3	2	1
O. I want a cigarette most when I am comfortable and relaxed.	5	4	3	2	1
P. When I feel "blue" or want to take my mind off cares and worries, I smoke cigarettes.	5	4	3	2	1
Q. I get a real gnawing hunger for a cigarette when I haven't smoked for a while.	5	4	3	2	1
R. I've found a cigarette in my mouth and didn't remember putting it there.	5	4	3	2	1

FIGURE 2

SCORE CARD

When you have completed the test, score yourself:

1. Take the numbers on the first line and add across; that is, add the numbers for A, G, and M and put the total in the last column.
2. Follow the same procedure for each line.

Scores can vary from 3 to 15. Any score 11 and above is high; any score 7 and below is low.

____	+	____	+	____	=	_____
A		G		M		Stimulation
____	+	____	+	____	=	_____
B		H		N		Handling
____	+	____	+	____	=	_____
C		I		O		Pleasurable Relaxation
____	+	____	+	____	=	_____
D		J		P		Crutch: Tension Reduction
____	+	____	+	____	=	_____
E		K		Q		Craving: Psychological Addiction
____	+	____	+	____	=	_____
F		L		R		Habit–Reflex

FIGURE 3

relieve you of excess nervousness.

2. Avoid some of the closer associations developed in smoking. Substitute other activities for ones you associate with smoking such as TV or coffee. These need not be permanent substitutions.

3. Decide that you are not going to let the "tail wag the dog." Each time you reach for a cigarette, think, "I am not going to allow myself to be a Pavlovian creature with a conditioned response."

4. Substitute opposite gestures. For example, instead of reaching for a cigarette, move something away from you.

STEP 5: FIFTH WEEK

Craving

Some people find that during withdrawal they gain weight. If this is your problem, here are two things you can do:

1. Get a bit of extra exercise to burn up those extra calories.
2. Reach for low calorie snack foods.

During withdrawal, smokers complain of a variety of symptoms including tightness in the chest, being out of breath, dizziness, or perspiring. There is no real physical basis for these symptoms, and most of them subside within a few weeks. Usually, the symptoms reflect anxiety. The body is learning a new way to deal with fear and tension and expresses itself in these ways. Of course, if serious symptoms persist, you should see your doctor.

Addiction vs. Habit

The reason that you have been able to work on your own smoking cure is related to the fact that smoking is a habit, not an addiction. *(Note: There are others in the medical profession who feel just as strongly that the nicotine in tobacco smoke is addictive.)*

"Addiction" refers to a physical or chemical change within the body that cues you to do something. Although smoking may have brought damage to your physical health and well-being and the continued process can trigger chain effects of disease, it is not a chemical addiction. It is a habit – a form of learned behavior you have trained yourself in. That is the reason you can learn to be a nonsmoker. And this is why thousands of smokers each year train themselves to be nonsmokers.

Have you found yourself thinking about yourself as a nonsmoker at this point? A famous chemist named Emile Coue once said, "When your imagination is working in one direction and your willpower in another, your imagination always wins the day."

Once you begin to change your true feelings about cigarettes and what they mean in your life so that your ideas are clear and match your will to stop, your chances of success increase. With this idea in mind, you cannot be discouraged. Even if you didn't make it this time, just crawl right back on the wagon.

Remember the ingredients of success:

- Find a motive or reason for stopping.
- Change your attitude.
- Change your behavior.

A positive attitude – a feeling that you are giving yourself a gift – will be most helpful. Consider the benefits of withdrawal: You get a habit under control, you acquire a renewed feeling of self-confidence, and you reduce the risk of being stricken and crippled at midlife by one of the chronic diseases associated with smoking. You also protect the health of others.

You have nothing to lose by trying to stop smoking.

You have the world to gain.

EPMS CORNER

Enlisted Personnel Management System

Aviation SQT Hands-On Testing Device

WO1 Gerald G. McGinnis
EPMS Project Officer
U.S. Army Transportation School
Fort Eustis, VA

IF YOU ARE AN E-5 or below with a militay occupational specialty (MOS) in the 67 (Aviation Maintenance) career management field, you may be interested to learn that the Hands-On Component (HOC) portion of your skill qualification test (SQT) has taken a new form. That new form is the *CMF 67 Composite Testing Device* (see figure) and it will be used for administering the HOC of 12 different aviation MOS skill qualification tests. Those MOSs are: 67G, 67N, 67U, 67V, 67X, 67Y, 68B, 68D, 68F, 68H, 68J and 68M.

The testing device was developed in September 1977 by SFC Wayne A. Damba of the Individual Training Design Branch, Directorate of Training Development, U.S. Army Transportation School at Fort Eustis, VA. SFC Damba took input from other subject matter experts of that branch, grouped the skills that were to be tested into categories and identified critical tasks that were common among several MOSs. This testing device is the result of his extensive research and work.

The device tests the Soldier's ability to use the micrometer; tensiometer; propeller protractor; torque wrench; calipers; depth gauge; duckbill pliers; and diagonal sidecutters. The last two tools, along with safety wire and cotter pins, will be used to test safe tying skills.

Every MOS will test at least one task on the device with the Soldier wearing nuclear, biological, chemical (NBC) protective clothing. This is to determine the Soldier's ability to perform the task in an NBC environment, where protective clothing must be worn.

Some tasks, such as *Put On Protective Mask or Perform Taxi Direction Duties*, also may be tested during the HOC *without* the use of the testing device (this will vary among MOSs). However, some of the tasks you may be required to do during the HOC *with* the device are:

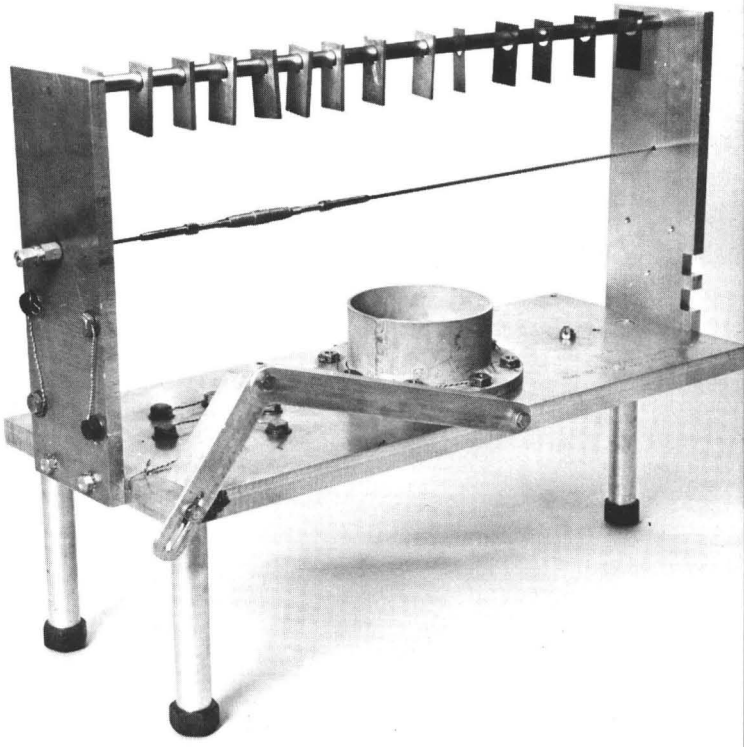
- *Select Micrometer And Measure Shims*
- *Measure Angles With Propeller Protractor*
- *Adjust Control Cable Tension*
- *Torque And Lockwire Screws*
- *Lockwire Four Bolts In Vertical Pairs*
- *Torque Nut And Install Cotter Pin*
- *Measure Inside Dimension*

No MOS will have all of these tasks in HOC.

These skills will *not* be listed as specific tasks in the Soldier's Manual, but will be integral skills within Tasks listed in the Soldier's Manual. The skill you will be expected to demonstrate during the HOC will be in a note following the Reference in the Soldier's Manual. The note states what tool you must be able to use. For example, Task no. 1243 from the 67Y Soldier's Manual is *Perform Minimum Blade Angle Check*. The skill *Measure Angles With Propeller Protractor* will be tested in the HOC. In the 67Y Soldier's Manual, Task no. 1243 has the following note after the reference: Must know use of propeller protractor.

With the testing device already set up properly, the examinee taking the HOC portion of the SQT will be required to measure angles with the propeller protractor. To eliminate any possibility that a Soldier may guess randomly the correct angle to be measured – without knowing how to use the propeller protractor – the scorer will grade certain steps in the process of determining the angle. These steps will be listed on the HOC Scoresheet in the SQT Notice. For example, the Soldier must properly zero the propeller protractor on a flat surface of the testing device, measure the angle within zero or minus 1 degree, and complete the task within 5 minutes. Each of these steps is called a performance measure and will be scored

The new test device can measure the Soldier's ability to perform 12 different MOS tasks



pass or fail. The Soldier will receive a "go" or "no/go" for the entire task. Each task will have several performance measures that are considered important in performing the task.

The Soldier's Manual for each MOS spells out some of the steps for accomplishing these tasks, and references the applicable aircraft Technical Manual (TM). However, the aircraft TM will not tell you how to use those tools listed in this article; for this you must go to the General Aircraft Maintenance Manual, TM 55-1500-204-25/1.

An SQT Notice will be sent to your unit 60 to 90 days before you take the SQT. This notice will state which tasks will be included in the HOC as well as those tasks that will be tested by the written component (WC) of the SQT.

For the Hands-On Component portion of the test it is essential for the Soldier to study and *practice* because if these skills can not be performed correctly there is little chance of passing the SQT. *Studying the Soldier's Manual is not enough.*

Soldier's Manuals And SQTs For Air Operations Specialties At Fort Rucker

THE U. S. ARMY Aviation Center (USAAVNC), Fort Rucker, AL is the proponent Training and Doctrine Command (TRADOC) service school for air operations which is part of Career Management Field 64, Transportation. The air operations specialties include three military occupational specialties (MOSs): MOS 71P, Flight Operations Coordinator; MOS 93H, Air Traffic Control Tower Operator; and MOS 93J, Air Traffic Control Radar Operator.

Soldier's Manuals for all three specialties have been developed and distributed to the field.

Skill Qualification Tests (SQTs) for the specialties have been developed and will be in the field for administering beginning 1 July 1978. Only skill levels 1, 2 and 3 will be tested in 1978. Testing of the higher skill levels is scheduled to begin 1 July 1979. Soldiers scheduled for testing should receive an SQT Notice at least 60 days prior to their SQT test date.

Questions regarding Soldier's Manuals and SQTs developed by the Aviation Center may be directed to: Commander, U. S. Army Aviation Center, ATTN: ATZQ-TD-TAD, Fort Rucker, AL 36362; AUTOVON 558-5412 or 5318. More on Soldier's Manuals and SQTs will be published in the May 1978 issue of the *AVIATION DIGEST*.

keeping up with Army Aviation R&D

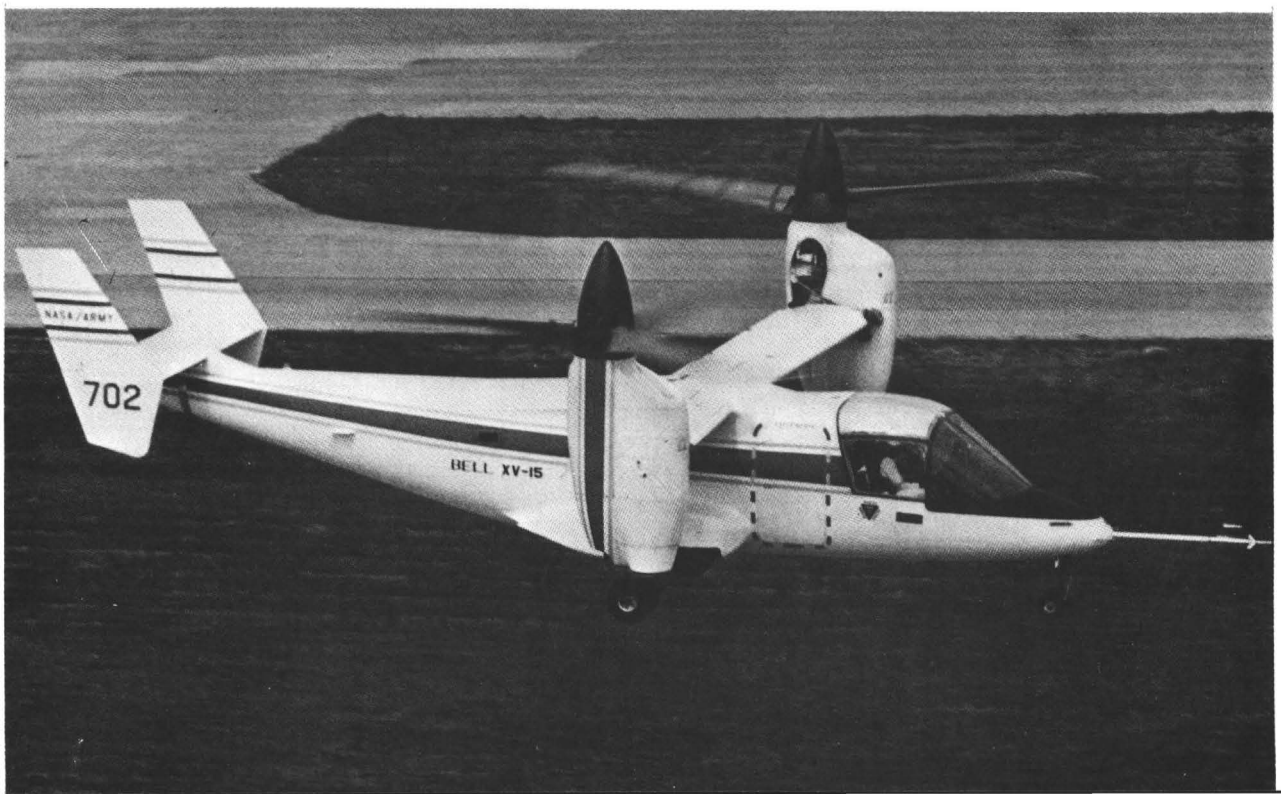
R. Bruce Deam
Public Affairs Officer
U.S. Army Research and Technology Laboratories
Aeromechanics Laboratory
Moffett Field, CA

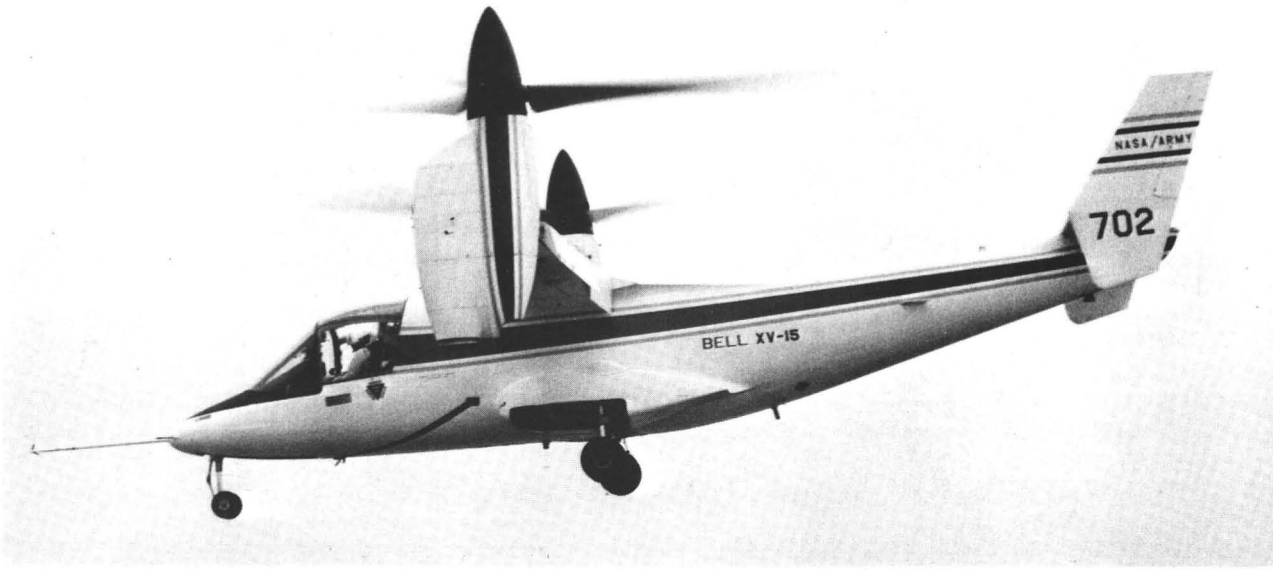
EFFECTIVE 30 AUGUST, the name of the U. S. Army Air Mobility Research and Development Laboratory, NASA Ames Research Center, Moffett Field, CA was changed to the *U.S. Army Research and Technology Laboratories* (AVRADCOM). AVRADCOM is the acronym for U.S. Army Aviation Research and Development Command, St. Louis, MO, commanded by Major General Story C. Stevens, the Laboratories' higher command.

The Laboratories' four subordinate directorates also have been renamed as follows: The Ames Directorate is now the *Aeromechanics Laboratory*, Moffett Field, CA; the Lewis Directorate is now the *Propulsion Laboratory*, NASA Lewis Research Center, Cleveland, OH; the Eustis Directorate is now the *Applied Technology Laboratory*, Fort Eustis, VA; and the Langley Directorate is now the *Structures Laboratory*, NASA Langley Research Center, Hampton, VA.

The mission of the Research and Technology Laboratories remains the same – to plan, develop, manage and execute for AVRADCOM the research and exploratory development programs, and advanced develop-

The Bell XV-15 VTOL tilt-rotor research aircraft is expected to combine the best features of helicopters and conventional airplanes in point-to-point transportation...





...engineers anticipate that the XV-15 will operate with less noise than conventional helicopters or aircraft of comparable size

ment programs through demonstration of technology to provide a firm technical base for future development of superior airmobile systems. Special emphasis is placed on improved aircraft engine and rotor performance; reduced structural weight; cost and complexity; improved maneuverability; survivability; safety; reliability; maintainability; and lower life cycle cost.

Major projects of the Army Research and Technology Laboratories include:

- **The XV-15 Tilt Rotor Research Aircraft** is a 42-foot-long, 32-foot wing span aircraft, incorporating wingtip mounted engines, transmissions and 25-foot prop rotors which tilt from a helicopter position for hover, vertical takeoffs and landings, to a horizontal position for forward flight. In the airplane mode the aircraft is capable of forward speeds in excess of 300 miles per hour.

Prior to the XV-15's first hover flight on 3 May 1977, the aircraft completed a series of extensive ground tiedown development tests, including full conversions from helicopter mode and back at normal operating revolutions per minute (rpm) and high power levels; operation of all aircraft and research systems and 5 hours of demonstrations of high power and overspeed rpm in helicopter mode.

During 3 hours of flight testing in helicopter mode, the aircraft hovered and air taxied at altitudes of up to 100 feet above ground level. It also attained airspeeds up to 40 knots forward, 25 knots sideward and 10 knots rearward.

Other flight test accomplishments include:

- Hovering with force feel system off.
- Hovering and landing with the stability augmentation system off.
- Hovering and landing with manual rpm control.
- Takeoff, hovering and landing at 85-degree pylon angle.
- Short takeoff and landing.
- Hover turns of 90 degrees in 25-knot winds.

Test pilots of both Ames Research Center and Bell were so pleased with the aircraft's handling qualities and performance that they made no request for design changes as a result of the flight tests. Preliminary external noise data obtained during the flights indicate that the 13,000-pound XV-15 is as quiet as a 4,000-pound Bell 206L helicopter.

In addition, Bell's tilt rotor chief project engineer reported that after almost 50 hours of ground and flight tests had been completed – including several hours at maximum power and one hour of overspeed running – "the transmission gears didn't look as if they had been used."

Following a 50-hour ground run to complete qualification of the aircraft transmission and drive system, and installation and checkout of a remote control system, aircraft Number 1 will be delivered to NASA Ames Re-

The ABC aircraft has completed 67 hours flight testing as a pure helicopter. Next, with the addition of four J-60 turbojet engines, the ABC will be prepared for flight tests to 350 mph

search Center for extensive tests in the 40 x 80 foot large-scale wind tunnel. Wind tunnel tests are expected to begin in early 1978.

Final assembly of the aircraft Number 2 is almost complete in Bell's experimental shop. The aircraft was delivered to Bell's Flight Test Facility for completion of research instrumentation installation, systems checkout and ground run checkout. Airworthiness flight test by Bell using the second aircraft will commence after wind tunnel testing of aircraft Number 1 and will include the expansion of the operating envelope and further evaluation of the aircraft's performance, dynamic stability and handling qualities.

• **The XH-59A Advancing Blade Concept (ABC)** is a coaxial, counterrotation, hingeless rotor research helicopter that features very stiff rotor blades and rigid retention of the blades to the hub; a tail rotor is not required. Unlike conventional helicopters which need a wing for high speed flight, the ABC uses only its rotor blade system throughout the entire speed range. Under a $3,548,750 contract modification, funded by the Army, Navy and NASA, two Pratt & Whitney J-60 turbojet (3,000 pounds thrust) engines will be added to each side of the ABC and flight tests up to 350 miles per hour will be made. Prior to the flight tests, ground tests, wind tunnel tests and simulations will be made to prove flightworthiness at the higher speeds.

• **The Rotor Systems Research Aircraft (RSRA)** is a test vehicle built by Sikorsky and used by the Army and NASA to evaluate a wide variety of existing and future rotor and propulsion systems. First flown as a pure helicopter, the RSRA completed its initial flight test phase at the Sikorsky plant. In July the RSRA was flown from the plant to NASA's Wallops Flight Center at Wallops Island, VA. The RSRA has now been fitted with two General Electric TF-34 tur-

The first of two Rotor Systems Research Aircraft built by Sikorsky is shown in its original configuration when it was flown as a pure helicopter

In this photo the same RSRA has been fitted with two General Electric T-34 turbofan engines and variable incidence wings

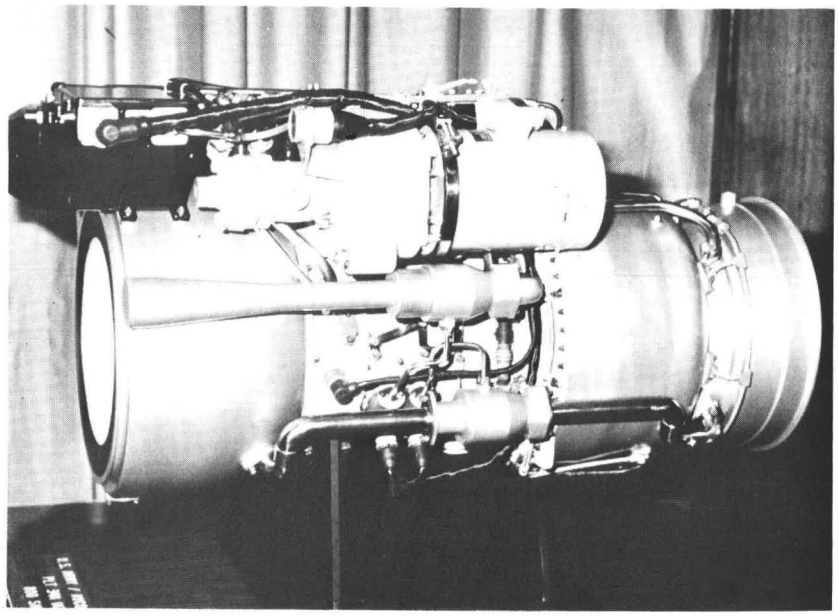
bofan engines, a 45-foot variable incidence wing, a stabilator, and smaller stabilizer for tests this fall as a compound helicopter.

Two RSRA test vehicles will be used by NASA and the Army to evaluate a wide variety of existing and future rotor and propulsion systems. Tests of both aircraft will be conducted at NASA's Wallops Flight Center.

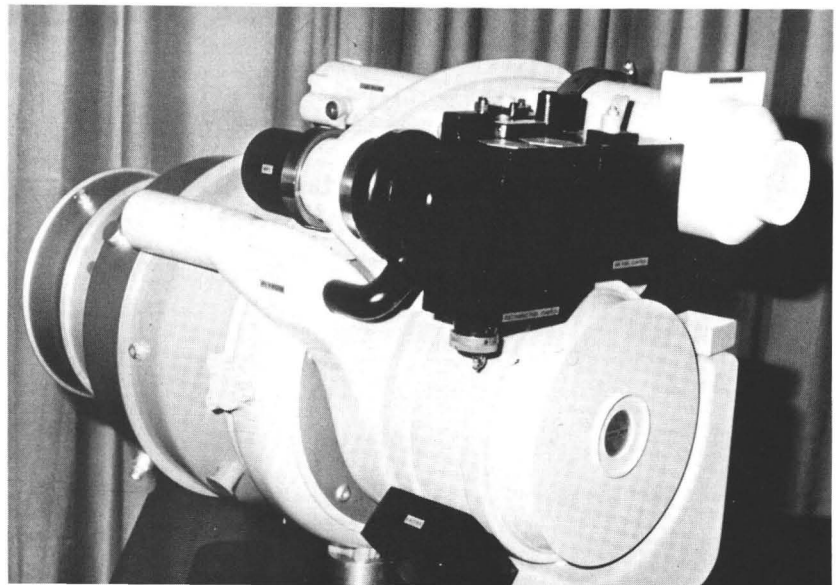
- **The 800-Shaft Horsepower Advanced Technology Demonstrator Engine Program.** Detroit Diesel Allison and AVCO Lycoming received contracts from AVRADCOM aimed at providing a low weight, low fuel consumption engine with good reliability and maintenance features, that result in significantly reduced total cost and ownership compared with current engines in this power class.

This program is the culmination of more than 10 years of research and development on the component parts of small helicopter engines sponsored mainly by Applied Technology Laboratory, U.S. Army Research and Technology Laboratories, Fort Eustis, VA. Twenty percent fuel savings are expected, and while primary application of the engine would be for rotary wing aircraft, the technology developed would be available for other Defense Department needs and for civil applications.

Program goals are to determine the achievable level of performance for an advanced technology engine design by test and evaluation, as well as providing a validated engine technology base from which future full-scale development and production may take place at minimum risk, time and cost.



The 800 shaft horsepower engines: above, Detroit Diesel Allison and below, AVCO Lycoming. Primary application is for rotary wing; however, technology would be applied to other military and civil needs



NEW Training Developments At Fort Rucker

Colonel Larry J. Baughman
Director of Training Developments

Flight Simulators

U.S. ARMY aviation was the first to develop and use helicopter flight simulators with a visual system. To date two helicopter simulators have been developed using a camera model visual system – the CH47FS and the AH1FS.

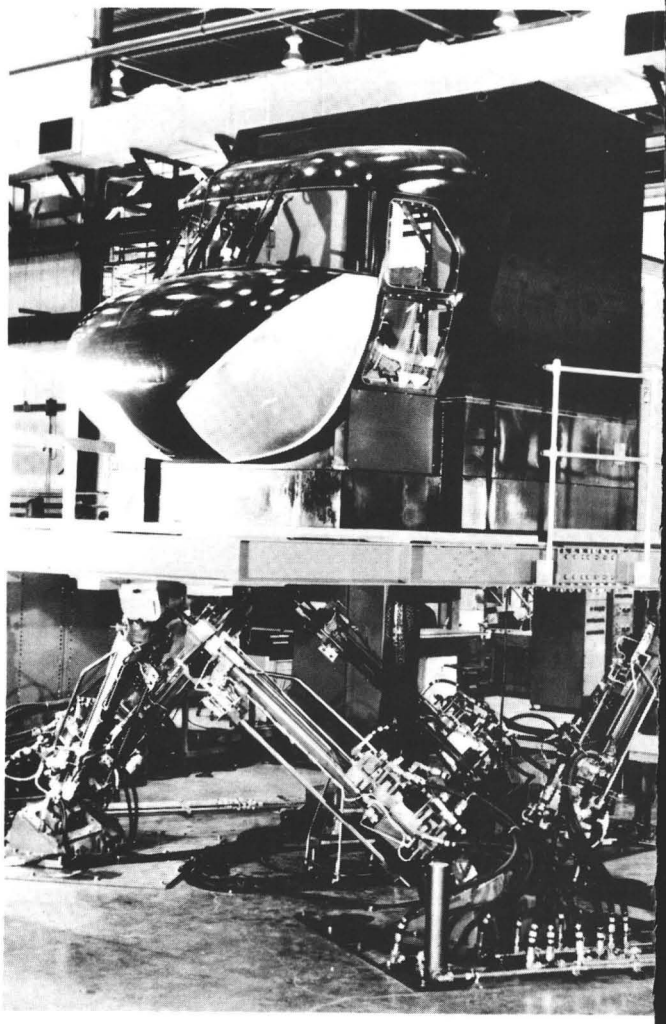
A new system designed for use with the Black Hawk simulator is being developed. This system (UH60FS) will use a computer generated image visual system. This will allow the trainee to fly the simulator during simulated day and night conditions.

Aviators will view scenes which have been created by the use of computers. Day scenes in computer generated imagery are stylized or cartoonish. However, the technology being used for the Black Hawk simulator will achieve a degree of scene detail with sufficient realism to furnish meaningful visual cues. These cues will provide detailed terrain features such as hills, valleys, ridges, roads and trees. Friendly and hostile weapons deployments to include tanks, artillery missiles and missile flight through the air also will be depicted. Compared to earlier visual systems, the scenes furnished by the computer will greatly enlarge the visual gaming area.

The flexibility provided by this visual system will satisfy a diverse range of training requirements. With the creation of a number of data bases aviator trainees will have a variety of totally different flight environments such as training in Alaska in the morning and in Germany in the afternoon.

The Black Hawk prototype simulator is under development. It will be delivered to Fort Rucker and is scheduled to be ready for training in June 1979. The first production unit is scheduled to be delivered to a field installation in early 1982.

Exterior view of CH-47 flight simulator. Elaborate hydraulic and electrical components (below) produce realism in the cockpit for trainees



Training Literature

THE FOLLOWING publications produced by the Training Literature Division of the Directorate of Training Developments, Ft. Rucker, AL will be forwarded for printing and worldwide distribution in March 1978. They will reach the field early this summer.

FM 1-2, "Aircraft Battlefield Countermeasures And Survivability." The intent of FM 1-2 is to make the individual aviator and commander aware of the threat and survival countermeasures applicable under various combat situations. Army aviation units are part of the combined arms team; therefore, combined arms employment is stressed as the key to survival throughout this manual. Tactics, techniques and countermeasures used in this manual are intended as a general guide since the complexity of future battlefields dictate that multiple solutions to demanding challenges will be required.

TC 1-5, "Tactical Instrument Flight." The purpose of TC 1-5 is to provide information for training rotary wing aviators in tactical instrument flight. Discussed within the publication are considerations for employment of tactical instrument flight, procedures for construction of tactical instrument airways and safety zones and a recommended course of instruction for tactical instrument flight training.

TC 1-10, "Mountain Flying Sense." TC 1-10 is designed to provide information for training rotary wing aviators in mountain flying. Discussed within the publication are the meteorological factors affecting mountain flying; premission planning considerations; nontactical and tactical mountain flying techniques; and a recommended course of instruction for mountain flying.

TC 1-60, "Forward Area Refueling And Rearming Points (FARRP) Operations." This publication presents guidelines and procedures for Air Cavalry and attack helicopter units operating on the modern battlefield to establish, operate, organize and resupply forward area refueling and rearming points.

Aircrew Training Manuals

EFFECTIVE 1 OCTOBER 1977, the Aircrew Training Manuals (TCs 1-134, 1-135, 1-136, 1-137, 1-139, 1-144 and 1-145) became the primary training publications for aviation units worldwide. Until the revised edition of the current Aircrew Training Manuals are received by field users in October 1978, the following measures are contemplated and will be implemented by Department of the Army (DA) message in the near future:

- TC 1-35, "Qualification Training and Standardization (UH-1)," June 1976, will be rescinded.
- TC 1-36, "Qualification Training and Standardization (AH-1)," September 1976, will be rescinded.
- TC 1-37 and TC 1-38, "Qualification Training and Standardization (OH-58)" and "Qualification Training and Standardization (OH-6)," respectively, are valid documents and will supplement TC 1-137, "Aircrew Training Manual, Observation Helicopters."
- Tasks, conditions and standards for each maneuver are derived from the appropriate Aircrew Training Manual. For a description of each maneuver, the corresponding Flight Training Guide will be used, which may be obtained by writing to: CDR USAAVNC, ATTN: ATZQ-T-AT-E, Fort Rucker, AL 36362.

The revised edition of the Aircrew Training Manuals will include a task, condition, standards *and* description for each manuever.

If further assistance is desired, call MAJ Brennan or CW4 le Riche at AUTOVON 558-4196/3378 or write to: CDR USAAVNC, ATTN: ATZQ-TL-ATM, Fort Rucker, AL 36362.

Course Development

Aviation Training Extension Course Lessions Available. The U.S. Army Aviation Center has 15 training extension course (TEC) lessons available to support Enlisted Personnel Management System (EPMS). These lessons are being distributed by Tobyhanna, PA Army Depot to aviation units worldwide.

Included is a six-lesson series on performing the preventative maintenance services (PMS) Daily Inspection of the UH-1D/H; four lessons on the PMS Daily Inspection of the OH-58A; two lessons on removal, inspection

and installation of hydraulic servos on the OH-58A; two lessons on dispatching visual flight rules (VFR) and instrument flight rules (IFR) flight plans; and one lesson on interpreting sectional aeronautical charts.

In addition, a 13-lesson course on Map Interpretation and Terrain Analysis is being prepared for distribution to the company/troop level to assist aviators in navigating while using nap-of-the-earth (NOE) flight techniques.

Educational Television

THE EDUCATIONAL Television (ETV) Branch uses flexibility inherent in the TV medium to meet demands for exportable training while serving school needs at the Army Aviation Center. When learning objectives are best met with a motion medium, ETV is usually chosen over film. The choice results from availability of Army TV production facilities and widespread distribution of television tape cassette playback equipment.

More than 1,450 TV tape programs (almost all aviation-related) are available from the video cassette library maintained at the ETV Branch. Two examples illustrate development of television materials to meet specific instructional needs.

The first example illustrates application of ETV's "multiplier effect" in stretching instructional resources to meet an otherwise unattainable demand. The Army's SPH-4 helmet is a proven way of markedly reducing aircrew crash fatalities. Yet many aviators have not been protected adequately because of improper helmet wear. At the request of the U.S. Army Aeromedical Research Laboratory (USAARL) a TV tape was prepared showing proper wear and adjustment by the Laboratory's helmet wear expert. Ample close-up shots make it possible for viewers to see every detail of adjustment. The result: expert demonstrations available Armywide at convenient times for viewers, simply by ordering the SPH-4 TV tape. Such widespread response would not be possible in other ways because of personnel, time and TDY funding restrictions.

The second example is that of a multisubject, multiprogram project under way in response to a Training and Doctrine Command/Forces Command (TRADOC/FORSCOM) requirement assigned to the ETV Branch. This TRADOC/FORSCOM TV course covers 10 subject areas representing all aspects of nap-of-the-earth (NOE) flight. Twenty-three productions, representing about 70 percent of the NOE TV course, have been completed by the ETV Branch. All 23 have been approved for Armywide distribution by TRADOC. Completed productions represent the following subject areas: The High Threat Environment, NOE Flight Maneuvers, Aeromedical Aspects of NOE, Suppression of Enemy Air Defense Weapons, and Army Aviation in a Chemical and Nuclear Environment. The remaining five units (11 video tapes) will be available in the field by end fiscal year 1978.

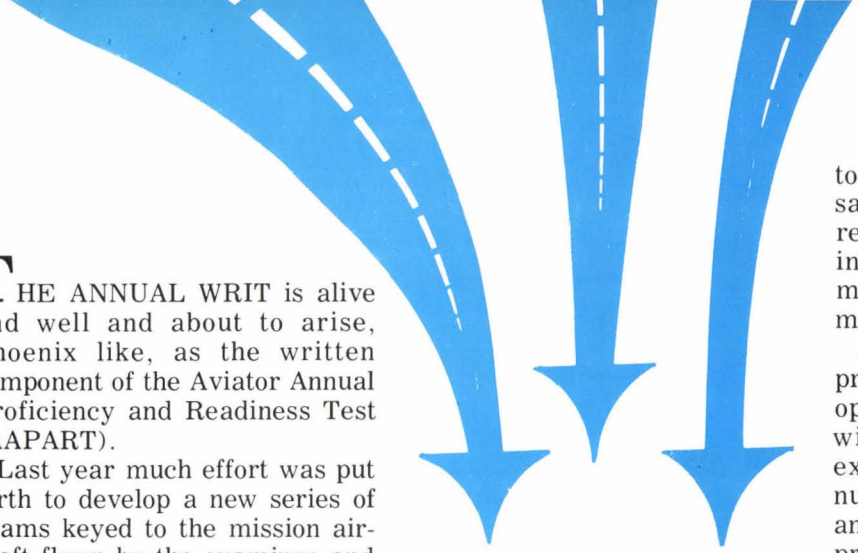
For title and content information on Army Aviation Center video cassette programs, consult the Television Video Tape Catalog published by the ETV Branch. For your free copy, write: CDR USAAVNC, ATTN: ATZQ-TD-TS-ETV, Fort Rucker, AL 36362. If time limitations require an immediate answer, please call Mrs. Mary Tomlin, AUTOVON 558-4388.

Simulator Requirements Study

THE OFFICE OF the Director of Training Developments is working on several studies which will have some long-range impacts and implications on Army aviation. These include a study on flight simulator requirements for the period 1980 to 1984. A follow-on study has been proposed to look at requirements from 1984 through 1994.

The Operations Research Systems Analysis personnel are prepared to start the data collection effort on the AH-1 Flight Simulator for a Cost and Training Effectiveness Analysis Study. This will determine the aviators required to support a simulator, the overall effectiveness and other information that will assist in future procurement and site determinations.

DTD personnel are working with the Fort Rucker Field Unit of Army Research Institute on several studies. One highly important one is a study to improve the selection methodology for entry into initial flight school and also to identify those best suited for entry into the proposed flight tracks from the Initial Entry Rotary Wing Program. This study which will take more than a year, will provide better selection methodology and testing resulting in greater prediction of success in flight training and reducing training costs.



Return of the Writ

Captain Peter M. Ryan
Directorate of Training Developments,
U. S. Army Aviation Center
Fort Rucker, AL

THE ANNUAL WRIT is alive and well and about to arise, Phoenix like, as the written component of the Aviator Annual Proficiency and Readiness Test (AAPART).

Last year much effort was put forth to develop a new series of exams keyed to the mission aircraft flown by the examinee and integrated with the Aircrew Training Manual (ATM) concept. So let's take a look at the new Annual Writ and see what it is, what it isn't, and where it's going.

First of all, there isn't just one exam but six – one for each type aircraft that has an ATM. The six aircraft types are defined as:

- Observation Helicopter (OH-58,OH-6)
- Utility Helicopter (UH-1)
- Attack Helicopter (UH-1 C/M, AH-1)
- Cargo Helicopter (CH-47, CH-54)
- Utility Airplane (T-42, U-21, U-8, etc.)
- Surveillance Airplane (OV-1)

The purpose of having a separate exam for each of these is to orient the exam to the combat mission requirements of each type and avoid the vague generalities of a single "catch all" test. An attack helicopter pilot obviously has a drastically different mission and aircraft than a surveillance airplane pilot, so why give them both the same exam? The exam itself is now the written component of the AAPART described in Chapter 6 of your ATM.

There are some problems with this approach, however. Each of the six types consists of two more series or model aircraft (e.g., attack helicopter includes UH-1 C/M as well as AH-1G/Q/S). In each of these categories a single "archtype" is used as typical of that mission type. For example, the AH-1S is the "typical" aircraft in the attack helicopter category, not because it is the most typical attack helicopter in numbers (it isn't–yet) but because it best represents attack helicopter doctrine and methodology. Generally, this works fine. The doctrine and principles of employment that govern the AH-1S are largely applicable to a UH-1M with the SS-11 system. In some instances these are differences that just cannot be reconciled. In these cases, separate questions within the exam are addressed only to those specific series or models that the examinee flies.

As with the annual standardization checkride, the written exam will be administered during the 90-day period prior to the aviator's birthday. Since the new exam went into effect on 1 March 1978, those aviators with birthdays in March, April or May will have until 31 May 1978 to complete the exam. Thereafter, the 90-day-prior-to-birthday schedule will be followed. The net effect of administering the exam on a birthday schedule is to eliminate the yearly "crush" to test every Army aviator in the same 3-month period. It also will result in a significant reduction in the total amount of exam material printed resulting in a major savings.

An important change to past practice is that only aviators in operational flying assignments will be required to take the exam. This reduces the total number of exams administered and eliminates the management problems involved in identifying nonflying aviators, especially those in assignments that aren't even near an Army aviation facility, such as Bootstrap, ROTC, etc.

Another major change to the system is the elimination of the Study Guide. In the past, a 100-question "sample test" Study Guide was distributed to all aviators. In 1976, for example, 28,000 Study Guides with accompanying Reference Data Booklets were produced at considerable cost. Experience has shown that they were not used regularly by a large number of aviators.

In place of the Study Guide will be the Examination Notice, a 3- or 4-page "information sheet" that will describe the current exam, the question areas covered and the applicable references that should be reviewed. A few sample questions will be included to give the aviator the "feel" of the exam. Examination Notices will be published on the basis of one per aviator.

The Reference Data Booklets will be very much the same as previous years. The two volume set will consist of extracts of Department of Defense flight information publications (FLIPs), Army regulations (ARs), technical manuals (TMs) and field manuals (FMs) necessary for taking the exam. Not every item used in the exam will be in-

cluded. Some references will be furnished by the examiner. The same Reference Data Booklet set will be used for all exams. Also, the set will be published in loose leaf format and will be updated with replacement pages, the same manner as a change to a TM or FM, rather than being completely reprinted every year. The potential savings here is obvious.

On the surface, the Exam Booklet looks just the same as before. After the administrative instructions are 50 multiple choice questions that are answered on a machine read card. The questions themselves, however, will vary in content and emphasis from one aircraft type to another. Federal Aviation Administration (FAA) instrument procedures are covered more extensively on the utility airplane exam than on the observation helicopter, for example. All exams emphasize tactical employment concepts as they apply to the type aircraft involved. You can expect target recognition questions involving pictures of threat and friendly equipment. Performance chart and weight and balance questions also are included. However, all questions are mutually exclusive; the answer to one question does not depend on the answer to another. Every effort has been made to weed out "gotcha" questions that have no valid evaluative or learning purpose. Questions are intended to be as straightforward and "real world" as possible.

The Annual Writ is a growing thing. It is constantly under development and evolving to meet the needs of Army aviation. The 1978 exam marks a significant departure from past practice but is nonetheless a transition from where we were to where we want to be.

Next year, for example there will be a European version of all the exams using International Civil Aviation Organization (ICAO) procedures instead of FAA. This is a change long overdue but requires much "homework" before implementation.

Also under development is the "scoreable unit" concept, similar to the enlisted Skill Qualification Test, whereby the tasks that are examined are organized into groups, or scoreable units, and graded separately. This way if one scoreable unit is not completed successfully only that part of the exam must be retaken instead of the entire exam.

So the writ is, indeed, alive and well. As the written component of the AAPART, its value both as a means of evaluation and review of current doctrine and procedures is enhanced greatly. It always will be developing and growing to meet the needs of Army aviators.

South Carolina National Guard

AFTER 35 YEARS and more than 7,000 flying hours, Colonel James R. Davis has put it in the Hangar. And, he's taken his favorite airplane with him.

When Colonel Davis retired last November from the South Carolina Army National Guard he also retired the U-6A Beaver airplane which he first flew to the state 21 years ago. That's when he and Master Sergeant Jacob B. Carol brought it back from Lincoln, NB, to the Army Aviation Detachment at McEntire Air National Guard Base.

The U-6 served well and so did Colonel Davis. During his flying career he has flown 40 different types of military aircraft and has finally called it quits. The U-6 also is being retired.

After serving as a bomber pilot in World War II, Colonel Davis became the first aviation officer in the state of South Carolina.

Right inset, COL Davis. Below, he and MSG Jacob B. Carol stand beside their "old friend" of 21 years. (SCARNG photos by SP7 Phillip Jones)

VIEWS FROM READERS

Continued from page 1

learn that this piece of hardware will allow you to expose yourself for short periods of time without greatly increasing your vulnerability to the ZSU 23-4.

Colonel John (Doc) Bahnsen
TRADOC System Manager for the Attack Helicopter
Fort Rucker, AL

Sir:

The inclosed poem is submitted for possible publication in the *AVIATION DIGEST*.

PVT 2 Virginia K. Eans
42d Co, 4th Bn, 1st Avn Bde
Fort Rucker, AL 36362

FLYING LOW

I have a dream of sunlit skies
through which someday I will fly
And in the time of white sleep
I will fly over oceans deep
Or hover over ice and snow
watching the run of buck and doe
I'll see the moon as it shines down
over the snow covered ground
Then I'll fly way up high
and watch the lovely winter die
But as the winter melts away
I'll see the coming of spring day
I will hover over fields of green
in that timeless season spring
Then I'll see the mountains wild
growing like a new born child
And when the days are full of mist
I'll fly through every cloudy wisp
But let me not forget the night
for it has beauty in its own right
How I'll love those stars above
flying through night skies that I love
As spring gives way to glorious fall
I know I'll hear the sky call
I shall fly over colors bold
trees of yellow orange and gold
Then I'll find to my surprise
that the year has passed me by
It is my wish to fly all the year
for to me flying is very dear
So open your eyes and look at the sky
and maybe you'll see me as I fly by.

Sir:

In answer to your article in the October 1977 issue about Liaison Pilots, I am in possession of orders rating me a Liaison Pilot. I was rated a Liaison Pilot on 6 March 1943 after taking a check ride at Waco, TX.

I went overseas with the 121st Liaison Squadron to Africa and later was transferred out of the 121st and helped form the 167th Liaison Squadron in France, where we flew for General Devers, 6th Army Group Headquarters. I was assistant flight leader of my flight with the rank of T/Sgt and was discharged 16 September 1945.

A couple years ago I organized a joint reunion of the 121st and 167th Liaison Squadrons. I head our organization and am also the secretary. In my latest newsletter to our members I reprinted your article requesting former Liaison Pilots to get in touch with you.

Would you please mention our next reunion in a future issue of the *DIGEST*.

The announcement should read: Joint 121st and 167th Liaison Squadrons second reunion will be at Tallahassee, FL 29 June through 2 July 1978. Please contact Bill Rieger, 3945 Parkview, Monroe, MI 48161.

Thanking you in advance, I remain.

Bill Rieger
3945 Parkview
Monroe, MI 48161

Sir:

I have just read the article "Check Six Or Checkmate" by CW3 Robert L. Baird in your October 1977 issue. The ideas on evasive tactics are good for "slicks" and "scouts" but what about the "guns?" The AHs and AAHs have the capability to defend themselves, in addition to evasive tactics.

Consider the conditions of a fighter aircraft making a gun attack on a fire team of Cobras. The fighter has its guns aligned with the airframe, is operating at low airspeed and altitude, and has limited maneuvering room. The conditions put him out of his effective environment – and into ours!

Since he needs to point the plane to shoot his guns, his intentions are obvious; and forewarned is forearmed. As he makes his run-in on you, his engine may be at low rpm, and susceptible to FOD induced engine stall. Once he is past you, he has only one choice for a maneuver – pull out for speed and altitude.

Now consider the AH or AAH. We have a gun turret which allows us to take evasive action while defending ourselves. This capability also makes our actions unpredictable. Also, consider the current types of ordnance that can be effective against a fighter attack:

VT (variable timed fused) rockets, ammunition – these can damage his aircraft. Shrapnel can damage his engines.

HE (high explosive) ammunition – 20 mm and 33 mm HE has the capability to destroy or damage the fighter.

TOW Missile: This weapon could be lethal to an attacking fighter.

Tactics will be as important as the ordnance in defending yourselves. When sighting hostile aircraft, helos should separate from one another. World War II Bombers grouped close to prevent fighters from diving through their formation – you don't have that problem at NOE (nap-of-the-earth). A separation of at least 500 meters at an angle of 60 degrees through 80 degrees from his flight path will make it difficult for him to transition between targets. This positioning will also give the gunship which is not under attack, the opportunity to use its turret on the fighter's pull-out.

The helo being attacked should fly toward the attacking fighter using pop-up/flair maneuvers to fire ordnance. TOW missiles, if available, should be used as soon as the fighter is in his run. Evasive patterns can be used between pop-up maneuvers. Banking maneuvers away from the fighter will allow the use of your gun turret.

The helo not being attacked should position itself for gun turret use on the fighter's run-in and pull-out. Rockets will not be as effective from your position because of your angle relative to the fighter's line of flight. A TOW missile, however, might prove effective during the fighter's run-in and pull-out.

With the advent of the HELLFIRE missile, the gunships will have an edge against hostile aircraft not similarily equipped. However, should the hostile aircraft have laser guided ordnance, the theory of "first see-first shoot" will apply.

With escalating battlefield technology, the advantage in my future engagement becomes more dependent on "heads up" pilots. Make sure your head is up!

Martin E. Moore
10865 Worthing Ave
San Diego, CA 92126

OPMS CORNER

Officer Personnel Management System

Aviation Engineering Test Pilot — A Challenging Career

The author's initial article on this subject appeared in the August *DIGEST*, page 11. Now Major Walker expands on that story, provides new information and discusses the changed quota for aviator participation in the Army's Engineering and Flight Testing Program

Major Thomas P. Walker
Aviation Management Branch
Officer Personnel Management Directorate

ARE YOU INTERESTED in the development and acquisition of new aircraft? Do you like the research and development field? Do the technical aspects of aviation excite you? If the answer to any one of these questions is "yes," opportunity is knocking right now for qualified Army aviators to participate in the Army's Aviation Engineering and Flight Testing Program.

The growth and development of Army aviation has opened many doors to the career Army aviator: command opportunity, advanced schooling, and research and development – to mention only a few. The door that leads to a career as an Army test pilot is open wider than ever and offers challenging assignments and unique opportunities to Army aviators who qualify for admission into the program.

Test Pilot Program Prerequisites: Army aviators in the grade of major and below are eligible to apply for the program. While grade criteria may be waived, the following prerequisites are less flexible:

- Must be a rated Army aviator on active duty and on flight status.
- Must be fixed and rotary wing rated with a minimum of 1,500 hours *military* flying time. Five hundred hours must be in rotary wing and 130 hours in fixed wing aircraft. Total military flying time is waiverable to 1,000 hours depending on the applicant's overall aviation qualifications.
- Must be twin-engine fixed wing and turbine-powered rotary wing qualified. The aircraft qualification requirements include, but are not limited to, UH-1 Huey, OH-58 Kiowa, CH-47 Chinook, and OV-1 Mohawk aircraft. Aircraft requirements may be waived; however, applicant – if selected will receive qualification training enroute to test pilot school training.
- Must have or previously held a current instrument rating.
- Must have completed college algebra, physics and calculus with above average grades. Completion of differential equations, although not mandatory, is highly desirable. A college degree in engineering is the most suitable academic background for the test pilot program.

Selection And Training: Selection of Army aviators for participation in the program is made by an Officer Personnel Management Directorate (OPMD) board. Representatives of the OPMD Aviation Management Branch, OPMD Grade Divisions, Naval Test Pilot School (NTPS), as well as the Army Engineering Flight Activity are included as board members. Only those applications of officers who are recommended by their respective grade division are considered. Applicants for the program are selected on a "best qualified" basis; the number selected hinges on Army requirements.

Once selected and prior to attending NTPS, officers are sent TDY to the Army Test Pilot Orientation Course at the U.S. Army Aviation Engineering Flight Activity (USAAEFA), Edwards Air Force Base, CA. The orientation course is about 60 days long and is designed to provide academic and flight refresher training. Academic subjects reviewed include college math through calculus, physics, aerodynamics, engineering slide rule and technical report writing. Flight orientation training includes high altitude environmental training, flight test techniques and familiarization in a number of aircraft used at NTPS.

The NTPS course consists of about 11 months of rigorous flight and academic training. Classes are held twice a year beginning in January and July.

The Army's training quota for NTPS is about nine per year (five for the January class and four to the July session); however, the number of officers trained is dependent upon force structure requirements. Upon successful completion of the NTPS course, graduates are assigned to USAAEFA or the Aircraft Development Test Activity (ADTA) at Fort Rucker, AL, for utilization as engineering test pilots or in staff positions involving decisions affecting the type, design and configuration of Army aircraft.

Officer Professional Development: In the past, some commissioned officer aviators have been reluctant to participate in the test pilot program for fear that specilization would limit their ultimate professional development. In reality, nothing could be further from the truth. Under the Officer Personnel Management System (OPMS), test pilots are eligible to fill a wide range of research and development (R&D) requirements and are ideal candidates for the Project Management Development Program. Following initial assignment at USAAEFA or ADTA, test pilots are geared to the R&D field and are *not* limited to filling only test pilot positions. Their experience and skills represent a high dollar cost investment and require a closely monitored program of utilization and professional development. R&D test pilots are qualified for and will be assigned to both R&D and Aviation (specialty 15) positions. Like all OPMD managed officers, their careers are managed under the dual specialty concept with school assignments, command opportunity and promotion potential determined by how well they perform in each specialty.

Opportunities In Space Shuttle Program: The Space Shuttle Program will usher in a new era of space transportation in the 1980s, opening the way to routine operations and expanded experimental investigations in space. This program is designed to provide the United States with an economical capability for delivering payloads of personnel, equipment, supplies and other spacecraft to and from space by reducing operating costs and order of magnitude below those of present systems.

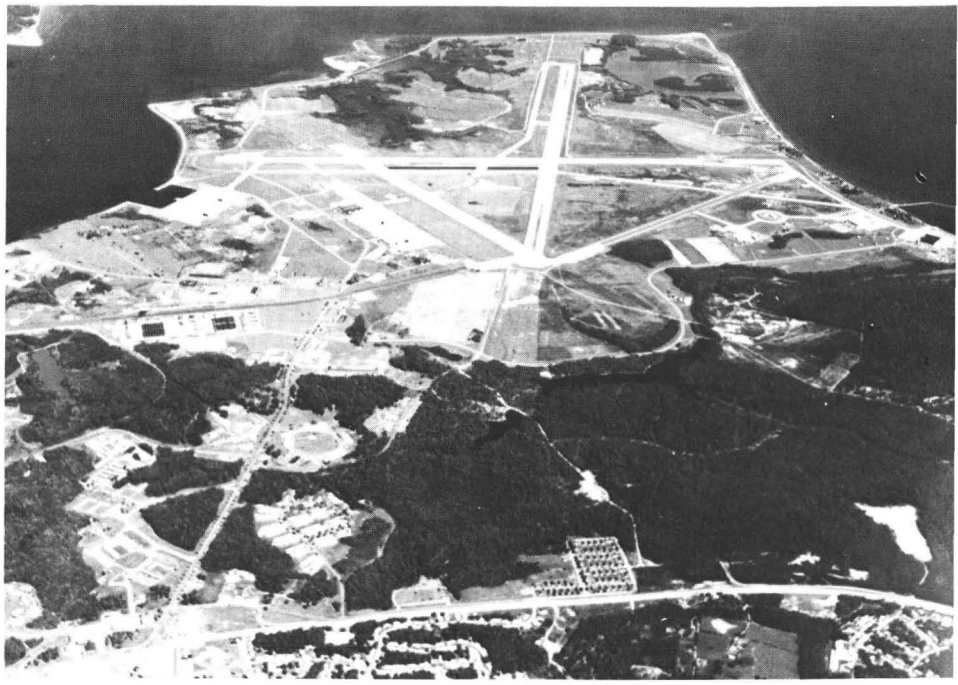
The National Aeronautics and Space Administration (NASA) recently convened a board to select qualified applicants for participation in the Space Shuttle Program as either an astronaut pilot or mission specialist. In support of this program, the Army nominated 33 officers to NASA of which eight were engineering test pilots. It is anticipated that results of the NASA board will be released during the 2nd quarter FY 78.

A review of the selection criteria clearly indicates that test pilot personnel are excellent candidates for the program. Although no official announcement has been made, future Space Shuttle Program Selection Boards are expected.

Army test pilots, whether working on a staff or performing engineering test flights, have both a challenging and rewarding military career. Army aviation is influenced by their accomplishments in the aircraft research and development field. When a prototype finally becomes part of the Army's aircraft inventory, test pilots know their hard work helped put it there.

To become part of this unique group of Army aviators, qualified officers should contact their respective OPMD grade division regarding application for the program. Application procedures are outlined in Department of the Army Circular 351-71, "Army Aviation Engineering and Flight Testing Program," dated 13 December 1976. Additional information concerning the Aviation Engineering and Flight Testing Program can be obtained through contacting the Aviation Management Branch, OPMS, Autovon 221-0727/0794; Commercial (202) 325-0727/0794.

Aerial view of the Naval Air Station, Patuxent River, MD, site of the Naval Test Pilot School



PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, DARCOM, ATTN: DRCPO-ALSE, POB 209 St. Louis MO 63166

Free Life Insurance

We got your attention again – right? The first thing that we have all learned is that nothing is free – wrong! Free insurance is available, but best of all, you are the beneficiary. Most insurance only pays your beneficiary when you die. This insurance makes you the beneficiary by helping make sure you live.

The insurance we are talking about is called aviation life support equipment (ALSE). This equipment is available to all aircrewmembers. However, it must be used, inspected and maintained to be effective. Wear and use your ALSE on every flight no matter how short the duration. Can you imagine trying to put on a pair of Nomex gloves while autorotating your helicopter during an engine failure – have we made our point?

Oxygen Systems

I would appreciate any information on the proper oxygen equipment authorized for Army aviators.

Oxygen equipment authorized for Army aviators is contained in SB 700-20. A proposed required operational capability (ROC) for oxygen systems was submitted by Ft. Carson, CO. They and the U.S. Army Aeromedical Research Laboratory, Ft. Rucker, AL, are evaluating and/or testing oxygen systems which eventually may be authorized for Army use. As soon as additional data becomes available, we will publish information in **PEARL.**

Air-Conditioned Face Mask

A lightweight, nonwoven textile fiber weather mask that the manufacturer claims not only keeps the nose and mouth warm but also helps warm and humidify inhaled air during colder winter months is available at your nearest hardware or drugstore.

Such a mask is needed by aviators, aviation mechanics and other personnel who work outdoors in extreme cold under conditions where the more bulky type of mask is impractical. It would be extremely valuable in survival situations to protect the nose and mouth from frostbite and help eliminate premature exhaustion caused by breathing cold air.

The Minnesota Mining and Manufacturing Company, who developed the mask, says the porous material used allows exhaled air to pass through but stops warmth and moisture. The warmth and moisture is held in a small chamber formed by the mask in front of the nose and mouth. Inhaled air must pass through this chamber and is thus conditioned for more comfortable breathing.

In tests made by the company it was found that inhaled air from temperatures as low as -70 degrees fahrenheit (F) were brought up to a level of +65 degrees F.

The lightweight molded mask is held in place by an elastic band. It can be used numerous times and cleaned by rinsing in clear cold water. It does not interfere with glasses and face mask and will not hinder voice communications.

The mask will neatly fold to fit into your jacket pocket, first aid or survival kit. The cost is approximately 25 cents each.

The Other Half

You are now out of your wrecked aircraft which brought you down in the middle of – well, you're not really sure where. You check to determine the extent of your injuries and treat them accordingly.

Now that your life is saved, it's up to you to make sure it stays that way. Captain Charles F. Nowlin, who crashed his helicopter in Vietnam and was burned seriously, was given some excellent advice by the medical people at Brooks Army Hospital. Captain Nowlin remembers that he felt extremely tired shortly after his accident and only wanted to sit down and rest. However, he was in an enemy area and knew that rescue would only be possible if he reached an area where he could signal the search aircraft. So he continued to struggle to an area where he was spotted and rescued. Captain Nowlin was advised that had he

stopped to rest, he probably would have died at that spot.

So, fight that urge to stop and rest until you have your rescue plan developed. Give all the assistance and signals to the search team that you are capable of.

Of course you may determine that immediate rescue is not imminent, so your thoughts must turn to survival. Let's see – lifesaving, signaling, shelter and food – or is it lifesaving, shelter, food and signaling. Signaling! That's it. As I recall, they said to be ready to signal at all times.

The importance of signaling cannot be overemphasized, nor can the possibility of having to walk out of an emergency situation. These two survival elements normally receive less attention than fire building, shelter building, food, water, etc. Signaling is the key to survival. Your signal equipment is extremely important at this time as well as the ability to improvise in the absence of equipment.

Our present signaling equipment is simple and easy to operate. However, you should be familiar with your signal devices before you encounter a survival situation. On-the-job training may result in your failure to be rescued.

The AN/PRC-90 survival radio is your most important signal device. Use of the radio depends on various factors: whether search aircraft or assistance is within its range, type of terrain, battery power, etc. If assistance is within range, transmit distress calls as necessary. Otherwise, to conserve battery power, transmit at 30-minute intervals or prearranged schedules.

The signal mirror probably will be your second most important device. The signal mirror has led to more rescues than any other single item of equipment. The main thing to remember is that once contact is established, it must be maintained by continually flashing the mirror at the rescuers. A shiny piece of metal is an excellent mirror substitute.

Sometimes failure to be rescued results because rescue units are unable to establish your position on the ground. This is when your flare, parachute panels or similar items are employed. An open area makes for easier sighting of your signal devices. Dye markers can be used in water or the coloring equipment can be scattered on the snow. Stones or rocks can be used for an SOS signal in the desert or on the beach.

It is possible that you will not salvage any signaling equipment out of your aircraft. Then the knowledge and ingenuity to improvise signals is more important than knowing how to use your standard signal devices. You're "the other half" of your rescue effort.

ATC ACTION LINE

UNITED STATES ARMY AIR TRAFFIC CONTROL ACTIVITY

Are military aircraft subject to Federal Aviation Administration (FAA) regulations?

When operating within the National Airspace System (NAS), military aircraft are required to comply with FAA regulations.

Are there exceptions?

Yes. One is the speed authorization. Normally, all aircraft operating below 10,000 feet mean sea level (MSL) must fly at speeds of 250 knots or less. Aircraft whose flight characteristics require higher speeds to remain maneuverable are exempt. Military aircraft on defense training missions or on actual missions in defense of the U. S. may deviate from the speed requirement. Defense training missions must comply with the terms of the speed waiver issued by FAA. Effective 18 May 1978 all military aircraft, with few exceptions, operating below 10,000 feet and above 250 knots must be operated within the boundaries of designated special use airspace.

What categories of special use airspace areas may be used in the above situation?

They are:

- *Restricted Area.* When being used for the purpose for which it was designated.
- *Military Operations Area (MOA).* Normally adjoining a restricted area for the purpose of containing aircraft "spilling-out" of the restricted area.
- *Instrument routes (IR) and visual (VR).* Routes established for special defense training missions. Operational requirements are the same as MOAs.

Does this affect Army operations?

Yes, to the extent that Air Force or Navy aircraft in support of the Army mission require special use airspace. In addition, Army installation commanders and/or air traffic and airspace (AT&A) officers must be aware of operational requirement of the other services, especially their IR and VR route requirement to ensure minimum impact on the Army mission.

How are these special use airspace areas established?

An airspace proposal must be developed and submitted, through channels, to the FAA for approval. Refer to AR 95-50 (effective date 1 January 1978) and contact the appropriate Department of the Army Regional Representative (DARR) for assistance in preparation and submission of such proposals.

Are nonparticipating aircraft restricted from operating in these areas?

Yes and no. Nonparticipating aircraft may not penetrate a restricted area when such area is activated. Nonparticipating VFR aircraft may penetrate an MOA or an IR/VR route at the pilot's discretion. FAA will *not* clear *IFR* aircraft into these areas unless normal IFR separation can be maintained from participating aircraft.

Where can aviators get detailed information about these special use airspace areas?

MOAs are depicted on U. S. Government aeronautical charts. Additional information can be obtained from any Flight Service Station within 200 miles of the area. IR/VR routes are depicted on aeronautical charts (sectional, ONC) also and in the FLIP AP/1B book. Flight Service Stations within 200 miles also will have pertinent information.

Readers are encouraged to send questions to:

Director
USAATCA Aeronautical Services Office
Cameron Station, Alexandria, VA 22314

AIR WEATHER SERVICE (AWS) aviation forecasting units implemented a new weather advisory service 1 March 1978. Weather advisories now are issued for observed and forecast low level wind shear (LLWS) conditions affecting take-off and landing operations. LLWS advisories are disseminated locally as Met Watch Advisories. Airfield personnel responsible for alerting arriving and departing aircraft of hazardous weather receive advisories on LLWS according to procedures established by Air Force Regulation 55-48.

Potentially dangerous LLWS conditions are associated most frequently with thunderstorm gust fronts, frontal passages, low level jets, sea breezes, strong gusty surface winds and mountain waves. A low level wind shear advisory applies within a 5-nautical mile (nm) radius of the airfield and between the surface and 2,000 feet above ground level (AGL). For LLWS associated with thunderstorm gust fronts,

AVNEC

AN ARMY AVIATION Employment Conference (AVNEC) will be held this month from the 28th to the 31st at the U.S. Army Aviation Center. The conference aims to achieve a consensus regarding Army aviation doctrine, tactics, employment concepts and prioritizing new aviation equipment items which will be reviewed indepth during the November 1978 Army Aviation Systems Program Review (AAPR). The AAPR also will be held at the Aviation Center.

Invitations to the 4-day AVNEC have been sent to more than 100 general officers and civilians of equivalent rank. The attendees will be divided among four workshops which include Army Aviation "How to Fight" Offense; "How to Fight" Defense; Interoperability/Standardization; and Army Aviation Personnel and Training Problems.

Future issues of the *DIGEST* will contain AVNEC results and discussions of selected issues and more information concerning AAPR.

ASH SYMPOSIUM

MORE THAN 140 people attended the Advanced Scout Helicopter (ASH) Survivability Symposium 14 and 15 February at the U.S. Army Aviation Center, Ft. Rucker, AL.

The symposium provided a forum to exchange information and ideas among the developer, manufacturer, user and other interested parties.

Major General James C. Smith, Ft. Rucker Commander, stressed the importance of the advanced scout helicopter in the combined arms team on the future battlefield. He discussed the need for industry to be aware of aviation's needs by making them aware of what the scout helicopter does on a mission.

Courtesy *The Army Flier*

Notice Re: TC 1-135

DUE TO THE increase in requests from units worldwide for the Programed Texts listed as references in the Aircrew Training Manual, TC 1-135 (DRAFT), some requests probably will be partially filled. With the requirement to furnish the instructional departments at the Aviation Center as well as field units with these Programed Texts, stockage level must be maintained. Requests that are partially filled can be resubmitted in 30 to 60 days and they will be completed.

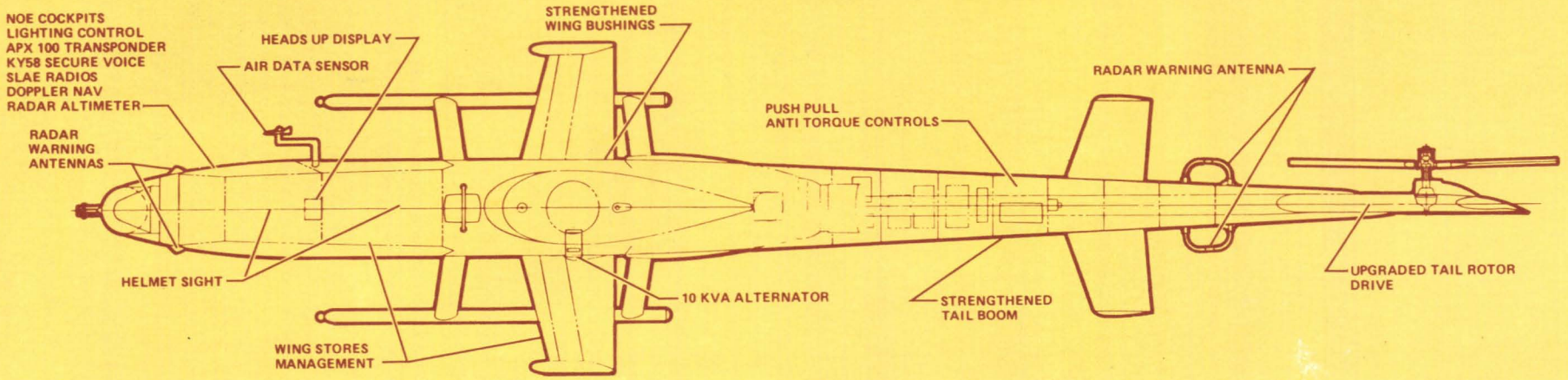
Contact for these Programed Texts is U.S. Army Aviation Center, Department of Academic Training, Extension Training Management Branch, ATTN: ATZQ-T-AT-E, Fort Rucker, AL 36362.

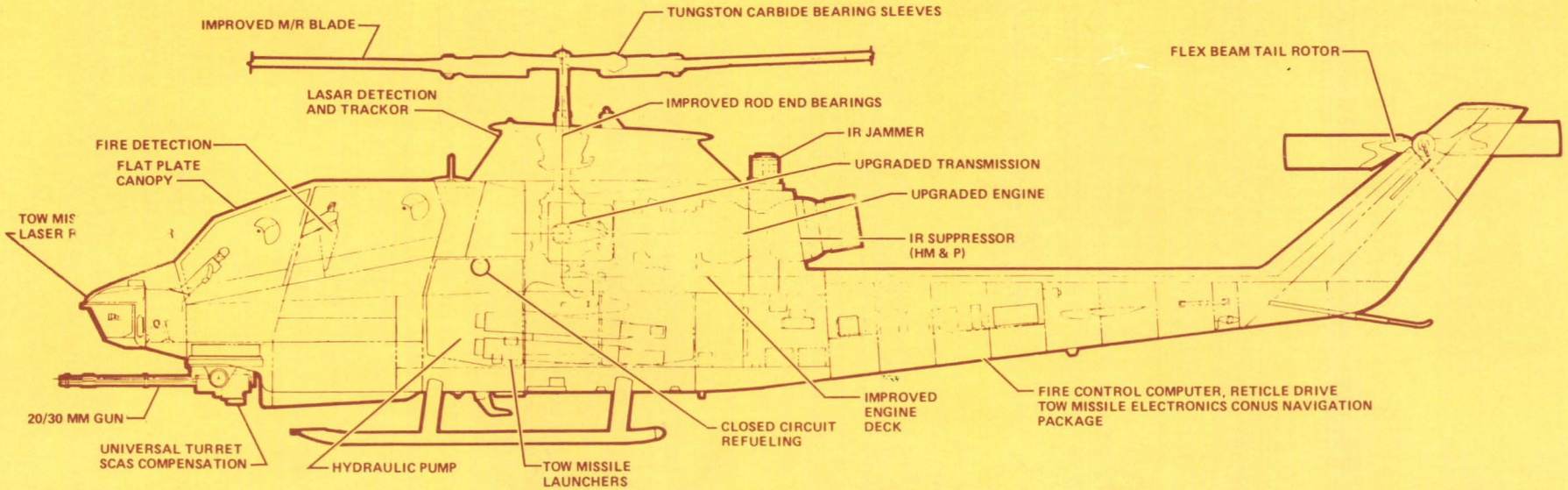
the advisory will be valid within a 10-nm radius of the airfield because the gust front can move a considerable distance from the visible storm or radar echo.

To help AWS fully evaluate and improve this service, aircrews are asked to provide pilot weather report (PIREP) information to the local base weather station whenever LLWS is encountered and when LLWS is forecast but not encountered.

The potential danger of the low level wind shear must not be underestimated. In recent years, several major civilian aircraft accidents were attributed directly to low level wind shear conditions. A review of past military aviation accidents indicated low level wind shear rather than "pilot error" as the probable cause or contributing factor to some major mishaps. The LLWS Advisory Program aims to minimize the LLWS hazard to military flight operations, and thereby enhance flying safety.

MODERNIZED COBRA CONCLUSION ON PAGE 8





The AH-1S Modernization Program includes all of these features