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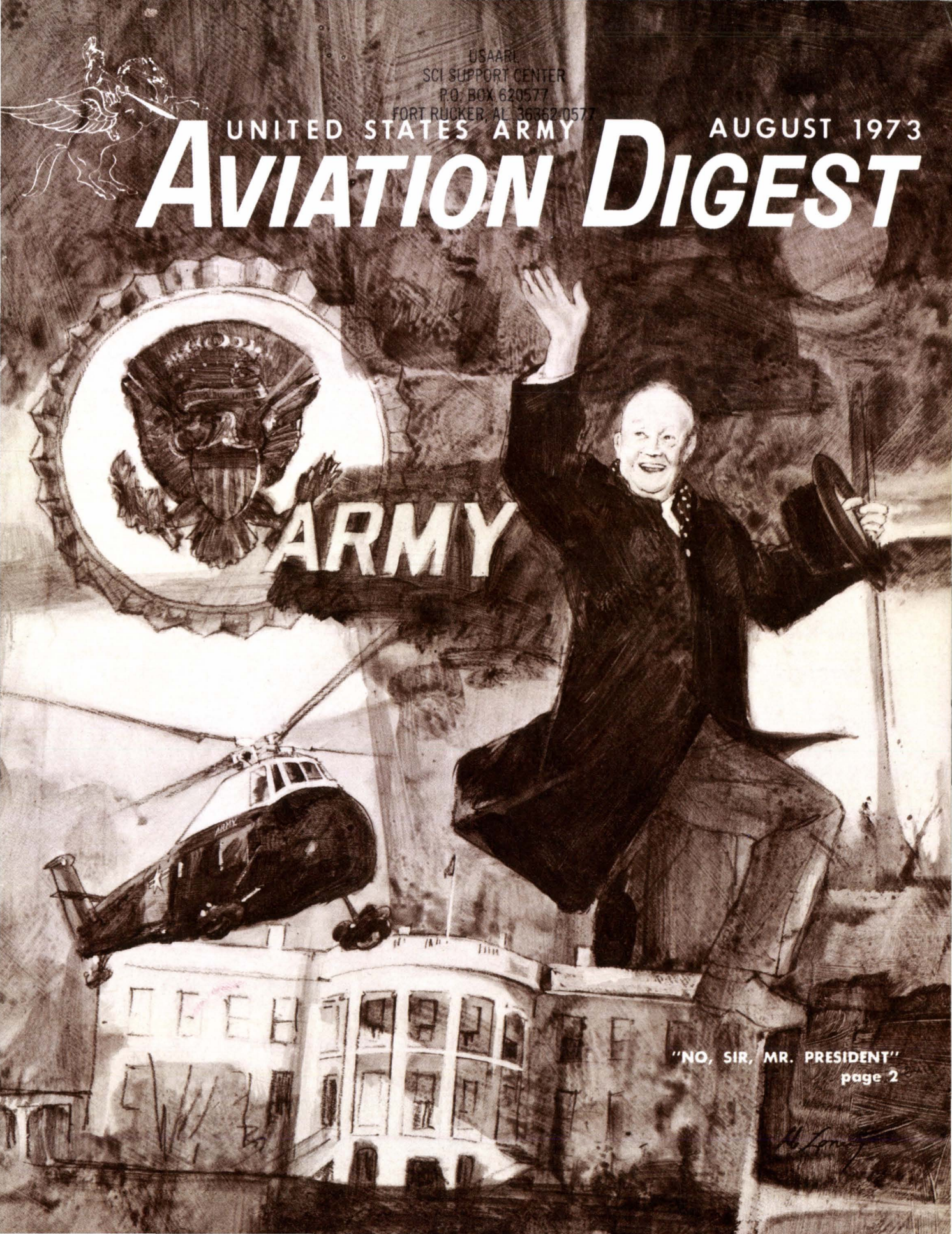
UNITED STATES ARMY AUGUST 1973

AVIATION DIGEST



"NO, SIR, MR. PRESIDENT"
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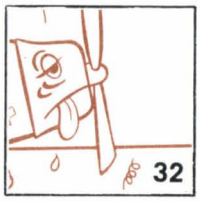
UNITED STATES ARMY AVIATION DIGEST

AUGUST 1973 VOLUME 19 NUMBER 8



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ABOUT THE COVER

Afraid to say "No" to the commander? What if you had to say "No" to the President of the United States? See page 2

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or 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 Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. 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 36360.

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VIEWS FROM READERS

Sir:

After carefully reading the article "A Wing And . . . An Arm" in the June 1973 issue, I feel it should be retitled "A Wing And . . . An Arm Equals Science Fiction."

MAJ Donald G. Broadhurst
Combat and Training Developments
Ft. Rucker, AL 36360

Sir:

In addition to aeromedical evacuation for the Ft. Sill, OK, area, the unit to which I am attached has been tasked with search and rescue responsibilities for two major Air Force training centers in the same area. Our problem is one of timeliness in successfully locating a pilot once he has ejected or crashed. The UH-1H helicopter is limited to FM homing capability while the Air Force emergency transmitters are limited to UHF guard or 243.0. Prior to deactivation, Air Force search and rescue units employed DF equipment on their helicopters in order to achieve homing capabilities.

Does the Army have, or are there plans to obtain, a comparable system for UHF homing that could be utilized in the UH-1H?

Although we have been involved in search and rescue only a short time, our mission of preserving life combined

Continued on page 18

Now Is The Time

"THUNDERHORSE 6, this is Redleg 6—smoke is out."

"Redleg 6, I've got cherry."

"Roger, from cherry go right 300, drop 100, over."

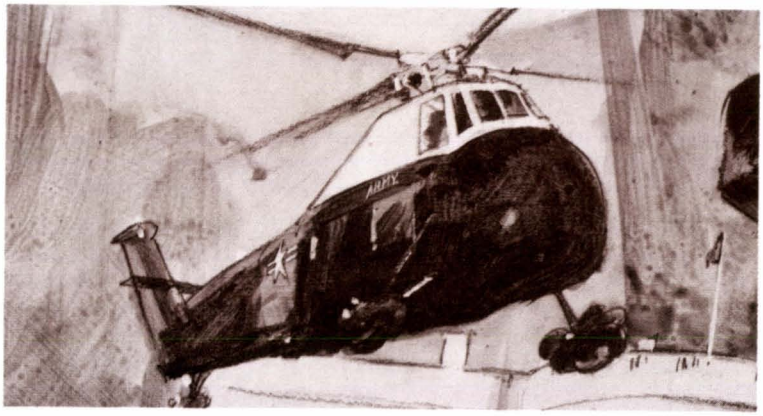
"Roger, right 300, drop 100, six is inbound."

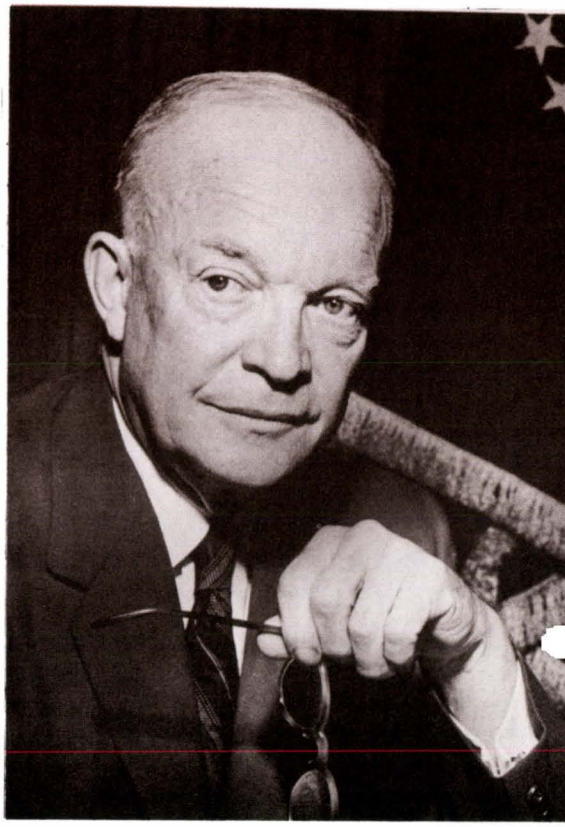
These were the days when many a ground commander would love to hear that whop-whop-whop. He didn't care what we looked or acted like as long as we accomplished the mission. He might even thank us for our assistance during a recent mission or buy us a drink in the club when he saw us. Yes sir, we proved we were "Above the Best" during those days, but those days are gone. COL J. J. Groundcommander now appears to us to have revamped his attitude toward aviators. Don't kid yourself, he hasn't changed, it's just that he now has the opportunity to take a good hard look at us, eyeball to eyeball, and determine if we are "professionals." How many lives we saved in combat may help our records, but how's it going to help us when he's giving us our "just due" for our long hair, untrimmed mustache or lack of enthusiasm in carrying out an additional duty? It's not!

This is our postcombat trial period that we have just wandered into. The majority of us in Army aviation are junior commissioned or warrant officers. The day we received our wings we inherited the duty to establish a precedent for professionalism which would be used as an example for all Army officers. Now that our real test is here let's rise to the occasion as we did in the past and prove once again that we are truly "professionals." Let's volunteer to set the standards of appearance, conduct and sense of duty. We owe it to all, in or out of aviation, because we are truly "ABOVE THE BEST."

1LT Richard A. Cowell
52nd Aviation Battalion
APO San Francisco 96301

an interview with Bill Howell, Army helicopter pilot for President Dwight D. Eisenhower, who always balanced mission accomplishment with good flying sense





"NO, SIR, MR. PRESIDENT"

COL FRANCIS MAX McCULLAR, COMMANDER, U.S. ARMY AGENCY FOR AVIATION SAFETY: *I selected Bill Howell for interview because of his most interesting career and his fine safety record. As Army helicopter pilot for the President of the United States, he had to be thoroughly safety conscious. To belabor the obvious, he could never take a chance with that passenger. In addition, Bill only had one aircraft accident—and that quite early in an aviation career that spanned 17 years—the cause being attributed to mechanical failure. But as he tells it, there is a lesson even in that mechanical failure worth learning for all of us. So I took a tape recorder and persuaded Bill to talk about ways and means to get a job done safely, ranging from figuring out a way to fly night missions safely with no artificial horizon to refusing to fly the President in marginal weather. The following is a transcription of my interview with LTC (Retired) William A. Howell, outstanding Army aviator, and personal Army pilot for President Eisenhower for 3 years.*

HOWELL: COL McCullar was over at the museum the other day, and he caught me in a talkative mood and couldn't stop me.

McCULLAR: That's what I'd like to do again today, Bill. On that particular day you told us of the events that took place one day when you were flying President Eisenhower to Camp David. I'd like to start out with that story because I think it illustrates good flying sense.

HOWELL: This was one of those mornings in Washington where we had about a thousand-foot ceiling and you could see 20 miles in any direction. President Eisenhower decided he wanted to go to Camp David. One of the staff called me, and I told him there wasn't any way to get to Camp David. There was about 2,000 feet of it sticking up in the weather. So nothing happened and about 30 minutes later I got another call. "The President still wants to know if he can go to Camp David." I said, "By car, but not by helicopter." "He wants to go by helicopter." I said, "Not this morning." He was apparently anxious to get out of there. So I got another call. "Can he go to Sunshine?" That's the farm at Gettysburg. I said, "We can go anywhere in the world but Camp David." He said, "Well, he wants to go to Sunshine then."

We went over to the south lawn

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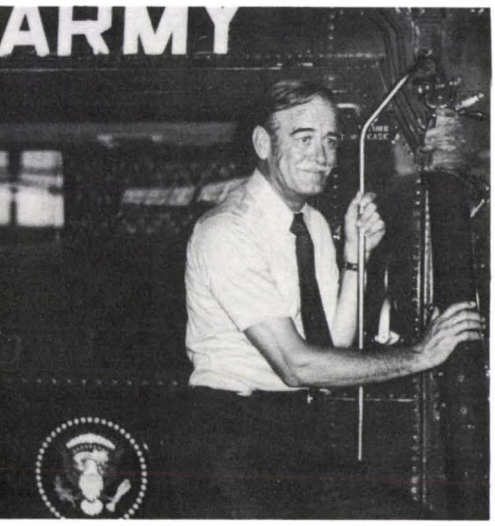

LTC (Retired) William A. Howell, President Eisenhower's personal Army helicopter pilot from December 1957 to January 1961, was the first Presidential helicopter pilot and the first commander of the Executive Flight Detachment. Retiring in 1963 as Director of Test, the U. S. Army Aviation Test Board, LTC Howell began his Army career with his enlistment as a private soldier in 1938. He graduated from OCS in September 1942, served in the North African and Italian campaigns, and in 1946, attended the Army Air Force Liaison Pilot School in San Marcos, TX. For the rest of his military career, LTC Howell was intimately associated with Army aviation, his assignments including such aviation-oriented positions as aviation advisor to the Republic of Korea Army during the Korean Conflict, staff and faculty member of the Aviation School, commander of the 3rd Transportation Battalion (Aviation), and commander of the U. S. Army Transportation Test and Support Activity. He is qualified in both single- and twin-engine fixed- and rotary-wing aircraft, having served as instrument examiner and as permanent member of the aircraft accident investigation board, student elimination board and flying evaluation board. He is now curator of the Army Aviation Museum, Ft. Rucker, AL.

Combat And Training Developments

Key changes have taken place at the home of Army aviation. To keep you up-to-date, the articles beginning on these two pages are presented as slightly modified versions of a VIP briefing given to senior officers visiting the newly organized Combat and Training Developments at the U. S. Army Aviation School, Ft. Rucker, AL. This organization was developed primarily from resources of the former Combat Developments Command Aviation Agency, which was a class II activity at Ft. Rucker, and the Aviation School's Office of Doctrine Development, Literature And Plans

Major Frank T. Peterlin
Chief, Training Literature Section
Combat and Training Developments
U. S. Army Aviation School

FOLLOWING major revisions within the Department of the Army last July, the U. S. Army Aviation School (USAAVNS) at Ft. Rucker, AL, has acquired a new look and added mission responsibilities.

The reorganization of the major elements of the Department of the Army is reflected in the photo above.

Combat and Training Developments (CTD) at the Aviation School is organized in accordance with a standard school model provided by TRADOC, the acronym for the Training and Doctrine Command. TRADOC has absorbed most of the responsibilities of the former Continental Army Command and the Combat Developments Command.

TRADOC manages all basic and advanced individual training, commands the Army schools and has operational control over the Defense Language Institute and Defense Information School. The key mission, however, of developing doctrine and materiel requirements rests with the Combat and Training Developments organizations within each major school.

Coordination in the important area of enhancing the Army's combat effectiveness is provided TRADOC by:

- **Combined Arms Center, Ft. Leavenworth, KS**
- **Logistics Center, Ft. Lee, VA**
- **Administration Center, Ft. Benjamin Harrison, IN**

These centers have developed tables of organization and equipment (TOEs) for division, corps and army levels. The Combat and Training Developments organizations within the TRADOC schools are responsible for developing TOEs for units through the brigade level for which they have proponency.

By agreement, each center has direct tasking authority for its associated schools. In the case of the Aviation School, Combat and Training Developments receives tasking from the Combined Arms Center, commonly referred to as CACDA.

Service Schools Associated With CACDA

- **Air Defense**
- **Armor**
- **Aviation**
- **Chemical**
- **Combat Surveillance and Electronic Warfare**
- **Engineer**
- **Field Artillery**
- **Institute of Military Assistance**
- **Infantry**
- **Intelligence**
- **Military Police**
- **Signal**

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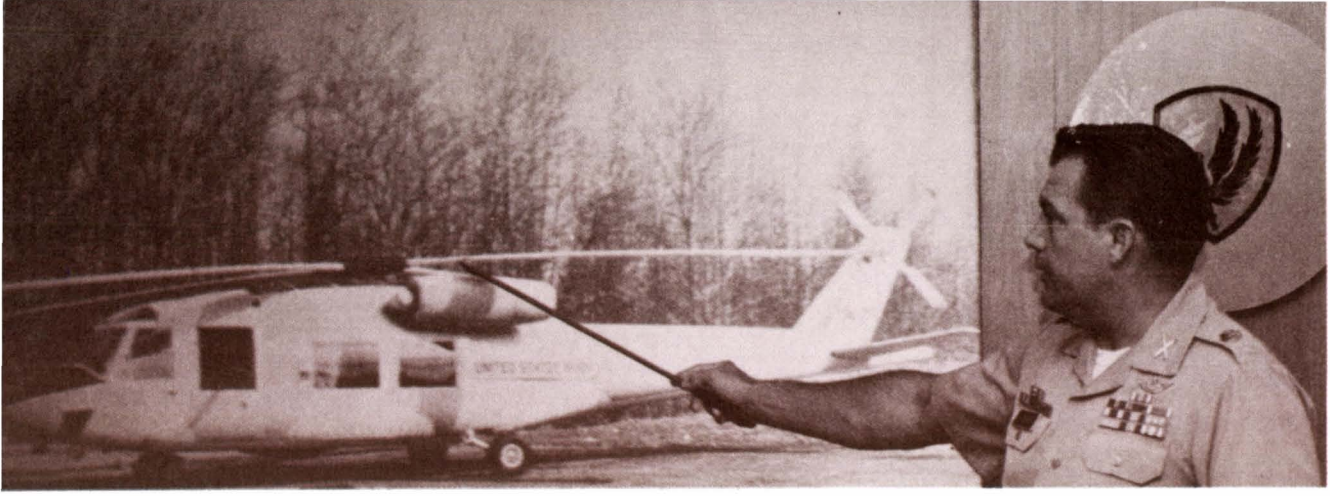


Concepts And Materiel And CTD

Major William E. Keller
Project Officer
Combat and Training Developments
U. S. Army Aviation School

THE ARMY'S reorganization, as discussed in the article at left, has thrust new responsibilities on the U. S. Army Aviation School (USAAVNS). Many of these fall in the areas of concepts and materiel and are incorporated in the mission of the Aviation School's newly organized Combat and Training Developments (CTD) organization.

Areas of concepts and materiel that have top priorities include aircraft systems; armament subsystems; avionics and visionics; and associated aviation equipment.

Concerning aircraft systems, extensive studies have established hardware performance requirements in the roles or missions of an advanced attack helicopter (AAH); a utility tactical transport aircraft system (UTTAS); a heavy lift helicopter (HLH); and an advanced reconnaissance helicopter (ARH).

Experience in the Republic of Vietnam has confirmed the value of the attack helicopter in complementing the firepower of ground forces. To capitalize on this capability, the Army has established a requirement for an advanced attack helicopter system (see box below).

Advanced Attack Helicopter

Characteristic	*Requirement*
VFPC	**HOGE @ 4000 Ft/95° F; 500 FPM VROC (450-500 FPM Band) @ 95% IP**
Agility	**0.25g Accel (0.25-0.35g Band) To 35 KTAS Lt & Rt Sideward Flt. Optimize For NOE**
Payload	**8 Antiarmor Missiles (8-12 Missiles Band) + 800 Rnds 30MM (800-1000 Rnds Band) 38-76 2.75 In. Rockets Combination Up To 16 Missiles/ 1200 Rnds 30MM**
Endurance	**1.9 Hrs Including Reserve; Capacity For 2.5-2.8 Hrs**
Air Speed	**Cruise @ 150 KTAS (145-175 KTAS Band)**
Maintainability	**8-13 MMH/FH Total System @ Org, DS, GS; Daily 300 Hr Inspections**
Deployability	**C-141 (2); C-5A (6); Sealift; 800-1000 NM Ferry**

CTD participated in a task force for an advanced attack helicopter which is less complicated, less costly, more maneuverable and lighter than aircraft previously evaluated. This required operational capability, which is the parent document for materiel

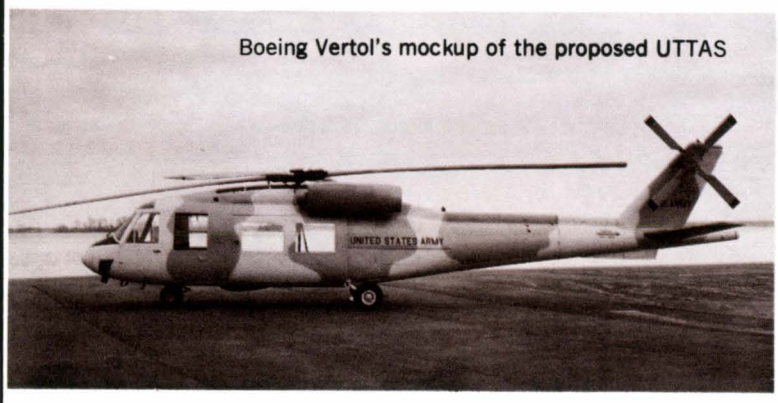
development, has been approved by the Department of the Army.

UTTAS is the aircraft system intended to replace the UH-1 helicopter. Its concept formulation was completed by Combat and Training Developments.

The UTTAS airframe and engine programs are proponent to CTD's Materiel Division and are on schedule. Technical performance specifications of UTTAS are listed in the box below.

Utility Tactical Transport Aircraft System

Characteristic	*Requirement*
VFPC	**HOGE @ 4000 Ft/95°F; 500 RPM VROC (450-550 FPM Band) @ 95% IP**
Payload	**11 Combat Equipped Troops (2,640 Lbs); 4-6 Litter Patients**
Endurance	**2.3 Hrs Including Reserve; Capacity For 3.0 Hrs Cruised 150 KTAS (145-175 KTAS Band)**
Air Speed	**150 KTAS (145-175 KTAS Band)**
Maintainability	**4.2 MMH/FH Corrective Maint. @ Org, DS GS; Daily & 300 Hr Inspections**
Deployability	**C-130 (1); C-141 (2); C-5A (6) Sea Lift**
Maneuverability	**Avoid 200 Ft Obstacle In 1100-1300 Ft @ 150 KTAS; 1.75g/3 Sec; 0.25g/2 Sec Sustained**



Boeing Vertol's mockup of the proposed UTTAS

UTTAS airframe manufacturers both completed their preliminary design milestones last March. A mock-up review is scheduled for next month but is expected earlier. The first flight is planned for November 1974. Boeing-Vertol and Sikorsky expect to beat the flight milestone by 1 or 2 months. Meanwhile, General Electric has been funded to deliver 12 engines—six each for Boeing and Sikorsky.

The first flight-qualified engines are to be delivered to the airframe contractors in August 1974, but may well be a month ahead of schedule.

The next major system is the heavy lift helicopter (HLH). CTD is conducting the concept formulation study which will establish the users' heavy lift helicopter requirements and satisfy Department of Defense prerequisities for initiating materiel development.

The HLH Joint Working Group has completed the tradeoff analysis (TOA) which is required prior to identifying the best technical approach (BTA), the next major milestone.

The HLH concept formulation study discussed above is based on a comprehensive study of users' needs. In addition to this, AMC is conducting an advanced technology program based on initial ad hoc committee requirements. This is covered in the article "HLH" beginning on page 8.

Another aircraft system receiving major attention is the advanced reconnaissance helicopter (ARH). *A draft proposed required operational capability* (DPROC) document for the ARH was written by CTD. It was later discarded and then written by COMSGP (CACDA) before going to DA on 19 March 1973.

ARH DPROC Mission Configurations

- **Baseline Aircraft Equipped For Day Mission Only**
- **Provisions For Space, Weight and Power Are Included For The Following Missions:**
  - **Night & Weather**
  - **C & C/Liaison**
  - **Ground LOHAR (light observation helicopter, armor)**
- **Proponent Branches Will Equip Baseline Aircraft As Required For Mission Accomplishment**

Advanced Reconnaissance Helicopter

Characteristic	*Requirement*
VFPC	**4,000 Ft P.A., 95°F, 95% IP, 500 FPM VROC, .25-.35g Lateral Agility**
Cruise Air Speed	**120-150 KTAS**
Endurance	**2.5-3.0 Hrs**
Visionics	**TGT Acquisition and Pilot's Night Vision Subsystem**

CTD also is deeply involved in the development of armament subsystems. The three highest priorities are:

- A point target weapon
- An area weapon
- An antipersonnel/antimateriel weapon

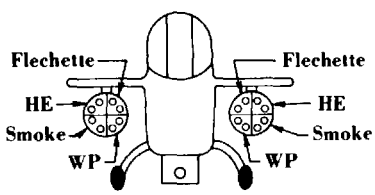
The point target weapon subsystem involves the TOW point target missile mounted on the AH-1Q HueyCobra helicopter. As user representative, CTD identified and commented on airframe modifications and safety of flight items. The aircraft system is being monitored at Yuma Proving Grounds, AZ, during development and missile firing tests which began 9 April 1973.

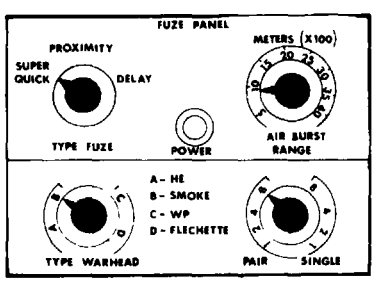
While the AH-1Q/TOW is a considerable improvement over past weapons systems, the helicopter must come out of the nap-of-earth environment to acquire, launch and guide the missile to target impact. Time used for target acquisition, plus the 15 seconds required during missile launch and guidance to target, is well within the enemy's antiaircraft capability to *acquire and fire* on an airborne target.

There is a stated requirement for a fire and forget missile system which will have in its final version either built-in laser or optical seekers—or a combination of both—for automatic homing on the target after launch from a helicopter. CTD supports a dual mode seeker and has an extremely high input to this program. Combat and Training Developments was instrumental in establishing the need for a task force to evaluate this requirement, and its position was supported by the symposium at Redstone Arsenal last May.

An area weapons subsystem also is high on the priority list, with CTD looking to SEAS or the selective effects armament subsystem. This system is to replace the present 2.75-inch rocket. It will provide a greater lethality and standoff capability while enabling the pilot to select specific warheads and fuze settings from inside the cockpit.

Cockpit Console Concept





In addition to these armament systems, the Army is developing an antipersonnel/antimateriel weapons system. It will consist of an automatic cannon firing a dual purpose round capable of penetrating light armored vehicles—and inflicting casualties on personnel in the open. The U. S. Army Weapons Command is conducting a study to determine the most suitable weapons system. Under consideration are—

The XM188 three barrel 30 mm cannon, an unsolicited proposal by General Electric.

The XM140 single barrel 30 mm cannon developed against a requirement written by Combat and Training Developments and the XM197 three barrel 20 mm cannon currently mounted on the U.S. Marines' Sea Cobra. The system selected will be turret mounted.

Combat and Training Developments is responsible to assure that the weapons system will be compatible with the aircraft and to assure that user requirements are met.

CTD's next functional area is Avionics/Visionics with these priority items:

- Air traffic management system (ATMS)
- Communications
- Navigation/standardization equipment
- Electronic countermeasures

Air traffic management systems (ATMS) requirements established by CTD have resulted in a **five** subsystem phased development plan being adopted. The **first** subsystem—for visual control—is in *two* parts. *One* is a man-portable air traffic control facility which is being tested by the U. S. Army Aviation Test Board at Ft. Rucker. It is equipped to provide wind speed and direction, barometric data and a three radio standard lightweight avionics equipment (SLAE) package for communications. Avionics Branch representatives of CTD's Materiel Systems Development Division are monitoring the test.

The *second* portion of the visual system involves a contract awarded last April to develop and test two towers. These 3-man towers are transportable but require about 8 hours to be emplaced and become operational. They will provide all of the functions of a normal control tower, except for radar coverage.

The **second** ATMS task identified by Combat and Training Developments is a portable approach system; **third** is a digital data link to tie the air traffic management system to the central computer. **Fourth** is a navigation subsystem that will be the common system used throughout the Army. It is anticipated that the system will be loran (long range navigation), available in about 1977. Last (**fifth**) is the air traffic

Continued on page 21

HLH

. . . to provide tactical logistics movement
the joint services are looking to the heavy lift helicopter

Captain Brendan P. Blackwell

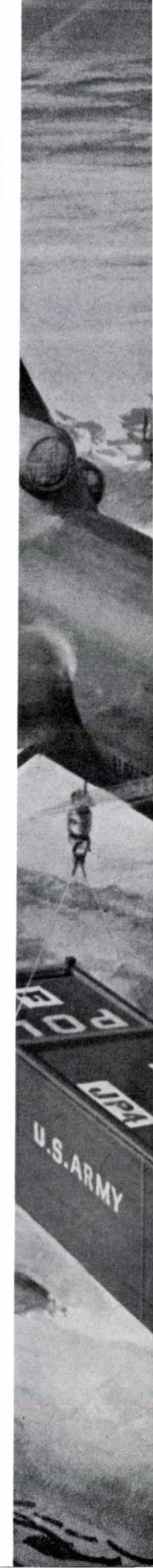
"GREY EAGLE Control, this is HLH 301 inbound with 22½ tons of containerized class V, over."

"Roger, 301, your backhaul will be an 8-inch, self-propelled at 27 tons . . . that heavy lift mission is still on a hold until the container ship is unloaded . . . are you going to take that mission? Over."

"Affirmative, that will help get our fuel down so we can take the 35-ton D9 'cat' to the new site."

"Roger, 301, they're standing by."

In this particular fictitious operation six Army heavy lift helicopters (HLHs) are providing the principal logistics movement support for an entire tactical operation. Specifically, the Army aviator quoted above finished the approach and placement of the container load of ammunition after having flown a new heavy lift helicopter over obstacles which were making surface operations difficult. Surface methods of discharging the ships were fighting such barriers as rocky beaches, extensive sand dunes, cliffs and low lying coastal marshlands. These were combined with 15-foot tides



Integrated self-contained air transportable shops, hospitals and electronics centers for both communications and data processing are also supporting the airmobile operation

that required the ships to remain clear and well offshore. Also, tactical pressures precluded anchoring the ships.

The military unit involved in the rapid airborne deployment was being supported inland by self-propelled artillery, construction equipment, mobile bridges, armored troop carriers, M551 Sheridan vehicles and antiaircraft missile defense. Supporting the heavy, yet airmobile, vehicles was a tailored logistics network that required only a small percentage of the array of road networks, security forces, roadway transport vehicles, supply areas and support equipment needed in the past. Integrated self-contained air transportable shops, hospitals and electronics

equipment for both communications and data processing also supported the mobile operation.

One hour later HLH 301 picked up the D9 "cat."

"Grey Eagle Control, this is HLH 301 on final with a big cat. Have mobile maintenance signal its location for placement, over."

"Roger, 301, Blacksmith is signaling . . . come up on its control frequency, over."

"Wilco, Grey Eagle . . . Blacksmith, 301, over."

"301, this is Blacksmith . . . put your load at the designated point . . . thanks for the haul . . . we'll have this thing fixed before midnight, out."

The sun slipped lower on the horizon as the aircraft commander of HLH 301 pointed the aerial workhorse toward his base area for a crew change. Additional container ships were moving slowly offshore waiting to feed the demanding machines, weapons, aircraft and men of the deploying friendly forces. A new crew would take over and fly the night segment.

* * *

When the HLH aircraft is heard on a battlefield, it will signal the arrival of a new level of airmobile lift capability that will not only stretch the imagination of field commanders but also provide critical lift support to ensure the implementation of dynamic logistics and airmobile concepts to counter enemy threats.

The vertical lift capabilities highlighted above are on the horizon for the U. S. Army as part of an enlightened and integrated aviation development effort led by the Department of Defense (DOD). The DOD has monitored the vitally important activities of aviation elements that have pointed to the necessity for greater vertical takeoff landing capabilities in future conflicts.

The fluidity of opposing military elements must be countered with the latest airmobile concepts carried out by a family of helicopters with the improved performance capabilities needed to defeat the enemy. The HLH is a critically important element in this respect.

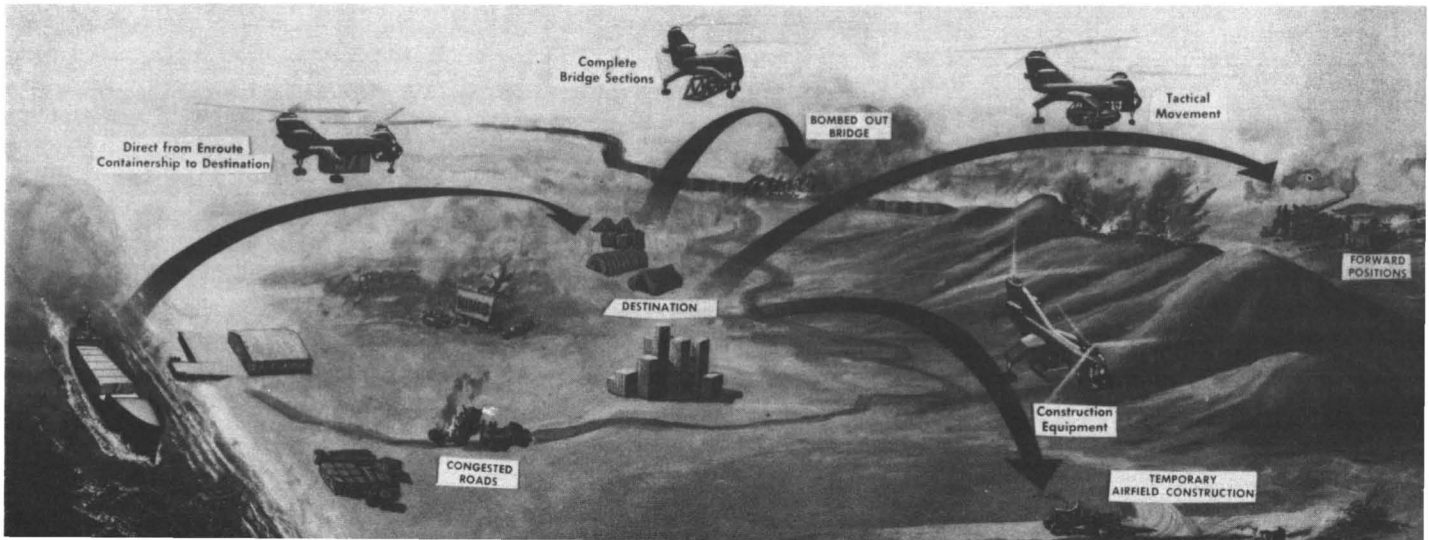
On 17 September 1970 the Deputy Secretary of Defense approved a joint Army/Navy development of an HLH. This multiservice program is the culmination of investigations that began in the 1950s with feasibility studies investigating helicopters with payload capabilities greatly in excess of those then available. Subsequent studies and hardware developments enabled the Army to field helicopters capable of lifting 10- to 12-ton payloads. This not only substantiated the value of vertical mobility in military operations but also pointed to the need for a greater lift capability. The Army was designated as the lead service to undertake an advanced technology component program.

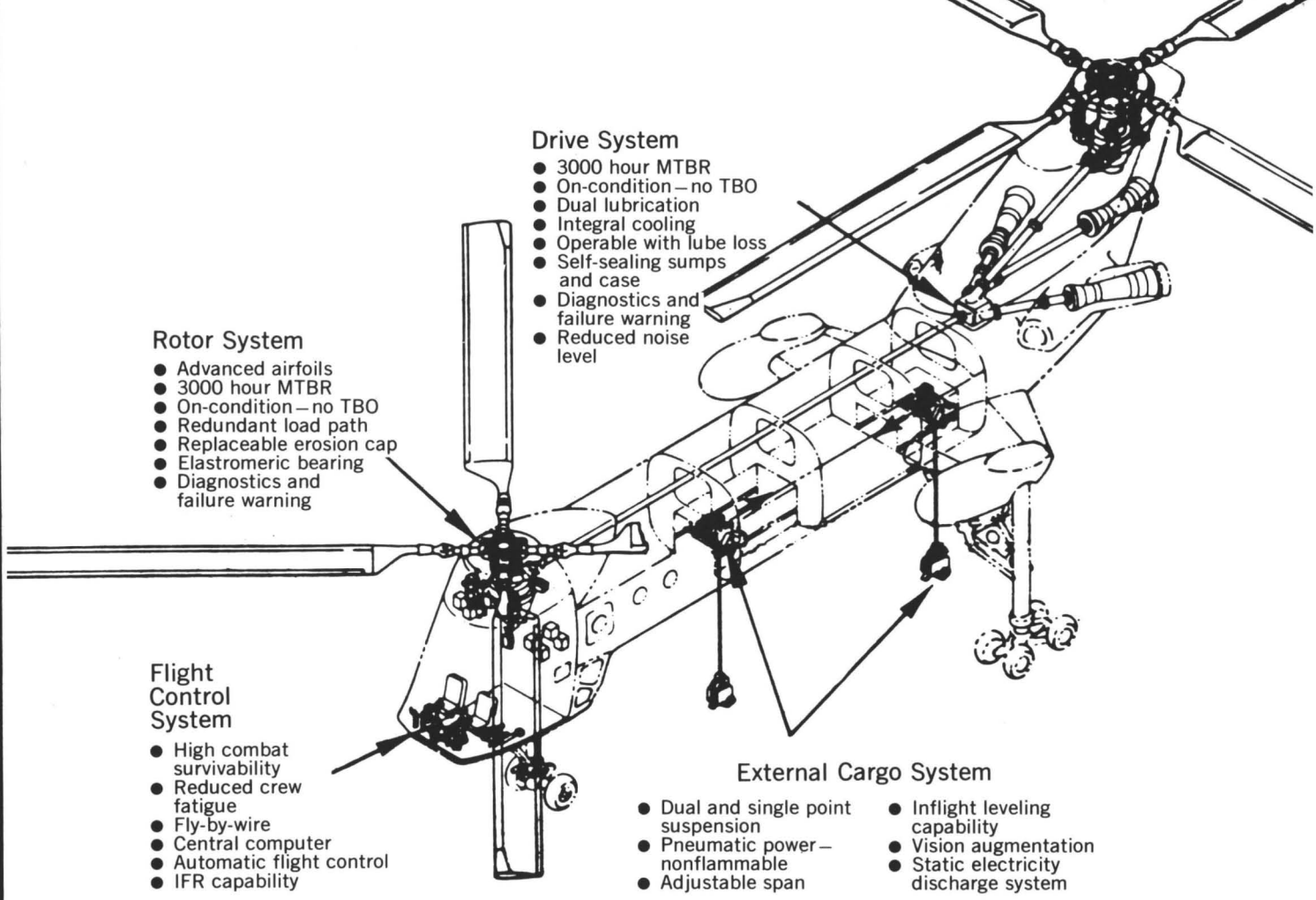
In June 1971 a contract was signed with the Boeing Vertol Company for the development of the critical components of an HLH. Among the many elements receiving attention within the program are the rotor/drive system, the fly-by-wire flight control system and the cargo handling system.

The advanced technology component program seeks maximum reduction of technical and cost risks associated with the development of an HLH system through the design, fabrication and testing of selected critical HLH components. These are primarily those that will integrate into an HLH capable of lifting 22.5 tons while hovering out-of-ground effect at sea level 95 degrees F. and of completing two 25-nautical-mile round trips with the design payload. By reducing the number of sorties, the range, the ambient conditions and/or the load factor (2.0 g's instead of 2.5 g's), the vehicle will lift up to 35 tons.

The rotor/drive system development effort will produce com-

The HLH provides critical lift support to ensure the implementation of dynamic logistics and airmobile operations





ponents with verified performance and reliability. Both survivability and reliability have received increased emphasis. The rotor blade spar is designed with integral crack detection and to retard crack propagation. Further, the airfoils will withstand hits from projectiles up to 23 mm and still permit flight operations to continue.

The rotor head will incorporate dual redundant load paths for fail-safe operations, permitting safe flight after experiencing battle damage to one load path. Elastomeric bearings (which are bonded units of rubber and metal plates) will eliminate hinges and hinge lubrication requirements while reducing the number of hub components from about 500 to less than 70.

The transmissions to be employed in the drive system will demonstrate the integration of lessons learned in combat. For example, each transmission will have integral lubrication and cooling systems—removing the necessity for long, vulnerable and often leaking fluid lines and oil coolers. The advanced gear materials will result in lighter units with an increased service life. In the event of loss of the major portion of the transmission oil a secondary system will provide the minimum essential lubrication for critical components to ensure survivability. Investigations in progress will determine if self-sealing capabilities in the sumps also will be incorporated to protect against battle damage.

A dynamic systems test rig (DSTR) will integrate the rotor and drive system to drive the aft rotor and cycle the system through the widest range of representative loads that may be experienced in flight. The tests will validate system integration, performance, downwash and the acoustic environment. The DSTR will be powered by the Detroit Diesel, Allison Division (DDAD) 501-M62B engine which beyond producing power for the test rig will provide essential data for an initial indication of airframe compatibility as well as substantiate engine reliability and maintainability characteristics.

The flight control system (FCS) will depart from conventional concepts in helicopter controls in two respects. The first, and generally the most interesting to visualize for aviators, is the basic fly-by-wire concept that will eliminate push-pull tubes, rod end bearings and control horns with the myriad of fixtures, bolts and vulnerable long hydraulic tubes of today's systems. Psychologically, modern helicopter pilots feel comfortable knowing that they have direct mechanical

Military commanders will not be burdened with constructing logistics nets that result in fair weather deliveries only

links to swashplate actuator valves even though they are not provided a mechanical link to the swashplate themselves. Now the link between the control stick and the hydraulic actuator in the HLH will be closed with electronic components and circuitry.

The second difference that will be obvious is the type of demand the pilot will be making when manipulating the flight controls. Currently, when an aviator at a hover translates into flight he must go through a mental process where he determines power available for the conditions, demands a pitch down attitude that will permit acceleration to the desired velocity, and upon reaching the velocity apply the required pitch attitude and power adjustments to maintain the desired speed. The FCS in the HLH will be a velocity demand system, i.e., a stick input will directly command aircraft speed. Protection is to be provided against automatic overtorques by computer generated controller envelope limits —but in an emergency the pilot will retain the capability to command the necessary power. To override and maintain control the system will have built-in redundancy for both reliability and survivability.

The system consists of components not common to Army aviation. A six-channel redundant direct electrical link will furnish an electrical equivalent of conventional mechanical control inputs to the swashplate. The triply redundant automatic flight control system will provide the necessary automatic control functions including those of a conventional stability augmentation system. Electrical signals from the pilots will be mixed electronically with stability and control augmentation signals and transmitted to the electrohydraulic swashplate actuator. Within this FCS effort will be a load controlling crewmember (LCC) controller and a self-contained precision hover sensor for an extremely stable hover capability.

The cargo handling system efforts will produce tested hardware and subsystems and thus reduce the technical risk of developing an effective lifting crane system for support of the primary mission of the HLH. The concept chosen consists of a winch system, a suspension system, controls and displays system, and a visual augmentation system (VAS). The advanced technology component program is intended to demonstrate hardware on a large test tower to verify feasibility, functional performance and reliability/maintainability. The dual point suspension system will be the desired operating mode because of the increased aerodynamic stability of this concept. The dual hoists for each hook are being designed to traverse a limited range to ensure better center of gravity control. Single point operations also can be performed by employing an adapter assembly.

The winches will be driven by a responsive air turbine motor powered by bleed air from either the main propulsion units or the auxiliary power unit (APU). In the event of one engine out operations, the APU can be engaged in flight, without risk, to provide air for normal operations of the winch assemblies. The VAS employing a low light level television will permit operations during periods of darkness and also operations encountering dust, blowing snow and rain without the necessity of penetrating illumination.

Two contracts signed last January represent logical steps toward an eventual HLH production decision and are in full support of the policy of prototyping major weapons systems. A prototype HLH program (Boeing Vertol) supported by a prototype engine development (DDAD) which is known as the XT701 is aimed at satisfying the "fly before you buy" requirements of the Department of Defense. This step in the acquisition process will result in the integration of the critical components and subsystems into an airworthy flying test-bed which will proceed into performance substantiation tests and an early user assessment of the HLH

design concept. The HLH prototype engine will draw extensively from the DSTR engine program and build upon this baseline to achieve the XT701-AD-700 prototype engine.

The first HLH flight is scheduled for August 1975. Through testing it will permit a decision relative to the advisability of entering engineering development at the earliest date with the least cost.

The new breed of container ships are called "non-self-sustaining" which means they have clear decks that are not cluttered with the booms and cranes normally found on today's self-sustaining container ships. During future deployments delivery times will be measured in minutes and unloading times for ships will be hours instead of months, as was sometimes experienced early in the commitment in the Republic of Vietnam. The HLH will integrate into a total system to include the normal variety of surface vessels when they become operational. Piers, large dockside cranes, extensive highway nets, large secure supply areas and battalions of trucks will not pace initial deployment but will be employed as the situation matures to the point where resources permit the use of the manpower-dense surface systems.

* * *

"Grey Eagle, 301, will be down 1 hour for fuel, maintenance and a crew change, over."

"Roger, 301."

HLH 301 positioned to a refueling point where the crewchief attached the refueling nozzle to the aircraft.

The crewchief signaled the aircraft commander to activate the onboard self-fueling system which began to draw fuel into the nearly empty tanks from fuel bladders positioned by the HLH company. The flight engineer, who manages the monitoring of all onboard aircraft systems, noted the faults which occurred during the long flight period and isolated the significant modularized components for replacement. Within an hour a fresh crew was airborne.

HLH 301 flew into the darkness out to sea to begin offloading the well protected but heavily burdened seaborne supply carriers. Other HLHs were operating in the darkness. As predicted the forecasted frontal activity became apparent as surface winds increased while the sea state, looking angrier in the failing light of ensuing darkness and lowering overcast, approached sea state three limits of 5-foot waves with 15-knot winds. Conditions were rapidly deteriorating.

"Pack Horse 32, this is HLH 301 inbound to continue offloading . . . understand we will operate in blackout conditions, over."

"That's affirmative, 301 . . . we're engaging the tactical landing aid system at this time . . . check for a signal . . . you'll be working forward . . . will have no obstructions . . . the bow is 185 degrees with the wind 25 degrees off starboard at 30 knots over the deck . . . we will remain steady underway, over."

"This is 301, we have your signal . . . we're 2 minutes out at this time."

Within the aircraft the copilot determined the delivery point for the container and arranged the radios for the return leg. The LCC engaged his precision hover sensor (an onboard laser signal source that will be engaged when established at a hover over the ship's hold) thus enabling the helicopter to hover very accurately for placement of the container lifting device precisely within the container guides. He also engaged his VAS (low light level TV) so that he would be able to see the ship and the load. The flight engineer at his station checked all subsystems and "set up" the position of the two-point cargo handling system for the 20-foot-long container to be lifted.

The HLH can be used to lift sections of field fuel tanks which will store 10,000 barrels

Extensive road security and maintenance resources will not be factors in early phases of an operation as the HLH and its valuable logistic cargos overfly destroyed bridges, mud or any other obstructions which hinder overland transport

After the hooks were armed and the winches properly positioned a functional check was performed indicating circuit integrity.

The aircraft commander, employing cues from the flight director and weather radar, completed the automatic approach to a hover and aligned the helicopter with the longitudinal axis of the ship at about 150 feet. The LCC then acquired the ship in the visual display and using his four axis sidearm controller grip maneuvered the aircraft to acquire a lock in the precision hover sensor (PHS).

The FCS, employing the fly-by-wire concept, had been advanced to a point where the LCC could concentrate on achieving precise position, while acquiring the load. The velocity demand control system removed the requirement for constantly making pilot control input to counter gusts or trying to optimize attitudes to achieve accelerations to desired velocities. The actuation of the PHS auto mode allowed the LCC "hand-off" precision hover capability and contained the hook within an accuracy of 4 inches in the three axes.

The LCC descended to a 50-foot hover height and moved 4 feet laterally by sidearm controller "beep" demands of low velocities to the desired position. The aircraft constantly moved to counter the gusting headwind quartering off the right from the northeast, but the LCC only needed to employ his controller to adjust his precise position.

While the LCC maneuvered, the aircraft commander monitored his own VAS display in order to retain full awareness of all aircraft motions. The winches were activated to pay out cable to lower the lifting device to the container which was three levels below deck (30 feet). The guides were contacted and the device was lowered into the guides to the "box" where the device locked on. The LCC reversed the winch taking up cable slack to the container down in the hole. The cable tension indicator at first fluctuated as the suspension members came tight, then settled at an indication of over 22 tons.

Two minutes had elapsed and the aircraft commander had contacted the area controller for clearances and routing to the landing zone as the climb was initiated. The LCC monitored "snugging up the box," completed the operation and instructed the flight engineer to secure the cargo handling system while this second generation aerial crane continued to climb and accelerate. The PHS and the VAS were then placed in a standby mode until after termination of the instrument approach and the subsequently established hover at the designated landing zone.

Automatic built-in test equipment onboard continually monitored the triply redundant flight control system by both the detection and the locating of faulty elements of the system. Other parameters were monitored by the automatic inspection diagnostics and prognostics system such as engine performance and mechanical status, transmission condition, drive shafting, fuel system and selected structural components. (The aircraft will also be capable of performing the design mission with one engine out adding to the mission reliability confidence levels under all conditions of flight.)

HLH 301 spent 5½ hours moving containers 25 nautical miles one way and on return trips hauled items of equipment that needed major work. During that 5 hours 301 alone delivered nearly 500,000 pounds of cargo to its supported elements. Numerous large items were returned to ships for major repair work. This movement took place at night when seas were very rough, 35-knot wind velocities and with a violent surf, low ceilings and rain.

"Blacksmith, this is 301 inbound for a backhaul . . . one big cat, over."

"Stand by, 301 . . . we'll get a man out there to hook up the load . . . it'll be pretty tough in that weather, over."

"No problem, Blacksmith. We'll hover at 100 feet and make sure the hooks are within reach . . . when your man moves away, we'll move down and lift up the cat, over."

"That'll be fine, Blacksmith, out."

This movement of the D9 trac-

tor 6 hours after it has been moved from the work site and repaired at the mobile site would return it to the operating unit.

* * *

Logisticians and field commanders can plan on the capabilities of the HLH in the 1980s. Army aviators flying a new generation of light observation, utility, attack and heavy lift helicopters will form an integrated team for the support of airmobile combat operations and bolster the national defense objectives of the United States.

Military commanders in the future will not be burdened with constricting logistics nets that result in fair weather deliveries only or that stop at night and that employ costly manpower resources.

Ships will not lay low in the choked harbors for many long, vulnerable, expensive weeks waiting to be offloaded.

Break bulk cargo will not sit in marginally secure dockside yards which require large numbers of men for physical security to prevent destruction and pilferage, though, retaining both vulnerability to artillery and airborne weapons systems.

Secure road nets which would employ extensive security and maintenance resources if constructed during early phases of an operation will have been diminished, reducing risk link which can be interrupted by a destroyed bridge or by mud and/or the performance of the many trucks and overland transport vehicles.

The associated maintenance support and operator manning is eliminated, releasing a higher number of men for combat duty.

Tactical operations will be enhanced with the short reaction time available for resupply and the low stockage levels required to be moved aboard vehicles organic to the line units. Terrain obstacles will not bog down units which will be able to count on resupply and maintenance 24 hours a day.

Airmobility concepts have been validated in the field in a severe test and have pointed out the features that are being corrected so that the Army will be ready to meet any future threats to the national security.

CPT Brendan P. Blackwell, a graduate of Washington State University, received his masters degree from Southern Illinois University. He is presently attending the Transportation Officers Advanced Course and was a project officer in the technical management division of the heavy lift helicopter project at the U. S. Army Aviation Systems Command when writing this article. In 1972 he was awarded the Federal Service Award for commissioned officer of the year. He is a world recordholder for altitude performance in the CH-54

HELP!

... Finite life items are being discarded for lack of records

Floyd H. Trudeau, DAC

NUMEROUS AIRCRAFT assemblies have been received at overhaul facilities with either the DA Form 2410 or the (component) DA Form 2408-16, or both, missing.

These forms, properly annotated, are extremely important to any maintenance facility performing maintenance on, or installing or removing a component.

Engineering has determined that certain aircraft parts must be replaced after a specified maximum number of operating hours to prevent failure of that part in flight. This time limit has been designated the maximum allowable operating time ("finite life" or "TBO") of the item. Of course, a reasonable safety margin has been included in this time.

Although there are many aircraft parts that fall in this category, it will be much easier to explain if we talk about a particular aircraft component such as the AH-1G HueyCobra main rotor hub assembly for example:

A DA Form 2410 is required to be filled out and sent to the Commander, U. S. Army Logistics Data Center, Lexington Blue Grass Army Depot, Lexington, KY 40507, whenever a "selected" aircraft component is removed or installed. Lexington provides the U. S. Army Aviation Systems Command (AVSCOM) with the information concerning aviation items. (There are other conditions which require a DA Form 2410; also, see TM 38-750.) The DA Form 2410 should be shipped with and received at the overhaul facility with the component.

If the component is received without the DA Form 2410, maintenance personnel can determine the time on the component by contacting the U. S. Army Aviation Systems Command, P. O. Box 209, St. Louis, MO 63166, and obtaining the latest DA Form 2410 information. They can, with this information, reconstruct the time on the hub assembly in question.

For some of the finite life items the DA Form 2410 is not forwarded but maintained locally (your bible here is TB 55-1500-307-25). The only record of the time on these items is the aircraft form, DA Form 2408-16, for the hub assembly. The (component) DA Form 2408-16 is supposed to be forwarded along with the assembly when it is shipped, but in many cases it is not included or it gets lost. When this happens the overhaul people are in trouble. Here is why: the serial number of one Cobra main rotor hub assembly received at the U. S. Army Aeronautical Depot Maintenance Center (ARADMAC), Corpus Christi, TX, without records was checked with the national maintenance point and determined to have 3,359 hours on it with two previous overhauls. The (component) DA Form 2408-16 would no doubt reflect that some of the finite life items were replaced at either the first or second overhaul and would have time remaining on them; however, since the (component) DA Form 2408-16 was not available the time on many of the parts could not be determined and they had to be replaced.

Many other assemblies have the same problem. Engines, transmissions, tail rotor hub assemblies and others are often received at overhaul facilities without the (component) DA Form 2408-16, and many expensive parts which have hundreds of useful flying hours remaining on them have to be discarded for safety's sake.

Thus it can be seen how important that (component) DA Form 2408-16 is. Each time that a maintenance-type takes the necessary precautions to ensure that an accurately prepared (component) DA Form 2408-16 is included with a component (rotor hub, engine, swashplate, etc.), he can hold his head high and flatly state, "I just saved Mr. Taxpayer (and this includes me) several thousand dollars."

Another problem arises because there are two data plates (sometimes three) affixed to the yoke near the center of the hub assembly. One of the data plates has the serial number of the hub assembly on it; the other data plate has the serial number of the yoke on it. The third data plate, when used, has overhaul information and is not relative to the subject at hand. When DA Form 2410 information is copied the individual reading the serial number from the data plate sometimes picks up the wrong number. We get DA Form 2410s with the nomenclature "Hub Assembly" and the FSN for a hub assembly, but the serial number is the yoke serial number. This is easy enough to correct at the overhaul facility but it confuses the computer.

In the event the DA Form 2410 is lost the overhaul facilities asks the computer for the latest DA Form 2410 information by hub serial number. The computer, which has the latest information filed under the yoke serial number, provides the latest correct information it has on the hub assembly. It does not recognize that this particular hub assembly was incorrectly reported under a yoke serial number. From that time on the finite life item is questionable and to be safe we must discard them. The cost of this mistake could be $5,000. To assure having the right serial number and that you are looking at the right plate, compare the part number on the plate with the part number and nomenclature as listed in TB 55-1500-307-25. After the comparison validates the right plate, then the serial number on that plate is the one to report on DA Form 2410 when removing a rotor hub assembly.

The author is a management analyst at the U. S. Army Aeronautical Depot Maintenance Center, Corpus Christi, TX. Mr. Trudeau is qualified as a test pilot

VIEWS FROM READERS

Continued from page 1

with foresight dictates the necessity of acquiring a compatible system before it is required to save a life.

I would appreciate any information you have available.

CW2 William R. Yancey
Operations Officer
4th Flight Platoon 507 Medical Co
Ft. Sill, OK 73503

• The following information pertaining to CW2 Yancey's letter was obtained from Combat and Training Developments, U. S. Army Aviation School, Ft. Rucker, AL:

There are systems available that will provide the capability as described, and can be obtained either from the U. S. Air Force or from a commercial vendor. The U. S. Air Force employs the AN/ARA-50 and AN/ARA-59 UHF-ADF systems for search and rescue missions. Engineering and test data for the installation of the ARA-50 on the UH-1 has previously been developed by Bell Helicopter Company. The cost of the system is approximately $1,200 per unit and the weight is approximately 15 pounds.

The commercial item is a UHF homing antenna designated 705-CA, developed by the Magnavox Corporation, and has been flight tested by the U. S. Army Electronics Command. The cost of the system is approximately $500 per unit, and the weight is approximately 5 pounds. In addition to the items that are available, the U. S. Army Electronics Command is in the process of awarding a contract to Collins Radio Company for the development of a multiband (30-175 & 225-400 megahertz) ADF system for engineering design tests to commence in January 1974. The proposed system will be used in connection with the conventional aircraft UHF communication set (ARC-51, ARC-116) to provide an ADF capability over the Army tactical frequencies as well as those of other services. This system is similar to the ARA-50 dimensions and weighs approximately 7 pounds.

INSTRUMENT CORNER

Request clarification of the following situation and question pertaining to instrument minimums.

SITUATION: Airfield does not have an instrument procedure published in authorized publications (DOD FLIP). A current Jeppesen Chart is on hand with minima of (800-1). To list this field as an alternate AR 95-1, paragraph 4-24, says to add 400 feet to ceiling and 1½ miles to visibility for fixed wing (which would be 1200-2½. AR 95-1, paragraph 4-24-2, says that helicopter pilots may reduce the visibility above by 50 percent.

QUESTION: Does this mean that you always add 400 and 3/4 in helicopters (as one of the questions in version III of the 1973 Annual Written Examination indicates), which would be 800-1 plus 400-3/4 which would be 1200-1 3/4; or do you *derive* the fixed wing minima first, then take 50 percent of it, which would be 1200 and 1½?

ANSWER: In the situation presented in your letter, authorization by an installation commander is required to enable your use of the Jeppesen Chart described (AR 95-1, paragraph 4-19*b*).

DOD FLIP is the official IFR publication for use by Army aviators. The permission to use the Jeppesen Chart you described does not fulfill the intent of AR 95-1, paragraph 4-19*b* (official IFR publication).

The provisions of AR 95-1, paragraph 4-24*c*(2), apply when pertaining to choosing an alternate airfield when instrument procedures are not published in authorized publications.

During the period from 1 hour before through 1 hour after ETA to your alternate airfield, the ceiling must be at or greater than 400 feet above the appropriate approach minima. The visibility must be at or greater than 1½ miles above the appropriate published minima.

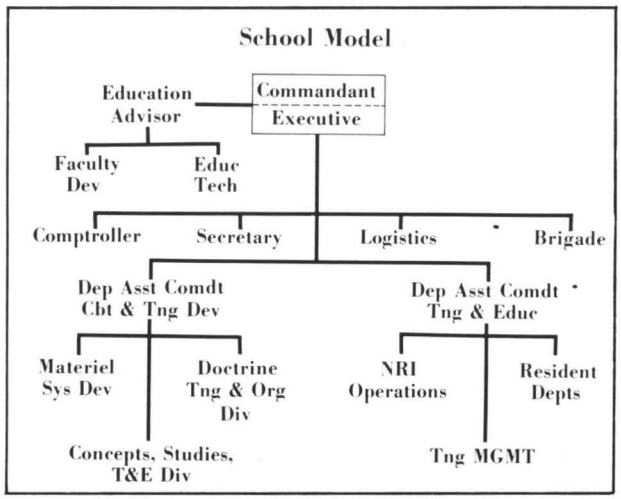
The provisions of AR 95-1, paragraph 4-24*c*(3), enable aviators flying helicopters to reduce the visibility (mentioned in the paragraph above) by 50 percent.

AR 95-2, dated 8 May 1970, has been superseded by AR 95-1, dated 1 January 1973. The old AR stated that for helicopter use "the derived visibility may be reduced by 50 percent." The old method was to add 1½ miles to the published visibility, then aviators flying helicopters could take half of this "derived visibility." The correct method according to AR 95-1, paragraph 4-24*c*(3), is for aviators flying helicopters to reduce the visibility requirement by 50 percent before applying it. Therefore, aviators flying helicopters would always add 3/4 mile to the appropriate visibility minima.

Combat And Training Developments

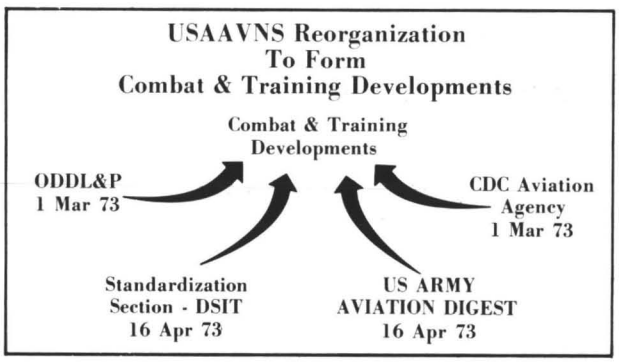
Continued from page 4

In keeping with the Continental Army reoganization, the box below contains a standard school model. The two new key elements are the Deputy Assistant Commandant for Combat and Training Developments and the Deputy Assistant Commandant for Training and Education.

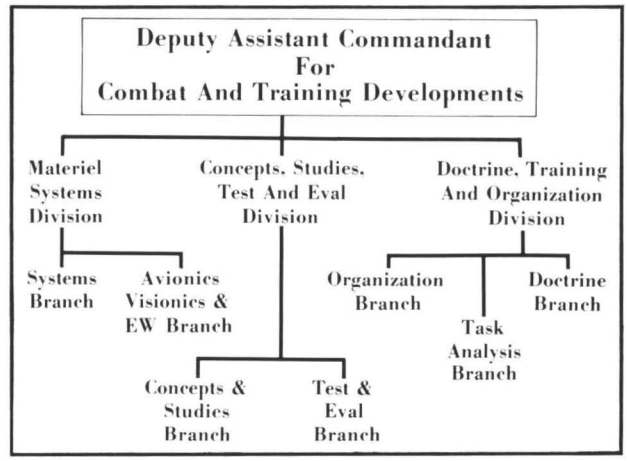


Within USAAVNS, Combat and Training Developments became an operational reality on 1 March 1973 when the Combat Developments Command Aviation Agency was merged with the Office Of Doctrine Development, Literature And Plans.

USAAVNS organizations which were combined to form Combat and Training Developments are listed in the box below. CTD now performs the missions of each of these former sections and organizations. As a result, CTD is the program manager for force/combat development; Army-wide aviation training literature; command-wide training literature; development of training aids/devices; occupational analysis of MOS and CMF (command management function); and the U. S. ARMY AVIATION DIGEST.



To accomplish this *major new USAAVNS* mission, Combat and Training Developments is functionally designed as shown in the figure below.



CTD's **Materiel Division** initiates, evaluates and prepares required operational capability (ROC) documents relating to areas listed in the box below.

- **Airframes**
- **Weapons**
- **Avionics**
- **Visionics**
- **Electronic Warfare**
- **Ground Support Equipment**
- **Life Support Equipment**

Due to the wide area of this division's responsibilities, those USAAVNS training departments and class II activities having expertise in these major fields are invited to participate in ROC developments. This will ensure a well-rounded USAAVNS position in these important Army aviation developmental fields. High priority items being worked on by the Materiel Division include the advanced attack helicopter; anti-icing/deicing equipment for helicopters; air traffic management systems; and night vision systems for helicopters.

The **Concepts, Studies, Test and Evaluation Division** is tasked with the responsibility to see to it that future Army aircraft systems requirements, for items which USAAVNS is the proponent, meet the needs of the field army in all major areas. This includes supporting proponent agencies in aircraft system formulation/integration; identifying future aircraft systems requirements; participating in test planning and programing; participating in operational tests and evaluations (OTEs); and analyzing test results. High priority actions include the heavy lift helicopter concept formulation study, position and navigation systems for Army aircraft, and electronic warfare aircraft self-protection systems.

The **Doctrine, Training and Organization Division** is CTD's largest. It manages the USAAVNS' portion of the Army-wide training literature program; develops/reviews TOEs, basis of issue plans, manning table equipment lists and manning authorization criteria; systems engineers individual training and training literature; develops MOS test material; and develops/reviews aviation standardization literature.

CTD's major training literature workload springs from its primary USAAVNS responsibility to develop and write all new and revised Army-wide training literature—except that developed by the Department of Army-Wide Training Support.

In the past the primary responsibility for writing training literature rested with the Aviation School's training departments. Assistance in this major area is obtained from these departments. Highly technical portions of some training literature is still being written in first draft within the training department having the most expertise on the subject, as determined by the USAAVNS' training literature board. In all cases USAAVNS' training departments having major subject matter expertise are responsible for assuring the technical correctness of new or revised Army-wide training literature. The roles of each of the USAAVNS' training departments will be worked out during the first meeting of the USAAVNS training literature board. This meeting is scheduled to take place as soon as the recently rewritten USAAVNS regulation on training literature has been staffed and approved.

As a result of recent Department of the Army actions, USAAVNS has been assigned materiel proponency for several major aviation related systems (see box below). These systems produce a major workload within CTD.

- **Medium Lift Helicopter**
- **Utility Airplanes**
- **Avionics**
- **Visionics**
- **Supression/ Vulnerability**
- **Ground Support Equipment**
- **Life Support Equipment**
- **Air Crewman Peculiar Equipment**

Due to the wide area covered by these proponencies, CTD personnel are required to be TDY much of the time in support of other centers and schools working on aviation projects.

In keeping with these proponent materiel actions, USAAVNS now has organizational proponency for the TOE units listed below:

- **Army Aviation Company**
- **Assault Support Battalion, Ambulance Division**
- **Headquarters and Headquarters Company, Assault Support Helicopter Battalion, Ambulance Division**
- **Assault Support Helicopter Company, Ambulance Division**
- **Headquarters and Headquarters Company, Aviation Group**
- **Headquarters and Headquarters Company, Aviation Battalion**
- **Aviation Brigade**
- **Medical Transportation Helicopter, CH-47**
- **Aviation Medical Helicopter Company**
- **Aviation Company, Corps**
- **Aviation Operation Teams**
- **Assault Support Helicopter Company, Air Cavalry Combat Brigade**
- **Aviation Air Traffic Control Unit**

USAAVNS has the primary responsibility for developing all aviation related materiel, concepts, doctrine and training literature for the listed units. Proponency for troop tests, field evaluations, combat evaluations and related actions parallels these TOE assignments.

The training literature program to support the doctrinal and unit proponency responsibilities is extensive. At the start of fiscal year 1974, Combat and Training Developments had the primary responsibility for 129 major pieces of Army-wide aviation training literature.

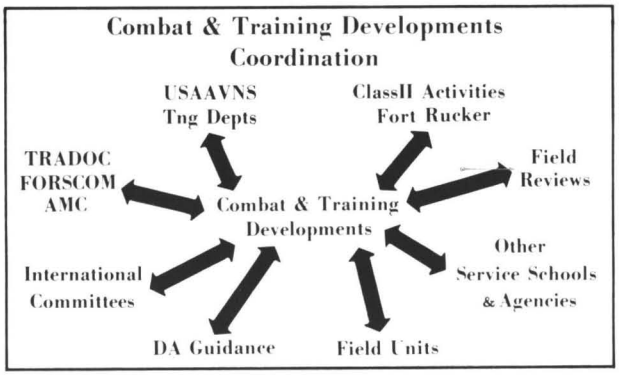
One of the most significant literature actions accomplished during the past fiscal year was the total revision of FM 1-40, Helicopter Gunnery. This manual includes information and guidance necessary for the conduct of helicopter gunnery training at the unit level.

Also, draft TC 1-15, Nap-Of-The-Earth (NOE) Flight Training, was developed by Combat and Training Developments to support NOE flight training at the unit level. This TC outlines the training required for both initial qualification and annual requalification. It has been approved by DA for publication.

The final draft of TC 1-65, Helicopter Operations From Amphibious Assault Ships, is near completion. This training circular provides guidelines for commanders, staff officers and personnel of Army aviation units for employment of Army helicopters from amphibious assault ships.

To accomplish all of these actions, for which Com-

bat and Training Developments has primary responsibility, requires constant coordination with the activities listed in the box below.



Local coordination with the Aviation School's training departments and class II activities is accomplished in two ways:

- When possible, direct action officer to action officer contact is used.
- When a formal school position is required, it is requested in writing through appropriate command channels.

Since coordination is a key factor, other agencies will become accustomed to seeing CTD action officers in their organizations. Combat and Training Developments will never be accused of *under*coordinating a U. S. Army Aviation School position.

Army agencies worldwide frequently will be dealing with Combat and Training Developments at the Aviation School on matters pertaining to Army Aviation. Listed below are the telephone numbers for CTD (AUTOVON prefix 558):

Deputy Assistant Commandant	**3203**
Concepts, Studies, Test & Evaluation Div	**3500**
Concepts & Studies Br	**3512**
Test & Evaluation Br	**2405**
Doctrine, Training & Organization Div	**3212**
Task Analysis Br	**5412**
Organization Br	**4905**
Materiel Systems Development Div	**5511**
Systems Br	**2704**
Avionics, Visionics & EW Br	**2406**
Doctrinal Literature, Training Literature & Programs Br	**3212**
Standardization Section	**3212**
Training Literature Section	**3801**
Doctrinal Literature Section	**3801**

Concepts And Materiel And CTD

Continued from page 7

management automated center. Here are the areas which need to be addressed:

- Resolution of aircraft and artillery conflicts
- Resolution of aircraft and aircraft conflicts
- Position data of all aircraft
- To pass and receive data to the Army tactical data system

The next major avionics system established by CTD's Materiel Systems Division is the helicopter integrated multifunction system (HIMS), otherwise known as rotor blade radar. The Avionics Branch participated in the military potential test with the Aviation Test Board and wrote the required operational capability.

HIMS can be used in these functional tasks:

- Landing aid
- Navigation
- Station keeping
- Surveillance
- Weather avoidance
- Terrain warning
- Beacon interrogation mode

During the military potential test conducted by the Aviation Test Board, it was determined that the HIMS aircraft, while sitting on the ground in an unimproved area, can provide an unequipped aircraft a surveillance type radar approach. An airborne moving target indicator has been added. Testing is continuing at Headquarters, Modern Army Selected Systems Test Evaluation and Review (MASSTER), Ft. Hood, TX, with the Avionics Branch monitoring.

CTD also prepared a requirements document for a "Dustoff" (medical evacuation) aircraft avionics stabilization system to allow medical evacuation missions to be performed under nearly all-weather conditions, day or night.

CTD has prepared three electronic warfare documents establishing requirements for warning devices to detect radar, infrared and electro/optical threats. These are being staffed at Department of the Army. Concurrently a DA decision was made to procure 200 AN/APR-39 radar warning receivers, identified by Combat and Training Developments, to meet contingency needs in USAREUR (U. S. Army, Europe) and for testing and training.

The final CTD functional area to be covered here is associated equipment.

In the life support area USAAVNS is proponent for the anti-icing/de-icing system for vertical take-off landing (VTOL) aircraft and for the escape system for AH-1G and AH-1Q helicopters.

The Army has an approved requirement for lightweight anti-icing/de-icing equipment which will allow VTOL airmobile operations in moderate icing conditions. CTD efforts have consisted of chairing a joint working group at the Aviation Systems Command to develop the required operational capability.

Helicopter in-flight escape systems have been receiving considerable attention the past few years. In December 1971 Teledyne/McCormick/Self and Sikorsky aircraft demonstrated the feasibility of severing rotor blades in predetermined directions using an S-61, 5-bladed aircraft. The transmission and frame were tied down while the blades were turning. The success of this demonstration was a major step forward in the development of helicopter escape systems.

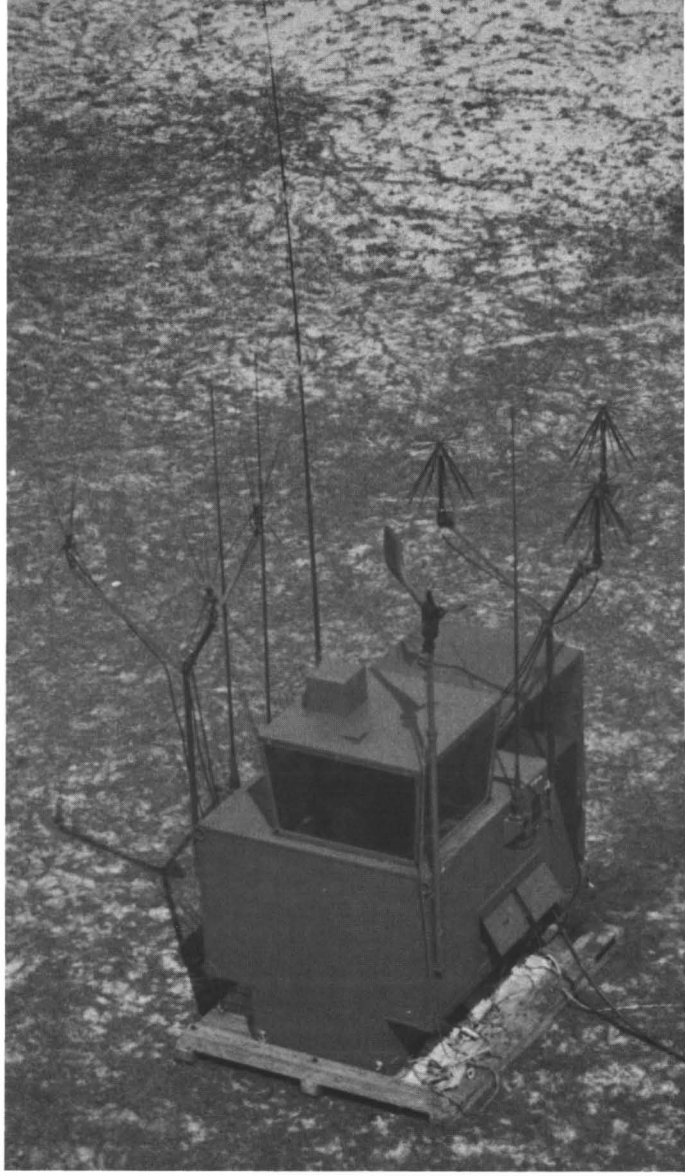
A required operational capability (ROC) for a helicopter in-flight escape system for attack helicopters was written by Combat and Training Developments and is being processed by DA. This ROC provides for low level extraction at unusual attitudes.

There are many other high interest areas in which CTD is involved. Some of the more significant are discussed below and introduced in boldface type.

CTD has furnished the senior U. S. representative to the **Quadripartite working group on Army aviation equipment** the last 2 years. This group consists of the Australian, British, Canadian and American representatives to the committee for Army aviation equipment standardization. CTD will present a briefing on the family of Army aircraft at this year's formal meeting. Communications among the representatives is continuous.

Area refueling equipment also is a matter of high interest. CTD has provided the supply agency with a detailed requirement for an air transportable area refueling system with a 300 gallon per minute output and a capability of refueling five aircraft simultaneously. Both open and closed refueling rates of existing and proposed aircraft systems were furnished with the requirement as justification. A proposed system was tested at MASSTER and monitored by Combat and Training Developments. It was obviously transportable, but not by air and it completely failed to meet aviation requirements.

A more appropriate system for airmobile operations exists in the Federal supply system. CTD provided comments on the shortcomings of the projected system to the supply agency.



Proposed three-man transportable tower which can be fully operational in 8 hours

The family of scatterable mines, envisions utility helicopters as special purpose aircraft, when required, to employ the XM56 mine dispensing system to close the lanes in the engineer's barrier plan. CTD has furnished munitions command, Picatinney Arsenal, with input on employment (air speed, altitude, bands of performance), doctrine (NOE-50, Low Level 50-200), training, basis of issue, identification of units and mid-intensity threat criteria.

The working party for guns (WPFG) is a subgroup of the joint technical coordinating group for air launched non-nuclear ordnance (JTCG-ALNNO). Both are tri-service groups. WPFG coordinates development and technology, starting with research and including all steps up to final standardization of weapons, ammunition and installations. In addition to the service developments the working party also monitors independent development programs being

conducted by private industry. Here again Combat and Training Developments provides input to a high level committee.

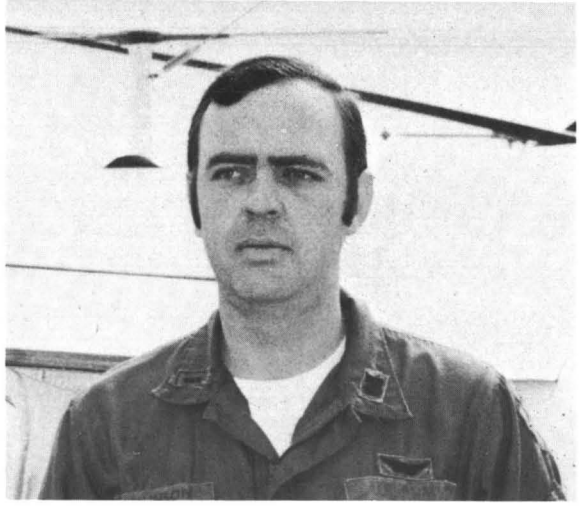
Night vision devices are an extremely high interest/manpower consumption area. A joint working group recently was convened and chaired by Combat and Training Developments which prepared a required operational capability for a "night vision system for Army aircraft." These systems are classified by function. *First* is the pilot's which envisions the PVS-5 goggles as an interim system with a 12-hour, 40-degree field of vision, at a weight penalty of 1.9 pounds. The armed services have agreed on a standard design. Another system under development for the pilot is the helicopter night landing system with a 50-degree-high by 170-degree-wide field of vision.

The *second function* is the observer's target acquisition and remote surveillance system which could include the AAS-25 forward looking infrared system. It would allow the observer a 95 percent probability of identification of a target at 3,000 meters.

The Army tactical data system required 5 man months expended at Ft. Hood, TX, to ensure computer interface with the air traffic management system. This resulted in a Combat Developments Command study titled "Functional Interoperability Of Tactical Data Systems In Support Of The Army In The Field And Continuity Of Operations." CTD's Avionics Branch is a standing member of the Army tactical data system (ARTADS) requirement coordinating committee and makes significant contributions to this system.

Engineering change proposals and product improvement proposals would appear to be an insignificant item; however, careful monitoring of 45 items submitted in the first half of 1973 resulted in recommended disapproval of unnecessary items and a total savings of $4 million—plus $2 thousand per utility aircraft.

Concerning test and evaluation, CTD is deep in the establishment of the new test methodology. As a result of the reorganization of the Army, the combat developer now plays a greater role in test and evaluation. The responsibility for operational testing, once held by the materiel developer (AMC), now rests with TRADOC. The proponent branch school represents the user during the operational testing phase of development. In the near future USAAVNS will serve as the user representative for several proponent systems. This new methodology will close the development loop and allow the user to ensure that the materiel developer produced what we asked for in the first place. What you want is what you get!



A First

CW3 Billy G. Tomlinson, an instructor pilot with Headquarters and Headquarters Detachment, Kentucky Army National Guard, Frankfort, KY, is the first to enroll in the Aviation Warrant Officer Intermediate Correspondence Course offered by the U. S. Army Aviation School, Ft. Rucker, AL.

The new career oriented correspondence course was announced in the June issue of the AVIATION DIGEST and parallels the resident course conducted at USAAVNS. Upon completion of the course administered by the Department of Army-Wide Training Support, CW3 Tomlinson will receive a diploma and credit identical to that received by the resident course graduate. All materials needed to complete the course are supplied by the Aviation School (and in the mail to CW3 Tomlinson).

Warrant Officers of the active Army, as well as the Reserve Components, interested in enrolling in the AWOICC may apply on DA Form 145, obtain approval from their commanding officer, and submit the form to:

Commandant
U. S. Army Aviation School
ATTN: Dept. of
Army-Wide Training Support
P. O. Box J
Ft. Rucker, AL 36360

1st Woman Candidate

Brigadier General Mildred C. Bailey, director of the Woman's Army Corps chats with Barbara Elizabeth Schoen, after administering her enlistment oath July 25, at the U.S. Army Aviation School, Fort Rucker, AL. Miss Schoen, seated in a TH-55, the Army's primary training helicopter is the first woman to enlist for the Army's flight training program.

Miss Schoen, a Florida elementary school teacher, entered the Army on the Delayed Entry Program and will begin her 9 months of flight training in the Warrant Officer Rotary Wing Aviator Course in January after completion of WAC Basic Training.

Aeromedical Factors In Midair Co

THE ACCOMPANYING article gives a penetrating review of the aeromedical factors involved in midair collision. These factors are important to know and understand for to some extent man can compensate for them. In certain circumstances... where rates of closure are high speed, man's limitations may exceed human ability to compensate. Such a situation recently was emphasized in the midair collision accident between a Hughes Air West DC-9 and a U. S. Marine Corps F-4B. The National Transportation Safety Board (NTSB) investigated this accident. An extract of their report emphasizes this kind of limitation for which the only apparent solution is technical development. There are some things for which training and experience cannot compensate. These must be resolved with development and use of supportive equipment.

"The board . . . reiterates the position taken many times before that for certain operational conditions, the 'see and avoid' concept is simply inadequate and the development of collision avoidance systems must be vigorously pursued."

This situation can apply to Army aviation particularly when the opposing aircraft is not Army. However, a more common situation exists *between* Army aircraft as the NTSB points out:

"Whereas this accident resulted from high closure rates and, consequently, small target size until shortly before the collision, the board also recognizes the more common type of midair collision occurring between aircraft at relatively low closure rates. The board believes that for this latter type of collision, the detectability and assessment of the collision threat from an intruding aircraft can be enhanced by proper pilot techniques and a more thorough understanding of visual phenomena."

So, while there are exceptions, those of us in Army aviation should be knowledgeable of our limitations because *most of the time we can* compensate for them in our flying environment.

NICHOLAS E. BARRECA, M.D.
LTC, MC, SFS
Deputy Director
OAET, USAAVNS

Aeromedic

Provided by the Society of U. S. Army Flight Surgeons

llisions

Lieutenant Colonel Royce Moses Jr.
United States Air Force

MIDAIR COLLISIONS should be an area of vital concern to all crewmembers since such accidents remain one of the most critical hazards faced during a flight. For example, a flight of four high-performance Air Force jet aircraft recently took off on a routine combat training mission. The crews consisted of one instructor pilot and three students who were transitioning to a new aircraft. The time was midmorning with a reported visibility of 10 to 15 miles. There was no cloud cover on this bright, clear day. Join-up was accomplished and the four aircraft went into an extended route formation in order to reduce the midair collision hazard. They entered a high-volume jet operational area at an 8,000-foot altitude with a rate of climb of 1,500 feet per minute.

Shortly thereafter, the instructor pilot, in aircraft number 2, moved closer to aircraft number 1 in order to evaluate a problem with the right external fuel tank of number 1 (figure 1). He had just stabilized in the new position when he heard number 3 call, "Light plane at 12 o'clock!" The instructor pilot looked ahead and saw a light-colored blur which passed between his aircraft and number 1. The lead pilot in number 1 stated he had been scanning ahead but did not see the light airplane. Number 3, who called the warning, had been clearing the area but estimated he only saw the light aircraft when it was less than 300 feet in front of number 1 and number 2.

The vertical stabilizer of the number 2 fighter sheared the right wingtip of the civilian aircraft, which crashed with all occupants fatally injured. The Air Force aircraft involved had no control problems and returned to base safely.

Recent Air Force experience emphasizes that this is not an isolated instance but rather only one example of a major problem area. An Air Force analysis of this experience is particularly pertinent and provides the source for the following data.

On initial evaluation we might consider we are making satisfactory progress since the Air Force midair collision rate per 100,000 flying hours has steadily declined since 1947—from 0.8 in 1947 to 0.16 in 1968. However, other types of aircraft accidents have declined at even greater rates, and the relative frequency of midair collisions (the number of collisions per 1,000 major accidents) has increased—from 19 per 1,000 in 1947 to 41 per 1,000 in 1968.

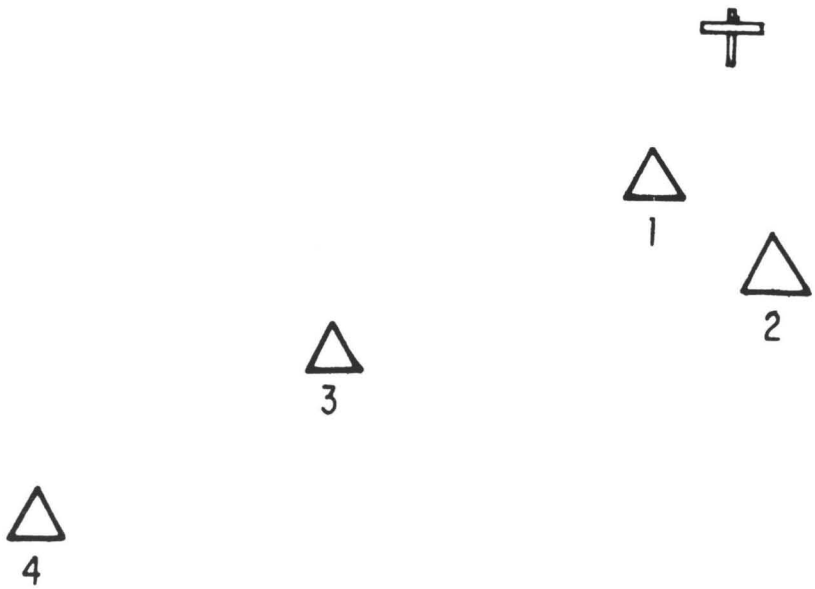


Figure 1

Aircraft position immediately prior to collision between fighter number 2 and civilian light aircraft

As in the example described at the beginning of this article, these aircraft collision accidents are of particular concern since they often produce fatalities. During the 10-year period of 1959 to 1968, almost one-half (45 percent) of the Air Force's midair collisions produced fatalities. (By comparison, 20 percent of all USAF aircraft accidents during this period produced fatalities.) The percentage of fatal collision accidents varied depending on whether the aircraft involved had ejection seats: 27 percent produced fatalities if both aircraft involved had ejection seats, but the percentage rose to 60 percent if neither aircraft involved had ejection seats.

As might be anticipated from the greater speeds involved, most of the midair collisions reviewed in the analysis involved jet aircraft: 82 percent involved only jet aircraft; 9 percent involved a jet and reciprocating aircraft; and the remaining 9 percent involved only reciprocating aircraft.

Formation flying demands precision and it is notable that 55 percent of the collisions occurred during formation flight. Associated flying, involving two or more aircraft operating in a limited air space where each pilot knows of the other aircraft but does not know the other aircraft's exact location, contributed 23 percent. It thus appears that any time aircraft are placed in proximity to each other the hazard increases. In view of the increased density of air traffic, it is not suprising that 40 percent occurred within 20.9 miles of an airport.

It also is pertinent that most of the midair collisions (82 percent) occurred during daylight hours. Naturally most of our flying is accomplished during daylight hours. However, one might expect a higher risk at night because of reduced visibility. Offsetting factors during night flight include decreased aircraft density, probable higher experience level of the general aviation pilot flying at night, effective identification lights on aircraft and possible increased use of positive control.

Aeromedical Considerations

After the significance of this hazard is recognized, the next question is: What do we do about it? It has been repeatedly emphasized that we must stress and utilize the "see and avoid" concept if we are to prevent midair collisions. However, analyses of the midair collisions clearly demonstrate the need to recognize physiologic limitations in using this procedure. A pilot's failure to recognize his limitations can readily set the stage for one more midair collision. It, therefore, seems appropriate to review briefly the many factors which can affect our ability to use the "see and avoid" concept before considering methods of improving the procedure.

Visual acuity: As one might anticipate, the ability to see clearly is crucial. This, of course, is the reason flight surgeons are so concerned about vision during the periodic examination. For practical purposes a person with 20/20 vision can detect an object which occupies 1 minute of arc (figure 2). Stated another way, a person with 20/20 vision can detect an aircraft with a fuselage diameter of 7 feet about 4½ miles away. If the crewmember is nearsighted (myopic) he will not be able to detect the object until it is closer. The more severe the myopia, the closer the other aircraft would have to be before it could be detected.

Peripheral vision: Peripheral vision poses a significant hazard dur-

ing high speed flight. All too frequently an individual believes he can rely on his peripheral vision to detect an aircraft approaching from the side of the flight path. Unfortunately, however, visual acuity decreases sharply in the periphery of the retina. A person with 20/20 vision will have vision of 20/200 or worse in the periphery. This means a target must be much closer before it would be detected. For example, an aircraft which could be detected at 4½ miles if viewed in the center of the field of vision could not be seen until it was less than ½ mile away if it were only 20 degrees off from the center of the field of view.

Relative motion: Relative motion is of particular importance in detecting another aircraft. An object moving across the field of view will be detected much more readily than will an object of the same size which is on a parallel course. The latter situation occurs not only when overtaking an aircraft but also when two aircraft are on a head-on course. Consequently, in the most critical situations the opportunity for detection is significantly reduced as a result of lack of relative motion.

Contrast: This also plays an important role in the "see and avoid" concept. An aircraft which contrasts with its background will be detected earlier than one of the same size which blends with the background. This is the principle behind the use of camouflage. Regrettably, the color of many aircraft blends with sky conditions frequently present and it is correspondingly more difficult to detect these aircraft. As a result the aircraft must come closer to be detected and the risk is correspondingly increased.

Accommodation time: This is the time necessary to change the eyes' focus from an object at one distance to an object at a different distance. For example, time is required to shift the view from outside the aircraft to the instrument panel, to focus the eyes to perceive and scan the instruments, and then look back outside and refocus the eyes to distant objects. The time necessary to shift vision from outside the aircraft to the instrument panel and then back outside again has been estimated to be at least 2½ seconds. Obviously, instrument grouping and method of display can affect this time. For example, if it is necessary to scan large portions of the cockpit interior to see all the instruments, or if it is necessary to read small numbers rather than scan pointers, the time spent looking in the cockpit will be increased. Also, accommodation time increases with both fatigue and age, thus posing more of a problem whenever either of these conditions exists.

Glare: Produced whenever light invades the eye, glare reduces distinct vision. Glare may be produced by reflection during mist or haze conditions and also by reflected light from a bright cloud layer below the aircraft. Of course, blinding glare also may occur while scanning near or into the sun or after exposure to a fireball. All such glare results in a temporary haze over the visual field; this reduces the ability to see objects and presents obvious hazards to the crew-

Object	a Angular subtense	b Size of geometric image in eye	c Size projected to 100 miles	Size projected to 10 miles
Retinal cone cell size (fovea) 1.0-1.5μ	12 sec. minimum	1.0-1.5μ	31 ft.	3.1 ft.
Minimum visible line	0.5 sec.	0.05μ	1¼ ft.	1½ in.
Minimum separable (two-point discrimination)	15 sec.	1.25μ	38 ft.	3.8 ft.
Aligning power (detection of break in contour)	2 sec.	0.17μ	5 ft.	.5 ft.
Visual acuity (resolution threshold)	1 min.	5.0μ	154 ft.	15.4 ft.
(whole letters)	5 min.	25.0μ	770 ft.	77.0 ft.

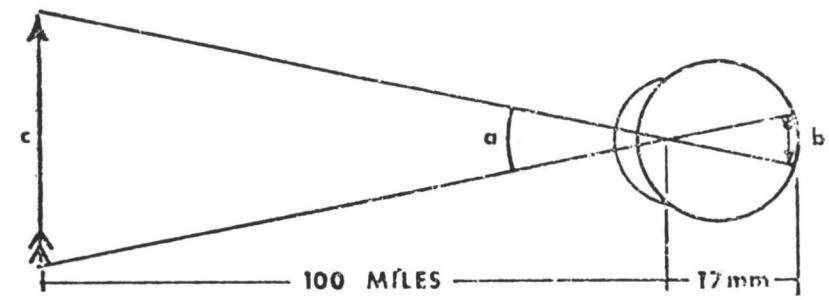


Figure 2

Theoretical and experimental summary of maximum visual capabilities*
***Source: Ophthalmology Branch, Clinical Sciences Division, USAFSAM**

member looking for other aircraft.

Empty-field myopia: An interesting phenomenon called empty-field myopia or nearsightedness can occur in flight. At high altitudes a pilot may have no distant object on which to focus. As a result the eyes accommodate to a focal point nearer than their usual point. In effect, the pilot has become nearsighted. Because of the resultant out-of-focus blurring, a target must be closer to be detected. The 4½-mile detection distance could be reduced to 3 miles or even in some individuals to less than one-half of the normal detection distance. The situation can be readily corrected by consciously focusing on some object, such as a wingtip, that is 20 to 30 feet away.

Hypoxia: Naturally, no aeromedical discussion would be complete without mentioning hypoxia. Even the mild hypoxia present at 4,000 feet can affect night vision, and vision under daylight conditions will be affected at 12,000 feet unless additional oxygen is supplied. The smoker must remember that a recent cigarette will reduce the altitude at which the effects on vision are detected because some of his red blood cells are carrying carbon monoxide from the cigarette smoke rather than oxygen. As a result there is less oxygen in the blood available for the body and vision is affected at a lower altitude than it would be otherwise. For example, the carbon monoxide saturation produced by smoking three cigarettes can have an effect on visual sensitivity equal to that of an altitude of 8,000 feet.

Design factors: There are design factors and human engineering considerations that can compromise the crewmember's ability to "see and avoid." A canopy bow can effectively produce a blind spot in a visual field. Dirt or other obscuring items on the canopy can similarily reduce the ability to detect another aircraft. As mentioned earlier, grouping of aircraft instruments and arrangements of pointers or indicators can affect the amount of time the crewmember has to spend looking inside the cockpit. These and other design factors can play an important role in setting the stage for a midair collision.

Acceleration: Forces caused by acceleration may be a factor, particularly during formation or combat maneuvers. Grayout, blackout and redout all directly affect a crewmember's ability to see another aircraft in time to avoid a collision. Proper G protection and flight profiles are essential to correct these situations.

Vibration: This is usually of minor significance but can be of concern during high-speed, low-level flight. In this instance, reduction of visual ability is coupled with possible greater aircraft density, including light planes, and the hazard is proportionately increased.

Other factors: In special circumstances other factors may compromise the "see and avoid" concept. Hood use eliminates at least one set of eyes otherwise available for outside scanning. Directing attention to a problem inside or outside the aircraft correspondingly reduces the chance to see another aircraft which is on a collision course. During night flight, failure to accomplish complete dark adaptation or failure to remember the central blind spot while scanning the sky can create obvious hazards. Night myopia can occur in the same manner as empty-field myopia and the resulting nearsightedness presents additional problems for the crewmember.

Perception and reaction time: A major problem in today's high-speed aircraft is that which results from the time necessary to perceive and react to a hazard (figure 3). It takes 0.4 second from the time an object is detected in the peripheral visual field until it is seen by central vision, approximately 1 second to recognize the aircraft and 2 seconds to determine the flight path of the other aircraft and decide what to do. Then the time required for the brain to direct muscle movement, for the muscles to respond, for the controls to move and for the aircraft to change its flight path represents another 2.5 seconds. Together the total time required to detect, see clearly, recognize, react and change the flight path can require 5½ to 6 seconds under optimum conditions. Stated another way, an aircraft traveling 600 miles per hour will travel about 5,000 feet, or about a mile, before the flight path changes. If two aircraft traveling at that speed approach head-on, they will have to detect each other at a distance greater than 10,000 feet or a collision will be inevitable. What if an aircraft flies much slower? It will, of course, travel a shorter distance before the flight path changes. It must be remembered, however, that the other aircraft may be approaching at 600 mph. Consequently, it will be necessary to add the distance traveled by the slower aircraft to the nearly 1 mile it will require the other pilot to change his flight path.

Perception and reaction time (in seconds)	
Detect and visualize	0.4
Recognize	1.0
Decide what to do	2.0
Direct muscle movement, move controls, change flight path	2.5
Total	5.9

Figure 3

Continued on page 48

ANNUAL AWARD
Monthly Winner
CONTEST

The Professional Investigation: WHY, not WHAT

Lieutenant Colonel Lester R. Kerfoot, Jr.

AIRCRAFT ACCIDENTS can be prevented when their *causes* (emphasis supplied) are known. Causes can be determined only by investigation. An aircraft accident generally indicates a weakness in the accident prevention effort. Only a thorough investigation will provide the necessary information on which to base corrective action for improving the accident prevention efforts."—Chapter 6, "Aircraft Accident Investigation—Purpose and Authority," AR 95-5.

Upon this statement is based the entire aircraft accident philosophy: learn from mistakes; correct, rectify and profit by the errors. Accidents are truly unfortunate, especially so as most are preventable. However, the professional aviation community must look upon an accident as another door to be closed against future accidents—perhaps one which had not been recognized before. It is far wiser to approach an accident with a positive attitude rather than with a negative one: *We have already lost one aircraft and sustained injuries and fatalities, but we learn from our loss and profit by it.*

Hopefully, a thorough, complete investigation will enable us to determine precisely the accident prevention program weaknesses and positively correct them to preclude recurrence of the type of accident experienced. If the problem is not approached in this manner, the lives and materiel have been lost in

vain. More than that, we remain ignorant, waiting for yet another accident from the same cause.

Causes of accidents, or to use the language of the DA Form 2397 series, "cause related factors," are the WHY of accidents, not the WHAT. But we persist in mistaking the WHAT for the WHY. Let me illustrate. A few years ago an investigation team found that the causes of a certain accident—the WHY—were supervision, maintenance, inspection and design. The accident was attributed to the failure of a rotor blade spar; that was the WHAT of the accident. Yet the approving authority stated that the *cause,* or WHY, of the accident was "fatigue failure of the blade spar." That it was the *effect,* or WHAT—but not the *cause*—can be seen from an examination of the history of this rotor blade spar.

At the time of the accident, maintenance personnel were required to inspect the spar every 25 hours using an electronically complicated and sophisticated piece of test equipment. The accident investigation board termed it a design deficiency that a rotor blade meant to be operated in a tactical environment had to be inspected every 25 hours using inspection equipment difficult to operate under normal field conditions. Also documented in the investigation report was the fact that this inspection had been superimposed on the normal intermediate inspection (PMI) because of a previous spar failure. Using rather simple logic and the process of deductive reasoning, the board found the spar problem to be a design deficiency.

The investigation board recommended that, barring redesign and refitting of the entire fleet with properly and safely designed rotor blades and rotor systems, the inspection kit should be redesigned and/or product improved to be maintainable under normal field operating conditions.

The board did not overlook the supervisory cause factor in the accident. The inspection, required every 25 hours, had not been performed in over 400 hours. This was a command malfunction: failure to allocate resources to inspect at least the high-time blades. This deficiency was corrected locally, and this unit experienced no more accidents attributable to that cause-related factor.

The point I want to make here is that the board did a professional job when it determined the WHY, or causes, of the fatigue failure (which was the WHAT, or the effect) and when it recommended corrective action to eliminate the causes and preclude recurrence.

In addition to the failure in many instances to distinguish between the WHAT and the WHY of an accident, we see another day-to-day reality in aircraft accident investigations that hinders the true prevention effort. Several years ago, the dubious quality of investigation reports forwarded from some commands made it evident that the qualifications of the boards were based upon "who is available" or "whose turn is it now" rather than upon "who is the best qualified, most experienced person who can best perform the task."

In one frightening instance, an accident investigation board found "pilot error" when both the pilot and aircraft commander said in their witness statements that there had been a loss of power. The pilot had taken off from a high pinnacle and subsequently crashed. The board stated that he had taken off downwind, although only a slight downwind condition was alleged to have existed at the time. The aircraft commander, a second-tour chief warrant officer, convinced the maintenance officer that the engine should be forwarded to USARADMAC for teardown analysis as prescribed by AR 95-5. USARADMAC found a definite failure of the fourth stage of the axial compressor section of the T53-L-13 engine, a known area of deficiency at the time. Yet the board disregarded the pilot and aircraft commander statements, neither proved nor disproved the assertion of a loss of power, failed to mention the upcoming engine teardown analysis and arrived at their finding of "pilot error." It should also be noted that the forwarding indorsements as well as the accident report failed to mention the teardown analysis.

Obviously, this investigation board shows a complete lack of professionalism. Worse, this type of board creates a credibility gap which weakens the effectiveness of the reviewing system and casts doubt on the attitude of immediate commanders. Fortunately for the system, however, there are many

professional boards. Let's take a look at two in action.

Within 30 minutes after arriving at the scene of an accident involving a simple, unsophisticated helicopter, the investigators found their "Easter egg," a main thrust bearing failure which ended in the catastrophic accident. The two Army aviators sustained fatal injuries. Finding the Easter egg was merely the starting point for the investigators. Two days later they had finished the task of "detail stripping" the helicopter, leaving no two pieces joined together in the thoroughness of the materiel examination. This examination proved that no other aircraft systems, components and parts had played a contributory role in the accident. The professional approach dictates that all systems must be investigated and held as suspect or exonerated in any accident. Most importantly, the professional investigator rules out all materiel subsystems before directing suspicion at the crew.

The professional investigation rules out all materiel subsystems before directing suspicion at the crew

Considering the crew as the last possible suspect in an investigation can have unexpected bonuses. In an OV-1 Mohawk accident, the pilot experienced what appeared to be fuel starvation and simultaneous lack of control response. He adamantly stated that there had been no indication of a fuel low-level state on the annunciator panel. (Some responsible individuals from the pilot's own battalion were among the first to pounce upon him as having "goofed." Whether they were right is not my point.) Followup analysis of the warning light bulbs from the annunciator panel proved that they had not come on at the time of impact, yet they were operational. The investigation revealed that there were no inspection criteria nor was any inspection required for the fuel low-level warning system in the aircraft. Professional investigators who refused to fix all blame on the crew until all materiel subsystems and associated procedures had been exonerated pinpointed two deficiencies that were definite cause-related factors in the accident. Thus we see how professional investigation and recommendations may eliminate causes of this nature.

When reduced to essentials, then, the end for which all aircraft accident investigations must strive, their absolute goal, is the actual WHY (the cause). The WHY underlies the twisted, burned wreckage—the blade spar that failed from fatigue, the failed bearing, the pilot who does not have an indication of a low-level fuel state on his annunciator panel. The WHY is the factor in the chain of man-machine-environment circumstances that really could have prevented the accident.

It is the moral duty of an investigator to ask himself: "Have I, within the limits of my knowledge and capabilities and the resources available to me, determined the true cause of this accident? Have I determined those cause-related factors and so stated them that, if acted upon, my recommendations can and *will* prevent a recurrence of this type of accident?" If he cannot answer with an unqualified "Roger that, sir," to both of these questions, then he has not completed his task of preventing similar accidents. He is honor bound to continue his investigation until he can say, "Yes, sir, this kind of accident need not happen again."

Lieutenant Colonel Max Moroz
Directorate for Education and Prevention
USAAAVS

BE IT EVER SO

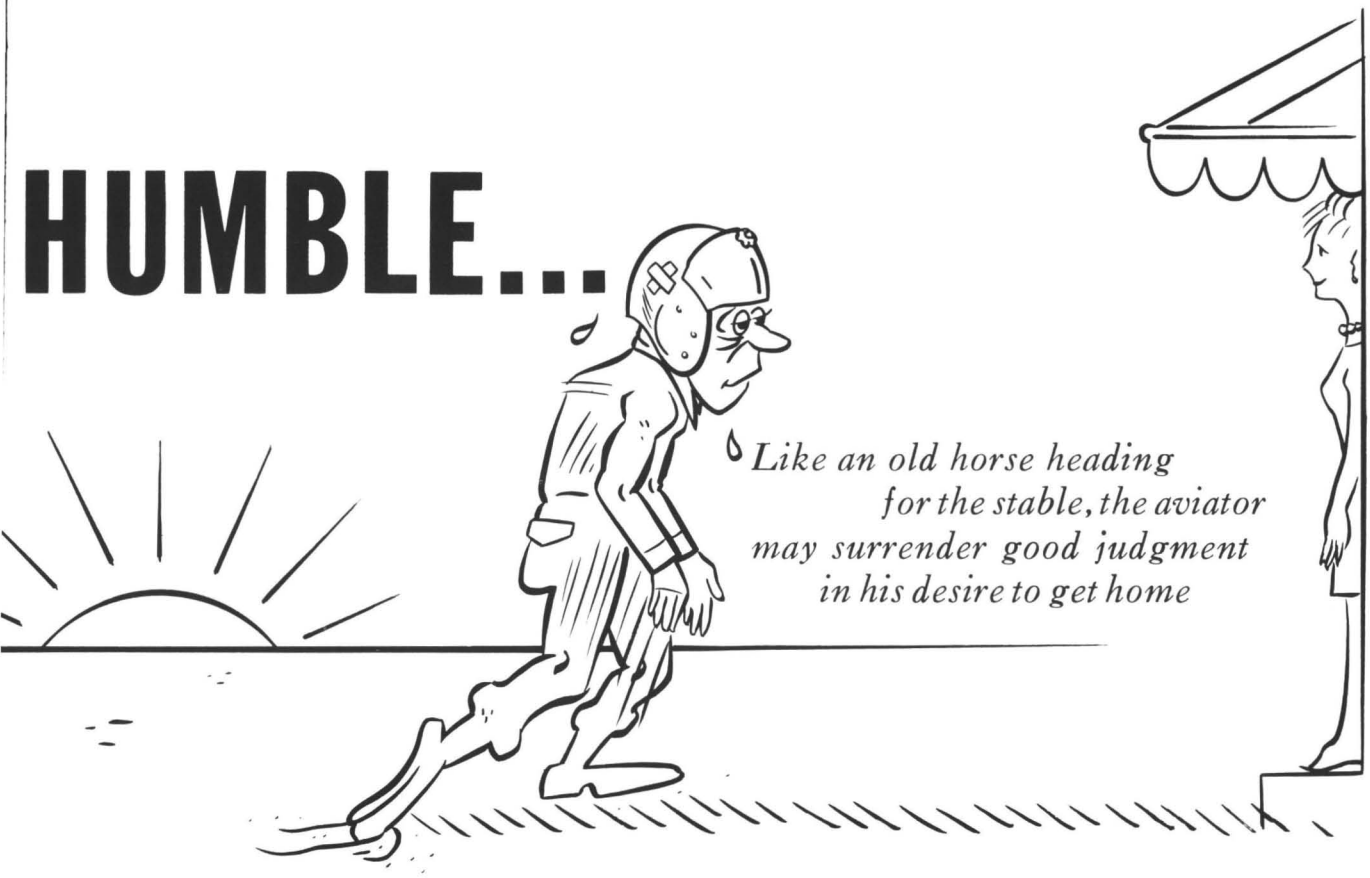
OF ALL PHASES of flight, the homeward-bound portion leads in the number of crew errors. If an aviator is going to overextend himself or his aircraft, if he is going to take a foolish chance, it will be while he is trying to get home.

Decisions to go or not to go are a part of every aviator's life. In training, he spends a lot of time learning how to evaluate all factors affecting his flight. With all this training, and as a self-styled professional, he may imagine himself as a cool, analytical machine, weighing factors objectively before making decisions. But if his destination is the place he currently thinks of as home, he is apt to abandon good judgment and professionalism, disregard obvious dangers and make his decision on the basis of emotion. This urge to return to the nest does not depend upon high-quality living quarters, nor must there be a loved one awaiting him. The mere presence of familiar and personal things—things which remind him of loved ones—makes it his emotional home.

A few years ago, one of the most highly qualified pilots in the Army, together with his copilot, crew chief and an aviation medical officer, was killed in an aircraft crash during an apparent attempt to get home on a night VFR flight under marginal weather conditions over mountainous terrain. This pilot was an instrument examiner and a graduate of the USC safety course. The accident investigation board reported the accident cause as inadvertent flight into instrument conditions leading to the crash on a peak some 20 miles off course. Actually, the most probable cause was the crew's openly expressed impatience to get on home as soon as possible. The home in this case was a sand-bagged hootch furnished with the typical canvas cot and ammunition box furniture. Hardly enough to attract anyone—except the resident. The desire to sleep in familiar surroundings, to have the use of personal articles, or perhaps to pick up the mail apparently were urges too strong to overcome.

The aviation psychologist refers to this desire as "get-home-itis," and recognizes it as a strong motivating factor. The aviator must make a conscious, diligent effort to keep it suppressed. When it is teamed up with another condition known as "end slump" or "end deterioration" (the human tendency to relax near the completion of any job), the aviator finds himself strongly tempted just when he has the least resistance. Controlled experiments of aircrew performance have revealed an almost irresistible

HUMBLE...



Like an old horse heading for the stable, the aviator may surrender good judgment in his desire to get home

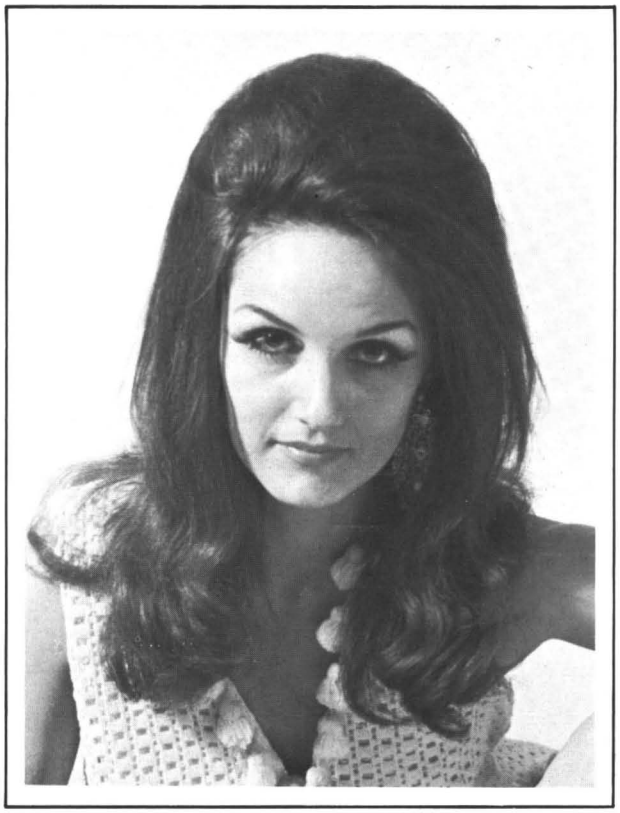
tendency to relax when home is in sight, and this leads to the greatest number of crew errors on the final leg of the mission.

In Europe, where aviators are exposed to some of the worst possible flying weather, it is frightening but true that, in the past, many aviators informally recognized two sets of weather minimums: one set for going and another for coming back home. At the smaller airfields, en route and landing weather was often disregarded or was forecast to suit the needs of the aviator. Weather forecasters working with Army units often began their briefing with the question, "What do you need to get in there?" It was not uncommon for the pilot to shop around at several forecasters until one was found who would give the necessary legal weather.

If we look back over our own flying careers we will find that nearly every poor decision was made on that leg of the trip pointing home. Not only have we disregarded weather, but we also have ignored sick aircraft and radios, and seriously low fuel conditions. All these problems we have pushed aside to get on home. Most of us, at one time or another have consciously filed and flown IFR through areas of known thunderstorms and moderate icing conditions, and have violated minimums—all for the sake of getting home. And those of us who are around to talk about it must have been lucky for we surely were not smart.

What can be done to prevent accidents caused by get-home-itis, this overextension of capabilities? First of all, the aviator must be aware that getting home is a temptation capable of overcoming his otherwise good judgment. Secondly, the commander must realize that he has much of the responsibility for avoiding this type of accident and should act accordingly. For example, he can foster a policy that accepts unplanned RONs without comment or at least without prejudice toward the crew. In addition, he can make it SOP for administrative flight crews to carry an RON kit of essentials whenever an unscheduled stop is possible. Further, it should be command policy that, where possible, all cross-country flight orders permit changes in itinerary and provide for the crews to recover expenses paid out of pocket.

If the aviator realizes that a 180-degree turn and an unscheduled stop are not against the law, he may contribute to the creation of another old pilot and the longevity of his crew and passengers—which are not all bad.



PEARL'S

Personal Equipment & Rescue/Survival Lowdown

SPH-4 Flight Helmet

It is ironic that, in our endeavor to establish our individualism for Army aviators, we lose sight of our initial goals of safety and protection for the Army aviator.

After 9 years and 5,000 hours, I feel that those of us who are considered old hands appreciate every ounce of safety equipment and the protection it ensures. But it does disturb me when I see good sense not being used. This is particularly true in the SPH-4 helmet.

We have spent time in research and money in design to produce a fine piece of equipment. Then what do we do? Paint it green forever and after. I will be the first aviator to recommend that in a combat environment a green helmet presents a far less visible target than a white one does. But, since our involvement in Vietnam is at an end and Army aviators will be doing their thing in "the friendly skies" of the U. S. and those of her friends, isn't it time we gave our pilots some extra safety protection?

A downed disabled pilot has more than a 75 percent chance of being located in a white helmet than he does in a green one. Even one percent in favor of the aviator is worth the effort. I personally have made several tests, both on the ground and from the air; and on every test run, I could easily locate the white helmet but not the green one. In darkness, which is the most difficult environment to conduct a search, assisted with searchlights and flashlights, the white helmet could be located easily and the green one not at all.

Tests were made using both helmets with reflector tape. During daylight, tests with the reflector tape produced little difference. Tests conducted in darkness produced a more significant result in that the white background of the white helmet illuminated the tape better than the green one. These tests are simple and can be easily duplicated. It saddens me deeply to know that we could possibly save the lives of downed aviators simply because we could locate them, and lost them because of the Army's hard and rigid rule of making all the troops look alike.

The SPH-4 is a good piece of equipment, but, again, we seem to go only half way. This is in reference to the two visors being shipped with the SPH-4, one tinted for sunglare and one clear. We can only install one at a time and there is a need and a use for two. Why not design a visor cover similar to the new type currently being installed on Air Force, Navy and Marine helmets where both visors are available to the aviator? The dark one would be used for sunglare (this is the one preferred over the two), and the clear one would afford the aviator eye protection, with clear undistorted visions during emergency land-

If you have a question about personal equipment or rescue/survival gear, write Pearl USAAAVS, Ft. Rucker, AL 36360

ings. Isn't the effort worth the added insurance of saving an eye?

In closing, I would like to state that aviation safety and its programs are not a panacea for preventing mishaps. There is no absolute cure, but they are the tools which, when properly and consistently administered, enable us to prevent unnecessary mishaps and to survive those that we cannot humanly control.
—National Guard aviator

Your discussion pertaining to what color the flight helmet should be painted is a perennial subject. Depending upon the posture of the U. S. Army at any given time, the argument pertaining to the color of paint shifts from white to OD and back to white. With the withdrawal of U. S. forces from Vietnam, the pendulum is now swinging back and the argument for a white flight helmet is once again being presented.

In determining what color the helmet is to be painted, camouflage, visibility and heat retention have always been considered.

I believe it can be said that the need for camouflage in a combat environment is obvious, both in concept and in practice. In 1965 when the buildup of American forces in Vietnam began, the then current flight helmets being furnished were painted white. A high level command decision made at that time was responsible for changing the color from white to OD. Any future change in the policy governing the color of the helmet must necessarily be as a result of a high level command decision. The question arises: Can a helmet be painted white for visibility and be easily converted to a camouflage configuration if need be? The answer is yes if consideration is given to the system used by the Air Force; i.e., providing camouflage decals to be put on a helmet and which are compatible to the terrain over or in which operations are being performed. The feasibility, as it pertains to safety, of using such decals is a subject being addressed by a project currently underway at the U. S. Army Agency for Aviation Safety (USAAAVS).

Under a given set of conditions, visibility pertains to the degree the adopted color can be seen. Aside from the discussion above, there are situations during which a white helmet is more effective; i.e., ground operations during which a member of the crew is directing an aviator and during a survival situation in a friendly territory. However, even a white helmet will not aid visibility in all cases. For example, the Navy uses a gold-colored helmet to enhance visibility on the water because a white helmet is easily confused with white caps on the water surface. Granted, the Army's operations are primarily conducted over land masses but conditions there also vary, such as with snow and in deserts. Marking flight helmets for conspicuity reasons is authorized by major commanders and details are supplied in TM 10-8415-206-13, dated April 1972.

According to heat retention tests performed by Natick Laboratories, there is no significant difference whether a helmet be painted white or OD.

Your second question pertaining to the adoption of a dual-visor helmet is answered as follows:

Based upon results of tests performed at the U. S. Army Aeromedical Research Laboratory (USAARL) and injury data furnished by USAAAVS, the Surgeon General has established a maximum allowable weight for a flight helmet to be 3.5 pounds. As yet, advances in technology have not been able to provide a dual-visor helmet within this weight limitation. The weight of the SPH-4 is 3.5 pounds for the extra large size and 3.4 pounds for the regular size.

Other services do use a dual-visor helmet. However, it has been discovered that pilots have experienced an increase in neck injuries during recovery operations to arresting gear. These injuries have been traced directly to the extra weight of the dual-visor helmet causing excessive elongation of the neck during deceleration. These findings support the decision of the Surgeon General.

Oops, We Goofed!

The article "Long-Johns" which appeared in the May 1973 PEARL column stated that Nomex underwear is authorized for issue to the National Guard. However, the underwear is made of 50 percent cotton and 50 percent wool knit and is not Nomex as previously stated, but is to be worn under the Nomex flight suit.

"NO, SIR, MR. PRESIDENT"

Continued from page 3
of the White House and picked him up. He'd flown so much that he couldn't understand, since you could see as far as you could, why he couldn't go up there. About halfway up he asked me if he couldn't go to Camp David now. I said, "No, sir." He said, "Why?" I said, "Look out the left window." He was sitting on the right side. He looked up and, sure enough, there was the top of the mountain disappearing in the clouds. He said, "Oh."

Then about 10 minutes out of Thurmont, which is a little town at the foot of the mountains, he said,

"Can we land at Thurmont and go up by car?" I said, "Yes, sir." So I called Camp David and they sent the motorcade down. In the meantime, I told my maintenance ship that was a little ahead of me to land at our preselected site—we had lots of places picked out to land in case we needed them—and be sure it was clear. This one was a baseball field on the edge of town. The maintenance man got in there and there was a National Guard company coming back from summer camp, having coffee at a little restaurant on the side of the highway. He went over to the company commander and asked him if his men would come out and make a perimeter guard around this ball field. He knew that as soon as we went in with the President there was going to be people appearing from everywhere. So they formed the guard and in about 5 minutes we went in and landed.

Here's this perimeter guard of soldiers around the field and the motorcade from Camp David is driving up at about the same time. The President got out and went to get in his car. I shut down because we were going to sit there until we could go on up to Camp David, which was only up the mountain. He got to the car and came back. He looked at me and said, "You didn't know we were coming here, did you?" I said, "No, sir, not until you said you wanted to come here." "Where did this guard come from?" There was no military post around anywhere. I said, "The Army's always on the ball. We're ready." He laughed, got in the car and drove off.

We decided to go across the road to this restaurant and have a cup of coffee and the waitress came over and wanted to know if I was Colonel Howell. I said, "Yes," and it was the telephone. Jim Hagerty, the press secretary, and the Department of the Army information office, the MDW information office, and I don't know who all were on this phone, saying it had just come over the radio that the President had just had a forced landing in his helicopter. I said, "He didn't have a forced landing. He landed where he asked to be landed." It took me 30 minutes to convince all these people on this telephone there was really nothing wrong, just a change in his plans. It was on the radio, television, news flashes, you know. The stock market went down. All because he wanted to go to Camp David and we landed someplace we'd never landed before. Of course nobody knew he was going anywhere that morning, which always shakes the press, particularly. So it was some kind of an emergency. I had a bunch of maintenance inspectors up there from somewhere. I don't know where they came from. They were put out when I wouldn't let them get near the helicopter.

Later, the President wrote the National Guard commander a letter and thanked him for using the troops down there. He saw just about everything and managed to let people know he appreciated it. That was the only emergency action I ever had on the job, if it was an emergency action.

McCULLAR: I like that being able to say, "No, Mr. President." I heard somewhere, maybe you told me, that two people Eisenhower never overruled were his doctor and his pilot.

HOWELL: This is true. However, he questioned the doctor more than he did the pilot, because the doctor tried to slow down his golf game. But I never tried to slow him down, I just tried to keep him home sometimes. He never argued. In fact, he was one of the best people I ever flew. Usually somebody's got to go somewhere and when you can't take them there's all sorts of problems. But all it took with him was no or yes. If it was yes, he never worried about the safety. If it was no, that was the end of that.

But nearly everybody was afraid to tell him no. There were always a couple of people between me and him who were willing to relay questions and answers, where it wasn't necessary for him to talk to me, unless it was a no. They didn't want to tell him that. But I would, and he would accept it.

For instance he wanted to go into New York into the Battery. Anytime he wanted to go any place, if I hadn't already been there, I'd go before I'd take him and see. I used a New York City police helicopter and went over to the Battery. That was a bad place. The wind was off the water always. No way to control people. It was rough. I told him we'd go into the 30th Street heliport, which is a little wharf sticking out in the river. But that was safe. This was relayed to him. That night after I was back home, Ann Whitman, his secretary, called and said the President wanted to go into the Battery but he got word that I wouldn't go in there, that I'd go into the 30th Street heliport. And I said, "That's right." She said, "Well, he'd sure like to go into that

Battery." I said, "It's not safe." She said, "You flew in there, didn't you?" I said, "Yep, but that's different. I'm not going to take him in there." That was the end of that. We went into the 30th Street heliport.

Another time was in Paris. We flew the President out to Versailles to a meeting. He didn't know exactly how long the meeting was going to be and I told him if he wasn't through in time to get back to Paris by dark he'd have to go by motorcade, that I wouldn't fly him at night. We sat there and it got dark. So about good dark here came the motorcade. And instead of passing the helicopters, up to the helicopters it came. And I'm standing on the ground which is unusual because usually I was in the cockpit with the engine running when he was coming. He got out of the car, came over, and said, "Is something the matter?" I said, "No, sir, not a thing." "Well, aren't you going to take me to Paris?" I said, "No, sir." He said, "Why?" I said, "I don't want to fly you at night. You haven't got any business flying in any single-engine aircraft at night and particularly these helicopters." So he said, "All right." But after he got in the car he got out and came back. He said, "What are you going to do?" I had four helicopters sitting there and the crews. I said, "We're going to Paris." He said, "How're you going?" I said, "We're going to fly as soon as you get out of the way." And he just laughed, got in his car and left.

McCULLAR: On another occasion, you were telling me about some of your experiences up at Fort Benning, particularly in flying at night. Can you recall those for us?

HOWELL: Yes. You know the 506th Helicopter Company was sent to Fort Benning in, I guess, 1952. It was really the first helicopter company assigned to perform as a helicopter company. Its mission was to be used by the Infantry School to develop techniques and doctrine for the tactical employment of cargo helicopters. That's the way it read. The point was that if the Infantry didn't have a use for helicopters, then the only use would be logistical work which dealt the tactical aspects out. Of course, a lot of us believed the helicopter had a lot of tactical use at that time. The company consisted of one platoon of H-25s and two of H-19s. It was an odd looking company, but that's the best we had at the time. We did pretty good with the H-19s. In 1955 we got H-34s, and things looked up with what we could do.

I had a company of new warrant officers out of the 40-some pilots assigned to the company. The average first pilot time was less than 500 hours, to give you an example of the experience. The average came out that high because most of the officers had been helicopter flight instructors in the school, which had built their time up. I was trying to be pretty particular trying to sell the idea of using helicopters because we didn't want to convince people they couldn't be used by having accidents with them and killing a bunch of people. So you might say I was kind of conservative.

But the first thing to come up was a requirement to use 12 H-19s on a night problem for the tactics department in the Infantry School. The operations officer told me about it and I said, "What do they want to do?" He said, "They said they wouldn't tell you, they just want 12 H-19s to fly from 8 to 12 tonight for the tactics department." I said, "Well, you call them back and ask them what they want to do with them." This was about noon, and we had another mission that afternoon that I was going out on. When I came back about middle of the afternoon, the operations officer said, "They told me that wasn't any of my business, they just want the helicopters." I said, "You call them back and tell them they'll get three helicopters. You'll fly one, the maintenance officer will fly one and I'll fly one, but that's

The "White House Badge," reminiscent of the Presidential Seal, was worn on the pocket of the Executive Flight Detachment crewmember's green uniform

all they'll get on that information. If they want 12 we'll get enough to brief the pilots or we don't go." So he says, "Suppose they won't?" I said, "That's all they'll get, three helicopters."

I went out again and I got back about 5. The operations officer had

all the pilots there. I said, "You must have got enough information to brief them on the night mission." He said, "No, sir, they won't tell me anything. They said it's none of my business. So I told them you would send three but not twelve." I turned to the pilots and said, "Go home. You've finished a day's work, except for the three crews of us who're going to do this."

About this time the phone rang. The director of instruction was wanting to know if I was going to give them those helicopters. I said, "Be happy to, sir, if you'll tell me what they're for, so I can brief the crews." He said, "I don't see where you need to know that. I don't know what they're for." I said, "Well, I'll take three," and that was the end of that conversation.

President Eisenhower arrives via Army helicopter with President Mateo of Mexico at Camp David, a favorite Presidential retreat

But the phone rang again in about 5 minutes, and this time it was the assistant commandant. He said, "You're not going to send the helicopters?" And I said, "Sir, I'd be happy to if they'll tell me what they're for. I can't send these people out at night over these dark swamps and they don't even know what they're doing, or where they're going, or anything." He said, "Why do they need to know that?" I said, "Well, you won't let anybody go out on the rifle range without having them snap a rifle for 3 or 4 weeks out here with nothing in it to be sure they don't kill one another. And these things are more lethal than any rifles you've got and I think we're entitled to have some idea of what we're going to do even if we don't get a chance to practice it." He said, "Are you going to refuse me?" I decided then that I might as well go all the way. I'd gone that far. I said, "Yes, sir." There was dead silence. I thought that this was it. He said, "That's pretty serious." I said, "Yes, sir, it's pretty serious. Do you think I'd be doing it if I didn't think it was real serious?" And then I said, "There's one way you can do it and that's relieve me now and give somebody else the company." He said, "Who?" I said, "Well, that'd be your choice." Of course, there weren't many of us running around in those days, you know. Then I said, "I wish I could do it. It'd be a lot easier. But I can stand in front of you or a court martial and it won't hurt anybody but me. If I send those helicopters out, we're going to have a bunch of funerals and there's going to be a lot of people hurt." Finally he said, "I can't afford to call your bluff, if it is a bluff." I said, "It's not a bluff, sir." He said, "Well, you do it like you think it ought to be done."

And we did. We went out with the three helicopters and finally, piece by piece, we found out what

the mission was, wandering around in the swamps and landing on roads with flashlights and hunting somebody to talk to. But we did accomplish their mission with three helicopters and he, the assistant commandant, was out there.

The next day I got a call to report to him. I thought, "He's thought this thing over and he's decided he's going to can me right now." I got up to his office and he had the department directors in there. He had drawn a crowd to do it by. When we got in there, he said, "You know, we don't know anything about helicopters. We've got this company of them here to see if we can learn something about them. The only man we've got here that's supposed to know anything about them is Howell and I find out we're not paying a bit of attention to him or telling him anything either. In the future, any mission that you plan to use helicopters for, he or some of his people will be in on the planning of it." And then he said, "You know, I think he might be able to do what you want." And we did, pretty well, from then on. But it took that little understanding, and I really believe that if I hadn't gone through that—and believe me, that was an ordeal to stand there and tell a general that you're not going to do something—we would never have got very far.

McCULLAR: This story has a happy ending, and I remember you went on to develop techniques of night flying depending on solar lunar light tables.

HOWELL: Yes, we did. Of course, a lot of Infantry tactics are at night, and if you're going to support them, you've got to be able to operate at night. And bear in mind my young warrant officer pilots with no experience and no instrument training at all. I came to the company from running the fixed-wing instrument training and the instrument examiner courses at the school at Sill so I was very conscious of instrument flying and had learned myself that you either do it or you don't do it; you don't do it halfway. Since none of my pilots had any instrument training, my idea was don't get into it, because if you do you're going to get in bad trouble.

I wanted to do night flying for the Infantry but if you don't have a natural horizon to fly by, then the only thing you do have is an artificial horizon which is instrument flying. So I made a rule that we would only fly at night if we had a natural horizon. Nobody in the Infantry School paid any attention to this until they had a night mission scheduled when, according to the moon, you didn't have a natural horizon. I told the operations officer to tell them we couldn't fly it at those hours but we could at certain other hours during the night. This caused a good bit of consternation until I explained to them what I meant by it: That the pilot's eyes weren't any better than anybody else's and if he couldn't see the ground or horizon he didn't know what he was doing, if he wasn't trained to use the instruments. We had instruments but none of these pilots was trained for them. "But can't you train them?" I answered, "Sure. Give me about 2 years to train all these and we'll get it done. But it's out of the question for what your immediate problem is. The aviation business is thinking about helicopter instrument training, too, and it won't be too long, I hope, before pilots come to a unit qualified to do this work."

We worked it out where we could fly for the Infantry just about every night in the month at certain hours with a natural horizon. For instance, on a dark night there is a horizon from sun reflection in the early part of the night to a certain time and then it gets black dark. There's nothing from then until a time in the morning, say 3 o'clock or maybe 4, where there's a natural horizon, and that's all you need. This worked beautifully with the Infantry School.

But my main problem was with our own people. There're some people that just don't believe you need any rules for anything. Somebody in CONARC found out I had this SOP for night flying. So they asked me about it and I explained it to them. They didn't see it was necessary. I said, "I think it is, and as long as I'm doing the job down there and I'm not killing anybody, I don't really think it's anybody else's business, except I think they ought to think about it." So we got by this one all right.

We operated there with this kind of rule and others like it that I had that were restrictions all right, but restrictions to get the job done safely. In other words, I figured we could do anything we were asked to do if it was properly planned and thought out, and we never killed anybody in 4 years of flying.

McCULLAR: You want to expand a little on that, Bill? I think you developed SOPs other than the rules in regard to night flying that

added to the longevity of all your pilots and crews.

HOWELL: We did. We had trouble with this clutch in the accessory drive shaft on the H-34 engine which would shear and when it did you lost your mags, or all your accessories really, and your engine quit. We had something like 15 engine failures there in 3 or 4 months and never damaged an aircraft, which I thought was pretty good. But we wouldn't fly passengers at night with the engine like that, but we would let the school use them for problems where they were learning to control helicopters in night landings. And for anything where they just needed helicopters.

Of course, somebody asked me why we flew that way. And I said, "Well, we are getting paid to fly but the 15 to 18 passengers we put in there aren't and I don't think they should take the chance." We didn't get too much static out of the Infantry School by then, but I got a lot out of all the other headquarters. And the funny part of it was that each call I'd get would ask me to rescind that part in my SOP. And I always said, "I won't do it but you can always order me to." Nobody would, so it stayed that way. Of course, the point I was trying to make through that whole thing was that you've got to think about your job a little bit and figure how you can do it rather than how you can't do it. It would have been better just not to have done these jobs, but I felt we could do them if we went about it right. I was accused of being overly conservative and this sort of thing, but when

The Presidential party boards a helicopter piloted by LTC Howell after a visit to Vatican City. Heading the Vatican delegation at the departure site is the President of the North American College of the Vatican. Mrs. John Eisenhower, the President's daughter-in-law, is seen at the far left

people looked at the work we were doing, they saw there wasn't anybody doing any better anywhere.

McCULLAR: Looking back at the record where you've had, I guess, hundreds of pilots working for you at one time or another, you've never had a single fatality.

HOWELL: That's true. The only fatalities I ever had in my units were automobile fatalities. We had some minor accidents but this is another story in itself. The worst one that I ever had was during the transition of a new H-34 pilot. The instructor pilot was doing a power recovery autorotation in a wheat field up at Fort Campbell, where we were on about a 3-month mission. When he flared, there was a single strand of telephone wire across the field which he didn't see until he was right there. He flared high enough that his tail wheel would hit it but the other pilot didn't think he saw it, and he jerked the stick back. When he did, he jammed the tail into the wire. It wouldn't have hurt anything if he'd hit it. It would have broken the wire but it wouldn't have hurt the aircraft. He knocked the tail wheel off and the tail rotor and the thing spun half around and tore one of the main gear out.

Of course we made an accident report and sent it in with a TWX. We had our own third-echelon maintenance [direct support] in the unit and they repaired it. In a week the aircraft was flying. About 6 weeks later I got disposition instructions to pack it up on a freight car and send it back to Sikorsky to rebuild it. When I answered and told them the aircraft had been flying for 5 weeks, some folks got upset. You weren't supposed to do that.

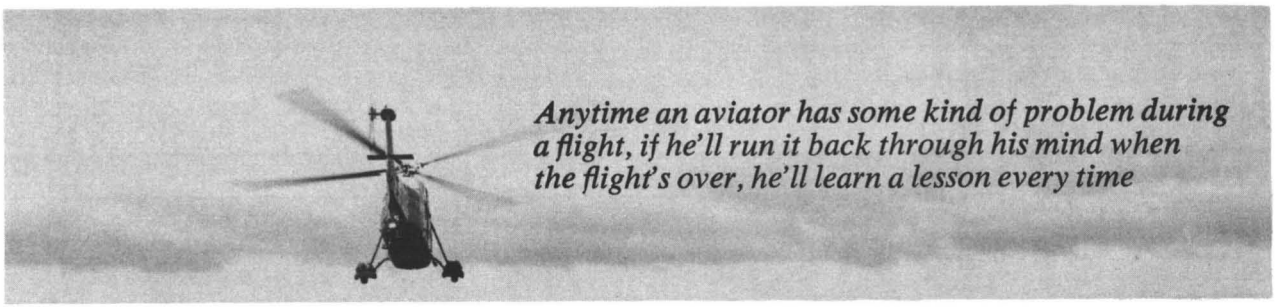
I tell you what this kind of policy does. When you can get the job done and do it in such a way where all the people that work with you know what you're trying to do it makes it a lot easier. It gives them a desire to do all they can for you. Of course, that's the key to it. If you can get them all working together you won't have any problem.

Of course, I'm just telling you about the successful things. We had other things we tried that didn't work, too, but we changed them when they didn't.

McCULLAR: As I remember, the Army had no formal helicopter instrument flight training until some time after you were at Benning.

HOWELL: That's right, and this goes to another little story in the exec flight. This was a composite unit—Marines and Army. The Marine component was out of the HMX1—the squadron at Quantico. The Executive Flight Detachment was the only H-34 unit in the Washington area so we were really a separate unit as opposed to the Marines coming out of a standard squadron. However, their aircraft were like ours. They came out of the same production line. They were just painted a different color when they came out.

But when we met in the White House the first time, the Naval aid to the President had operational control of the White House helicopters. He was a Naval aviator, but he didn't fly helicopters and didn't know much about them. He did have quite an aviation history. He had the first jet squadron on a carrier and this sort of thing. He was fascinated by helicopters, and he had my Marine counterpart and me up there discussing the White House operation, and he wanted to know if we flew instruments—if we were helicopter instrument qualified. The Marine said they were, and I said we weren't. He looked like he thought we were second-rate citizens because we weren't instrument qualified in helicopters. I said, "Now, my officers are all instrument qualified in fixed wing but we don't have a helicopter instrument rating." And the Marine explained that if you're instrument qualified in the Marine Corps you're instrument qualified,



Anytime an aviator has some kind of problem during a flight, if he'll run it back through his mind when the flight's over, he'll learn a lesson every time

period. If you flew a helicopter you were supposed to be able to fly it on instruments. I said we hadn't extended ours quite that far and I'd think about it.

I checked our regulations and ours didn't say anything about it either. They said if you were qualified in the aircraft and it was qualified to fly instruments and you were, that's all it took. So I got to inquiring around. Does anybody know a legal reason why you can't fly a helicopter on instruments? Nobody knew one. There wasn't any regulation that said you couldn't. So when I got a bunch of this kind of answers, I went back out and told the boys we were going to fly helicopters on instruments.

At that time they were running the experimental courses down here at Fort Rucker, and they had even had some experimental helicopter instrument examiner courses but it still wasn't in the field. I got one of the instrument examiners assigned to the detachment and I gave him the job of taking the ones of us who were instrument qualified and qualifying us in the helicopter. I didn't say anything about getting qualified. It hadn't come up at the White House anymore. But we got ready.

We got a call one afternoon and the President wanted us at Atlantic City the next morning. The weather was about 500 feet all the way to Atlantic City and about a quarter to a half mile visibility. I said we'd better go. So we got our bug-out bags and went to operations and filed our instrument flight plan to Atlantic City. This was the first time we'd done it. My copilot wasn't instrument qualified. In fact, we were lucky to have enough first pilots instrument qualified. The Marines went in and we all filed our flight plans. As we started out to the helicopters, we picked up our bags and the Marines started without theirs. They said, "What are you taking your bags for?" I said, "We're going to need them in Atlantic City tonight." "You mean you're going?" I said, "We filed a flight plan, didn't we, and you did, too. Aren't you going?" "Well, we do that, but we cancel out before we take off." And I said, "Well, I didn't file it to cancel it." This put the Marines on the spot. When it came to the helicopter instrument flying end, they became the second-class citizens and they had to go behind the barn and make good what they said earlier.

McCULLAR: Bill, you were offered a regular Army commission. How about telling us why you refused it?

HOWELL: Sure, I would have loved to have a regular Army commission but not at the stage it was offered to me. I guess it was in about '58 or '59 the Army was going through something like they're going through now and trying to settle back and get down. Reserve officers with 20 years service were being retired, whether they wanted to or not. I was in that category—I had a little over 20 years.

I got a letter from the Army telling me my retirement date was about 60 days from then. I took the letter up to the White House and told the military aide he'd better be hunting another pilot because I was leaving. I showed him the letter. He said, "Come on." We went over to the President's office and when he went through that door, I stopped. I heard the President's voice. He had a pretty good voice when he was excited. "What the hell is this?" The aide explained it to him. He picked up the phone and called Secretary Brucker and told him he took a damn dim view of the Army's firing his pilot. The aide came back out and said, "I don't think you'd better plan on leaving." Well, I got another letter quick asking me if I'd stay on in the Army, which I did.

But then later on the President wanted to see me. I went up there and he told me I was being commissioned in the regular Army. He was going to put a stop to that being fired stuff. I stood there and shifted from one foot to another. I said, "I appreciate it, sir, but I don't want a regular Army commission." And he looked at me. President Eisenhower had quite a temper but he controlled it except when it wasn't necessary for him to control it, like in the official family or something like that. He was turning red and I was trying to figure out what do you say next. I decided I'd sure better say something. "Sir," I said, "I've got over 20 years in the Army and I can retire and I can do anything I want to. I can work for the Army. I can sell to the government. If I take that regular Army commission at this stage I'll be greatly restricted in what I can do when I retire. As a matter of fact I won't be able to do anything connected with the Army or the government. And I'd rather at this stage leave it like it is." And he said, "Is that right?" And I said, "Yes, sir." And he thought a while and said, "You know, I don't blame you." So I got back in his good graces.

This shows you how considerate

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he was, but let me tell you another story that shows it even better. This one is about my NCOIC line chief and his promotion to E9.

When E8 and E9 ratings came out for enlisted men, I had no problem getting an E8 for Sergeant Dunn. He'd been with me for about 7 years and he was a good one. The E9 ratings came along, and as I remember it he was qualified for that in every way except the regulation required him to have a job in a battalion or higher to be eligible for promotion. So I put in a request to get him promoted. We were under MDW and by that time everybody in MDW from experience had become leery of disapproving anything from the Exec Flight. If it had to be disapproved, which it wasn't, it went to the commander of MDW who was a general officer. But he called me to his office to talk about this one. He explained to me that Sergeant Dunn couldn't be promoted to E9 and stay in the Executive Flight because he should be in a battalion. I reminded him that I was a lieutenant colonel and according to the same regulations I should be commanding a battalion but the Executive Flight was all I had to command, and that's all the sergeant had. He said, "You just can't do it." I said, "I think I ought to transfer him some place where he can be promoted because he's qualified, and I don't like to hold a man back for a job." He said, "Well, that's all right." I said, "Of course, the President's going to want to know where he is and that may be hard to explain." He said, "Well, if the President thinks so much of him, why don't you get him to recommend him for promotion?" I said, "Do you mean that?" He said, "Yes, if he'd recommend him, there wouldn't be any problem." I said, "Yes, sir!"

I went over to the President's office and dictated a letter to Ann Whitman for the President to sign, recommending Dunn for promotion to E9. She took it in to him and I heard this loud, "What is this?" She was explaining it to him and I thought, "Oh boy, I've done it now." He said, "Where is Howell?" "He's out there." "Come in here. What is that?" And I explained to him just what I'd gone through. He said, "I'll write a letter." He dictated one to whom it may concern and brought out the qualifications of Sergeant Dunn. He had flown as crewchief every time the President flew and he knew him. The President said it was his desire that Sergeant Dunn be made E9 as soon as possible and signed it, "Dwight D. Eisenhower, Commander in Chief," and gave it to me. I put one of those little green buck slips on it to the CG, MDW, and put it in message center.

It wasn't an hour later that I got a call from the general wanting to see me again. I went over there and he said, "Did you see this?" I said, "Yes, sir, you asked for it." He said, "Good God, I didn't mean it. Do you realize Dunn's an E9 now?" I said, "Yes, sir."

McCULLAR: There was another interesting experience you related to me one day, Bill, and that was the realization that all of the Joint Chiefs of Staff were in one helicopter.

HOWELL: The President wanted the Joint Chiefs of Staff up to Camp David for a meeting. This was on a Saturday. I picked them up at the Pentagon pad, the Joint Chiefs of Staff. About halfway up it occurred to me that if I did have an accident there was going to be a lot of vacancies in all the services the next day, besides the situation the country was going to be in while everybody was figuring out what to do about it. It bothered me very much the rest of the trip but I didn't say anything.

When we got to Camp David, I called the Marine who was supposed to have the weekend off and told him to get in his helicopter and come up there and bring another one with him. On the way back the Joint Chiefs were surprised they weren't going to get to ride together. We divided them up among different helicopters and took them back. Somebody figured out later what I did and I think a lot of people were real concerned because we hadn't thought of that sooner. These single-engine machines—there's a lot more hazard there that everybody knows you don't have with multiengine aircraft. Even with multiengine aircraft it pays to split up these key people.

McCULLAR: On your desk you have some of the little medallions and souvenir coins and the like that President Eisenhower passed out.

HOWELL: On these trips we went on—particularly overseas—we had to get a lot of help from people to support us because if he flew into a place—even though we were there to carry him and the immediate official group—there were a lot of other people like the press who had to have transportation—people

that you just couldn't get on our helicopters. So we would borrow helicopters from American units in the area and use them even to haul the baggage to get it there at the same time. On all these trips he would have some souvenir item made up to pass out to these people who helped us on the trips. One of the things he used several times was quarter or half dollar medallions he had the Philadelphia mint to make up. On one side was engraved "With appreciation, DDE" and on the other side was the name of the trip like the 11-nation trip he made and that sort of thing. This was a souvenir that we could give the helicopter crews and the people who helped us. It was his thanks to them—the people he knew he'd never get to speak to. The people really treasured those things when you gave them to them. They were one of a kind and no way to ever get another one.

McCULLAR: Bill, you completed a long accident-free flying career. Is there any one thing to which you can attribute your success?

HOWELL: COL McCullar, this is something that's always bothered me: Has it been a success, or has it been luck? But I think the only thing that I can say is that I've always tried to understand the problem as it came up and tried to face it and see if there wasn't some way that you could accomplish what you set out to do with full consideration for all the responsibilities involved in it. Because everything that has to do with aviation has a lot of responsibility attached to it. If you're going to make a decision that you've thought out—and this doesn't mean that you're always right, but it means that if you've really thought about it you'll be close enough—it'll come off safely. And then from that you'll be all right the next time, too. But you leave a little room where you can get back out. In other words, I don't believe in getting yourself backed against a wall where there's no way out.

President Eisenhower had one-of-a-kind silver medallions such as the one pictured above made up to be given as souvenirs to flight crewmembers and other people who helped out on trips to special events. The obverse of the medallion commemorated the event for which the service was rendered and the reverse expressed his gratitude

I think that most accidents happen—and I'm speaking now of nonstructural or nonmaintenance type accidents that are strictly pilot error—because the pilot lets it happen. He gives up. He gets into a situation where it looks like it's going to result in an accident and he makes sure it does by giving up, where if he'll keep doing something right down to the last second he might get surprised. The reason I say that, it's happened to me many times and I'm sure it has to you and other people where you're in a tight situation and an accident seemed unavoidable at the time. But something happens if you keep at it that just might prevent it.

I had one accident—you say "accident-free"—better get the record straight. I did have one. There used to be an old adage in aviation that if you could get by the first 1,000 hours of flying you'd probably be pretty safe. Back in the early days, a thousand hours was a lot of flying time because you didn't have airplanes in the Army that would fly more than 2 or 3 hours at the time. You just didn't get it very fast. But I had an accident when I had been out of school about 5 months, and I've thought about this a lot. I had about 200 hours of first pilot time after I graduated. It was an L-4 test flight at Fort Bragg, NC. They'd put a new engine and a new wing on it and the sergeant and I went out to see if it would fly. And it did. It flew good.

So we flew all over the reservation and there was a lake out there —McArthur Lake—I'll never forget it. I was new at Ft. Bragg and

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I was a big fisherman and that lake fascinated me. I flew around it and looked at it and I saw a little air strip by it and I decided I'd land on that strip and take a closer look. I hadn't been out of school long and I knew all about getting into strips. It was right in the middle of a pine forest. So I pulled my throttle back and made a fast pass over this strip at treetop level to make sure the Infantry hadn't dug any foxholes in it or anything. When I got to the end of it, my air speed was down to just above stalling and my engine was idling so I applied power to come back around and land. I opened the throttle, and nothing happened. I tried it again, and nothing happened so I told the sergeant something was wrong. So he tried the throttle a few times. In the meantime I'm losing what little air speed I had with an engine at about 800 or 900 rpm. The engine and airplane were both working fine but not together. So I started a turn. In the Cub you could get by with a lot, but when it ran out of altitude and air speed, it did what any other airplane did. It stopped flying. I turned back to try to get in the strip and I made the turn with that idling rpm just enough to keep it on a burble—just on the verge of a stall. I surely did hate to go into those pine trees. Well, I got it turned around and it looked like I was going to get back to the strip but there was a pine tree just a little bit higher than I was between me and the strip. And I didn't have enough air speed that I dared even drop a wing, much less try to turn in it. So I hit the tree which was about 75 feet high, right in the top and cut the mag switch just before I hit it. One of the wheels came up between my legs, and it dawned on me, how do you get out of this tree now. I found out how a few seconds later. We started falling out of it. The hardest part of the crash was from the top of the tree to the ground. The airplane went in on the tail and the left wing and one of the struts came through the window right past my face.

We didn't have any shoulder straps or helmets either in those days and in the jar somewhere my head hit something. It must have addled me for a few seconds. Anyhow after we got on the ground the first thing I knew the sergeant was down on his hands and knees trying to pull me out of it. The gas tank had busted and you could hear the gas sizzling on the manifold and I was just drenched in it. The gas tank was right in your lap. He said, "Are you hurt?" And I said, "No, but we'd better get out of here. This thing's fixing to blow up." I couldn't move, and he was pulling. I said, "I must have broken my back and don't know it." Then I looked and I was still fastened to the seat, what was left of it. I unfastened the belt and got out.

The airplane was a complete washout but neither one of us was hurt. The air officer called it mechanical failure. The throttle linkage had come loose at the carburetor so the two weren't connected. I'd always heard that if this happened your engine would go to full throttle but I learned that's not so. It didn't. It stayed right exactly where it was.

I've thought about what happened a lot and I think it's kept me from having a lot of accidents. Even though it was mechanical failure and they said there was nothing I could do about it, there was a road beside that strip—a wide long dirt road, and I could have made a low reconnaissance over that road at rpm you're trained to fly at which meant I could have flown that airplane for 3 hours even with the throttle linkage out of it. I could have flown it back to Pope Field. I could have done all sorts of things if I had been doing what I was supposed to be doing the way I was supposed to be doing it. But I wasn't. I wasn't supposed to be looking at that lake to fish in to begin with, and I had more or less buzzed the strip with the power off. If I was going to make a low drag over the strip I should have done it the way I'd been taught to do it, which was the safe way to do it. But that hadn't dawned on me up to that point. But you slow fly over it. You don't buzz it.

McCULLAR: I think there's a great moral lesson in that story, too.

HOWELL: I think that any aviator when he makes a flight that is anything other than routine—and there is no such thing as a routine flight but a flight where everything goes well as opposed to one where he has some kind of problem—when the flight's over with and he's resting some place, if he'll run that thing back through his mind he'll learn a lesson every time.

McCULLAR: Thank you, Bill.

If you have a question concerning aviation accident prevention, write to Commander, USAAAVS ATTN: Orval Right Fort Rucker, AL 36360

Tail Rotor Strikes

In our unit's safety meetings, I want to emphasize the hazards involved in tail rotor strikes. Does USAAAVS have any statistics that would help me make our personnel more aware of the problems? —ASO

Statistics support your position that this problem area should be emphasized. During the period from 1 January 1967 through 31 October 1970, 1,036 tail rotor strikes were reported to USAAAVS that were caused by people walking into the tail rotor or by the tail rotor striking objects in the operational environment (wires, trees, revetments, etc.). These mishaps resulted in 50 fatalities, 199 injuries and $43,472,768 in damages. To reduce these losses, we believe that comprehensive training on the precautions to be observed around aircraft should be included in basic combat training as well as in the Army Training Program (ATP) for all units having or using Army aircraft.

Broken Wing Award

Can Broken Wing Awards be given to student pilots and civilian pilots?—Aviator

Change 3 to AR 385-10, 25 April 1973, states: "The provisions of this award [Broken Wing] are applicable to all military personnel, including student pilots, and civilian personnel authorized to pilot Army aircraft. The aircraft must be owned or leased by the Army at the time of the occurrence."

Accident Rate

Can USAAAVS give me the accident rate for my unit? How is the rate computed?—Commander

USAAAVS does not maintain a record of flight hours on units and therefore cannot furnish you with the accident rate. If you know the number of accidents that occurred during a given number of flying hours, you can figure your unit's rate for that period as follows:

$$\frac{(\text{number of accidents}) \times (100{,}000)}{\text{number of flight hours}} = \text{accident rate}$$

Marking Obstructions

How do I go about marking and lighting obstructions on or near an airfield?—Maintenance officer

The proper method may be found in FAA Advisory Circular No. 70/7460-1B, "Obstruction Marking and Lighting," Department of Transportation, 1 October 1972, copies of which may be obtained from Department of Transportation Distribution Unit TAD-484.3, Washington, DC 20590. You may also be interested in a companion circular, FAA Circular No. 70/7460-2D, "Proposed Construction or Alteration of Objects That May Affect the Navigable Airspace," 20 February 1973, which outlines the situations when the FAA must be notified and when no notice is required.

NOE Flight Training

Do you know of a publication which details the U. S. Army Aviation School's technique for nap-of-the-earth flight training?—Aviator

"Flight Training Guide: Phase II—Officer/Warrant Officer Rotary Wing Aviator Course; Phase III —Warrant Officer Candidate Rotary Wing Aviator Course; Tactical Training," 2C-1981B0011AS-4/2C-100BB0011AS-4/2C-100BC0011522, U. S. Army Aviation School, Ft. Rucker, AL, April 1973. You will also find helpful information regarding the safety aspects of nap-of-the-earth flight in an article entitled "Nap-of-the-Earth Flying," that appeared in the June AVIATION DIGEST.

Continued from page 28

Accident Analysis

Considering these limitations, let us now reevaluate the accident reviewed earlier (figure 1). As noted by the investigators, the aircraft were on parallel flight paths and the target size was represented by the fuselage cross section of 4½ feet. If a person has 20/20 vision, 1 minute of arc expands to 4½ feet in about 2½ miles.

Visibility was reported as 5 to 10 miles, but a haze condition reduced color contrast. The light plane was colored white and turquoise and blended with the background haze at a distance of 1 mile. The parallel flight paths eliminated relative motion. The Air Force aircraft were climbing, and the light plane was above the normal upward scan of the pilots. The thick windscreen had a canopy bow which produced blind spots in the visual field. The number 2 pilot had directed his attention to the fuel tank on number 1 aircraft.

Evaluating these factors, the life sciences investigator felt the existing conditions reduced the 2½-mile maximum visual perception to approximately 1 mile. The closure rate was computed at 5½ miles per minute. At that rate the aircraft would become visible less than 11 seconds before impact. With a perception-reaction time of 6 seconds, the collision would have been inevitable if the pilot were not looking in the direction of the other aircraft for a period of 5 seconds. Certainly in today's aircraft it is not unusual to be unable, because of navigation requirements, radio channel changes, instrument monitoring or other duties, to clear the flight path every 5 seconds.

This review emphasizes the fact that the eye has basic limitations reducing one's ability to use the "see and avoid" concept. However, pending the use of automated instruments to prevent collisions, the eye is still one of the most effective instruments, provided it is properly used. A flyer, therefore, is left with the question of what he must do if he is to obtain maximum benefit from his facilities.

First, he must understand the physiologic limitations as well as capabilities he possesses. The pilot must be familiar with visual capabilities, limitations in perception and reaction time due to neurologic factors, and other restrictions due to such factors as hypoxia and acceleration forces. This recognition will avoid the false sense of security which in itself can produce a midair collision.

Second, crewmembers can correct those items which can be corrected. Instead of squinting at the time of the flight physical to avoid having to wear glasses, pilots must recognize that glasses may give them the extra detection distance needed to avoid becoming another statistic for discussion at some future flying safety meeting. If an air crewmember has difficulty reading signs at night or clearly seeing other objects, he should check with his flight surgeon immediately rather than waiting until his next flight physical. If an eye infection develops, he should obtain proper treatment, even if it means a brief medical disqualification for flying duties, since vision can be affected by the infection. Because fatigue can affect accommodation time, it is necessary to be especially vigilant if tired. When exposed to bright light in flying, authorized sunglasses should be used to avoid eye fatigue. Polarized sunglasses should *not* be used while flying. The stress lines in the plastic present in laminated glass used in some aircraft, combined with polarized sunglasses, may filter *all* light rays. As a result, repeated reports have been received of large blind spots when looking through a windscreen. Polarized sunglasses may be satisfactory while fishing or relaxing on the beach but a crewmember must switch to the authorized glasses while flying. If flying in an unpressurized aircraft, it is necessary to remember the deleterious effects on vision of even mild hypoxia and to be even more concerned if a smoker.

Third, a flyer has to use properly the capabilities he does have. He cannot rely on peripheral vision while constantly looking straight ahead. Instead, it is necessary to use systematic scanning to cover the hazardous area with central vision. Detection and recognition require a finite time, so segmented scanning with brief pauses of at least 1-second duration should be used rather than continual uninterrupted sweeps of the area. Naturally, a pilot's eyes are able to detect another aircraft only if they are looking outside the aircraft. Prolonged instrument monitoring or other "head in the cockpit" actions invite trouble. One aid sometimes overlooked is to use the eyes of others in the cockpit. Their capabilities should be used whenever warranted.

Fourth, a pilot needs to recognize the high-risk situations and be extra vigilant in such situations. Since over three-fourths of midair collisions occurred during formation or associated flying, he should be particularly concerned whenever in such situations. The high proportion occurring near airfields further emphasizes the need to avoid giving the instrument landing system (ILS) undivided attention during an approach. It is known that positive control is not a final answer, although use of positive control whenever possible will aid in reducing the risk. Finally, whenever in the environment where a midair collision is possible, crewmembers must remember the advice to *stay alert!* At today's speeds an attention lapse of even a few seconds can be fatal.

☆ U.S. Government Printing Office 1973—746-161/5

USAASO Sez

The U. S. Army Aeronautical Services Office discusses

EXPERIENCE shows that each year some of us try to beat the RIF program by sticking our noses in where they hadn't oughta be, like thunderstorms, turbulence, hail, etc. Those of you who know you are immortal, stop here—everyone else might benefit by reading on.

Another balmy spring, replete with heavier than usual storm and flood, has passed, leaving in its wake an indication that we who are not fortunate enough to jock around IFR in radar-equipped stiff wings should be aware of the limitation of ATC radar. First, no matter how sympathetic a controller may be, his primary responsibility is safe separation between aircraft. Services that derogate this responsibility will not be provided. Secondly, limitations of ATC radar equipment, comm congestion, other air traffic, etc., may also reduce the controller's capability to provide additional services.

In consideration of ATC's primary responsibility, developments in recent years have generally served to decrease the controller's abilities to provide weather vectors. For example, if you are advised that only secondary radar is available (painting only beacon-equipped aircraft), weather is eliminated entirely from the scope. The use of "circular polarization" on primary radar eliminates all but the most severe portions of weather and, if you are slow enough, it may eliminate you from the screen as well. The lack of weather information to the controller is further derogated with the immigration of many high-performance craft to the upper regions, thus decreasing the number of PIREPs on local severe weather. On occasion, even if you are being provided vector service, the going may be too rough for the equipment in the vicinity of hardcore areas that do show up well on the radar scope.

USAASO sez:

· *Avoid known severe weather.* There is no doubt that all thunderstorms are potentially dangerous and should be avoided if possible and penetrated only when there is *no other choice.* The best place to start thinking of the possibility of the famous 180 is before you leave the flight planning table.

· *Report.* Forward reports of any severe weather activity ASAP giving nature, location, route, altitude and intensity (review FAR 91.125 PIREPs).

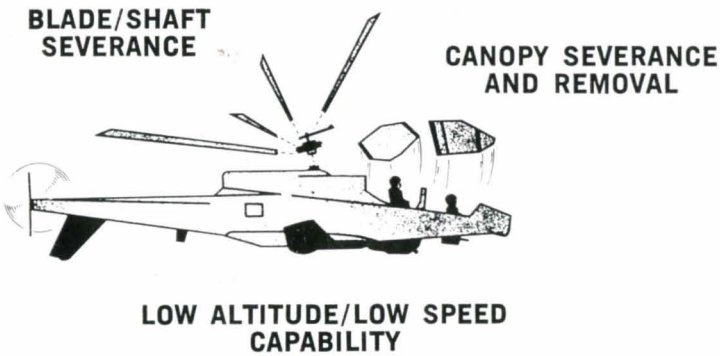
· *Initiate requests* for route deviations early enough for controller and you to plan actions. Include route and altitude you desire.

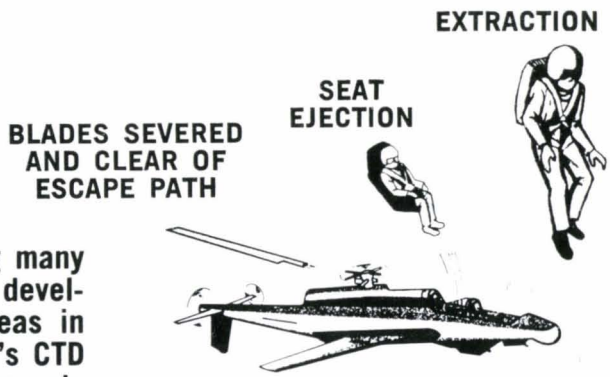
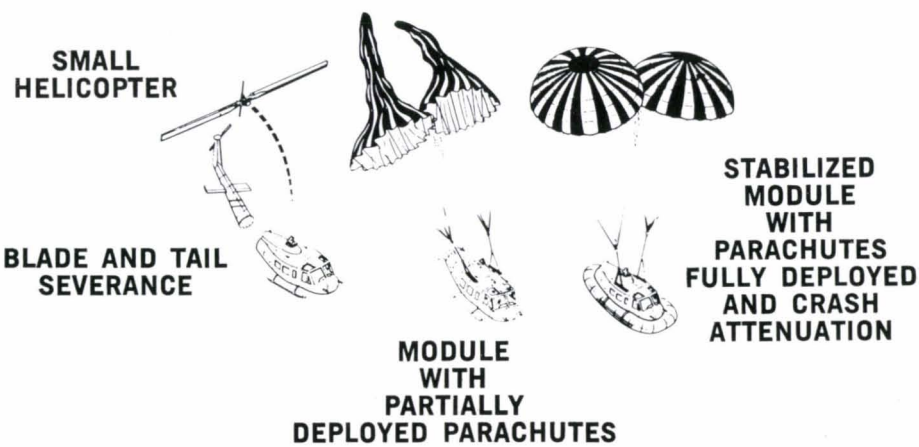
· *Adjust speed* as necessary in the event of penetration to maintain control and lessen airframe stress and advise ATC if required. *Know your dash 10.*

· *Do not rely* on ATC to provide information or initiate radar vectors around weather, particularly for arrival/departure routes and holding patterns in terminal areas.

· *Plan ahead.* Anticipate the need for avoiding areas of known severe weather. If necessary, delay takeoff or landing.

· *Know all limitations* and keep in mind that "pride goeth before something or other."





Helicopter escape systems are among many high priority items the Army has has been developing. This with many others are areas in which the U. S. Army Aviation School's CTD has newly acquired missions. See "Concepts And Materiel And CTD" beginning on page 5