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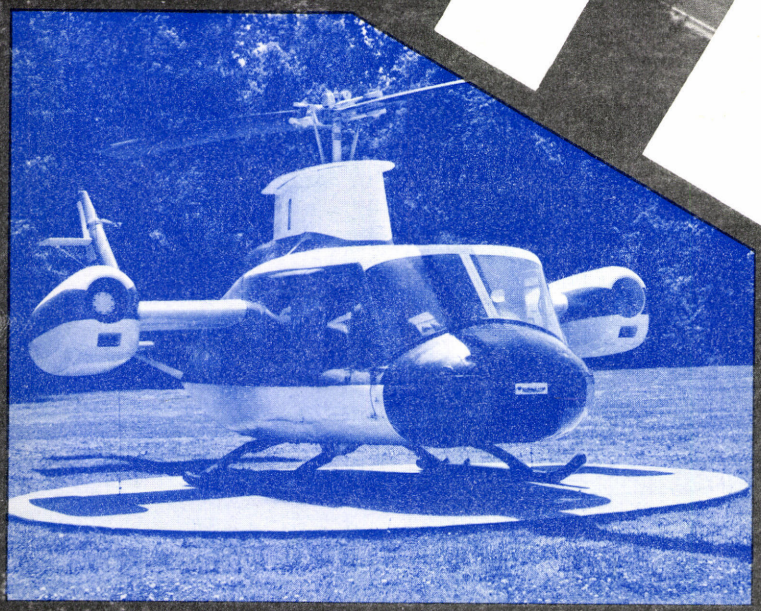
AVIATION DIGEST

ATL

APPLIED TECHNOLOGY LABORATORY



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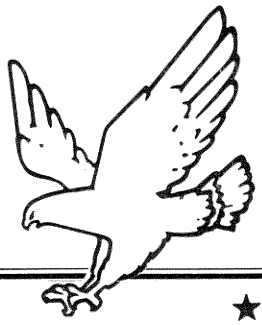

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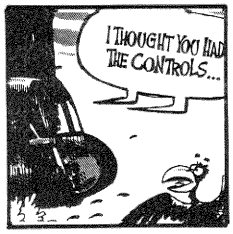
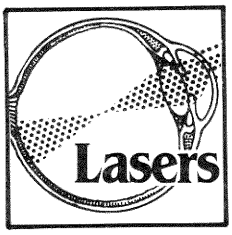


page 10



page 22

page 36

2 **Applied Technology Laboratory,** COL Emmett F. Knight
10 **Communication,** MAJ Craig E. Geis
17 **Hangar Talk: Aviation Life Support Equipment,** MSG Jackson J. R. Ooten
18 **The Odds Are on the Thunderstorm**
20 **PEARL'S**
22 **Laser Safety Hazards,** Mr. John Hogan
26 **Threat: Laser,** CPT (P) Dale L. Radtke
28 **Consolidated Glossary**
29 **Aviation Personnel Notes**
30 **Reporting Final**
32 **DES Report To The Field: Checklists**
34 **Maintenance Test Flight Standardization,** CPT Steven L. Ochsner
36 **Sustained Combat Operations,** CPT Mike Ryan
42 **Views From Readers**
44 **1983 Worldwide Aviation Logistics Conference,** COL Thomas M. Walker

Inside Back Cover: **ATC Action Line: Helicopters and the National Airspace Review,** CW4 Peter C. McHugh

Back Cover: **Annual Writing Awards**

Cover: **View of the ATL whose purpose is to conduct exploratory and advanced research to both improve current aircraft/systems and create those of the future (see page 2). Photograph by SP4 Ronald Bowman.**

page 44

Honorable John O. Marsh Jr.
Secretary of the Army

Richard K. Tierney
Editor

The mission of the *U.S. Army Aviation Digest (USPS 415-350)* is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

The *Digest* is an official Department of the Army periodical published monthly under the supervision of the Commanding General, U.S. Army Aviation Center. Views expressed herein are not necessarily those of the Department of the Army nor the U.S. Army Aviation Center. Photos are U.S. Army unless otherwise specified. Use of the masculine pronoun is intended to include both genders unless otherwise stated. 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,* P.O. Drawer P, Fort Rucker, AL 36362. Manuscripts returned upon request.

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ATL, which you may remember as AVLABS, or TRECOM, has been around since 1944, working to improve the Army's combat effectiveness. In this month's feature article, Colonel Emmett F. Knight, the Applied Technology Laboratory commander, tells us how ATL has had a hand in virtually all aircraft developments ranging from the XV-4, XV-5 and XV-6 of the late 1950s and early 1960s to the UH-60 Black Hawk and AH-64 Apache of today, and to the emerging LHX, or Light Helicopter Family of the 1990s. ATL's R&D program is far too broad to cover in one article, but Colonel Knight ably describes some of today's more significant programs underway at this U.S. Army Aviation Research and Development Command agency.

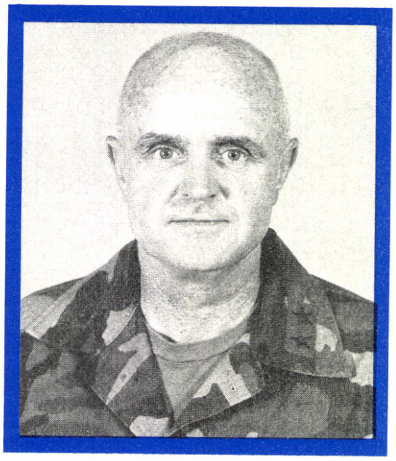
Captain Mike Ryan, in his article "Sustained Combat Operations," discusses another aspect of combat effectiveness. He describes an Army study which indicates that current staffing of aviation units is "insufficient to realize their full potential during sustained combat operations." In his article he tells us one potential way to overcome this problem with the establishment of "sustainment battalions" together with a plan that would provide for increased aviator staffing to support mobilization.

One of the latest efforts to improve combat effectiveness is the development of laser technology for application on the battlefield. But, laser use can be potentially hazardous to individuals. Mr. John Hogan's article, "Laser Safety Hazards," describes laser safety procedures and warns that suitable laser goggles must be worn if there is danger of exposure.

A companion article entitled "Laser" appears in the Threat section. Captain (P) Dale L. Radtke describes potential uses of the laser as a weapon. Captain Radtke writes that instead of large explosions, laser weapons could blind the enemy or ignite clothing, wires, Plexiglas, etc. He adds that the laser can greatly increase the probability of first-round hit capabilities for tanks, helicopters and artillery when used in conjunction with target acquisition and engagement.

Our efforts to improve combat effectiveness will be useless if we allow accidents to deplete the force. One quick way to obtain "an immediate reduction in the accident rate" is to improve communication among crewmembers, writes Major Craig E. Geis in his article, "Communication." Major Geis lists six accidents in which a lack of communication was a common cause factor. The sin of omission—failing to speak up about potential problem areas—is a serious problem. The author recommends solving this through training programs at Ft. Rucker as well as Armywide.

This issue is replete with superb articles reflecting how we strive for excellence both in combat effectiveness and in our endeavors to be Accident Free In '83. I recommend you read it, cover-to-cover.



Major General Bobby J. Maddox
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ATL APPLIED TECHNOLOGY LABORATORY

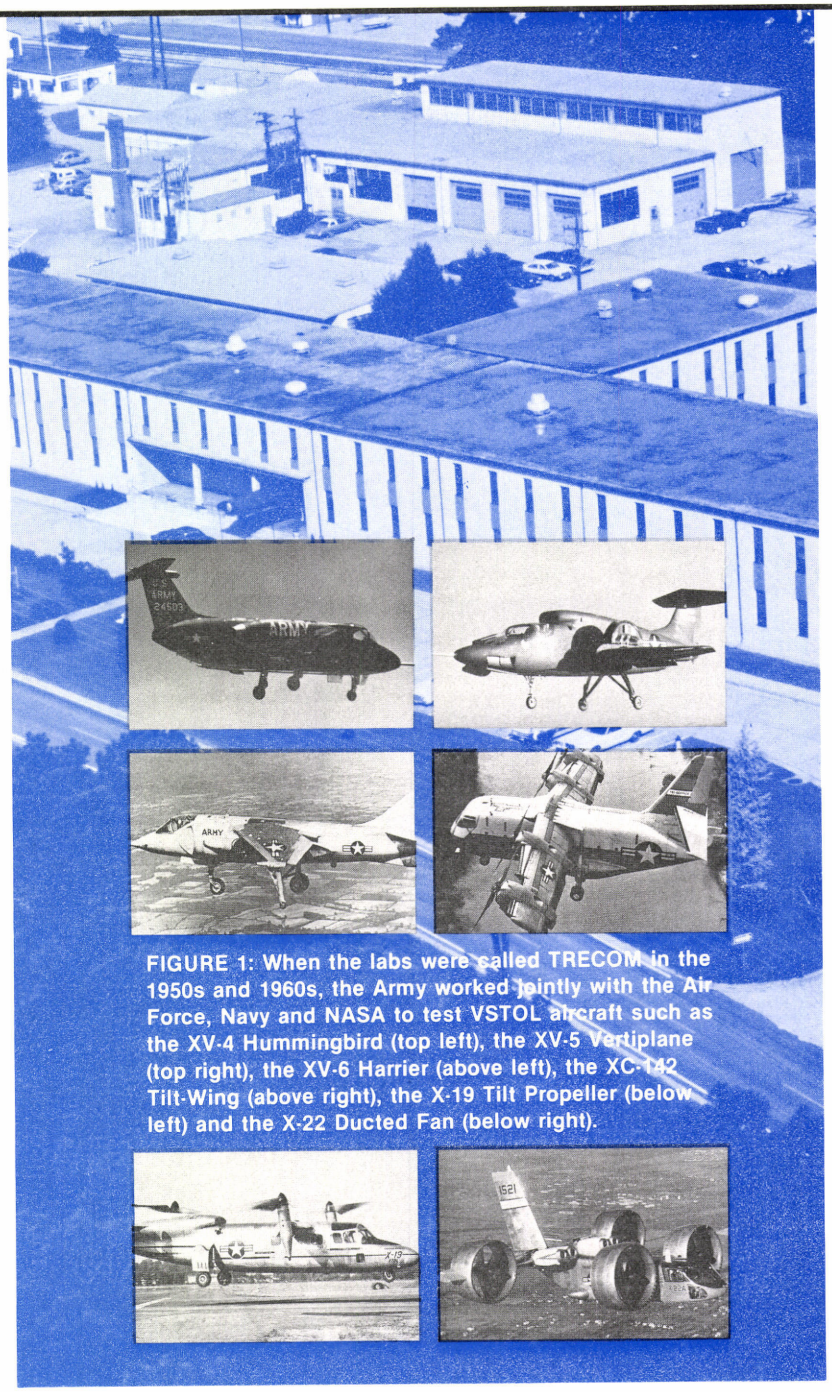


FIGURE 1: When the labs were called TRECOM in the 1950s and 1960s, the Army worked jointly with the Air Force, Navy and NASA to test VSTOL aircraft such as the XV-4 Hummingbird (top left), the XV-5 Vertiplane (top right), the XV-6 Harrier (above left), the XC-142 Tilt-Wing (above right), the X-19 Tilt Propeller (below left) and the X-22 Ducted Fan (below right).

TRECOM, AVLABS, Eustis Directorate, regardless of the name, today's modern Army aircraft with all their associated capabilities, inherent reliability and safety features can trace some major roots to the U.S. Army Aviation Research and Development Command's Applied Technology Laboratory located at Ft. Eustis, VA. ATL is one of four laboratories of the U.S. Army Research and Technology Laboratories and is responsible for conducting exploratory and advanced development programs leading toward the introduction of tomorrow's advanced aeronautical systems into Army inventory.

The original mission of the laboratory included research and development of all modes of transportation when the Transportation Corps Board was established at Ft. Monroe, VA, in 1944. As aviation expanded into its current role within the Army and the aviation R&D mission evolved, the other modes were transferred to allow concentration in this important area. The laboratory also evolved through successive redesignations until now ATL's mission is specifically directed toward R&D in support of Army Aviation. The commitment at ATL focuses on improvement programs for the current fleet, on advancing technology in a wide range of technical areas and on building a foundation of knowledge and technical know-how from which future military aircraft systems and

CONSOLIDATED GLOSSARY—Page 28

CROSSROADS OF HELICOPTER RESEARCH AND DEVELOPMENT

Colonel Emmett F. Knight
Director
Applied Technology Laboratory
Fort Eustis, VA

equipment can be created.

During the 1950s and 1960s conceptual and experimental aircraft activities were conducted unilaterally and jointly with the U.S. Air Force, U.S. Navy and the National Aeronautics and Space Administration. The organization was then called TRECOM and was primarily engaged in research and demonstration of high speed vertical/short takeoff and landing configurations (figure 1) suitable for potential surveillance and target acquisition missions. Significant work was conducted on the XV-4 Hummingbird, XV-5 Vertiplane and XV-6 Harrier, in addition to triservice transports XC-142 Tilt-Wing, X-19 Tilt Propeller and X-22 Ducted Fan Research Aircraft. During the same period, improved helicopter features were being developed. These included crashworthy fuel systems, elastomeric bearings, cargo handling improvements, and engine and drive train components.

With the Air Force/Army fixed wing/rotary wing decision of 1966, the R&D activity shifted to investigate high performance rotary wing configurations with experimental helicopters being flown to record speeds. Research vehicles included the XH-51 Compound Research Helicopter, HPH (UH-1) High Performance Helicopter, S-61F Compound Research Helicopter and the UH-2 Compound Utility Helicopter (figure 2). These activities led to major involvement in the concept formulation and technology development for the 220-knot, 2g, AH-56 Cheyenne advanced gunship (figure 3). Research aircraft concepts aimed at 250 to 300 + knots were developed under the Composite Aircraft Program. (The CAP considered composite configurations for high speed rotary wing aircraft—stopped rotor, stopped-stowed rotor and tilt rotor. The composite referred to low and

FIGURE 2: The XH-51 Compound Research Helicopter in flight test to explore high speed and improved performance hovers at Oxnard, CA, during 1966. An earlier model of this aircraft is now in the Army Aviation Museum at Ft. Rucker, AL.

FIGURE 3: Eleven AH-56 Cheyenne Compound Helicopters were produced by Lockheed for the Army.This advanced gunship flew at 215 knots in level flight, 245 knots in a dive, and demonstrated high maneuverability and excellent first-hit accuracy with its weapons systems. One of these "prototypes" can be seen at the Ft. Rucker Aviation Museum or the Transportation Museum at Ft. Eustis, VA.

high speed capability in one aircraft and should not be confused with the Advanced Composite Airframe Program.) These efforts are as relevant now as then in providing a foundation for major increases in rotorcraft productivity and response.

In 1965, TRECOM became the Aviation Materiel Laboratories and was busy establishing the technology base for the UH-60 Black Hawk (then called UTTAS) and for the AH-64 Apache. The earliest work on the UTTAS was a series of preliminary design studies conducted at AVLABS in the 1967 to 1970 timeframe. These studies were done for the UTTAS project manager office and the U.S. Army Combat Development Command, and they covered a wide range of performance options. The result of this preliminary design effort was the performance specification for the UTTAS.

Maneuverability studies also were conducted in this timeframe with the result being the maneuver requirement which enhances Black Hawk and Apache capability for nap-of-the-earth flight. In addition, in 1967 the 1,500 horsepower Demonstrator Engine Program was initiated by AVLABS. This led to the T-700 engine which powers both the Black Hawk and the Apache as well as the Navy's Seahawk and the Air Force's Nighthawk. The reliability and maintainability requirements for the Black Hawk and Apache were based on analyses and studies relative to design features and test requirements necessary to ensure that these helicopters would have the desired reliability, availability, maintainability attributes. Specification requirements related to crash survivability, vulnerability reduction and signature reduction were all based on R&D efforts conducted at AVLABS.

Numerous reports on design techniques for increased RAM, safety, survivability and vulnerability attributes were provided to the contractors and to other government engineers. In addition, several reports on special materiel properties were available to Sikorsky and government engineers to aid them in designing and evaluating the structural aspects of the Black Hawk and Apache.

In 1970, AVLABS became the Eustis Directorate of the U.S. Army Air Mobility Research and Development Laboratories. This was a result of Aviation Systems Command's effort to increase its aviation R&D capability by expanding the Army Aeromechanics Research Laboratories colocated at NASA Ames Research Center, CA, and by establishing the Structures and Propulsion Laboratories at Langley and Lewis Research Centers. In the 1970s the Eustis directorate served as program technical manager to the heavy lift helicopter project manager in development of the rotors, drive train, cargo hoist and flight controls for the HLH and development of the XT-701 engine (figure 4). In addition, experimental blades and fuselage components were fabricated from composite materials and flight tested. Small gas turbine engine technology development was pursued in the 300 to 800 HP category. Also, developments in crashworthy seats and restraints, improved ballistic damage tolerance concepts, as well as the Aquilla remotely piloted vehicle advanced development program were conducted during this period.

The 1980s brought another name change—ATL—and the initiation of the major advanced development programs which have become the technology foundation for the new conceptual Light Helicopter Family. These programs will also contribute technology advancements for the Joint Services Advanced Rotary Wing Aircraft Development Program and block improvement programs for currently fielded helicopters. The Advanced Technology Demonstrator Engine, Advanced Composite Airframe Program, Advanced Digital Optical Control System and Integrated Technology Rotor are advanced development demonstration programs which have been covered recently in this publication and others. They are cornerstone programs at ATL. Aviation weaponization technology development responsibilities as well as engineering development responsibility for common ground support equipment were also assigned to ATL during this period.

Organizationally, two technical divisions (which include seven technical areas), two support divisions, a contracting division and an Office of Counsel make up the laboratory's team which operates with a complement of about 335 civilian and military people. Two-thirds of these are engineers, technicians and other professionals directly associated with research activities. The laboratory is organized to handle a large, varied and continuous workload while maintaining a wide degree of flexibility to assure an ability to meet unprogramed or "crash" projects. A significant in-house capability exists for structural and ballistics testing (figure 5). Facilities are also available for a number of additional aeronautical and systems investigations.

photo courtesy of Boeing Vertol

FIGURE 4: The XCH-62 Heavy Lift Helicopter stands on the ramp at the Boeing Vertol plant, [illegible] beside a CH-47. The XCH-62 development was terminated in 1975. Current Army interest indicates [illegible] possible flight demonstration may be completed in the next few years.

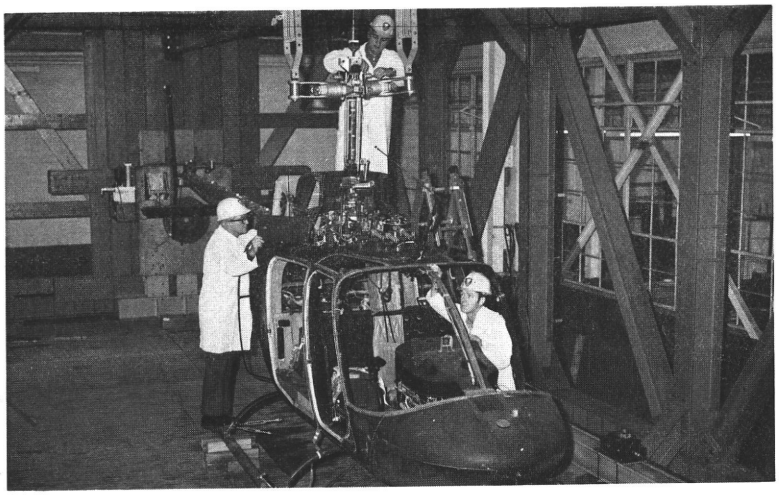


photo by SP4 Ronald Bowman

FIGURE 5: An OH-58 is being mounted and instrumented to undergo a model analysis test to check out software developed to conduct airframe structural modifications and to develop flight hub loads to be used for ground flying, i.e., full-scale aircraft fatigue testing. The test fixture or "backstop" is capable of suspending complete helicopter systems up to Black Hawk size and accommodate eight phase-related loads that can be applied on the aircraft simultaneously. It also can accommodate large structures for static testing.

The ATL mission requires a close working relationship with the military planner and user. ATL strives to define the potential of developing technologies so that future capabilities can be anticipated and assimilated into the requirement process. In addition, a significant amount of technical support is provided to Army project managers and other government development organizations. The mission of the laboratory is accomplished through in-house studies and projects, joint programs, and coordination with other government agencies, as well as contractual arrangements with aerospace industrial firms, colleges and universities.

The program at ATL covers too broad a range for full explanation in this article. However, to provide a flavor of ongoing activities, here are some of the major programs being conducted:

ATL The purpose of the Advanced Digital/Optical Control System program is to demonstrate the advantages of a helicopter flight control system designed to be survivable in the battlefield environment with enhanced mission performance provided by decreased pilot workload and improved handling qualities. ADOCS consists of a digital/optical component development phase and a control system flight demonstrator phase. Twelve contracts for various hardware and design studies, awarded to nine different contractors, were essentially completed in 1982. The flight demonstrator phase, initiated with Boeing Vertol in November 1981, will use component technology to develop next-generation hardware. This will be mechanized in a redundant configuration to demonstrate and verify the battlefield compatibility and improved mission performance predicted. During 1982 the preliminary design phase of the program was completed and detail system design and hardware fabrication were initiated. The first flight of the ADOCS demonstrator is planned for 1984.

ATL The No Tail Rotor program was conducted by Hughes Helicopters Company to demonstrate the capability of the concept of flying a single rotor helicopter with antitorque and directional control devices other than a tail rotor (figure 6). The NOTAR system is comprised of a circulation control tail boom, a direct jet thruster and a vertical fin. A 19-hour flight test program investigated the concept in hover, forward, sideward and rearward flight; during steady and transient maneuvers; and in autorotation to power recovery. The NOTAR showed improvements over the standard OH-6A in hover and sideward flight, with lower cockpit vibration and lower noise levels. ATL and the contractor are continuing investigation of this promising method of eliminating the tail rotor in future applications.

ATL An advanced oil debris discrimination and filtration system has been developed which extends component life, permits full implementation of on-condition maintenance and provides a quantum improvement in operational readiness. See April issue of the *Aviation Digest,* page 2, "Army Aviation Lube Systems," for complete details. The system has been proposed for incorporation into all Army UH-1 and AH-1 helicopters. It also has immediate potential for broad application to turbine engines and drive systems in all other helicopters, fixed wing aircraft and turbine-powered surface vehicles.

ATL In an effort to improve the battlefield survivability of the AH-1S Cobra helicopter, a Survivability and Vulnerability Improvement Modification contractual program has been initiated (figure 7). This program will eliminate the threat of fuel fires due to small highly explosive incendiary ballistic impacts by incorporating a fuel fire suppression system. The fuel fire suppression system includes treatment for the dry bay areas around the fuel tanks as well as protection for the fuel and remaining space within the tank. To allow for in-

photo courtesy of Hughes Helicopters

FIGURE 6: NOTAR—an OH-6A hovers at the Hughes Helicopter's Palomar, CA, facility to demonstrate no tail rotor flight. Work is sponsored by the Army Concept Team and the Defense Advanced Research Projects Agency to explore the feasibility of a single rotor helicopter directional control system other than a conventional tail rotor. This is accomplished with a hybrid system of a circulation control tailboom and a direct jet exit system.

tegration of the fuel fire suppression system with no increase in weight to the aircraft, two additional concurrent tasks were conducted. The first task would replace the current armored crew seats with lighter weight, crashworthy, armored crew seats. The second task will redesign the engine armor to provide nearly equal protection at less weight. Prior design efforts confirmed that the modifications could be applied to the AH-1S helicopter without a weight increase and would significantly increase the overall combat survivability. The objective of the program is to conduct the advanced development phase of the SAVIM program for subsequent engineering development and timely integration into an AH-1S block improvement program.

ATL Advancements in gas turbine engine technology have multiple impacts on helicopter acquisition, operational cost, improvements in capability, improvements in performance, reductions in maintenance man-hour per flight hour and improvements in survivability. The Army continues to be a leader in advancing rotary wing aircraft propulsion technology. ATL recently initiated a new Modern Technology Demonstrator Engine program which offers a significant benefit for current and future Army, Navy and Air Force aircraft. This advanced engine has been identified as the prime power plant for the triservice JVX aircraft program (figure 8). The engine will provide a fuel cost savings of more than $500 million allotted over the lifespan of the JVX fleet and similar savings can be expected if the engine is applied to the Army CH-47 fleet.

The MTDE is ATL's third major turboshaft technology demon-

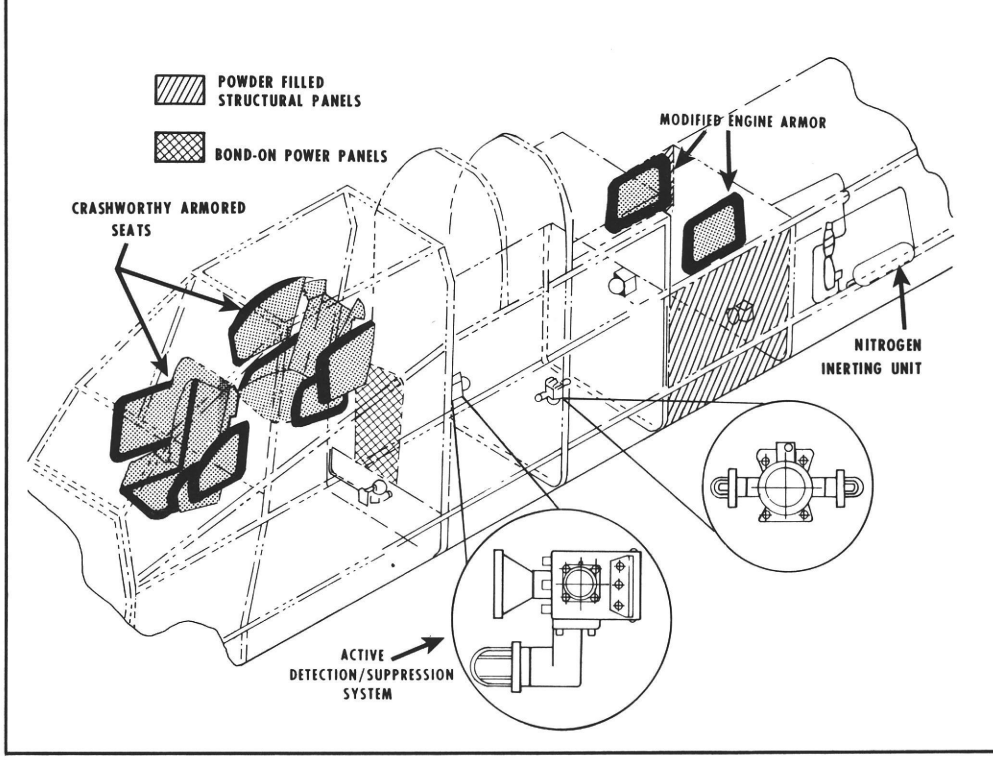


FIGURE 7, AH-1S improvement: The Survivability and Vulnerability Improvement Modification program.

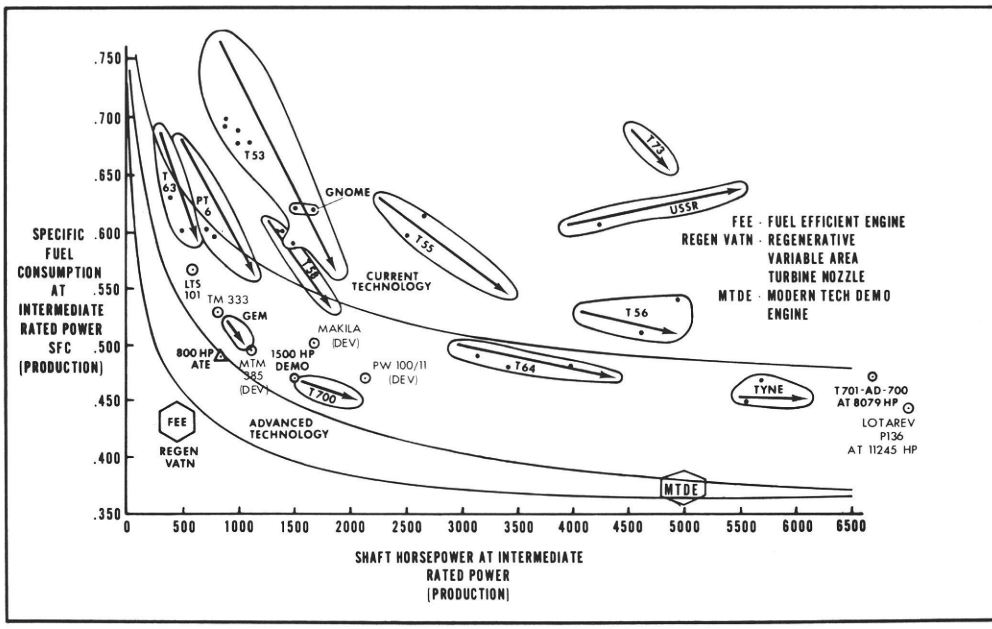


FIGURE 8: Turboshaft Engine Performance: The current engine technology that is being used by the Army and other DOD agencies is represented by the upper line or group of engines, i.e., the T63, T53, T58, T55, T64, etc. Through the use of advanced technology, represented by the lower band shown on the figure, significant improvements in fuel economy can be realized. This technology has already been demonstrated in the 800 shaft horsepower size in the Army's ATDE program. The Army has just initiated the contractual phase of the MTDE program to demonstrate the technology in the 5,000 to 6,000 shaft horsepower size. The T700 engine which is now entering the inventory and represents the latest production technology in turboshaft engines, is above the advanced technology band.

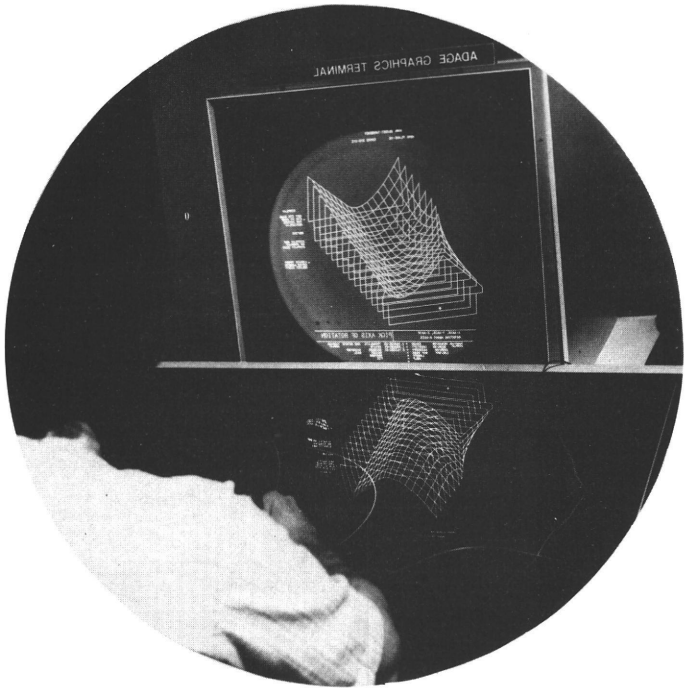


FIGURE 9: Computer aided design/computer aided manufacture has proven to be an unanticipated benefit of the ACAP.

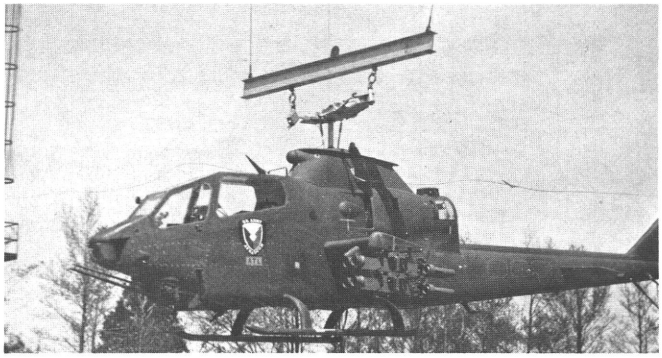


photo by SP4 Ronald Bowman

FIGURE 10: The upper cutter, one of four components of the WSPS installed on an AH-1S Cobra helicopter, severs a 3/8-inch steel, seven-strand cable during tests conducted by AVRADCOM's ATL. The tests of the AH-1S Cobra WSPS were conducted at the Impact Dynamics Test Facility, NASA-Langley Research Center, Hampton, VA.

strator effort and was preceded by the 1,500 HP Demonstrator Engine program (which provided the basis for the T-700 engine development) and the 800 HP Advanced Development Technology Engine program which is providing the basis for an LHX-size engine. The engines resulting from these technology demonstrator programs will undoubtedly receive widespread commercial applications including foreign military sales.

ATL continues to lead an ambitious R&D program to demonstrate the major advantages and benefits of composite materials and advanced structural concepts for helicopter airframe components. The primary goal of the ACAP is to reduce airframe production costs and airframe weight while improving crashworthiness, ballistic tolerance, electrical/electronic compatibility, reliability and maintainability and improve other military characteristics. Design support tests have been performed on all critical areas of the airframe structure, to include coupons, panels, subelement and subassembly tests of the materials, design concepts, joints and attachments. All qualitative goals and requirements of the ACAP have been met or exceeded during the detailed design and support testing phase (figure 9). The contracts with Bell Helicopter Textron and Sikorsky remain within cost and schedule targets. The first flight of the ACAP is planned during 1984.

ATL participated in the design and conducted qualification tests of the Wire Strike Protection Systems on OH-58, UH-1 and AH-1 aircraft (figure 10). Qualification tests on the OH-6 are currently underway, and similar tests for the UH-60A are scheduled in the spring of 1984. Successful cuts of 3/8-inch steel cable have verified the performance and structural integrity of the system. The Mexican Government has experienced at least three known incidents of actual wire strikes involving Jet

Ranger equipped with WSPS. All resulted in successful cuts of 1/2-inch steel cable. This modification holds great promise in eliminating a major cause of fatalities in Army aircraft accidents.

ATL The Integrated Technology Rotor/Flight Research Rotor Project is a joint undertaking of the AVRADCOM's Research and Technology Laboratories and NASA. Joint project responsibility rests with ATL, the Aeromechanics Laboratory and NASA at Ames Research Center. The objective of this program is to demonstrate a significant advance in rotor systems technology through the integration of rotor design, aerodynamics, structures and materials, and dynamics and acoustics. The program will demonstrate that life cycle costs can be reduced; that reliability, maintainability and survivability can be enhanced; that performance characteristics such as rotor lift over drag, fuel consumption, high speed maneuverability, agility and handling qualities can be improved; and that rotor weight, rotor noise and vibratory loads can be reduced. The concept definition phase of the program has been successfully completed and preliminary designs are about to begin. The ITR program also will provide NASA with an advanced flight research rotor, fully instrumented, having the capability for significant variation in selected rotor properties for future research programs.

ATL ATL in 1977 initiated a combat maintenance program which is beginning to produce useful products in a number of areas. The program is keyed to the concept that maintenance during midintensity combat operations must be tailored to the situation at hand. Criteria for maximum deferral of routine scheduled and unscheduled maintenance are being developed to provide maintenance and operation officers the flexibility of responding to an unusually high flying hour program for short periods of time.

Practical concepts for performing combat damage assessments also are being developed along with quick, effective field repair techniques that can get an aircraft safely back into the air for limited periods.

One concept showing particular promise is the use of shape memory alloys to perform field repairs on fluid lines, flight control linkages and drive shafts. Concepts for carrying out rapid repair of electrical wiring and conducting extensive cannibalization of combat damaged aircraft also are being developed. Action is underway to use portions of the ATL combat maintenance program to support a U.S. Army Materiel Development and Readiness Command directed initiative to develop improved procedures and guidance for maintenance and repair of Army equipment during combat.

ATL In 1979, the Army's aviation weaponization responsibility was assigned to ATL. Among the first programs conducted under this new management was the field test in 1979 of a Hughes 500D helicopter equipped with a mast-mounted sight. The following year similar tests were conducted using an MMS-equipped Bell OH-58C developed in a joint AVRADCOM/ARRADCOM program and an MMS-equipped UH-1H. The test results contributed to the establishment of requirements for the Army Helicopter Improvement Program/Near Term Scout Helicopter, now in engineering development. The utility of the electro-optical sensors in the MMS and other such systems on Army helicopters will be further enhanced through joint advanced development programs being pursued by ATL in cooperation with the Night Vision/Electro-Optical Laboratory. These and other programs will greatly reduce the time required to detect, classify and prioritize targets in the sensors' field of view—further reducing the exposure time of the helicopter and thereby increasing its survivability.

As the 1980s close, LHX and JVX engineering development activities will be using technology brought to credibility through AVRADCOM advanced programs. Future emphasis can be projected toward increased aircraft productivity, integration of functions to improve reliability and reduce cost and increase combat effectiveness with mission systems. The work being accomplished today at ATL runs the gamut from advanced technology engines to battlefield protection concepts, from smarter weapons to composite structures. A major thrust involves investigation of methods to manufacture, support and operate these new technologies economically. Programs underway or envisioned encompass a basic premise common to all: To achieve substantially improved military characteristics and performance by applying advanced technology while striving for reduced weights, costs and complexity, and to do this in consonance with user requirements.

COMMUNICATION

Effective communication and crew coordination within the cockpit are as important as learning the technical aspects of flying.

Major Craig E. Geis

ANOTHER YEAR has passed in which the inflation rate climbed, unemployment hovered around 10 percent, our pay raise was held at 4 percent, cost of living continued to spiral and Army Aviation posted its highest accident rate ever. The 86 individuals who died in 1982 Army Aviation mishaps would welcome the opportunity to face these problems anew today.

Instead, the rest of us are still faced with the ever nagging question, "What can we do to decrease the number of accidents?" We continue to study each accident to determine what happened, what caused it and what we can do about it in the future. This is a worthy approach as long as we can achieve our objective of reducing the number of accidents. The realization, though, is that as hard as we investigate, educate and regulate, the objective just slips away. Realizing that

CONSOLIDATED GLOSSARY—Page 28

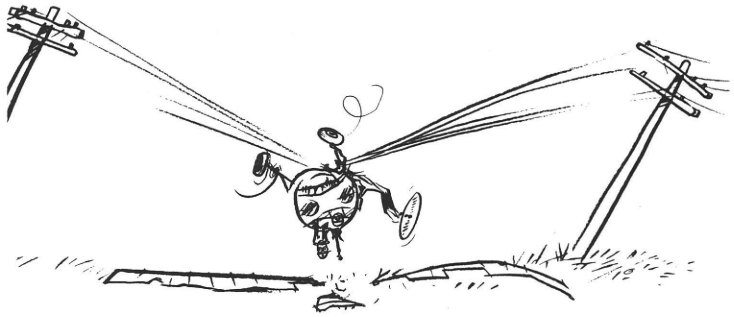
accidents consist of a multitude of contributing factors, this article focuses on one area that can produce an immediate reduction in the accident rate. Effective communication—the elusive key needed to begin to unlock the mystery of aviation accidents.

One essential component of teamwork in the cockpit is good communications flow. Studies have shown that some of the key factors involved in this process include leadership style, group dynamics, emotional makeup, problem analysis and decision-making style. But it is communication, or information flow, that effectively integrates all the other factors. Commercial airline studies have furthermore shown that we need to develop pilots who have the ability to exercise authority without ambiguity, who are at the same time sensitive to the cockpit workloads of other crewmembers, are able to delegate appropriate tasks and are supposed to do all of these things by communicating intent within the cockpit to the copilot, crewchief or observer. How effective we are in relaying intent will, to a great extent, determine cockpit performance and error rate. Whether our communications are clear or ambiguous plays an important role in cockpit performance.

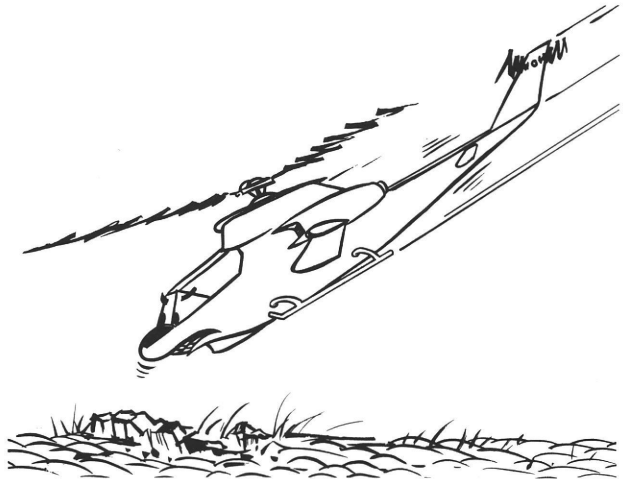
Factors that influence cockpit communications.

We also need to examine the relationship between communication and human error. The National Aeronautics and Space Administration's Aviation Safety Reporting System showed that human error was the primary cause of 70 percent of all civil aviation incidents during a recent 5-year period. The Army identified pilot error in 80 percent of their aviation accidents from 1958 through 1972. The error was usually manifested by interpersonal problems in the improper transfer of information between crewmembers, or no transfer at all! Sixty civil pilot-error accidents studied were caused by a variety of interpersonal problems, including: preoccupation with minor mechanical problems, inadequate leadership, failure to set priorities, inadequate monitoring, failure to use available data and failure to communicate intent.

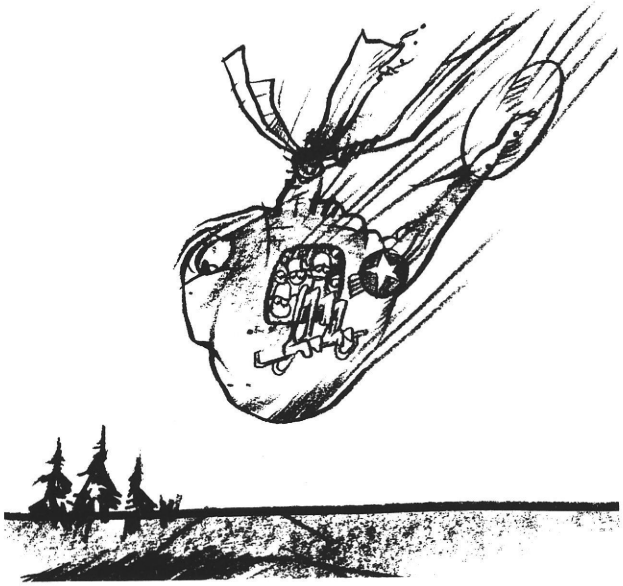
The following accidents analyzed by the author show that communication problems similar to civil incidents are also experienced in Army Aviation:



☐ A UH-1H pilot on a terrain flight navigation training mission experienced a right fuel boost segment light and master caution light. The pilot was descending the side of a hill when this occurred, and it caused him to concentrate on the inside of the aircraft rather than the outside. Neither the pilot nor the copilot was looking outside when the aircraft struck wires and crashed. *What instructions did the pilot communicate to the copilot after experiencing the emergency situation? What information did the copilot communicate to the pilot in terms of the assistance he could offer?*



☐ A TH-1G instructor pilot was assigned to fly an aircraft with a known unreliable fuel quantity indicator (during the previous 30 days it had been written up as unreliable 7 times). The maintenance officer released the aircraft for flight. The IP relied upon the inaccurate fuel quantity indicator to continue his checkflight, later fuel exhaustion occurred with an indication of about 780 pounds of fuel. *Why didn't the IP communicate with the maintenance officer as to why the aircraft was released for flight? Why didn't the IP communicate with the student to ensure sufficient fuel quantity checks were made after the decision was made to fly the aircraft? Why didn't the student communicate with the IP regarding the significance of the unreliable fuel quantity indicator?*



☐ A UH-1H instructor pilot failed to compute a weight and balance computation for a day-standardization flight, after making a special effort to complete the flight portion which had been twice before delayed. If computed it would have shown an aft center of gravity. The instructor pilot allowed the pilot to maintain an excessive nose-high deceleration; as a consequence, the tail rotor blades struck the runway. *Why didn't the IP communicate with the student and have him compute a weight and balance? Why didn't the student communicate with the IP and ask to have a weight and balance computed? Assuming time permitted, why didn't the IP communicate with the student about an excessive nose-high deceleration?*

☐ A UH-1H instructor pilot allowed the pilot, after a demonstration and two practice nap-of-the-earth quick-stop maneuvers, to enter a third practice quick-stop at a lower altitude (about 5-foot skid height) and apply incorrect flight control actions. The tail rotor blades struck the ground. *Why didn't the pilot communicate with the copilot regarding the lower altitude of the third practice quick-stop? Why didn't the copilot communicate any concern to the pilot regarding the 5-foot skid height?*

☐ A copilot of a CH-47D exceeded the longitudinal and lateral cyclic limits because he lost composure due to repeated warnings from the flight engineer. The aircraft experienced a forward transmission oil cooler fan failure, which was misinterpreted by the flight engineer as an impending power train failure. *After receiving information from the flight engineer, why didn't the pilot communicate with the copilot regarding an appropriate diagnosis of the problem? Why didn't the pilot communicate further with the flight engineer regarding the symptoms? Why didn't the copilot recognize the concerns of the pilot and communicate his desire to be of assistance?*

☐ A copilot of a UH-1H, during an emergency landing approach with power available, placed the governor switch into the emergency position without the pilot's knowledge while the throttle was in the full on position. The pilot compensated for the overspeed by adding collective and rolling off throttle. However, the copilot returned the governor switch to the auto position at this point, causing further confusion and an accident ensued. *Why didn't the pilot communicate his intent and issue instructions to the copilot during the emergency approach? Why didn't the copilot communicate his intent to place the governor into the emergency position then return it to the auto position?*

It is important to find a common link among the six accidents described. The accident investigation boards listed the causes as divided attention, improper motivation, poor judgment, lack of training, etc. Although these causes include a multitude of factors which must be considered, I believe effective communications is the key integrative factor.

We must begin to analyze the cockpit environment as a management situation in which we freely share information to arrive at an acceptable decision. Throughout our careers in aviation, we continue to emphasize technical instruction in the use of aircraft controls. Very little time is actually spent learning the communication skills which are needed to integrate the various subsystems.

Looking back, now, at the accidents from the perspective of effective communications, imagine the personal thoughts which might have gone on in the minds of the people involved. "I think it may help to switch the governor to emergency." "No need to compute a weight and balance on this one because it's just like all the others." "I ought to ask the IP about the fuel gauge write-up, but *he* must see it." "I don't feel confident doing this maneuver at 5 feet, but the IP is there if a problem develops." "He said it looks like a power train failure, so I better not check for anything else, just get it on the ground." "The student has enough to worry about so I can keep track of our fuel easy enough."

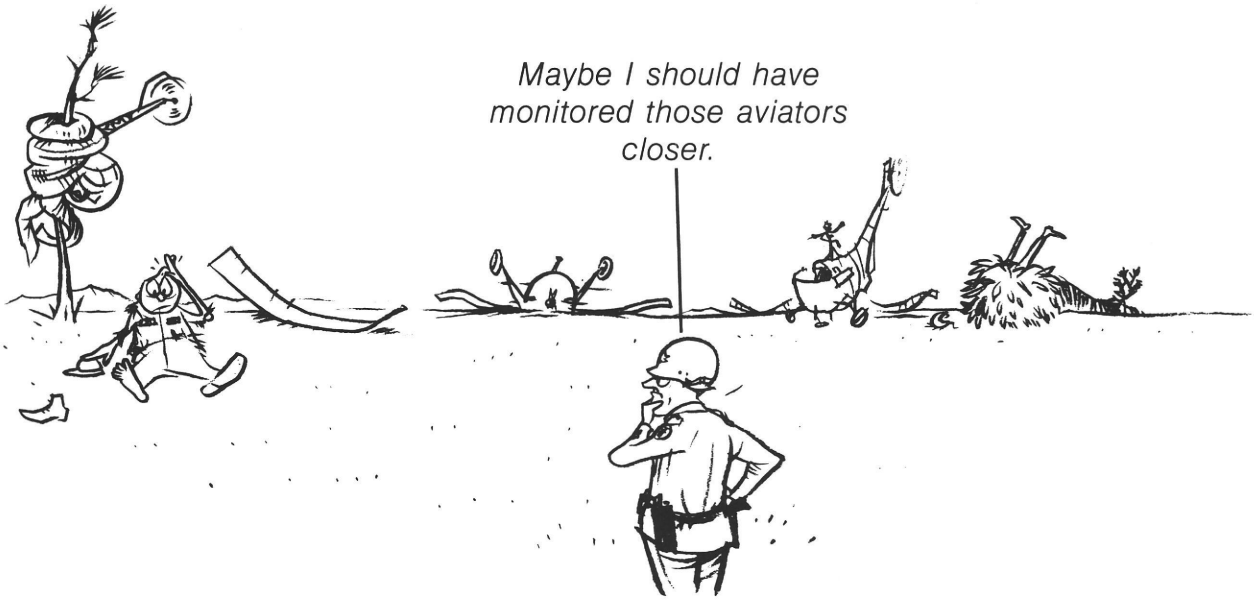
The remedial measures recommended by the accident investigation board include: unit commanders improve monitoring of instructor pilots, inform personnel of problems encountered and remedies via publications, revise procedures for emergencies, improve monitoring of personnel, and pilot in command improve monitoring of copilot activities. In most cases like these, we are talking about one-way downward communication. We must work to ensure that information passes from lower levels upward just as freely as directions come down. We are talking communications flow. We may find a pilot at fault for his actions, but if the crew withheld information or passed it in an unclear manner, they should be equally at fault. We all realize that time is usually a critical factor in most emergencies and some of the questions asked of each accident may not be pertinent. The important thing is that we become aware of the fact that effective communications flow among all crewmembers is essential to safe flight.

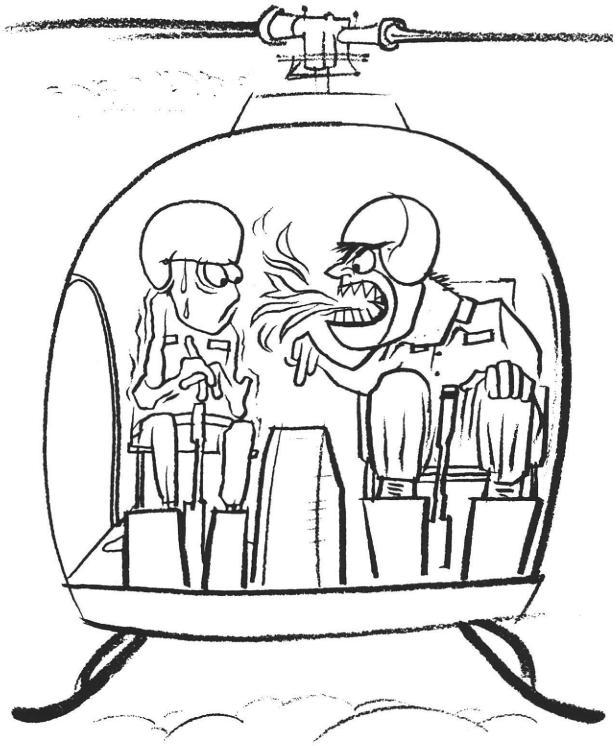
Take a moment now to reflect on your aviation experience and answer these questions:

1. Have you ever been in a situation in the cockpit where you had information which you felt could impact on the safety of the flight?

2. If yes, did you ever *not* relay that information to the other crewmembers?

3. If yes, what was the result of your decision to withhold this information? i.e., accidents, incidents, precautionary landing, near incidents, cockpit confusion (low fuel status, wrong landing zone, missed checkpoints, preflight errors, inadvertent instrument meteorological conditions), etc.





> We must begin to analyze the cockpit environment as a management situation where we freely share information to arrive at an acceptable decision.

4. What do you think was the significant factor leading to your decision not to share the information? i.e., proficiency of other person at the controls, your proficiency, responsibility for the flight, fear of rebuttal, fear you were not correct in your evaluation, inexperience, rank, number of flight hours, what was happening was so obvious you thought anyone could see it, etc.

5. What reasons did you give above that you now consider important enough to bet your life on?

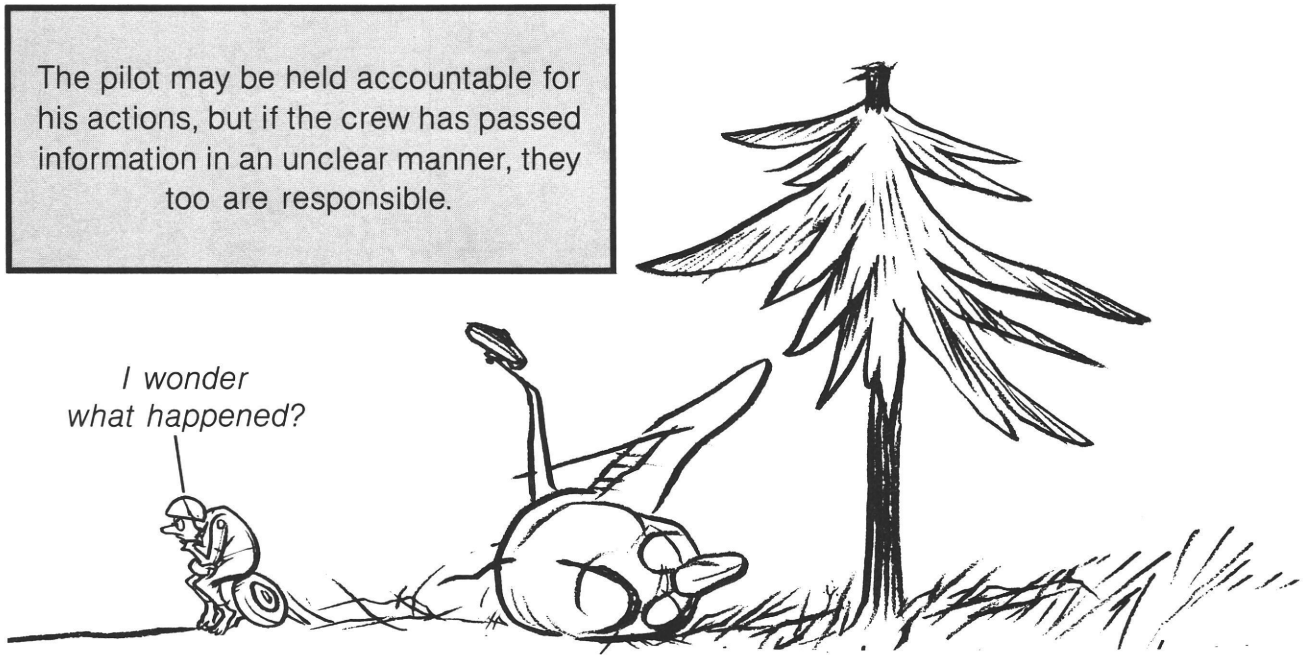
I am certain that poor cockpit communications surfaced somewhere in your answers. A number of factors could contribute to this, among them:

- Decisionmaking in the cockpit cannot be a totally democratic endeavor because of short decision times.
- The trait of assertiveness among pilots far outweighs passivity.
- The military teaches and places a premium on aggressiveness.
- There is a fine line between assertiveness in the cockpit and the perception of mutiny.
- Senior-subordinate relationships may affect communications.
- The emotional make-up of the pilot, copilot and crew will more than likely be different.
- Flying with different crews can change crewmember's relationships to each other.
- The measure of time.
- The individual with less experience may defer decisionmaking to the more experienced member.
- Lack of confidence of any crewmember causes the others to try and do too much themselves.
- Clear lines of authority are usually set.
- High goal orientation or desire for mission accomplishment without consideration for the other crewmembers.

Each of these factors are made up of many parts, but the effective sharing of information among crewmembers is one common link which must be considered in resolving any of these.

Recognizing what is going on within the cockpit is vital to effective two-way communications. The commercial airlines have approached this problem in a number of ways. First, they recognize the need for training in crew communications; second, they do something about it with new employees and seasoned crews. Northwest Airlines has been using line-oriented flight training simulators to improve cockpit communications and decisionmaking. Other airlines send individuals to the Institute of Safety and Systems Management at the University of Southern California which teaches human behavior in the cockpit.

NASA personnel have said that United Airlines has a program in operation now which is far ahead of the rest of the industry. I interviewed Captain Robert Crump of United's pilot training center in Denver and found an exceptional training program in full swing. United's training course is titled "Command, Leadership and Resource Management." The training program is a systematic approach to improving the



transfer of information among all members of the flight crew. It is not intended to be a one-shot approach. It is an integral part of the entire training effort, designed to include all members of the flight crew in every phase of their career. In the program's introduction, Richard Ferris, chairman and chief executive officer UAL, Inc., explained that: "Cockpit management is a team effort and the ultimate measure of success will depend upon the contribution of each crewmember." The captain orchestrates this effort so that each does what has to be done, when it has to be done, and with a knowledge of why it has to be done. In order to make consistently good decisions, you must get input from all members of your team. Although Richard Ferris uses the term "Cockpit Management" in the UAL program, the key lies in the ability of all crewmembers to share information freely.

The first part of the UAL program consists of self-study based on a modification of the Managerial Grid Leadership Theory of Robert Blake and Jane Mouton. Using case studies, the participants analyze the situations to identify problem areas in communication and recommend solutions. Affording the opportunity to work with actual cockpit transcripts, this learning program teaches that awareness is not only "what is going on in the cockpit" but "the most effective way to manage the situation." After completing the self-study course, which takes about 10 hours, a 4-day seminar provides the participants the opportunity to look at how they lead and manage, and to acquire new resource-management skills.

Actually, a number of approaches can be used to address the outcome of improving the exchange of information in the cockpit. The Managerial Grid, Situational Leadership, Vertical Dyad Linkage, Path-Goal and the Contingency Model of Leadership Effectiveness all are beneficial in teaching awareness and communication-transfer skills. It is not my intent to discuss these theories in detail because each theory has its strong points to offer which should be considered. The important thing to remember is that each theory proposes a single most effective leadership style; therefore, a blend may be the best approach. If an individual is in a situation which does not fit the expected model, the tendency is to abandon it. The knowledge that different approaches are available allows a pilot to tailor the situation appropriately.

The question no longer remains, "Do we need a training program?" but "When can we start one?" The method to reduce accidents through an effective training program which will encourage all crewmembers to readily share information is at our fingertips. A training program instituted at the U.S. Army Aviation Center, Ft. Rucker, AL, could be used to train all initial entry aviators and individuals attending follow-on training. This program also could be fielded for Armywide use and integrated into unit safety instruction and aircrew training programs.

Postscript 1983

The mission called for four aircraft to move some personnel from one location to another. A pilot and copilot flew to the pickup zone to make a reconnaissance of the zone and to get a detailed briefing of the mission. After receiving the mission briefing, the crew flew back to their station. They did not do a route reconnaissance on their way back.

Arriving at their station, the pilots briefed the crews of the other aircraft. The map from which the briefing was given had no wire hazards marked along the mission route. There was a known wire hazard at the pickup zone, which was briefed.

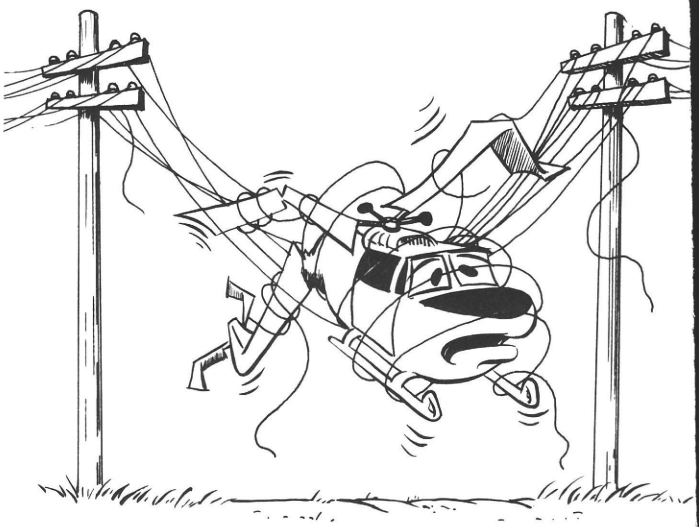
The flight of four helicopters took off and flew along a highway for several miles. The flight then went into a tactical trail formation, flying about 125 feet above the ground and 90 knots indicated airspeed. While flying down a valley, following a stream and a road en route to the pickup zone, the PIC of the lead aircraft, who was navigating, checked his map. The copilot saw a set of wires and flew over them, watching them pass under the aircraft to his right. When the copilot returned his attention to the area in front of the aircraft, he saw more wires in his flight path. He applied aft cyclic, increased collective and yelled "Wire!" over the intercom. The PIC looked up about the same time and saw the wires.

The UH-1 came to rest lying on its left side with the nose and left cockpit door jammed against a tree trunk.

Commentary

The unit was operating in violation of Field Manual 1-51 and its own standing operating procedure. No wire hazard map was maintained in the field operations office, and a route recon was not done before a flight being conducted below the highest terrain feature. Had the pilots who had earlier flown to the pickup zone for the mission briefing made even a cursory inspection of the route on their return to their station, noting only the most significant wire hazards, the wires involved in the accident could have been marked on the operations map and properly briefed. The pilots maintained individual wire hazard maps and informally discussed wires they had seen. Reliance on individually maintained maps and informal discussions does not provide adequate protection from wire strikes.

The 90 knots airspeed was excessive for the altitude being flown, particularly in an area of unknown hazards. The wires had become dark through aging, and the rising vegetation-covered terrain provided a dark background for the wires, making them extremely



difficult to see. The high speed being flown reduced the time available to see and react to the wires.

The copilot focused his attention on the first set of wires that they passed over. When he looked forward again, he did not have enough time to miss the second set of wires. The PIC, who was also the mission commander, did not see the wires because his attention was channelized on his map. Neither pilot saw the poles on which the wires were strung. Only two of the four crews in the flight saw the poles and were aware of the wires.

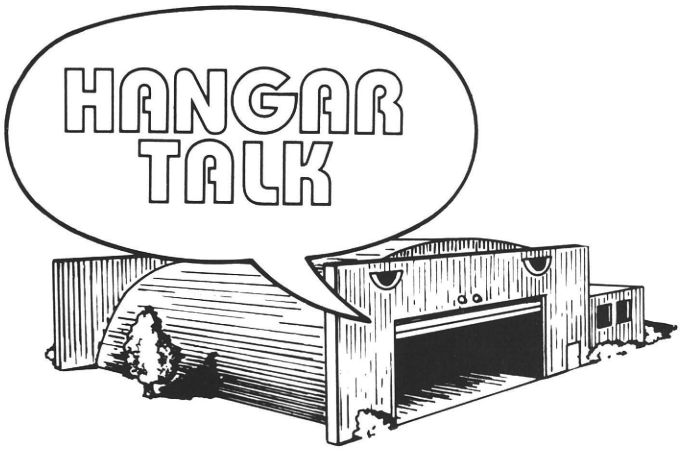
It is now time to test your own awareness and see what could have been done differently in this situation.

- How many individuals had information which had an impact on the flight?
- What information was not relayed to other crewmembers?
- What prevented crewmembers from sharing information they had?

ACCIDENTS LIKE THIS CAN BE PREVENTED THROUGH EFFECTIVE COMMUNICATIONS IN THE COCKPIT.

ABOUT THE AUTHOR

Major Craig E. Geis is chief of the Organizational Effectiveness Division at Ft. Rucker, AL. He received his B.B.A from Long Island University, an M.B.A. in management from Georgia Southern College, Statesboro, GA, and an M.A. in psychology from Austin Peay State University, Clarksville, TN. Major Geis is a graduate of the U.S. Army Command and General Staff College, Ft. Leavenworth, KS, and has commanded an aviation platoon in combat and an aviation company in Korea. He has served as a management analyst at Ft. Campbell, KY, and an assistant professor on the faculty of the Department of Behavorial Science and Leadership at the United States Military Academy, West Point, NY.



"Hangar Talk" is a quiz containing questions based on publications applicable to Army Aviation. The answers are at the bottom of the page. If you did not do well, perhaps you should get out the publication and look it over.

Aviation Life Support Equipment

TM 11-5820-800-12 and TC 1-62

MSG Jackson J. R. Ooten
Directorate of Training and Doctrine
U.S. Army Transportation School
Fort Eustis, VA

1. The AN/PRC 90 radio set is capable of operating in one out of how many modes?
a. 4 c. 2
b. 3 d. 5

2. When in the MCW mode, the AN/PRC 90 will operate on either 243.0 MHz or 282.8 MHz.
a. True b. False

3. Under normal conditions, the antenna of the AN/PRC 90 radio should be pointed directly toward the rescue aircraft.
a. True b. False

4. The AN/PRC 90 is normally used as a beacon transmitter which transmits a continuous "down-going beeper" AM signal for about how many hours?
a. 14 c. 12
b. 24 d. None of the above

5. When operating in temperatures below 50 degrees Fahrenheit, the AN/PRC radio and spare battery should be carried inside flight clothing to prevent cold soaking.
a. True b. False
c. Not important because batteries are stored in refrigerators.

6. The battery enclosure of the AN/PRC 90 should be cleaned with boric acid or vinegar.
a. True b. False

7. The night end of the Mark 13, Mod 0, flare can be identified by:
a. Red plastic cap
b. Protrusions on the plastic cap
c. A washer attached to the night end lanyard
d. All of the above

8. Survival vests containing signal kit, personnel distress, A/P 25S-5A, must be stored in accordance with DOD 5154.45, DOD Ammunition and Explosives Safety Standards.
a. True b. False

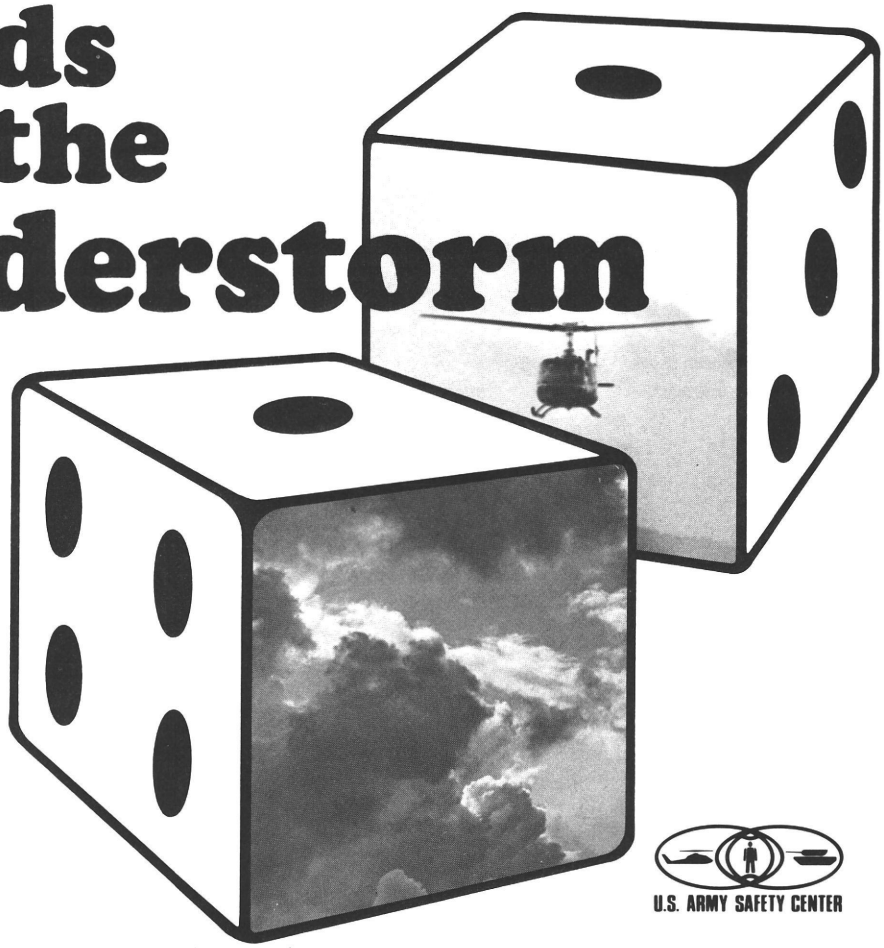
9. When the SRU-21/P survival vest has the survival kit, individual, tropical, installed, it must be safeguarded in accordance with AR 40-61 because:
a. It contains flares
b. It contains a controlled drug
c. It contains classified information
d. None of the above

10. If trioxane fuel (fire starter found in some survival kits) is ingested, which of the following first aid measures must be taken?
a. Induce vomiting, treat for shock, seek medical help
b. Treat mouth area for burns and treat for shock
c. Do not induce vomiting; drink milk, eat bread or any high protein food. Seek medical attention
d. No first aid measures apply; trioxane is nontoxic

Answers:

1. B, TM 11-5820-800-12, para 3-4
2. B, TM 11-5820-800-12, para 3-4
3. B, TM 11-5820-800-12, para 3-5
4. A, TM 11-5820-800-12, para 3-5
5. A, TM 11-5820-800-12, para 4-5
6. A, TM 11-5820-800-12, para 4-5
7. D, TC 1-62, page 36
8. A, TC 1-62, page 22
9. B, TC 1-62, page 27
10. C, TC 1-62, page 35, Warning

The odds are on the Thunderstorm



U.S. ARMY SAFETY CENTER

ON ANY SUMMER DAY there may be as many as 45,000 thunderstorms occurring around the world. The chances that your aircraft will encounter one of these storms are quite good. In the central region of the United States, from the Canadian border to Texas and from the Rockies to the eastern seaboard (with the exception of the Northeast), a thunderstorm will occur on the average of at least once every 3 days during June, July and August. (Thunderstorms are even more frequent in some areas of the Rockies and over the Florida peninsula.) It's easy to see why almost every aviation safety publication you pick up at this time of year contains at least one warning about thunderstorms.

The Army takes a dim view of your gambling an aircraft and the lives of everyone aboard by flying into thunderstorms.

"Aircraft will not be intentionally flown into thunderstorms."

Paragraph 4-2c(3), chapter 4, AR 95-1, "Army Aviation: General Provisions and Flight Regulations," is quite clear on this point. The difficulty is not whether thunderstorms should be avoided but rather how to avoid them.

The National Transportation Safety Board reports that there is an average of 45 to 50 accidents every year—more than half of them fatal—which can be attributed to thunderstorms. Thunderstorms tear wings off of aircraft, bend control surfaces out of shape, shatter windows and silence radios. Preventing this from happening to your aircraft depends to a large extent on you. There are three things which will help you avoid the hazards of thunderstorms.

PREFLIGHT WEATHER BRIEFINGS

It is a command responsibility to provide a weather briefing—it is your responsibility to get it. Unless you want to play "you bet your life" with high winds, shear, turbulence, lightning, downbursts and hail in a thunderstorm, it's a responsibility you won't neglect. Remember, too, the weather forecast you receive before takeoff will be void 1 hour and 30 minutes from the time it is received. Coordination with a weather facility will be required to extend the forecast.

If you are flying a mission from one of the many sites where weather observation and forecasting facilities are inadequate or nonexistent, a forecast can be obtained from a civil or military air weather facility. Depending on weather information from a supported unit may make you a loser. An overeager, mission-minded unit commander may not be the best judge of whether or not a mission should be cancelled because of marginal weather conditions. In one case, an equally eager pilot launched a weather check mission under such marginal conditions. He, his crew and his aircraft were lost. An official weather report from a

trained forecaster/observer was available to him by telephone. He didn't have to gamble.

MONITORING WEATHER ADVISORIES

A vigilant ear tuned to radio weather reports will keep you abreast of en route weather conditions as well as those at your destination.

IN-FLIGHT WEATHER OBSERVATIONS

While you can't expect to be your own weather forecaster, close observation of the clouds can help you avoid thunderstorms.

Airmass or convection thunderstorms begin as fluffy, white puffs of cloud in the summer sky. There is no way to predict which of these innocent-appearing clouds will turn into raging thunderstorms. Unfortunately, they don't always fit the classic picture of a towering, anvil-topped, black, cumulonimbus cloud and identification can be difficult. Any rapid, vertical growth of such clouds must be watched carefully.

Frontal thunderstorms can be as low as a few hundred feet or as high as 10,000 feet above ground level. The cloud tops range from 25,000 to 45,000 feet or higher. They form more slowly than airmass thunderstorms, are larger (up to 30 miles in diameter at the base) and are more concentrated. These thunderstorms are longer-lived than other types and several can be hidden in the stratiform clouds of a front. Fortunately, the presence and movement of frontal thunderstorms can be forecast with considerable accuracy. This is one area where the preflight briefing pays for itself.

Squall lines of thunderstorms can extend over 100 miles and reach up to 60,000 feet. Storms in a squall line are particularly vicious and they are too closely linked to penetrate safely. You may also encounter tornadoes along their trailing edges. Squall lines occur most often in late summer afternoons.

Mesoscale convective complex (MCC) is a type of thunderstorm system which has only recently been given the attention it deserves. These storms develop rapidly and persist from a minimum of 6 hours to as long as 12 hours. MCCs appear to grow in areas of favorable flying conditions (weak pressure gradients and light winds). Upper air charts may even indicate the MCC has developed within a ridge of high pressure. However, detailed analysis by meteorologists shows the areas were usually unstable, with an upper level disturbance embedded in the winds at higher altitudes.

MCCs are usually circular or elliptical in shape. They can be 100 times the size of an airmass thunderstorm; large enough to cover one or several states. The rapid development, tremendous size and lingering habits of the MCC give it a substantial impact on flight planning and operations. Your best bet is to sit this monster out on the ground.

Tornadoes form when updrafts in thunderstorms create a rotating motion at the cloud base. The particularly violent winds in these funnel-shaped clouds may be moving at 200 miles an hour. Invisible tornadic vortices may occur below the base of thunderstorms, but they can also occur as far as 20 nautical miles from the rain and lightning associated with storms. Vortices are not visible on radar but the dust they pick up over land, or spouts they form over water, are clues to the presence of these dangerous weather phenomena.

The operator's manual for your aircraft includes RECOMMENDED procedures to be used for thunderstorm penetration when avoidance is impossible, but any safety specialist will tell you there are no SAFE procedures for flying through thunderstorms. Pilots who have inadvertently flown through them—and survived—can tell you it is an experience you can well do without.

Trying to climb over a thunderstorm or penetrate between the storms of a squall line is risky. If you attempt to slip under the storm, the violent winds blowing down and out from behind and up and into the storm in front may pull your aircraft into it. Circumnavigation of a large storm may exhaust your fuel. Trying to go around one on the downwind side can involve you in hail and lightning. Northwest Airlines Captain William Kenmir developed this useful rule of thumb several years ago: "For every knot of wind at your flight level, stay one nautical mile away from the downside of the storm."

The odds of winning always favor the thunderstorm. Don't gamble. Get that preflight weather briefing, stay alert to en route weather advisories and be vigilant in your in-flight observations. The last minutes of one flight were described this way by witnesses, "Parts of the aircraft were falling from low-ceiling clouds, followed by the aircraft which looked like it had no wings on it." This pilot had received a severe weather warning but he did not ask for help in circumnavigating the heavy turbulence and continued his flight. The aircraft was subjected to stresses for which it was not designed. There were no survivors.

References:
"A New View of Thunderstorms," *Flying Safety,* May 82.
Flightfax, 9 May 79, 5 Sep 79, 12 May 82.
AR 95-1, "Army Aviation: General Provisions and Flight Regulations."

PEARL'S

Personal Equipment And Rescue/survival Lowdown

Lolley Young

Antiexposure Suits

"His hands became very cold, making some survival kit items difficult to manipulate after he had been in the raft 30 to 40 minutes. The pilot stated that the antiexposure suit he *wore* was instrumental in his safe recovery, and long-term survival would have been doubtful without it. Sea temperature was 46 degrees Fahrenheit." This story certainly tells it all about overwater flying. Without an antiexposure suit, one is risking safe recovery after a safe escape from a downed aircraft. Cold water works fast on rendering the unprotected body useless. Life supporters must continue to "preach the word" and ensure the suits are properly maintained for use. Also, don't forget to pack some winter gloves in the kit. The aircrew personnel will appreciate that little extra.

Nomex Flight Clothing

Clearly and briefly stated, fire protective (Nomex) clothing for aircrew personnel is *it*. All others are *out*. Sufficient time has elapsed for all aviation units to budget and procure Nomex flying clothing. The nylon flight jacket is no longer authorized for wear by aircrew personnel in flight. The N-2B nylon winter parka is currently used by aircrew personnel in Alaska and some cold weather regions. Unfortunately, this parka contains nylon. We are taking action to adopt the U.S. Air Force CWU-45/P Nomex winter jacket and for the information of all concerned the "CLO" values for the N-2B and the CWU-45/P are the same.

Anti-G Protection

For those of you who are undergoing test pilot training for high performance aircraft, or who are already assigned to Edwards AFB, CA, or other test sites requiring anti-G suit protection, just remember that a "blackout" from loss of G protection is an average of 15 seconds. Use that G suit when you need it.

Questions and Answers

Dear PEARL, I have heard some scuttlebutt that there is a move to authorize the removal of lifesaving fire extinguishers from some Army aircraft. Could this be true?

No, this is not true, although we were privy to a letter which had asked for authority to eliminate fire extinguishers and first aid kits because they wanted to put fuel or ammo in for the weight that would be saved. I would like to quote the requirement for fire

CONSOLIDATED GLOSSARY—Page 28

extinguishers and first aid kits and this will be clarified in a soon to be published Army Regulation 95-XXX, "The Army Aviation Life Support Equipment System Program." Chapter 2, Aviation Life Support Equipment Requirements, paragraph 2-2, is quoted: "First aid kits will be installed in Army aircraft in accordance with TM 55-1500-328-25 and in the minimum quantities specified in CTA 8-100. Medical supplies will be updated, deleted or extended in accordance with SB 8-75." Paragraph 2-3 covering fire extinguishers is also quoted: "Each Army aircraft will have a minimum of one currently inspected, operable fire extinguisher (of the proper type identified in the appropriate aircraft TM) per aircrew and passenger compartment installed and accessible during all flights and while conducting run-up procedures." PEARL is most happy to respond to questions such as these. Be looking for the new ALSE regulation expected to be fielded in the near future.

Dear PEARL, I have recently been assigned responsibility as the unit ALSE officer. Can you tell me where I can get copies of all the PEARL articles?

We agree that PEARL is very important to the ALSE area and no red-blooded Army aircrew person should ever be caught without "PEARL." We have always recommended that you read PEARL and keep the articles handy. You can start by first making sure you receive the *Army Aviation Digest.* All aviation units do receive copies and unfortunately they also love PEARL, but ask your commander to be sure you get copies so you can start a PEARL library of ALSE. As time will allow, we will put together a pamphlet of PEARL articles and make them available to ALSE officers and their personnel. We cannot give you a definite date when this will be completed, but if you will identify yourself and give us your address, we will compile a listing. Please be sure your request identifies PEARL's ALSE pamphlet.

Dear PEARL, now that summer is here, would you please resurface your article on scuba diving? Can flying after scuba diving cause the "bends" at altitudes less than 10,000 feet which is where most of the Army Aviation's people fly?

We are always happy to oblige, so here it is. **"Flying After Scuba Diving Can Be Dangerous.** Are you aware that flying your plane to a day of scuba diving at the lake or seashore and then flying home in your civilian aircraft, all within a few hours' time can be dangerous, particularly if you have been diving to depths for any length of time? Under the increased pressure of the water, excess nitrogen is absorbed into your system. If sufficient time has not lapsed prior to takeoff for your system to rid itself of this excess gas, you may experience the 'bends' at altitudes less than 10,000 feet where most Army aircraft and light planes fly." This is another information article and PEARL is sure it will be helpful.

Dear PEARL, you have always given us the straight "poop" so here is my question and I am sure others also would appreciate this information. Where does one wear the hunting knife on their SRU-21/P survival vest?

PEARL has taken a long, hard look at your question and as previously stated, "There is no best place nor can PEARL recommend such a place since it depends upon the type of aircraft you are flying in and the physical size of the individual." The survival knife should be in the best location for you, and the best place that does not interfere with the flight controls and a place that will ensure the knife does not come out of its sheath during a crash. It must be readily accessible to you during a post crash situation. Can the knife be reached if you have one arm that is severely injured? Some aircrewmembers are wearing the survival knife on their back "macho," maybe, but if it is practical then why not? At least this article will get us all "thinking." At least let us be sure we mount the knife so it remains in its sheath and so that it is readily accessible in a crash/survival sequence. Hope this little soul searching will do it for you.

Do you have a PEARL's photo to nominate for publication in the *Aviation Digest?* Send it to Editor, *U.S. Army Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362.

If you have a question about personal equipment or rescue/survival gear, write PEARL, DARCOM, ATTN: DRCPO-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120 or call AUTOVON 693-3307 or Commercial 314-263-3307

Mr. John Hogan
Directorate of Training Developments
New Equipment
Training Development Branch
U.S. Army Aviation Center
Fort Rucker, AL

CONSOLIDATED GLOSSARY—Page 28

region	tissue of the eye most susceptible to damage
Ultraviolet	Cornea
Visible	Retina
Near-Infrared	Retina
Far-Infrared	Cornea

FIGURE 2: Spectral regions of laser outputs and that part of the eye most susceptible to damage.

Lasers are being used at an increasing rate throughout the civilian community as well as the military establishments. A few examples of civilian use of lasers are: construction, surgery, engraving and alignment of instruments. Although still in its infancy, laser technology has excited the imagination of both scientists and the public at large because its possible uses are so many and so diverse. In the military, laser technology is being continually applied in the development of new weapon systems. Range finding, missile guidance, target designation and communication systems are just a few examples.

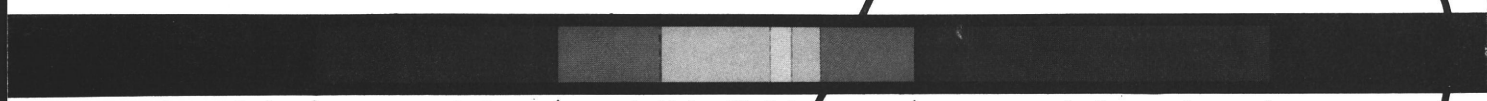
With the widespread use of lasers in the Army, it is important for everyone associated with them to be aware that potential hazards exist with laser use or misuse. A laser is not a toy or another light source for seeing in the dark. Serious injury can occur to anyone unaware of the biological effects of laser radiation. In fact, the same philosophy used in handling a loaded gun should be applied when using an activated laser.

The term *laser* is an acronym derived from light amplification by simulated emission of radiation. The common denominator of all laser systems is the emission of an unusual type of light. Light is a form of electromagnetic radiation and represents an extremely narrow band in the middle of the spectrum (figure 1).

Laser radiation results from a source of highly collimated (paralleled) extremely intense monochromatic (one color) light. Laser light differs from conventional light emitters primarily in its ability to attain highly coherent light. The increased directional intensity of light generated by a laser results in a concentrated light beam at a considerable distance. It is the directional intensity of the light that presents biological implications and creates hazards.

When laser light strikes the human body, a portion of that light

FIGURE 1: Visible light is a narrow band in the electromagnetic spectrum.



short ultraviolet | ultraviolet | visible light | near infrared |

is absorbed by the body tissues. Depending upon the intensity of the radiation, the absorbed energy can cause injury. This article does not address the technical aspects of lasers but is intended to create an awareness of their capability to cause injury.

Laser hazards can be categorized into four groups:

- **Radiation.** Corneal or retinal eye burns (or both), depending upon laser wavelength (figure 2), can occur from acute exposure, and corneal or lenticular opacities (cataracts) or retinal injury can occur from continued exposure to high levels of radiation. Skin burns can occur from acute exposure to a high level of optical radiation. At some specific ultraviolet wavelengths, skin carcinogenesis (skin cancer) may occur.
- **Chemical.** Laser induced reactions can release hazardous particles and gaseous fumes.
- **Electrical.** Lethal electrical (shock) hazards may be present, particularly with high-powered systems.
- **Secondary.** These include cryogenic coolants, excessive noise, x-radiation from faulty high voltage power supplies, explosions from optical pumps and fire hazards.

Since the eye is designed in a natural environment to collect and concentrate light on the retina, it should come as no surprise that it is the most sensitive organ of the human body to laser radiation. Certain wavelength ranges in the visible and near-infrared part of the spectrum are transmitted through the ocular media and focused on the retina. Although lasers can be hazardous to any part of the body, this article discusses only eye hazards because they can occur at much lower power levels.

The structure of the eye (figure 3) allows parallel rays of light to be focused to a very small area on the retina. Certain parts of the eye are more sensitive to impairment from laser beams than other parts because of their ability to absorb light in a given spectral region. This is shown in figure 4. Notice that the short-ultraviolet region is absorbed by the cornea and does not penetrate to the more sensitive retina.

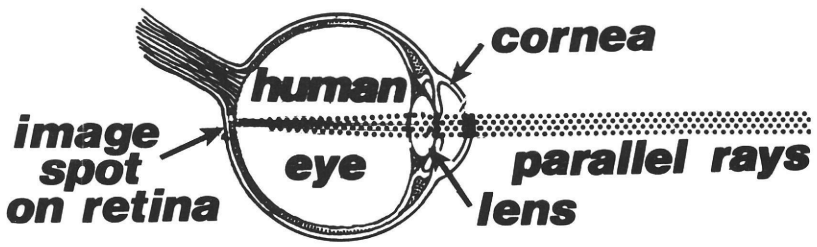
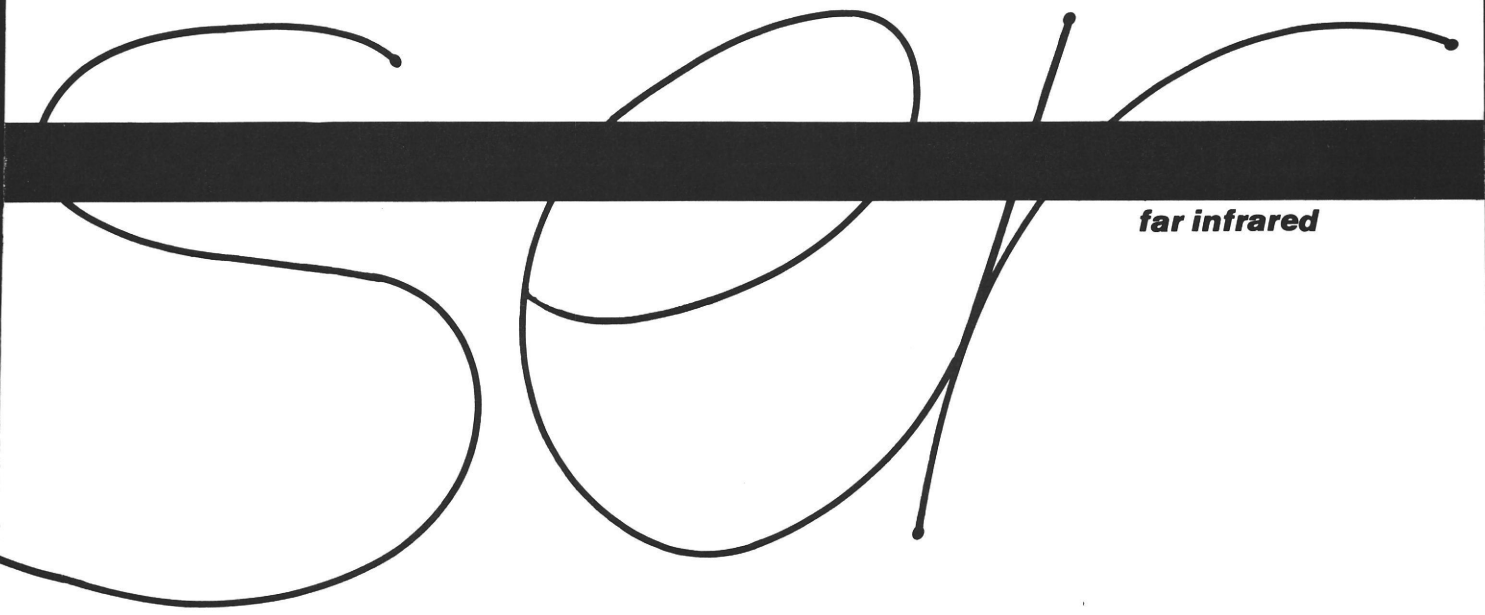


FIGURE 3: Focusing of parallel rays in the eye.

Safety Hazards



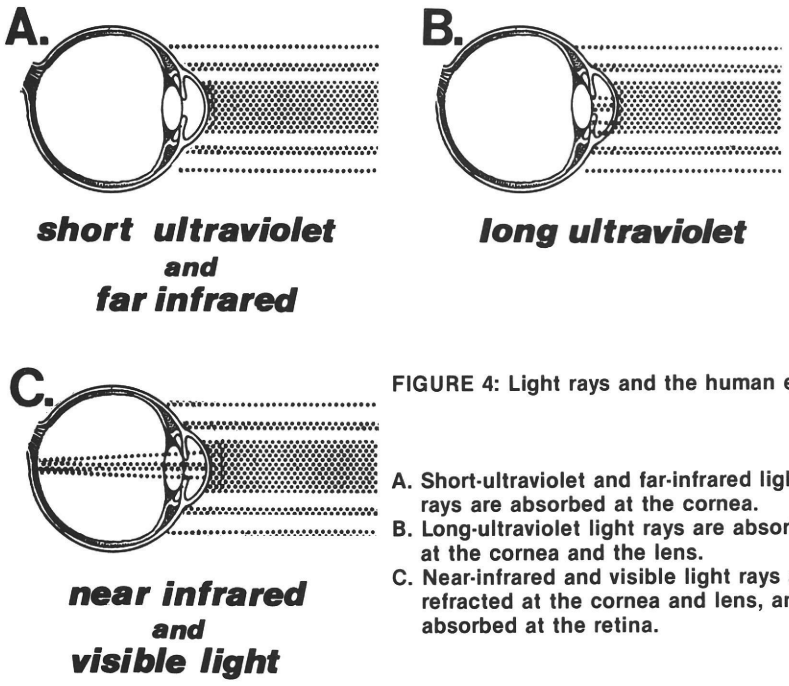


FIGURE 4: Light rays and the human eye.

A. Short-ultraviolet and far-infrared light rays are absorbed at the cornea.
B. Long-ultraviolet light rays are absorbed at the cornea and the lens.
C. Near-infrared and visible light rays are refracted at the cornea and lens, and absorbed at the retina.

The visible spectrum and near-infrared are transmitted by the optical components of the eye with little loss. This radiation is then refracted by the eye to a spot on the retina. Such focusing can cause intensities high enough to damage the retina.

Although near-infrared is focused to some extent on the retina, other parts of the eye absorb some of the radiation and can suffer damage. The far-infrared, like the short-ultraviolet, will affect only the cornea because of its ability to absorb at these wavelengths. Although far-infrared is absorbed at the surface of the eye, some middle-infrared penetrates deeper and can cause "glass blower's" cataract. This type of cataract is believed to be due to a chronic exposure to infrared radiation.

Viewing laser beams. Intrabeam viewing is the most dangerous to an observer (figure 5). If the power output is high enough, the eyeball can explode during intrabeam viewing. This, however, is not the normal situation, and lasers that powerful should have sufficient safeguards to avoid this type injury. However, there is a proliferation of low-power lasers on the market today, and some of these can even be built at home. A nominal 2-milliwatt laser beam can be focused by the eye components to a spot on the retina smaller than a blood cell. This concentrated energy can cause damage to the retina. To avoid this type injury, lasers should be handled with extreme caution at all times.

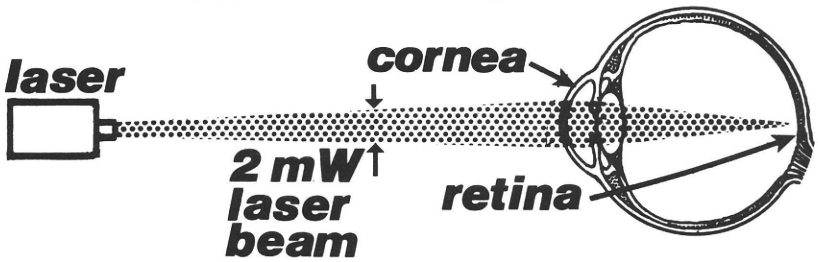
Laser beams can be reflected by several objects such as a mirror or a flat chrome piece. This is called specular reflection (figure 6). Smooth, flat surfaces like this will only change the direction of the beam and not the characteristics of the beam itself. If the reflected beam enters the eye, the hazard is almost the same as direct intrabeam viewing.

Another less serious hazard is diffused reflections (figure 7). A diffuse reflector is a rough reflecting surface, such as a piece of paper, that reflects light randomly in all directions and does not maintain the internal order of a light beam. Each surface element of a diffuse reflector acts essentially like a tiny mirror. The random construction of the surface elements causes light to be reflected in all directions. The irradiance, therefore, is reduced considerably because only a small fraction of the original laser beam energy enters the eye, and it is distributed over a larger area of the retina. Viewing diffused reflections is generally a serious problem only with high-powered lasers.

This article's approach is centered on lasers that are not considered eye-safe. You the reader should respect and develop safe practices around these type lasers.

Eye-safe lasers are generally low-powered and operate outside the visible and near-infrared regions. Eye-safe lasers are now being used in the Army in various roles. Any unfounded fear about this type laser

FIGURE 5: Intrabeam viewing conditions



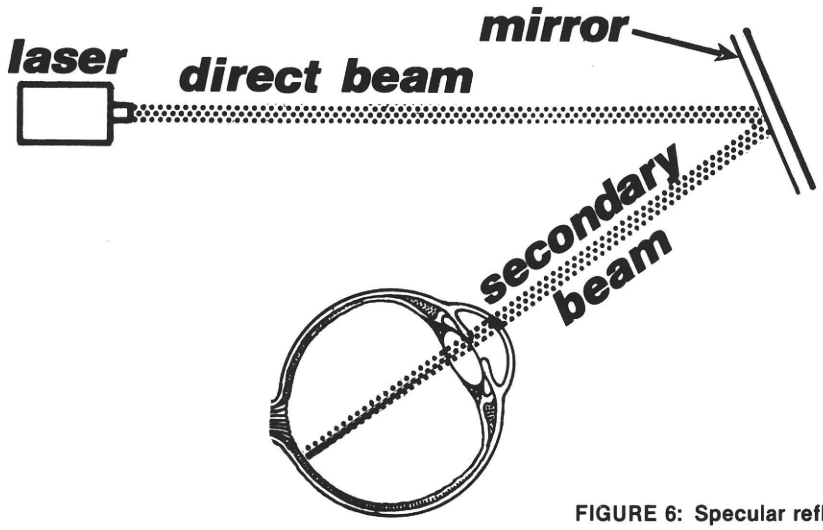


FIGURE 6: Specular reflection.

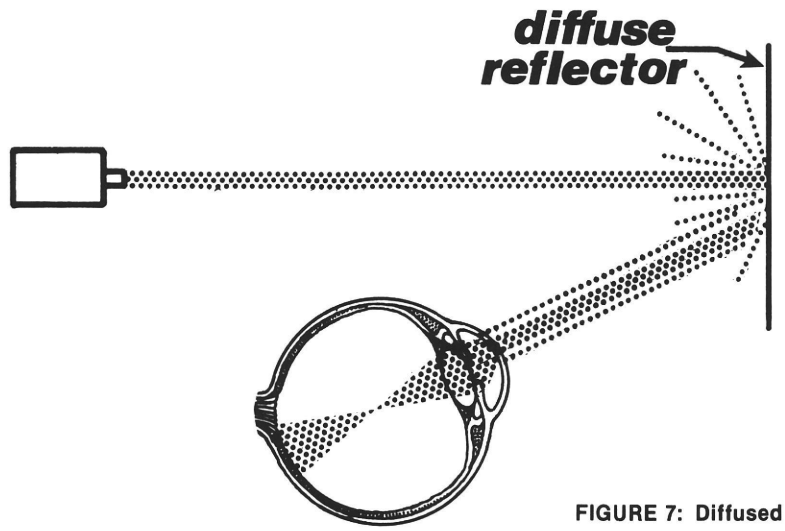


FIGURE 7: Diffused reflection.

could inhibit a soldier's performance during training exercises. For example, MILES is a system that substitutes low-power, eye-safe lasers for live rounds of ammunition during field exercises at the National Training Center.

Eye protection. Personnel whose assignments require exposure to laser beams must be furnished suitable laser safety goggles. These goggles are designed to protect against the wavelength of the laser being used and are of sufficient optical density for the hazard. Lenses also may be curved to reduce specular reflection hazards.

Safety procedures. The following procedures should be used around all lasers, regardless of their output power.

- Avoid looking directly into any laser beam or at its reflection.
- Remove all unnecessary specular (shiny) reflective surfaces from the work area.
- Operate lasers only in well-defined areas with controlled access and only under the direct supervision of a person who knows the hazards involved.
- Post the area with appropriate signs to alert people passing through the area that a potential hazard exists.
- Ensure the laser system is inaccessible to unauthorized personnel.
- Report any accident immediately to the responsible medical authority.

Additional information on laser safety may be obtained from the Laser-Microwave Division, U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD 21010.

THREAT

MONTHLY WRITING AWARD

Captain (P) Dale L. Radtke
Threat Branch
Directorate of Combat Developments
U.S. Army Aviation Center
Fort Rucker, AL

LASER

LASERS have many applications for the battlefields of the future and may profoundly change the tactics required to wage war successfully. The laser can be used to identify the exact range to any visible target, designate which target a smart weapon should destroy and blind or destroy a target by itself.

In the minds of most people, lasers create an image of a tight, needle beam of light that can be seen as it shoots from the weapon to the target, which instantly disappears in a gigantic, violent explosion. If the target is a person, he or she simply fades away, because no one cares to watch a body explode. These images are perpetuated by Hollywood and television writers because they are more spectacular than real-life effects, and the audience can readily tell that a laser has been used.

In truth, however, many lasers with a military use cannot be seen, because they do not operate in the visible light spectrum. You never know that they are being used unless you are the target, or you have special detection gear. If you could see a laser beam in use, you might be surprised at its size. While the diameter of a laser beam may start out small, by the time the beam reaches a target 3 km away, it may cover an area the size of a basketball. The beam is strongest near the center, but the beam does diverge.

The effect a laser has on a target is also much different than the Hollywood image, and depends upon the amount of energy striking the target over a relative length of time. These effects can range from temporary blindness or sunburned skin at mild energy levels to melting metal at very high energy levels. Typical effects at moderate energy levels would include permanent blindness, igniting military clothing and paint, charring skin, melting Plexiglas and wires, and glazing optical devices. Spectacular explosions would probably never occur unless a high-energy beam makes contact with a fuel cell or possibly a missile warhead.

It is ironic that the easiest damaging effect to obtain with a laser, blinding, is also the most personally terrifying. Like a sunburn, the pain associated with laser damage to the eyes may not be felt until long after the damage has been done. Because many battlefield lasers are not visible, the first indication you receive that your eyes have been damaged may be blurred vision or total blackout. You will not know if you are temporarily or permanently blinded; only that you cannot see. The shock of this realization can be devastating, especially to pilots all of whom rely heavily on their eyes. In a hovering helicopter, the combination of unexpected blindness and shock or panic will prove to be deadly.

An individual does not have to look in the direction of a laser to receive its blinding effects. In October 1981, a police helicopter flying near Los Angeles was inadvertently exposed to an argon laser. Even though only one pilot was looking in the direction of the laser, both pilots were blinded because of reflections off the Plexiglas and dash. Luckily for them they had sufficient altitude and one pilot regained his vision after about 20 seconds.

Lasers that operate in the visible portion of the light spectrum usually damage the retina of the eye, and that damage may be temporary at lower energy levels or ex-

CONSOLIDATED GLOSSARY—Page 28

FIGURE 1: Propagation characteristics for 1 second exposure time using a 200 kilowatt pulsed carbon dioxide high energy laser.

	Range (km)			
	1.5	3.0	4.5	6.0
Beam Diameter (cm)	12	28	49	68
Fluence (j/cm²)*	1,000	200	57.5	24.7

*j/cm²:joule(s) per centimeter squared

FIGURE 2: Biological effects from a 1-second exposure to a high energy laser.

Effect	Fluence Required
Cutting with CO_2 laser surgical knife	80,000 j/cm²
Immediate charring of skin tissue	20 j/cm²
Immediate blistering	7.8 j/cm²
Permanent corneal scarring	8 j/cm²

posure for short durations. However, lasers that operate in the ultraviolet or infrared spectrum damage the cornea and that damage is usually permanent. More energy, or a longer dwell time on target, is required to damage the cornea. Lasers operating in the visible light spectrum are often referred to as *in band* (to the human eye) lasers, while all others are out of band lasers.

Laser rangefinders can greatly increase the probability of achieving first round hit capabilities for tanks, helicopters and artillery. At the same time, LRFs have the capability to damage an individual's eyes. The extent of damage from a currently fielded LRF can vary from possible permanent blindness at 500 meters to temporary blindness at 2 km. For an individual looking through any type of magnifying optics, the effects and ranges are greatly increased. Laser designators use more power than most LRFs, creating more damage to eyes out to even greater distances.

A laser weapon is capable of obtaining a hard kill or a soft kill, with a hard kill being the actual destruction of the target, such as shooting down a helicopter. A soft kill would be damaging the optics or gunner's eyes causing a mission abort. The maximum range for obtaining a soft kill is usually much greater than the hard kill effective range. Once a laser weapon system acquires a target by radar or visual means, it can be kept on target automatically by tracking the reflection of the laser, if equipped with hot spot tracking capabilities.

To better understand the devastating effects a postulated high energy laser might have, refer to figures 1 and 2. This information is derived from a Letterman Army Institute of Research study (no such weapon system currently exists) of a carbon dioxide laser weapon system and includes considerations of bloom, jitter and turbulence. Notice in figure 1 that the beam diameter at 3 km is about 1 foot. At 6 km, the beam diameter is well over 2 feet and 24.7 j/cm² are received by the target each second. From figure 2, only 8 j/cm² are required for the blinding.

The many military uses for lasers and their possible effects on rotary wing aircraft will require a great many changes in helicopter tactics for the future. The purpose of this article has been to arm you with the knowledge of these effects, and to stimulate thought on what changes will be required.

"Why Me?" — The Threat Officer, April 1983, page 35, item number 4, should have read: DEP CDR, USACACDA, ATTN: ATZL-CAT-T; AUTOVON 552-3366

CONSOLIDATED GLOSSARY

AAMAA	Army Aviation Mission Area Analysis
ac	alternate current
ACAP	Advanced Composite Airframe Program
ACT	air cavalry troop
ADOCS	Advanced Digital/Optical Control System
AHC	attack helicopter company
AHD	attack helicopter detachment
AIR CAV DET	air cavalry detachment
ALSE	aviation life support equipment
AM	amplitude modulated
AMOC	Aircraft Maintenance Officer Course
AAPRSO	Army Aviation Personnel Requirements for Sustained Operations
APRT	Army physical report test
AR	Army regulation
ARNG	Army National Guard
ARRADCOM	(U.S. Army) Armament Research and Development Command
ARTEP	Army Training and Evaluation Program
ASI	additional skill identifier
ATC	air traffic control
ATL	Applied Technology Laboratory
ATM	aircrew training manual
ATK HEL DET	attack helicopter detachment
AVLABs	Aviation Materiel Laboratories
AVRADCOM	(U.S. Army) Aviation Research and Development Command
BN	battalion
CAP	Composite Aircraft Program
CAS^3	Combined Arms and Services Staff School
CBAA	Cavalry Brigade (Air Attack)
CDR	commander
CEWI	combat electronic warfare and intelligence
CGSC	Command and General Staff College
cm	centimeter
CMF	career management field
CSAC	combat support aviation company
CTA	common table of allowances
DA	Department of the Army
DAC	division aviation company
dc	direct current
DIV	division
DOD	Department of Defense
DOES	Directorate of Evaluation and Standardization
EER	enlisted evaluation report
FAA	Federal Aviation Administration
FAC	flight activity category
FAAO	field artillery aerial observation
FM	field manual
FM	frequency modulated
GOV	governor
GPS	Global Position/Precision System
GSAD	general support aviation detachment
HAI	Helicopter Association International
HEL	high energy laser
HHD	headquarters and headquarters detachment
HLH	heavy lift helicopter
HP	horsepower
HPH	high performance helicopter
HQDA	Headquarters, Department of the Army
IAW	in accordance with
IFR	instrument flight rules
IP	instructor pilot
IRR	Individual Ready Reserve
ITR	integrated technology rotor
km	kilometer
j/cm^2	joule(s) per centimeter squared
laser	light amplification by simulated emission
LES	leave and earnings statement
LHX	Light Helicopter Family
loran	long-range navigation
LRF	laser rangefinders
MCW	modulated continuous wave
MFO	Multinational Force and Observers
MHC	medium helicopter company
MHz	megahertz
MILPERCEN	Military Personnel Center
mm	millimeter
MMS	mast-mounted sight
MOPP	mission oriented protection posture
MTDE	Major Turboshaft Demonstrator Engine
NAR	National Airspace Review
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NASP	National Airspace System Plan
NATO	North Atlantic Treaty Organization
NBC	nuclear, biological and chemical
NCO	noncommissioned officer
NCOIC	noncommissioned officer in charge
NOE	nap-of-the-earth
NOTAR	no tail rotor
NSN	national stock number
NVA	North Vietnamese Army
NVG	night vision goggles
OER	officer evaluation report
PIC	pilot in command
POM	program objective memorandum
RAM	reliability, availability and maintainability
R&D	research and development
rpm	revolutions per minute
SAVIM	survivability and vulnerability improvement modification
SB	supply bulletin
SQT	skill qualification test
SUST BN	sustainment battalion
TAMC	transportation aircraft maintenance company
TAMD	transportation aircraft maintenance detachment
TC	training circular
TG	task group
TM	training manual
TOC	tactical operations center
TOE	tables of organization and equipment
TRADOC	(U.S. Army) Training and Doctrine Command
TRECOM	Transportation and Engineer Command
TSARCOM	(U.S. Army) Troop Support and Aviation Materiel Readiness Command
USAASO	U.S. Army Aeronautical Services Office
USAF	United States Air Force
USN	United States Navy
UTTAS	utility tactical transport aircraft system
WALC	Worldwide Aviation Logistics Conference
WSPS	Wire Strike Protection System
YG	year group

AVIATION PERSONNEL NOTES

Personnel Changes

Military Personnel Center has announced major personnel changes which should be of interest to all Officer Personnel Management Directorate managed officers. Major Chris Sieving, Aviation Plans and Programs Branch, will be reassigned to Germany this month; he will be replaced by Major Tom Stewart who will arrive from the Command and General Staff College. Captain David Schock has arrived after a tour in the 25th Infantry Division and will become the Specialty Code 15 captains overseas assignment officer. He replaces Major Vic Sathre who was reassigned to Korea in June.

Additional Skill Identifier Code 6H

As part of an ongoing effort to identify critical skills/educational background within our officer corps, MILPERCEN recently added the ASI code 6H to the records of 460 officers. ASI 6H designates aeronautical engineers. It was added to the record of each officer who has completed either an undergraduate or graduate level degree in the disciplines of either aeronautical or aerospace engineering. No officer will be assigned to a position requiring aeronautical engineering skills based solely upon possession of this ASI. The ASI is used as a tool, primarily by personnel managers, to aid in the overall effort to "match the right officer to the right position." Further information is available from Major DeLoach, AUTOVON 221-8156.

CAS³ Changes

Completion of the Combined Arms and Services Staff School is *not* mandatory for Year Group 1976 captains as was reported in this column in May. CAS³ is mandatory for all captains in YG 1977 and subsequent.

So—revised prerequisites are as follows:

- Be in YG 1977 or subsequent
- Be an advanced course graduate and not have entered 10th year active federal commissioned service.
- Successfully complete Phase I and the comprehensive examination.

Officers in YGs 1977 and 1978 who have availability dates between now and April 1984 should contact their professional development officers to discuss CAS³ programing.

Evaluation Reports to Contain Additional Data

The Officer and Enlisted Evaluation Reporting Systems were changed 1 May 1983 to include Army Physical Readiness Test performance and height/weight data on OERs, EERs and most service school academic evaluation reports.

The change is made as part of the Army's continuing emphasis on physical fitness and weight control. Further, it reflects selection board desire to be able to check soldiers' compliance with physical fitness and weight standards.

APRT performance data will be entered as PASS, FAIL or PROFILE and the date of the most recent APRT or date the profile was awarded.

Height and weight expressed in inches and pounds (example 71/185) will be entered on the evaluation form as of the last rated day covered by that report. The height/weight data will be followed by the word YES or NO to indicate the individual's compliance with the standards of AR 600-9, "Army Weight Control Program" which became effective 15 April 1983.

The rater will be required to make narrative comments for APRT entries of FAIL or PROFILE and for height/weight entries with a NO indicating a weight that exceeds the standards of AR 600-9. The purpose of these comments is to explain progress in a weight control program, ability to perform assigned duties with a PROFILE entry or medical exception to regulatory requirements.

The permanent change to the applicable regulations was distributed to the field during April 1983. Evaluation reports will no longer be accepted without APRT and height/weight data entries.

In another recent change affecting OERs, the minimum period for complete-the-record OERs has been extended to require 180 calendar days in the same duty position under the same rater. This change became effective with an immediate action change published 17 December 1982, and applied to all complete-the-record OERs submitted for 15 December 1982.

REPORTING FINAL

Late News From Army Aviation Activities

FROM JAPAN

Awards of Excellence. During a ceremony at Camp Zama's Rankin Army Airfield recently, the U.S. Army Aviation Detachment, Japan was presented two Department of the Army Accident Prevention "Awards of Excellence" plaques.

The awards covered 3-year periods between July 1976 to June 1979 and July 1979 to June 1982. In addition, the detachment has a previous award indicating an accident-free era from July 1970 through June 1976, making a total of 12 years of accident-free flying.

"For one of the smallest aviation units in the Army our pilots fly about twice as many hours as aviators in other Army Aviation units," commented CW4 Earle C. Irwin, flight safety officer. "The safety record is very impressive."

The Camp Zama aviation unit maintains a 7-day, 24-hour operation that includes more than 50 aviation personnel who support the mission of transporting individuals on medical evacuation flights, emergency medical evacuation flights, U.S. Army, Navy and Air Force personnel in Japan and dignitaries that visit Camp Zama.

FROM GERMANY

Mr. Perfect. Sergeant Glen Swartz got the nickname "Mr. Perfect" from the troops he supervises. He laughs at the title, saying nobody is perfect. That might be true, but it sure seems he's a lot closer to perfection than most.

Sergeant Swartz, NCOIC of the 59th Air Traffic Control Battalion's communications and electronics section, was recently inducted into the SGT Morales Club. You don't need to be perfect to make the club, but you've got to be doing something right.

The SGT Morales Club is an organization comprised of NCOs who've consistently demonstrated leadership traits, professionalism and genuine regard for the welfare of their subordinates in keeping with the standards of SGT Morales, a fictitious name for a real-life NCO.

What that means in simpler terms is that inductees must supervise at least three troops, do it well, and maintain a real interest in their training, welfare and morale.

Sergeant Swartz exhibited all those traits, and after being recommended for induction into the club went through several selection boards which all agreed he was top-notch enough to earn a place in the elite 1,200-member SGT Morales Club.

(Richard Saunders, PAO, 5th Signal Command)

FROM WASHINGTON

Sinai Rotation. About 800 soldiers of the 2d Battalion, 327th Infantry, 101st Airborne Division (Air Assault) from Ft. Campbell, KY, will be on their way to the Sinai Desert in August for a 6-month tour of duty with the Multinational Force and Observers, say Army operations officials.

The 2/327th will be the main element of the U.S. forces there, replacing the 2d Battalion, 508th Infantry, 82d Airborne Division, from Ft. Bragg, NC. The Ft. Bragg unit has been in the MFO assignment since February.

Officials say about 350 other soldiers from various support units will deploy for 6 months' duty with the MFO Logistical Support Unit. That unit provides administrative, finance, medical, logistics, maintenance and transportation support to the MFO elements.

The August exchange represents the fourth U.S. Army contingent to serve in the Sinai in support of the United States' commitment to the peacekeeping effort.

The Multinational Force and Observers was set up under the provisions of the protocol entered into by the governments of Egypt and Israel in 1981 to supervise implementation of the provisions of the 1979 Egyptian-Israeli Treaty of Peace.

FROM FORT BRAGG

Accident Free. The aviation program of 7th Signal Command's 58th Air Traffic Control Battalion has more than 12 years of flight service and more than 11,000 flying hours to its credit, and it has all been accident free. The unit has maintained an unblemished safety record—a zero percent mishap rate—quite an accomplishment for the flight crews and maintenance personnel of the battalion. But more than that, it has been a

combined effort of the entire unit.

The accident-free record has been the result of a diligently applied aviation safety program. Battalion policy demands a high degree of safety awareness and compliance, which includes all standard requirements (for example: monthly safety meetings and familiarity with unit reading files). And there is a strong emphasis on training which is evidenced in the standardization program as well as monthly professional development classes.

FROM FORT RUCKER

Aviator's Handbook. The Aviation Center has announced that FM 1-400, "Aviator's Handbook," which supersedes FM 1-105, is scheduled to reach the field this fall. This manual will provide the aviator with an up-to-date Army Aviation pocket guide.

The handbook is organized into four chapters.

Chapter 1 covers:

- Pre-mission planning
- Aviation life support equipment
- Aircraft servicing
- Types of environments

Chapter 2 covers frequently performed aviation-related tasks to include:

- Terrain flight
- Electronics warfare
- NBC operations
- Tactical formation flight
- Amphibious operations
- Parachuting
- Rappelling
- Aeromedical evacuation
- FM homing
- Search and rescue

Chapter 3 is devoted to:

- Artillery
- Naval gunfire
- Close air support

Chapter 4 is condensed survival information by geographic location to include:

- Arctic
- Desert
- Tropics
- Mountain
- Sea

To assist both the new and veteran aviator in finding reference material, an expanded reference file—by topic—is included as Appendix A. Twelve additional appendixes cover everything from how to fill out a flight plan to downed aircraft procedures.

Facility Of The Year. SFC Larry D. McJunkin, facility chief, Ech Stagefield, received the award for 1982 Facility of the Year for 7th Signal Command's Air Traffic Control Company (Stagefield), USACC Signal Battalion-Ft. Rucker. The presentation was made by CPT Michael T. Inman, commander of ATC Company (Stagefield).

The award is presented annually to the stagefield that best exemplifies the total facility concept. Judging is conducted in the areas of mission performance, skill qualification tests, physical training tests, appearance and improvement of the facility, and competitive spirit.

Each Tower accumulated 238,422 aircraft movements, all accident free, and beat out the other 14 air traffic control facilities in Stagefield Company on the way to winning the honor.

Aircrew Training Manual Update. Many questions have arisen regarding changes to the ATMs. Check your ATMs to ensure you have all of the changes listed below:

Change 1, dated 27 July 1982:

- TC 1-134, ATM, Commander's Guide, 10 Oct 1980
- TC 1-135, ATM, Utility Helicopter, 16 Jan 1981
- TC 1-136, ATM, Attack Helicopter, 16 Jan 1981
- TC 1-137, ATM, Observation Helicopter, 16 Jan 1981
- TC 1-138, ATM, Utility Helicopter (UH-60), 31 Jul 1981
- TC 1-139, ATM, Cargo Helicopter, 10 Oct 1980
- TC 1-144, ATM, Surveillance Airplane, 10 Oct 1980
- TC 1-145, ATM, Utility Airplane, 10 Oct 1980

Message changes:

- Msg, HQDA, 211532Z Jan 1983, subject: Army Aviation Policy Changes
- Msg, HQDA, 011530Z Mar 1983, subject: Additions/Corrections to Army Aviation Policy Changes 211532Z Jan 83
- Msg, HQDA, 011630Z Apr 1983, subject: Helicopter Emergency Procedure Training
- Msg, HQDA, 061945Z Apr 1983, subject: Changes to Helicopter Touchdown Emergency Procedure Training

The ATMs are being revised to incorporate the above changes along with other recommendations which were received from the field to improve the manuals. When the revised manuals are printed, they will be published as field manuals. The new FM numbers and corresponding TC numbers are:

TC 1-134 - FM 1-210	TC 1-138 - FM 1-212
TC 1-135 - FM 1-211	TC 1-139 - FM 1-216
TC 1-136 - FM 1-213	TC 1-144 - FM 1-217
TC 1-137 - FM 1-215	TC 1-145 - FM 1-218

The Directorate of Training Developments, U.S. Army Aviation Center, is responsible for writing the ATMs and answering questions regarding all aspects of the aircrew training program. Mr. James D. Patton, Training Literature Division, Directorate of Training Developments, is the Army's ATM coordinator and may be contacted by writing: Commander, U.S. Army Aviation Center, ATTN: ATZQ-TD-TL-PD, Ft. Rucker, AL 36362; or by phone at AUTOVON 558-7120/4619, commercial (205) 255-7120/4619.

Checklists.
Here We Go Again!

IN 1969, ARMY Aviation began enforcing a regulation that requires the use of checklists from preflight to shutdown. The idea for using standardized procedures when operating an aircraft was not new in 1969, but it was the first time the Army had adopted the policy of reading items from standardized checklists.

Since 1969, checklists have increased in volume to the point where aviators have suggested that they are overly complex, contain unnecessary checks, list too many emergency steps that require memorization and require to much time to be accomplished. Other factors indicate that revisions can be made that will have a positive impact on their overall effectiveness.

• Over the past 2 years, the U.S. Army Aviation Research and Development Command was involved in a Department of the Army directed effort to determine how Army helicopter operations can be changed to reduce fuel consumption. The final report shows that significant fuel savings can be realized by changing starting and runup procedures without any compromise to flight safety.

• An Artillery officer recently commented to an Army aviator that it seemed strange that Army aviators train one way in peacetime, then when the balloon goes up, standing operating procedures are cast aside in order for Army aircraft to respond rapidly to combat operations. His point was that the Artillery trains today as it will fight tomorrow. Are Army flight procedures relevant to tomorrow's battlefield? LTG Julius W. Becton Jr., summed it up at the 1982 Aviation Standardization Policy Committee meeting with the brief statement, "Train as we fight."

• Army aviators are training in mission oriented protection posture equipment. During some tests of aircraft preflight and runup, it was determined that aviators become incapacitated after extended periods in MOPP gear. If the time the aviator spends on the ground prior to becoming airborne can be reduced, more time can be spent accomplishing flight tasks.

• For years we have made some systems checks because we had the time and capability. Now the question is asked, "Are all the checks we make necessary for safe flight?" All of these issues were considered when work began this past year to revise all helicopter and airplane checklists.

The first checklist to be revised and distributed was for the OH-58A Kiowa. Revised OH-58C, OH-6A Cayuse and UH-1H/V Huey checklists will be distributed soon. Here are some examples of and reasons for changes that will appear in the revised UH-1H/V checklist.

• Imagine yourself entering the right side of a UH-1H cockpit. Upon discovering that someone had run the pedals all the way to the short stop, you move them to a position that is comfortable to you. Similarly, you make adjustments to the seat. You do all of this because you recognize the need to do it and not in response to a checklist. Had you picked up a checklist first, a few seconds would have been required to read and respond to the step "Seat and pedals—Adjust." Then you would lay the checklist down while you made the adjustments. Putting the checklist down, picking it up again and finding the correct step on which to begin again consumes more time. The time might seem

CONSOLIDATED GLOSSARY—Page 28

trivial, but when combined with all of the other similar time-consuming checks, a significant amount can be saved by their elimination. By now you've guessed that the step "Seat and pedals—Adjust" is deleted.

• The flow pattern of the old checklist is another time consumer. The pilot begins the cockpit check at the flight controls, moves to the center console, then overhead, down to the instrument panel, then again to the center console and finally back to the flight controls. The new sequence begins overhead and moves through the instrument panel and center console to the flight controls. One objection expressed to this sequence was that the battery switch would be turned on before checking fuel switches OFF. If the old *or* new checklist were followed, the fuel switch would not be a factor because it is checked OFF during the BEFORE EXTERIOR CHECK.

• When the UH-1H checklist appeared in 1979, it was obvious that some thought had been given to reducing steps that required reading and responding. An example is the checklist step that reads: "Overhead switches and circuit breakers—Set as required." In the dash 10, there is a step-by-step explanation of how the switches should be set. When this step originated, there was no intent that the pilot repeat from memory each switch position from the dash 10; yet, some aviators insist that each item on the overhead panel be called out. This is but one example of how mission response is unnecessarily delayed. If the pilot looks at the overhead panel and only moves three switches (not calling out any switches or positions), the checklist step, "Overhead switches and circuit breakers—Set," has been accomplished. Furthermore, a considerable amount of time can be saved by visually checking switch positions and not making the call-outs and responses. The new checklist treats the center console the same as the overhead console: "Console switches—Set."

• There is no requirement in the new checklist to decrease the rpm switch for 10 seconds prior to the first start of the day or at any other time. The rationale is that in the past 5 years, the GOV switch has not been decreased on through flights; then, there is no reason to decrease on the first start.

• You will also note that PITOT HEAT, BLEED AIR, AC VOLTMETER, INVERTER, DC VOLTMETER and GENERATOR checks are no longer accomplished during engine runup. They are checked during shutdown only. It is mandatory that engine temperatures be stabilized for 2 minutes prior to shutdown; therefore, these checks can be performed without extending engine run time. The crew on a morning flight must rely on the systems being checked on the last flight the previous day. Since the spare inverter is checked on shutdown, only the main inverter is used from start to shutdown on all flights. This prevents time-consuming switching from spare to main during runup.

• Another check that has been eliminated during runup is the hydraulic system. The previous check of the hydraulic system told the pilot that the hydraulic switch worked; it turned the system off and on. The normal mode of flight is with the hydraulic switch on and the only time it is to be turned off is in the event of a hydraulic failure. Normal flight control responses prior to flight indicate that the hydraulic system functions properly; so—why check to see that it is disabled by the switch? None of the in-flight failures that have ever occurred, including pilot initiated "hydraulics off," could be detected prior to flight by the hydraulic system check we have been using.

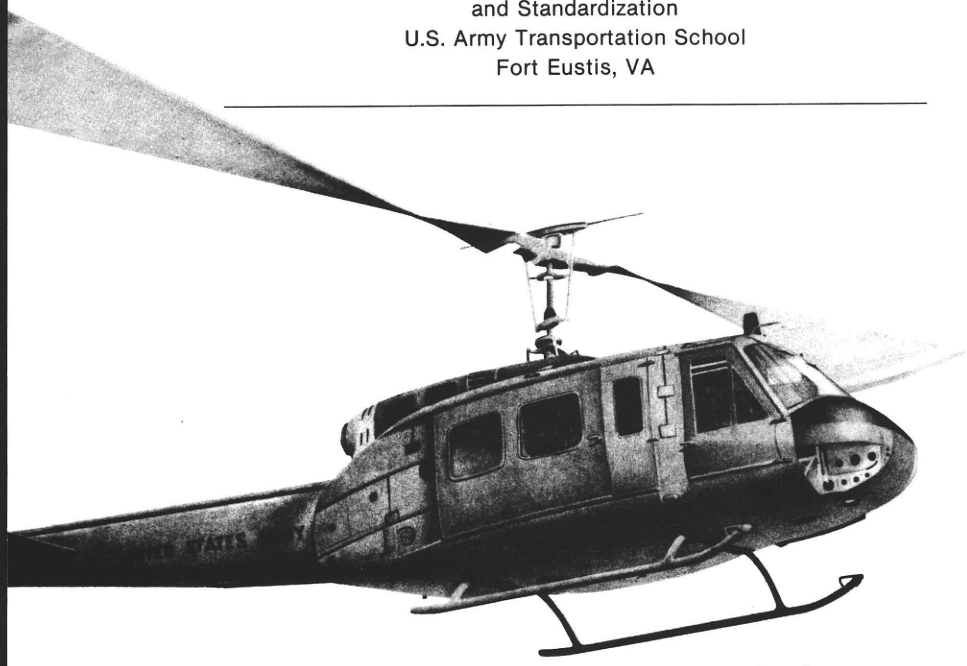
• Finally, the step requiring a check of force trim is gone. That does not mean that a force trim check is not made. Consider this. If the force trim is engaged with the switch in the ON position during start and runup and it releases when the pilot uses either switch to deactivate it before hovering, a check of the system has been made. Therefore, a checklist step is not necessary to accomplish the task.

These major checklist changes are brought about for three valid reasons: Responsiveness to combat needs, flight crew MOPP requirements and fuel conservation. While these necessary improvements are warranted, the importance and requirement for use of the aircrew and maintenance checklists in accordance with AR 95-1 must continue to be enforced. If the new checklists are used as they are intended, anticipated improvements in efficiency will be realized.

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362; or call us at AUTOVON 558-3504 or commercial 205-255-3504. After duty hours call Ft. Rucker Hot Line, AUTOVON 558-6487 or 205-255-6487 and leave a message

Maintenance Test Flight Standardization

Captain Steven L. Ochsner
Directorate of Evaluation
and Standardization
U.S. Army Transportation School
Fort Eustis, VA



The recent release of implementation instructions for FM 55-44, "Standardized Maintenance Test Flight Procedures," marks the beginning of a worldwide effort to standardize the test flight of Army rotary wing aircraft. Rotary wing maintenance test pilots are required to complete annual evaluations on standardized test flight procedures, complete semiannual task iterations of maintenance test flight maneuvers and be subject to no-notice maintenance test flight evaluations administered in conjunction with the Army Aviation standardization program. This article highlights major provisions of the program and clarifies some misunderstanding associated with it.

CONSOLIDATED GLOSSARY—Page 28

THE NEED FOR maintenance test flight standardization was recognized by the 1976 Aviation Flight Standardization Policy Committee. In 1979, the U.S. Army Training and Doctrine Command, Ft. Monroe, VA, directed the U.S. Army Transportation School, Ft. Eustis, VA, to develop a governing manual and procedures for accomplishment of this goal. The Transportation School established the Maintenance Test Flight Standardization Division within its Directorate of Evaluation and Standardization and developed FM 55-44 as a direct result of TRADOC's tasking. Working closely with the Aviation Center's Directorate of Evaluation and Standardization, the Maintenance Test Flight Standardization Division has established the framework for worldwide maintenance test flight standardization. Now an integral part of the Army Aviation standardization program, the Maintenance Test Flight Standardization Division develops standards for maintenance test flight and evaluates maintenance test pilots in conjunction with major command aviation resource management survey teams.

Impact. FM 55-44 provides commanders at all levels with the means to assess the proficiency of test flight programs. Locally designated maintenance test flight evaluators provide commanders with annual assessments of maintenance test pilots assigned to their commands. Task standards delineated in FM 55-44 provide an objective yardstick for maintenance test pilot evaluation. Semiannual performance of maintenance test flight tasks ensures maintenance test pilot familiarity with tasks in all assigned aircraft. Evaluations by the Transportation School's Directorate of Evaluation and Standardization provide feedback on the overall effectiveness of standardization programs.

Clarifications. The Transportation School's Aircraft Maintenance

Officer Course is divided into two phases. Phase I, a comprehensive 12-week course, encompasses all aspects of aviation maintenance management. Phase II (the test flight phase) consists of in-depth maintenance test pilot training in either the UH-1 Huey, AH-1 Cobra, OH-58 Kiowa, CH-47 Chinook or UH-60 Black Hawk. All courses last 3 to 4 weeks and fully qualify aviators for maintenance test pilot duties in the specific aircraft.

While initial maintenance test pilot qualification through the AMOC test flight phase is highly desirable, current requirements dictate that only maintenance test flight evaluators must complete this course prior to performing evaluator duties. Evaluators must be AMOC test flight phase qualified in category and should, when possible, be test flight phase qualified in the specific aircraft in which evaluation duties are to be performed. Evaluators need not complete an evaluation from the Transportation School's Directorate of Evaluation and Standardization, prior to conducting their duties. Prior to designation, however, they should be given an evaluation by a locally designated maintenance test flight evaluator, emphasizing the ability to administer training and evaluation. Initial evaluation of this ability for the first evaluator in a specific aircraft at a given activity may be administered by a standardization instructor pilot.

Local standardization boards are not regulated in the number of qualified evaluators they designate, but an adequate number would be selected to provide for local maintenance test pilot/maintenance test flight evaluator training and evaluation. Although there is no requirement for evaluators to be contact instructor pilot qualified, candidates meeting all other requirements, and who have previously completed a Department of the Army approved instructor pilot course, should be given favorable consideration when designating evaluators.

The aircrew training manual requirements for maintenance test pilot/maintenance test flight evaluators remain unaltered. Commanders are encouraged to designate maintenance test pilots as FAC II aviators using requirements of FM 55-44 as the special mission tasks for the maintenance test pilots. Proration of maintenance test flight tasks iteration is in accordance with TC 1-134.

Maintenance test pilots currently on test flight orders who have never completed the AMOC test flight phase, and who wish to obtain this qualification, may challenge the test flight course. A prerequisite for challenging the test flight course is completion of AMOC Phase I, obtainable by attendance, correspondence or receipt of credit for course completion based upon previous maintenance management experience. Requests for credit should document maintenance related experience and education and be submitted via the chain of command to:

Commandant
U.S. Army
Transportation School
ATTN: ATSP-DT
Ft. Eustis, VA 23604

Request to challenge AMOC test flight will include documentation of credit for AMOC Phase I, gradeslip verification of completion of test flight training signed by an evaluator, and should be submitted via the chain of command to:

Commandant
U.S. Army
Transportation School
ATTN: ATSP-ES-MTFSD
Ft. Eustis, VA 23604

The course challenge process will include satisfactory completion of written and oral examinations as well as a practical flight evaluation administered by an evaluator from the Transportation School's Directorate of Evaluation and Standardization. Personnel desiring to challenge AMOC Phase II should submit required documentation to arrive at DOES 1 month prior to a DOES visit to their installation, or 1 month prior to the applicant's arrival at Ft. Eustis for evaluation.

Additional information may be obtained by contacting LTC McGinness or CPT Ochsner at AUTOVON 927-4164/3266.

illustrations by Bill Totty

Sustained Combat Operations

The Aviation Center has prepared an implementation plan that would provide for the increased aviator and maintenance personnel staffing needed to support sustained operations.

Captain Mike Ryan
Directorate of Combat Developments
U.S. Army Aviation Center
Fort Rucker, AL

THE SCENE IS the Tactical Operations Center of the 69th Combat Aviation Battalion (fictitious) located somewhere near Schweinfurt, West Germany. Hostilities had commenced 10 days before and since that time the pilots of the 69th have been flying their pants off. Most have gone with little or no sleep, while a few have had short breaks of up to 2 hours.

To avoid catastrophe, pilots have been taking turns napping while not actively at the controls. However, the intensity of the battle has permitted little of this. Missions con-

tinue to roll in—so many, that the S3 must turn some of them back. The radio begins to crackle:

"Lancer 06 (BN CDR), this is Eagle 06, over (DIV CDR)."

"Eagle 06, Lancer 06, go ahead."

"Lancer 06, Eagle 06. We need those aircraft flying. These missions must be filled."

"Eagle 06, Lancer 06. My guys have been flying for 72 hours straight. If we continue at this rate, there won't be anything left to fly or anyone left to fly them."

"Lancer 06, Eagle 06. Understand the situation, but these missions must be filled or we'll all be calling each other comrade tomorrow morning."

Sound familiar? It should. Today's combat aviation units are not designed with sufficient manpower (pilots and maintenance personnel) to conduct sustained combat operations in a midintensity European environment. Hence, the U.S. Army Aviation Center, Ft. Rucker, AL, was tasked by the Department of the Army, through the Training and Doctrine Command, to study the problem.

The Threat.

The greatest threat to Army Aviation on the modern battlefield continues to be the Soviet air defense elements which are organic to the maneuver forces. The Soviet Union, together with its Warsaw Pact allies, has produced and deployed the world's largest array of air defense systems. This capability includes aircraft with air-to-air missiles, antiaircraft artillery, surface-to-air missiles, radar and radio-electronic combat systems. In addition to the air defense threat, our aviation forces will be subjected to a wide variety

CONSOLIDATED GLOSSARY—Page 28

illustration by Mark Irwin, *Armor* magazine

of other weapons systems that could be used in an antihelicopter role, such as the main gun of Soviet tanks.

More importantly, the preponderance of Soviet attack helicopters on the battlefield will make the possibility of air-to-air engagements a reality. In order to counter these potential enemy forces, highly responsive and alert aircrews must be available anytime, day or night. For these crews to be responsive and efficient, they must receive adequate rest to prevent fatigue from reducing their ability to perform critical tasks on the battlefield.

Fatigue.

The Air Force, Navy and Marine Corps have long acknowledged the weakening effects of stress and fatigue on the pilot while flying. Their experience indicates that to achieve maximum use of their aircraft they must have more than one crew available for each aircraft. This is especially true of the new, advanced systems that the Army is beginning to field, such as the AH-64 Apache. The reliability, availability and maintainability data for each new aviation system shows that they are capable of extended use, which in turn indicates that to derive the additional benefit, more than one crew would be required.

In addition to increased availability afforded by high technology airframes, Army Aviation is faced with a threat which will require the increased use of terrain flight. Protection from acquisition and tracking (optical and radar) by Soviet air defense systems can be effectively afforded by the use of proper nap-of-the-earth flight techniques. The additional stress and fatigue encountered when flying at NOE altitudes have been well documented by the U.S. Army Aeromedical Research Laboratory at Ft. Rucker. With the added development of sophisticated night vision devices, and threat doctrine calling for around-the-clock combat operations, it became apparent that additional aircrews would be needed to achieve optimum use of the capabilities of modern aircraft.

The AAPRSO Study.

Highly responsive, well-rested aircrews must be available to commanders if they are to realize the maximum potential of their aviation assets. Effectiveness on the battlefield is largely dependent on the aircrews' timely reaction to combat situations. The Army Aviation Personnel Requirements for Sustained Operations study was conducted to determine the aircrew ratio of pilots to aircraft seats for a midintensity European conflict. In addition to an analysis of the aircrews, the study included an analysis of the maintenance personnel (rated and nonrated) required to support the aircraft.

The AAPRSO study was approved by Headquarters, TRADOC, in December 1979. It was validated by Headquarters, Department of the Army, in August 1981 with approval of the aviator-to-seat ratios shown in figure 1. The study concluded that current staffing of aviation units is insufficient to realize their full potential during sustained combat operations. Aviator-to-seat ratios greater than one-to-one (more than one pilot per seat) and maintenance personnel increases are required.

Differences in the aircrew ratios shown in figure 1 result from the diverse missions of the units evaluated, and also from the various mission profiles of the aircraft in those units. For example, the mission of the medium helicopter company (CH-47) is quite distinct from that of the air cavalry troop (AH-1, OH-58). Further, the mission profiles of the scout helicopter in the air cavalry troop are different from those of the attack helicopter in that same unit.

In September 1981, the Aviation Center was tasked to prepare an implementation plan that would provide for increased aviator staffing to support mobilization. Inclusion of the additional maintenance personnel was initially deferred pending completion of the career manage-

FIGURE 1: AAPRSO Aircrew Ratios.

Attack Helicopter Company	
AH-1S	1.20
AH-64	1.25
SCOUT	1.42

Air Combat Troop	
AH-1S	1.33
AH-64	1.29
SCOUT	1.80

Division Aviation Company	
UH-1	1.29
FAAO	1.42
OH-58	1.31

Combat Support Aviation Company	
UH-1	1.42
UH-60	1.36

Medium Helicopter Company	
CH-47	1.14

Aeromedical	
UH-1	1.45
UH-60	1.49

ment field 67 study (see October 1982 *Aviation Digest,* "Aviation Personnel Notes, CMF 67 Update," page 22). This was primarily because of unforeseeable impacts the study might have on the aviation force. This restriction was removed when the study was completed.

Computation of the total requirements to sustain the aviation force was a relatively simple matter. The number of additional aviators was determined by multiplying the number of aviator positions in a particular unit by the recommended aircrew ratio. For example, one Army 86 attack helicopter company has 6 attack aircraft which require 12 aviator positions (2 pilots per attack aircraft). The 12 attack positions multiplied by the aircrew ratio of 1.2 (AH-1S) yields a requirement for 14.4 positions. Any computation yielding less than .5 is rounded down, while those resulting in .5 or greater are rounded up. Therefore, the attack helicopter company equipped with the AH-1S should have 14 pilots for its 6 aircraft instead of 12. Computations for the scout aircraft are the same, with the exception that there currently is only 1 aviator position per aircraft (4 scout aircraft per company). The aircrew ratio is 1.42 which equals 6 scout pilots instead of the 4 now authorized.

Computations for the additional maintenance personnel requirements were accomplished in accordance with Army Regulation 570-2, "Organization and Equipment Authorization Tables— Personnel." The flying hours derived from the wargames conducted for the Army Aviation Mission Area Analysis (figure 2) were inserted in the manpower authorization criteria formulas to determine the requirement for maintenance personnel. Once the total requirement was identified, the current requirements were subtracted to determine the difference. Thus, the difference represents the additional requirement necessary to support sustained operations. The AAMAA flying hours were used because they incorporated the most current data available. Once the total requirement was identified, the implementation plan was developed.*

Department of the Army Tasking.

The Aviation Center's charter in determining the methodology to support the implementation proposal was to do what we thought was best for *the total Army.* Our objectives were threefold. First, to design what we called sustainment battalions; second, we would develop alternatives to resource these battalions; and third, we were to complete the project in order to impact on the 1985 to 1989 program objective memorandum.

We decided early that development of the sustainment battalions would coincide with development of Army 86 aviation organizations. Hence, while we would create sustainment units for all aviation units, only the sustainment battalion for the Cavalry Brigade (Air Attack) of the heavy division would be submitted for approval. As of December 1982 (the date our proposal was submitted to DA for approval), the heavy division was the only *approved* Army 86 organization.

Figure 3 depicts the organizational characteristics of the CBAA sustainment battalion for the heavy division "J-Edition TOE." Each element of the sustainment battalion is linked to a similar element of the

*For more on the Army Aviation Mission Area Analysis, see *Aviation Digest,* April 1982, page 17. Other related information was carried in the *Aviation Digest's* coverage of the "Army Aviation Systems Program Review '82": June 1982, page 38; July 1982, page 8; September 1982, page 36; and October 1982, pages 2 and 9.

FIGURE 2: AAMAA Flying Hours Results (Flight Hour Planning Factors).

Attack Helicopter Battalion

AH - 3.28
SCT - 2.71
UH - 2.31

Air Cavalry Troop

AH - 5.53
SCT - 4.74
UH - 2.21

Combat Support Aviation Company

UH - 6.11

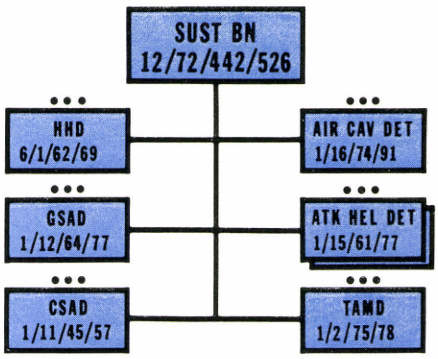
General Support Aviation Company

OH - 3.21
UH - 5.93
FAAO - 6.42

Combat Electronic Warfare and Intelligence Aviation Company

EH - 5.0

FIGURE 3: CBAA Sustainment Battalion J-Edition, Heavy Division.



parent organization—the CBAA. For example, the attack helicopter detachments are designed to support the attack helicopter battalions. The battalion is commanded by a lieutenant colonel, and his headquarters detachment provides a skeleton staff to perform peacetime administrative functions. It is interesting that the largest element of the headquarters and headquarters company consists of a general support class III/V platoon which was removed from the base CBAA and placed in augmentation. In simple terms, this means that the general support class III/V platoon, although recognized as a wartime requirement, was deemed to be unaffordable in peacetime. In the detachments, captains serve as commanders and warrant officers serve as section leaders and fill the remaining pilot requirements. Configured in this manner, these units enhance the resiliency, redundancy and robustness of the supported unit and provide a traditional chain of command.

Resourcing.

One of the more complex problems facing the Army today is the need to fill our wartime requirements in the face of dwindling resources and limited budget growth. This was also a major obstacle in the development of the sustainment battalions. It was a relatively simple task to calculate and document the requirements for Army Aviation to conduct sustained combat operations. However, it was a much more difficult task to identify potential candidates for resourcing these battalions. Increases to the force structure allowance were not considered a viable alternative in light of the fact that resources are continually being constrained to meet fiscal demands. The Army could not afford new structure when many of its front line units were not organized at the required level. Therefore, resources to fill Army Aviation's sustainment requirement would have to come from existing assets.

Use of the Individual Ready Reserve was, at first, thought to be an attractive and useful alternative in that it would not require an increase to the force structure allowance. However, upon closer scrutiny, we found that the viability of the individual mobilization augmentation program for aviators was undetermined and, therefore, not quantifiable. However, data currently being gathered by Forces Command, under the auspices of a test program called "Battle Rostering," may make the use of these aviation personnel in the IRR a desirable option in the future. The present alignment of Army National Guard aviation units makes them easily and readily adaptable to unit integration and, therefore, the most logical and practical solution.

Our resourcing analysis methodology was primarily concerned with the most efficient means of implementing the sustainment battalion proposal. Recognizing that all units would not be resourced and in accordance with priorities, our proposal (figure 4) recommended that the aviation units of the five lowest priority National Guard divisions be restructured to provide the sustainment requirements of the heavy divisions in the rapid deployment force and in Europe and to provide a tailored combat aviation battalion for those divisions.

As depicted in figure 5, the Reserve Component unit would consist of the parent unit plus the attached sustainment element. During annual training or upon mobilization, the sustainment unit would be attached to the appropriate Active Army division, thus comprising what we call an "enhanced unit." At all other times, to include monthly training, the sustainment element would work for and with the parent Reserve Component unit.

To further the illustration of this proposal, we have portrayed, as an example (figure 6), how a National Guard division might provide support (round-out) to an Active Component division located in Europe. Each aviation unit of the 47th Infantry Division would provide a like element of the sustainment battalion with the exception of the one combat support aviation company located in Illinois. Monthly training would be conducted in conjunction with the supporting unit of the 47th Infantry Division—or it may be conducted on opposite weekends. All facilities and equipment available to the aviation units of that division also would be available to the detachments of the sustainment battalion. For annual training and upon mobilization, the detachments of the sustainment battalion would deploy to Europe as a battalion and become assigned to the appropriate units in the 8th Infantry Division.

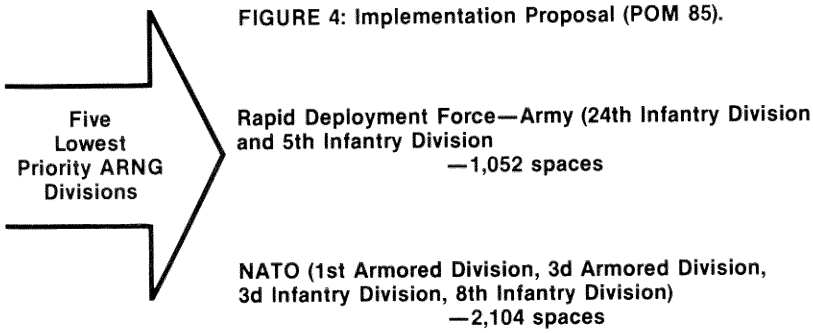


FIGURE 4: Implementation Proposal (POM 85).

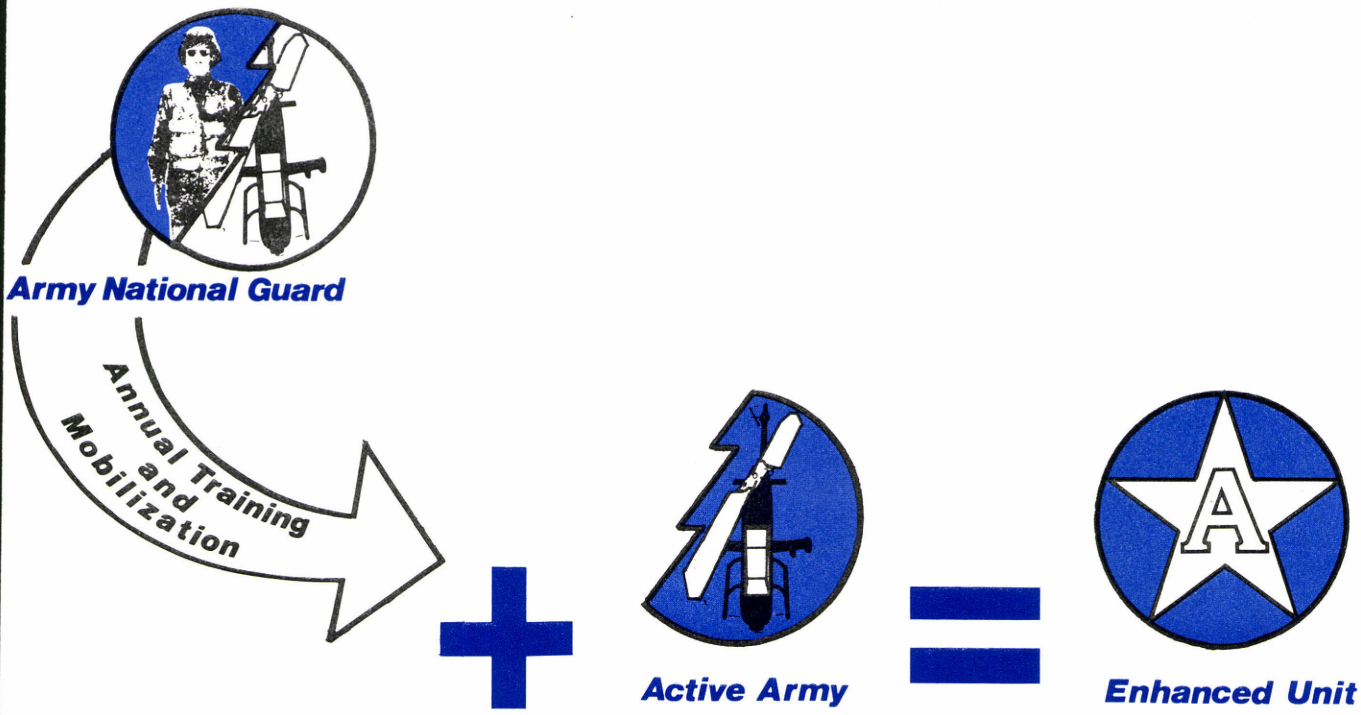
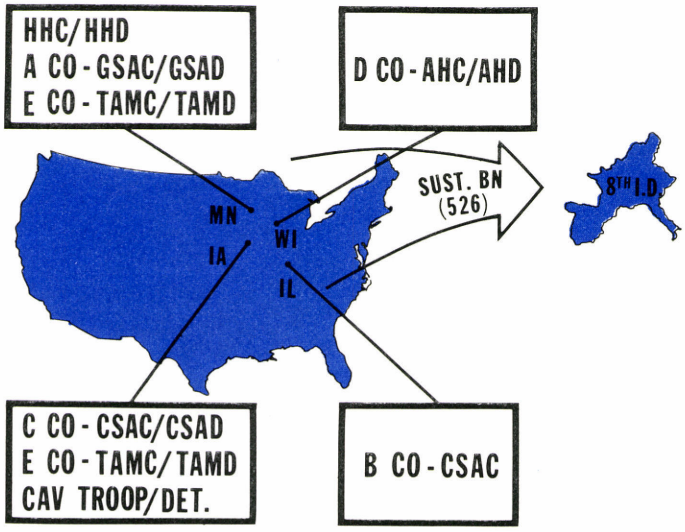


FIGURE 5: ARNG sustainment personnel are attached to the supported Active Army unit for annual training and assigned to them upon mobilization. At all other times (weekend training) they are attached to their parent ARNG unit.

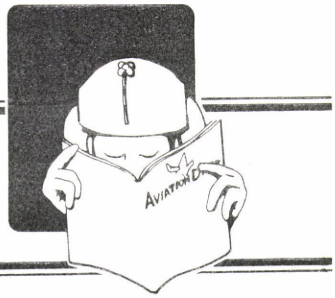
An important aspect of this proposal is the fact that the units of the supporting element (47th Infantry Division) must be equipped with sufficient numbers of the same type aircraft and associated support items as the supported element (8th Infantry Division). This is crucial to the program in that upon mobilization, the sustainment battalion would require little or no preparation time. We emphasize that only personal equipment is included in the organization of the sustainment battalion, thus allowing it to mobilize and deploy rapidly. All equipment, such as aircraft, would stay with the supporting element upon mobilization, thus simultaneously providing for a more rapid equipment modernization of Army National Guard aviation units.

FIGURE 6: 47th Infantry Division sustains the 8th Infantry Division.



This proposal offers a somewhat radical departure from established procedures. However, in a period of increasing tensions and economic decline, perhaps radical procedures are in order to fully meet our commitments. This proposal will allow the Army to meet the requirements to conduct sustained combat operations while concurrently modernizing our Reserve Component forces at a more rapid rate than is currently programed.

VIEWS FROM READERS



Editor:

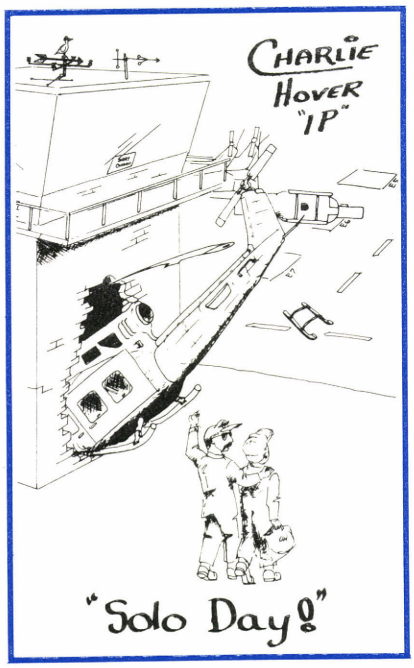
I would appreciate receiving a copy of the article, "Chemical Agents, First Aid and Long-Term Effects," by Captain Timothy Savage. It appeared in the December 1981 *Aviation Digest.*

Captain Penetar
Division of Ocular Hazards
Letterman Army Institute
of Research

Editor:

This is an open letter to many people in Army Aviation.

So you're still smoking. You still refuse to admit to yourself that the profession you have chosen requires you to be among the most physically fit people in the world and you're still sucking on tobacco. I will concede that it is a personal choice, but when millions of dollars are spent on research and the results are so conclusive, I still have to admit I just don't understand why you continue.



It is true that smoking after eating is supposed to help digestion, and that cigarettes help to keep your weight down. But being light as a feather won't help you climb stairs without losing your breath. It is no wonder you hate the physical training test and that "delicious" taste you have in your mouth when you wake up in the morning.

Then there is the aspect of money spent on those enjoyable little devils. Why if you're just a medium smoker, defined as 20 to 30 "coffin nails" a day, you spend $312.00 a year. What a bargain! More than 10,000 chances a year to gum up your lungs, tint your teeth and drive your heart nuts.

Let us not quibble over all the wonderful little bonuses you get when you volunteer to pollute your respiratory system and environment. Bonuses like a heavenly aroma, overloaded ashtrays and that ascending trail of blue-white smoke that has an uncanny attraction for nonsmokers. Next time you desire companionship, look for that nice fellow that always asks for your last smoke.

I find a great deal of humor in those of you who try to enjoy your cancer stick while you attempt some small tedious task like trying to fill out a flight plan and your favorite brand is smoldering away. Even with smoke-filled eyes you prevail until your eyes are squeaking.

Out to the aircraft you go, rushing preflight, runup and takeoff. Think of the advantages of flying NOE and being able to log high altitude cross-country at 8,000 to 10,000 feet. Even better is the advantage of having less than the normal 20/20 vision that the rest of us have at night. What you can't see won't hurt you.

Ladies and gentlemen of Army Aviation, you can be proud of the things you have accomplished. All the tests and evaluations you have endured. I have one oral evaluation that may save your life. Ask yourself, "Why do I still persist!"

CW2 Mike Benson
UH-60 Branch
Cairns AAF

Editor:

It would appear that the *U.S. Army Aviation Digest* may be a source of information which will aid the research of the de Havilland DHC-2/U-6A aircraft's history. I would appreciate information about your publication with regard to subscription and content.

PROJECT DHC-2 is a historical research project dedicated to the tracing and documenting of all the 1,692 "Beavers" and "Turbo Beavers" manufactured by the de Havilland Canada Company located in Ontario, Canada. Obviously a great portion of this research focuses upon the U.S. Army which received many of the 968 of these type aircraft which were delivered to U.S. military concerns.

Should you find that information on this aircraft is held in the files of the *Aviation Digest* I would enjoy hearing from you. Please feel free to suggest any other avenues of enquiry regarding any of the military roles performed by the DHC-2/U-6A. Thank you very much.

Steven J. Todd
Campbell River
British Columbia, Canada

Editor:

I enjoyed the recent series that appeared in *Aviation Digest,* "Forty Years of Army Aviation," and respectfully request a copy of the complete series.

Phil Graziano
Utica, NY

Editor:

This seems like a long time after the period, but I really did not think of this solution until recently.

In 1961, I was a commander of the 150th Armored Cavalry Aviation Company. Our unit was called to active duty at Ft. George G. Meade, MD. While at the post during January, I took the aviation company on a field problem at

Camp A. P. Hill. The unit went to a field located on the northwest corner of Camp A. P. Hill. It was about 15 miles from this airfield to the main post headquarters down on U.S. 301.

On the way from Ft. Meade to A. P. Hill it started snowing. It continued snowing all day and into the night. The next morning there was about 15 inches of snow all over the place. The snow pulled down the power lines and the phone lines from the main post. Needless to say we were more or less isolated. As you can understand the helicopters had no problem, but the fixed wing—L-20s and L-19s—were grounded until the snow could be removed. The men made draglines from chains and heavy timbers. This was the only way we had of clearing the snow from the runway. It took about 3 days to get the majority of the snow removed so we could use the fixed wing aircraft.

I believe if we had had some sort of snow plow that could be attached to a 2½ ton truck or 5 ton truck we could have cleared the runway in a much shorter time. I also believe that some sort of plow would help in combat until the Engineers could come to help. Our trucks are now heavy and powerful enough to do considerable earth moving and/or snow plowing in emergency situations. I also feel sure this type of equipment would have other uses in and around a field exercise.

I'm not suggesting we make Engineers out of Aviation personnel, but believe this suggestion has merit.

MAJ Edward A. King, Ret.
Huntington, WV

Editor:

Let me have a minute to discuss the new requirements for award of Senior/Master Aviator ratings IAW AR 600-105.

These ratings should be an indication of an Army aviator's experience, not time out of flight school. If an aviator wants to remind himself or others of his time out of flight school he need only consult his leave and earnings statement. Granted, in today's Army of specialization everyone can't get 50 hours of instrument time or 50 hours of NVG time but some flying hour requirement should remain. I see aviators getting awarded Senior wings who have less than 500 hours of total time in 7 years. What does it all mean? When I was a new guy I used to look at my pilot in command's wings, not his rank and whether he was a chief warrant officer or a major. If he was wearing a star or wreath I felt comfortable, the passengers felt comfortable, and I expected to learn and to improve my techniques from this veteran. Not so any more. He may be old but he might not be good.

For those of you proud of what your wings represented and feel a revision of AR 600-105 is in order, ensure that your command addresses this as an issue at the next Aviation Policy Committee meeting.

CW4 Ralph D. Martin
Schofield Barracks, HI

Editor:

The debate over the issue of what criteria are best for determining the award of the Senior or Master Army Aviator Badge is unfortunate. If we were to consider ourselves only as *pilots*, I believe the sole criterion concerning the award would appropriately be the number of flight hours accrued as an individual pilot. However, the unfortunate aspect of this is that the Army needs people who consider themselves to be *aviators* not just pilots or individuals solely concerned with the object of accumulating "X" hours of flying time.

Accumulating flight time per se does not necessarily mean an individual is a Senior or Master Army Aviator. Remember the old adage "the experience of one thing done a 1,000 times"? Such experience is not necessarily the stuff Senior badges are made of.

On the other hand, an Army aviator has been defined to be "an expert in the doctrine, organization, equipment and personnel of Army Aviation in order to command, direct, coordinate and/or control Army Aviation elements as they train or operate in conjunction with other land and/or air forces as fully functioning component members of the combined arms team." Total Operational Flying Duty Credit not only applies to flying positions which result in the accrual of flying hours but also to experience in other aspects of being an *Army aviator.* Increasing experience and expertise as an Army aviator, an individual with Army Aviation experience as well as flight experience, reflects the real criteria for recognizing expertise as an Army aviator.

In these days in which there is a crying need for developments in our doctrine, combined arms tactics, force structures and threat awareness, we don't need just pilots with "X" hours but professional Army aviators who are capable of growing in experience in a number of areas, to include piloting aircraft to be sure, but also more importantly in applying that knowledge and experience accrued to the development of the combat ready Army Aviation force we need and our Army and nation deserve. As such, the current TOFDC criteria is a much better method of designating individuals as Army aviators of various levels of expertise.

No method may be perfect, but the current one certainly helps recognize a means of designating professional growth and experience among all Army aviators and not just the few pilots in high flight time accruing positions.

MAJ Charles B. Cook
Army Aviator at Large
Alexandria, VA

Editor:

I am an Army helicopter veteran researching the UH-1 Huey in preparation for writing a book dedicated to the complete Huey story. I would appreciate receiving photos, unit and aircraft information, or personal highlights about Hueys and Huey units from anyone interested in helping with this research.

Wayne D. Mutza
3728 S. 19th St.
Milwaukee, WI 53221

Articles from the *Aviation Digest* requested in these letters have been mailed. Readers can obtain copies of material printed in any issue by writing to: Editor, *U.S. Army Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362

1983

WORLDWIDE AVIATION LOGISTICS CONFERENCE

Colonel Thomas M. Walker

THE 1983 Worldwide Aviation Logistics Conference was held at Headquarters, U.S. Army Troop Support and Aviation Materiel Readiness Command, St. Louis, MO, during the week of 11 through 15 April.

This annual conference is directed by the Army Deputy Chief of Staff for Logistics and has been hosted by TSARCOM and its predecessor commands since 1971.

As in past years, the 1983 WALC was attended by senior logisticians and aviation officers of Army commands worldwide. A total of 113 attendees represented 34 commands and installations.

The 1983 WALC was organized into 15 system-oriented work groups and 4 support program groups chaired by the systems managers or function supervisors.

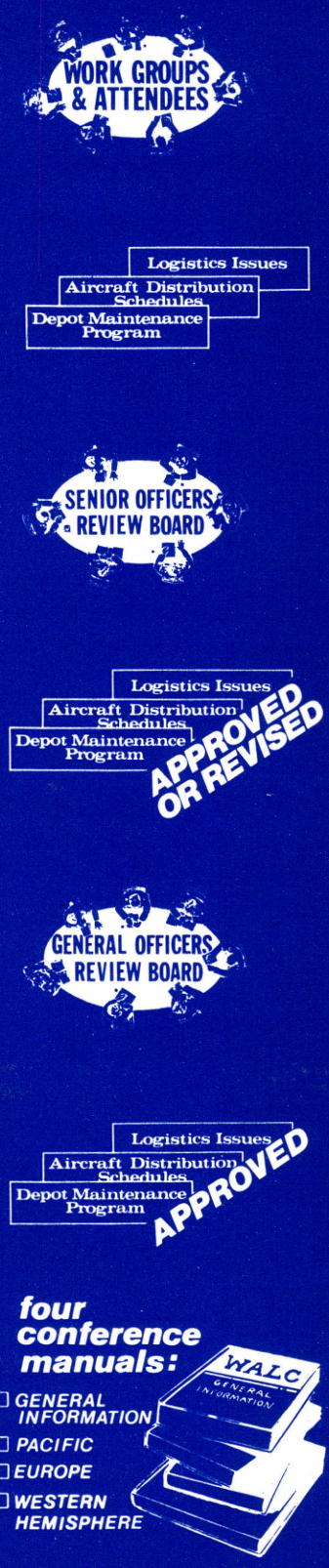
Prior to convening the WALC, each command had reviewed the applicable Army Authorization Document and had submitted suggested changes to the Deputy Chief of Staff for Logistics (Aviation). Concurrently, the commands had submitted logistics issues to the TSARCOM WALC project officer to be considered and resolved during the conference. Many of these appeared as agenda items of the conference.

During the week command representatives and work groups developed distribution schedules for aircraft for fiscal years 1983 and 1984. They also established a Depot Maintenance Program for the overhaul and return to field units of aircraft in need of maintenance or repairs. A third task of the conference was the resolution of logistics issues aired by Army Aviation units.

The schedules, programs and logistics actions developed were presented to a board composed of senior officers of the commands and chaired by Mr. Joseph P. Cribbins, the aviation assistant to the Army's Deputy Chief of Staff for Logistics. After approval or revision of the schedules, programs and actions by the Senior Officers Review Board, these items were briefed to a General Officers Review Board composed of commanders of major Army commands, or their personally designated representatives. This board was chaired jointly by Mr. Cribbins and Major General Emil L. Konopnicki, TSARCOM commander.

The proposals, as finally approved by the General Officers Review Board, will be distributed to all Army Aviation units upon publication. The approved WALC schedules affect the state of preparedness or combat-ready condition of Army Aviation units. Indeed, they are the directives upon which theater commanders must base the assessment of our Nation's ability to deter aggression throughout their areas of influence.

Colonel Thomas M. Walker was the project officer for the 1983 Worldwide Aviation Logistics Conference. He is now director, Systems Management, TSARCOM.



U.S. Army Communications Command
ATC ACTION LINE

Helicopters and the National Airspace Review

CW4 Peter C. McHugh
U.S. Army Air Traffic Control Activity
Aeronautical Services Office
Cameron Station, Alexandria, VA

THE NATIONAL Airspace Review is a joint FAA/DOD/aviation industry program conducting an indepth study of airspace and procedural aspects of the air traffic control system. The NAR, part of the National Airspace System Plan, studies preidentified areas and provides the FAA with user input, suggesting a near-term solution to mutual problems and promoting greater use of the National Airspace System.

The NAR will continue for 42 months. Its task groups are composed of about 10 members from such user groups as FAA, DOD, Helicopter Association International, Aircraft Owners and Pilots Association, National Association of State Aviation Officials, National Business Aircraft Association, Experimental Aircraft Association, Airline Pilots Association, Air Transport Association, American Helicopter Society. Sessions last 3 weeks in each area of interest.

Proceedings are compiled in a staff study incorporating numbered recommendations which are forwarded through an executive committee to the FAA Administrator. Recommendations approved by the Administrator are staffed and implemented under procedures established by law and will therefore be circularized for public and DOD comment prior to becoming regulatory. Many issues must be referred to committes which exist to establish specifications for aeronautical information products. In these, the Army has an opportunity to influence task group recommendations. The U.S. Army Aeronautical Services Office provides representatives to all pertinent NAR task groups for the DA. USAASO represents DOD in the Helicopter Task Groups.

The first of four NAR task groups devoting attention specifically to helicopters completed its session in February 1983. These deliberations focused on ATC separation as expressed in FAA Handbook 7110.65c. Recommendations to make substantial reductions in separation criteria for helicopters may produce economic and operational benefits. Following on FAA's presentation of its Rotocraft Master Plan at the HAI Symposium in Anaheim, CA, these may provide a national impetus to exploit the unique capabilities of helicopters in the NAS.

Army positions within the task groups provide unique Army Aviation influence at the national level which will hopefully have a favorable impact on use within the NAS. The studies have addressed a variety of topics and provided perspectives complementary to future Army mission objectives and equipment capabilities. For example, in TG 1-3, Random Routes, the Army's forward looking statement of requirement demands that the NAS provide for assured IFR clearance from any departure point/field site to any destination at minimum IFR altitudes without ATC radar coverage. This considers that the route selected by the pilot may include overflight of specific points en route or may be direct with ATC providing assurance that clearance will be available via the filed random route. Conceptually, aircraft navigation equipment may be Doppler, loran or GPS.

Army initiatives in TG 2-4, Helicopter Separation, led to recommendations reducing standard ATC separation of helicopters. Drafted in concert with ATC expertise at Ft. Rucker, AL, this met with strong civil/commercial support in the task group. These recommendations will lead to separation standards derived from unique helicopter performance. Terminology reflecting the vernacular of rotary wing operation will be included to facilitate pilot/controller communication and to expedite control. This contributes to reduced delay and to more efficient use of the NAS with uncompromised levels of safety.

Schedules of NAR meetings and their assigned areas of interest are published in the Federal Register. Minutes and staff studies are available. USAASO encourages readers to direct comments or questions regarding the NAR to the address below. These will be considered in formulating DA positions for task group discussion. The NAR represents an unusual opportunity for Army influence of national legislation to the advantage of Army Aviation's use of the NAS.

Readers are encouraged to address matters concerning air traffic control to:
Director, USAATCA Aeronautical Services Office, Cameron Station, Alexandria, VA 22314

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ANNUAL WRITING AWARDS

January
Threat: The DEW Threat
CPT Donald R. Faint

February
The Chemical Environment and Army Aviation
CW2 Thomas E. Whitson

March
The Last Alert
CW3 Ernest D. Kingsley

April
ATC Action Line: Want To Become an Old Pilot?
Mr. Kenneth S. Arnold

May
ANVIS—Now a System Designed for Aviators!
Mr. Tim Neal

June
Threat: Soviet Attack Helicopters—King of the Hill?
Mr. Ed Bavaro

July
When Will We Learn About Mountain Flying?
Raymond P. Johnson

August
Threat: Soviet Air Defenses Against Attack Helicopters
LTC Brian P. Mullady

September
Knights Train For The Night
MAJ Frank L. Carson and CW3 Owen D. Scruggs

October
Where's The Foreign Clearance Guide?
CW4 Thomas A. Story

November
JAAT, A Present Concept
MAJ William J. Filippini and CPT David S. Prewitt

December
Who Needs It Anyway?
CW3 William W. Shawn

1st CW3 Ernest D. Kingsley

2nd Mr. Ed Bavaro

3rd CW3 William W. Shawn