UNITED STATES ARMY MAY 1971

AVIATION DIGEST

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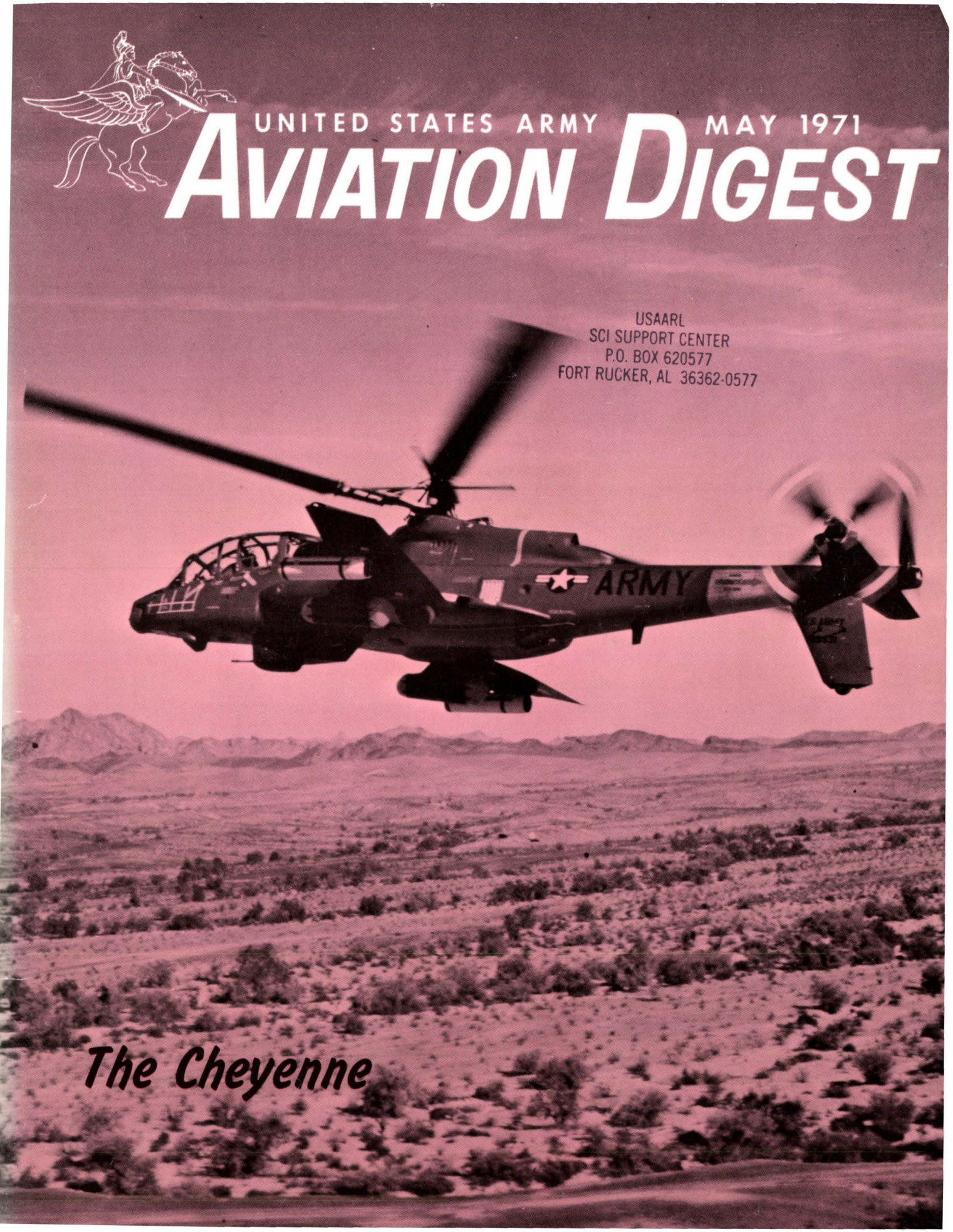

The Cheyenne

UNITED STATES ARMY AVIATION DIGEST

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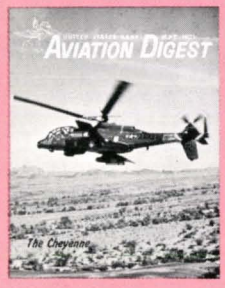

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, U. S. Army Aviation Digest, Fort Rucker, Ala. 36360.

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VIEWS FROM READERS

Sir:

I read with dismay the article entitled "Good Safety Practices Do Pay Off" in the February 1971 edition of AVIATION DIGEST.

I am in full agreement with the use of safety equipment and maximum application of good safety practices; however, the article was about an incident that, from the facts presented, was both an unsafe act and tactically unsound. (I realize that criticizing in retrospect a tactical situation as unsound and/or conducted outside safety limits is always risky when you were not there to know the whole situation.) From the description of the incident, it appears that the AH-1G was not being employed within established sound tactical or safety limits because a gunship that is covered with mud has overflown its target and must have been too low. There are, of course, times that the tactical situation would require such action but from the article this is not indicated.

All in all, I believe it was a poor example of good aviation safety, not a seldom found situation that promotes the value of good aviation safety as claimed by the article. From the facts presented in the article this "accident" could have been prevented and that is the best practice of safety.

MAJ R. A. Neuwien Jr.
Assistant Inspector General
U. S. Army Primary Helicopter Center/School
Ft. Wolters, Tex. 76067

Sir:

I am a Marine major who was one of the first four Marines to go through the Army Cobra training at Hunter AAF, Ga. I was truly impressed with the overall syllabus, especially the emphasis placed on the cardinal rules of employment of attack helicopters. One of those rules is: "Do not overfly the target."

On page 32 of your February issue reference is made to damage sustained by a Cobra in a gun run when it flew through a secondary explosion. Although I realize your article is attempting to emphasize the value of protective flight equipment, I think it would have been much more effective if you had also questioned the wisdom of the tactics which produced the damage.

Your photos also imply that the pilots were wearing utilities rather than Nomex flight suits. Is this a fact? If so, is this a good safety practice?

I enjoy your magazine very much, especially because it deals so much with helicopter problems. I especially appreciate your recent increase in emphasis on supervision and command attention with respect to aviation safety. I was the helicopter analyst at the Naval Safety Center in 1968 and am firmly convinced that these areas are the two remaining untapped sources for decreasing our accident rate and subsequently increasing our operational readiness.

MAJ J. L. Pipa
Marine Corps Liaison Office
Code 142
Naval Weapons Center
China Lake, Calif. 93555

• The DIGEST has received numerous letters on this article. We couldn't agree with them more. However, the article in no way endorsed the *tactics* involved. Rather it took the opportunity to point out that the *good* safety practices involved *did* pay off. The aviators were wearing Nomex flight suits during the flight; the photo was posed for later.

Sir:

The article "Accidents Are Stupid" in the February 1971 issue is great to point out the "stupid" errors committed and the disastrous results. The author left out one important step in the solution to prevent aircraft accidents . . . use of performance data charts to determine probable aircraft performance.

It is useless to compute the weight of an aircraft and density altitude unless some kind of performance standard is used to determine aircraft capability. The mere fact that it is a hot day will indicate that the aircraft will not perform as well as it does on a standard day but this information, like density altitude, does not tell the degree of deterioration in performance. This information is found in chapter 14 of the operator's manual (dash 10). After determining probable aircraft performance from performance data charts, actual performance can be confirmed at a hover.

CPT James P. Wall
504 Morgan Lane
Ozark, Ala. 36360

Sir:

I think you put out some bad information in the "Instrument Corner," page 27, March 1971 edition. The last question concerning reporting errors in estimates was answered incorrectly. My reference in the 4 Feb 71 issue of FLIP, section II, tells me that this report is not necessary when in radar contact.

How say ye to this?

MAJ Raymond E. Evans
California Army National Guard
Long Beach, Calif. 90822

• Yea verily, to err is human but to do so in print embarrassing, however legitimate in this case. Please see "Instrument Corner" on page 30.

The Army Cheyenne

Out of the advanced aerial fire support system (AAFSS) program arose the AH-56A Cheyenne. Featuring the latest aerial equipment, the Cheyenne can fly up to 26,000 feet, day or night, and in most weather. The low level, high speed flight capability, coupled with its outstanding maneuverability, make the Cheyenne an extremely difficult aircraft to hit with ground fire. The versatile weapons system and computerized fire control enables the crew to engage most any target with high probability of first round hit. This article contains the most accurate information to date on the amazing Cheyenne

Colonel Robert J. Dillard

THE NEED FOR airmobile forces in the Republic of Vietnam was quickly established and the concept of the 1950s became a proven success in the 1960s. Although loss rates early in the conflict were less than expected, they were high enough to bring sharply into focus a demand for improvements in helicopter survivability. Of immediate concern was the reduction of vulnerability against small arms fire in Vietnam, particularly for the attack helicopters.

Bolt-on armor plate and flak vests substantially lowered pilot and helicopter loss rates. Other features were later "added" that further improved helicopter survivability. But how could helicopters expect to survive in potentially less permissive combat environments of the 1970s and the next decade? It was for this purpose that the Army directed its concern and attention to designing survivability into the AH-56A Cheyenne.

From the time the advanced aerial fire support system (AAFSS) concept was conceived in 1964, the Cheyenne was designed and developed to stringent protection requirements. The intent was not only to make organic to the U. S. Army an accurate and lethal direct aerial fire support system, operational and effective in all potential world-wide natural and hostile environments, but also to make it the most invulnerable aircraft to enemy fire in the history of the Army. It was from these demands that the exceptional survivability features of the Cheyenne evolved.

Future Combat Environment

The decade of the 1960s ended with definite indications of diminishing U. S. military involvement in Southeast Asia. The Army enters the 1970s with the responsibility for maintaining an economical combat-ready posture for a spectrum of possible future conflict situations. Potential world-wide actions could range from antiguerilla counter-insurgency to high intensity warfare against massive armored forces equipped with the latest weapons. In addition to automatic small arms fire, which is the major threat to helicopters in Vietnam, future aerial attack systems must be prepared to encounter sophisticated antiaircraft threats—surface-to-air missiles (SAMs) and antiaircraft guns with high explosive *HE* rounds— in this spectrum of potential conflicts.

From Vietnam we have learned that the attack helicopter can withstand considerable punishment from fire delivered by light automatic weapons. However the survivability of these same attack helicopters is reduced when encountering ground forces equipped with the larger caliber weapons.

While current attack helicopters can be adapted to accommodate limited additional weaponry appropriate for the higher intensity conflicts, survivability in a sophisticated threat environment is not so easily ascertained. The key to long range preparedness is to develop a survival philosophy at the inception of an attack helicopter program which is of

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COL Dillard was the advanced aerial weapons systems project manager with USAAVSCOM, St. Louis when he wrote this article. A Senior Army aviator, he qualifies in both fixed and rotary wing aircraft

Designed To Survive

equal importance with all other desired attributes. Then design in survivability as an integral part of the overall aerial weapon system. The Cheyenne evolved under this integrated weapon system approach.

The Attack Helicopter

It was prior to the deployment of U. S. combat troops in the Vietnam conflict that the Army's 11th Air Assault Division (T) developed and demonstrated the rotary wing airmobile concept. By the time U. S. Forces in Vietnam were energetically engaging a fleeting enemy in search and destroy missions, it became apparent that a new dimension had been added to modern warfare. Transport helicopters were being frequently engaged by enemy ground fire. This situation created an immediate need to arm the transports for both self and mutual protection. The response to this requirement was adapting helicopters to accommodate door gunners with light machine guns.

The "armed helicopter" soon became an established vehicle for combat. Separate armed helicopter units were created and proved themselves as effective escorts. The success of the armed helicopter against hostile ground forces in these missions clearly indicated the need for an expansion of tasks to include attacking ground targets in proximity to engaged U. S. troops. This type of discriminating fire, delivered at the behest of the ground commander and called

Figure 1

direct aerial fires (DAFs), as distinguished from close air support, soon proved to be the decisive contribution to the success of many firefights. The Army learned that traditional methods of fire and maneuver could be vastly improved by using its most mobile combat vehicle—the helicopter—to deliver effective firepower.

Unfortunately the forced landing and loss rate of these aggressive combat vehicles, while acceptable, were higher than desired. The Army now began in earnest to study aircraft survivability problems and in the interim provide the current combat helicopters with some means of passive protection.

It was in the mid 1960s that the first "attack helicopter" was introduced into the Army inventory, the AH-1G HueyCobra. For the first time the Army had a helicopter specifically designed for the direct aerial fires mission. The Cobra, a modification of the successful UH-1 series of helicopters, was equipped with antipersonnel weapons in a chin-mounted turret and capable of carrying 2.75-inch folding fin aerial rocket (FFAR) pods. But of equal importance to increased firepower, the Cobra also offered several vulnerability reduction features—bolt-on armor for vital engine components, crew seat armor and self-sealing fuel tanks. These features, for the purpose of defeating or negating the effects of small arms fire, were the result and the initial implementation of Army planning for improving helicopter survivability.

Cheyenne Characteristics

The Cheyenne advanced attack helicopter is the realization and culmination of the Army AAFSS requirements initiated in the mid 1960s. The Cheyenne compound helicopter is currently under development. It is the most advanced, fully integrated rotary wing weapon system in the world (figure 1). It is capable of carrying and delivering large payloads of lethal ordnance. Deadly accurate fires are accomplished with the finest computerized fire control system of its type ever developed. A swiveling gunner's station with a 360 degree field of view and containing a stabilized periscopic sight is tied into all aircraft armaments through the computer.

Basic armament (figure 2) includes: (1) TOW antitank missiles externally mounted in pods on the wings, (2) 30 mm cannon in the belly turret with a 360 degree field of fire that can deliver dual purpose rounds (antipersonnel/light armor) with demonstrated accuracies that equal or exceed the accuracies of any aircraft flying today and (3) an accurate 40 mm antipersonnel/grenade launcher located in the nose turret. A 7.62 mm automatic gun serves as an alternate weapon for the nose turret.

Additional onboard systems that further enhance the devastating firepower of the Cheyenne are the self-contained Doppler inertial navigation system and a gunner's night vision system for around-the-clock combat operations.

A Matter Of Survivability

Before reviewing the specific survivability features of the Cheyenne, it is appropriate to first clarify the term survivability. Survivability in the aircraft context is a capability to survive hostile fire during the conduct of its mission. How well a vehicle accomplishes this goal is the measure of survivability. That which is to be measured is the efficacy of the active and passive defense features of the aircraft (figure 3).

The overt actions of any aircraft during approach, delivery of fire and departure from enemy target engagements are of-

ten referred to as active defense features. The active defense features of any aircraft are: (1) the combat tactics and safety of flight options available to the pilot, determined by the maneuvering capabilities of the aircraft; and (2) the ability to avoid or neutralize enemy fire that can threaten achievement of fire mission objectives—a function of the acquisition, fire control and armament system which is integral to and harmonized with the aircraft.

Aircraft protection by design (or modification) of airframe and onboard systems is referred to as passive defense features. Methods for survivability improvement of this type include: minimal visual, radar and infrared signatures; and improved invulnerability. Decreasing the vulnerability is by far the most widely used technique, but also most often incorrectly assumed to be synonymous with the degree of overall aircraft survivability.

Survivability Features

Aircraft survival during a combat mission depends on the success of: (1) avoiding being hit—low detectability, minimum exposure and threat suppression; (2) withstanding a hit—low vulnerability; and (3) continued operation with a high level of safety when flown and landed in a damaged condition.

Avoid being hit—Flight tactics used to attack hostile ground targets can significantly affect the survival of the aerial support system. Assuming a midintensity armored conflict with U. S. air superiority, an attack aircraft should expect to encounter a spectrum of threats. These threats include: (1) optically controlled antipersonnel and high explosive antiaircraft weapons, (2) radar controlled antiaircraft weapons of similar caliber, (3) small arms fire and (4) surface-to-air missiles.

Predictable antiarmor attack maneuvers, such as straight-in dives, may be prohibitive in this threat environment. Incoming the aircraft would be exposed to surface-to-air missiles and the optical and radar controlled high explosive incendiary antiaircraft fire. Following commencement of the attack the aircraft would be exposed to optically tracked antiaircraft weapons and automatic small arms fire as it flies close by or over the target.

The Cheyenne would employ its unique characteristics in performing the required attack tasks by attempting to operate below the radar horizon and below the minimum SAM altitudes. We are all familiar with a helicopter's ability to fly at low speeds close to the terrain, referred to as nap-of-the-earth flight. The AH-56A compound helicopter will use its stabilized fire control system with a 360 degree field of view and a 12 power periscope to detect and identify designated targets and protecting threats. Then by taking advantage of its helicopter flight regime to remain close to the terrain, the crew can either visually—or by using the pinpoint accuracy of its demonstrated laser range finder/navigation system—"fix, record and recall" the target locations. The Cheyenne can subsequently select a spectrum of attack modes, dependent on the type of target. Against mechanized and light armored vehicles, for example, the Cheyenne can deliver a sustained 360 degree field of fire, accurate at long ranges with a 30 mm cannon. One method of employing the Cheyenne in a TOW missile attack against even the heaviest of enemy tanks would be a pop-up maneuver from behind terrain and then entering a sideward flight maneuver until missile impact. Tank kills with TOW missiles have been demonstrated in AH-56A flight tests at standoff distances beyond the effective range of many antiaircraft weapons and all small caliber ground weapons.

The AH-56A also has the unique capability of maneuvering and engaging multiple targets simultaneously. For example,

Figure 2

AH-56A CHEYENNE PASSIVE DEFENSE FEATURES

Item	Facts
Crew	Two crew members; armor protection
Fuel and oil system	Self-sealing; fire suppressant; fuel pump inside tank; gravity feed outboard tanks to main tank
Flight controls	Dual separated push-pull rods; armor protection
Engine	Armor protection
Hydraulic system	Dual independent systems; automatic shifting, primary to secondary
Electrical system	Dual components; automatic switching; sectional wire bundles
Rotors/propellers	Primary structure designed to withstand a direct hit; helicopter backup flight mode
Transmission and drive	Drive shaft designed to withstand direct hit; gears and bearings have oil retainers, 30 minutes of flight without oil cooling
Airframe	Safe flight with loss of any one primary load-carrying structural element; safe flight with any three of four bolts used for all major attachments; safe flight with loss of any one main transmission support bulkhead member

Figure 3

the TOW missile could be delivered against a tank by the gunner while the pilot engages other targets, thus protecting against the armored threat with the 30 mm cannon and/or the 40 mm grenade launcher. The primary target, the tank, is engaged by the gunner using the swiveling gunner's station with the stabilized periscope sight. The pilot, simultaneously, employs his helmet sight to suppress antiaircraft threats with the flexible 30 mm belly turret or 40 mm grenade launcher in the nose turret.

Withstand a hit—UH-1 Huey gunships and AH-1G Huey-Cobras operating in the Rupublic of Vietnam have clearly demonstrated the effectiveness of the attack helicopter. Some of the first attempts to design protection into helicopters are found in these rotary wing aircraft. They have performed their tasks well and valuable lessons were learned which were not lost on the Cheyenne. Recognizing that the AH-56A could be expected at any time in the future to conduct its support function in a much less permissive environment than Vietnam, the Army demanded of the Cheyenne unprecedented protection against loss by hits from potential heavy enemy fire. Low vulnerability was one of the key building blocks for design of the Cheyenne.

It is estimated that the AH-56A is almost invulnerable to hits from small arms fire and can significantly reduce the lethal effects of larger antiaircraft rounds. Numerous passive defense features, never before collectively designed into any aircraft, were employed in the AH-56A design concept. The current Cheyenne configuration ensures the lowest probability of key systems and airframe failure from damage received from enemy fire possible within the present technology. Note in chart 1 the comparative improvements in U. S. Army attack helicopter passive defense measures.

The passive defense features to be found in the Cheyenne include: (1) self-sealing fuel cell protection, (2) component protective positioning, (3) redundan-

cy, (4) structural and attachments design and (5) armor used only as a final method for reducing vulnerability. These features are described in more detail below.

The fuel and oil systems aboard the Cheyenne are protected against leakage, fire and explosion; and designed for continued operation by incorporating the following items:

- Self-sealing fuel system.
- Gravity feed if fuel pump becomes inoperative—outboard to main fuel tank.
- Thirty minutes transmission operation without oil cooling (gears and bearings have oil retainers).
- Breakaway sponson fuel tanks.

Another method of reducing Cheyenne vulnerability was to strategically position key components; for example:

- Fuel pump inside the main tank.
- Hydraulic pumps and avionics shielded by structure.
- Wire bundles sectionalized and routed for structural protection.

There are certain critical systems and components that demand continual operation following hits by enemy fire. One method to preclude failure is to armor the exposed area (discussed below); another is to duplicate and separate the vital elements. Redundant systems aboard the Cheyenne include:

- Hydraulic system with automatic shifting, primary to secondary.
- Electrical system components with automatic switching.
- Selected components of the flight control system.

Beefing up the structure and configuring components and attachments to accept a hit without danger of subsequent systems or airframe failure also was considered as a technique for reducing the vulnerable area:

- Drive shaft designed to withstand a direct hit.
- All blades and flight control rods also are designed to withstand a direct hit.
- Continued safe flight with loss of:
  - a. Any one primary load carrying structural element.
  - b. One transmission support bulkhead member.
  - c. Any one of four bolts for all major attachments.

A final method for protecting certain critical items is to bolt on armor. Armor, to be used only after all other passive defense measures have been considered, is placed about the exposed vital component to prevent bullet impact and reduce explosive blast effects. While the use of armor is the least desirable method of protection, it is often necessary and has proven to be an effective way to reduce aircraft vulnerability.

The Cheyenne has included the latest types of armor to shield the crew and vital aircraft components.

An infrared (ir) suppression kit for the Cheyenne's GE-T64 engine has been built and readied for flight testing. Although further technology is being pursued, bench testing and analysis of this system show promise of a significant reduction in the engine exhaust ir signature.

Damaged flight and safe landing—The airframe and systems design features employed in the Cheyenne for reduced vulnerability also offer a significant improvement in damaged flight capability for rotary wing aircraft. The AH-56A can operate safely at reduced speeds with major damage to the fuselage and rotor blades. Also, should the pusher propeller be unusable due to explosive hits or, if a wing receives massive damage, the Cheyenne can reduce speed and continue flight in the helicopter mode.

The best known crashworthiness features have been designed into the Cheyenne for maximum safety possible. When combat damage received is sufficient to disallow continued safe flight, the Cheyenne, like the helicopter, has the inherent capability to autorotate. Autorotation (controlled descent with loss of engine power) allows the pilot to select the most favorable area in which to land his aircraft. The benefit of this unique autorotation feature is evident from Vietnam recovery and refurbishment statistics—a large percentage of all downed helicopters were returned to flying status. By comparison a small percentage of the fixed wing aircraft were recovered and repaired.

The Army airmobile concept born in the 1950s reached adolescence in Vietnam. Proven in combat, the attack helicopter has come of age. The next step is the Cheyenne. The full combat potential of the Cheyenne can only be realized by tactical trial and error. But the Army's wealth of knowledge and experience gained over the past 15 years has gone into the development of this weapon system.

The attributes of survivability and reduced vulnerability of the Cheyenne could not be realized by using the strap-on/bolt-on method for adapting various systems to an existing airframe. It required the design and development of a fully integrated weapon system harmonized in an airframe specifically configured for that purpose.

The Cheyenne is one of the greatest potential fighting machines of the 1970s. But more, it will survive on the battlefield and thereby ensure the ground commander uninterrupted, around-the-clock fire support.

Charlie and Danny's Write-In

DEAR CHARLIE: Why does the dash CL for the U-8D have procedures for landing with one gear up? The aircraft can be landed gear-up with little damage if the landing gear malfunctions.

CPT C. L. R.

Charlie's answer: The dash CL is a condensed form of the normal and emergency operating procedures chapters in the operator's manual (dash 10). It contains only the sequence of events of a procedure without any instructions, warnings or cautions. Its purpose is to remind a pilot, qualified in the aircraft, of the steps outlined in the operator's manual. It is not intended to be used as an instruction manual. The U-8D manual clearly states (page 4-11) that if all three landing gear cannot be fully extended and locked, the landing should be made with the landing gear retracted. Procedures are also given in the event a gear(s) cannot be retracted. These procedures appear in the dash CL in condensed form. A pilot must know his aircraft and use the procedure applicable to the emergency.

Dear Danny: What is the correct procedure if you lose transmission oil pressure in the UH-1B? I hear conflicting stories.

1LT S. B. F.

Danny's answer: Your TM 55-1520-219-10, page 4-7, paragraph 4-36 explains this situation. It says to land at the nearest safe landing area and no further flight until the cause of the light has been determined and proper corrective action taken. Do not make an autorotative descent. You want your engine turning your transmission on the descent. Some aviators have attempted an autorotative descent under these conditions and their rotor blades stopped turning prior to reaching terra firma. You can well imagine the end results.

Dear Danny: What is the correct emergency fuel for the OH-6A? I say any aviation type fuel will do; others say it must be a jet type fuel. Who is correct?

1LT R. R. S.

Danny's answer: Your answer is partway correct. TM 55-1520-214-10, page 7-1, paragraph 7-1.1 holds your answer. It says that MIL-G-5572 (aviation fuel without TCP) (80/87, 100/130, 115/145) can be used under the following conditions:

- **The electric fuel pump must be on at all times.**
- **The use of emergency fuel is limited to a total of 6 hours between TBOs.**

Dear Danny: In the OH-58A manual, in chapter 3, it says to turn the anti-ice switch on when OAT is 4 degrees C. (40 degrees F.) or below, and chapter 10 says OAT 5 degrees C. (41 degrees F.). Which is correct?

CW2 S. D. F.

Danny's answer: Chapter 3 in the TM 55-1520-228-10 is correct. Change 1 to the manual, which is in distribution, corrects this error between the two chapters.

Dear Danny: In the event of a hydraulic failure in the TH-13T, does the waste gate control in the supercharger become inoperative?

CW3 P. M. S.

Danny's answer: The notes of pages 2-19 and 4-7 of TM 55-1520-226-10 provide you with the answer you desire. Hydraulic pressure will be provided to the waste gate control if there is a loss of hydraulic pressure. If the pressure line to the waste gate ruptures, then of course hydraulic pressure will be lost and the waste gate will go to the full open position and horsepower available is reduced.

Dear Danny: What is the proper use of the electric fuel pump in the OH-6A? Some of the guys say it's on all the time. I disagree.

1LT R. R. S.

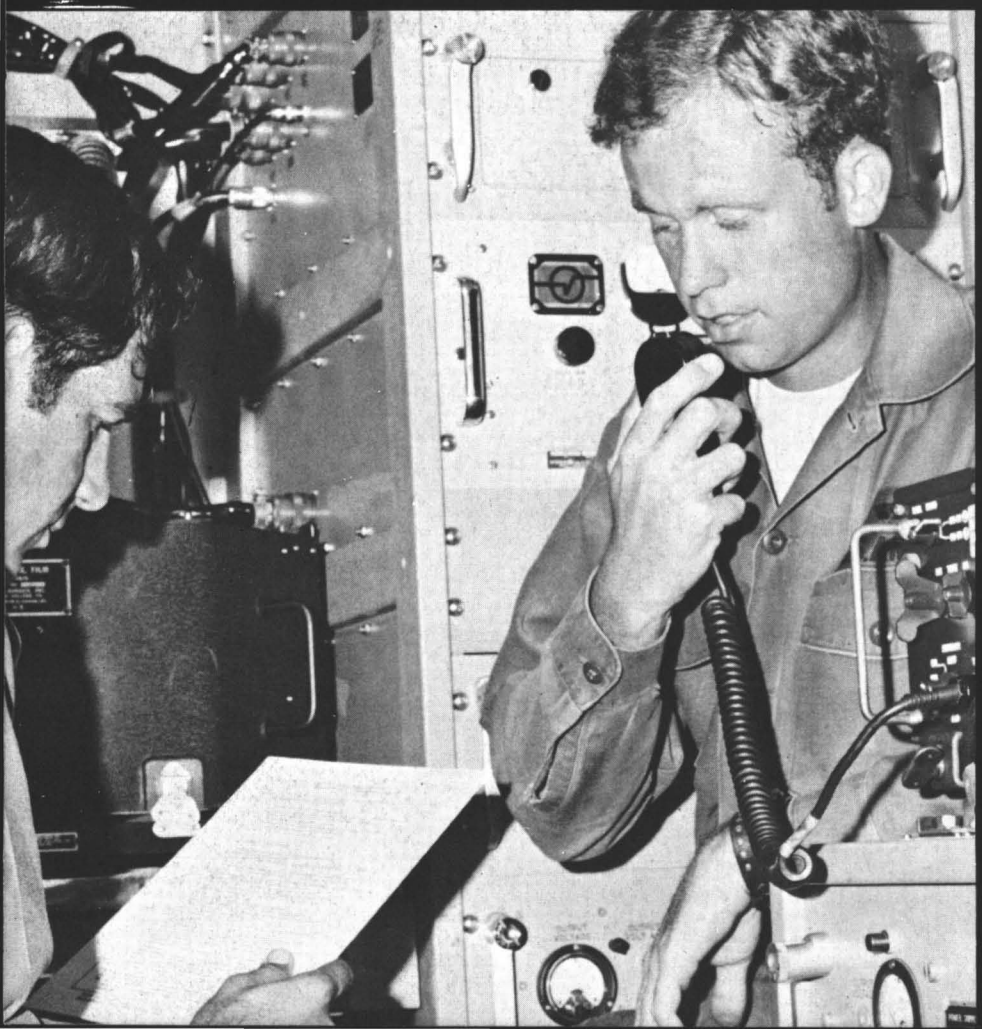
Danny's answer: You, sir, are correct. I suggest your friends read page 2-18, paragraph 2-58 of TM 55-1520-214-10, change 4. It states the electric fuel pump is on and provides fuel to the engine pump during engine starts since it operates automatically because of its electrical connection with the starting circuit. Other than starting it should only be used during high altitude or high temperature flight conditions, which is 15,000 feet MSL or 45 degrees C. (113 degrees F.) OAT/fuel temperature.

Dear Danny: The normal gear warning horn setting in the U-8D is 14 inches Hg. During transition at Ft. Rucker, Ala., I was taught to make my normal pattern descent at 15 inches Hg. It appears to me that this procedure makes the horn invalid as a warning device, as the horn will not sound in the event of a "gear-up" approach until the aircraft is over the threshold and the power is further reduced for landing. This may be too late.

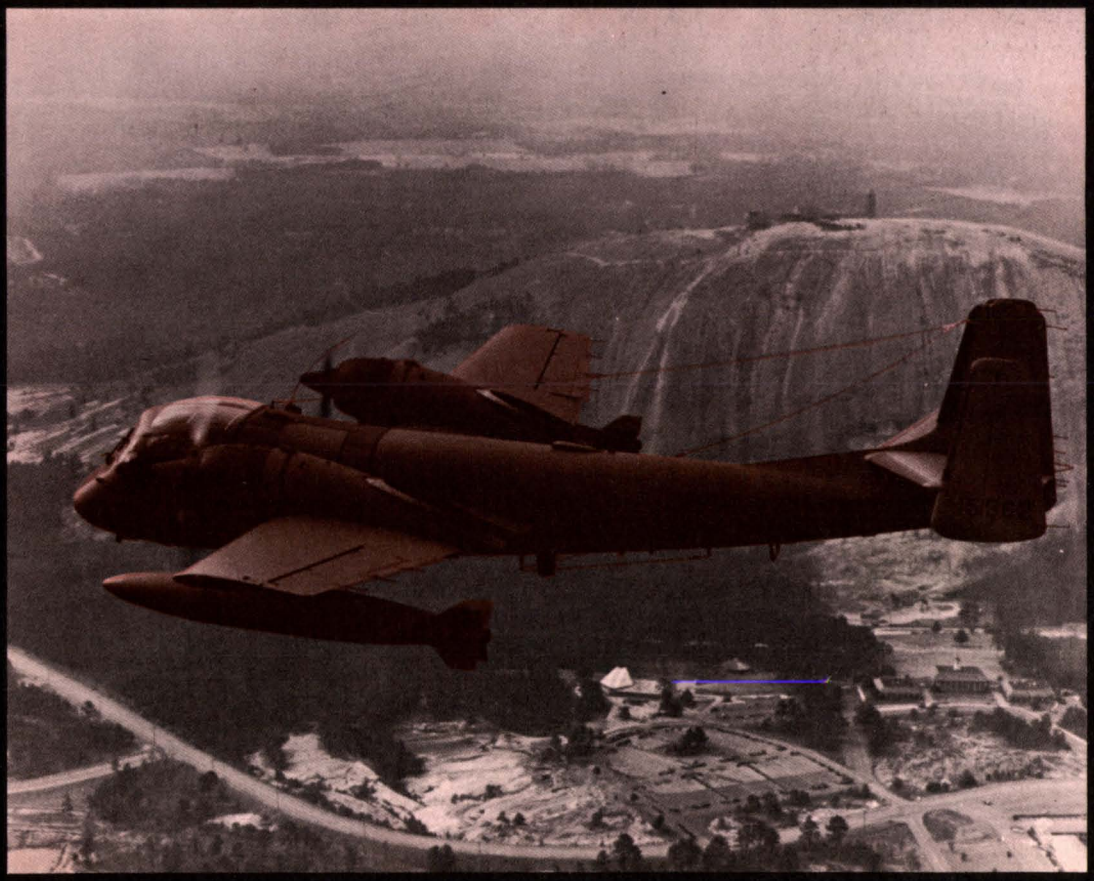
CW2 G. G. D.

Danny's answer: Too late is correct! I wonder how much good a horn will do when Peter Pilot doesn't use his checklist during the BEFORE LANDING check and arrives on final with his head and gear "up and locked." However, you may be happy to know that this information has been passed on to U. S. Army Aviation Systems Command engineering and the setting of the warning horn will be changed to 16 inches Hg. This will appear in a change to TM 55-1510-201-20 which will be published in the near future.

Georgia National Guard



With the slowdown of the war in Southeast Asia, and the lessening of our materiel and logistic requirements in the combat zone, many new pieces of equipment are finding their way into the National Guard and Reserve Component inventory. The Georgia National Guard is one of the first components of our nation's backbone of defense to receive new, modern equipment. Photo left: Georgia National Guardsmen monitor infrared receiving equipment in its terminal station as a National Guard Mohawk (above right) flies near Stone Mountain, Ga.



FLYING AND supporting the most sophisticated aircraft in the Army's inventory, Georgia Army National Guardsmen of the 151st Aviation Battalion (Combat) recently conducted their first operational training during January in their recently acquired OV-1 Mohawks at the Savannah, Ga., municipal airport.

Manning the twin-engine, prop-jet Mohawks were pilots of the 158th and 159th Aviation Companies. The 158th and its parent organization, the 151st Aviation Battalion, are colocated at the Winder, Ga., municipal airport. The 159th is based at Fulton County airport near Atlanta.

Six of the high-flying, infrared and electronic-equipped aircraft were flown from Savannah on tactical training missions similar to those being conducted in the Republic of Vietnam. The Mohawk has a capability for providing both conventional aerial photogra-

NG pilots discuss route of flight prior to flying mission

phy plus electronic surveillance and reconnaissance. Training flights, designed to test the abilities of flight crews and ground support personnel, were conducted by the Guardsmen at night as well as during daytime operations.

Acquisition of the Mohawk began with the reorganization of the Georgia Army National Guard on 1 January 1968. At this time Georgia accepted the assignment of the two air surveillance companies and the complicated mission of recruiting personnel with special aptitudes to qualify in the many hard skills necessary to successfully man such complex units.

Although it was 2 years after reorganization before the aircraft were first delivered, the units attended training at Ft. Lewis, Wash., with active Army surveillance units in 1969. Training in a critical MOS 17L (airborne sensor operator) was delayed due to a lack of school space. However, some were trained prior to their annual active duty, allowing missions to be accomplished with fully qualified crews.

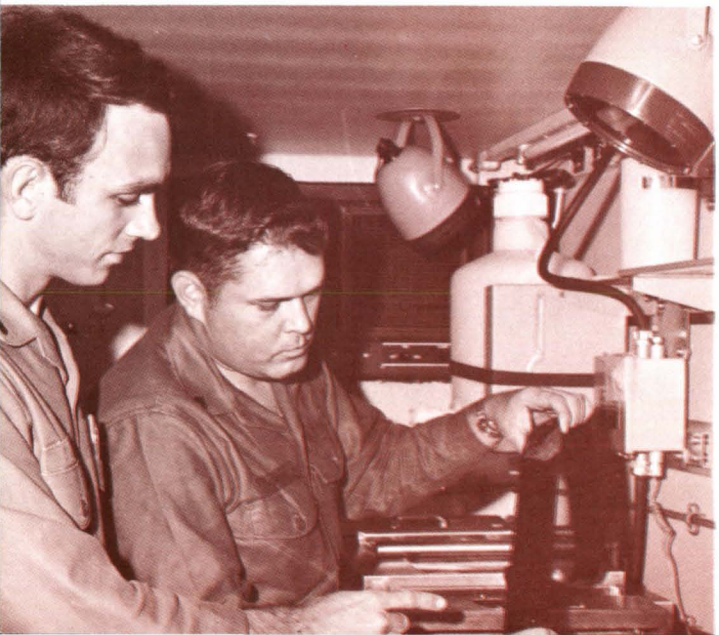
The first two Mohawks were picked up factory fresh from the Grumman Aircraft Company, Stuart, Fla., in January 1970 by two Georgia ARNG OV-1 pilots and flown to Winder. Four more were flown to Georgia during the next 6 months.

The allied ground equipment necessary for the functioning of the two aerial surveillance companies has been delivered in stages since January 1970. Not until the units arrived in Savannah, however, did they get some of their essential equipment. There the aviation companies were well supported by technical representatives of the U. S. Army Electronics Command.

With the direct and personal interest of Major General Francis S. Greenlief, Director of the Army National Guard, National Guard Bureau, the Georgia Mohawk aviators have been given a high priority. The general has visited the unit several times, flown in the Mohawk and has challenged the Georgians to master the complex aircraft and its sophisticated capability.

Another interested visitor to the field training at Savannah was Major General John M. Finn, deputy commanding

Film developing (below left) and image interpreting (below) both complement the Georgia NG's tactical surveillance capabilities



Sophisticated data terminal stations receive surveillance information from the Mohawks

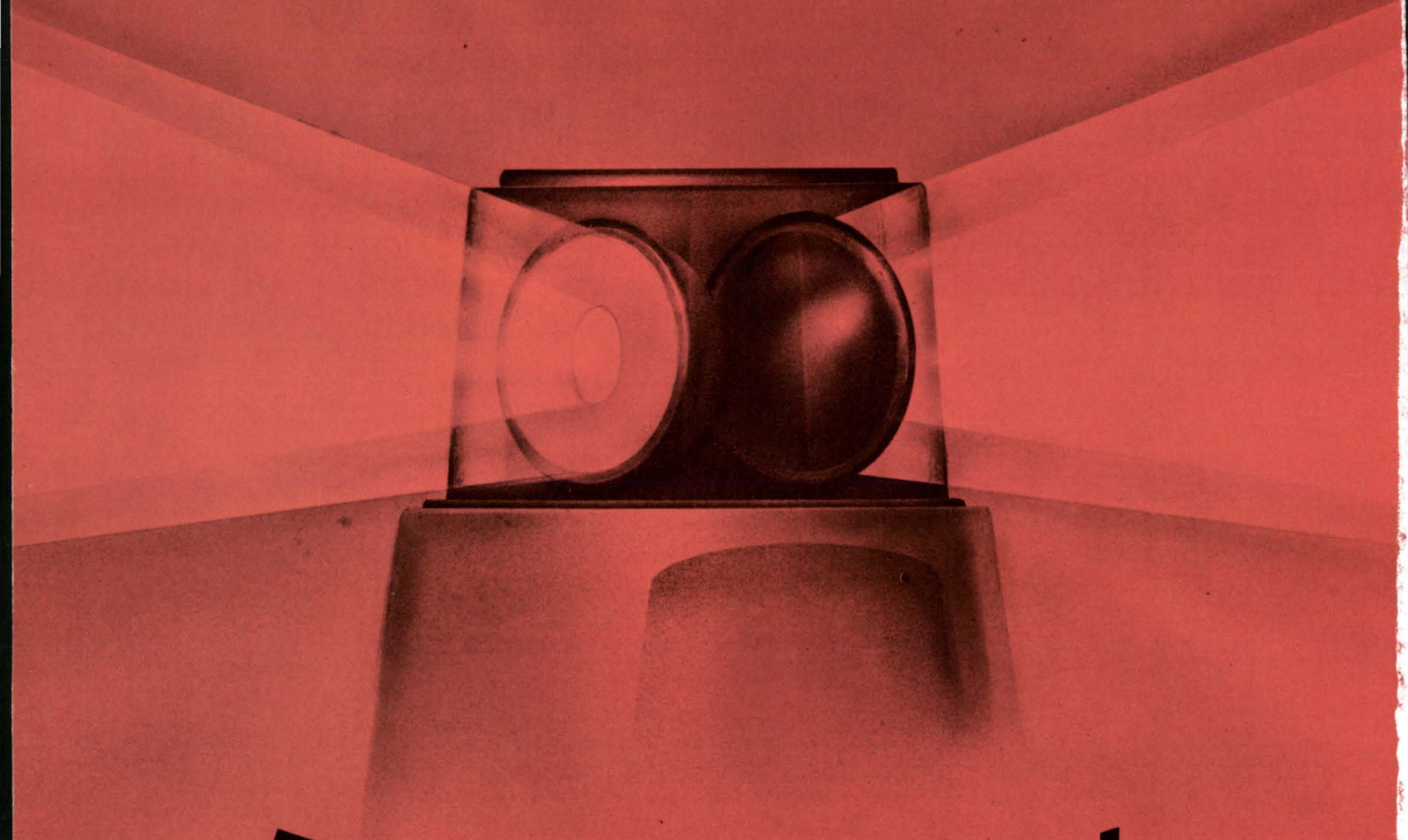
general of Third U. S. Army for Reserve Forces. General Finn toured the flight line after being briefed on the mission and training progress, appearing confident that the Georgians were well on their way to becoming combat ready.

To personally see that training of the aviation companies was progressing satisfactorily, Major General George J. Hearn, Adjutant General of Georgia, spent part of his annual field training time with the aviation personnel at the Savannah airport.

The first working day after arrival at Savannah, each company flew a mission. This was accomplished only after a maximum effort at all levels. Each morning and afternoon thereafter, the 158th and 159th flew two missions each for a total of 80 missions during the 2-week period of intensive training. Photo technicians and imagery interpreters were kept busy. Skilled personnel recorded incoming data from airborne Mohawks and were processing photos by the time the aircraft landed. Total Mohawk flying time during their Savannah training was 130 hours, accomplished by six pilots. Missions included support of National Guard units and active Army commands in several states.

MG Greenlief (above left) discusses the Mohawk training exercises with members of the guard while MG Finn (left) receives briefing on the training from Georgia NG commanders

EMERGENCY



PROFICIENCY

Quick reactions do not always imply safe reactions. Following a few simple rules could possible save your life in a given emergency situation. Use your head first . . . then react

CW2 J. M. Adkins

MELVIN CONSIDERED himself a top-notch Army aviator, proficient enough to handle any emergency.

Having thus established Melvin's qualifications, we can join him as he hovers his UH-1 Huey between two rows of revetments. He still has about 100 feet to go before he reaches the end of the row of parked aircraft where he will have to execute a 90 degree right turn to reach the active runway.

Melvin had hovered down this row so often that he could do it blindfolded. He reaches down to put his transmit/selector switch on position #2 just as he arrives at the end of the taxi way. Since Melvin was sitting in the left seat he had to place his left hand on the cyclic and his right hand on the transmit/selector switch. Upon applying right pedal to make his turn, the tone of the engine rises sharply and the aircraft yaws to the right in a climb.

In spite of the strange position of his hands, Melvin reacts quickly. As his left hand reaches the collective, he immediately applies pitch which raises the aircraft to approximately 60 feet in the air. He snaps the throttle to flight idle, leaving the collective up under his armpit and the rotor rpm is now decaying rapidly. Melvin's big problem is that the aircraft is almost out of control.

The aircraft begins falling and Melvin's reaction is to lower collective. As his rate of descent begins to increase, it crosses Melvin's mind that stopping the aircraft at the bottom is going to be tricky. He increases throttle but the rpm doesn't seem to be responding. At about 5 feet off the ground he attempts to cushion the aircraft onto the ground.

As he applies collective the engine rpm catches and begins to increase. This causes the aircraft to spin, then hit the ground and roll over into a revetment wall. Luckily Melvin survives.

The experience of his accident has influenced Melvin a great deal and helped him develop good safe flying habits. It only cost the Army approximately $350,000 to turn Melvin into a good safe pilot.

If Melvin would have followed a few simple rules he could have prevented the loss of an aircraft and would not have placed the lives of his crew in danger. The first mistake was in assuming that one emergency procedure can be applied under all circumstances. The correct procedure to follow must be modified to cope with the position of the aircraft (i.e., air speed, altitude, wind, load and pilot proficiency). A professional pilot will realize that emergency procedures as published in the dash 10 are only a guide. He will also anticipate possible solutions to different emergencies and thus cut reaction time when it counts.

In determining possible variations to an emergency, an aviator is wise to consult other pilots who have experienced that particular type of emergency. If no one is available with first-hand knowledge, a round-table discussion about symptoms and results will do a great deal to reduce reaction time and increase a pilot's awareness of how to recognize a particular type of emergency.

Melvin's second mistake was in developing a complacent attitude toward his flying. No one pilot is good enough to cope with any possible emergency in all possible configurations, and no pilot ever reaches a point where he can afford to close his mind to new ideas or techniques.

Melvin's third mistake was in taking his hands off the controls to tune the radios. He apparently did not use the prescribed aircraft checklist in his runup which provides for the tuning of aircraft radios . . . as well as failed to utilize his copilot. The man in control of the aircraft should focus his attention on flying and follow standardized procedures.

As Melvin tried to cope with his emergency, he got further and further behind the aircraft. Consequently, his degree of control diminished until in the end he had no control at all.

Melvin wasn't such a "hot-shot" after all, but he was lucky.

VISUAL ILLUSIONS

Due to space considerations, this article was condensed for publication in the September 1969 U. S. Air Force Medical Service Digest. The original report, SAM-TR-67-28, was published in April 1967 under the title "Visual Illusions and Aircraft Accidents." Names of investigators who reported findings at various points in the article have been deleted, but are available in the above cited references

IN A MAJOR overseas command it was found that spatial disorientation was the cause of 4 percent of all flying accidents and 14 percent of all fatal accidents. Investigators isolated one of the visual factors when they stated that the primary cause of undershooting or overshooting nonemergency accidents was "faulty distance-rate-of-closure on the part of the pilot."

The U. S. Air Force is not alone in accidents caused by illusory phenomena. Disorientation was credited as the most common probable cause of fatal ac- [redacted] in the Royal Air Force. More recently the Military Airlift Command (MAC) has illustrated that landing-short accidents have not shown an improvement in the 10-year period between 1955 to 1964. Thus, aircraft accidents caused by illusory phenomena resulting from visual, emotional or vestibular factors constitute a major portion of all U. S. Air Force accidents.

It is the purpose of this article to analyze some of the visual factors which contribute to disorientation or faulty distance judgment in an effort to provide information which may be used in the analysis and correction of aircraft accidents.

It is evident that during the landing phase the pilot is busier than during normal flight, but at the same time he is usually more attentive to the required procedures for landing. Many of these procedures require visual surveillance prior to the pilot making decisions regarding the safety of the landing.

There is always the danger of confusing approach and runway lights. When a double row of approach lights joins with the boundary lights of the runway, pilots have reported confusion in determining where approach lights terminate and runway lights begin. The beginning of the runway must be clearly shown. This can be solved by having radically different runway and approach lights or special lights separating the approach from the runway.

Approach lighting systems should be designed so that they do not give illusory or false information. When flying into a gradually thickening fog on approach, the pilot feels that he is climbing; in compensating, he descends too low. Under certain conditions approach lights can make the aircraft seem higher when it is in a bank than when its wings are level.

The intensity of the approach and runway lighting system is important. For example, pilots have the impression that they are in a bank when they are actually flying level if one row of runway lights is brighter than the other. Attention has been called to a rather unique illusion. If a

Aeromedic

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

The Society of U. S. Army Flight Surgeons wishes to call attention to the reprint of this particularly informative article on a subject easily overlooked by air crewmen. It appeared in the December 1970 issue of the U. S. Air Force INTERCEPTOR. The information, though pertaining to fixed wing flight, is applicable both to fixed wing flying and to rotary wing flight. A sequel with an Army aviation slant will appear in a future AVIATION DIGEST. Our thanks to the author, LTC Donald G. Pitts, USAF (Ret), and to the U. S. Air Force's INTERCEPTOR magazine for granting permission to reprint the article

Lieutenant Colonel Donald G. Pitts

USAF, BSC (Ret)

single row of lights is used along the left side of the approach path, a pilot misinterprets the perspective and "corrects" his glide path to the right. Thus, the touchdown point would be far to the right of the runway as the aircraft crosses the runway threshold.

The approach and runway lighting problem has received extensive research in recent years to minimize these illusions. As improvements are tested and evaluated, changes are incorporated into present systems. It is important to note that a standardized approach lighting system has not been adopted; therefore, one of the major hazards in approach and glide-slope systems is that different airfields use different systems, and consequently, complicate the pilot's task of making height and distance judgments on approach and landing. Instrument approach systems combined with a standardized improved approach lighting and glide-slope system should eliminate or drastically reduce the false or illusory information received by the pilot. It must be remembered that as long as the human subsystem is operating the aircraft, there is the possibility of human error.

A normal approach glide path is illustrated in figure 1. Actual or physical height (x) corresponds to apparent height (y), and the resultant glide slope provides a safe landing. Illusory cues may be provided by a runway that is narrower or wider than the normal runway to which the pilot is accustomed. Additionally, the runway slope and terrain around the runway approach can induce visual illusions. We shall attempt to illustrate these factors which serve to provide illusory visual cues on landings and approaches. In

most of these illustrations, x will represent the normal glide path height; y will indicate the apparent height due to illusory cues; and x′ will represent the compensatory glide path which the pilot uses so that the glide path will appear normal to him.

Illusions can result when a runway is narrower than that usually experienced by the pilot (figure 2). The actual height of the aircraft for a narrow runway width is h + h′. For a narrow runway, the pilot feels as though he were at h + h′ when he is actually flying at a height of h′; therefore, the apparent height does not correspond to real height but is somewhat less. Thus, the glide slope results in a low approach and the tendency to undershoot or land short of the runway. An approach of this type could result in a serious aircraft accident.

While landing on a wider than normal runway, the pilot feels as though he were flying at h when he is actually at a height equal to h + h′ (figure 3). Again, the actual height does not correspond with the apparent height. The apparent height is somewhat greater than the real height. The glide slope would result in a high approach and the tendency to overshoot or land down the runway. This would not be a serious illusion if the runway were long enough for safe braking.

Most runways are level, but those few which have some degree of slope provide tricky visual cues to the pilot. For the upslope runway (figure 4) the pilot feels as though he is at y height above the terrain; therefore, in an attempt to fly a normal glide path, his compensatory glide path at x′ results in landing

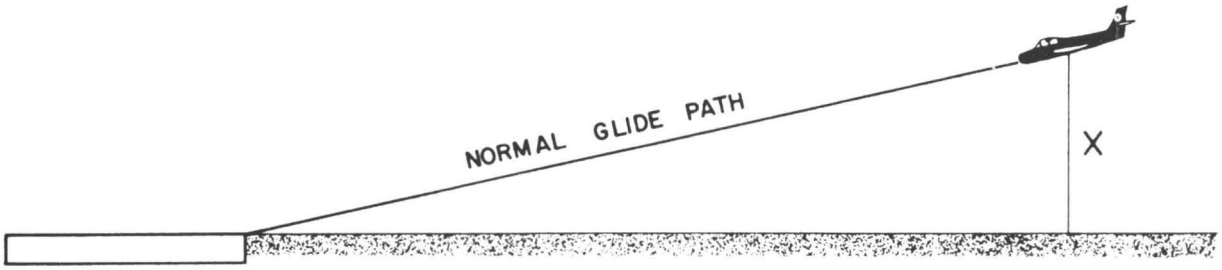


Figure 1. Normal approach glide slope

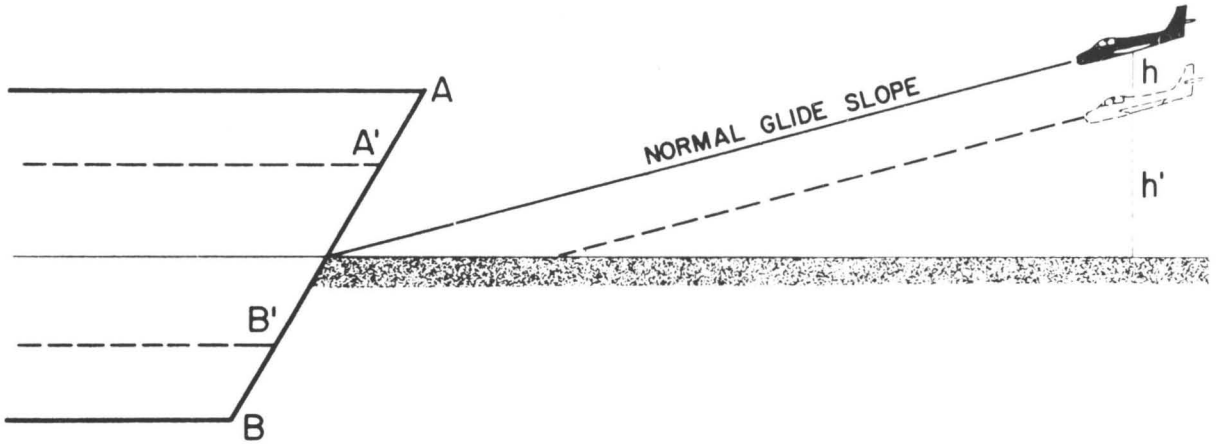


Figure 2. The effect of a narrower as against a normal width runway on landing an aircraft: AB is the width of a normal runway; A'B' is the width of a narrow runway; h' is the height for a narrow runway; h + h' is the height for a normal runway. At the same point in the approach the pilot feels as though h' is the same as h + h'. A normal glide slope height h' would result in the tendency to undershoot and land short of the runway

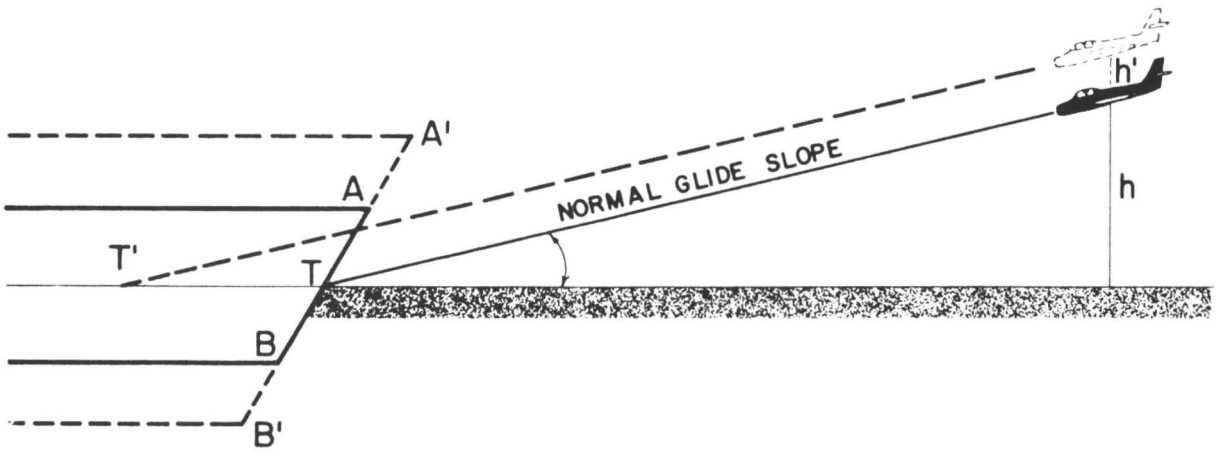


Figure 3. The effect of a wide runway as against a normal width runway on landing an aircraft: AB is the width of a normal runway; A'B' is the width of a wide runway; h is the height for a normal runway; h' + h is the height of aircraft for a wider runway. At the same point in the approach, h + h' is thought by the pilot to be equal to h. Thus, the normal glide slope of the aircraft results in an overshoot or landing down the runway

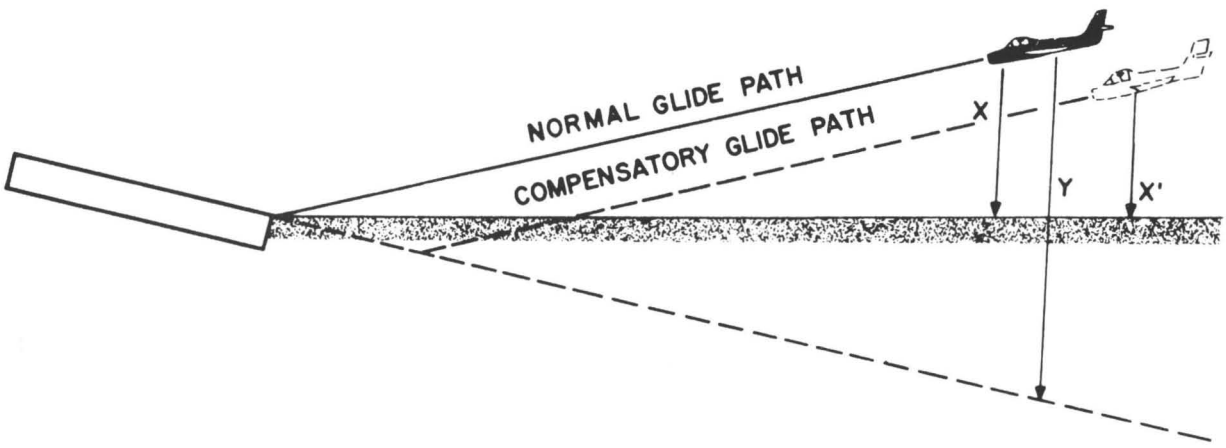


Figure 4. The effect of runway upslope on glide path: With an upslope, the normal glide path will appear to be too steep. Flying in a glide path that appears more normal could result in an approach which lands short of the runway

short of the runway. A similar situation occurs when there is a downslope in the approach terrain, i.e., the compensatory glide path results in landing short of the runway (figure 5).

The downslope runway provides illusory cues which make the pilot believe that he is lower (y) than his actual height (x). To compensate for this phenomenon, he flies a compensatory glide path (x′) which will result in landing long or overshooting the runway (figure 6). Upslope terrain in the approach zone creates a similar visual illusory effect (figure 7).

If a pilot is in doubt concerning the runway and approach terrain slopes, he should "drag" the landing strip and be aware of the illusory effects which can be induced. It should be emphasized that a pilot usually encounters multiple illusory cues instead of the simplified single

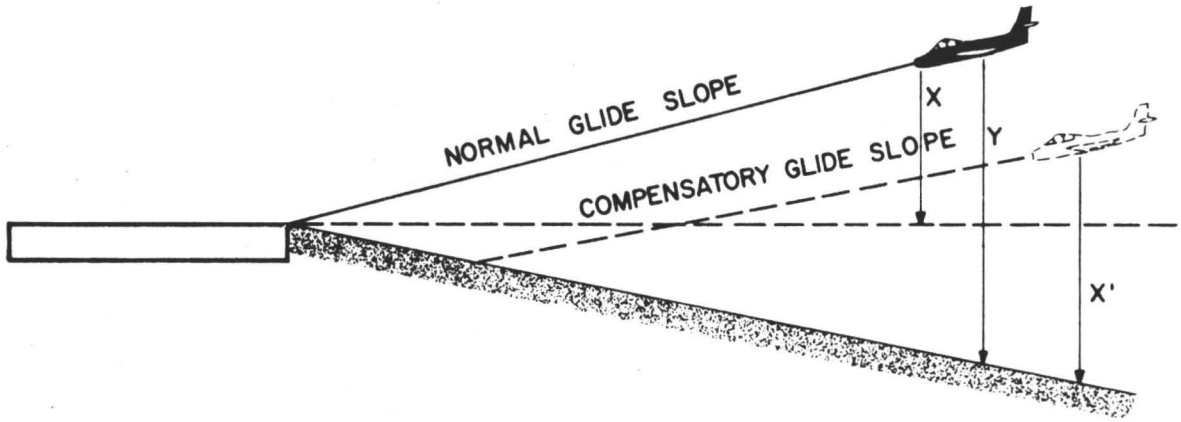


Figure 5. The effect of terrain downslope in the runway approach on the aircraft glide slope: When the terrain slopes downward, the pilot will believe the aircraft to be on low, flat approach, and there is a tendency to land short of the runway

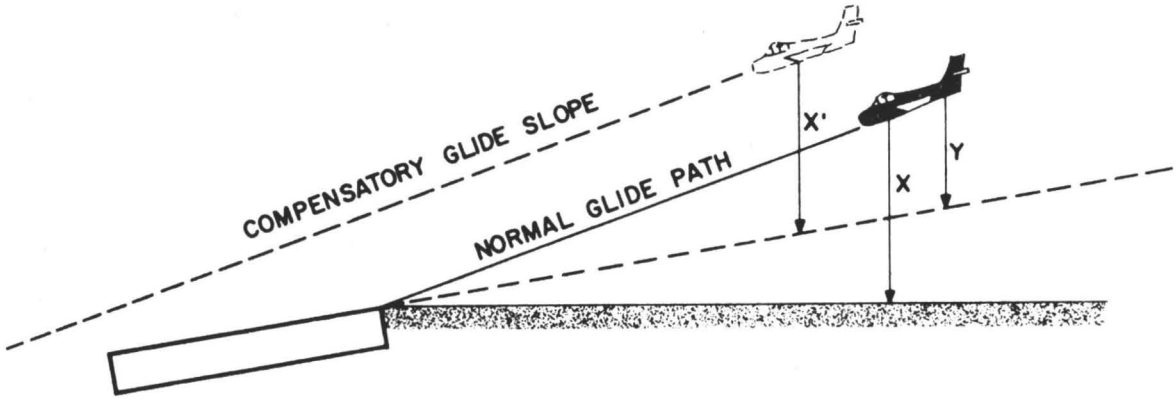


Figure 6. The effect of runway downslope on the aircraft glide slope: With a downslope the glide path will appear flat; there is a tendency to overshoot the runway

cues mentioned above. Combinations of these cues may serve to lessen or increase the total illusory effect. A severe illusion might result from a narrow, upslope runway and downslope approach terrain. Conversely, an upslope runway could be canceled as an illusory problem by upslope terrain or a wide runway, or both. Inclement weather and poor ambient luminance would most probably increase the effect of these illusions.

It may be of value to be aware of other changes in experienced or accustomed visual cues which may result in poor height and distance judgments or give false cues for landing. For example, landing over water reduces visual cues to a minimum. Pilots not accustomed to landing over water tend to land too low or short of the runway. External objects on the approach path may serve as false cues to height. If a pilot were accustomed to landing with an approach over large evergreen or

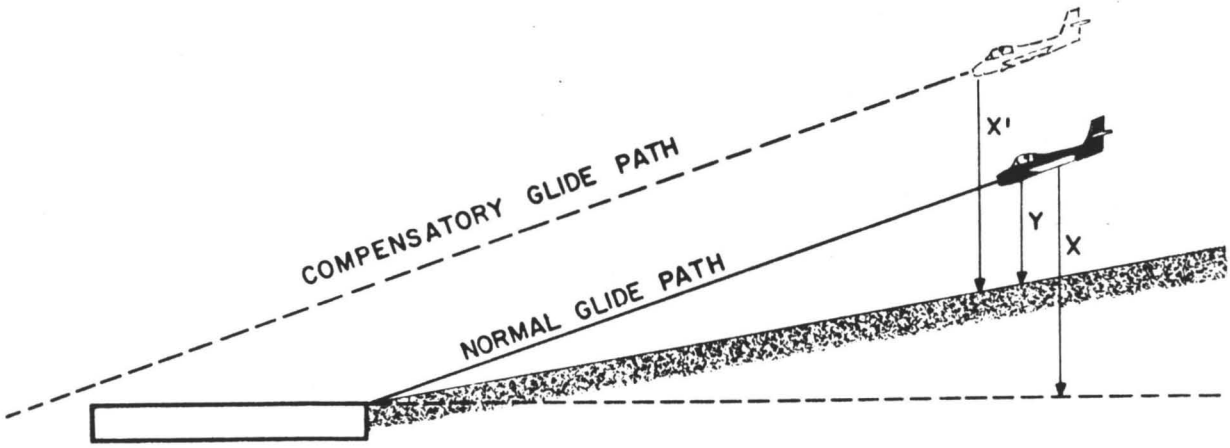


Figure 7. The effect of terrain upslope on glide slope of an aircraft: When there is an upslope in the runway approach zone, the aircraft appears to be above the normal glide path. To compensate, the pilot would try to fly a glide slope which can result in a long landing

spruce trees and were required to land in the Aleutian Chain, he might misjudge his height and distance from the runway because the spruce trees in the Aleutians are small and scrubby.

One of the best means of eliminating or reducing aircraft accidents from these types of visual illusory cues is through careful briefing of the aircraft crew prior to the flight. A pilot should be cognizant that distance and height judgments can be affected by changes in experienced visual cues and should simulate a landing before making the actual landing. The combination of good air crew briefing and discipline is required to result in safe approach and landing procedures over all types of terrain and landing field configurations.

Summary

Standardized runway and approach lighting and instrument landing systems aid the pilot in this apparent height and distance judgment by providing nearly identical visual cues for each landing. Thorough briefing before flying into a strange or unfamiliar airfield is necessary. Under certain conditions imposed by weather, repair, etc., a pilot should drag (fly over) the landing strip at least once before landing to provide himself and the rest of the air crew a familiarity with the approach and runway. A portable self-powered approach lighting system would be desirable at remote airfields to aid in maintaining the proper glide slope.

A pilot must trust his instruments and cross-check those which give him information on aircraft attitude. It is seldom that all instruments fail at the same time, and pilots should be trained to rely on their instruments although their information may be opposite the "seat-of-the-pants" orientation cues. Therefore, instrument performance should continue to be an integral part of each annual checkride.

It is recommended that investigation teams for aircraft accidents compile data relative to runway conditions, i.e., width, length, lighting and surrounding terrain. These terrain and human factors would probably reveal the factors responsible for certain types of accidents. Corrective measures could be taken by each major air command commensurate with their accident experience.

At the time the article was written LTC Pitts was assigned to the U. S. Air Force School of Aerospace Medicine, Brooks Air Force Base, Tex., as the Assistant Chief of the Physical-Physiological Optics Function, Ophthalmology Branch. He was commissioned in 1950 and served as a clinical optometrist until 1957. He was the first Air Force optometrist to receive the Ph.D. degree in Physiological Optics. His assignments since 1957 have been in research and teaching at Wright-Patterson Air Force Base, Ohio, and the U. S. Air Force School of Aerospace Medicine.

Beyond The Best

Captain Edward A. Bickel

I was a pilot . . . not a body to be delegated the dubious honor of "sitting shotgun"

WELL SIR, YOU'VE been around a long time and I'm sure you'll agree life as a copilot is death. Really could you imagine a more boring existence? After all, I was a pilot, trained and proficient, not an extra arm of the man flying the machine and certainly not a body to be delegated the dubious honor of "sitting shotgun."

to smile, to keep a good wit, but I began to loathe the word copilot. I felt as though all my training was for naught. I was a natural, a real ace of the skies. If it had wings and an engine I could make 'er perform. What coordination! And a control touch that was smoother than silk. When I flew there wasn't any need for an "extra" to handle my radio calls, to monitor my engine instruments or keep his eyes peeled for "the oth-

ers." My tuned ear could analyze any problem the minute an engine coughed and, if worse did come to worse, I'd just have to exercise my expertise on short field work to make an uncanny, but miraculous, forced landing. So what if I had only logged 260 flight hours. Half of that time was spent polishing my already fantastic techniques. Why I can even remember my first flight instructor throwing up his hands and saying, "You're really something, Ace." That man was a cool head. He recognized my inherent abilities, but I must admit he was pretty good himself. I suppose he already placed me in the same class with Rickenbacker and Von Richthofen, the Red Baron.

But time dragged on, sir. Day after day I assumed the right seat. One flight was all I needed with a man to tell whether he could "really hack it." Inside of 2 weeks I'd flown with 10 of 'em and had 'em all pegged. Most of them flew only once with me, but I could tell by the way they all avoided me after hours that each and every one had placed me on a plateau "Above The Best." When one of the other boys did come around it was for consultation. The look of awe on their faces belied the great admiration they had for me. And it seemed that I was forever answering questions such as "How did you ever manage?" "Would you run that by us once more but slowly?" "Tell us again about the time. . . ." Everyone laughed with me whenever I related humorous exploits about how I handled seemingly overwhelming situations.

And then finally today my chance came. Only 1 month incountry and they were ready to let me demonstrate how "a real pro" could handle it. It was just a short mission and the company standardization instructor pilot was *my* copilot. Although we hadn't had the opportunity to knock around the skies together before, I'm sure everyone had told him about the days when they were fortunate enough to have me along. This morning my U-6 literally bounded into the blue. She responded beautifully to every control movement—ah, sir—it was as if she knew who was master today, but then—eh, well— don't let me bore you with the rest. It was an accident—just one of those things that happens to the best of us. Sir . . . sir, now I do have one question, "When do I get to dazzle the others with my skill in handling real feathers? St. Peter, St. Peter, sir. . . ."

Maintenance

. . . SO LOOK FOR TIPS EACH MONTH ON THESE PAGES

Removing Engine Fuel Pump On U-6A: When removing the engine-driven fuel pump from the R-985 engine, be sure to place the fuel selector valve in the OFF position. Make a sign or tag and place it on the valve stating, "Fuel line disconnected." (Reference: TM 55-1510-203-20, chapter 5, paragraph 5-204, page 5-36)

Beaver Caburetor Air Filter: Be sure to stay abreast of all technical manuals. Washing the air filter of the U-6A and immersing it in a lubricating oil mixture after drying is no longer the approved method of cleaning. TM 55-1510-203-20 (12 Aug 70), paragraph 5-28, CLEANING states that the only method authorized is "tapping" the filter. Place the dirty face of the filter down and tap until all the dirt and dust is removed.

Save The Cannon (Plugs): When removing larger electrical cannon plugs that have a habit of sticking and the proper tool is not available, use a small strap wrench. This will do the job effectively and will not damage the cannon plug.

FOD: When working on an aircraft equipped with a gas turbine engine, always use a bucket or some other means to collect all cut safety wire to prevent FOD.

Turbine Engine Maintenance Malpractice: Turbine engine repair and replacement has been one item that has almost put modern aviation out of business. The cost of turbine engine repair and replacement operations in Vietnam has become a matter of grave concern by the Department of Defense. If we continue to opreate without a decrease in cost for turbine engines, it will be extremely difficult to predict our future and the future of Army aviation.

TM 55-1520-220-35, chapter 5, section II, paragraph 5-11 (which pertains to turbine engines) states: "Caution: do not use cadmium plated tools for any procedures outlined in this section. Cadmium plating will chip. If any of these chips enter the engine they will contaminate the lubrication system and cause deterioration to magnesium engine parts." This is good information for maintenance personnel assigned to the engine shop. Prevent them from using improper tools. What it fails to do is let the crew chief or mechanic assigned to a PE team understand how easy it is to contaminate the oil system of a turbine engine, transmission and gear box in other ways.

Electro cadmium plating is one of the most inexpensive platings used by industry today. Many items normally transported in a mechanic's tool box, on a key chain or in his pocket will be cadmium plated. When the mechanic uses his handy

Matters...

beer can opener (which he carries day and night) or a plated screwdriver to open a can of oil, he doesn't realize that he has contaminated the new oil he is using to service the aircraft. Cadmium plating chips or a cadmium plated surface that comes in contact with the synthetic base turbine oil presently utilized is dissolved by a chemical action contaminating the oil. The present spectrometic oil analysis system utilized by the Army tests for seven different types of metal wear contamination; but, cadmium plating doesn't happen to be among these. It's up to you to keep cadmium plated items and oil away from each other. Remember, if you are a honcho, it is imperative that all of us check our maintenance personnel to ensure that they have been properly educated on this subject and utilize the proper tools especially when servicing oil system reserviors.

Food for thought: Would you fly a mission tomorrow if you thought there was any chance of oil contamination?

Overgreasing? When lubricating the UH-1 tail rotor crosshead bearing, it should be noted that overlubrication will cause contamination of the 90-degree gear box. Hand pack when grease fitting is not installed. When using grease fitting limit lubrication to two shots from hand grease gun. Lubrication should be accomplished in accordance with chapter 2 of the appropriate dash 20.

Check Those Pins: Double-check to make sure hose quick disconnect indicator pins are fully extended after reconnecting hoses.

Do It Up Right: Installation of lockwire—the following rules apply when using lockwire to prevent the loosening of bolts and general hardware used on aircraft:

- Use carbon steel wire, zinc coated Federal specification QQ-W-461 for all normal lockwire operations.
- Use steel corrosion resisting wire Federal specification QQ-W-423 Condition A for specific application where heat resisting properties are desired, except in instances where instrumentation is adjacent then use QQ-W-423 Condition A nonmagnetic type (any 300 series specified).
- Install lockwire so that when wired bolts, screws or threaded items begin to loosen the wire will apply a restraining force in the tightening direction. Remember, do not overstress the wire.
- Apply the recommended torque to parts to be secured and align holes before attempting to proceed with the installation of lockwire.
- New lockwire will be used for each application. Removal of lockwire for any reason will necessitate its replacement.
- Avoid causing kinks or sharp bends in lockwire.
- The length of the pigtail at the twisted end should be ¼ to ½ inch or 3 to 6 turns.

Note: When safetying vented plugs, caution should be used to ensure that the safety wire is of such a diameter that it will not completely block the vent hole.

Safetying Emergency Devices: Use 0.020 inch diameter copper wire Federal specification QQ-W-343 for security of items where easy accessibility must be maintained by breaking the wire.

- When emergency devices such as canopies, exits and the like require securing with lockwire, use 0.020 inch diameter copper wire.
- A 0.020 inch diameter copper wire is also used to secure nonstructural parts such as emergency valves, oxygen regulators and the like.
- Secure first-aid kits, portable fire extinguishers and items requiring lockwire with 0.020 inch diameter copper wire. Seal with a lead seal. This aids the determination of use and ensures completeness of contents.

Remember These Words

The artillery committee of the U. S. Army Aviation School at Fort Rucker, Alabama, provides the following commentary on the infrequent and sometimes nonexistent use of artillery assets by Army aviators in the Republic of Vietnam. Our thanks to Captains Robert B. Armstrong, James V. Cronkhite, David L. Greer, Clyde Hamilton, Paul H. Eaves and Alfred G. Snelgrove

EACH OF THE four military regions in the Republic of Vietnam presents unique problems to the Army aviator. They have been, however, sharing one rather perplexing situation . . . that being the infrequent, almost nonexistent use of available artillery fire support.

Far too often the aviator has thought only in terms of gunships when requesting fire support. The fact that artillery can be employed faster, with equal accuracy, hasn't deterred the average aviator from relying almost exclusively on aerial support. Unfortunately, the principal reason for this infrequent use of artillery has been a lack of confidence in his ability to request fire.

The following stories, each from a different Vietnam military region, illustrate some of the problems aviators have faced. Some are psychological, some contrast with situations in other areas; nevertheless, they all are serious.

Military Region I

This area (formerly I Corps) has been saturated with a wide assortment of artillery units. Control in the northern sector was delegated primarily to U. S. Army units; around Da Nang the U. S. Marine Corps becomes responsible; Korean and Army Republic of Vietnam units con-

Fire Mission, Over!

trol areas south of Da Nang; and only a few miles further south U. S. Army units again exercised primary control.

In the north most targets observed by aviators have been neutralized by either aerial rocket artillery or gunships. But such targets as troops in the open, heavily fortified bunkers, sampans and truck convoys generally were neutralized more effectively with artillery fire than with armed helicopters. Aircraft can deliver only the type ordnance on board. Artillery batteries have numerous shell and fuze combinations, allowing the commander to select the most appropriate for a specific target. Too often 2.75-inch rockets have been unsuccessful used against bunkers that could easily have been destroyed with less ammunition if artillery rounds with delay action fuzes had been used.

In the central region around Da Nang the general rule for engaging enemy personnel on the ground has been to use tactical air support or helicopter gunships. Artillery fire is used only if these are not available.

There were numerous delays encountered when artillery was used. For example, it took two or three times as long to get a basic clearance for artillery fire than one for air support, even when the target was a bunker complex with no personnel involved. Also, limitations were imposed upon artillery when friendly troops were nearby. In this region artillery clearances also were difficult to obtain because of the uneven distribution of various sectors.

Estimates from the field indicate the average aviator required about a week to familiarize himself with these various sectors and then feel comfortable calling and adjusting artillery fire.

Unfortunately, artillery has been primarily used against small, point-type, immobile targets or in precision fire mission roles in region I.

Military Region II

Extensive use of artillery by aerial observers has been common in military region II (II Corps). The majority of these observers were either English speaking South Vietnamese, U. S. forward air controllers (FAC) or the aviators themselves. As one might expect, the ARVN observers preferred calling their own artillery. However, it wasn't always available.

An ARVN observer was a definite asset because he could communicate directly to the South Vietnamese, thus avoiding numerous communications problems. This observer could obtain clearances from his unit while the U. S. aviator could do likewise with his.

Generally, artillery support was limited to "live" targets due to shortages of ammunition. In the absence of shortages the observer could request fire on bunkers on suspected enemy positions. Often he would utilize this support to recon by fire.

Upon arrival incountry the new aviator can expect a minimum of five or six missions before he becomes proficient in requesting fire support. A word of caution: be alert to the artillery fire of allied units. You'll find that it often isn't reported to the clearance authority. Thus it is extremely important to monitor the artillery frequency, an insurance step that should keep you out of artillery fire sectors.

Military Region III

On 21 November 1969 at approximately 2000 hours two aviators were returning from a routine mission. The aircraft commander (AC) was experienced with 10 months incountry, while the copilot was a recent arrival having been in Vietnam only 2 weeks. Approaching the heliport the AC requested landing instructions.

The tower operator advised him not to land because the airfield was receiving mortar rounds. The AC immediately started a 180 degree left turn. Just as the ship was completing the turn the copilot announced on the intercom, "I see the mortar tube flashes!" The AC initiated a circling climb while the copilot kept the flashes in sight. Then he called operations, requesting an AH-1G HueyCobra gunship to silence the mortar.

Thirty minutes later the Cobra arrived, but it was too late to silence the mortar crew which had vanished into the darkness. The point is not why the gunship was late, but why was it requested when heavy artillery was readily available and could probably have silenced the mortar within a few minutes? It could easily have been that the AC, like the average aviator, lacked confidence in his ability to request and adjust artillery fire. All aviators should have at least a basic knowledge of artillery procedures, including when it could best be used to neutralize targets. Had the AC used his basic understanding of artillery, he undoubtedly could have neutralized the target.

Other problems existed in region III, congestion being a principal one, with Saigon representing the major population center of Vietnam. In addition, this area was divided into numerous sectors of allied responsibility, making it difficult to discuss artillery utilization patterns. However, if one examines the 1st Cavalry Division (Airmobile) concept of artillery and aviation support he can get an idea of the difficulties encountered in each area.

The airmobile concept is based in part on the ability to provide immediate fire support to maneuver elements. Therefore, with an artillery battalion in direct support of each maneu-

ver brigade, plus other assets provided by the corps artillery commander, fire support usually was readily available.

Usually, the maneuver battalion commander would oversee even the smallest airmobile operation when his elements were involved. His staff included an artillery liaison officer who generally controlled supporting fires under direction of the ground commander. Thus, the aviator rarely became directly involved.

However, in the aviation section of each maneuver brigade a different situation existed. Normally these units operated a daily minimum of one reconnaissance team, i.e., two light observation helicopters. The teams checked intelligence reports and bomb damage assessments. The aviators in this section became very adept at using artillery firepower to engage targets of opportunity. Despite the deviations from standard artillery procedures, the overall results were impressive.

In Vietnam the 1/9th Cavalry Squadron was generally responsible for providing visual reconnaissance in the division area of operations. Generally, a light observation helicopter and an AH-1G escort gunship composed each recon team. Often operating outside artillery coverage range, these teams usually employed organic weapons to engage targets. Consequently, when they operated within artillery support range the recon teams, accustomed to previous tactics, generally overlooked artillery fire capability in favor of organic weapons.

The aviators in the division's aerial rocket artillery battalion employed conventional artillery in lieu of expending onboard ordnance, depending on the target. The obvious advantage was the preservation of the onboard ordnance until it was absolutely essential to use it.

Generally speaking, if artillery was employed as indicated above the result was quite satisfactory. The aviation school's basic instruction in artillery procedures is sufficient, but it is up to each individual aviator to become proficient and confident once he arrives incountry.

Military Region IV

In military region IV (formerly IV Corps) ARVN forces lacked organic artillery, a fact which probably helped account for the infrequent calls for fire. Also, permanent fire support bases were not used because of range limitations and the large area of operations. Consequently, guns were moved with respect to the ground commander's priorities, assuming he also dictated each fire base location (ARVN forces often moved from site to site even when operating in the same area).

Even when artillery was available it wasn't used as much as it should have been. Usually, communications posed the major obstacle. If an aviator made an attempt to communicate without getting the desired results, he would likely avoid contacting ARVN troops on subsequent missions. And, obtaining clearances through ARVN channels was extremely time consuming if intelligence channels report negative activity.

In many cases the ammunition supply itself limited the number of fire missions. Aviation support directly affected artillery support. For example, CH-47 Chinooks can haul only so much cargo, and if the mission called for artillery relocation the men of that battery may not be resupplied until the next relocation move.

Delta region airmobile operations normally involved two to four gunships. When artillery support was unavailable, their mission was to recon the landing zone, escort the lift ships and remain onstation to provide direct fire support for the ground forces. After the insertion the gunships either could recon ahead of the maneuver elements or deploy as a blocking force.

What happened when these troops got into a fire fight . . . who provided supporting fires?

Gunships had little effect against well prepared positions. If the enemy had several automatic weapons positions with large fields of fire, the air mission commander (AMC) stood a good chance of losing some gunship support. Once the gunships began delivering ordnance onto a specific target, the AMC also had to face a rearming problem.

Situations like this became the rule rather than the exception. It was also apparent that a pilot, if

unable to call gunships to neutralize a target, would generally give that target up as a lost cause. Pilots justified this action by stating they didn't have the proficiency to accurately place fires onto a target, so they avoided artillery support altogether. However, they enthusiastically adjusted AH-1G HueyCobras or pinpointed a target location to a FAC. If these pilots had expended the same effort calling artillery fire, they could have received more firepower over a greater period of time. In a life or death situation it makes a difference.

INSTRUMENT CORNER

LEAD TIME required for submission of articles for print in the AVIATION DIGEST, coupled with the rapid changes occurring in Army aviation, may cause some information to be incomplete or erroneous by the time it reaches the reader. As an example, the Instrument Corner in the March issue stated that a report is required when an estimate previously submitted is in error in excess of 3 minutes even under radar contact. This is no longer true with the publication of DOD FLIP, section II, effective 4 Feb 71. In an effort to keep the reader as informed and current as possible, future answers to questions in the Instrument Corner will contain the effective date of the referenced publication. So please bear with us.

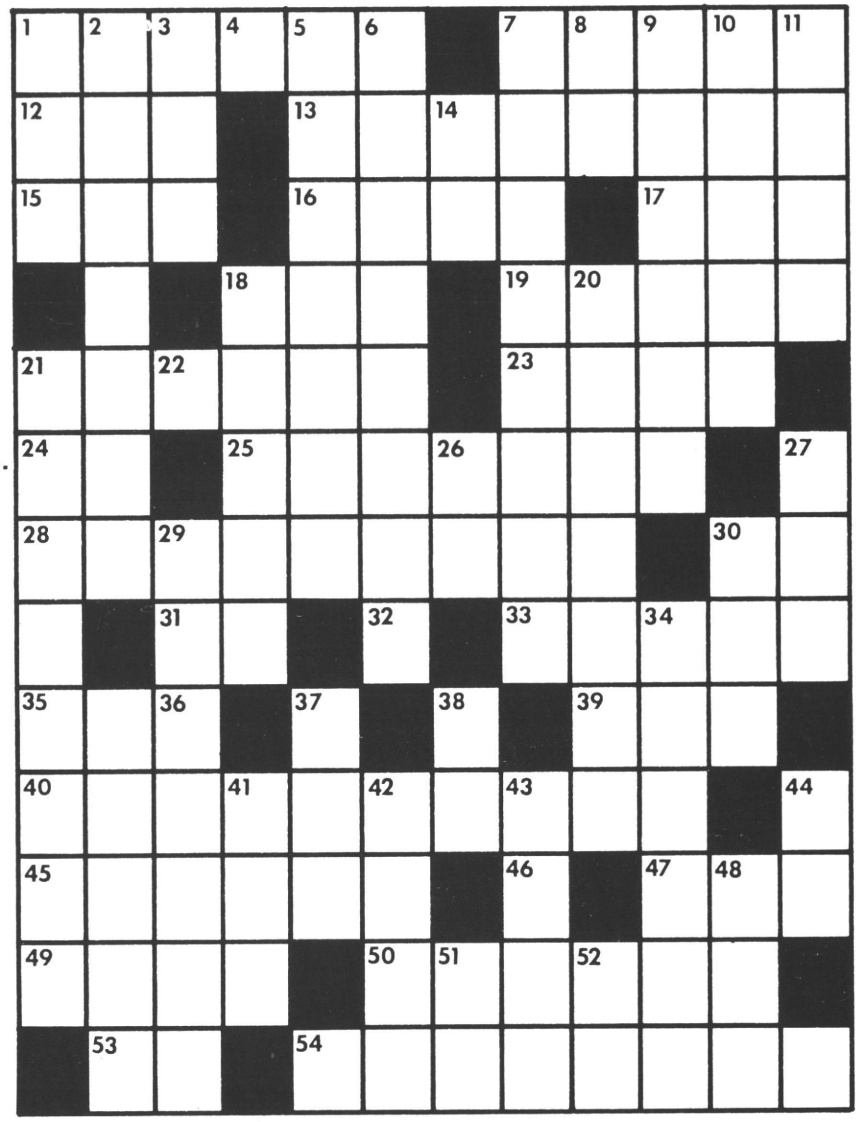
Q. Having been radar vectored to the final approach and cleared for the approach, to what altitude may descent be made?

A. AIM's Part 1, page 1-59, paragraph 1a(1) states: "When established inbound on the final approach course, radar separation will be maintained and the *pilot will be expected to complete the approach utilizing the approach aid designated in the clearance* (ILS, VOR, radio beacons, etc.) as the primary means of navigation . . . After passing the final approach fix (outer marker, radio range, etc.) on final approach, aircraft are expected to proceed direct to the airport and complete the approach. . . ." U. S. Standard for TERPS, chapter 10, Radar Procedures, paragraph 1013, Feeder Routes and Initial Approach Segments states: "Navigational guidance . . . may be provided by ASR, other navigational facilities or a combination thereof . . . When other navigational facilities are used . . . the criteria specified in chapter 2, sections 2 and 3 shall apply as appropriate." The terminal ATC Manual 7110.8B, paragraph 1360c states: "If terrain or traffic does not permit unrestricted descent to lowest published altitude specified in approach procedure prior to final approach descent, controllers shall. . . ." Then it goes on to tell what the controllers' actions are. Therefore, when cleared for the approach and in the absence of any restrictions issued by the controller you may descend to the lowest altitude specified in the procedure [low station altitude at FAF (final approach fix)] prior to final descent. The criteria for the altitudes, lateral separation, etc., are found in TERPS. Compliance by the aviator is simply a matter of flying the altitudes as published on the appropriate approach chart (AIM dated February 1971).

CROSSWORD PUZZLE

ACROSS

1. Horizontal cyclone
7. Consolidate
12. Move through air
13. Enthusiastic reformer
15. Type of bread
16. Solemn pledge
17. Fall behind
18. Not none
19. Arabian leaders
21. Faucet
23. Functions
24. Technical inspection: abbr.
25. Entertaining
28. Municipal investment: 2 wds.
30. Post office: abbr.
31. Compass direction
32. Symbol for volts
33. Strong winds
35. Barometric depression
39. Old horse
40. Scrambled transmissions
45. Type of approach
46. Top grade
47. Foot extremity
49. Group Fire Distribution Center: artillery abbr.
50. Aircraft that has touched down has ———
53. Flight surgeon: abbr.
54. Climbed



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Answers on inside back cover

DOWN

1. AVIATION DIGEST letters column
2. International amateur games
3. A whiskey
4. Temperature: abbr.
5. Frugality
6. Produces rays
7. Escorting
8. Not applicable: abbr.
9. Engine running slowly
10. Rips
11. Units of energy
14. Universal time: abbr.
18. Stone charm
20. Earthly
21. Losing lift
22. The ego
26. Therefore
27. Emergency signal
29. Towards the center
30. Secures a tent
34. Endured
36. Power switch: 2 wds.
37. Air defense artillery: abbr.
38. College degree: abbr.
41. Unit mail clerk: abbr.
42. Ailments
43. Air route
44. High explosive: abbr.
48. Musical poem
51. Aircraft commander: abbr.
52. Department of the Navy: abbr.

On Fire And Going Down

Captain William D. Bristow Jr.

On 19 MARCH 1969 I was flying as a UH-1H aircraft commander on a 196th Infantry Brigade resupply mission in the Republic of Vietnam. Most of the morning had been spent hauling wounded infantrymen to the rear following a heavy night action in the Thien Phouc Valley. Now, however, the mission was to resupply "D" Company.

I had been into the "D" Company area just recently and had not received any fire going in and only a little small arms coming out. Suddenly hostile fire appeared to be coming from all sides of the unit and we had to make a very tight, high overhead approach. As the aircraft descended it received minor small arms fire but no hits.

After offloading and picking up three ground troops (two of which were minor casualties), we took off on a heading of 220 degrees as had been recommended by the ground troops. After gaining some air speed we broke to the right. (The battalion S-3 air had told me that a North Vietnamese Army regiment was in the area, and to break left would have put me nearer their location.)

Just after I broke right the aircraft began receiving intense automatic weapons and .50 caliber fire, taking numerous hits. With each hit the aircraft shuddered violently and seemed to jump about 10 feet. I noted the instruments were vibrating, but everything appeared to be holding together. Then either my crew chief or gunner cried out, "We are on fire! Get it on the ground!"

I immediately started an autorotative descent, and turned the selector switch to company UHF to get out a Mayday call, "This is 16, I am on fire and going down."

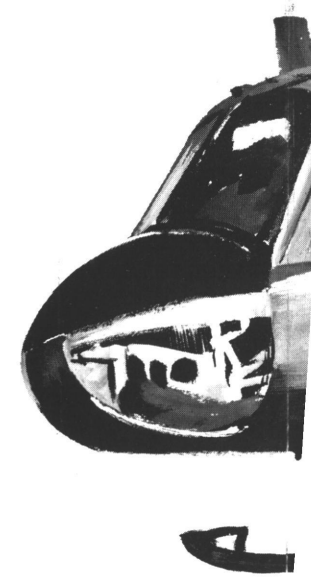
Someone answered saying, "16, where are you?"

I replied, "About five klicks southwest of Thien Phouc." I remembered something in the dash 10 about reducing air speed when on fire, so I held about 60 knots going down. I had to pull a little pitch at the bottom to clear a small hedgerow and then landed the aircraft.

While on short final the flames had reached me, and by the time I was on the ground the cockpit was engulfed in flames. I knew I had to shut it down but couldn't even see the main fuel or battery switches, so I decided to leave it alone and exit the aircraft. Unbuckling the seat belt and shoulder harness, I looked to my left—my armor side plate was still forward and the door was still closed. The fire to my left was the worst, so I dove over the pilot's seat and out his open door.

The crew and passengers were all in a hedgerow just a few feet from the aircraft so I told them to get away before the aircraft exploded. We crossed the hedgerow and an adjoining rice paddy and took cover in the next hedgrow. The aircraft then exploded in a ball of fire and smoke as the flames reached the fuel cells.

A quick check of the weapons revealed an M-16 and two .38 pistols with about 30 rounds for each weapon. I told everybody to stay down and keep quiet



since the enemy was between us and the friendlies. Our best chance for survival was to remain undetected.

I then checked for casualties. One of the ground troops had hurt his back pretty badly and would not be able to move. I briefed the gunner that when the rescue aircraft came we would have to carry the wounded men out. After approximately 10 minutes the first aircraft arrived overhead. There was no difficulty in locating the aircraft as black smoke was billowing up in the sky. Our problem was to let him know where we were without also informing the enemy.

We did not have a survival radio because of the critical shortage of them in the unit. Only a few aircraft had the radios on board. Not only could we have more readily effected our rescue with a radio, but also we could have directed the gunship strike.

I cut my white T-shirt out from under my Nomex jacket and chicken plate and then hung it on a small shrub. Actually, the T-shirt was so small and discolored due to sweat and dirt that it was impossible to see from the air.

My gunner had crossed the rice paddy and was waving his rifle at passing aircraft, but I had to tell him to get down since he had no cover whatsoever. Mortar rounds started coming in near our location at this time. It was later discovered that these were probably short rounds that were meant for "D" Company.

On Fire And Going Down

Charlie probably didn't know we were alive.

By this time the aircraft orbits were getting larger and many aircraft were onstation in areas far away from us. I felt around on my chicken plate to see what I had to speed up rescue. I was particularly looking for pen flares, but there were none. I then found the strobe light, but could not unsnap the carrying case. We had to cut it out of the case. I gave the strobe light to the pilot, who laid on his back and tried to catch the attention of one of the aircraft.

It was starting to get dark and chances of rescue were getting slim. Each time an aircraft tried to make a low level pass over the burning aircraft it received intense small arms and .50 caliber fire. The gunships had determined the .50 caliber position and had set up a daisy chain, attacking the enemy with miniguns and 2.75-inch rockets. The third ship in the chain was the maintenance aircraft equipped with a free gun M-60 on each side in addition to the door guns.

I began to plan for spending the night. I knew we would not be able to move due to the man with the back injury. Also, the enemy was all around us (we could see them to our front and hear them tramping through the bush to our rear) and our chances for rescue were far better near the aircraft.

Suddenly the hedgerow was strafed by tracers. The rounds were coming in from above and to our rear, so we couldn't tell if it was an aircraft or the enemy firing from higher ground. We couldn't move but everyone did get a little closer to the ground. Finally, one of the gunships flashed his landing light to indicate that he had seen our strobe light.

Now the problem was how to get an aircraft in and out safely. The gunships began a strike about 100 meters to our north—they were going to make their attempt.

On the hill the Muskets were attacking I saw three North Vietnamese soldiers dressed in green uniforms with a long, large weapon. It looked like either a .50 caliber or a recoilless rifle. Each time one of the gunships would make a run the enemy would duck out of sight, like into a bunker or foxhole, and as the gunship broke off they would be back up aiming their weapon.

At approximately 1900 hours, after a long 1 hour and 10 minutes on the ground, a Minuteman aircraft appeared out of nowhere. I had not heard or seen him coming down, and it was not until he was on 10 foot final that I realized what was happening. Both his door gunners were putting out maximum suppressive fire, but we could not hear it due to the mortar and the gunship strikes. The gunner and I carried the man with the back injury, and we all jumped on board and prayed.

Fortunately, we got out of there with no problems. To say that all of us are thankful to the Minuteman crew is quite an understatement. The professionalism and calm they displayed were tremendous. Enroute to the hospital, the crew chief on the rescue aircraft applied first aid to the burns on my crew chief's arms and head and also to the ground troop who had been burned.

We owe our lives to the strobe light, without it we would have been given up for dead. Both the aircraft circling overhead and the Charlies were certain that we had all perished in the explosion and fire. We could also have used, however, a survival radio and red flares.

My Nomex flight suit saved me from severe injuries in the fire. I wore no gloves because none were available, and was very lucky just to be singed on the backs of my hands. My visor was down which saved my face from possible burns.

I learned that in a situation such as ours the only thing that comes out of the aircraft is what you have on. Weapons, emergency kits, etc., went up with the aircraft.

* * *

The Department of Aeromedical Education and Training, U. S. Army Aviation School at Ft. Rucker, Ala., reviewed this article and provided the following comments:

"Only those items of survival, signaling and personal protection which are attached to the body are going to be conveniently available to the air crew member under emergency conditions of all contingencies. Following emergency landings there is a need for rapid egress from the aircraft because of the potential of a postcrash fire or enemy activity. This creates a need for an integrated survival system. Provisions have been made for an item of this type: vest, survival, SRU-21/P, hot climate (FSN 8465-177-4819). The basis for issue is one survival vest per each air crew member in the Republic of Vietnam only. This vest incorporates many items of survival, emergency signaling and personal protective equipment. The purpose and contents of this piece of equipment are found in TM 55-8465-215-10."

CREW CHIEF

A SPECIAL SOLDIER

CW2 Vance H. Labounty

ON MY FIRST TOUR in the Republic of Vietnam, I served with the 240th Assault Helicopter Company at Bear Cat. This is where I first encountered a very remarkable breed of soldier: the crew chief. The 240th supported ground units all over III Corps, from Song Be to Binh Phouc, and during May 1970 moved troops into Cambodia. With the 240th averaging 3,000 hours a month, each crew chief had to perform an intermediate inspection every third day.

Up each morning by 0500 hours, flying all day and then working until midnight getting the aircraft ready for the next day, the crew chief had his hands full. Plus, whenever the flight shut down during the day, the crew chief seized the opportunity to clean his helicopter. Daylight is valuable time to any crew chief and every minute was used to the fullest extent.

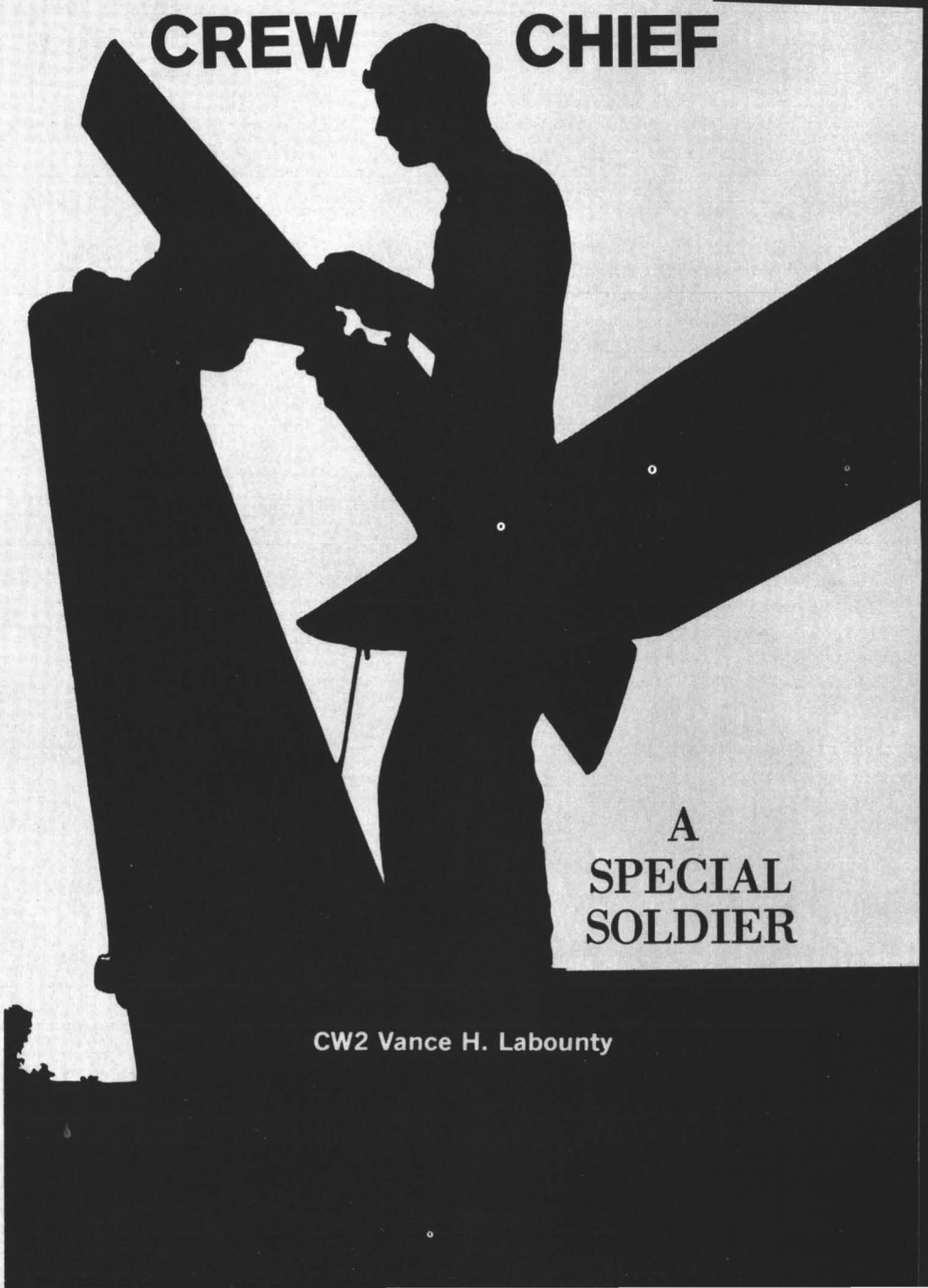
Performing maintenance was not the crew chief's only responsibility. In the air he kept the pilot informed of other aircraft in the vicinity, cleared the tail rotor when entering or leaving a landing zone (LZ), manned a door gun, helped in loading and unloading, etc.

On a resupply mission for the 199th Infantry Division, I had to rely completely on my crew chief to clear the aircraft. "D" Company had broken contact with the enemy at 0430 hours and needed supplies and medevac in order to continue pursuit. No equipment was available to prepare an LZ; the most they could do was to provide smoke so we could work our way down.

We came to a high hover over the 200-foot jungle and began the descent. I lost intercom with my door gunner in the first 50 feet, and then it was completely up to my crew chief to get us in and out. Verbally he would give directions to guide the aircraft in. At times there was less than a foot between the trees and the tail rotor. One wrong move and all of us would spin 200 feet to our death. As the aircraft touched down, all gave a sigh of relief.

Then I looked up and saw the small hole in the jungle which we had just come through and I couldn't believe it. But we made it in and, with a little more work, made it out. Our day did not end until we returned three more times.

The mission was finally finished after 9 hours of continous flying. Then as soon as we reached Bear Cat, the crew chief started performing his daily inspection; the aircraft had to be ready for the next day. Maybe there would be an easier mission, maybe not, but it had to be ready.



Etiology of a Midair Collision

CW3 Jose A. Suarez
Data Center
USABAAR

ETIOLOGY:

A science or doctrine of causation or of the demonstration of causes; a branch of science dealing with the causes of particular phenomena; all the factors that contribute to the occurrence of a disease or abnormal condition

THE DAY HAD been long and tiring. The flight leader called the tower on the way home and requested permission for a flyby. "Always good for morale," he thought. The five slicks locked in right echelon. Before reaching the end of the runway, Chuck 4 collided with Chuck 3. The results included four fatalities and two post-crash fires.

Members of the aircraft accident investigation board agreed the major cause of this accident was pilot error because the pilot of Chuck 4 misjudged his distance when it was his responsibility as wingman to maintain adequate separation from Chuck 3. Considerable investigation and deliberation by the flight surgeon revealed several factors that played an etiological part in contributing to pilot error.

One of the major factors was an attitude of overconfidence, with subsequent carelessness on the part of the pilot of Chuck 4. He was one of the most experienced aviators in the unit, with more than 1,500 hours in helicopters and 1,336 hours during his current 11-month tour. He had been averaging more than 120 hours monthly and had no previous accidents. After considerable discussion with him and his fellow aviators, it became obvious he considered himself an exceptionally capable aviator and undoubtedly took great pride in his flying record and prowess. His platoon leaders and others had noted he was rather resistant to suggestions regarding his flying techniques and habits. He had been admonished on several occasions that he was flying too close during formation flights. On the day of the accident, he had been told twice, once earlier in the day and again just prior to the accident, that he was flying unusually close. It would seem his overconfident attitude allowed him to become unusually careless about keeping his proper distance between helicopters.

Faulty attention was another factor which played an important role in this accident. It was manifested by a low level of attention, channelized attention and momentary distraction. Several observations led to the belief that the Chuck 4 pilot did not have an optimum or adequate level of attention for the existing conditions. He stated that he thought he was 4 to 5 feet above Chuck 3. However, several statements by various witnesses indicated he was at least on the same level as Chuck 3. In fact, the aviator flying right seat in Chuck 4 stated that one of the last things he remembered before the accident was that he thought they were actually lower than Chuck 3. In addition, examination of the rotor blades of both helicopters indicated Chuck 4 hit the underside of the rotor blades of Chuck 3. To further confirm inattention was the pilot of Chuck 4's failure to heed a radio call from Chuck 5, just prior to the accident, warning him he was flying too close. Since inattention was probably present, we should next ask what caused it.

As previously mentioned, overconfidence and carelessness may have contributed to inattention. Pilot fatigue may well have been a very important factor. Two types of fatigue were probably present—namely, chronic flying fatigue and acute (skill) fatigue. The pilot of Chuck 4 had averaged more than 120 hours a month for 11 months. During the 30-day period prior to the accident, he had flown 134 hours. While he did not fly the day before the accident, chronic flying fatigue is a cumulative phenomenon, occurring after incomplete physical and mental recuperation between repeated missions.

Most experienced aviators agree that, although an individual may not feel tired, if he is smart enough to recognize his symptoms, he will notice evidence of chronic fatigue, such as decreased attention span, slowed reaction time, minor mistakes, etc. Although individual tolerances vary, it is difficult to see how an aviator could have flown

ETIOLOGY

this much over this period of time without having some element of chronic fatigue. Acute (skill) fatigue was undoubtedly present. He arose at 0445 after 6 hours' sleep; missed breakfast; flew 3 hours in the morning; rested, talked and ate lunch from 0900 to 1230; and then flew 3 hours on an extraction from a PZ. He had been on the controls approximately 15 minutes prior to the accident.Although the 6.5 hours of flying time that day was long in comparison to many of the 8- to 12-hour marathons of other days, it was still considerably fatiguing since his group had been on some type of duty for 12 hours and flying formation some 5 to 6 hours.

It is difficult to fly that many hours of formation without being very fatigued. Although there is no device or gauge available to measure fatigue, we can state with reasonable assurance that fatigue was an important factor and probably contributed considerably to the pilot's low level of attention.

Another contributing factor to the low level of attention was the fact that this was the last flight of the day, with the desire to get back home and the feeling of relief associated with getting safely home from an operation in a location which had gained a reputation as a bad area. This phenomenon of accidents associated with the last flight of the day, or the end of a flight, has been previously noted as a source of inattention, decreased motivation and decreased alertness.

The pilot of Chuck 4 stated that, prior to the accident, he was primarily concerned with maintaining the proper angle (45 degrees between his ship and Chuck 3). In doing this, he may well have so channeled his attention to obtaining a correct angle that he became less aware of the distance between helicopters.

Finally, momentary distraction may have contributed to the pilot's lack of attention. Several causes of distraction were present. First, the Chuck 4 pilot stated he made a slight left pedal adjustment a few seconds prior to the accident. Second, he may also have been slightly distracted by radio communications. Third, a movement by Chuck 3 may have concerned him, Finally, he stated that, at the moment of impact, his eyes were momentarily in a forward position, looking at the panel. He may well have looked at the instrument panel much longer than he realized.

Another related factor in causing this accident was suspected erratic flight movements of Chuck 3. From several indirect indications, it can be concluded that the aircraft commander of Chuck 3 was flying his ship. A review of this aviator's history revealed several possible human factors for unsteady flying. He was one of the more reliable and experienced aviators in the unit. During formation flying, he was described as locking in and being very stable. However, a few months prior to this, he suffered a missile wound in his chest during a combat mission. Since recovery, he had been noted to be a little more jumpy while flying, but not excessively so. He had told others on previous occasions that he did not enjoy formation flying because he could never be certain of what the other guy was going to do.

In addition to these human factors causing erratic flight, two other factors may have been important. There was slight to moderate air turbulence which could have produced erratic flight patterns. The crew chief in Chuck 3 was seen to be moving about the cargo compartment. This certainly could have contributed to difficulty in keeping the helicopter stable by occasionally shifting the center of gravity.

Although these are all small bits of evidence, a combination of any or all may well have played a definite role in causing the unsteady flight of Chuck 3. Nevertheless, Chuck 4 should have been far enough away to allow clearance for Chuck 3's movements.

There was probably an error in supervision because the flight leader allowed the formation to assemble closer than the recommended minimum for formation flying (two rotor discs). The esprit of the unit was high and the encouragement of the flight leader to "close it up and look real good" probably caused the pilots to form a tighter formation than usual. In fact, most of the aviators and crew members interviewed remarked that it was one of the tightest formations they had experienced.

In conclusion, we may summarize the human cause factors in this accident as:

Flying too close. The two reasons for this pilot error were: (1) Faulty attitude of overconfidence and carelessness and (2) faulty attention. The low level attention was caused by: (1) Overconfidence and carelessness, (2) pilot fatigue (chronic and acute), and (3) decreased motivation (desire to get home and relief from dangerous area). Channelized attention was caused by concentrating more on correct angle than correct distance. Momentary distractions were due to radio communications, aircraft adjustments and looking at the instrument panel.

Possible erratic flight of Chuck 3.

Supervisory error due to the flight leader urging the formation to close it up.

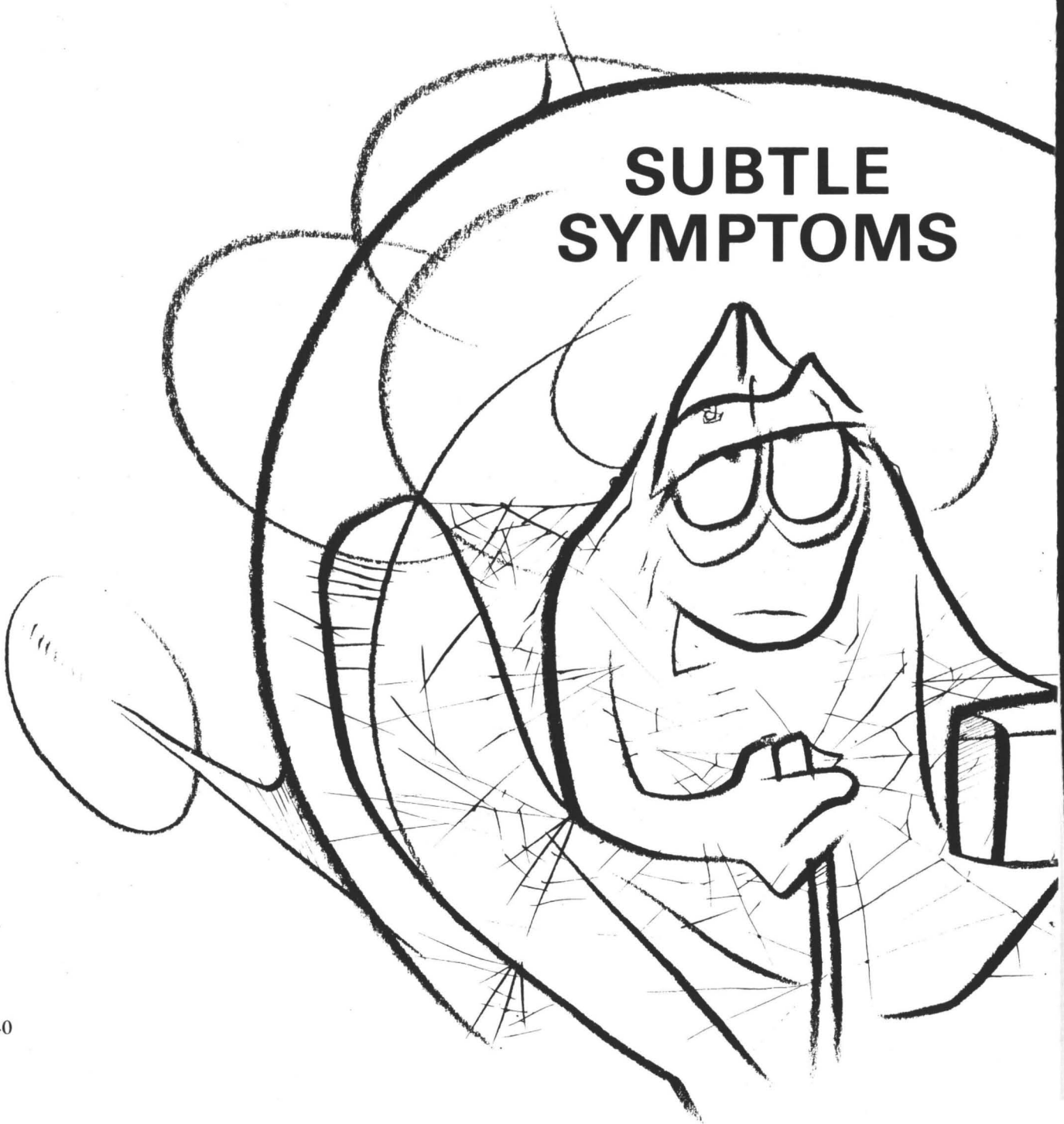
BROKEN WING AWARD

AUSTIN, TEXAS—CW2 Billy H. Miller, left, 322d Aviation Company, Texas Army National Guard, was presented the Army aviation Broken Wing Award by his company commander, Major Gerard H. Stokley Jr. While on a training mission for his unit, CW2 Miller's engine stopped at 150 feet after takeoff from the company's airfield at Austin Municipal Airport. He autorotated the CH-34 to a small field bordered by trees on three sides and a fence on the other, landing with no damage. In civilian life, CW2 Miller is an instructor pilot employed by Southern Airways of Texas, Inc., civilian contractor for the Army's Primary Helicopter School, Ft. Wolters, Tex.

FROM THE DAY man first became airborne, getting back on the ground safely has been a major challenge. Over the years of trial and error, successes and failures, the art of safe descent has improved to the point where it is no longer the most serious problem. The real problem lies with the pilot. While his flying technique, skill, judgment and knowledge are important, these abilities are directly proportional to his state of mind, his attitude toward flying, his consideration of others and even his imagination.

A pilot may be a professional, but he is a human being and human beings make mistakes. Mistakes are often caused by physiological and psychological factors that may come in many forms. These factors may be called *symptoms* which affect the behavior of pilots. Many are easily recognized—anger, hunger, vertigo, pain, fear. These symptoms can generally be controlled by the pilot. But the dangerous symptoms of complacency, overconfidence, fatigue, inattention and boredom are the insidious types which propagate

SUBTLE SYMPTOMS



slowly until the right combination of circumstances results in an accident.

It's possible to treat many of these symptoms by additional training, change of habits, rest, etc. A more serious approach involves a reprimand or flight evaluation board. No doubt, the most effective and lasting cure is to scare yourself out of a bad habit. When this happens, you tell yourself, "I'll never do *that* again!" You lucked out.

The tragedy of any accident involving a pilot who didn't luck out is that in most cases it could have been avoided. He did not recognize or heed the warning signs of inattention from fatigue, recklessness from overconfidence, preoccupation from emotional conflicts or daydreaming, or boredom from repetition. The subtle way in which these symptoms occupy conscious thoughts makes it difficult for a then unreceptive mind to discipline itself. Have you ever flown or driven over a certain route for a certain distance or time and not been able to recall doing so? No doubt, it disturbed you when you realized the possible consequences.

What should have been just another routine mission turned one experience into a tragic loss of life, heartbreak for the survivors and anguish for their rescuers. The mission was to pick up passengers at two sites and return to home base. The crew of four gathered at the helicopter, preflighted and cranked up. Runup was routine and the helicopter was hovered to the takeoff pad. After liftoff, the Huey climbed to altitude and flew to its first destination. Five passengers were loaded and the helicopter departed for the second pickup area located on the top of a pinnacle. A routine approach and landing were made.

A group of so roached the running helicopter and six . The Huey now had its crew of four and 11 passengers aboard. Symptoms of complacency, haste, boredom, inattention and indifference then reared their ugly heads. No one bothered to make a head count. No attempt was made to reduce the number aboard. No instructions were given about the use of seatbelts or safety and emergency procedures. Only one passenger fastened his seatbelt.

The pilot glanced back into the troop compartment and saw one of the passengers smile and give a thumbs-up signal. The Huey was lifted off and, before it had time to lose rpm, the takeoff was attempted. It reached the edge of the pinnacle and the rpm fell dangerously low. The aircraft commander shouted, "Kick some of them off!" But, airborne, over the edge of a pinnacle whose rock and stump-filled sides dropped rapidly away, made jumping inadvisable and no one volunteered. A pedal turn was attempted in an effort to return to the pinnacle and land. But antitorque control was lost and the helicopter began spinning out of control. It impacted the mountainside 150 feet downslope, rolled nearly inverted, slid 50 feet further and came to rest in a minefield.

The aircraft commander, the pilot and the passenger who fastened his seat belt remained in the helicopter. The other 10 passengers, the gunner and the crew chief were thrown out. The crew chief and three passengers were killed and one passenger sustained major injuries. The gunner, who lost his helmet on impact because it had no chinstrap, stated that he and the crew chief never wore seatbelts.

Not knowing they were in a minefield, the survivors started up the steep slope for help. A mine exploded, killing one of the passengers and seriously injuring three others. Dense vegetation, the steep angle of the slope and the fear of mines and boobytraps made rescue attempts a nightmare.

The aircraft commander and pilot later stated that they were unaware of their responsibilities for informing passengers to use their seatbelts and briefing them on emergency procedures, although their unit SOP clearly stated these responsibilities.

It's a good idea to occasionally sit back and take stock of yourself. Do you find yourself daydreaming more than you used to? Do you become easily upset over trivial things? Do you take shortcuts in routine flight activities? Do you take things for granted? Be honest with your answers and own up to any symptoms of inattention you may display. This is the first step to get your attention back where it belongs—on every detail of your flying.

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ARMY AVIATION has come of age over the past several years. We've seen our aircraft and pilot numbers soar. Recip engines have gone out and turbines have come in. Payloads have gone up and up and the accident rate has gone down. In rotary wing, we've dropped from a rate of 43 per 100,000 flying hours in 1960 to 18.1 per 100,000 flying hours in 1970. This is a substantial drop, but not the ultimate goal. We must continue our efforts in all areas of accident prevention. One area is wide open for improvement, an area that includes the type mishaps which should be easiest to prevent—ground taxi accidents and incidents.

Army cargo helicopters were involved in 19 ground taxi mishaps during the period 1 January 1967-31 August 1970. Two of these involved total losses, one was a major accident and the remaining 16 were incidents. Two people were killed and seven injured. Helicopter losses and damages cost $3,497,000.

Why do we have so many of these mishaps? You'd think a guy who can fly a million dollar machine through the air could drive that same machine on the ground without running into something. It appears that when the wheels are on the ground some pilots ignore all safety precautions. The following cases reveal this.

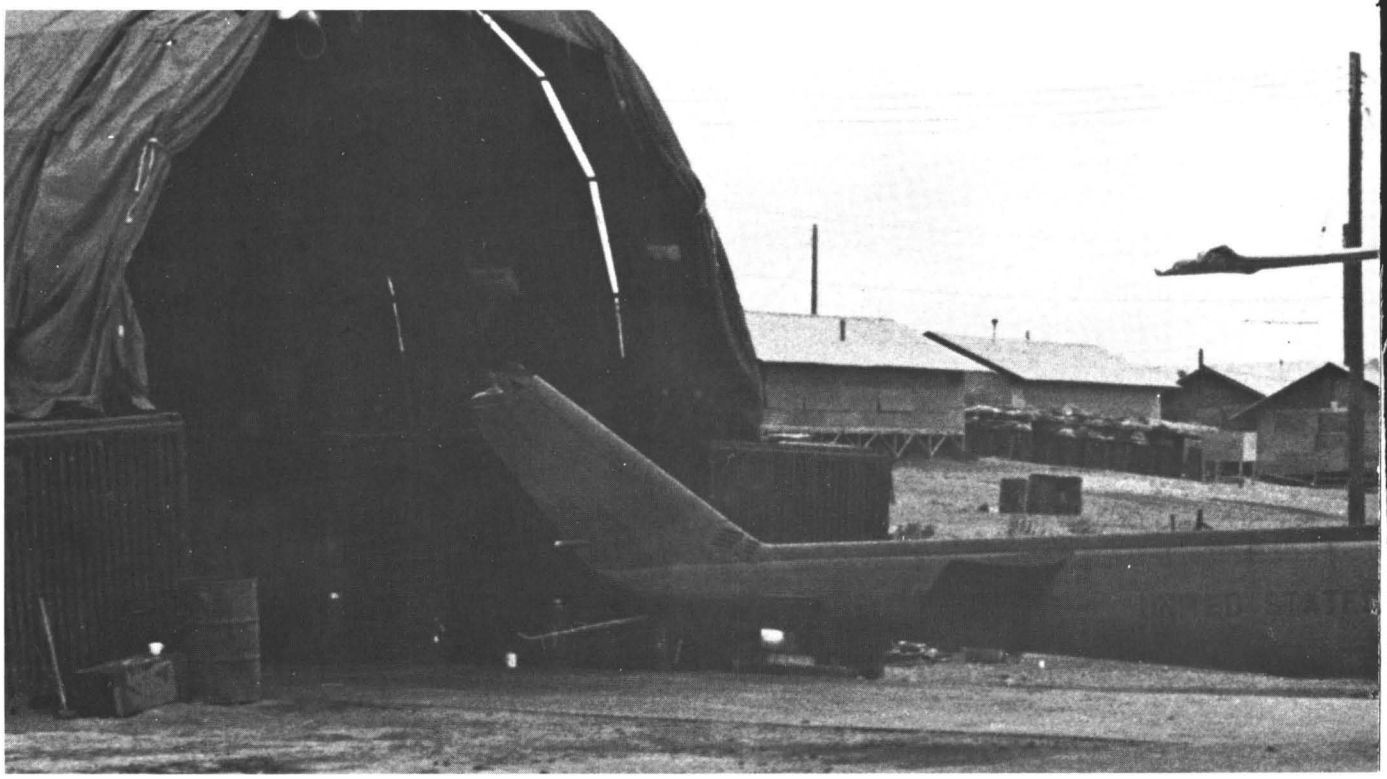
A CH-47 pilot was taxiing out of a revetment and started a left turn. The forward blades hit the aft blades of a parked CH-47. No ground guide was used. This accident cost $1,038,000.

Another CH-47 was being ground taxied and had moved approximately 25 feet when the forward blades hit the main rotor blades of a parked UH-1. Flying debris killed the ground guide and damaged another UH-1.

Using power steering, an aircraft commander was taxiing a CH-47 to the takeoff pad. During a left turn, the aft wheels went out of phase and steering control was lost. Brakes were applied, but they did not respond. The CH-47 struck a parked UH-1.

In these three mishaps, certain factors stand out.

Case 1: The most glaring thing in this accident is the fact that a ground guide was not used. AR 95-1, paragraph 4-22, states: "When an aircraft is



maneuvered in close proximity to other aircraft, buildings, or other obstructions, or in gusty or high winds, members of the ground crew will be positioned to insure adequate guidance." This statement was written because, over the years, it has proven to be a sound practice to use a ground guide.

Another factor in this case is the fact that the forward blades of the moving helicopter hit the aft blades of the parked CH-47. What were the pilots doing while taxiing? Making radio calls? Completing pretakeoff checks? Checking the cargo hook? One thing is certain. Their attention was not where it should have been—on the movement of the helicopter!

Case 2: This one has the appearance of complying with the above regulation. A ground guide was posted, but the mishap still occurred. Either the guide was not properly clearing the helicopter or the pilots were not following his guidance.

Case 3: What happened to checklist and dash 10 procedures? The checklist calls for a brake check just prior to taxiing. It is not likely that the brakes failed while taxiing. It is more likely they were inoperative prior to movement.

The wheel dephasing may have resulted from exceeding the turning limits of the power steering. The limit for a right turn is 80 degrees. However, the left turn limit is set at only 58 degrees.

In these three cases, there is one glaring factor—inattention and poor planning by the flight crews.

As stated, ground taxi mishaps should be one of the easiest types to prevent. The following procedures, if followed, will prevent most ground taxi mishaps.

- Use the checklist. A seemingly insignificant item may prevent a mishap.
- Know the dash 10 for your aircraft (operation and limitations of all systems).
- Comply with AR 95-1. USE A GROUND GUIDE and coordinate with him prior to movement.
- Make operational and pretakeoff checks prior to taxiing and at the takeoff pad—not while taxiing.
- Be as professional and alert on the ground as you are in the air.

GROUND TAXI

It's played by people who have integrity and determination and it's played by people who are irresponsible and incompetent

THE GAME

TWO OF THE 12 definitions of the word "game" are: "A contest covered by set rules" and "a test of physical or mental prowess." With these two definitions in mind, is it possible to consider such an enormous operation as Army aviation maintenance a game? Yes, it's a game. It's a game where spectators are allowed in free and seats are always available. It's a game played 8 hours a day, 5 days a week by some; 24 hours a day and 7 days a week by others. To play, you should be a professional. Regrettably, it

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is all too often played by individuals who never attain a standing higher than amateur.

It's a game you can sometimes play, merely by being present when a player is needed. It's played by people who have integrity and determination and it's played by people who are irresponsible and incompetent. It's a game that is all too often influenced by very special spectators called commanders whose constant prodding and unrelenting pressure induce haste, handicapping the players. A win is considered adequate and a loss deplorable. There are no cheers for the winner and the loser can only endure. It's a game where praise is scarce and criticism abundant.

The game has rule books, but they are not always used. The pressure to produce often doesn't allow the wealth of carefully gathered information to be used as directed. As an alternative, the coach and players use short cuts and choose other ways to play than those prescribed by the books. After all, if the play doesn't succeed, they can always try again.

The players in this game often attain professional standings, but are all too soon lost to civilian player leagues. Inequitable conditions within their own league encourage transfers. Why be a team member if they won't let you play? The coach is constantly pleading the fact that he is short of players, but other people desire their services elsewhere—services such as cutting the grass, helping in the kitchen, guarding equipment, etc. "All part of the training," these others say. But a player wonders why, after going through all those fine schools, he is only allowed to sit on the sidelines.

As time goes by, the game becomes more complicated and the plays more demanding. Simplicity is lost amid advanced techniques and procedures. The players have to maintain their professional standings or the game is lost. The coach's burden is a heavy one. He constantly reminds his players they are concerned only with the present and the future. The past is only a means of noting errors and providing improvements for the future.

The players are always confronted with a formidable and aggressive opponent called mother nature. All too often, the game must be played in mud, dust, dirt and even snow and rain. Drop the ball and there can be no complaints. Complaints only fall on deaf ears. Isn't the game supposed to be played that way, if necessary? There can be no games called because of weather!

At times, the game falters for lack of supplies. When this happens, the coach and his players are forced to employ a strategy play called "scrounge." Whether they are labeled moochers, spongers or beggars, the game goes on. The supply coach, surrounded by punch cards and computers, somehow escapes the wrath heaped on the playing coach when the game grinds to a halt. The computer is his guardian, providing him a sanctuary by forever spitting out words like "due in" and "due out."

This game requires no secret plays or hidden talents. It is managed and played by commanders and supervisors alike, down to the lowest ranking member of the team. As in all games, each individual is responsible for doing his part. In no other contest could teamwork be more important for producing desired results.

If the game is lost, blaming the loss on one individual alone is a passing play called, "Who gets the buck?" Commanders and supervisors have to instill discipline and esprit de corps among their players. Discipline must result in proper conduct and technical integrity, both held together by a high level of esprit. Discipline will relax if esprit is low and this, in turn, can lose any ballgame. If the players are untrained, you must train them. It's all too easy to bemoan the fact they are rookies and do nothing about it. If discipline is lacking, there is a need for better supervision. Supervise by setting standards. This has a direct bearing on the quality of players whose attitudes we help to shape and whose character we help to mold.

Army aviation maintenance is a game that should only be played by professionals. What is a professional in this game? The real pro in any contest is one whose performance consistently sets him apart from the average or run-of-the-mill competitor. While each type of contest calls for particular natural talents, great talent alone does not gain admission to the select circle. Nor does average talent mean one is automatically excluded. The real test is how the individual makes use of whatever natural talent he has. A real pro gets that way because he always makes use of his natural talents. He never stops practicing, never stops learning, never stops improving in every aspect of the game. He becomes one of the best, not so much by natural ability, as by *acquired* ability.

Whatever position you may play in this game, stop and ask yourself, "Am I doing my part? Am I a professional?"

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TOOSOONOLDT AND TOOLATESCHMART

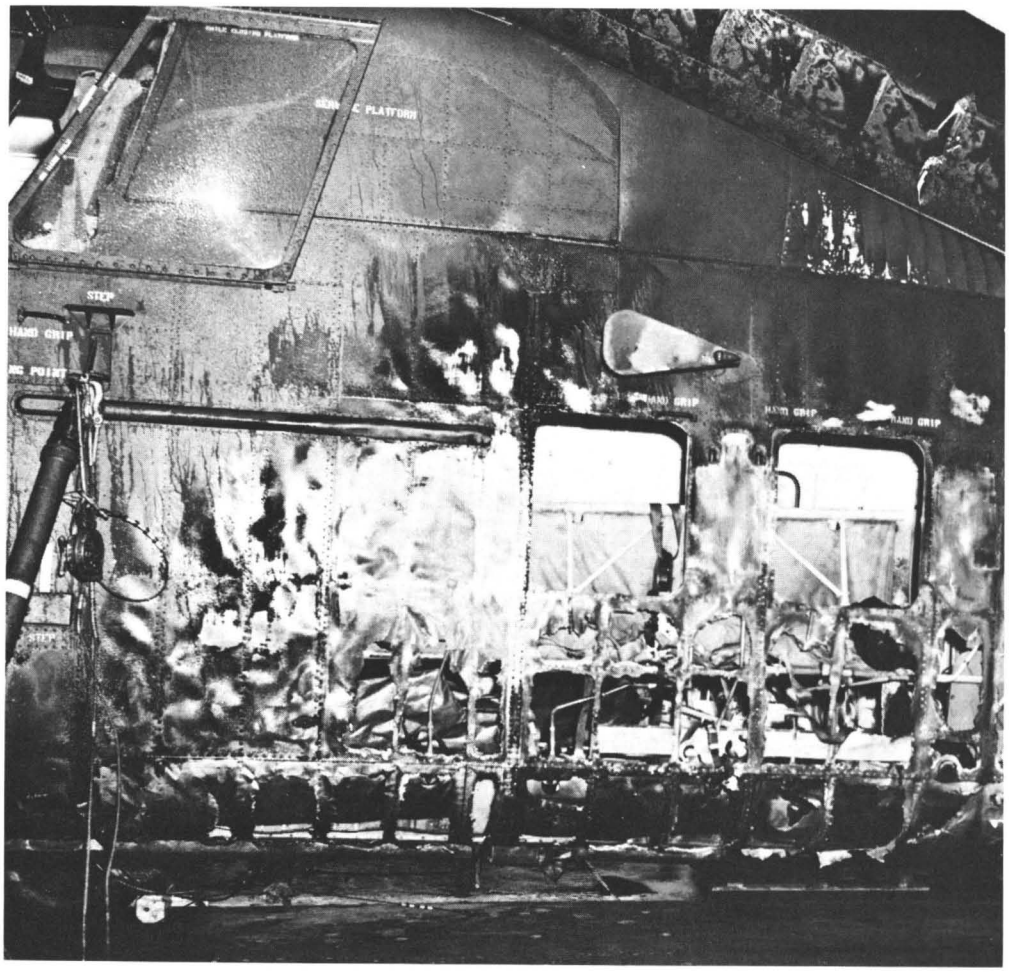


Photo 1. Note tubular structure of troop seats and webbing blocking exits of this burned CH-34

I SAW THESE words painted on a sign in a bar out west many years ago. As humans, it's safe to say this philosophy applies to most of us. If we're honest, we'll admit that most of us reach a ripe old age *in spite* of what we do rather than *because* of what we do.

In reviewing hundreds of accident reports, my special interest is crash injuries and their causes. While it's a well known fact that the human body, properly protected, can withstand more crash forces than the aircraft in which we fly, injuries do occur. Certain types of injuries, caused by the postcrash environment, can be reduced or eliminated.

Crash survival requires impact survival, followed by timely evacuation. Crew members generally know what to do and how to escape after a crash. But what about the passengers? Accident experience indicates a simple briefing to passengers about the location and operation of normal and emergency exits may make the difference between life and death. In the event of a postcrash fire, aircraft occupants are subjected to instant panic. Then it's too late to conduct a briefing.

The tragedy of surviving a crash impact, only to perish from an inability to escape the postcrash environment, is inexcusable when a timely coordinated evacuation can be accomplished by crew training and leadership. Human escape reactions in an emergency are often predetermined by knowledge gained *before* the emergency. A fact worth considering when briefing passengers is that even if they are Army aviators many are not dual rated. Although aviation oriented, they should not be expected to know the location and operation of normal and emergency exits in aircraft they are not familiar with. A passenger briefing should ALWAYS be given, no matter how experienced the passengers may be. The briefing should include the location and operation of the first aid kit and fire extinguisher. If equipped with helmets, passengers should be told to keep them on until clear of the aircraft. Helmets will protect them from jagged metal and plexiglass, fuel spray, thermal injuries, rotor blades or even a fall.

There are several cases on record where the tubular structure of troop seats and associated webbing crossed emergency exits and interfered with timely evacuation (see photo 1). Although these obstructions can be easily removed under normal conditions, they can prove fatal in emergency situations.

Photo 2 shows the remains of a CH-34 that was on a photo mission. There were 13 people aboard, including a pilot, copilot, crew chief and 10 non-aviation-oriented passengers. The engine failed at approximately 900 feet and the pilot autorotated toward a highway. A car, traveling in the same direction and at the same speed, prevented touchdown on the smooth road surface and the pilot landed on the rough median. The right main gear failed and the helicopter rolled slowly to its right side, blocking the cargo door. Fire and panic erupted simultaneously. One of the passengers used a piece of 2 x 4 wood his camera was

Photo 2. Burned remains of CH-34 in which five occupants perished

TOOSOONOLDT AND TOOLATESCHMART

Photo 3
Pearl points to overhead window of UH-1 which can be easily broken out and used as an emergency exit

Photo 4. Inside diameter of this CH-47 is 90 inches and exits on top are out of reach.

mounted on to break out one of the two available emergency escape windows. Seven passengers escaped through this opening. Three others didn't make it. It would be speculation to say all could have escaped by using both windows.

The pilot and copilot could not use the cockpit windows because of the flames and they could not get enough room to kick out the windshield. They had given up hope of escaping when a passerby broke the windshield out for them and they escaped. Five fatalities resulted from this accident. Investigation revealed that only periodic briefings were given to passengers. Those involved in this accident were unsure about what to do.

Doors that slide fore and aft or up and down inside fuselage hulls are susceptible to jamming due to the intricacy of operating mechanisms and any deformation of fuselage hulls. If a UH-1, for example, is involved in a severe hard landing that deforms the fuselage, with the doors closed, it is likely the cargo doors will be jammed. It's possible for cockpit doors to also jam if accidents are severe enough. If the helicopter rolls over on its side, those doors are blocked. The top side doors of the UH-1 in photo 3 are 7 feet above the ground and virtually useless without some type of breakout tool. It's nearly impossible to break an intact windshield from the inside for an escape route. The most available exits are the overhead windows (Pearl points to one) which can be easily broken away. However, these windows are not marked as emergency exits and I seriously doubt that many passengers—and some crewmen!—know the use of these openings may save their lives. Why not tell them about it during passenger briefings?

When large helicopters, such as the CH-47 in photo 4, come to rest on their sides, the topside exits cannot be reached because of the width of the cabin. The inside diameter of the Chinook is a whopping 90 inches! While it's possible to get out through the rear ramp, if the ramp is in the up position, the size of this exit is reduced by nearly two-thirds. If there is any collapse of overhead structures, it will be reduced further. And if the rear cargo door is installed, as it is on the Ch-47 in photo 5, and the cabin is filled with smoke, directions for jettisoning this door may be impossible to read.

While it may be impressive to have the engines fired up and be ready for immediate takeoff as soon as VIPs board, no one should be in that much of a hurry to die. Unfortunately, unlike the airlines, we don't have cute young things in miniskirts to tell VIPs what to do in an emergency. It's *our* responsibility to tell them.

Photo 5
Rear cargo door is installed on this CH-47, blocking ramp exit. If cabin is filled with smoke, directions for removing cargo door are likely to be unreadable

Photo 6
The occupants of this U-21 escaped injury, but the pilot had to push his way through the passengers to the rear of the cabin and had difficulty opening the door because of its design and because he was crowded by the anxious passengers. Photos 7-10 explain operation of door

TOOSOONOLDT AND TOOLATESCHMART

Some of our fixed wing airplanes also have egress problems. During takeoff, the U-21 in photo 6 struck an ambulance that was crossing the runway en route to another emergency. Fire erupted at impact. The pilot had to push his way through the passengers to reach the door at the rear of the cabin. He had difficulty opening the door because of its design and because he was crowded by very anxious passengers. When the door was opened, one of the passengers still had his seat strapped to him, The seat had broken loose at impact and, in his panic, the passenger forgot how to release the lap belt.

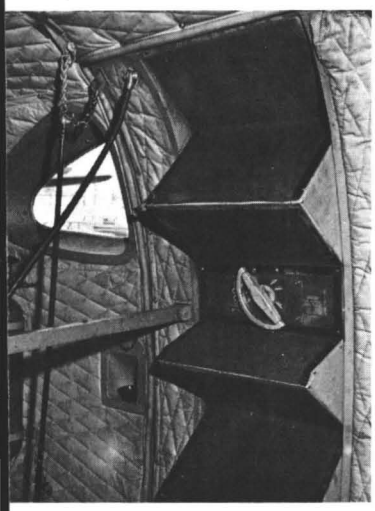


Photo 7. U-21 cabin door in closed position with safety chain in place

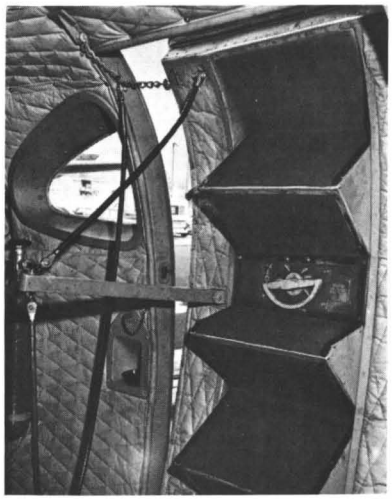


Photo 8. When attempt is made to open door with chain in place, chain cannot be released

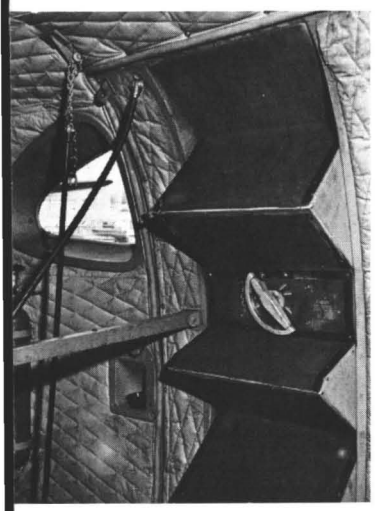


Photo 9. Correct procedure is to remove chain from door . . .

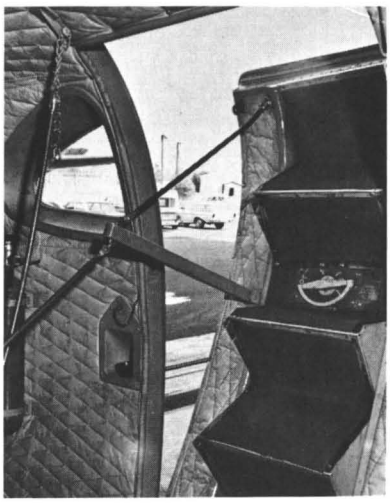


Photo 10. . . . turn door handle counterclockwise and push door open

Human reactions are unpredictable when lives are in danger. Some people may freeze in place, become hysterical, and forget where they are, what to do and where to go. It may become impossible for them to perform even the simplest task, such as releasing the seatbelt. They need help!

I believe I deserve to be given a briefing about any aircraft I ride. When I board an airliner and enter the tourist compartment, I look for the emergency exits and I'll push little old ladies aside to get seated next to an exit. When the stewardess briefs the passengers, I try real hard to concentrate on her instructions and plan my escape.

Would you believe that in a full fledged postcrash fuel fire, cockpit temperatures can reach 800 degrees F. in approximately 10 seconds? Temperatures hot enough to melt magnesium (1204 degrees F.) have been reached in 16 seconds. Prolonged exposure (12-16 seconds) to high temperatures may cause serious or fatal thermal injuries. A temperature of 158 degrees F. for 1 second will produce second degree burns on unprotected skin. IT IS EXTREMELY IMPORTANT NOT TO INHALE WHILE IN A FIREBALL. The respiratory system may be so severely damaged that death is inevitable. If you're like most people, you can hold your breath for 30 seconds and this could be long enough to escape.

No other factor plays such an important a role in postcrash survival as the potential escape routes provided in an aircraft. Placarding and operating instructions of emergency exits should be self-explanatory to the extent that inexperienced passengers or bystanders can operate them with one simple operation without crew assistance. The operation of release mechanisms should be so simple and obvious that a person should be able to open the exit in near darkness with one hand. Since this is not the case in most aircraft—BRIEF YOUR PASSENGERS! Brief them about all emergency exits, including those in the cockpit. You may be pinned in and need their help in an emergency. Would you rather be helped by a passenger who's had a thorough briefing or one who's had no briefing at all?

You, as aircraft commander, IP or pilot-in-command, are the person in sole charge of your aircraft. You are responsible for the safety and welfare of those who entrust their lives to you. It is your moral obligation to give them the protection they deserve.

OH-13 PILOT'S account of night accident: ". . . I then turned south, with the intention of flying across the western section of the city . . . As I neared a shopping center at an altitude of 1,500 feet and an air speed of 50 knots, I turned east, and the other helicopter, which was on my right, followed. After the turn, the other helicopter was in the lead. I radioed the pilot I would be coming up on his right. Before I could move to that position, I heard a loud snap or crack and my helicopter shuddered violently. The engine stopped. I lowered the collective and looked for a forced landing area. I saw a parking lot ahead and descended toward it. As I neared the site, I discovered I was not going to make it. I knew I was going to hit the trees about 100 feet short of the area. At approximately 25 feet from the trees, I flared and pulled collective just before the helicopter struck the tree. . ."

Aircraft accident investigation board's account of the same accident: ". . . The helicopter, while in powered flight at an altitude of approximately 100 feet agl, struck a 3/8-inch guy wire attached to a 140-foot unlighted tower with one main rotor blade. The guy wire was pulled from its upper mounting and propelled into the tail section of the helicopter, severing both tail rotor control cables. The guy wire then became entangled in the tail rotor guard, pulling off an 18-inch section of the guard. The helicopter proceeded approximately 400 feet, struck the top of a 60-foot tree, traveled another 40 feet, struck a 35-foot utility pole, then came to rest in an almost inverted position. . ."

TWO VERSIONS

After striking a tower guy wire, tree and utility pole, this OH-13 came to rest partially inverted in trash can area. Miraculously, the pilot escaped with minor contusions

MAINTENANCE MAYDAY OR

MAYDAY IS THE international distress call, derived from the French word *M'aidez*, meaning "Help me." It's time for a new distress call. The one I'd like to see is *Maintenance Mayday*, meaning "Help my maintenance." It could be passed from the operations officer to the maintenance officer, right on down to the mechanic on the line. It could even be used as a greeting after a unit has a maintenance-caused mishap.

This would serve as a glaring reminder that someone failed to do his job properly and created a situation where money was wasted, equipment damaged or destroyed, missions aborted or delayed and, worse, the lives of members of his own unit endangered. If you had created such a situation, how would you feel walking down the company street and saluting the pilots you passed with the greeting, "Maintenance Mayday, sir!"?

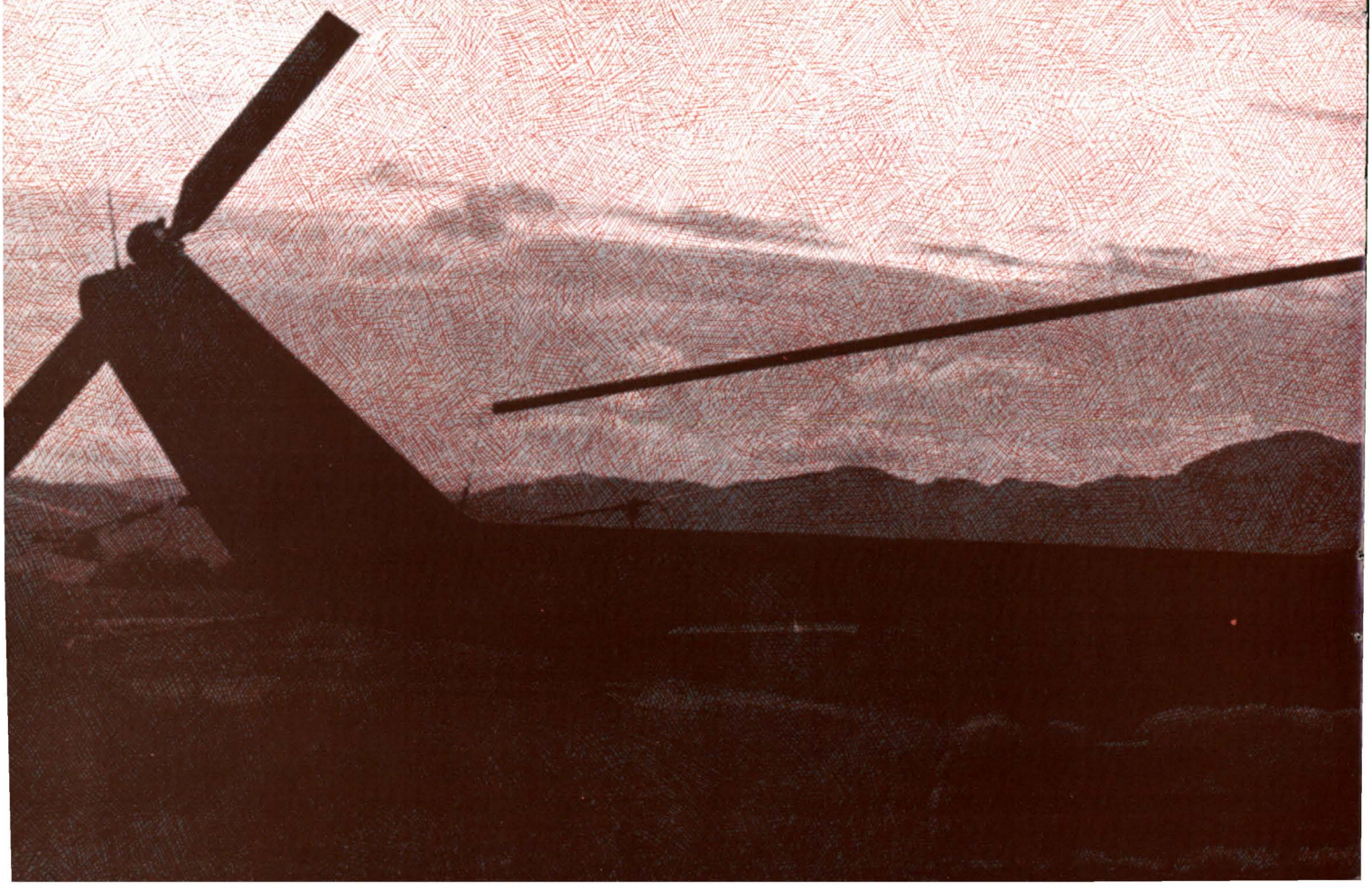
You will never be subjected to this type of public degradation. But let's look at some facts and see why it might be a good idea! Table 1 shows 691 maintenance-related mishaps during a recent 1-year period. These mishaps resulted in 23 fatalities, 17 injuries, 10 lost aircraft and a dollar cost of $6,978,000.

What causes a maintenance-induced mishap? There are only two real causes:

- Someone didn't do his job.
- Someone didn't do his job properly.

Of course, there are some circumstances which help to explain why these causes exist. For example, there is the combat situation. Often, experience levels, training and knowledge of mechanics or technical inspectors must be considered. And what about supervision of the supervisors?

Leading salesmen quote a little phrase that



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MAINTENANCE INTEGRITY?

goes, "Plan your work and work your plan!" Think about this for a minute. If you're in aviation maintenance, your plan is already laid out. Do you work the plan? Maintenance involves a series of checks, rechecks and more rechecks during which we use varying degrees of inspection at predetermined times to ensure aircraft are safe.

Most units work on a team concept with this in mind: "Let's see how it should be done!" First, they find a discrepancy and the team performs the work required. Do they then grab the nearest TI and get the book signed off? No, not if they are going to work the plan. They first get the team leader and he should be real handy, almost looking over their shoulders. He checks the work, then notifies the platoon sergeant or maintenance supervisor, who, in turn, inspects the work again to ensure it has been properly accomplished. He will also ensure that all necessary EIRs have been submitted in accordance with TM 38-750, and that proper requisitions were submitted through supply, even if the parts were scrounged. After all, supply is in the plan we have to work and we must place demands on the supply system.

Now it's the TI's turn. When the maintenance supervisor notifies him the work is ready for his inspection, does he run right out and look at it? Not quite! Not if he's working the plan. He will first look over the logbook to make sure all entries have been properly made. After he is sure of what has been done, he will inspect the work, sign it off, and that's the end of it. Right? Wrong! There's still a fellow we call the crew chief who has to inspect the work. There are also the pilots who are going to fly the ship who should take a

TABLE 1

Recap of Maintenance Mishaps
16 November 1969 Through 15 November 1970

	Factors		Classification				Systems															
	INSPECTION	MAINT. PROCEDURE	ACCIDENT	INCIDENT	FORCED LANDING	PREC. LANDING	AIRFRAME	LANDING GEAR	ENGINE	TRANSMISSION	PROP/ROTOR	HYDRAULIC	INSTRUMENTS	ELECTRICAL	FUEL	FLIGHT CONTROL	UTILITY	POWER TRAIN	ARMAMENT	INJURIES	FATALITIES	AIRCRAFT LOSS
UH-1A	2	10		2		10	2		3			1		4		1	1					
UH-1B	8	21		2	5	22	3		6			3		9	2	2		4				
UH-1C	13	23	1	2	2	31	1		2	5	1	15		5	1	5		1		1		
UH-1D	43	84	1	3	20	103	1		17	12	3	33	3	41	5	8		4				
UH-1H	58	135	8	8	14	163	6		32	18	3	92	1	10	6	5		20		7	13	1
UH-1M	1	2				3			1					1		1						
AH-1G	27	42	2	3	10	54	3		2	10		27		6	2	7	1	10	1	2		2
OH-6	10	31	8	1	5	27	6	1	14	5			3	5	2	2	1	2		3	1	3
OH-58		2				2								1	1							
OH-13	4	27	1	1	7	22	6		14		1			2	3		2	3				
OH-23	1	27		2	3	23	6		8	3	1			7	2			1				
TH-55	6	33	2		11	26	5		15	1	5		4	6	1	1		1			1	1
CH-47	2	27	1	2		26	3		8		1	7		3		6		1		2	1	1
CH-54A		4	1			3			2		1							1		1	3	1
CH-21C																						
CH-34C		7	1	1		5	1	2				1				1		2		1	3	1
CH-37B		2			1	1			1	1												
UH-19																						
OV-1		11			1	10		4	1		1	3	1			1						
U-1		1				1			1													
U-6	1	2		1	1	1	1								2							
U-8	1	6		3		4		2	2					2	1							
U-9		2				2		2														
U-10																						
U-21	1	6	1			6		3	3							1						
O-1		4			1	3			2						2							
T-41		2			1	1			2													
T-42																						
C-45		2				2									2							
C-47																						
TOTAL	178	513	27	31	82	551	44	14	136	55	17	182	12	102	32	41	5	50	1	17	22	10

close look at the area where work has been performed.

With that many people checking on each other, how can we fail? Those 691 mishaps say we have failed. Why? Somewhere along the line, someone broke the chain.

A lot of excuses can be offered. For example, when a hydraulic failure is caused by a chafed hydraulic line, we can always say there are no instructions in the manuals about how or where to install Adel clamps. Does the man with this excuse also have a copy of the 2028 he submitted about the lack of instructions on clamps?

How about the hydraulic failure caused by overtorquing a fitting, with the excuse, "I didn't have a torque wrench!" Does the man who said this have a document number for the requisition he submitted to obtain a new torque wrench? Of the 691 mishaps shown in table 1, 182 involved maintenance-caused hydraulic failures.

What about engine failure caused by maintenance-induced FOD? If the mechanic cleaned up the work area like he said and the TI checked it like he said, where did all those pieces of safety wire and loose nuts and bolts come from? Heaven help us, the gremlins are back! Table 1 shows 136 maintenance-induced engine failures.

There are many factors to be considered when a maintenance-caused mishap occurs. There is the psychological impact on pilots of the unit involved. What happens to their confidence in their aircraft? Do they really feel their equipment is as safe as they did before the mishap? Would you? The faith pilots and crews have in their aircraft and maintenance crews is like the faith a child has for its parents. At 4,000 feet in a lift ship, or 120 knots and 50 feet in a gunrun, it's impossible to get out and walk. This is bound to become prevalent in the mind of a pilot who flies an aircraft maintained by the same personnel who were responsible for the ship that went down yesterday.

And what about the faith of those aviation serves? What about a wounded soldier waiting for a medevac ship that will never make it because its crew is down due to a maintenance error and in need of medevac themselves.

Though the impact of a fatal maintenance-caused mishap is greater then the impact of a precautionary landing, the end result of destroyed confidence may be the same, especially when a rash of maintenance-caused forced landings, incidents and precautionary landings occur in a unit.

Another consideration is the impact on the mechanics. What about the crew who worked on a ship that has just had a fatal accident? Every man is saying to himself, "Please don't let it be my fault." Even if they are topnotch men, mechanics live with constant fear of this situation.

Though the impact of a fatal maintenance-caused mishap is greater than the impact of a precautionary landing, the end result of destroyed confidence may be the same . .

How can we avoid such a situation? It's easy to say so-and-so didn't do his job or so-and-so didn't know any better. But how can it be one so-and-so when the system calls for so many people to check and recheck all maintenance?

Integrity is defined as:

1. An unimpaired condition; soundness.
2. Adherence to a code of moral, artistic or other values.
3. The quality or state of being complete or undivided; completeness—synonym: See honesty, unity.

Can it be that maintenance mishaps are created by a lack of maintenance integrity? They do not occur where there is sound or complete maintenance.

Here's what it takes to develop and foster good maintenance integrity:

1. Awareness of everyone from the highest ranking officer to the lowest ranking enlisted man that integrity *must* be maintained.

Can it be that maintenance mishaps are created by a lack of maintenance integrity? They do not occur where there is sound or complete maintenance

2. Awareness on the part of each supervisor about the training, experience and abilities of every man under his supervision.

3. Qualified technical inspectors. If there aren't enough to go around, does your unit have an OJT program in progress to train and use some of the better mechanics as technical inspectors?

4. Technical inspectors directly responsible to unit commanders and not to maintenance officers. The maintenance officer's job calls for quantity and quality, while technical inspectors should only be concerned with quality.

5. Up-to-date technical manuals available in each unit in sufficient quantities to be in the hands of mechanics. If you were to walk across your maintenance line right now, how many mechanics would have the proper TM open to the proper page to cover the work they are performing? It's true that after a mechanic works on a particular aircraft for awhile he begins to remember torques and tolerances, and even assembly and disassembly procedures, but manuals change. Thus far, pinpoint distribution of changes is not refined to the point where it can reprogram the mechanic's brain. He *must* use the book every time.

6. Proper flight scheduling to ensure all preventive maintenance (PM) inspections are performed when due.

7. Constant supervision to ensure all PM inspections are thoroughly performed.

8. The use of FM 101-20, The Army Aviation Planning Manual, by commanding officers, maintenance officers and maintenance NCOs to determine if their aircraft are receiving the maintenance they should in terms of man-hours. Using the UH-1, for example, FM 101-20 states that it takes an average of 5.5 hours of maintenance for each hour of flight. If a UH-1 flies 100 hours in a 30-day period, you can expect to perform approximately 550 man-hours of maintenance over that same period. What about a hypothetical UH-1 unit with 25 UH-1s assigned? If each of these helicopters flies 100 hours in a 30-day period, the unit will need approximately 13,750 man-hours of maintenance to keep them in a safe, well-maintained condition. That's a fair number of man-hours, isn't it? The following formulas will help to check your maintenance man-hours:

To determine man-hour workload, where:

X = minimum maintenance man-hours required

N = number of aircraft (by type) involved

M = MH/FH ratio (man-hour/flight hour)

P = average monthly flying hour factor

Use formula X = NMP

Example:

N = 25

M = 6:00

P = 30

X = 25 x 6.0 x 30

X = 4,500 man-hours required per month

To determine maintenance man-hours available, where:

X = maintenance man-hours available

A = number of direct maintenance personnel

B = hours per work day

C = number of work days in period (week, month or quarter)

D = percentage of time personnel are available, excluding leave, KP, guard, sick call, etc., based on local situation and specific period

Use formula X = D (ABC)

Example:

A = 20

B = 8

C = 20

D = 76%

Therefore:

X = D (ABC)

X = 76% (20 x 8 x 20)

X = 3,952 available maintenance man-hours per month

In these sample problems, the unit has a deficit of 548 maintenance man-hours, just about what would be required to maintain one UH-1. Note: 76% is a high figure for man-hour availability.

9. Constant supervision at all levels to ensure all links in the chain of maintenance pull at the same pressure, smoothly and efficiently.

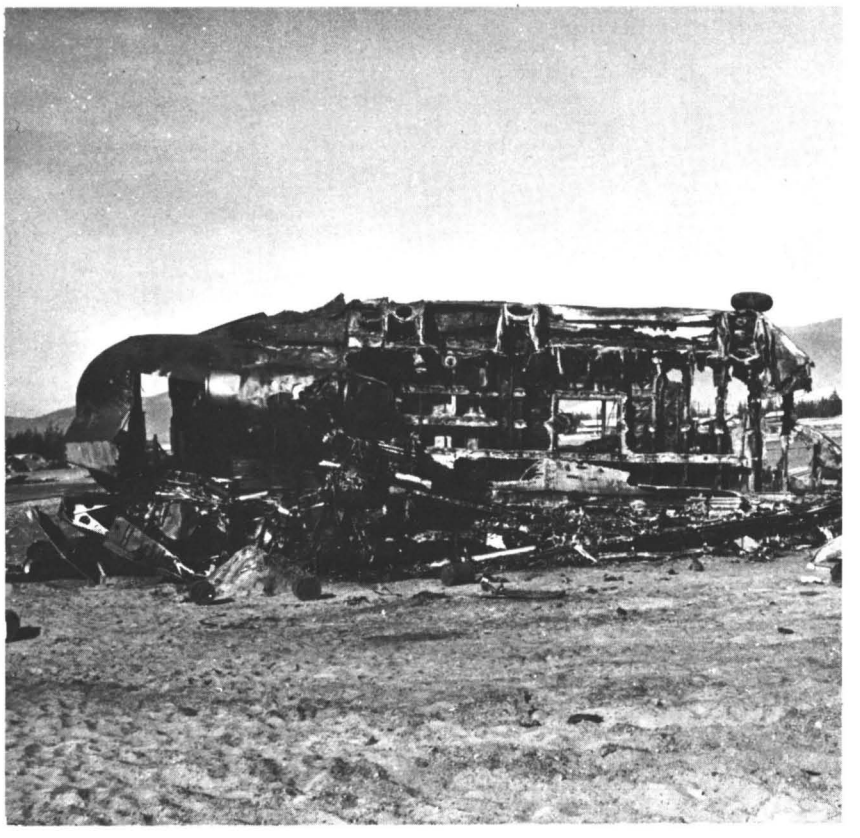
10. Submission by all personnel of DA Form 2028, when required. No matter how hard we try, erroneous information may appear from time to time in our publications or some important item may be omitted. The use of DA Form 2028 will enable DA to correct these items rapidly.

11. Constant command emphasis on all of the above points.

Only with diligent and vigilant use of the above points can it be assured that our greeting will be "Maintenance Integrity" instead of "Maintenance Mayday."

This easily preventable taxi accident occurred during turn near ramp when forward blades struck one blade of a parked CH-47 and resulted in damages of $1,850,000

CREW ERROR



WHEN AN ACCIDENT occurs and the aircraft accident investigation board determines the cause to be pilot error, the first thought that goes through many pilots' minds is, "When they can't find the real cause, they blame the pilot!" Nothing can be further from the truth. When an accident occurs, the board wants to find the true cause, regardless of where the chips may fall. If a materiel failure or malfunction was determined to be the cause, definite action can be taken by the U. S. Army Board for Aviation Accident Research, the U. S. Army Aviation Systems Command, and other appropriate agencies and manufacturers to improve the reliability of the component. Once this is done, that particular problem is solved for all practical purposes.

If, during the course of the investigation, pilot or crew is determined to be the cause, this becomes an area of concern. The human element is unpredictable. If procedures were wrong, If a violation occurred, or discipline was a factor, there is cause for worry because every aviator who flies under a like set of circumstances can be considered an accident potential.

During the period 1 January 1967 through 31 August 1970, CH-47s were involved in 1,057 mishaps. Of these, 156 resulted from crew errors. Causes for these errors varied. Several of the more prominent problem areas were:

NUMBER OF MISHAPS BY YEAR

	1967	1968	1969	1970
Tree strikes	5	5	18	6
Taxiing mishaps	1	4	4	3
Cowling or doors lost in flight	4	2	2	1

These are preventable mishaps and the figures show there are far too many. We can wonder whether these were caused by negligence, lack of training or poor supervision. However, in most cases, only pilot error will be cited.

As a rule, tree strikes are caused by the failure of uncoordinated crews to observe outside obstacles. A successful flight begins at the mission briefing. If the mission will involve operations in confined areas, all potential problem areas should be discussed and understood. Each individual should know who is to watch where. Although the pilot is usually cited for tree strikes, there are times when he must depend on his crew to keep him well informed of proximity of obstacles. Crew members should be aware of and warn pi-

lots about obstacles before aircraft approach them.

In addition to tree strikes, five CH-47 mishaps involved striking poles, towers or stakes. These were also due to the lack of outside observation and crew communications.

Taxiing mishaps are pilot error nightmares. As long as pilots have 20-20 vision, full control and can stop their aircraft, there is no excuse for taxi accidents. While taxiing, pilots should know where their rotor blades are at all times and should be aware of all obstacles. If a pilot doesn't know what is around him, he should stop and find out. As with inflight obstacles, other crew members should give assistance and warn pilots about obstacles. Groundguides should be used whenever taxiing in confined areas is required. If outside groundguides are not available, it only takes a few seconds for the crew chief to dismount and serve as a groundguide from outside where he can clearly see the rotor tips and obstacles. Even in cases where an outside groundguide is present and pilots are unsure they can clear obstacles, they should stop, shut down and have their aircraft towed into parking areas.

Typical taxiing accidents from crash facts messages:

"A CH-47 was taxied between tower and aircraft in revetment. After forward blades cleared, pilot started left turn and aft blades struck guard tower."

"A CH-47 moved approximately 25 feet when the forward blades hit the main rotor blades of a parked UH-1H. Flying debris killed the groundguide and damaged a second UH-1."

Accident: A CH-47 had just returned from a mission and was taxiing to what appeared to be an empty revetment. When it arrived at the revetment, the crew saw another helicopter occupying it and decided to taxi to another open revetment. As they turned the corner of the revetment, they saw it would be too close to taxi onto the ramp because there was a CH-47 parked in the taxi lane. They decided to make a 180-degree turn. During the turn, the forward blades struck a blade of a parked CH-47. A portion of the forward blade was lost and the helicopter went into ground resonance. The AC lifted it off the ground and hovered sideways away from the parked helicopter. Due to loss of lift, the CH-47 struck the ground, rolled over and caught fire.

Causes:

- Pilot misjudged distance between his helicopter and the parked helicopter.
- Groundguide was not used during 180-degree turn.
- Parked helicopter was parked in revetment with portion of blade overhanging taxiway.

Recommendations were that all pilots be cautioned about taxiing too close and that groundguides be used at all times while taxiing in congested areas. The reviewing official stated that all units had established positive procedures to use groundguides for taxiing on parking ramps.

Many mishaps involving the loss of doors or cowling have been traced to improper latching. This reflects inadequate preflights. If a preflight is performed hurriedly, many components can be overlooked. You may save a few minutes of groundtime with a hurried preflight, but you'll create a much longer groundtime, perhaps permanent, if a cowling should come off and go through the rotor blades.

Exceeding personal and aircraft limitations may make for good war stories and may impress the boys at the bar, but sooner or later the odds take over

Accident files are filled with all types of crew error mishaps. Many are unbelievable and it is difficult to understand how they could possibly occur. In some instances it appears that flight crews really worked at getting themselves into trouble.

Accident: A CH-47 was loaded with refreshments, soft drinks, rice, vegetables and an *unknown* number of troops. The engines were started and a hover check performed. The helicopter could not hover, so an *unknown* number of passengers were unloaded.

Another hover check was made and the helicopter could barely hover with minimum power reserve, so *more* passengers were unloaded. Takeoff was attempted and the rate of climb was not enough to clear telephone wires in the takeoff path. Cyclic climb was started to clear the wires, rotor rpm dropped and the helicopter began to descend. It landed left side low and the fuselage struck oil drums. The left rear landing gear was torn off and the helicopter skidded 300 feet and

struck an antenna guide wire. It then skidded 90 feet more and slid into a ditch, rolling on its side and caught fire.

Causes:

- The AC failed to analyze the effects of high gross weight and density altitude on expected takeoff performance.
- The load aboard the helicopter at takeoff exceeded the unit's allowable load by 1,965 pounds and exceeded the design alternate gross weight by 874 pounds.

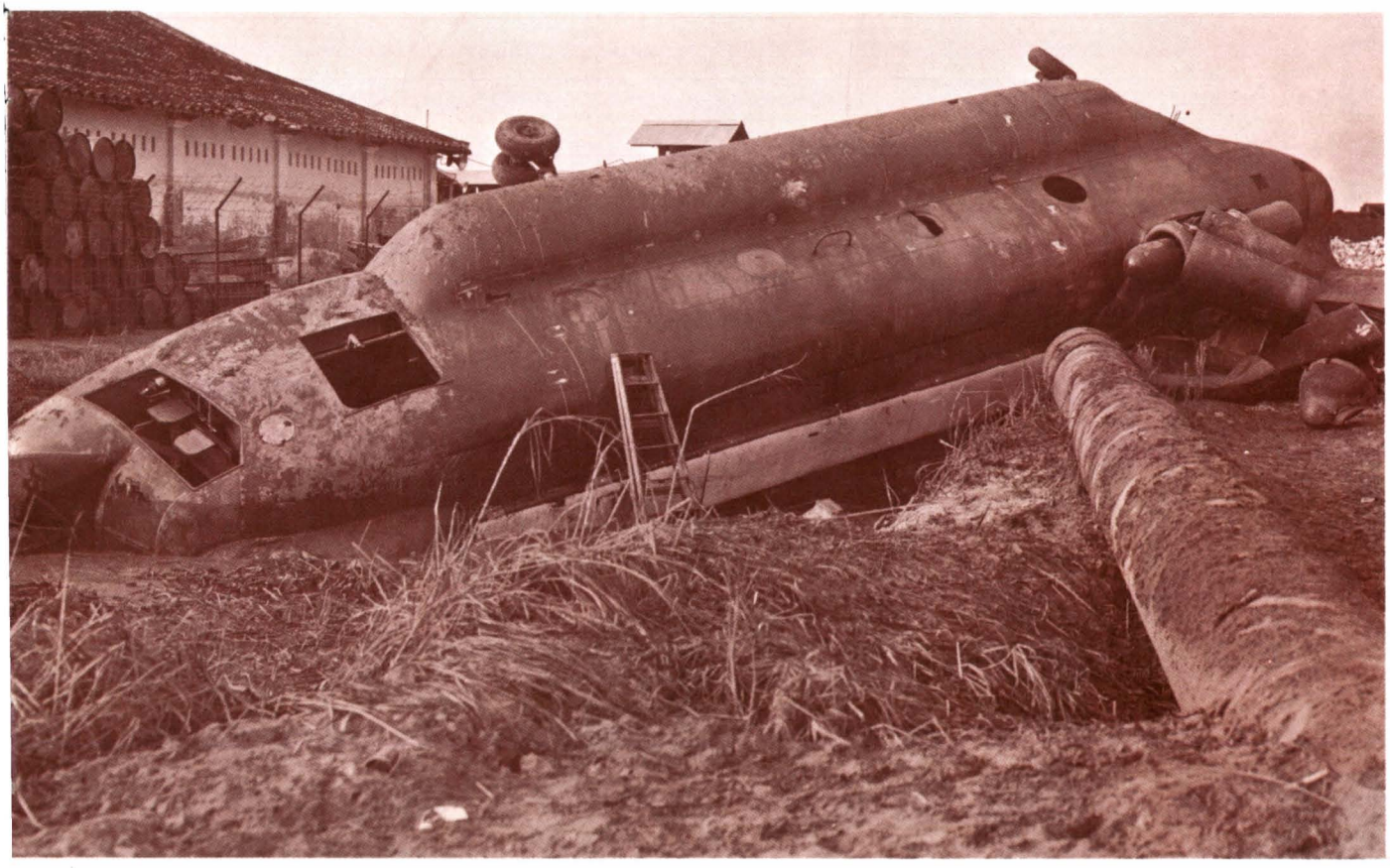
It was recommended that command emphasis be placed on refresher courses of instruction to be given pilots and crew members for computing loads, and the effects of density altitude on performance characteristics of heavily loaded helicopters, as well as the inherent responsibility of aircraft commanders.

Unit SOPs are established for a purpose—to help you become standardized and provide guidance. When catastrophic mishaps occur due to crew error, it's a good bet the unit SOP was violated.

Exceeding personal and aircraft limitations may make for good war stories and may impress the boys at the bar, but sooner or later the odds take over. Who really cares who carried the most passengers on one flight; who carried loads in excess of allowable limits; who flew VFR under IFR conditions; or who flew all day after partying all night? Such accomplishments are not admired by your mature professional aviator colleagues.

To avoid the pitfalls of crew error mishaps, determine your personal and aircraft limitations. Insist on adequate preflight briefings and thorough preflights. Train your crew to work as a team and serve as your 360-degree eyes. Know your clearances before you taxi or hover. Insist on ground-guides for all confined area movements. Aviators who follow this advice will contribute much to the prevention of needless crew error mishaps and the conservation of aviation resources.

After twice unloading an unknown number of passengers because hover checks indicated they were overloaded, the crew of this CH-47 attempted to take off with a load exceeding the unit's established allowable load by 1,965 pounds



WHOSE ERROR?

CW2 Joseph T. Robbins
Aircraft Accident Analysis and Investigation Department, USABAAR

A STUDY OF major accidents in which command supervision was a factor was recently conducted for FY 1970. With the help of USABAAR's information management system, including a third generation computer, 8,290 mishaps involving all types of Army aircraft were reviewed. Of these, only 13 cases of LOH command supervision type major accidents were reported—repeat—were *reported.* All of these 13 command supervision accidents could have been prevented.

Thirteen is an unlucky number, at least it was for the seven people injured. There were no fatalities involved, but these accidents cost $588,000. The sad part of any accident is the fact that sometimes people are killed, so we could say lady luck smiled on us in these particular cases.

An OH-6A in a flight of four had engine failure and the pilot could have made a successful autorotation, but some rice paddy dikes appeared in the water a few seconds away from his intended touchdown point. The pilot was a recent graduate of flight school, who had 400 plus total hours, 200 plus combat flying hours and 31 hours in the OH-6A. He had everything going for him except, maybe, the 31 hours of OH-6A time.

There were several errors prior to engine failure. Some could be attributed to the pilot. Remember, though, he only had 31 hours in this particular helicopter. Records indicated the engine had 412 total hours and the teardown analysis revealed that worn threads allowed the oil to leak out because of a loose fitting. Who does this error belong to? The mechanic for installing it—the crew chief for overlooking it—the tech inspector for signing it off—the maintenance officer for running a loose maintenance section—or the commander, who was probably more interested in *quantity* than *quality?* After all, he had to meet his mission. Or maybe we should chalk this one up against the pilot for overlooking it?

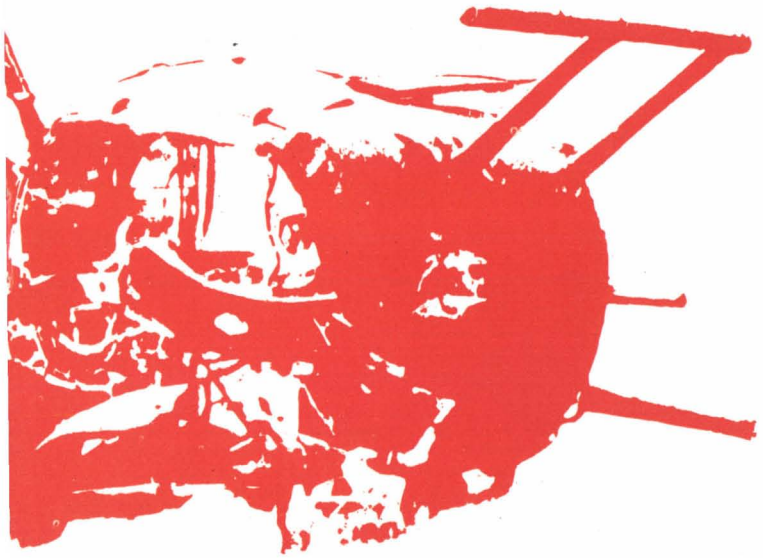


TABLE 1

STATUS SYMBOL	FAULTS AND/OR REMARKS	ACTION TAKEN
	N_2 percent fails to adjust properly.	
	Air speed indicator unreadable.	
	N_1 percent gauge unreadable.	
	Air speed indicator unreliable.	
	Altimeter unreliable.	

A review of the 2408-13 included in this accident report contained the entries shown in table 1. This indicates some degree of supervisory error, in particular on the part of the maintenance officer for allowing a helicopter that wasn't mission ready to fly.

What about the entries that should have been made with a circled red X status symbol? Who was responsible for this? Which supervisor should have been monitoring the -13s? This should be quality control. Right, and we have already chalked up an error for the tech inspector. It probably stands to reason that if he doesn't know how to check a simple oil line and "O" ring, he isn't going to know his forms either. But what has his supervisor been doing all this time?

Maybe we should look to the crew chief's supervisor for allowing him to make improper -13 entries and install the fitting incorrectly. Or maybe we should look to the commander for all these errors.

The pilot almost made a successful autorotation. He was a little slow in recognizing engine failure, but this was corrected. He did a decent job in the autorotation, considering he only had 31 hours in the helicopter.

This accident was reported as materiel failure (engine). Should this have been listed as the cause, or should it have been command supervision, with materiel failure and pilot error as contributing factors? If everyone had supervised as they should have, would this accident have occurred? Would the engine have lost its oil? These are big *IF's.* Unfortunately, from an aviation accident prevention standpoint, we have a lot of big *IF's* we can't afford.

Have you, as a supervisor, failed to supervise full time?

WELL DONES

MAJOR SAMUEL J. TILLMAN, flying an 0-1A, had engine failure at 700 feet over wooded terrain while inbound to an airfield. He immediately entered traffic for an 800-foot sod strip and made a futile attempt to restart the engine. Despite a strong crosswind and trees on all four sides of the strip, he completed a dead-stick landing with no damage.

CAPTAIN CHARLES BAILEY, aircraft commander of a UH-1D, had just taken off and was approximately 25 feet above powerlines when he heard a loud noise, followed by a severe vibration. The nose pitched upward and rotor rpm dropped rapidly. Captain Bailey quickly reduced collective and rolled off throttle, maintaining a 40-knot attitude to avoid a tail low wire strike over a crowded road. He continued to decelerate, applied collective as his ground speed approached

zero and landed on a slope with no damage.

CAPTAIN LAWSON W. DURFEE, aircraft commander of a UH-1H, was en route at 1,500 feet on a support mission when his engine chip detector light came on. He elected to make an immediate precautionary landing on a hard surface road. Engine noise on base leg made it apparent the engine would soon fail. After his turn to final, a loud bang was heard from the engine. Captain Durfee reduced throttle and autorotated 200 feet to the road, landing with only incident damage to the skids and cross tubes. In addition to nine persons aboard, there was approximately 500 pounds of cargo, including weapons, ammunition and personal belongings.

CW2 ROBERT R. SILVA, flying a UH-1C gunship, was on an assault mission when enemy ground fire severed his pedal control cable. Streamlining his helicopter, CW2 Silva set up a long, shallow approach and made a running landing with no damage.

CW2 ROBERT W. KUND, aircraft commander of a UH-1D, was flying number 2 in a flight of two. On short final to a confined area, at approximately 50 feet, the helicopter began a slight turn to the right which he interpreted to be caused by turbulence from the number 1 helicopter departing the landing zone. An increase in collective at approach termination resulted in a hard right turn which full left pedal did not correct. Recognizing antitorque failure, CW2 Kund immediately leveled the helicopter, reduced throttle and landed with no damage. Postflight inspection by the crew revealed failure of the tail rotor chain.

CW2 TERRY LNENICKA, aircraft commander of a UH-1H, was on an assault mission. He landed, unloaded troops and took off from the LZ. After reaching translational lift, he encountered heavy ground fire and his helicopter took 14 hits, causing hydraulic failure and numerous holes through his fuel cells. He declared an emergency, flew his disabled helicopter to an airfield and landed with no further damage.

WO1 STANLEY D. STRUBLE, flying an OH-6A, was on a reconnaissance mission in level flight at 50 feet over a triple canopy jungle when he had a complete loss of tail rotor thrust. He quickly diagnosed his problem, increased air speed to streamline the helicopter, flew to the nearest prepared landing strip and made a running landing on an asphalt runway with no damage.

JAMES E. CAMPBELL, a Department of the Army civilian flight instructor, was on climbout in a T-41B when the chip detector light came on, dimned, then went out. While climbing back toward the airfield, at approximately 700 feet, the engine oil pressure began to drop, the chip detector light came on steady and the engine lost power and began to run rough. Over wooded and swamp areas, Campbell flew the most direct route to a nearby strip. He was unable to climb or maintain altitude. While approaching the strip, the engine failed completely and Campbell lined up for a downwind landing, slipped the airplane into the strip and landed downslope with only incident damage.

USAASO Sez

The U. S. Army Aeronautical Services Office discusses

Two saves credited to Air Traffic Controller Gerald Hahn

Submitting ideas to your Aeronautical Services Office

Aircraft "Save" Accomplishment: Ever since the Wright Brothers first defied the laws of gravity pilots have, on occasion, become temporarily disoriented, accidentally flown into clouds without proper equipment or found themselves flying in conditions which were beyond their capabilities. The 1 percent of you pilots who have never encountered these situations read no further. The rest of us are thankful that we have air traffic controllers like Mr. Gerald Hahn at Simmons Army Airfield, Ft. Bragg, N. C.

This professional controller handled two such problems in a 1-month period involving students from the local flying club. In one instance the student pilot was temporarily disoriented with a malfunctioning directional gyro and an erratic magnetic compass. There also was more than a touch of panic in his radio calls for assistance. Mr. Hahn, with a calming but authoritatively professional manner, successfully led the student pilot through "no gyro" turns in vectoring for a final approach and landing.

In the second incident a student pilot had inadvertently become lost in the clouds. Weather at Simmons was marginal at best with 400 feet broken, 4,500 feet overcast and 2½ miles in fog, haze and smoke. Mr. Hahn attempted to identify an airport with VFR conditions within the aircraft's fuel range. When informed that Simmons had the best weather in the area, Mr. Hahn proceeded to talk the pilot through a modified GCA approach into Simmons. A surveillance type approach with successive stepdown descents was selected as the best method due to the limited experience of the pilot. This flight was also successfully terminated.

Mr. Hahn's professional attitude and good judgment, as well as technical competence, averted two probable crashes and possibly saved the lives of two aspirant pilots. His conduct brings great credit to himself and the air traffic controller profession. He also has the undying gratitude of us "throttle benders."

Well done, Mr. Hahn!

The COMM Card—ID For Ideas: "You have power you haven't used." That is what the COMM Card poster says and it's true. If you have questions, criticisms, revisions, problems, additions or comments on Army flight information and air traffic control, you can get action by contacting the U. S. Army Aeronautical Services Office (USAASO) or in overseas areas the local Aeronautical Services Detachments either by telephone, letter or COMM Card. Comment Cards (COMM Cards) are available at all U. S. Army airfield operations offices worldwide. They are preaddressed and postage paid.

Best of all you are guaranteed a prompt response from aviation personnel who know and appreciate all aspects of your mission. There are no administrative "fronts," diversions or head winds to delay your inbound queries. AR 95-14 establishes a direct course between you and us—USAASO, that is.

Get good ideas and suggestions off the ground and on a direct course to your Aeronautical Services Office. You can contribute to better flight conditions. After shutdown shift from throttle to COMM Card. Try pen power and see!

Chief Warrant Officer Wayne Geer (left) explains some of the characteristics of the OH-58 helicopter to Major N. P. Tvede, commander of the Danish Army's aviation section, and First Lieutenant P. E. Christiansen

Photo by Sergeant Ed Blocker

Here Come The Danes

Specialist 5 Patrick Svacina

THE DANISH Army's helicopter pilots—and that includes all four of them—have recently been roaming the skies of the 3d Armored Division near Frankfurt, Germany.

But if helicopter pilots seem scarce in Denmark, the helicopter is even less evident. There are no helicopters in the Danish Army.

Four LOH-6A aircraft are scheduled to arrive in Denmark soon. Until they do the four pilots must train with American units every 2 months to keep up their flight proficiency.

The company size Danish aviation unit is being reacquainted with the helicopter by the 3d Armored Division's command aviation section. Under the guidance of Captain Durwood R. Ross Jr., the command aviation operations officer, each Danish pilot has logged about 10 flight hours.

"Most of the flying they have done with us," said CPT Ross, "was within our mission limits." One has logged some of his flying time as the copilot of Major General M. G. Roseborough, the 3d Armored Division commander. The other officers took a turn at flying daily courier missions or training flights.

When the Danes obtain their helicopters, they will use them for reconnaissance, road traffic consultants, medevac and search and rescue tasks.

The Danish Army aviation unit has 22 fixed wing pilots and hopes to expand its helicopter fleet to 12 by 1975. The Danish pilots have attended the rotary wing course at the U. S. Army Aviation School, Ft. Rucker, Ala., to become the first helicopter pilots in their Army.

CROSSWORD PUZZLE ANSWERS

1 V	2 O	3 R	4 T	5 E	6 X	■	7 U	8 N	9 I	10 T	11 E
12 F	L	Y	■	13 C	R	14 U	S	A	D	E	R
15 R	Y	E	■	16 O	A	T	H	■	17 L	A	G
■	M	■	18 A	N	Y	■	19 E	20 M	I	R	S
21 S	P	22 I	G	O	T	■	23 R	U	N	S	■
24 T	I	■	25 A	M	U	26 S	I	N	G	■	27 S
28 A	C	29 I	T	Y	B	O	N	D	■	30 P	O
L	■	31 N	E	■	32 E	■	33 G	A	34 L	E	S
35 L	O	36 W	■	37 A	■	38 A	■	39 N	A	G	■
40 I	N	A	41 U	D	42 I	B	43 L	E	S	■	44 H
45 N	O	R	M	A	L	■	46 A	■	47 T	48 O	E
49 G	F	D	C	■	50 L	51 A	N	52 D	E	D	■
■	53 F	S	■	54 A	S	C	E	N	D	E	D

Crossword Puzzle on page 31

" . . . A study has been made that shows that if the Army had had a platoon of all-weather helicopter gunships, such as the AAFSS in World War II during the Battle of the Bulge, the Germans would have been stopped cold. For ten out of the seventeen days, regular aircraft could not fly because the weather was too low. It was well within the minimums for the new helicopter, however. Just think, with only fifteen helicopters all of those lives could have been saved. . . ."

Major General John L. Klingenhagen
Commanding General
U. S. Army Aviation Systems Command

Artist conception by Mr. Harold G. Linn, USAAVSCOM