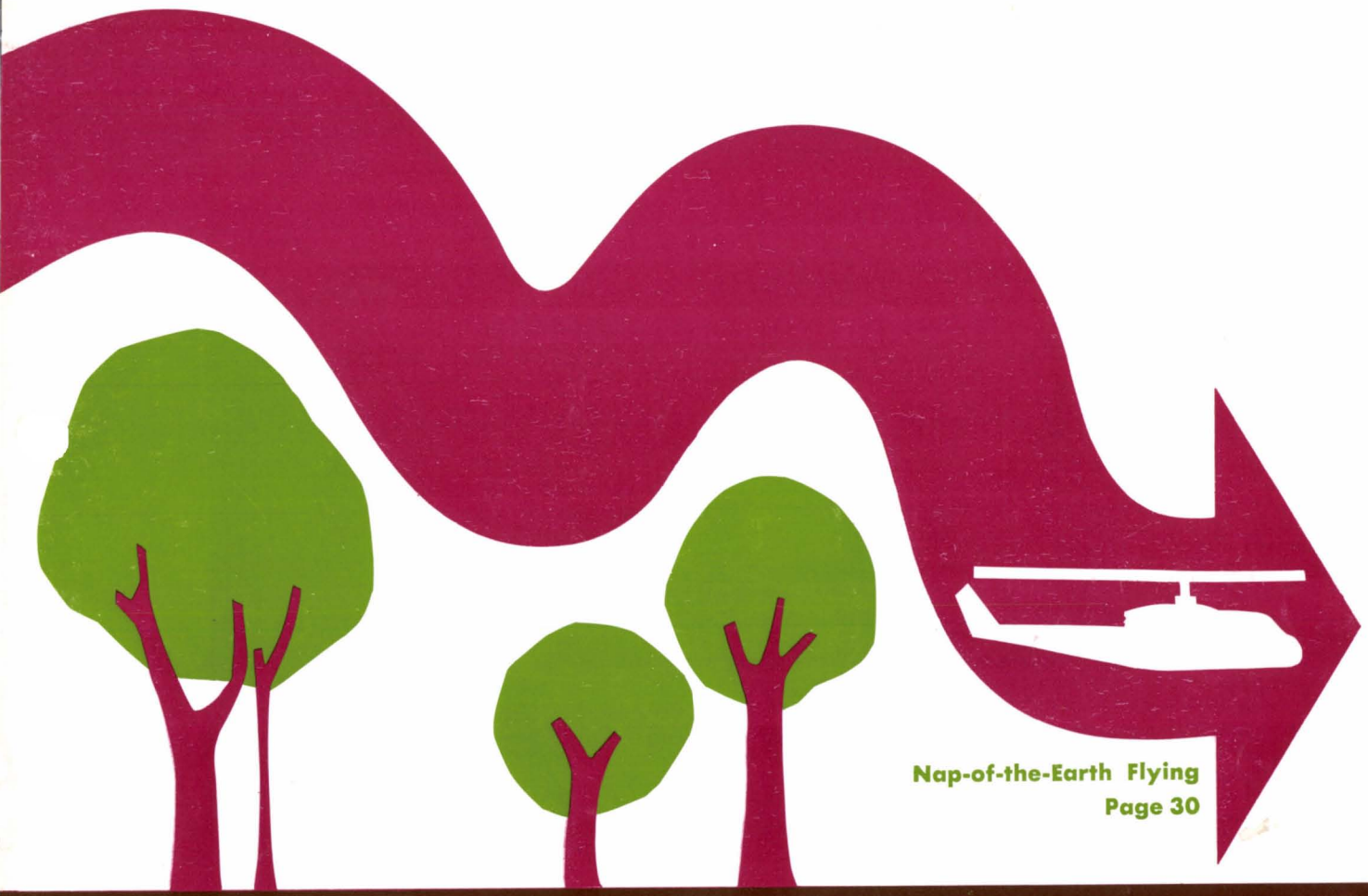

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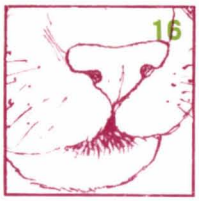
UNITED STATES ARMY
JUNE 1973

AVIATION DIGEST

UNITED STATES ARMY AVIATION DIGEST

JUNE 1973 VOLUME 19 NUMBER 6



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ABOUT THE COVER

USAAAVS takes a penetrating look at the aviation safety aspects of nap-of-the-earth flying
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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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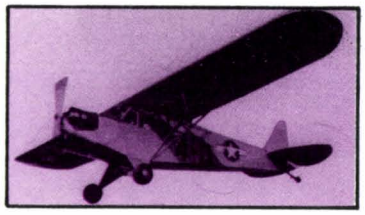
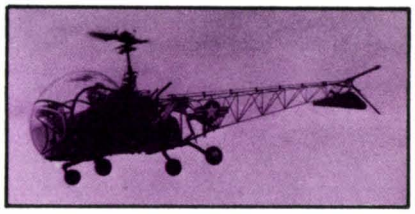
31 Years Of Growth

CW3 Michael S. Lopez





AS ARMY AVIATION commemorates its 31st anniversary on 6 June, we reminisce over its tremendous advancement since World War II. This surge has been directly proportional to the untiring efforts of the officers and men who have pioneered the field.

Army aviation's steady growth began in 1942 when it was authorized ten light observation airplanes per infantry division and six per armored. It mushroomed during the past decade to nearly 4,000 aircraft in the tactical field army.

Although Army aviation is not a separate Army branch such as Artillery, Armor or Infantry, it is used virtually everywhere to give mobility to Army units that would otherwise be hindered in their missions by ground transportation.

The use of aviation in the Army is simply the integration of modern improved means to enable the Army to perform its missions more effectively. Its employment has been characterized by the immediate flexible and responsive support to the ground commander with the movement of troops and equipment and allows him a means of rapidly massing and deploying his troops. He is freed from the limitations imposed by natural obstructions and is afforded a greater benefit of suprise with fresh troops who have not had to spend hours —or even days—marching and trudging into the combat area. The timely assault of an airmobile force into a critical area has been the turning point in many engagements, changing the tide of battle from looming defeat to victory in the Republic of Vietnam.

The past decade has seen an influx and change in the faces of the untiring pilots and crews; even equipment has and is changing but the mission remains much the same—hauling everything from pay for the troops, to food and ammunition, and of course the troops themselves.

More recently we have seen the movement of the colors of the 1st Aviation Brigade, at one time the Army's largest aviation command, from the tactical zone in Vietnam to the U. S. Army Aviation School at Ft. Rucker, AL.

As Army aviation assets in CONUS become more available to assist our civilian populace, we have seen expansion of the MAST (Military Assistance to Safety and Traffic) program and increased and improved support in local disaster areas or wherever missions of mercy are required.

In recent years Army aviation units have been dispatched worldwide to provide assistance to the needy. For example, units of the 1st Aviation Brigade were dispatched for flood relief in Malaysia in January 1971. Active Army and units of the Reserve Components provided relief to 14 mining towns in West Virginia after a slag dam broke last year, flushing water through the narrow Buffalo Creek valley with a destructive force. Units of the 1st Cavalry Division (Airmobile) were sent to the scene of the Nicaraguan earthquake to assist and evacuate victims in December 1972. Units of the Reserve Components as well as the active Army provided haylifts to starving livestock in the western United States during the recent spring snowstorms and assisted in relief operations up and down the nation's midsection as the Mississippi and other major rivers burst over their levies and banks.

Yes, trends are changing as we see the revival and expansion of tactical nap-of-the-earth flight training at the Army Aviation School and elsewhere.

The headlines of the newsclippings which recall some of the heritage of Army aviation's people tell only a part of the story. What we consider today as routine missions for Army aviation were the dreams of those pioneers who were able to maintain the insight and the determination needed to plant the seeds of Army aviation despite the dark and gloomy years in which America was plunging into World War II. Today, we salute those pioneers who provided the means for the Army to perform its combat mission so effectively!

Among The HONORED

Between the years 1966 and 1971 the "Blackhorse Regiment" became a legend in the Republic of Vietnam. This fame came from one source: the unselfish devotion to duty of its troopers. Many 11th Cavalry troopers performed heroic feats, from Loch Ninh in Northern MR III to Tay Ninh Province in the south. A number of "Blackhorse" troopers now sleeping in "Fiddler's Green" belong to history. Countless, often unrecorded, deeds performed by

WHAT HAD BEEN an uneventful New Year's Day 1969 for the Air Cavalry Troop, 11th Armored Cavalry Regiment, was shattered when the operations shack received a call that a "pink team" had made contact with a sizable enemy force just north of the Dong Xai River in the Republic of Vietnam.

The troop commander was enroute to Alpha Pad when the call came concerning the enemy sighting. His crewchief was Sergeant First Class Rodney J. T. Yano, the troop's senior technical inspector. Yano, no stranger to enemy fire, had volunteered to replace the commander's crewchief. Thus, he was aboard the C&C (command and control) UH-1 helicopter when it arrived in the enemy area.

The scout ship was marking

many of these soldiers may never be known.

The pressures of war breed the unusual, but the unusual became the commonplace in the units of the 11th Cavalry—including the Air Cavalry Troop. "What more can a soldier do than risk his life for his fellow soldier?" The question invites the answer, "This man could do no more than he did."

The following narrative describes how one "Blackhorse" trooper gave all that he possessed—his life—through a superb example of raw courage that all cavalrymen can respect and follow. This is the Yano story which will endure as long as history lasts.

GEORGE S. PATTON
Brigadier General
United States Army

the enemy position and the troop commander began placing artillery fire on their bunkers. During orbits around the bunker complex, the helicopter received extensive small arms and antiaircraft fire. The door gunner and Yano were both busy placing machine gun fire into the area in answer to the enemy fire.

The U. S. Air Force fighter plane strikes came on station to pound the bunker complex following an extensive artillery preparation. However, the Air Force pilot was unable to pick up the bunkers. The troop commander decided to mark the complex himself so there would be no doubt. He yelled to Yano to prepare to mark with a grenade.

The first two attempts to mark were unsuccessful as the heavy enemy fire kept the chopper at a distance which made it impossible to hit the exact area. "One more time," yelled the troop commander, "and this time we'll mark it." As he started to make the third pass, however, a blinding explosion ripped the helicopter with burning white phosphorous fragments splattering over the entire crew.

The troop commander, unable to see through the thick phosphorous smoke, gave a frantic radio call, "We're on fire and going down!" Looking around he saw Yano, his left hand almost completely blown off and his face covered with painful burns, frantically throwing burning ammunition and grenades out the door.

Only later did the crew learn that the chopper had not been hit by enemy fire. Instead, a phosphorous grenade had exploded prematurely with Yano receiving the full impact. Yano kept working until he had completely cleared the aircraft of burning material and the pilot regained control of the helicopter as it reached just above the treetops.

The pilot flew directly to the 93d Evacuation Hospital and the crew was treated for burns.

Following surgery on his burns and hand, Yano was visited by the troop commander. "How is everyone else?" Yano asked and was greatly relieved when told they were alive. Then, as he lay in great pain, he told his commander, "Don't worry about me, sir."

A few hours later Sergeant First Class Yano died. The white phosphorous burns had been too much for his lungs. However, he died knowing that his actions had been successful in saving the lives of the rest of the crew.

Yes, by his conspicuous gallantry at the cost of his own life, in the highest traditions of the military service, Sergeant Yano had earned and posthumously been awarded the nation's highest award . . . the Medal of Honor. He rests Among The Honored.

Other Army aviation Medal of Honor winners that have been covered to date are SP4 Gary G. Wetzel ("Eyewitness To Valor," August 1969 DIGEST); WO Frederick E. Ferguson ("Stay Clear Of Hue," April 1970 DIGEST); and MAJ Patrick Brady ("Out Of The Valley Of Death" and also page 1 of the May 1970 DIGEST)

Helicopter Retired

AMRDL Public Information Office •

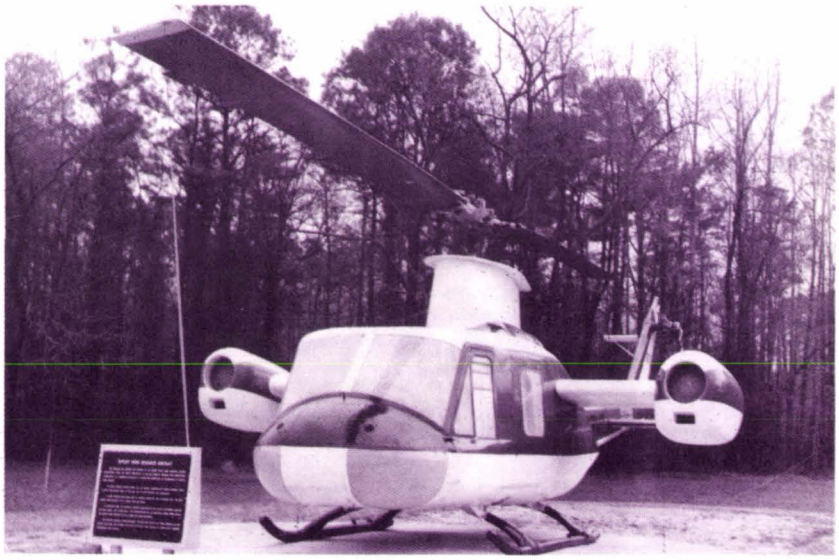
IN A SMALL meadow, across the street from the Eustis Directorate of the Army Air Mobility Research and Development Laboratory (AMRDL), Ft. Eustis, VA, sits a research helicopter that set an unofficial world speed record for rotary wing aircraft on 15 April 1969.

Paul J. Carpenter, recently retired AMRDL engineer and one of the original research pioneers in developing high performance helicopters, notes that the research project started in 1961 when some military planners were thinking about doing away with helicopters because they would only fly 90 miles per hour.

"We knew they'd do 175," Carpenter said, and in 1961 a group of his engineers worked with Bell Helicopter Company engineers to prove it by modifying the standard UH-IB Iroquois (Huey) built in 1957 to reach air speeds of 179 miles per hour.

Project Engineer Gary Smith, who saw the program through to its completion in 1971, pointed out that the first modification consisted of applying known aerodynamic techniques to streamline the helicopter. He said that the next step was to mount wings and auxiliary jet engines on the basic Huey airframe—although this was originally done only to test the behavior of the aircraft's rotor blades at high speeds.

Following two contracts with Bell in 1963 and 1964, the high performance aircraft reached speeds up to 222 miles per hour (193 knots) and moved on to become the first rotary wing aircraft to exceed 200 knots or more than 240 miles per hour.



Wings and auxiliary jets were modified to their present configuration in 1966, and 3 years later two Bell test pilots flew the aircraft to an unofficial world's record of 316 miles per hour. The aircraft used two JT12-A3 jet engines mounted on small wings (see photo).

Mission accomplished, the helicopter was retired last year after 750 hours of experimental flight time. Smith pointed out that we got our money's worth out of it, since the most important part of the program was the research data gained—with many of the project's discoveries put to use in later production aircraft such as the Army's AH-1G HueyCobra helicopter gunship.

"Big Windy's" In Europe

The first and oldest cargo helicopter company in the U. S. Army, Europe (USAREUR) recently was inactivated and redesignated at Schwaebisch Hall Army Airfield, Germany.

A brief ceremony was conducted at Schwaebisch Hall in tribute to the 4th Aviation Company and all the men who have served in it over the years. What was the 4th Transportation Company switched from trucks to helicopters in 1956 at Ft. Benning, GA.

The 4th Aviation Company came to Hanau, Germany, in 1959. At that time it was equipped with CH-37 Mojave helicopters. Recently, the 4th became known as USAREUR's "first and only" CH-47 Chinook company. On 29 March USAREUR General Order Number 682 inactivated the 4th and redesignated it the 180th Aviation Company.

The 180th Aviation Company ("Big Windy" as it became known by its unclassified call sign) served primarily in the II Military Region in the Republic of Vietnam until recently when it was reassigned to USAREUR.

The last notes of the unit history (while in Vietnam) were written at Lane Army Heliport, An Son, where the 180th had already started to support the International Control Peacekeeping Commission just prior to closing out as the last U. S. Chinook unit in Vietnam.

Operation "Haylift"

Specialist 4 Dick Waugh
Ft. Carson Public Information Office

STARVING and freezing, tens of thousands of cattle lay helpless on land which once provided them with grazing grass. Mother Nature had turned against them, and now instead of the precious greens they were accustomed to munching on there was only the depths of mud and snow. Muck was so deep anxious ranchers could not reach their herds with four-wheel drive vehicles.

"Operation Haylift" began on 1 April with the assistance of aviation units from Ft. Carson, CO. UH-1 and CH-47 helicopters began the task of flying over southeastern Colorado, dropping bales of hay to the stranded cattle. The state's agriculture office in Denver, along with local agencies in the stricken areas, requested the Mountain Post's helicopter assistance.

The CH-47 Chinooks of the 179th Aviation Company averaged 150 bales of hay during each flight, while the UH-1 Hueys of the 1/10th Cav and 4th Aviation Company averaged 27 bales of hay per trip.

Farmers and ranchers load bales of hay into Army UH-1 Hueys to resupply cattle stranded by heavy rains and snow in the west

U. S. Army photos by PFC Jack Duffy

The helicopter crews were grounded frequently due to weather conditions. However, they were able to drop almost 100 tons of hay during the first 3 days of the operation near Lamar and Trinidad.

The effects of the previous week's heavy rain and snowfall were not limited to southeastern Colorado. On 3 April Hueys from D Troop, 1/10th Cav flew to Clayton, NM, to drop hay to isolated cattle in the northeast part of the state.

The operation turned out to be more than just dropping bales of hay to the four-legged animals. A 71-year-old farmer had been missing for 3 days since the haylift began. He was found by a helicopter crewman in the Lamar area. They followed his tractor trail for 5 miles, winding around canyons, swamps and mud until the farmer was located unharmed.

In Clayton an elderly couple was flown to a hospital in Raton, NM, by an Army helicopter. The two had been snowed in for a couple of days, their food supply was low and they lacked heat in their house.

During "Operation Haylift" Carson helicopters dropped a total of 416 tons of hay, flew 553 sorties and logged 388.2 hours of flying time.

On a final note, one Carson participant described the expression of one hay recipient. "A bale of hay had just been dropped from our helicopter. It rolled around and landed right in front of a cow. She looked at it for a second, and then gazed up toward the sky as if to say, 'Thank you, Lord.' "

A Ft. Carson CH-47 Chinook is loaded with nearly 150 bales of hay during "Operation Haylift"

The "Eyes" Have It

. . . worth its weight in sunlight

Captain Edward I. Carroll

IT WAS GROWING dark that quiet 26 February 1969 at Dong Tam in the Republic of Vietnam. I was on standby, supporting the LRRPs (long range reconnaissance patrols) in the 9th Division area of operations. About 30 minutes prior to coming on duty I checked my UH-1 helicopter and also replaced the tinted visor of my helmet with a clear one. Little did I know that those few minutes and that clear visor would determine my fate that evening.

Now, this may sound like the start of just another war story, but it has a purpose. Have you ever stopped to think about your abilities of flying a UH-1 without any eyesight? I didn't . . . until that night. Vaguely, I can remember the flight surgeon at one of our safety meetings saying something about flying and the use of the visor. During his talk he quoted Publilius Syrus, one of the great Roman senators: "He is truly wise who gains wisdom from another's mishaps."

This statement did not create any great shakes but it did remind me of something that had happened. It was 3 days earlier when an aviator had come in with a smashed windshield and was having great difficulty seeing where he was going. A grenade had exploded about 10 meters in front of his aircraft, shattering the windshield and blinding his copilot. Sitting in the ready room I wondered how I would react in a similar situation and what precautions I could take to alleviate some of the complications.

It dawned on me that a clear visor, especially at night, could be a great asset. I called the supply shop and arranged to have the visor brought over to the ready room. It took me about 5 minutes to attach it, and I figure it later saved me from a lifetime of blindness.

It was just after dusk when the scramble alarm sounded. In less than a minute we pulled pitch and departed the airfield. My radios were crackling. An LRRP team had been ambushed and needed to be extracted. It had one dead and four wounded and was in a precarious predicament.

While my copilot marked the team's position on the map, I checked the artillery. Over the area I contacted the team getting the direction of fire, approximate number of enemy, type of fire and location of the wounded. As I chose my direction of landing, I remembered my clear visor and lowered it in front of my eyes.

The gunships prepped the area as I descended and for awhile it looked as if we would make out all right. On short final the Viet Cong (VC) opened up with small arms and then I saw the basketballs, .50 caliber machine gun rounds. We took some hits in the tail boom and the ship yawed. I realized then that the tail rotor was gone.

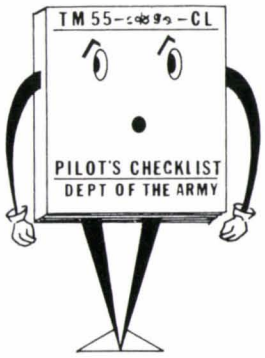
We crashlanded in the trees just as a blinding flash appeared in front of the aircraft. That was the last time I saw anything for awhile. I departed the aircraft and hollered for my crew. My crewchief and gunner emerged without injuries, followed by my copilot who was limping. They led me to the LRRP positions where we settled down to wait for help. It was a few minutes before I noticed that my helmet was still on my head. Removing it brought a revelation . . . my eyesight returned!

The VC were soon pushed back by an American force and we were evacuated a few hours later. The rest of the night I spent in a hospital bed and the next morning pieced together some of the loose ends about my temporary loss of vision.

The explosion was a B-40 rocket that went off in the trees. Its force shattered the helicopter's windshield—throwing plexiglass, branches and mud into my face. To say that the visor saved only my eyesight would be an understatement. There were two gouges in the helmet and two deep cuts in the visor. I have no doubts that I had learned from another's mishap and saved my own eyesight.

A visor on a hot, humid day can be a pain in the neck. Many pilots feel uncomfortable using it. However, if you weigh the discomforts as opposed to the amount of protection, I'm sure you'll agree that a visor is worth its weight in sunlight.

Charlie and Danny's Write-In



Dear Danny: Paragraph 10-39b of the UH-1D/H Operator's Manual (TM 55-1520-210-10) instructs the pilot that the "right hand, left hand and top engine air inlet filters" should be removed when it is anticipated that the helicopter will be flown under atmospheric conditions conducive to icing. With all of these filters removed, the cowling is loose. Is there some method of restraining the cowling when the filters are removed?

CW2 J.P.W.

Danny's answer: The problem that you mentioned has been recognized and the U. S. Army Aviation Systems Command has a solution for it. By leaving the top filter in place, adequate structural support for the cowling is provided. A future change to the operator's manual will include instructions to remove only the left and right engine air inlet filters.

★ ★ ★

Dear Danny: We are wondering why U-21 prop levers must be placed in the high rpm position before propeller reversing. We had looked closely at the component parts and can see nothing that would keep the lever from going into reverse mode. The books tell you not to reverse during this condition, but accidentally this was done and everything worked fine. How about an explanation.

CW2 E.T.A.

Danny's answer: Information in "the books" is correct as regards positioning of the prop controls prior to reversing. As a matter of fact the note appearing in the dash 10 has been changed to a caution to indicate possible damage to equipment if prop reversing is attempted without first positioning the prop levers full forward.

Affected parts can better be observed on page 5-17, figure 5-7, detail b, of TM 55-1510-209-34. When the prop lever is moved back from the high rpm position, the spool is raised and dimension "Z" is increased. When the power lever is moved into reverse, the cam lever must move down to accomplish reversing, so you can see bending and damage to component parts will result.

★ ★ ★

Dear Charlie: My question is about the fuel crossfeed check in the checklist, page p-18, for U-21A aircraft. Note that after setting the switch to open and observing the crossfeed light comes on, we then go to closed, check light goes out, then set switch to auto. Why don't we go to auto instead of closed and eliminate one step?

We checked all our U-21s and found that the valves close when we switch back to auto and the lights extinguish. This would save on switches and solenoids as well.

CW2 J.H.

Charlie's answer: Your suggestion is completely valid and will appear as a change to the dash 10 and CL at a later date.

It was first thought that it is necessary, under all conditions, to set the switch to the closed position before switching to auto so that the holding circuit would be reset. This is only necessary, however, when the system automatically goes over to crossfeed (see NOTE, page 3-17, paragraph 3-34.7 (6) of the dash 10). If the crossfeed system is activated manually, the switch can be reset back to auto as you suggested.

Thanks for your suggestion to improve the U-21 publications—"keep 'em coming."

Responsibility for the administration of the Army's aeromedical education, training and consultation program falls upon the small but dynamic Office of Aeromedical Education and Training of the U. S. Army Aviation School, Ft. Rucker, AL. This office is responsible for the training of flight surgeons through its Army Aviation Medicine (Basic) Course; Army Aviation Medicine Officers' Orientation Course; and the final phase of Aviation Medicine Residency training. Additionally, the office trains air crewmen in aeromedical subjects and conducts the worldwide Army Aeromedical Consultation Service

Education And Training In Life Support For Army Aviation

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

LTC Nicholas E. Barreca, M.D.

Aeromedic

MODERN ARMY air crewmen have become increasingly aware of their human capabilities *and* limitations while engaged in the man-machine-environment system complex. Partly because of the more highly developed consciousness and perception of society, but more largely due to the specific and directed efforts of aeromedical health and safety professionals, a comprehensive program of education and training in life support has been developed in Army aviation.

Not too long ago Army air crewmen grumbled at what seemed like a lack of concern shown toward their physical and emotional well being while personnel of other military flying services received "coddling" support or protection of their every psychophysiologic need or vulnerability. Those days are gone forever. Today, Army aviation personnel go *first-class* to engage the military aviation environment.

Prior to 1970 primary emphasis was placed upon training flight surgeons with the expectation that they would impart necessary life support knowledges and skills to air and ground crewmen in the operational environment. Except for survival, escape and evasion, and ejection seat training, only limited excursions into the aeromedical training of air crewmen had been attempted.

Flight surgeons, already absorbing countless responsibilities in the 1960s could not undertake a comprehensive program of basic and advanced instruction in health and safety subjects without neglecting more immediate operational requirements. Thus in July 1970 the first series of formal lectures in aviation medicine and life support were presented to initial entry rotary and fixed wing student pilots in the Army Aviation School. Starting then with a basic 4-hour block of instruction, this training has since increased to a 9-hour block and soon will expand to 15 hours. Much of the more recent development was stimulated by the NATO Standardization Agreement 3114 entitled "Aeromedical Training of Flight Personnel." To complement this initial training, a form of continuation training was established within the confines of the Army Aviation School and directed at aviators receiving advanced aircraft qualification or transition and career development courses.

Since the large majority of Army aviation missions involve helicopter operations, which are by nature flown at low altitudes and moderately low absolute air speeds, much life support education and training is directed at crash injury prevention, personal protection, and avoidance of dangerous levels of flying skill fatigue. Such training becomes vital with the increase of nap-of-the-earth flying missions based on engaging an enemy with sophisticated weaponry in a mid- to high-intensity conflict. To accommodate special missions and periodic deviation from usual helicopter flying mission profiles that may be dictated by geographical, geophysical and geopolitical constraints in given combat or training theaters, each Army aviator is provided with a basic understanding of general aeromedical principles, stresses and protective measures.

Army Officer/Warrant Officer
Rotary Wing Aviator Course, Phase II
Aviation Medicine and Life Support Annex

Subject	Hours
Altitude Physiology	3C
G-Forces	1C
Spatial Disorientation and Sensory Illusions of Flight	1C
Noise In Aviation	1C
Stress and Fatigue	1C
Night Vision Orientation	1C, D
Examination	1E
Altitude Chamber Indoctrination	2PE
Adverse Effects of Temperature Extremes	1C
Toxic Hazards in Aviation	1C
Protective Equipment	1C
Review of Aviation Medicine and Life Support	1S
Total	15

Key: C - Conference
D - Demonstration
PE - Practical Exercise
E - Examination
S - Seminar

Figure 1

Today, all Army aviation candidates are *initially* trained exclusively as rotary wing aviators. During the first 14 weeks (Phase I) they receive introduction to life support from a 5-hour block of conference and programed instruction in aviation medicine. Emphasis is primarily on terminology and basic aeromedical principles, with little coverage of specific life support equipment or procedures.

Advanced aviation candidates pursue an additional 20 weeks of rotary wing training (Phase II). This includes 9 more hours of platform instruction from the *Office of Aeromedical Education and Training*. This training soon will be expanded to 15 hours as the result of the approval of a systems engineered course. Upon examining figure 1, note the first 9 hours currently taught followed by the additional 6 anticipated. The following nine paragraphs cover subject matter taught in this block of instruction.

Altitude Physiology introduces the student to the respiratory and cardiovascular functions of the human body that are essential in adapting to the stresses of decreasing or changing barometric pressure. The problems of hypoxia and hyperventilation are examined in the perspective of Army aviation mis-

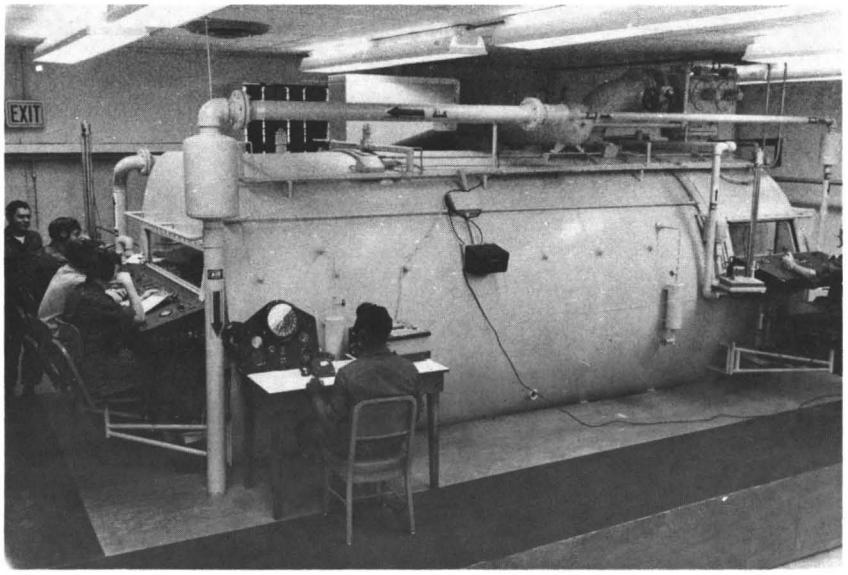


Figure 2: Specially trained physiological training officers and chamber technicians operate USAAVNS' 16-man cylindrical low pressure altitude chamber

sions. The risks of the trapped and evolved gas dysbarisms (see "Aeromedic," DIGEST, December 1972 and January and February 1973) are recognized as the insidious but real threats that they can often become against successful mission completion. First and foremost, prevention is stressed through caution and adaptive procedures.

Hands on equipment, doing and feeling are the criteria of the day during the **Altitude Chamber Indoctrination** (figure 2). This practical exercise and demonstration simulates pressure altitudes to 25,000 feet for these basic students. Familiarity with oxygen regulation and breathing systems provides a useful foundation for subsequent advanced or continuation training (figure 3). Emphasis is placed on each air crewman's ability to handle ear and sinus pressure equilization as well as recognize his early and individual symptoms of hypoxia.

Instruction in **G-Forces** enlightens the prospective aviator about the response of his body fluid compartments to low magnitude acceleration. This prepares the budding OV-1 Mohawk or attack helicopter pilot to the physical stresses of sharp pullouts and tight high-speed turns. More importantly, he is introduced to the risks of high magnitude or abrupt accelerations and decelerations such as those associated with ejections or rocket extractions and crash forces. Again protection and preparation are the key words of the day. The **Protective Equipment** presentation extends this somewhat didactic presentation of **G-Forces,** to the daily flying environment. The aviator's personal protective and life support equipment is described in detail. The qualities and use of protective helmets, fire retardant Nomex flight clothing and gloves, boots, and survival and rescue equipment are explained and demonstrated.

Spatial Disorientation and Sensory Illusions of Flight introduces the student pilot to those confusing sensations that even seasoned aviators deny they are capable of experiencing. Their importance as hazards to be coped with has recently been emphasized by USAAAVS (see DIGEST, October, November and December 1972 entitled "Right Side Up, or Upside Down?"). Vivid descriptions and explanations of these interesting illusions are carefully and graphically presented to the student using the latest methods of instruction (figure 4). Perhaps more impressively, the student can experience disorientation through simulation on the rotating chair (figure 5). Even the most determined doubter will become a believer after this sometimes disturbing series of maneuvers.

Certainly no expose of aviation stresses would be complete, especially among the rotary wing set, without an explanation and description of the hazards of **Noise in Aviation.** In this presentation, the student learns the importance of protecting against not only aviation noise exposures, but also matters related to a noise polluted society

Figure 3: Army air crewmen become familiar with the effects of changing barometric pressure and learn to cope with oxygen regulating and breathing systems

Figure 4: Graphic methods of instruction enable the student to better understand his physiologic responses to flight while learning about spatial disorientation and sensory illusion of flight

of mechanization and musical frenzy.

The Adverse Effects of Temperature Extremes and **Toxic Hazards in Aviation** cover the details of certain more tangible stresses to which the airman may be exposed in pursuit of the operational mission. These and all other stresses are put in perspective in **Stress and Fatigue,** a conference on the subtle and insidious compound strains which result in the acute and chronic flying skill fatigue that often attends an arduous and sustained mission requirement.

Perhaps the most enjoyable and impressive presentation of the block of instruction is the **Night Vision Orientation.** The visual limitations of the night-seeing man are perhaps more easily demonstrated and well understood. In the face of potential night nap-of-the-earth flying nothing could be more appropriate. First the student experiences the process of dark adaptation and is introduced to the limitations of his blind spot and rod vision. Then he is taught how to protect his night adapted eyes with red lighting or red filtered goggles (figure 6). Lastly, he sees how this type of vision is important operationally and learns to effectively use signaling equipment (figure 7).

No major block of technical instruction would be complete without a seminar to provide a **Review of Aviation Medicine and Life Support.** To give credence to the subject's importance each student must pass a comprehensive examination.

Armed with these knowledges and skills the new Army aviator is certainly better prepared to intelligently engage a sometimes hostile military aviation environment.

Survival, evasion, resistance and escape training also is covered in Phase II. This is taught by aviation line officers and noncommissioned officers from the Army Aviation School's Department of General Subjects. Emphasis is placed on demonstrations and a practical exercise upon the Alabama countryside. This annex of the course encompasses 40 hours of instruction (figure 8). It is the only formal school survival training received by Army aviators except that before being deployed an individual may receive additional specialized training from schools in other branches of the military services.

Once trained in rotary wing, a graduated Army aviator may be directed to pursue other aircraft qualifications. Upon attending the fixed wing qualification course (T-42) at USAAVNS, he again will receive a refresher or continuation subcourse in aviation medicine and life support. At this time, an additional 2-hour block of instruction covers oxygen systems in the various models of Army fixed wing aircraft. This is reinforced by a special altitude chamber indoctrination to 43,000 feet, including a rapid decompression simulation. It prepares the now dual-rated aviator for transition to the U-21 Ute, U-8 Seminole and OV-1 Mohawk aircraft since they are equipped with operationally useful oxygen systems.

During transition to the OV-1, the aviator receives a 5-hour block of ejection seat training from the Army Aviation School's Department of Maintenance Training. No training is received in the use of a

Figure 5: Angular acceleration of flight are simulated by spinning the student in a rotating chair with his eyes covered. Sudden head movements reproduce the disturbing and sometimes alarming coriolis illusions that can occur under IMC flight

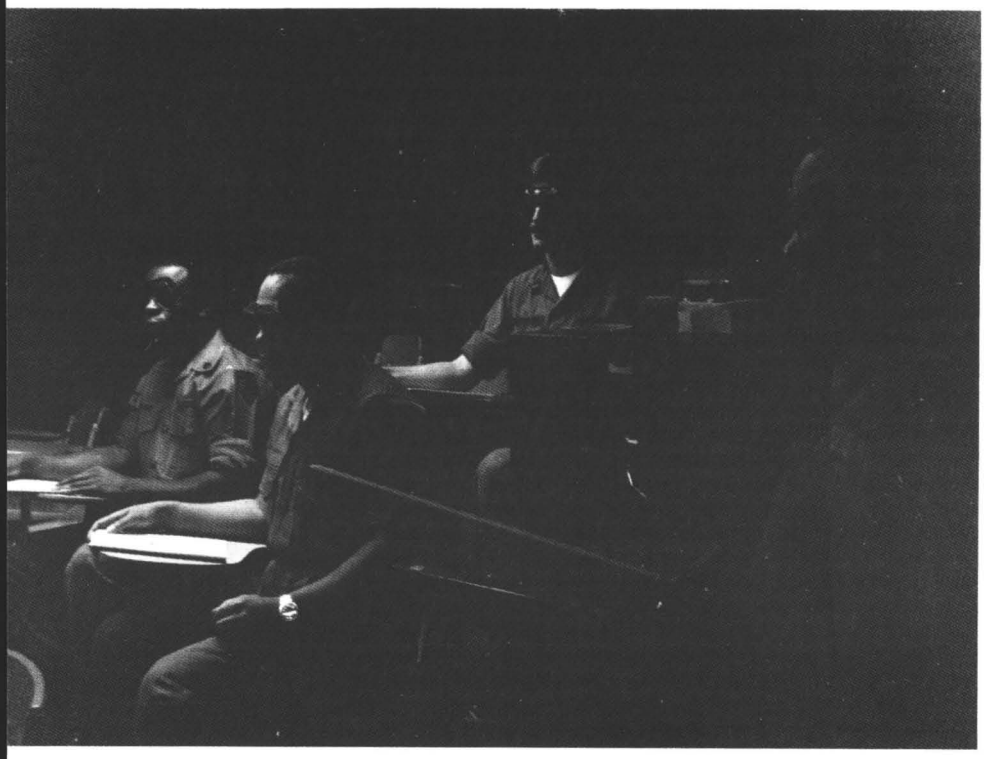


Figure 6: The instructor presents a specially designed slide conference on the night-seeing man, while students continue to dark adapt with red-filtered goggles

parachute for landing. This is left up to the resourcefulness of the individual air crewman. A special 2-hour G-Forces lecture, presented by medical personnel, covers the aeromedical aspects of ejection. OV-1 crewmen must then seek annual ejection seat refresher training in CONUS at Ft. Rucker, Ft. Huachuca, AZ, Ft. Eustis, VA, or at prescribed locations in other major theaters.

Instructor pilots in the T-42, U-21, U-8 or OV-1 receive an additional block of aviation medicine and life support subjects to include a refresher altitude chamber indoctrination. Emphasis is on IP/student relationships.

A recent reorganization of Army rotary wing instructor pilot instruction will enable additional input in aviation medicine and life support from the Office of Aeromedical Education and Training.

Once an aviator departs the Army Aviation School for an assignment, he must depend upon his operational flight surgeon for any continued training and reinforcement in aviation medicine and life support requirements. At present, this training depends solely upon the initiative and resourcefulness of the individual unit or supporting flight surgeon and also aviation command emphasis. A plan is in the conceptual stage that will establish Army subject schedules to standardize unit and individual aeromedical training provided by operational flight surgeons. It will provide them with training materials in the form of programed text training circulars and certain graphics if adopted. Army training programs and subject schedules require between 6 and 16 hours of training in survival for all personnel. The extent to which this is accomplished depends upon individual unit commanders.

For now, the only other formal continuation aeromedical training an Army aviator receives is upon his happenstance return to the Army Aviation School for career development courses. For warrant officers, there is the Intermediate and Advanced Career Courses. Each of these contain a block of instruction in aviation medicine and life support with altitude chamber indoctrination. The recently developed Aviation Command and Resources Management Course will permit indoctrination of aviation commanders in the requirements for aviation medicine and life support.

With respect to enlisted air crewmen and ground support personnel, education and training in aeromedical subjects is limited. There are a few classes in first aid and other medically related subjects taught in maintenance courses at the U. S. Army Transportation School, Ft. Eustis. However, this is not consistently supervised by medical personnel. Survival training is limited to basic and ad-

Figure 7: After becoming fully dark adapted the student sees that the extremely brief flash duration of the Xenon strobe light distress marker does not destroy his night vision. This gives him confidence to utilize signaling equipment when needed

vanced noncommissioned officers education system courses in the form of 23 hours of instruction at Ft. Rucker. However, crewchiefs and flight engineers do not receive such instruction.

In the immediate future some shift in emphasis may be required for certain aspects of aeromedical and physiological training. It is becoming more and more evident that Army aviation missions will require pilots highly skilled in instrument flight. This will be particularly so under night flying conditions.

Continued research is developing devices and techniques that will enable more vivid and realistic spatial disorientation training. A rotational device is being considered. It can simulate the various confusing sensations that can be experienced during IMC (instrument) flying. Simultaneously, techniques may be adopted to incorporate controlled simulation of certain illusions under actual flight conditions.

Another requirement that may change for certain aircraft missions is the nature of emergency escape. The use of ejection or extraction systems in attack helicopter aircraft may become essential under nap-of-the-earth conditions. Certainly the autorotative maneuver becomes somewhat limited under this condition. If ejection or extraction become favored and commonplace, Army air crewmen certainly will need to undergo additional parachute training, particularly regarding the landing phase. This can be efficiently, effectively and safely accomplished through various types of parasail training techniques.

Renewed emphasis must be made on survival training requirements in the face of potential mid- to high-intensity conflicts. Army experience in Southeast Asia has perhaps spawned complacency about the extent or duration of air crew survival roles. Due to the seeming omnipresence of fellow air crewmen or adjacent supporting units, it was seldom that Army air crewmen went down that they weren't promptly rescued. The premium was thus placed on signaling and communications equipment.

In the future the risk of launching search aircraft in great numbers may be prohibitive with combat airspace teeming with threats and terrain bellowing with fire-tongued vengeance. Perhaps then, each of us must be prepared to survive, escape, evade or resist. It is imperative to continue to stress the preparation and constant training required to ensure that each air crewman will be able to perform to the limit of his ability and with the greatest chance for success.

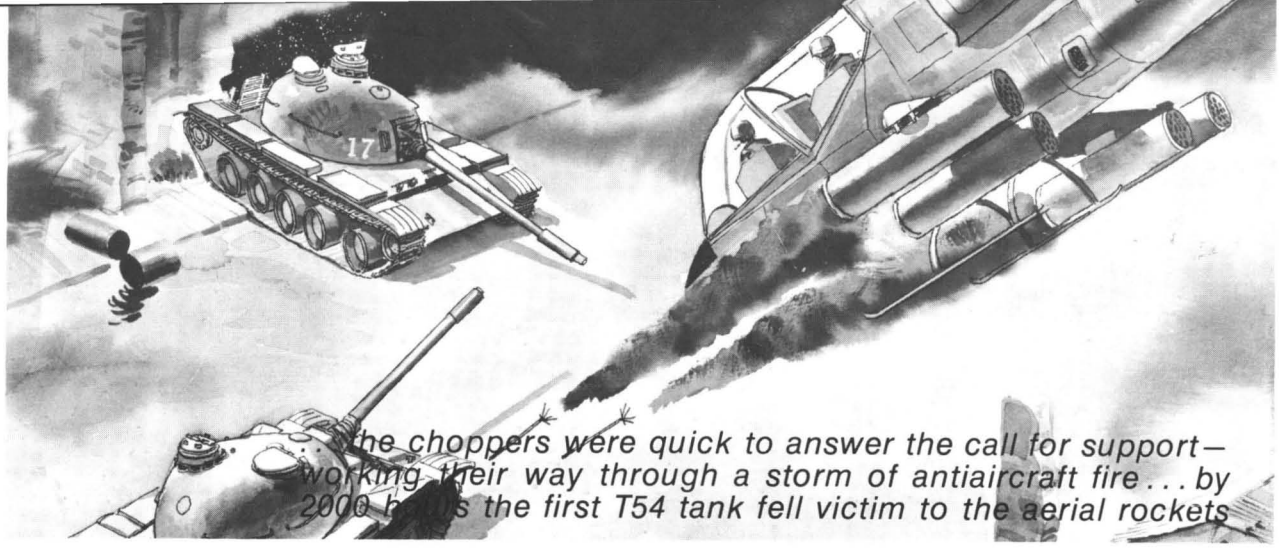
Army air crewmen are and should be trained to cope physically and emotionally with the aviation environment. In the future it is expected that this educational program will continue to mature and expand to encompass every aspect of Army aviation's mission requirements.

Figure 8

Army Officer/Warrant Officer
Rotary Wing Aviator Course, Phase II
Survival, Evasion, Resistance and Escape Training Annex

Subject	Hours
Introduction to Survival	1.5C
Survival Medicine	1.5C
Signaling	1.0C, D
Firemaking	1.0C, D
Personal Protection	1.0C
Procurement and Preparation of Food and Water	2.0C, D
Survival at Sea	1.0C, D
Navigation	1.0C
Travel	1.0C
Rescue Procedures	1.0C, D
Introduction to Resistance	2.0C
Evasion	1.0C
Prisoner Exploitation	5.0C, PE
PW Organization	1.0C
Practical Application of Survival Techniques	5.0PE
Evasion and Extraction Field Exercise	12.0PE
Examination	2.0E
Total	40

Key: C - Conference
D - Demonstration
PE - Practical Exercise
E - Examination



. . . the choppers were quick to answer the call for support—working their way through a storm of antiaircraft fire . . . by 2000 hours the first T54 tank fell victim to the aerial rockets

2.75-Inch Rocket Provides Tank Kills

Leo Horowitz Chief, Fuze Development Branch Picatinny Arsenal

"Army Cobras Blast Tanks Near An Loc" newspaper headlines announced in April 1972. They were referring to the then newly acquired capability of the U. S. Army's AH-1G HueyCobra helicopter equipped with a new 2.75-inch antitank rocket.

Two tanks were hit during that 15 April engagement by a Cobra from Battery F, 79th Aerial Field Artillery, a unit of the Third Brigade, 1st Cavalry Division (Airmobile).

From 1 April through 11 May, which included the fighting around An Loc, the unit claimed 10 Soviet-built tanks destroyed and another 6 damaged in the all-out Viet Cong effort to capture Saigon.

The rocket capability was provided from a project which had been initiated at Picatinny Arsenal, Dover, NJ, only 12 months earlier. The helicopter-delivered antitank capability was achieved by the development of the XM247 dual-purpose warhead and the XM438 fuze in combination with the MK40 rocket motor of the existing 2.75-inch rocket.

To reduce lead time in the availability of the warhead and fuze, components from other items being produced for other weapons were used. Minor modification or direct usage of these components formed the basis for the design.

The warhead casing from the 17-pound M229 high-explosive warhead of the 2.75-inch rocket provided the fragmentation antipersonnel effects. The liner and ogive from the M72 lightweight assault weapon (LAW) was used for the armor penetration capability. Fuzing used the impact crystal of the LAW and the safety and arming device and the battery and the impact switch from the M429 proximity fuze. The only new component developed with the aid of CAD-E (computer-aided design engineering) was the fuze control circuit.

The design that evolved from this program was basically the same as originally proposed when the program was approved. It consists of the M72 piezoelectric crystal used on LAW, the M72 ogive and the M72 precision copper liner from LAW, the M229 warhead body modified on the front and rear end, a 2-pound composition B4 high-explosive fill, a new fuze (XM438) and a base plug.

The ogive is magneformed onto the loaded warhead body. The warhead is completed after the cable is assembled to the fuze, inserted into the fuze cavity and the closure disc is assembled. The assembly to the rocket motor is similar to the M151 warhead. The complete round is packed in the standard 2.75-inch rocket fiber container.

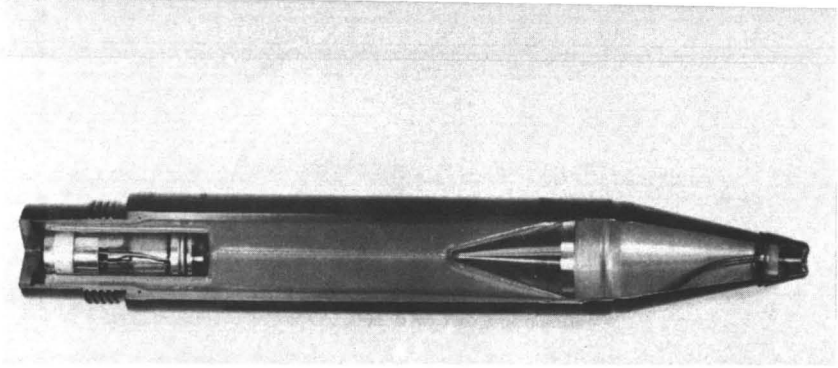
Warhead characteristics were verified in a series of static tests. Average penetrations were similar to those of the LAW missile in each of the five standoffs. Additional static tests established fragmentation characteristics used in the computerized effectiveness calculations, showing distribution of fragments similar to the M151 high-explosive warhead for the 2.75-inch rocket. Dynamic tests verified that results are the same as the static tests.

In June 1971 track tests at Aberdeen Proving Ground, MD, further verified the static test results and were followed in July by ground-to-ground firings against two steelplate targets 1,200 feet from the launcher with satisfactory results.

The point impact-base detonating XM438 rocket fuze is a mechanical arming and electrical firing device. It consists of the safing and arming (S&A) device, battery and impact switch from an M429 fuze, a fuze firing circuit (FFC) to provide logic and controlled firing, an ogive, nose-cap assembly and elongated wire harness from the M72 LAW weapon.

The arming function is accomplished initially by acceleration

Cutaway view (right) of the XM247 antitank warhead



forces characteristic of the 2.75-inch rocket, causing the spring-loaded weight in the S&A device to move rearward. When the weight has moved to the setback position the unbalanced rotor is released, causing it to rotate under control of the time-delay gear train. After about 0.25 seconds the rotor releases a firing pin to initiate the thermal power supply for the FFC and the detonator. Under sustained acceleration of 1.03 and 1.35 seconds the rotor locks in the armed position, aligning the M84 electronic detonator with the explosive train and closing switches to the detonator circuit and FFC.

Initiation occurs via the FFC by one of two modes. The primary mode functions on target impact when the piezoelectric crystal sends a signal to the FFC, triggering a silicon controlled rectifier which allows the battery-capacitor system to fire the detonator. The secondary mode functions on graze impacts and piezoelectric crystal malfunction.

The system will fail-safe on preshorted impact switches. If the system is prearmed the battery will maintain power for approximately 30 seconds. When onboard power is dissipated neither the backup impact switch nor piezoelectric crystal impact will function the round.

The mechanical arming component of the fuze is a Harry Diamond Laboratory developed unmodified M429 S&A device which has been safety certified and has an excellent record to date.

Since this fuze is completely surrounded by the warhead's explosive fill, the out-of-line detonator safety test had to be performed not only to assure explosive train safety but also to a greater extent assure safety of the explosive fill. Steps have been taken in the design to ensure confinement of the detonation within the fuze housing.

Military standard tests of 296 fuzes were performed with satisfactory results at Yuma Proving Ground, AZ. The only problem encountered was that of the warhead separating from the motor during unpackaged transportation vibration. This deficiency was corrected by specifying a locktight adhesive on the threads between the warhead and motor.

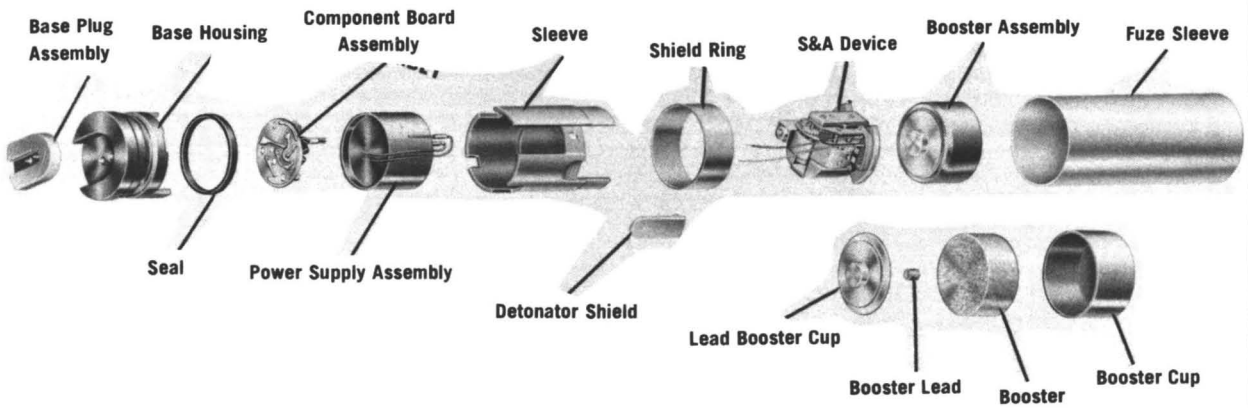
Based upon the results of these tests the U. S. Army Test and Evaluation Command (TECOM) issued a safety statement in late 1971 that the warhead is considered safe for handling, transportation and aircraft flight provided the warheads are positively locked into position.

Subsequently, the U. S. Army Aviation Systems Command issued a safety of flight release statement that a full load of 19 rockets XM247/XM438/MK40 can be utilized with the XM159C or M200 rocket launcher pods on the UH-1 series and AH-1G helicopters.

Based upon these approvals the drawings were finalized. Engineering test and service test quantities were approved for manufacture and TECOM was authorized to conduct its evaluation program.

In April when the first ET/EST rockets were completed at Picatinny Arsenal the project manager for the 2.75-inch rocket system directed their diversion to the Republic of Vietnam to meet the tank threat, resulting in devastating proof of their lethality in combat.

XM438 Rocket Fuze Assembly



The Illusive CAT

Don't be deceived by the apparent safety of VFR conditions. For nearly 10 years the research efforts of several agencies of the federal government have centered on detection of the illusive CAT. Some of the approaches used have included sonic and scientillation techniques, radiometry, microwave and low frequency radar, optical laser radar and pulsed laser Doppler

This is the third article in a series on air turbulence

ANNUAL AWARD
Monthly Winner
CONTEST

William C. Whisnant
Academic Instructor, U. S. Army Aviation School

DURING THE PERIOD 1964 to 1969 the National Transportation Safety Board records show 97 air carrier accidents involving turbulence with at least 34 being clear air turbulence (CAT).

CAT is a special problem because it is encountered unexpectedly without visual or instrumental evidence to warn pilots. James Muncy, a Federal Aviation Administration aviation weather branch engineer, puts it simply: "CAT is not quite, but almost, a will-o-the-wisp."

Encounters with CAT became more numerous and serious in the late 1950s and early 1960s. In 1964 it was deemed necessary by the United States to determine more about the cause of CAT and work started on the development of detection devices for studying this illusive wind.

The National Committee for CAT submitted a report to the federal coordinator in December 1966. The committee felt that the major constraint on improving CAT forecasts is the lack of theoretical understanding of the physical nature of turbulence and that precise forecasts of CAT did not appear feasible. For this reason, an airborne device is needed to detect and locate CAT ahead of the aircraft.

Many concepts to detect CAT and determine its physical characteristics have been tried, but with little knowledge about the causes of CAT these efforts have been based on speculation and no reliable instrumentation system suitable for military and commercial aviation is now available. The approaches to CAT detection include sonic techniques, radiometry, microwave and low frequency radar, scientillation techniques, optical laser radar and pulsed laser Doppler.

Studies have shown that temperature variations are often associated with CAT. A U. S. Department of Transportation-sponsored radiometric temperature sensor is being tested at the National Aeronautics and Space Administration (NASA) Flight Research Center, Edwards AFB, CA. By early indications the sensor may be able to detect temperature

changes associated with CAT up to 50 miles ahead of the aircraft. Further tests are underway to determine the reliability of this system.

The laser Doppler technique appears to be the most promising since it would measure atmospheric wind velocity directly. Variations in this velocity could be directly correlated to the degree of turbulence. In 1969 a very early version of the CO_2 laser Doppler was used in a cooperative effort between the Langley Research Center, Hampton, VA, and the Marshall Space Flight Center, Huntsville, AL. Tests were made at Huntsville in November 1970. Simultaneous measurements of surface winds were made with the laser Doppler and with the cup anemometer, a standard wind measuring instrument (figure 1). Velocity changes sensed by the laser Doppler generally lead the cup anemometer velocity changes. This is attributed to the relatively slow response of the anemometer to wind speed changes. This system has been in operation at Ft. Collins, CO, since February 1971. Wind speeds of 100 miles per hour have been measured.

In a cooperative effort between the U. S. Air Force and NASA, the Raytheon Company is developing a pulse CO_2 laser Doppler for inflight measurements of CAT. The CO_2 laser has a 20 times better signal to noise ratio over visible lasers. Ordinary glass and plastics will reflect the CO_2 laser beam and prevent eye damage; however, this required development of a germanium window, the only available material that is transparent to the 10.6 micrometer wave length.

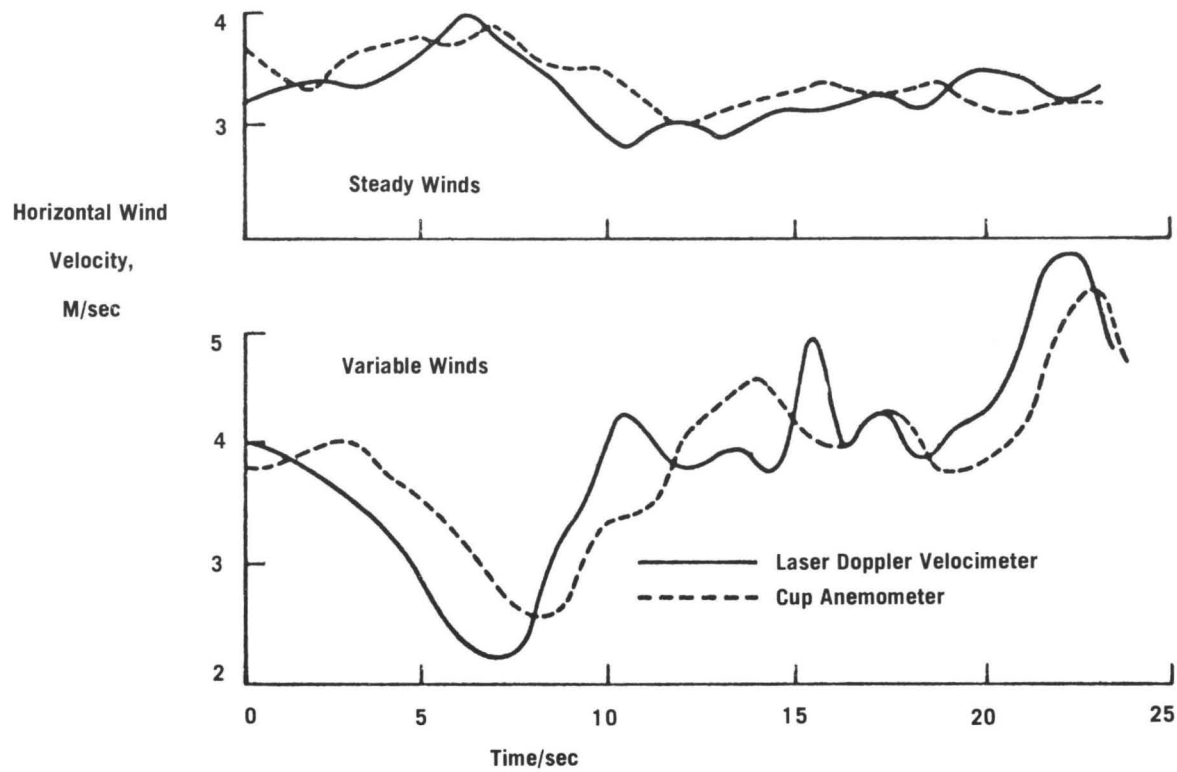
Raytheon Company suggested a program which could lead to operational CAT avoidance instrumentation in the 1975 to 1976 time period at an estimated cost of $37 million for flight test, supporting research and development, prototype development and test, and production of 100 sets. Estimated cost was based on experience in developing similar new products.

Until an airborne CAT detector can be developed and placed in use, pilots must rely on forecasts, pilot reports and individual judgment in avoiding or minimizing encounters with the illusive CAT.

The laser Doppler generally senses wind velocity changes more quickly than does the cup anemometer whether in steady or variable wind conditions

Figure 1

GROUND WIND DATA FROM CO_2 LASER DOPPLER SYSTEM



Taxi, takeoff and landing techniques are enriched by an awareness of turbulence that may be present in the vicinity of man-made structures

Army aircraft normally operate at 25,000 feet or less. At these altitudes *severe* turbulence is generally associated with weather or is generated mechanically.

Squall lines and thunderstorms are prime sources of weather turbulence that may be identified visually and are readily detected with weather radar. Turbulence often extends several miles beyond these identifiable areas into clear air. A leading commercial air line's "five-and-dime policy" is a good rule to follow when using weather radar. Simply avoid displayed turbulent areas a minimum distance of 5 miles where the temperature is above freezing and 10 miles where the temperature is below freezing.

Where trees, buildings, hills, mountains and valleys interfere with the normal flow of air, a snarl of eddies and air currents is mechanically generated. Low wind speeds create stationary eddies or rotating pockets of air of mild intensity which remain close to the windward and leeward side of the obstruction. Strong winds or sudden increases in wind speed will not only increase the intensity of the irregular eddies but will also carry them some distance downstream. Thus, during taxi, takeoff or landing the complacent pilot may be caught "fat, dumb and happy" (figure 2). Exercise care, under these conditions, with wind speeds in excess of 20 knots.

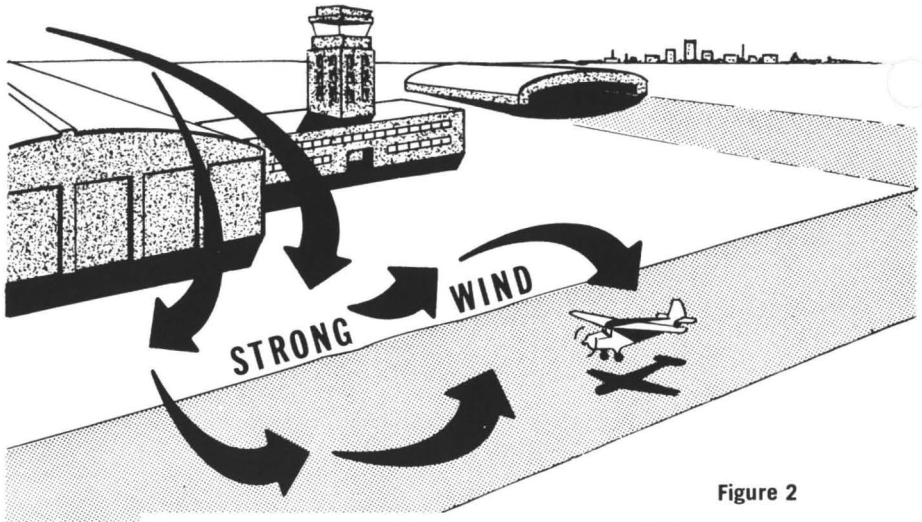


Figure 2

TURBULENCE CAUSED BY OBSTRUCTIONS

A similar but potentially more severe mechanical turbulence is over mountainous terrain when wind speeds are 35 knots or more, wind direction is approximately 90 degrees to the mountain range and there are abrupt changes in terrain elevations. An especially vicious form of the "mountain wave" may be encountered in mountainous areas such as the Rockies or Alleghenies (figure 3). The crest of the waves may be marked by lenticular clouds which seem to hang stationary over the mountain ridge or at some distance downwind and may exist in several layers to above 20,000 feet. The roll cloud is generally about the height of the mountain ridge and may be as much as 10 miles downwind. Under stable conditions the wave may extend up to 150 miles downwind. When the air is unstable, turbulence immediately to the lee of the mountains may be intensified and the mountain wave shown in figure 3 will not develop downstream. Clouds indicated in figure 3 are visible signs of much turbulence. Remember, however, that *the same turbulence can exist without clouds.*

This type of turbulence can cause structural damage to the aircraft or result in loss of control. Winds and gusts strong enough to lift a P-38 15,000 feet with both propellers feathered or to tear the vertical stabilizer and rudder from

Turbulence associated with the mountain wave may extend up to 150 miles downwind of the range. Roll clouds may be encountered 10 miles downwind

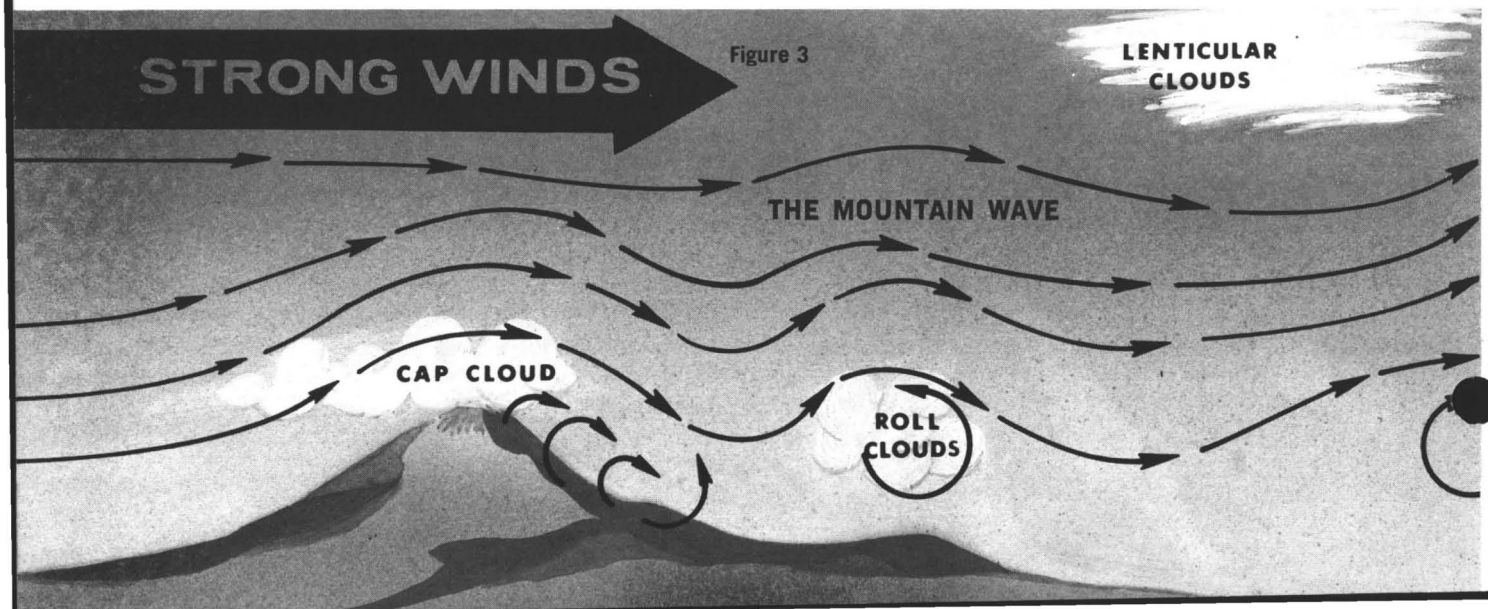
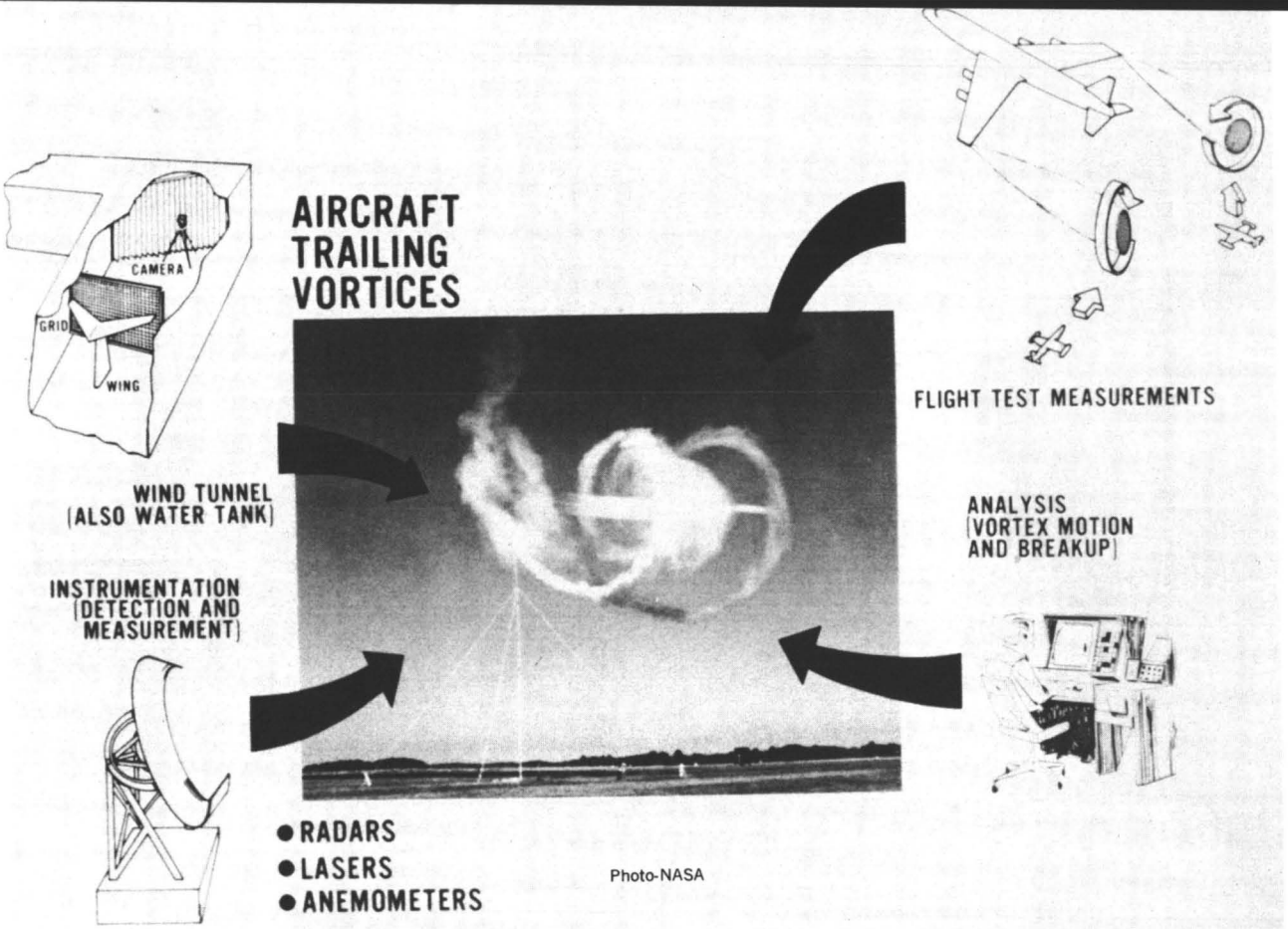


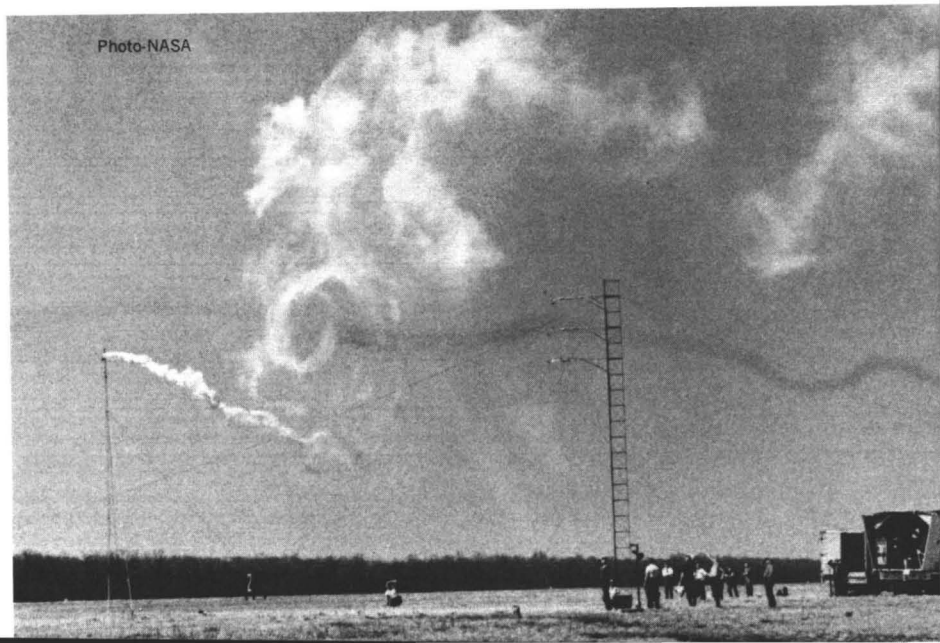
Figure 3



Aircraft trailing vortex or swirling wind wakes are under intensive study as potential hazards to small aircraft. Note the vortex core in the photo

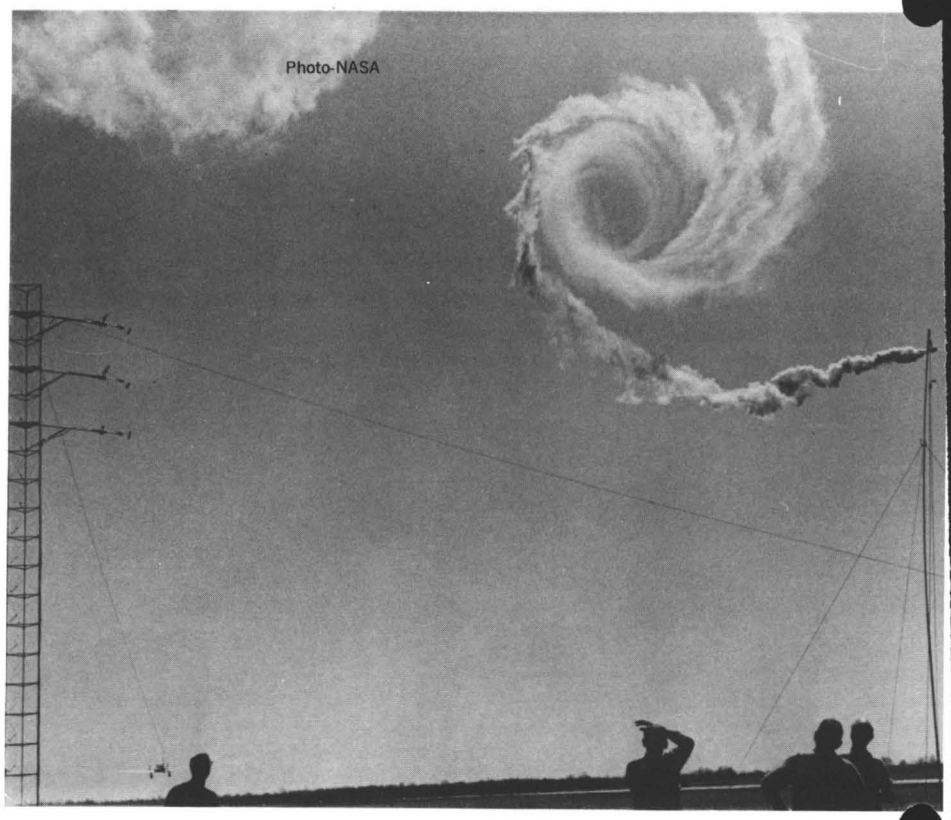
a B-52 have been recorded. Certain types of mechanical turbulence must be classified among the most hazardous conditions of the atmosphere.

Wake turbulence is another example of mechanically generated turbulence. This disturbance is a pair of counterrotating vortices trailing from the wingtips of an aircraft in flight. The greatest vortex strength occurs when the generating aircraft is HEAVY—CLEAN—SLOW. A smoke tower was used in tests to make the vortex visible. Vortex tangential velocities were recorded at about 90 knots. Do not operate below and



In field test for NASA, aircraft trailing smoke from wingtip nears tower with smoke generator. Seconds later vortex is visible while the darker smoke from the aircraft remains in the core

Several revolutions of vortex are visible after passage of the aircraft, left horizon, near tower that supports instrument sensors

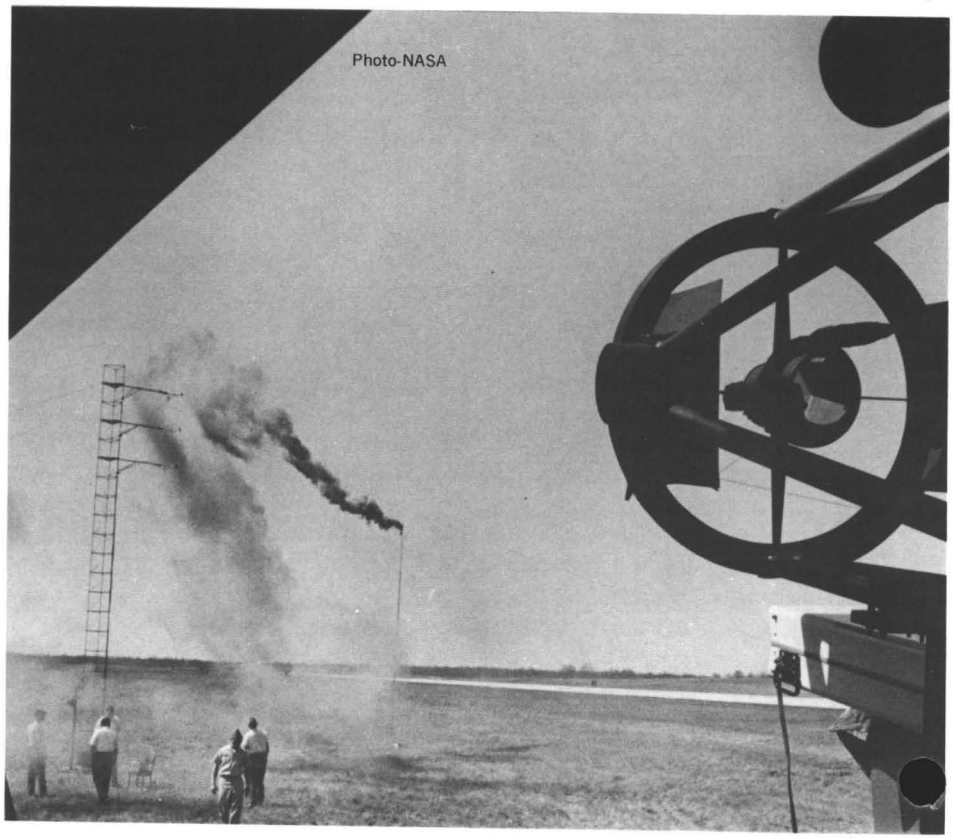


close behind the generating aircraft at low altitude where even a momentary encounter could be hazardous.

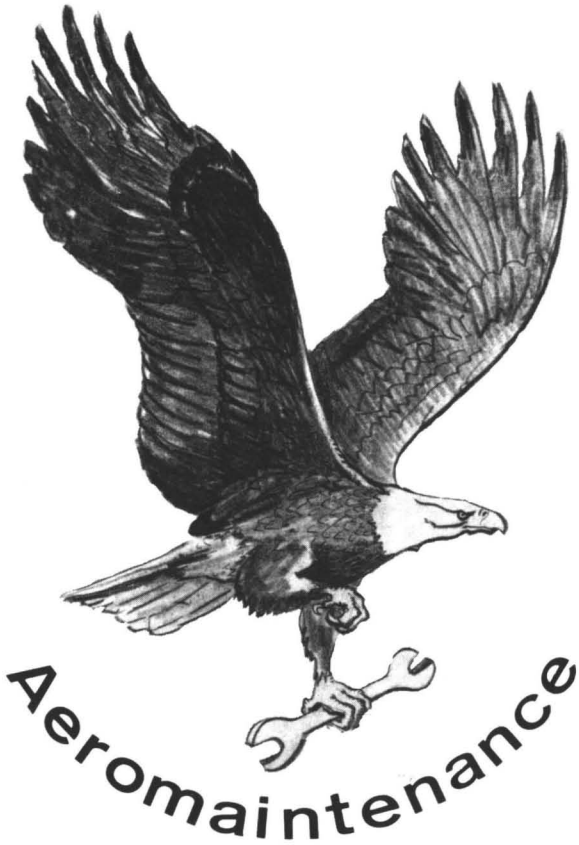
This brief information shows that invisible hazards do exist in the atmosphere. NOTE: Additional information on turbulence is found in the following FAA Advisory Circulars and Army manuals:

- AC-00-17, Date: 16 Dec 65, Subject: Turbulence in Clear Air
- AC-00-24, Date: 12 Jun 68, Subject: Thunderstorms
- AC-00-30, Date: 5 Mar 70, Subject: Rules Of Thumb For Avoiding Clear Air Turbulence
- AC-90-23C, Date: 16 May 72, Subject: Wake Turbulence
- AC-006, Date: 20 May 65, Subject: Aviation Weather
- AIM Part 1, Date: May 1973, Subject: Basic Flight Manual and ATC Procedures
- TM 1-300, Date: 10 Jun 63, Subject: Meteorology for Army Aviation
- TM 1-225, Date: 9 Dec 68, Subject: Navigation for Army Aviation

Carefully consider pilot reports or weather forecasts that indicate the presence of clear air turbulence. Obviously flights should not be made in areas of severe turbulence. However, when unexpected turbulence is encountered, or flight must be conducted under these conditions, throttle to turbulent air penetration speed, tighten your safety belt and outwit the illusive CAT.



The open object on the right is the front of a 24-inch reflecting telescope that collects laser beams reflected and transmits data to a read-out system



Huey Short Shafts

Captain Robert W. Simon

Department of Maintenance Training
U. S. Army Aviation School

ON THE UH-1 series helicopters many main drive shaft problems have occurred causing excessive downtime and unnecessary expensive parts consumption. Fortunately, during technical inspection the following maintenance discrepancy has been discovered in various units throughout the world.

The main drive shaft (short shaft) attaching clamps (figure 1) employ internal wrenching, high tension bolts with a beveled shoulder as indicated in note 1, figure 2. This beveled shoulder prevents stress from being applied at any given point and distributes torque forces. Note 2, figure 2, illustrates the proper countersunk, heat-treated washer used on the bolt head. Note 3, figure 2, depicts the plain, heat-treated washers for the nut side of the internal wrenching bolt.

Figure 3 illustrates the improper placement of the washer on the internal wrenching bolt.

When installing the drive shaft, improper installation of the washer will:

a. Cause high tension stress at one point on the bolt which weakens the bolt and renders it as unserviceable (note 1, figure 3).

b. Give false torque indications to the mechanic which would result in loose attaching clamps during operating conditions. In the event of drive shaft destruction an emergency situation exists due to the loss of drive to the main transmission. Depending upon the terrain available for autorotational landings and pilot proficiency, loss of life and/or aircraft may occur.

We highly recommend all maintenance officers, NCOs, technical inspectors and mechanics be made aware of this problem and its seriousness. With proper management procedures this problem will never exist in any unit.

The use of internal wrenching bolts and utilization of special washers can be referenced in TM 55-1500-204-25/1, page 2-3, paragraph 2-25 and figure 2-82 and TM 55-1520-210-20, page 7-8, 7-9.

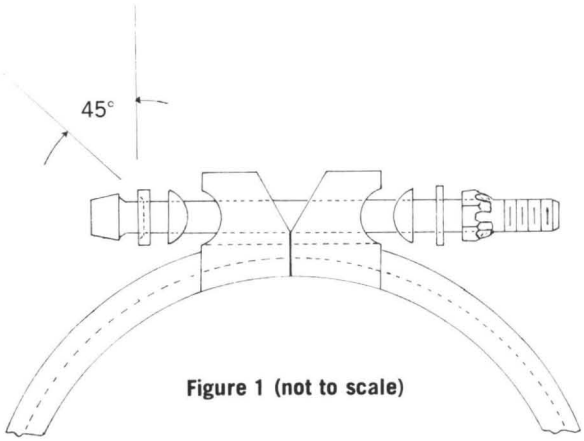
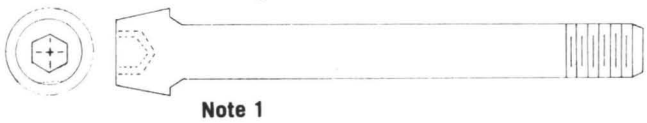


Figure 1 (not to scale)

Figure 2 (not to scale)



Note 1

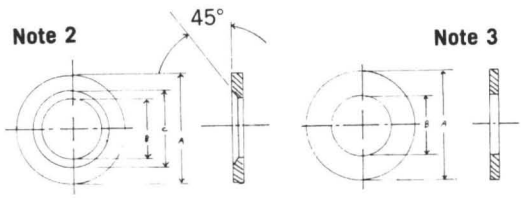
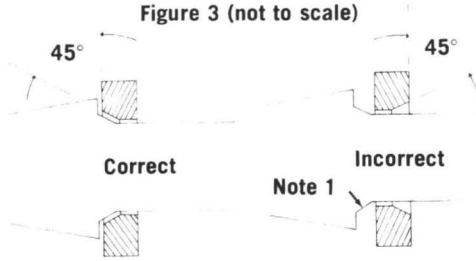
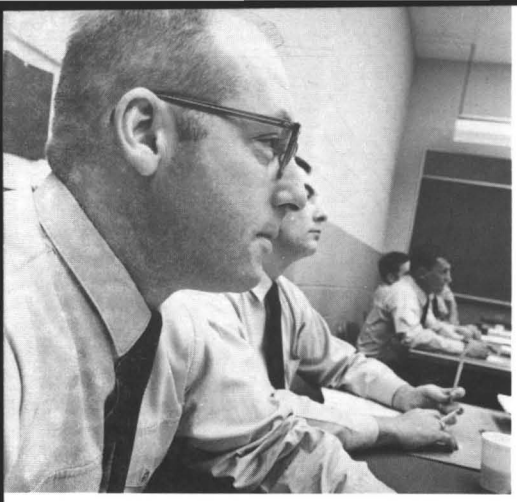
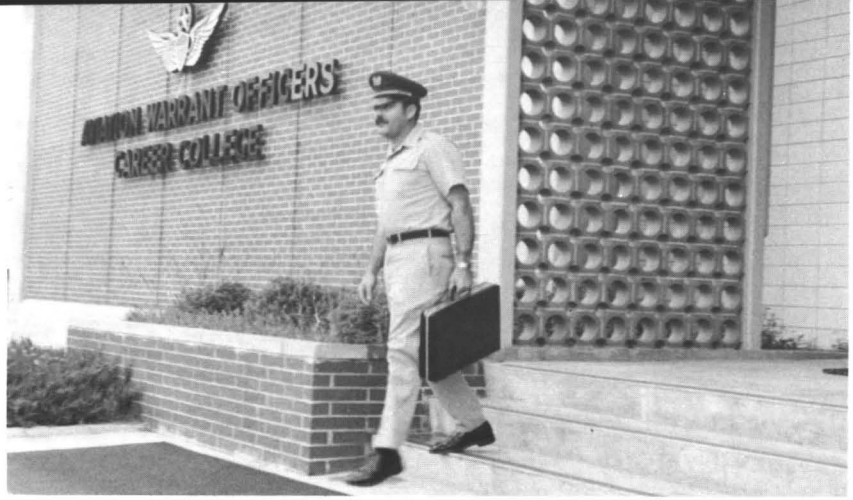


Figure 3 (not to scale)







Opportunity Knocking

Major Samuel G. Firman
Correspondence Courses
Army-Wide Training Support

Attention — AWOs!

With recent structure changes and reorganization of the U. S. Army's Continental Army Command, the Department of Non-Resident Instruction at the U. S. Army Aviation School, Ft. Rucker, AL, has undergone a name change. Renamed Army-Wide Training Support, it now offers several new courses which will benefit the careers of both enlisted men and officers, particularly for those unable to obtain allocations for attendance at the resident courses. The Aviation Warrant Officer Intermediate Correspondence Course and the Aviation Accident Prevention Management Course are now available. The NCOES Courses (Basic and Advanced) as well as the Aviation Warrant Officer Advanced Course are programed to be available by correspondence in the near future

Phase I - Selected Training Subjects
Phase II - General Subjects
Phase III - Army Aviation Management
Phase IV - Combined Army Tactics
Phase V - Safety & Medicine
Phase VI - Resource & Maintenance Management
Phase VII - Flight Subjects
Phase VIII - Command and Staff
Phase IX - Special Operations

A GREAT OPPORTUNITY for career development is knocking at your door. Applications are now being accepted for the Aviation Warrant Officer Intermediate Correspondence Course E-30. This course parallels the resident course being conducted at the U. S. Army Aviation School, Ft. Rucker, AL. Upon completion of the correspondence course you will receive a diploma and credit identical to that received by the resident course graduate.

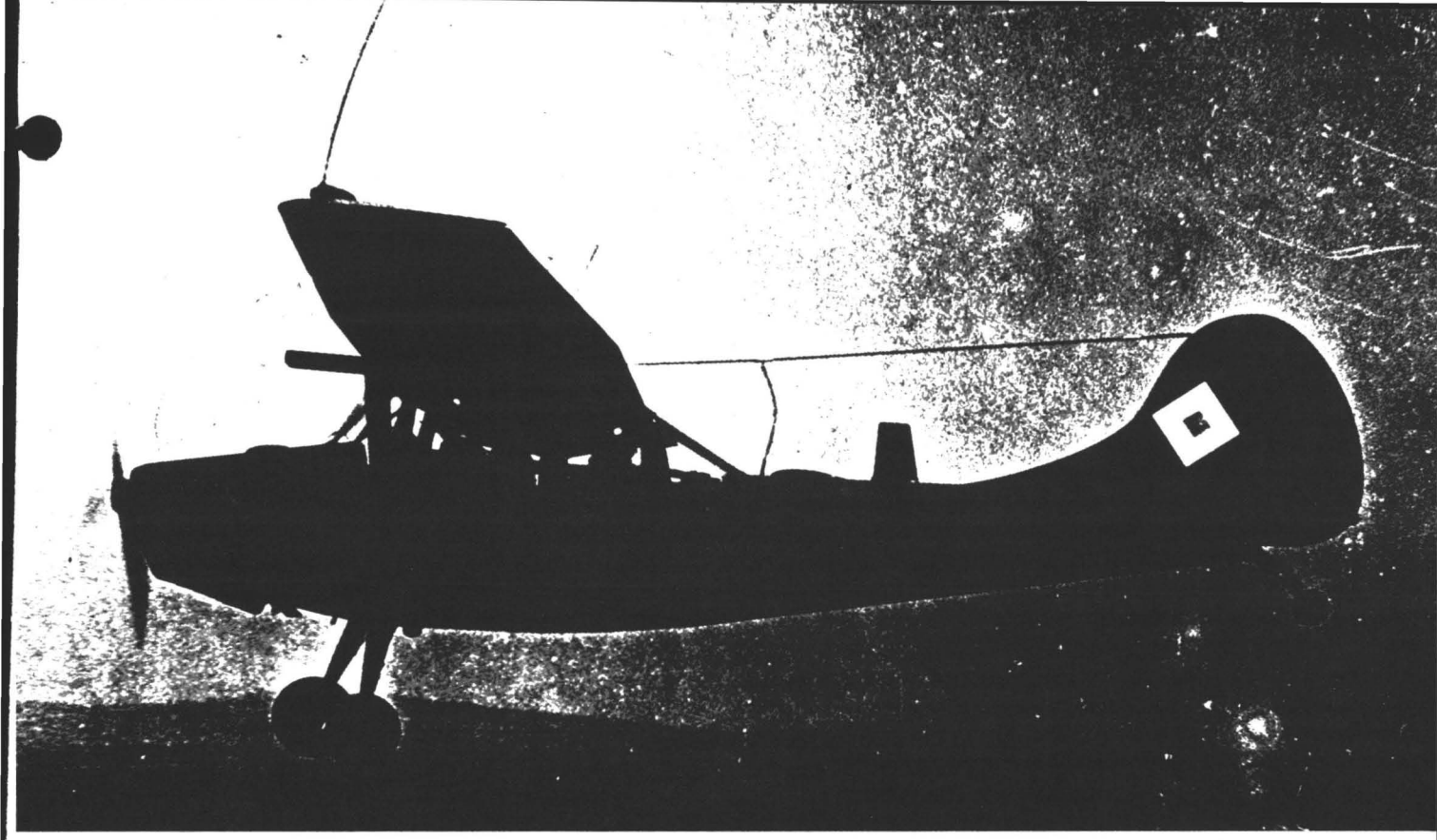
Prerequisities for enrollment in the AWO Intermediate Correspondence Course are completion of 3 years as a rated aviation warrant officer, or a nonrated aircraft repair technician, and a member of the active Army or a Reserve Component. Others may enroll in any or all of the individual subcourses which make up the intermediate course.

The course contains 75 subcourses for a total of 448 credit hours. The hours are based on the approximate time required by a student to complete the necessary study. Materials needed for completion of the course are furnished by the Aviation School. The study material is diversified and broken down into nine phases (see box).

Application for enrollment on DA Form 145, approved by your commanding officer, should be submitted to—

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

Who says opportunity knocks only once? The Aviation Warrant Officer Advanced Correspondence Course also will be available in the near future.



A Wing And . . . An Arm

Captain James J. Michalak

The pilot stuck his arms out of the window and used them as airfoils

CAPTAINS James Cronkhite and Dale Ward, who were with the 21st Reconnaissance Airplane Company at DaNang in the Republic of Vietnam in March 1970, will certainly never forget the 0-1 Bird Dog and its survivability characteristics. They brought one back on a wing and an arm!

While supporting a 1st ARVN Division sweep the aircraft was circling high over suspected enemy positions. Suddenly it was caught in a fusillade of enemy ground fire and torn up pretty badly. Both crewmen were wounded, the observer severely.

The 0-1 was still flying but the ground fire had severely damaged the tail section. When this happened rudder control was lost and the Bird Dog starting spiraling to the right directly over the enemy. CPT Cronkhite, hampered by a wound in his left foot, fought the controls but to no avail . . . the plane continued to spiral and lose altitude directly over the enemy.

Then Cronkhite remembered a story he'd heard in flight school about a pilot sticking his arms out of the window and using them as airfoils. Quickly, he threw open the left window and stuck his arm out. CPT Ward did the same and together they were able to create enough drag on the left side of the aircraft to fly away from the enemy and to a safer altitude. They headed for a nearby airstrip.

Uncoordinated without rudder control, they maneuvered their way to a final approach and landed. Upon touchdown, lacking directional control, the plane swerved, hit some loose sand and overturned. The aircraft proved itself survivable once again. Neither crewman suffered any further injury.

The Bird Dog is being phased out, but like its predecessors—such as the famed L-4 of World War II—it leaves many fond memories . . . not the least of which is *a wing and . . . an arm.*

For Aviators:

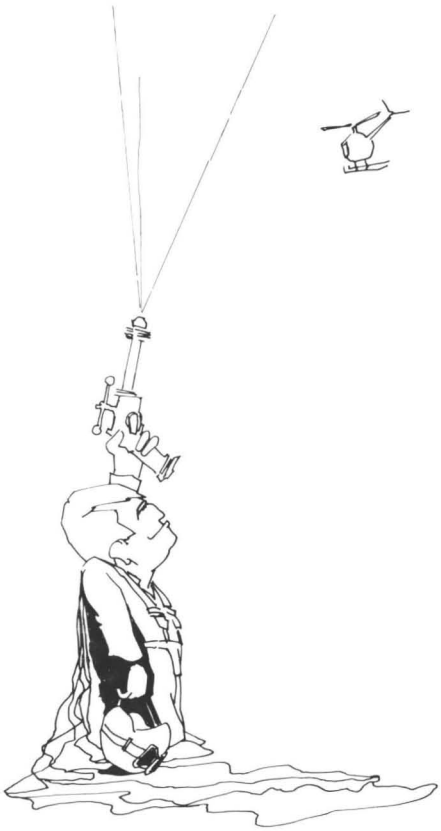
Visible Laser Beacon

Steve Kimmel

Public Information Office
Harry Diamond Laboratories

DEVELOPMENTS in laser technology—particularly the development of a small, portable, battery-powered Helium-Neon laser at the U. S. Army's Harry Diamond Laboratories (HDL), Washington, DC—suggest that a laser signaling device may be practical for emergency and military use.* Complete with batteries the device weighs about 2 pounds and can have a form somewhat like a flare pistol, enabling a variety of emergency signaling applications such as downed air crew recovery, landing zone designations and friendly force markings.

Visible signaling devices of various types have been in use from the earliest days of mankind. A flag or torch or smoke from a fire provided instantaneous communications over line-of-sight paths for thousands of years before the invention of electrical or electronic devices such as the telegraph, telephone and radio. In the last hundred years, however, these new and convenient methods of conveying information have almost totally supplanted visual signals in everyday life, and for most of us the only visual signaling still in use is a vague hand wave or a flashed automobile headlamp.



The two major areas where visible signals are still in use are military and emergency situations. In emergencies the need for communications is pressing, the means may be limited and the required vocabulary is small. The message is simple: "Here I am" in the case of flares, signaling mirrors, smoke and flashlights; and "Get out of my way" in the case of flashing lights on emergency vehicles. In the military the message may be much more complex, but the level of training and discipline among military users allows more complex conventions. This combines with more extensive equipment to provide an expanded vocabulary. Thus, red smoke may mean "This is your target," while green smoke could mean "This is a friendly position." Also, the military often has

The compact laser weighs only 2 pounds and when activated can be seen by a search aircraft flying at 20,000 feet over a 1,000-square-mile area

use for the simple emergency message such as "Here I am."

Most visual signals are insecure. The flare that says "Here I am" to a rescue helicopter also delivers the same message to hostile ground forces in the area. The smoke that says "This is a friendly position" to attacking aircraft also compromises the code (color) of the day and allows later "spoofing" by the enemy. The most obvious relatively secure optical signals are hooded searchlight beams and heliograph systems such as simple signaling mirrors. Both depend on an aimed beam of light which is visible only to the intended receiver. Various infrared signaling devices also offer security, but require apparatus of some sort at the receiver and thus reduce one of the major advantages of any visible signal, which is the fact that each and every individual is equipped with an extremely sensitive and versatile set of optical receivers.

A team of engineers and physicists in HDL's Applied Physics Research Branch established the technology base that makes it possible to reduce the laser size while increasing its output power. Several commercial sources are building small lasers, but the prototype used at HDL was conceived to enable downed pilots to signal a search aircraft flying up to 20,000 feet and 450 knots.

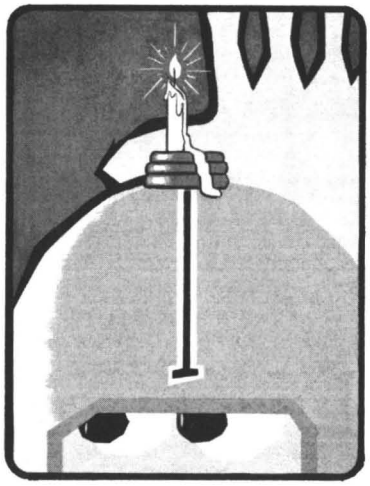
Under realistic field conditions a prototype laser signaler was located at the tree line on the bank of the Potomac River and a UH-1 helicopter from Davison AAF, Ft. Belvoir, VA, flew a series of prearranged paths at ranges from 1 to 18 miles and at altitudes from 1,500 to 4,500 feet. Observers on the helicopter noted the subjective visibility of the laser signaler at all test conditions.

Although only a prototype, the field test demonstrated the feasibility of using a low-powered, portable laser as a secure, visual signaling device. Other applications may occur to potential users as further development proceeds on the laser signaler.

Miss Billie Richardson displays a prototype portable laser being developed at the Harry Diamond Laboratories

*There are five research and development laboratories reporting directly to Headquarters, Army Materiel Command. Each of these laboratories conducts research in the areas important to the Army of today but constantly is on the lookout for leads that will benefit the Army of the future. One of these laboratories is the Harry Diamond Laboratories (HDL), Washington, DC. HDL conducts research on radiation, time and command fuzing, target detection and signature analysis, fluid amplification, and weapon and system synthesis relevant to fuzing.

VIEWS FROM READERS



Sir:

Just a few minutes ago I finished reading the article in your magazine concerning the 1973 Annual Writ. Since I am attending graduate school at Stanford University, I did not think I had to take the writ. But after reading the article I have found out that I must under the new regulations. There are several aviators here at Stanford.

Since we are assigned to Sixth Army and not collocated with them, we may have difficulty in securing the necessary study materials for this year 's writ. I would like to know whether or not you can send several copies of this material to us; or, if you can not, if you would forward this letter to someone at Ft. Rucker that could.

Thank you for your time and consideration in this matter. Your help will be greatly appreciated by all here concerned.

CPT Francis S. Delia
830 Doyle Road
San Jose, CA 95129

• The study material you need is available through Sixth Army. The DIGEST has been in contact with the Sixth Army Aviation Officer and you should be able to obtain the study material from him.

Sir:

Upon reading the December 1972 issue of the DIGEST concerning the article of interest in the April 1972 article entitled "Another Helicopter Concept," I was concerned with the thought of the .50 caliber on the ramp area. I used to think I knew a little about a CH-47A when I was a flight engineer and was wondering if anyone has considered the stress, strain and the many vibrations the poor ole ramp is going to take? The ramp, or rather most ramps if like the one on my ship, vibrated enough without a .50 caliber on it. All those vibrations would be rough on the ramp, airframe and utility hydraulic system. I'm sure that the hydraulic fittings and unions that connect the hydraulic system to the ramp would either loosen or crack from the constant shaking.

If these problems have been worked out, please disregard this letter; but if not, please give my thoughts a little consideration.

Thank you.

Larry D. Scott
317 Sunset Drive
Mount Airy, NC 27030

• The DIGEST received the following response to Mr. Scott's questions from the U. S. Army Test and Evaluation Command:

This headquarters conducted a search of historical records and made numerous FONECONs regarding ramp-mounted automatic weapons on the CH-47A helicopter. Information received during this investigation indicates that the armed Chinook version of the CH-47A was the only known U. S. Army helicopter to be equipped with a .50 caliber ramp weapon.

Historical records revealed that limited testing of the armed Chinook was conducted in 1966 at Aberdeen Proving Ground (APG), MD, prior to deployment of this special purpose aircraft to RVN. The final report of this testing was reviewed in hope of locating specific references to ramp problems resulting from firing of the .50 caliber gun. However, no problems were documented. Following a review of the test report, the individual who directed the 1966 APG test was interviewed. The test director stated that only minor problems (loosened hydraulic fittings) were experienced during the firing of approximately 1,000 rounds from the ramp-mounted .50 caliber. These minor problems were easily remedied. The test director also stated that no unusual vibrations were noticed during the airborne firings.

In order to determine if ramp problems were experienced after deployment, the maintenance officer and one of the Boeing-Vertol technical representatives who supported the armed Chinooks in RVN during 1966 were located by telephone. Neither could recall any maintenance problem associated with the ramp gun, or incompatability of the gun and airframe.

Based on all of the above, it appears that no problems were experienced as a result of the installation of a .50 caliber gun on the ramp of a CH-47A.

Sir:

It seems that no two teams in the Army work on anything alike. When it comes to the final moment of decision as to whether an airplane will fly or be grounded, we find that in different units we have different standards of maintenance.

I can remember a time when if a mechanic even thought that his aircraft had something wrong with it the maintenance sergeant, the TIs [technical inspectors] and the maintenance officer would be all over that aircraft, double checking each other to ensure a safe flight for the pilot and passengers. This is not the case of things today. Everyone is concerned with only one thing and that is the availability of their aircraft, because that availability means so much when someone writes your EER or OER.

It appears that many equipment operators do not recognize the concept of good maintenance and are creating a tremendous strain on the enlisted maintenance personnel, therefore becoming a monster and exerting their influence with your efficiency report when it comes to mission requirements and safety of flight.

All this is leading up to a problem that I am now going to pass on to the people who know the most, and can solve the problem.

My unit has a U-8D that has seen its better days, but we are still flying her and on a clear day you couldn't ask for a better flying bird. The only thing

wrong is that she doesn't like to fly in moisture of any amount. Here is a report that I get from the pilots after a flight into moisture on this bird.

We had a normal start and then taxied out for runup. Both engines started to run rich, black smoke could be seen coming out the augmenters and we had to run the engines at 1600 rpm to keep them from loading up. Engine runup was normal and #1 engine no longer ran rich. However, #2 engine at times continued to run rich.

Takeoff was normal and we started to climb using 3200 rpm and 44 inches. The weather was good as we passed through 3,500 feet, but as we started through 4,000 feet and a very light cloud, #2 engine started to drop off about 100 to 125 rpm. The engine tach showed this as long as we were in a cloud. I scanned the other gauges and everything was A-OK, the engine tach was the only thing that showed it. As the engine continued to fluctuate I began to feel it in the aircraft. We broke through the clouds at 4,800 feet and I decided to level off and still keep the aircraft at 3200 and 44 inches. To my surprise I still had the fluctuation in #2 engine. A change to cruise power eliminated this miss in the engine.

We reached our destination without further trouble and dropped off our passengers. Upon our departure in clear weather #2 engine again started the same thing. This time we had no clouds but the moisture content of the air was on the high side. When we got home I entered this write-up in the logbook: "#2 engine misses in climb at 3200 rpm at 44 inches."

The maintenance people are about to go nuts around this aircraft. Here is a list of the things that have been done to try to eliminate the problem with this aircraft:

1. The carburetor has been changed five times.
2. The air filters have been changed.
3. The induction hoses have been changed (all of them).
4. The engine was changed (internal failure).
5. The magnetos were changed.
6. The spark plugs were changed.
7. The ignition harnesses were changed.
8. The rpm gauge was changed.
9. The alternate air system was checked out.
10. The lower cowls were swapped around.
11. Beech aircraft was contacted and the fuel cells were checked out.
12. The one-way valves in the fuel system were checked out.

The rpm is the only thing that drops off—MP—OK, fuel pressure—OK, oil pressure—OK, cylinder head temp—OK.

What can be done about this problem I don't know, but you just do not go flying passengers in an aircraft that misses in a climb power setting. The maintenance sergeant wants to ground the aircraft but doesn't know what to do to eliminate the problem. The CO doesn't know what to do and the pilots are a little afraid of the aircraft.

The CO says that the aircraft has been doing this for at least 4 years that he knows of and a few of the other officers say they have been in units where this has gone on and nothing was able to be done about the problem.

What can we do? Should we keep flying this aircraft and hope that nothing happens to the pilots and/or passengers? Or should we ground the aircraft and call our support maintenance again and have them keep the aircraft until it is fixed or turned in. They have spent many hours on this bird and can get no farther ahead than we have. They have no more ideas as to what is wrong with this aircraft than we do.

I know that somewhere in the Army there is someone who knows what the problem is and what to do about it. We need help and this is the last place that I know to see if the question can be answered because we are still flying the aircraft.

SFC Edgar R. Thompson
Maintenance NCO
5th Army Flt. Det. CENA
Ft. Sheridan, IL 60037

• The DIGEST received the following comments on Sergeant Thompson's letter from the U. S. Army Aviation Systems Command:

. . . SFC Edgar R. Thompson's letter . . . indicates items critical to the operation of subject aircraft's engine have been changed without effecting a solution to the rpm problem. Also, the changing of engines on the subject aircraft resulted in no solution to the problem. Therefore, the problem must lie outside of the engine installed on the aircraft. Power Plants Engineering Branch suggests a reinspection of the aircraft auxiliary air (warm air) induction system for correct operation.

Sir:

As a former U. S. Army ATC examiner, I feel I should make some comments on the article in the February 1973 issue USAASO Sez [AVIATION DIGEST, page 48] concerning certification and rating of controllers.

The article stated that the time limit of 6 months for a new controller just out of school starts on the date he/she passed the CTO [control tower operator] written exam. Also, that the current AR 95-37 did not clearly state when to start counting the 6 months.

To me, AR 95-37, dated 19 January 73, chapter 2, paragraph 2-3b, clearly states: "The time limit for certification and rating will be based on calendar days commencing the day after the controller reports for duty in the facility." How can it be stated any clearer than that? What would happen to a new controller during the time he/she passed the CTO written exam and reported to a new duty station? The controller would lose possibly 45 days of the 6 months if an overseas assignment was involved. There are also cases where a new controller reports into a unit and is not utilized as an air traffic controller for some time. Even though this should not happen, it does. Is the new controller to be penalized for something he has no control over?

FAR 65 states a controller must satisfactorily serve as an air traffic control tower operator for at least six (6) months. It seems to me that serving as an air traffic control tower operator means working in a control tower, not just passing the CTO written exam.

SSG Jerry B. Downey
Simmons AAF
Ft. Bragg, NC 28307

• The U. S. Army Aeronautical Services Office has furnished the following answer to Sergeant Downey's letter.

FAR 65 requires that a military air traffic controller spend a *minimum* of 6 months as a controller before he *may* be issued a facility rating. This time commences when the individual completes the basic portion of the ATC course and has passed the required written examination.

AR 95-37 states that the time limit for certification and rating will be based on calendar days commencing the day after the controller reports for duty in the facility. This is a *maximum* time limit. The controller *must* obtain his facility rating within this period.

Sir:

First question: AR 95-1 page 4-3, paragraph 4-10, a, states that IFR "clearance *will not* be requested or exercised unless all requirements for IFR operations can be met."

The next subparagraph states that "all aircraft assigned to active Army units which are instrumented for IFR flight and have an instrument rated aviator in command will operate on IFR flight plans. . . ."

Subparagraph b does not mention the status of the copilot. Therefore, is it

legal to file IFR under VMC with a noninstrument rated copilot aboard?

Second question: How is the ETE to the alternate airfield computed for filing DA Form 175?

DOD FLIP Section II states that it is the time required to fly from the original destination to the airfield shown as the alternate on the flight plan. Does this mean that the ETE is computed from the missed approach point to the alternate airfield?

On a recent checkride the examiner stated that the ETE was computed *after* completion of a published missed approach. The flight time involved while executing the missed approach was not included in the ETE to the alternate.

MAJ Albert J. Turnage Jr.
Jackson, MS 39209

• The following answers to Major Turnage's questions were provided by the U. S. Army Aeronautical Services Office:

An instrument rated copilot is not required when filing an IFR flight plan, provided the entire flight is to be flown in visual meteorological conditions. However, AR 95-1, paragraph 4-21a, requires an instrument rated copilot for all flights *into known or forecast* instrument conditions.

In answer to your second question, the ETE to the alternate airfield is computed from the missed approach point to the termination of the missed approach procedure, then selected routing to the alternate. Unforeseen delays (holding or ATC deviations) cannot be considered.

Sir:

I have a couple of questions concerning your article "What's Your IFRIQ?" in the February 1973 DIGEST.

I interpret the answer to question 6 to mean that the pilot may cancel IFR any time he is in VFR weather conditions. I believe this is true only while he is not in positive controlled airspace. Further, there are a few terminals designated "high density terminal areas" which occasionally restrict entry to VFR aircraft even when the HDTA is VFR. Would not the pilot be prevented from canceling IFR, even though in VFR weather conditions?

Question 18 concerns the emergency static source. I believe that some, if not all, nonpressurized aircraft vent this source to the cabin of the aircraft instead of to the outside. Generally speaking, aircraft cabins have a lower pressure within them due to leaks around the doors and windows. Static sources are carefully placed to avoid local high and low pressure areas along the skin of the aircraft caused by local slipstream variations—venting to the cabin should result in a different (lower) pressure reading. This in turn should cause the altimeter to read higher than actual altitude, shouldn't it? Also, since the altimeter is not designed to measure rate of change in pressure, and therefore equalizes pressure rapidly, there should be very little lag to any change in its indication.

Captain W. C. Magathan
U.S. Army Aviation Test Board
Ft. Rucker, AL 36360

• The DIGEST received the following comments on CPT Magathan's letter from the U. S. Army Aeronautical Services Office:

You are correct in your belief that the pilot may not cancel his IFR plan in positive control airspace (above FL 180) except in some precoordinated cases. In high density terminal areas such as category I and II TCAs, the restrictions placed on a pilot would more appropriately be called control procedures rather than a limitation to canceling IFR. We feel that the sense of the author's question is that no one but you, the pilot, can cancel the IFR plan once activated or in other words no one can arbitrarily eject you from the IFR system once you have been accepted into it.

In reference to your comments concerning altimeter readings relative to use of emergency static sources, your premise may be correct; however, from an operational standpoint significant altimeter error should not be evident in nonpressurized aircraft. In some aircraft there may be sufficient ram air pressure induced through ventilating systems to give an opposite indication than your premise. The author's statement as to altimeter lag was most likely in reference to TM 1-215 which covers breaking the VSI glass as an emergency static source in which the equalization system is slowed through the "calibrated leak" of that instrument.

Your technical interest is sincerely appreciated and should serve to help promote professional interest in our business. Within the parameters of operational knowledge, the IFRIQ was designed to challenge; the answers presented are essentially correct.

Sir:

Having recently read the March 73 issue of AVIATION DIGEST and your request for material to include in the magazine, I couldn't resist sending the enclosed clipping.

The article "Helicopter crash-down . . . " came from a local news magazine in The Hague, Netherlands, which made its debut with "Edition O" on 5 April. I think it points out the fact that it's not only the military aviator that has his problems during checkrides. The pilot of the Corvair certainly pulled a miracle out of the hat when "with one motor fallen out . . ." he still managed to land perfectly with four motors running.

Besides a chuckle over the technical errors in the article, it was interesting as a nonflying aviator in this assignment to pick out the unsafe acts of the individuals involved in these two mishaps.

LTC Bruce W. Merrill
Deputy Commanding Officer
U. S. Army Transportation
Terminal Group, Europe
APO 09159

Helicopter crash-down during examination flight

ROTTERDAM—Zestienhoven Airport had a turbulent Friday two weeks ago. At about 2.15 a helicopter crashed down when a pilot was asked to make an emergency landing during his examination flight for a helicopter flying license. He made a mistake however, that could not be corrected by the instructor.

From a height of about 300 metres the Alouette III of Schreiner Airways crashed down on the grass in front of the main platform. The four occupants, two instructors and the two Austrian pilots, who had to do the examination, were unharmed. The brand new helicopter, that had barely reached 10 flight-hours, was badly damaged. The tail had snapped and the nose had been forced into the fuselage. The wrecked propeller did not disrupt the remaining air traffic.

The second incident occurred just after 7 o'clock. Fifteen minutes previously a Corvair from British Air Ferries was announced with one motor fallen out and fuel loss. Fire engines and ambulances drove to the landing strip ready to come into action in case of accidents. It wasn't necessary. The airplane landed perfectly with its four motors running. The 32 passengers were not in danger at any time. The fuel loss had probably been caused by a loose tank lid.

Sir:

Aviation warrant officers, seeking to distinguish themselves within the Army from the nonrated warrant officer, are certainly provoking a lot of thought lately. Some aviation warrants, in fact,

have voiced their belief that they should be recognized as a separate branch.

This problem, I believe, is basically a problem of identity, coupled with aviation pride of the rated warrant—and rightly so, at least in respect to identity. I believe the rated warrant officer should be identified from other nonflying warrant officers; we must certainly agree that this identification problem is only partially resolved in their MOS designation, but I propose a further identification by *title*. A title designation would serve to further delineate them from their nonaviation counterparts. We already have such a separation in enlisted ranks for example, sergeant first class versus platoon sergeant (this clearly distinguishes the two positions). Today, there is no rank or position designation with chief warrant officer—he may be CW2, CW3 or CW4.

My proposal is that an aviation warrant officer (W-1) be changed to flight officer (F-1). Chief warrant officers (since there is no real distinction between them today unless, of course, one puts the W2, 3 or 4 pay grade behind the title) would be designated as follows: CW2 to chief flight officer, CW3 to senior flight officer and CW4 to master flight officer. We would then have an easily recognizable title without the necessity of using the undesirable pay grades to designate rank, and can easily set the aviation warrant officer apart from his nonrated brothers. This distinction can be carried yet further by simply redesignating the pay grade prefix "W" with an "F." The warrant insignia could remain the same or be tinted blue in place of the present color on the bar.

Were the above changes incorporated, the aviation warrant officer would have his own title and insignia of rank—something he is certainly deserving and has been seeking for some time now. I am not really proposing something new; this terminology has a historical precedence dating back to 1942. From 1942 to 1944 the Army Air Forces used similar designations for their noncommissioned pilots.

I hope you will share my thoughts on the subjects with your readers; hopefully they will provoke/stimulate further discussion.

CPT Albert J. Ferrea
Command and Staff Department
U. S. Army Armor School
Ft. Knox, KY 40121

Sir:

I am writing in regard to a light system used on several UH-1Ds while I was in Vietnam during 1969-1970.

I am not sure exactly what the technical name was, but we called it simply "night light." It consisted of a triangular set of green lights on the top of the fuselage; a light on an extended portion of the tail fox-mike antenna; lights on the tiptops of the main rotor blades; and three rheostat knobs on the overhead cockpit center panel.

As an aircraft commander with the 175th Assault Helicopter Company in Vinh Long, it was one of my jobs to test and report on the effectiveness and utilization of this system.

There were three ships exactly like this in the company and we flew them extensively at night for 4 months. The number on my ship was 61882 and I am fairly certain that it was a retrograde ARADMAC.

I am writing to see if you know anything about the system and what the Army's final testing decision on it was. Are they still testing it? How many of this type aircraft were built?

Many of my friends and fellow pilots refuse to believe that there actually was such a system. The 175th found that it was a useful system and could be used to fly a good formation at night and was much better than nav lights in formation work. It was hard to see over a heavily lighted area because rheostat brightness was not sufficient. The rotor blades were unusual in that the wiring came up through the mast and head—and was wired inside the blade, down to the blade tip.

I hope that you can help me dig up something—it was an ideal system for combat night operation.

Thank you.

CW2 Randolph S. Diuguid
North Carolina National Guard
Raleigh, NC 27609

• The DIGEST received the following comments from the U. S. Army Aviation Systems Command concerning Mr. Diuguid's letter:

The night light system described by CW2 Randolph S. Diuguid in the enclosed letter is a development of the Army Electronics Command with the cooperation of Night Vision Laboratories. The final results are not available; however, the system is in military potential tests at Project MASSTER.

The above information was obtained from the Utility Helicopter Branch of AVSCOM's Systems Engineering Support Division.

INSTRUMENT CORNER

Captain Roger G. Ladd, Ft. Benning, GA, posed the following question concerning VOR receiver checks: "Does the procedure published in DOD FLIP and the requirement published in the FARs concerning the receiver check of the VOR apply to Army aircraft?"

The answer is yes, even though FAR 91.25 specifically states: "No person may operate a civil aircraft under IFR using the VOR system of radio navigation unless the VOR equipment of that aircraft. . . ."

TM 1-225, Navigation for Army Aviation, dated Dec 1968, states in paragraph 10-12: "VOR receivers and their associated indicators (e.g., ID-453) must be checked periodically for accuracy. The specific requirement for performing these checks is contained in Federal Air Regulations. There are several types of checks which can be performed to ensure equipment accuracy. In performing these checks, current data for designated station frequencies, specific VOR radials and station identification are contained in current navigational publications." The procedures for making the various VOR checks and their associated tolerances are found in the remainder of this chapter (TM 1-225, paragraph 10-13 through paragraph 10-18).

Page 10-21, TM 1-225, also contains the following warning: "Pertinent information for VOR receiver checks should be verified from current navigational publications and regulations. This information is subject to change." The publication mentioned would of course be the DOD FLIP publication. It also is interesting to note that the FAA has ruled that the VOR test circuit, AN/ARN-82, does not meet the intent of FAR 91.25.

P. R. Thompson
Directorate for Education and Prevention
USAAAVS

NAP-OF-THE-EARTH FLYING

NOE operations will present no additional risks if commanders properly supervise, control and authorize only approved areas for training

DURING THE Vietnam conflict, the helicopter proved to be one of the most important machines in the counterinsurgency environment, both in support of the ground soldier and as a highly effective weapons' platform. However, as our involvement in the Republic of Vietnam was closing, Army aviation began focusing its attention to that of a mid- to high-intensity combat environment. For Army aviation to be effective and survive in this type of environment, it must possess the capability to minimize the effect of advanced enemy defensive weapons, particularly in the vicinity of the forward edge of a battle area (FEBA). The regime of flight to obtain this capability is nap of the earth (NOE), which requires unique knowledges and skills in teamwork, flying and navigation.

Many individuals erroneously use the terms "nap-of-the-earth" and "low-level" navigation synonymously. Habitual NOE is used only to defeat or avoid a specific threat environment developed around an array of sophisticated air defense weapons. NOE is flight as close to the earth's surface as vegetation and obstacles will permit which generally follows the contours of the earth. Together with the mastering of current tactics and techniques, NOE flight which takes advantage of the terrain mask for cover and concealment can defeat the enemy air defense threat. Air speeds used in tactical NOE flight are influenced by the enemy situation, the terrain, weather and the ability of the crew to navigate and handle the helicopter. Helicopter operations near the FEBA will most often be from 0 to 60 knots. However, due to the tactical environment and situation and terrain familiarization, air speed may vary from zero to velocity never to exceed (Vne). It should be remembered that the main objective of tactical NOE is to remain undetected from both visual and electronic means and still accomplish the assigned mission. Aviators operating at high air speeds will very often find themselves inadvertently and unnecessarily exposed to enemy view The slower air speeds provide the

aviator the ability to "sneak and peek" and to move with forethought, thus allowing him time to make tactical decisions which will determine the success or failure of the combined arms team mission and his survivability.

Compared to NOE, low-level flight is conducted at selected altitudes at which detection or observation of the aircraft is avoided or minimized. The route is preselected and conforms generally to a straight line and a constant air speed and indicated altitude. This method is best adapted to flights conducted over extended distances or periods of time.

There has been much concern that attaining NOE proficiency will sacrifice safety for mission accomplishment. As the NOE flying program is relatively new, its impact on the Army aviation accident rate can only be predicted. The best method to determine this impact was to review past low-level type accident cause factors for a 30-month period. It was found that the majority of low-level accidents occurred under uncontrolled conditions and resulted from pilots violating published altitude regulations. Examples of other causes were pilot inattention and failure to maintain sufficient clearance from obstacles. Almost all of the accidents reviewed could have been prevented by proper command supervision. Using this accident experience as a basis for comparison, the U. S. Army Agency for Aviation Safety (USAAAVS) predicts that NOE will present no additional risk, *if commanders properly supervise, control and authorize only approved areas for NOE training.* Tests conducted by U. S. Army commands and agencies during the past 4 years and by the British, Canadians, French and Germans further substantiate that Army aviators with extensive formal NOE training can operate and survive in this low flight regime.

The U. S. Army Aviation School at Ft. Rucker, AL, has prepared an NOE Department of the Army training circular for individual and unit tactical training which is geared to a realistic combat environment. The circular will be available to the field in the near future. While the Army must conduct NOE training with the maximum amount of realism, it must, at the same time, conserve its aviation resources. USAAAVS, Ft. Rucker, AL, has responsibility for providing positive assistance to major commands and, as requested, to individual units in establishing their NOE programs.

For the new aviator, NOE training will begin at the training base. The philosophy of the mid-intensity environment, combat tactics and safety will be instilled in student aviators. Training will provide the student with the basic proficiency to operate aircraft NOE and to meet the range of inflight

emergencies that can occur close to the ground. Initial training is paced to each student, since individual levels of comprehension of the various aspects of training vary greatly.

Primarily, observation, utility and attack helicopter-equipped aviation units will conduct NOE training when required by their missions. There appears to be little requirement for administrative-type flight detachments to perform NOE missions. Cargo helicopter units primarily would be required to perform low-level/contour missions.

It is the commander's discretion to determine if his mission requires the unit to become NOE qualified, and which personnel will be trained. When deemed necessary, USAAAVS recommends that aviation-school NOE-qualified IPs be assigned to the unit prior to the start of training. Unit commanders should train previously rated aviators as well as extend the training of new aviators received from the training base in order to develop a high degree of individual proficiency in NOE operation.

Aviation skills learned during initial qualification training must not be allowed to deteriorate through inactivity. An annual requalification course has been designed to provide aviation unit commanders, regardless of their geographical location, a means for instilling confidence in their assigned personnel and for maintaining individual NOE flight proficiency. The requirements for this course are stipulated in the DA training circular.

When an aviator returns to an aviation assignment, he will receive sufficient flight refresher training to ensure he is currently proficient and otherwise qualified for operational flying. The conduct of refresher training is the responsibility of the gaining command unless the Department of the Army has specifically directed that this training be conducted otherwise. In accordance with AR 95-1, a minimum of 10 hours of refresher flight [NOE] training is recommended.

TRAINING ENVIRONMENT

There is much merit in ensuring that a training environment designed to develop a pilot's flying proficiency is equally matched with a realistic training environment that increases his tactical operational capability and success. However, the training environment also has a direct effect on the safety of NOE flying. Therefore, before NOE is initiated, commanders must establish and then use only approved areas for this training. The area must be selected based on the local geographic lay of the terrain, the number of aircraft to be used, aviator proficiency, location of populated or built-up areas, size of available area and safety conditions. The initial training areas recommended by USAAVNS should be 15 kilometers wide by 25 kilometers long, if possible. Terrain permitting, an area this size can accommodate training on about four routes. Flight routes should be selected so as to:

- Provide for an approximate

Lower altitudes require slower air speeds to increase aviator reaction time to avoid obstacles

2-hour flight period. A distance of 20,000 meters from the initial point to the FEBA is sufficient, allowing a total route distance of 40,000 meters.

• Provide a minimum distance of 1,000 meters between any two routes to be flown during the same flight period to compensate for aviator disorientation.

• Allow for a thorough map study and aerial reconnaissance.

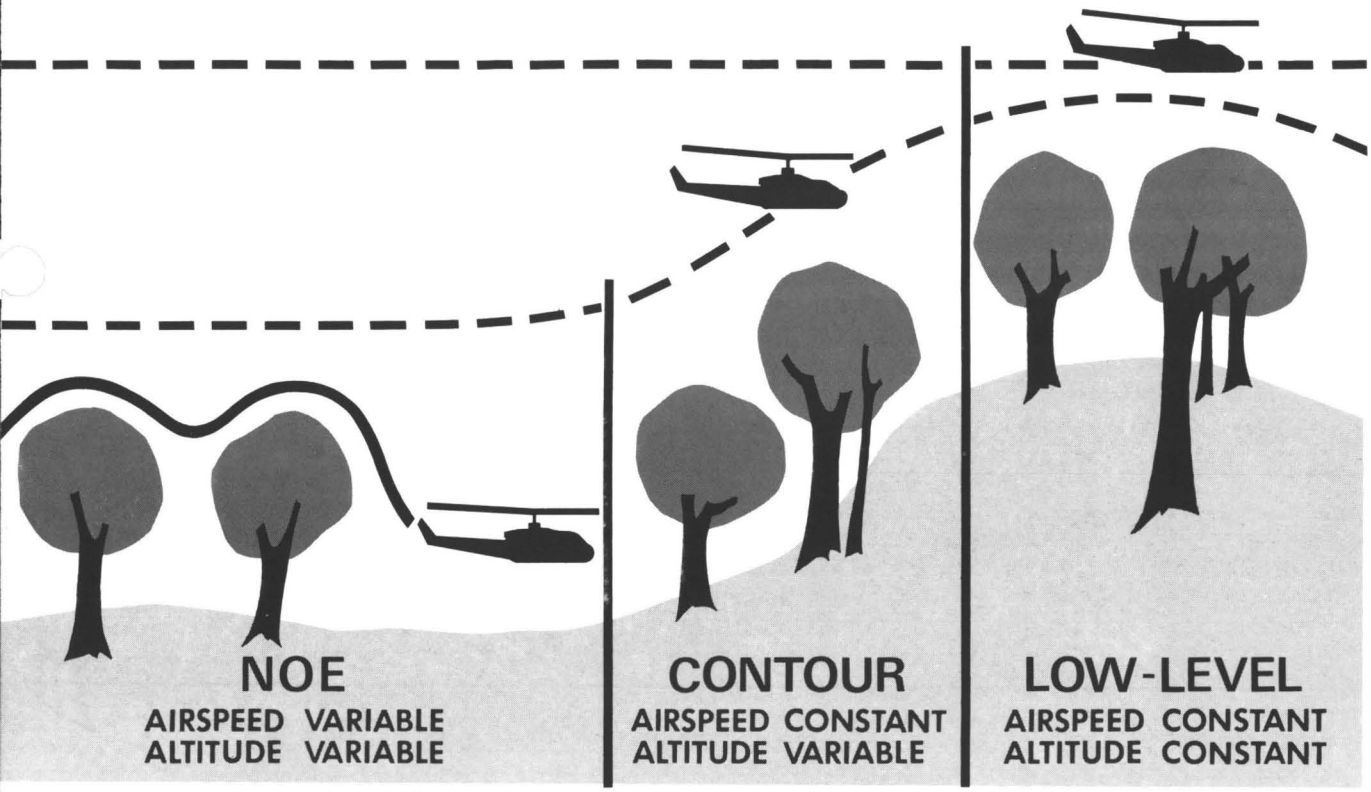
• Facilitate use of air control points.

• Instill in and test the aviator's fundamental knowledge and skills that are essential for mission accomplishment and survival in a mid- to high-intensity environment.

• Minimize the possibility of wire strikes.

After the training area has been established, special consideration must be given to marking obstacles in the area, especially wires, during the initial and early phases of training. A map will be prepared showing all routes and all hazards along the routes, and, in accordance with AR 95-1, the map will be posted in the briefing room and updated as required. Each pilot is held responsible for knowing the location of all wires in the training area.

(continued on page 42)



NOE: Flight as close to the earth's surface as vegetation or obstacles will permit, while generally following the contours of the earth. Air speed and altitude are varied as influenced by the terrain, weather and enemy situation. The pilot preplans a broad corridor of operation based on known terrain features which has a longitudinal axis pointing toward his objective. In flight, the pilot uses a weaving and devious route within his preplanned corridor while remaining oriented along his general axis of movement in order to take maximum advantage of the cover and concealment afforded by terrain, vegetation and manmade features. By gaining maximum cover and concealment from enemy detection, observation and fire power, nap-of-the-earth flight exploits surprise and allows for evasive actions. CONTOUR: Flight at low altitude conforming generally, and in close proximity, to the contours of the earth. This type flight takes advantage of available cover and concealment in order to avoid observation or detection of the aircraft and/or its points of departure and landing. It is characterized by a constant air speed and a varying altitude as vegetation and obstacles dictate. LOW LEVEL: Flight conducted at a selected altitude at which detection or observation of an aircraft is avoided or minimized. The route is preselected and conforms generally to a straight line and a constant air speed and indicated altitude. This method is best adapted to flights conducted over extended distances or periods of time.

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

Flight Jackets

Regarding your commentary pertaining to flight jackets in the March AVIATION DIGEST, *I fear our unrated brethren will use it to justify a requirement for Army aviators and other flight personnel to wear the field jacket, even for flight. Granted, all you say in the commentary is true, but you didn't conclude the flight jacket is the safest and only available item for wear for flight when the temperature so dictates. Further, you didn't indicate that the Nomex flight suit and flight jacket are authorized parts of a recognized uniform (although some don't want to recognize it as such) designed to protect the aviator AND ENABLE HIM TO PERFORM HIS FLIGHT DUTIES WITH A MINIMUM OF CLOTHING INTERFERENCE, a matter of safety for the aircrewman and passengers alike. Let's not allow nonrated personnel to dictate uniform composition which detrimentally affects our flight safety, but allow this uniform to be worn whenever the fatigue uniform is authorized or directed.—Senior Army aviator*

We agree that the bulky cotton field jacket is more likely to interfere with a pilot's flight duties than the flight jacket. We should not minimize the fact, however, that the man-made fiber content of the currently available flight jacket poses a definite hazard in the event of fire. No comparative studies have been made of the relative hazards of the non-fire-retardant nylon flight jacket and the non-fire-retardant cotton field jacket; such a study, however, is planned for the near future with an answer to be available in about 6 months. The advent of the Nomex flight jacket that combines flame resistance with freedom from interference will make a significant step toward our mutual goal of flight safety.

Flood Damage

One of my helicopters was submerged for several hours during a recent flood. Where can I find what actions should be accomplished to get this bird back flying?—Company commander

The information you need may be found in chapter 1, section V, Change 2 to TM 55-1500-204-25/1 (pages 1-38), which outlines procedures and disposition instructions.

Survival Radio

Where can I find the authorization for survival radios?—ASO

Check your TOE or TD, as applicable, for the authorized number of radios. If radios are not listed on your TOE/TD, you should initiate the necessary action to get them added to the TOE/TD.

Forecast Turbulence

Is there an Army regulation which prohibits a pilot from filing into forecast severe turbulence? If there is

no regulation prohibiting it, then what are some reasons for not filing into severe turbulence?—CWO, ASO

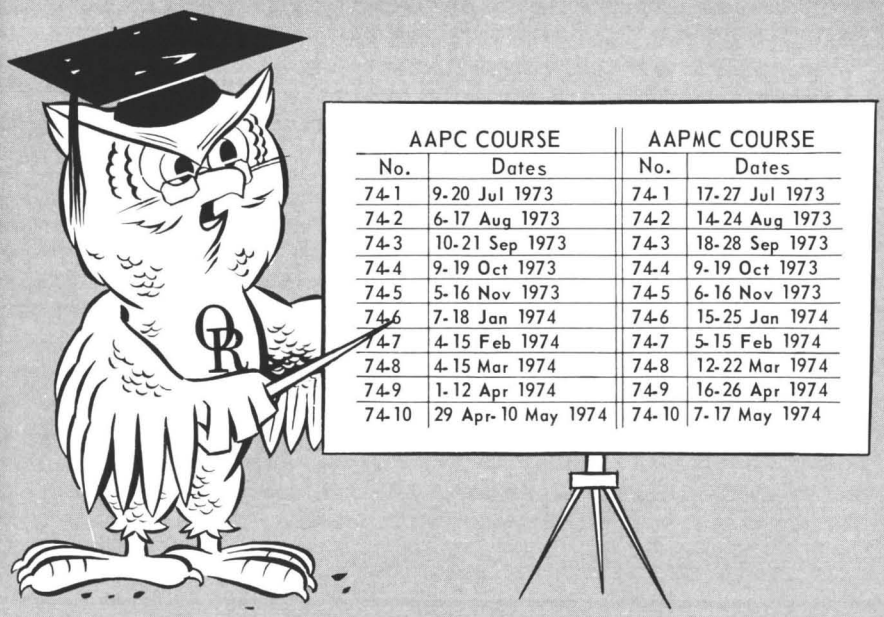
There is no Army regulation prohibiting flight into known severe turbulence, but neither is there a regulation prohibiting upside down flight in a helicopter, and both of these practices fall into the same category—extreme foolhardiness. You will find many reasons for avoiding turbulence spelled out in "Unruly Weather Sense," February 1973 AVIATION DIGEST, the most important being that you usually don't walk away from an aircraft accident caused by turbulence or any other type of weather.

Environmental Study

The engineers are going to build us a new heliport; however, before they will begin construction they require an environmental study. Who does these studies, and how can I get one done for our facility?—National Guard commander

DCSLOG Environmental Services, Washington, DC, should be able to tell you how to get this done. Write them through your command channels.

USAAAVS Accident Prevention Courses Scheduled Through FY 74



AAPC COURSE		AAPMC COURSE	
No.	Dates	No.	Dates
74-1	9-20 Jul 1973	74-1	17-27 Jul 1973
74-2	6-17 Aug 1973	74-2	14-24 Aug 1973
74-3	10-21 Sep 1973	74-3	18-28 Sep 1973
74-4	9-19 Oct 1973	74-4	9-19 Oct 1973
74-5	5-16 Nov 1973	74-5	6-16 Nov 1973
74-6	7-18 Jan 1974	74-6	15-25 Jan 1974
74-7	4-15 Feb 1974	74-7	5-15 Feb 1974
74-8	4-15 Mar 1974	74-8	12-22 Mar 1974
74-9	1-12 Apr 1974	74-9	16-26 Apr 1974
74-10	29 Apr-10 May 1974	74-10	7-17 May 1974

Aviation Accident Prevention Course (AAPC)

The AAPC is conducted by USAAAVS at Ft. Rucker, AL, and is designed primarily for personnel who will serve or are serving as aviation safety officers in company/detachment-size units and for personnel in responsible positions. Officers, warrant officers, or professional civilians may attend. Two weeks in duration, classes start on Monday and continue through Friday of the next week. Those who are interested should see their local school officers.

Aviation Accident Prevention Management Course (AAPMC)

The AAPMC for noncommissioned officers and specialists, grade E-6 or higher, will continue through FY 1974 under the direction of USAAAVS, at Ft. Rucker. Currently one week long, the course will be expanded in July 1973 to two weeks in response to the many student comments that additional time should be made available for more comprehensive treatment of the course materials. Classes will start on Tuesday and close at noon on Friday of the following week. Individuals interested in attending this course should get in contact with their local school officers.

During the period 1 January 1967 through 1 June 1971, USAAAVS records show 50 cases involving OH-6A and OH-58A helicopters in which battery problems contributed to aircraft mishaps

THERMAL RUNAWAY

YOU ARE late for work. As you race to the car, the hot early morning sun tells you that the 2-week-long heat wave may linger another week. Giving devout thanks for auto airconditioning, you jump in the car, fasten your seat belt, turn the key and wait for the soothing purr of a started engine. Nothing happens. The awful truth hits you—you haven't checked the water in your battery since hot weather began. It's dead, and you've locked yourself out of the house.

You think this battery problem can ruin your whole day? Take comfort. There are things worse. You could be flying a low-level reconnaissance mission in an OH-6A or OH-58A "over heavily forested terrain" (that's accident investigation board talk for, "There wasn't any place within a mile to put it on the ground") when the nickel-cadmium battery catches fire. The next few minutes will make a good war story if you are around to tell it. You might even entitle it "Thermal Runaway."

It wasn't just happenstance that we chose the OH-6A and OH-58A for our story. During the period 1 January 1967 through 1 June 1971, USAAAVS records show 50 cases involving these helicopters in which battery problems contributed to aircraft mishaps. Battery burn-ups, explosions, spills, corrosion and heat—all major problems associated with the present battery, its installation and its components (case, connectors, vents, airframe grounding, etc.)—have been cause factors in aircraft mishaps and fires. Deficiencies range from aircraft design limitations (space availability in the OH-6A and venting problems in the OH-58A) to inadequate design of the battery and related components. Nickel-cadmium battery problems exist in other Army aircraft; however, they are not being addressed in this article.

Since June 1971, the nickel-cadmium battery used in the Army's observation helicopters has been modified several times with some resultant improvement in the failure rate. Two important modifications were a redesigned battery case and a new intercell connector. Despite these changes, battery failures continue. There is still a high unscheduled removal rate for observation helicopter batteries.

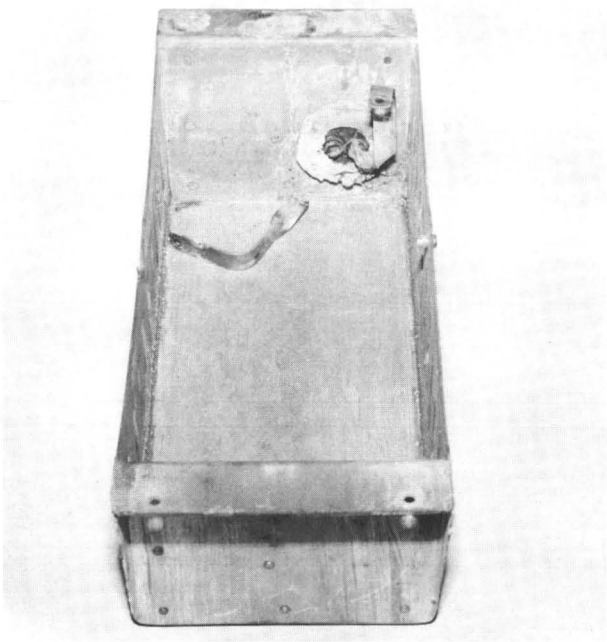
This is where the maintenance man and, to some extent, the pilot come in. Many nickel-cadmium battery failures could be avoided if the mechanic and operator were more familiar with the peculiarities of the battery and worked around them.

Let's look at the design of the battery and discuss

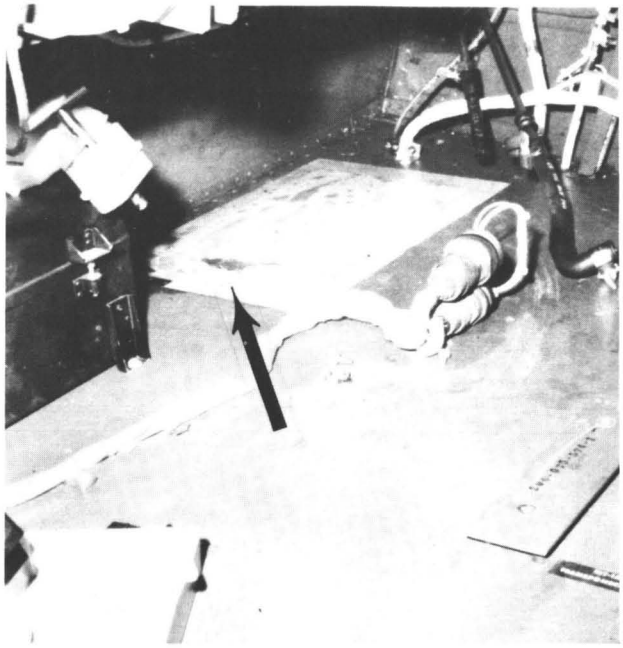
William P. Christian
Directorate for Aircraft Accident Analysis and Investigation

Gene Berta
Directorate for Education and Prevention
USAAAVS

Battery case removed from OH-6 after approximately 100 flight hours shows heavy corrosion and separation of two-pronged connections



Arrow points to corrosion of deck area of OH-58 due to spilled electrolyte that could not exit through vent lines

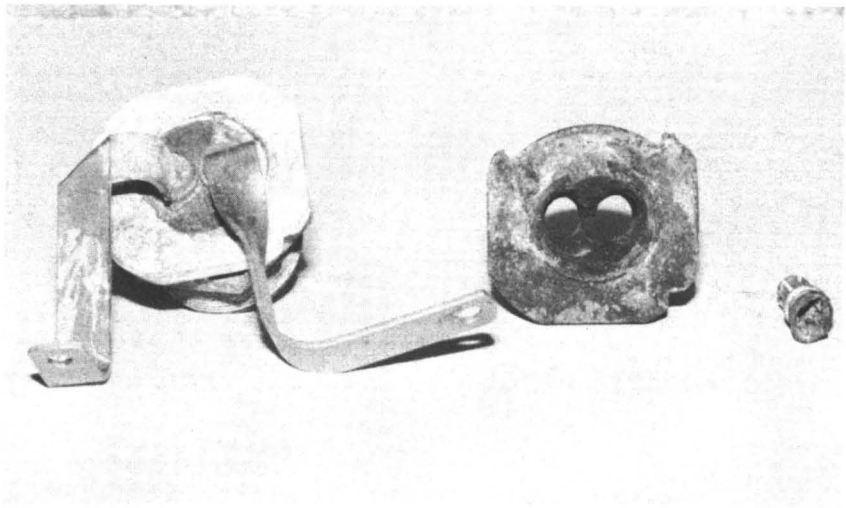


what we as mechanics and operators can do to avoid the conditions that lead to battery fires and failure.

Nickel-cadmium batteries, as a result of their low internal impedance, deliver extremely high discharge currents for their size and weight when compared with lead-acid batteries. (For this reason they are worth a little "TLC" on our part.) The battery consists of a series of cells in individual cases joined together by means of intercell connectors. The cells are built with a multiplicity of positive and negative plates interleaved with separators and are in a solution of potassium hydroxide, commonly referred to as "electrolyte." The positive and negative terminals of each cell are usually bolted to the intercell connectors. The battery of cells is brought out to a terminal that mates with the aircraft or system bus and is connected through a starting relay to the engine starter. Looseness of the battery intercell connectors generally creates a shorting condition that results in battery fire. These intercell connectors can be checked only by retorquing during scheduled maintenance (discussed later).

An increasing frequency of high rate usage of the nickel-cadmium battery, coupled with uncertainties in voltage regulation and maintenance procedures, also appears to have escalated the unscheduled removal rate of the battery. Heat generated by several different sources both inside and outside the battery seems to be a primary cause. Whether by accident or design, most nickel-cadmium aircraft batteries are exposed to relatively high degrees of heat at some period of their service life, and this exposure may sharply curtail that life. Unfortunately, most battery locations and cases are not properly ventilated to provide adequate cooling for nickel-cadmium batteries.

Repeated engine starts can raise the electrolyte temperature of a battery more than 100 degrees F. above ambient if many starts occur within a short time and the battery is not sufficiently cooled between starts. Such temperature increases damage the gas barrier portion of the cell plate separator. If this barrier is damaged, the oxygen generated during subsequent charging on a constant-voltage DC generator migrates to the negative electrode, combines with the charged cadmium and causes more heat. The



Cannon plug connector from OH-6A battery case shorted and burned

results are a rise in current that also raises battery temperature while battery resistance and voltage drop. This condition progressively increases the charging rate and heat to the point that the heat destroys the separator in a cell (or cells) and ultimately destroys the battery. This phenomenon, which is usually observed during constant potential charging, is called "thermal runaway."

Problems also arise when the level of electrolyte in the cells is allowed to get too low. The battery cells lose electrolyte by evaporation and dissociation. (Dissociation is defined as the process by which a chemical combination breaks up into simpler constituents.) Because evaporation is a very slow process as a result of low electrolyte vapor transmission, dissociation during overcharge accounts for most electrolyte loss. On an aircraft operating with a DC bus, the bus voltage maintained by the generator is reasonably constant. The charging current is a function of the difference between the battery electromotive force and the bus potential. The electromotive force required to charge a battery system is high at sub-zero temperatures and drops with increasing temperatures. At high temperatures, it is much lower than the bus voltage, resulting in large amounts of overcharge current and much electrolyte dissociation. At very low temperatures there may not be enough voltage difference even to charge the battery.

Battery overheating and failure also can be the result of a voltage regulator set for cold temperature operation and allowed to operate at this setting in a high ambient temperature. This would bring about an increase in charge current and a rise in battery temperature. A faulty regulator might yield an increase in charge voltage/current and a rise in temperature, especially dangerous in the overcharge region. Also charging a battery immediately after an aborted engine start or any high current discharge could create a dangerously hot environment.

In view of the preceding, the following cause factors appear to be involved, either individually or collectively, in battery overheating and failure problems:

a. High initial inrush charging currents as in the case of an aborted engine start, frequent, prolonged engine starts creating very high discharge rates, and starts imposed upon an already hot battery.

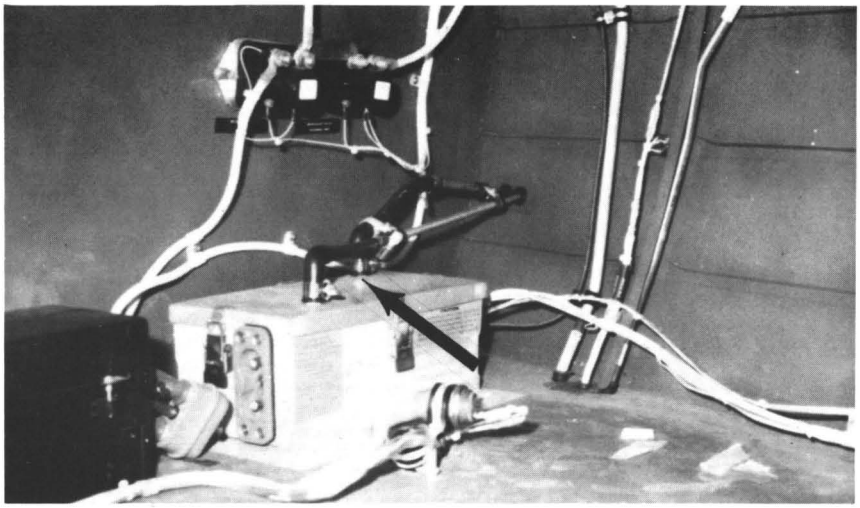
b. Aircraft voltage regulator set too high for ambient temperatures or operating in an uncontrolled fluctuating condition.

c. Loose intercell connections.

d. Low level of electrolyte in the battery cells.

e. Poor or no ventilation of battery or battery compartment.

The preventive maintenance duties assigned to the operator and organizational repairman for correcting



High temperatures, plugged filler cap vents and failure to service and maintain the battery as specified in the technical manuals have contributed to the present nickel-cadmium battery problems

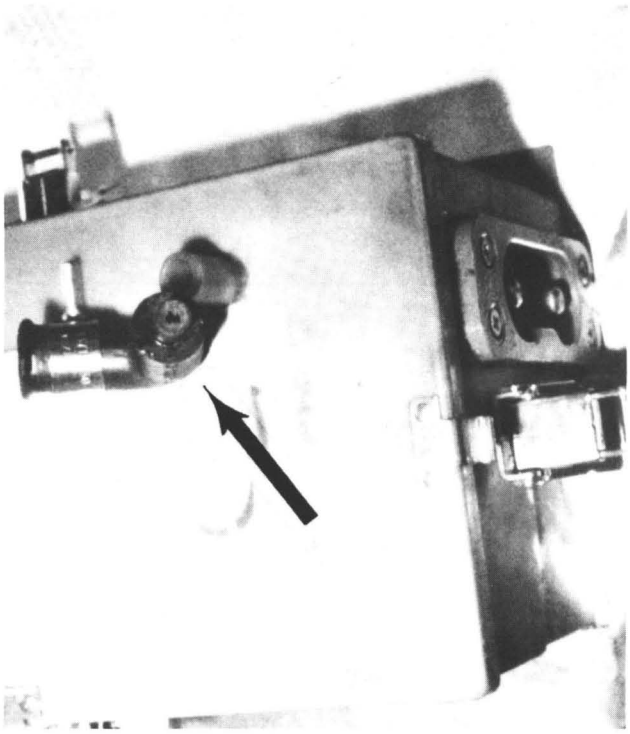
these problems and for properly maintaining nickel-cadmium batteries are contained in aircraft operator and maintenance manuals and in TM 11-6140-203-15-1 and -2.

To prevent battery overheat and failure, the operator must avoid frequent or prolonged starts (allowing the battery sufficient time to cool between starts) and then complete the starting and runup procedures in strict accordance with operator manual instructions. Starting an aircraft without an APU should not be regarded as routine procedure. The operator should monitor battery current with his ammeter. In normal operation, the charge rate should decrease progressively as the charge continues. Any reversal in this trend such as a continuous rise in current should be investigated as the possible start of a condition leading to battery failure and possible fire.

An understanding of the following preventive maintenance and services will considerably improve your preflight and operational checks. Organizational preventive maintenance and service are required *weekly* or *every 25 flight hours* (whichever shall occur first) and *120 days or every 100 flight hours* (whichever shall occur first).

In summation, we know from actual operating service experience that high temperatures, plugged filler cap vents, failure to service and maintain the battery in accordance with TM 11-6140-203-15-1

Above photo shows OH-58A battery installation. Arrows point to neck of vent line found plugged from a combination of spilled electrolyte and dirt accumulation



During the weekly or 25-flight-hour checks:

- Check to see that the battery is clean, dry and free of white deposits which are formed as expelled electrolyte reacts with carbon dioxide.
- Inspect exterior for damage and loose or missing filler caps and hardware.
- Inspect top of cells for cracks and signs of electrolyte leakage.
- Inspect electrolyte level of each cell (remove battery from aircraft, if necessary, to inspect electrolyte level). If the electrolyte level of any cell is less than one-fourth inch above the top of the cell plates, remove the battery from the aircraft to adjust electrolyte level.

During the 120-day or 100-flight-hour check:

- Check the condition of the battery in accordance with procedures contained in paragraph 4-13 of the dash 2.
- Clean the installation area before installing a serviceable battery in the aircraft, using procedures outlined in paragraph 4-8 of TM 11-6140-203-15-2.

TM 11-6140-203-15-1 and -2 spell out the proper procedure for charging nickel-cadmium batteries. In addition remember:

- Never add electrolyte to your nickel-cadmium battery while it is in the aircraft.
- If the battery is in a low or discharged state, don't add electrolyte. Wait until the battery reaches full charge. Use multimeter (one type is TS-352B/U) at organizational maintenance level to check battery charge.
- Do not allow the battery vent valve in the filler cap to become clogged. The cell can rupture from gas expansion.

and -2, and failure to adjust the voltage regulator as specified in the aircraft maintenance manual have all contributed to the present nickel-cadmium battery problems. We are forced to conclude that if we take strict control measures to ensure that nickel-cadmium batteries are maintained and serviced as specified in applicable technical manuals, then we can avoid most nickel-cadmium battery fires and failures. And perhaps the "thermal runaway" stories will be merely a relic of days before then.

When Is A Torque Wrench ...

Like A Hand Grenade?

WHEN IT'S...

MISUSED

NOE FLYING

(continued from page 33)

At a minimum, prior to each day's training flight in the NOE area, one wire reconnaissance will be made. Then, during flight, the pilot and navigator will orally identify all wires—an excellent way to continually remind themselves of the wire danger.

Wire strikes cannot be overemphasized as they have been and are a significant hazard to Army aviation. A high percentage of wire strikes occur as a result of low-level operations which are not required by the mission. In addition, violation of regulations and/or unit SOPs concerning low-level flight and the conduct of training in unfamiliar areas are major causes of wire strikes.

Habitual NOE flight is used only to defeat or avoid a specific threat environment developed around sophisticated air defense weapons

During the Southeast Asia involvement, a majority of the wire strikes occurred during *administrative type missions* in relatively secure areas, pointing to the pressing need for command action to eliminate risks not essential to mission accomplishment. On the other hand, wire strikes were not a major problem during low-level *combat missions* in this same area. In Europe, as we all know, wires will be a definite hazard to NOE flight and the ability to operate effectively within this environment must be developed.

Attempts to provide the aviator with a reliable means of detecting and/or coping with wires have been and are continuing to be made by the U. S. Army Electronics Command. Wirecutting devices and radar and laser detector systems are being studied. However, the availability of such systems is not foreseeable in the near future. Presently, the best means of coping with wires during low-level operations are the detection and avoidance of wires by well-trained aviators, who know the relationship between air speed, wire detection and avoidance. Since most wire strikes occur at cruise or high speeds, slower air speeds in worldwide unreconned areas must be emphasized.

After the training area has been established, special consideration must be given to marking obstacles, especially wires, during initial phases of training

In addition to the wires, trees, birds and other aircraft are hazards with which crewmembers must cope. Helicopters are particularly vulnerable to blade strikes when operating in confined areas and aviators must be extra careful when using trees for masking and unmasking maneuvers. A majority of past blade strike mishaps have been caused by lack of crewmembers to maintain adequate clearance of the aircraft during confined area operations. To guard against personal injury from tree branches or birds striking and shattering the plexiglass, crewmembers must wear their clear visors down at all times.

At least one rotary wing command and control (C&C) aircraft must be available per four NOE aircraft to flight follow and control *each aircraft* and to establish a simulated tactical situation necessary for realistic training. Also, the C&C aircraft crew monitors the progress of NOE training and acts as focal point for mishaps, should they occur. To maintain safe separation between each training aircraft and to follow each aircraft along the mapped route, NOE pilots must report their positions to the C&C aircraft every 20 minutes, at initial and rendezvous points, at phase lines every 15 minutes, and anytime they stray off course.

The C&C pilot, who also must be NOE IP-rated, must know the position of each NOE aircraft at all times, follow the NOE flight to and from the training area, monitor each aircraft's fuel situation, report any unanticipated hazards, such as stray aircraft, inclement weather, etc., to the NOE crew, and monitor and answer any tactical calls from the NOE aircraft.

In providing realism to the training, the C&C aircraft acts as the combined arms teams' higher and adjacent headquarters in creating suitable tactical situations. During simulated situations, the NOE pilot is required to perform a mission with limited communications. However, a rendezvous point in the training area must be preselected in case radio contact is lost, thus eliminating the possibility of an unnecessary radio search or an air search by the C&C.

During initial training, the student commonly becomes disoriented and wanders off course. When the training area contains

a simultaneous given number of routes, coordination with the NOE aircraft is a vitally important safety aspect. When the Germans first established their training routes, they used a series of circular courses and little thought was given to the coordination of route usage until two training aircraft, traveling in different directions on the same circular course, collided.

There will be a tendency for many people to try to observe NOE training as this is a high interest item. This leads to serious problems of aircraft control and congestion, and there have been near misses as a result of observer aircraft becoming intermingled with training aircraft. To eliminate this risk, all aircraft other than the C&C must be restricted from the training area. A good, high mountain observation post would satisfy this requirement.

To eliminate the risk of midair collisions, all observer aircraft, other than the C&C ship, must be restricted from the training area

A crash-rescue team should be on the scene should an accident occur and the crewmembers are trapped inside the aircraft or are physically unable to exit without outside help. As NOE training routes are generally located within confined areas, entry to a crash scene by a ground vehicle may be impossible. Because of the time element required for a stand-by crash-rescue team or an on-call medevac to reach the area, USAAAVS recommends that a minimum of two highly trained specialists be aboard the C&C aircraft at all times. The installation commander must ensure that the crash-rescue team is properly dressed and equipped and proficient in fire suppression, forced entry of aircraft, rescue and removal of crewmembers, first-aid medical treatment and evacuation of injured to medical facilities. This can be accomplished through a complete and fully coordinated training program.

A hazard identification map showing all obstacles along the training routes will be posted in the briefing room and updated daily

MACHINE

Maintenance is another area that is of utmost importance and demands special emphasis. Because of the low altitude used during NOE flights, there is absolutely no margin for maintenance error. Like a professional athlete, the aircraft must be constantly maintained in peak condition to ensure reliability. Maintenance personnel must perform by-the-book inspections and take necessary and prompt action to correct any problems encountered. Prior to the beginning of the training program, maintenance personnel also should be briefed on the special requirements to be completed by flight line personnel, to include daily inspections of the rotor blades, bottom fuselage, tail boom and tail rotor for tree strike damage.

Good maintenance, however, is not the sole responsibility of maintenance personnel. To aid in alleviating maintenance problems, an intensive training program for aviators would increase their knowledge as to why certain components are checked during preflight, runup, shutdown and postflight and what the consequences would be if a component fails to function properly during flight.

The aircraft maintenance concept is based on correcting minute shortcomings before they have a chance to develop into major deficiencies. This is where the checklist serves its valuable purpose in detecting problems and preventing accidents. The pilot must ensure that thorough call-out procedures are performed by the checklist.

Aviators must ensure that any deficiency discovered during inspection is entered and accurately described on DA Form 2408-13, the invaluable tool for all maintenance personnel.

Commanders must select the best aircraft available for NOE, both from a structural and mechanical standpoint, and ensure that sufficient time is allowed for the aircraft to be continually maintained in the best possible condition. Using aircraft which have a past history of maintenance problems, particularly with the engine, transmission or communication equipment, is asking for trouble. Problems of this type occurring at a critical point during low altitude flight could cause a serious situation. Windscreens are another area of concern and must be cleaned prior to each flight to avoid any obstruction to visibility. Aircraft with scratches on wind-

screens which are normally accepted for daylight flight only are unacceptable for NOE. Other requirements for NOE aircraft are that they be equipped with crashworthy fuel systems and armored seats and that the UH-1 have the student's jump seat centered behind the pilot's and copilot's seats.

During the Vietnam conflict, a majority of accidents and personnel injuries was attributed to loss of rpm from overloading the aircraft for the prevailing atmospheric conditions, power available or type of terrain. It is imperative that this unsafe practice be avoided during NOE operations. Aviators must know the performance capabilities and limitations of their aircraft under all conditions; must plan their missions correctly, employing the dash 10 performance charts; and must adhere to the go/no-go takeoff data placarded in the aircraft. Particular attention must be given to ordnance and fuel loads when hovering out of ground effect (OGE). The best insurance for avoiding overgross weight conditions is knowledge of the factors affecting helicopter performance, which are load, power available, prevailing atmospheric conditions and type of terrain.

During training, the aviator will not only be taught the maneuvers in the contact and tactics phase, but all maneuvers conducted in a manner differing from the current standardization guide when operating in the low altitude flight regime. Aviators must be familiar with the dash 10 emergency procedures and how they differ for NOE operation to successfully cope with an inflight malfunction or failure.

Unit SOPs must establish specific flight altitudes to and from the NOE training area

Navigation is one of the most critical requirements of NOE flight and is the key to safe and successful operation

MAN

Navigation, the most critical requirement of NOE, is the key to safe and successful operation. The crew must be able to navigate precisely and to know the location of their aircraft within 100 meters at all times along any segment of the flight route. This can be accomplished only by intensive training in navigation techniques (comprehensive flight planning, accurate dead reckoning and/or pilotage, and extensive use of checkpoints), mapreading and accurate interpretation, and teamwork between pilot and navigator/observer. The pilot must concentrate on clearing obstacles and maintaining proper heading and air speed, so he must be free for flying outside the cockpit at all times. The pilot must be able to handle the aircraft with ease and finesse and use only sure, smooth and coordinated control movements during all maneuvers. On the other hand, the navigator/observer must monitor the engine, transmission and other instruments in addition to navigating. He must remain oriented at all times and inform the pilot of the headings to be flown and the time to the next checkpoint. When time permits, he describes the next checkpoint so the aviator may assist in identifying the checkpoint. If an aviator should become disoriented, he should stop, reorient himself, return to the last checkpoint, if necessary, replan and begin again.

Based on experiments of navigation systems by U. S. Army agencies and the Canadians, it was concluded that maps are the best method of navigation. While navigation systems prevented gross errors which were sometimes experienced using the pilot/map method, small errors in location at NOE altitudes left the pilot just as disoriented as occasional gross errors using the hand-held map. So until something better is available, individual navigation skill must be worked on and improved.

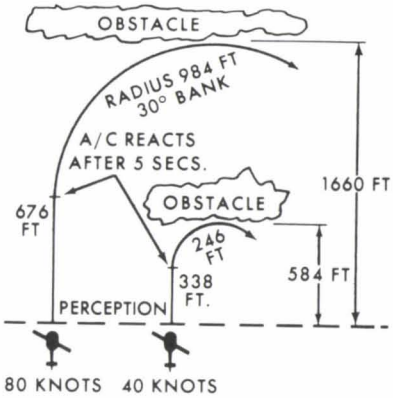


Figure 1

Prior to the mission, the pilot/navigator team should memorize the layout of the flight route and of the countryside to avoid study of the map for long periods of time during flight. The team must develop an intimate acquaintance with obstacles along the flight route, as faulty division of attention causes confusion and leads to

error. Once an individual has developed expertise in mapreading, he will be able to anticipate obstacles in the training area well in advance.

Also, while navigating, the aviator must demonstrate his ability to fly a segment of the NOE flight route and perform all normal functions as pilot in command while restricted by the M-24 CBR protective mask. While the time duration for wearing the mask is optional, it should be of sufficient length to prove challenging to the pilot.

NOE should be flown *only* when required. A reasonable minimum altitude for carrying out a tactical mission depends on the mission itself. Such factors as reduced visibility, height of obstacles in the flight path, nature of the terrain, and turbulent winds close to the earth's surface can further compound the problem of navigation. During flight, altitudes will vary according to the maneuvers being performed. For instance, during masking maneuvers, altitudes will vary according to the terrain features that are being used to mask the helicopter. Take for example a firing position from a hill 500 feet above ground level. NOE flight to the firing position would not be necessary to remain masked from enemy detection. Another instance when aircraft should remain at altitude is when going to or departing the training area. There have been several reported blade strike mishaps during training due to this type of unnecessary NOE flight. This problem can be eliminated if specific flight altitudes are established in unit SOPs for flights to and from authorized NOE training areas.

Commanders must select the best aircraft available for NOE flight and ensure that sufficient time is allowed for error-free maintenance

Any time visibility is reduced because of sun, haze, drizzle, fog, snow, etc., altitude either must be increased or air speed must be reduced to increase aviator reaction time to avoid obstacles along the flight route. Flight into the sun is particularly tricky, and attempts should be made to avoid this situation. This is extremely important during NOE flying because of the aviator's decreased area of view at lower altitudes. In a combat situation, however, it would not always be possible to increase altitude without being detected by the enemy, so in this case air speed would have to be reduced.

From a safety standpoint, it is imperative that aviators understand the relationship between forward speed and existing forward visibility as shown in figure 1. This figure is based on the assumption that it takes about 5 seconds to perceive, to make a decision and to start a corrective action. The forward distance traveled during these 5 seconds under no-wind conditions is a function of true air speed and is shown by the straight line on the lower portion of the graph. At 80 knots, the aircraft's forward displacement in 5 seconds is 676 feet.

Assuming that the evasive maneuver consists of a coordinated turn, it is obvious that the first 90 degrees of this turn will bring the aircraft closer to the obstacle over a distance equal to the radius of the turn. For reference purposes, a bank angle of 30 degrees is used as a standard. At 80 knots, this would produce a turn radius of 984 feet (and a rate of turn of about 8 degrees per second). Therefore, the total displacement of the aircraft towards the obstacle, from the moment of perception until the completion of a 90-degree turn, would be 676 + 984 = 1,660 feet. With a given visibility of 1,000 feet, your problem is simply the lack of 660 feet in which to maneuver and a collision is inevitable.

If air speed is reduced to 40 knots with the same 1,000-foot visibility, the total displacement would be 338 + .246 = 584 feet, allowing an approximate 400-foot visibility margin and a 6-second time margin.

During all phases of NOE operation, there must be absolute crew coordination. The pilot and navigator each must be familiar with his position and its responsibilities and with all the aspects of the assigned mission. Also, crewmembers must constantly be on the lookout for any obstacles in order to maintain enough distance from and above hazards to avoid blade strikes or collisions. However, crew coordination is not necessarily limited to actions alone. Misunderstandings and communication gaps in the cockpit have been and will continue to be responsible for mishaps unless each individual is aware of what causes and prevents them. For example, a UH-1H major accident occurred when the copilot failed to take control of the aircraft when he thought he heard the pilot say, "You have it." On the other hand, the pilot failed to ensure that the

copilot had assumed control of the aircraft when he thought he heard the copilot say, "I have it."

In another mishap, one of the cause factors was a gap in radio communications which were inadequate because a combination of low and high VHF transceivers prevented optimum communications between aircraft. With no communications with the flight leader who was aware of the environmental hazards, the pilot flew the aircraft into wires and was fatally injured. Several other mishaps have occurred under similar circumstances. Therefore, it will be necessary for all aviation personnel to improve their knowledge and practice in the art of communication and to coordinate their use of terminology prior to each flight.

Aircraft should fly no lower than is absolutely essential to obtain the necessary ground cover and terrain mask

Another safety aspect that commanders must consider is that NOE flight is more fatiguing than flight at altitude because of the demanding tasks required of the aviator. He must think more by himself, make his own radio calls, fly his own aircraft and make his own decisions. The effects of fatigue result in deterioration of aviator performance and efficiency, causing distorted judgment, poor coordination and slowed reaction time. So to successfully and safely accomplish necessary tasks during NOE flight, the aviator must be both physically and emotionally fit.

Fatigue is a difficult problem to cope with because it cannot be measured. It can only be averted by recognizing and controlling the physical, emotional and self-imposed stresses that produce fatigue. A few of the common stresses are prolonged flight; temperature extremes and weather; confinement, constraint and design of cockpit and aircraft characteristics; colds; flicker vertigo; daily problems; daydreaming; poor eating habits and overweight; moonlighting; alcohol indulgence; use of drugs; and lack of physical activity. Some of the ways to avert, or at least to minimize fatigue in both the training and combat environment, are:

- *Establish training flight time limitation and crew rest periods.*
- *Recognize tolerance to stress.*
- *Establish crew requirements for two qualified pilots or one pilot and a qualified observer/navigator.*
- *Encourage good physical conditioning.*
- *Ensure adequate training.*

OTHER SAFETY REQUIREMENTS AND CONSIDERATIONS

- NOE flying will be conducted only in areas designated for NOE flight by installation commanders having Flight Standardization Boards. Spur-of-the-moment NOE flight is prohibited.
- Neither troops nor passengers will be transported on board the helicopter during initial NOE training and crewmembers are limited to IP, pilot and navigator. A flight evaluator may be aboard when required.
- NOE aircraft are operated in the same flight area that is encountered during takeoff and landing; therefore, smoking is prohibited at NOE altitudes.
- During individual and unit training, all personnel, to include the crew and passengers, will be seated and restrained by a seat belt when flying nap-of-the-earth, contour or low level.

It is imperative that we do not experience a high loss in either aircraft or aviation personnel during training and that our aviators are well qualified in their techniques. The aviator who is not well trained, psychologically prepared or properly supervised should not be flying NOE, as evidenced by the following accident case history.

ACCIDENT

Three UH-1H pilots were performing a low-level tactical training mission in loose trail forma-

tion. The mission called for lifting a platoon into a lagger area, using NOE flight techniques. Prior to flight, the crewmembers were briefed and the pilots updated their maps. The three 4-man crews then flew to the first lagger position and landed. The pilot of the number two aircraft picked up eight passengers and 753 pounds of baggage and equipment, and then took off with 900 pounds of fuel and a total of 12 persons aboard. He proceeded low level, below the treetops when possible, to a rendezvous point with the gunships for the insertion. Arriving early, the pilots proceeded to orbit below treetop level as much as possible while awaiting the arrival of the gunships.

Maintaining flight at approximately 50 feet AGL and 70 to 80 knots, the aircraft entered a valley, heading approximately perpendicular to a treeline. The number two aircraft was about 7 to 10 rotor discs behind and slightly to the right of the lead aircraft when the lead pilot broke to the right to avoid the trees and did not call his break, although radio silence had not been imposed. The number two aircraft slid slightly lower than the lead aircraft and attempted to break to the right. The pilot then began a very tight turn (45 to 60 degrees of bank), but saw that he could not clear the treeline at his present altitude and rate of turn. He then applied aft cyclic and increased collective pitch to climb over the trees.

Map memorization and visualizing how terrain/checkpoints will appear is the key to successful navigation

The aircraft shuddered and, with the nose tucked down to the right, began to settle. Realizing that impact was inevitable, the pilot attempted to level the aircraft, but it struck the ground slightly nose high on its right side, collapsing the front cross tube and breaking the tail boom. The aircraft rolled over several times before coming to rest inverted. The crewchief who was wearing only a monkey strap and one of the passengers who was not wearing a lap belt were thrown from the aircraft and fatally injured. Seven of the eight passengers sustained major injuries and the pilot and copilot had minor injuries. The aircraft was destroyed.

The accident investigation disclosed that both crew and supervisory error were prevalent in more than one instance. It was found that:

- The pilot flew the aircraft into a situation beyond his ability. He was a recent flight school graduate and had only 31 hours of flight time since graduation.
- Pilots did not appreciate the need for proper rest before a mission.
- The most inexperienced aviator in the platoon was flying with the platoon leader whose attention was centered on the activities of the entire operation, particularly mapreading, and not on supervising the pilot. Not only did the platoon leader overestimate his ability to supervise the operation and train a new aviator, but also overestimated the pilot's abilities.
- The aircraft was flown below treetop level at excessive speed and weight. It was found that there was no unit SOP defining low-level flight parameters of air speed, altitude and gross weight.
- The platoon leader elected to combine navigation and pilot training with a low-level tactical training mission. Transporting the passengers during this training mission was in direct violation of AR 95-1.
- The passengers were not properly restrained because the air crew disregarded safety procedures.

The investigation board stated:

"Crew error in this accident can only be considered the direct result of inadequate guidance and supervision on the part of the platoon leader, operations officer and troop commander. This tactical low-level mission was permitted to be flown by an inexperienced pilot in an aircraft operating at high gross weight, transporting eight passengers with baggage, and with the more experienced copilot (platoon leader) not directly supervising the flight. Both crewmembers had only a maximum of 3½ hours of sleep the night before the accident.

"This accident occurred when the aircraft was placed in a bank angle that exceeded both pilot and aircraft capabilities for the aircraft weight configuration at the time. The situation was further aggravated when the pilot applied collective and aft cyclic in an attempt to recover which only placed additional loads on an already overloaded rotor system."

This case history strongly indicates the need for positive command supervision which is a must if we are to eliminate the risk of accidents during NOE operations.

With a well-organized and planned training program and proper supervision and control, the desired results of NOE operation can be obtained without jeopardizing safety or mission accomplishment.

USAASO Sez

The U. S. Army Aeronautical Services Office discusses

CTO certificates

Current SOPs

Say It Again, Sam: Recently there was an article in a local paper about a Japanese soldier being holed up somewhere in the hills of Guam. He hadn't heard that the war had ended and was still hanging in there. It seems we have a similar situation with the conversion of the AFCS Form 7 to Federal Aviation Administration (FAA) control tower operators (CTOs). The deadline on this conversion was October 1971 yet the FAA is still receiving requests to exchange Form 7s for CTO certificates. The only course of action open to anyone still holding a Form 7 and desiring a FAA CTO certificate is to retake and pass the written test for the FAA CTO certificate.

Generally, military CTO examiners are the first to greet these controllers who come down from the hills still clutching their Form 7s and their initial sage advice is to obtain a CTO Study Guide. This is an excellent idea, particularly if the Form 7 possessor has a friend who has purchased that guide—alas, without friends it is only available from the FAA—for $10.31.

Who's Minding The Store?

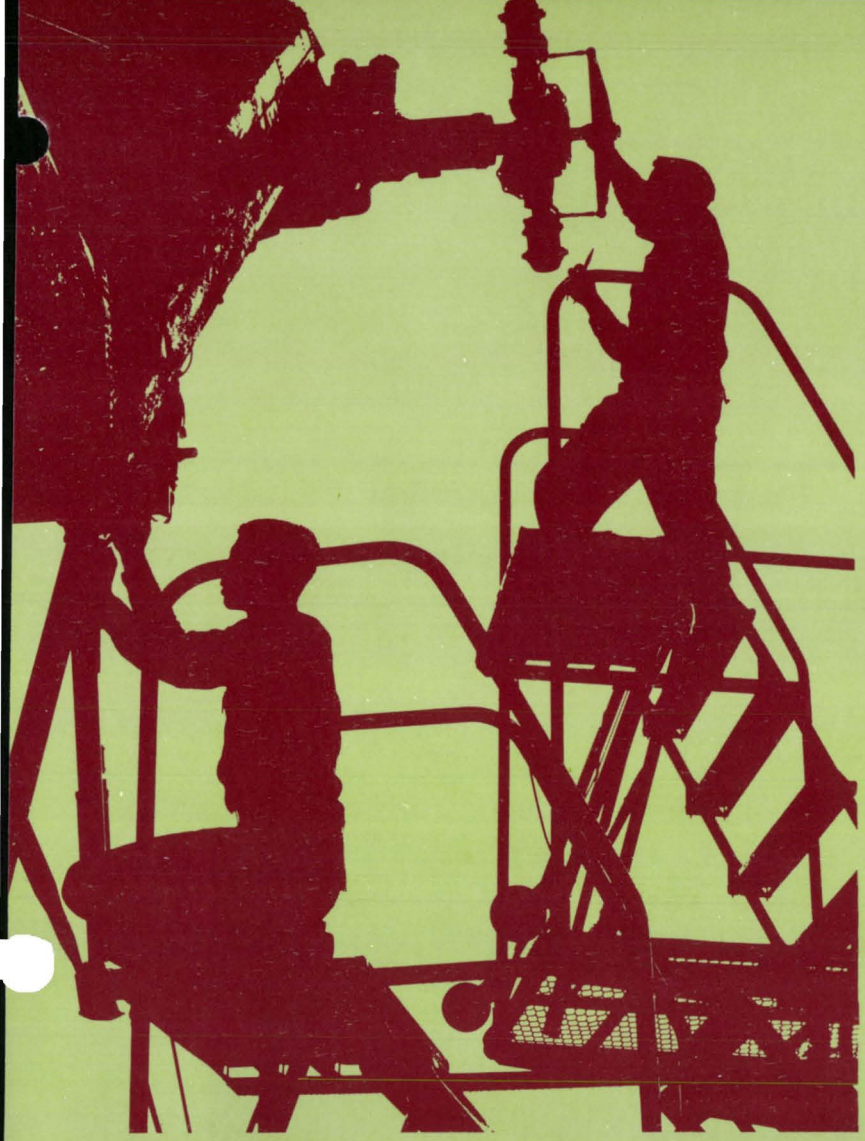
AOD—"Sir, I'm reporting for duty."
Ops O—"Have you had AOD before?"
AOD—"Yes sir, about 6 months ago."
Ops O—"Well, you've got it again. If you have any problems, I'll be at the club for the next few hours."

It is a paradox that during normal duty hours we often make a big thing out of weather forecasters, clearance authority, VIP welcoming procedures and other elements of airfield professionalism and supervision and then when the flag comes down at some Army airfields we turn the whole mash over to the low men on the pole and expect them to know everything the daytime pros do as a matter of course.

How are your briefing and shift turnover procedures? When was the last time your operations SOPs or AOD INSTRUCTIONS were REVIEWED FOR CURRENCY, simplicity and effectiveness? Will they stand up to the test of a "green" AOD or OJT 71 Papa? A recent informal survey of some AAF operations sections revealed responsible personnel who didn't know what an inflight advisory was; some that did had no SOP at hand for initiating one. Some thought that a terminal weather change would be given automatically to enroute aircraft by tower or approach control facilities. Pity the poor pilot who is turned over to an approach control and is advised that late in the flight that Podunk AAF went below minimums 30 minutes ago! Paragraph 2f, AR 95-11 and FAA Manual 7110.10B place responsiblity for inflight advisories on the military operations office. Is your SOP for this and similar departures from routine buried forever amid volumes of night shift inspection or janitorial instructions? Is someone on duty qualified to advise a pilot as to possible alternate solutions? Nothing is sadder to watch than the "What do I do now?" telephone scramble that occurs in some operations offices along with a departure from routine.

USAASO Sez—your night or holiday shift should be a reassuring asset rather than a high-risk headache. Instructions should be adequate for functioning when the big boys have called it a day!

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



NCOES Aviation Courses

At The T-School

William H. Smith

Staff Writer

THE U. S. Army Transportation School, Ft. Eustis, VA, is now offering two aviation courses in the Noncommissioned Officers Education System (NCOES). One is a basic aircraft maintenance course and the other an advanced maintenance course.

The Aircraft Maintenance NCO Basic Course is designed to prepare E-4s and E-5s for duty as E-5s, E-6s and E-7s. The course takes 12 weeks to complete. To be eligible one must be a member of the active Army or a Reserve Component and not have more than 8 years of service for grade E-4 and 12 years for grade E-5.

Students for the basic course are selected by their unit commanders on a "best qualified" basis and the schooling approved by higher commanders.

The Aircraft Maintenance NCO Advanced Course is designed to give E-6s and E-7s a working knowledge of duties required to perform as noncommissioned officers in grades E-8 and E-9. Not all of those eligible for the basic course are accepted for the advanced course. Students are selected by the Department of the Army using a "selection board" procedure. The course takes 11 weeks and 4 days.

To be eligible for the advanced course an NCO must be a member of the active Army or a Reserve Component and have not more than 17 years service and 10 months or more active duty service remaining upon completion of the course.

Students in the advanced course study general military training, military operations, military staff, management, transportation common subjects, aviation maintenance management and aviation maintenance.

The Noncommissioned Officer Education System (see "NCOES! What, When, Where, How?" AVIATION DIGEST, June 1972) is an Army-wide program to provide Army enlisted personnel with a program for educational and professional career development. It is designed to give each branch of the Army professionally qualified noncommissioned officers.

NCOES at the Transportation School has been in operation since March 1972. The basic aircraft maintenance course started at that time and the first advanced class began last October.

You don't have time to come to Fort Rucker?

You can't get away from your job that long?

TAKE THE AVIATION WARRANT OFFICER INTERMEDIATE COURSE (A W O I C) BY MAIL

write to

Army-Wide Training Support
US Army Aviation School
P.O.Box "J" Fort Rucker, Alabama36360

Additional information appears on page 22