Cancelate
KAK

USAARL
SCI SUPPORT CENTER
P.O. BOX 620577
FORT RUCKER, AL 36362-0577

UNITED STATES ARMY

# AVIATION DIGEST

JANUARY 1977

# UNITED STATES ARMY AVIATION DIGEST

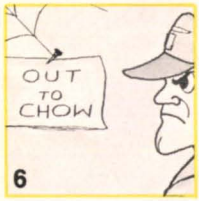
JANUARY 1977 VOLUME 23 NUMBER 1

MG James C. Smith
COMMANDER
U. S. ARMY AVIATION CENTER
A major activity of the
U. S. Army Training and Doctrine Command

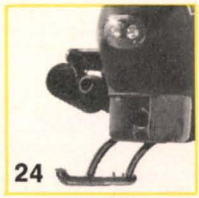
COL Keith J. Rynott
COMMANDER
U. S. ARMY AGENCY FOR AVIATION SAFETY
A major activity of the
Inspector General and Auditor General
of the U. S. Army

Richard K. Tierney
EDITOR
U. S. ARMY AVIATION DIGEST

2



6


24

46

Introduction, LTG Sidney B. Berry ..... 1
There Is An Army "AVCAD" Program, CPT Michael D. Butcher ..... 2
Reflections, LTG Robert W. Williams, USA Retired ..... 4
Hatchet Man, CW4 Frank W. Kervin ..... 6
CH-47 Chinook Flight Simulator. .Evaluator's Viewpoint, CW3 Joe F. Sefers ..... 8
Hand-Held Aerial Photography—A Forgotten Tool? MAJ Ballard M. Barker ..... 13
Helicopters In Combat Training Exercises, LT V. Uso I'tsev ..... 18
Improved IR Protection For Army Aircraft, Robert C. Miller ..... 20
Inadvertent IFR, CPT Stephen E. Martin ..... 24
OPMS Corner: Transition/Saved Pay Provision Terminated 31 May, LTC James P. Hunt ..... 28
The Unused Talent In The Cockpit, Gerard M. Bruggink .. 30
The Cold Facts, LTC David H. Karney and Ted Kontos ..... 34
Aviation Safety Officer Course At USAAAVS ..... 38
A Close Look At Mast Bumping, LTC James A. Burke .... 40
Briefs That Teach ..... 44
Pearl ..... 46
ATC Action Line ..... 48
The Pink Lady, William L. Ruf ..... Inside Back Cover

## ABOUT THE COVER

**The Army aviation program is open to West Point cadets and affords them a splendid opportunity. It wasn't always that way. See pages 1, 2 and 4. The *DIGEST* thanks Dr. Lawrence Epstein, chief historian at the U. S. Army Aviation Systems Command for the cover photograph**

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

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

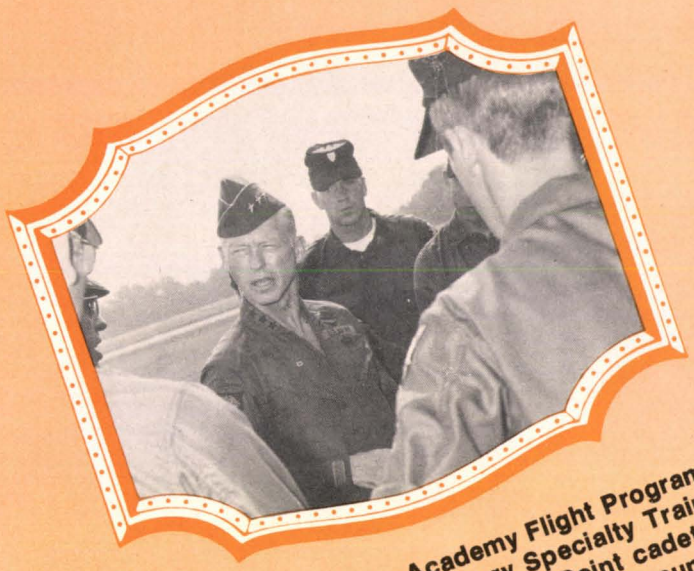
Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, U.S. Army Aviation Digest, Fort Rucker, AL 36362.

This publication has been approved by The Adjutant General, Headquarters, Department of the Army, 23 December 1975, in accordance with AR 310-1.

Active Army units receive distribution under the pinpoint distribution system as outlined in AR 310-1. Complete DA Form 12-5 and send directly to CDR, AG Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220. For any change in distribution requirements, initiate a revised DA Form 12-5. Controlled circulation paid at Atlanta, GA.

National Guard and Army Reserve units under pinpoint distribution also should submit DA Form 12-5. Other National Guard units should submit requests through their state adjutant general.

Those not eligible for official distribution or who desire personal copies of the *DIGEST* can order the magazine from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription rates are $15.70 domestic and $19.65 overseas.



THE U.S. Military Academy Flight Program is one of six Cadet Military Specialty Training (CMST) schools that the West Point cadet can attend during his second class or junior summer. This article by Captain Butcher aptly conveys some of the challenges and excitement that the cadets encounter in this very demanding but most rewarding program.

I am enthusiastic about the course and appreciate the efforts made by the Aviation Center to tailor the program to the needs of the cadets. In light of the current worldwide military situation it is essential for today's Army officers to know how to employ both air and ground assets, which might be available to them in a combined arms team. This program, in conjunction with other cadet training, goes a long way towards achieving this goal.

LTG Sidney B. Berry
Superintendent
United States Military Academy
West Point

# There Is An Army "AVCAD" Program

AS THE SUN assumes its 0545 hours position and the fog lifts lazily from the Choctawhatchee River, 38 qualified and highly motivated West Point cadets clamor from the bus in front of Primary Flight Division, Hanchey Army Heliport.

A crisp voice pierces the July morning calm, "Sir, Cadet Bazile, leader, Class 7-T-1 reports!" Thus commences for them the finest hands-on, performance oriented training that the Army offers—aviation flight training at the U.S. Army Aviation Center, Ft. Rucker, AL. Heretofore, they had learned the merits that this ultimate training method affords as opposed to conferences, lectures and such; now they were to realize it.

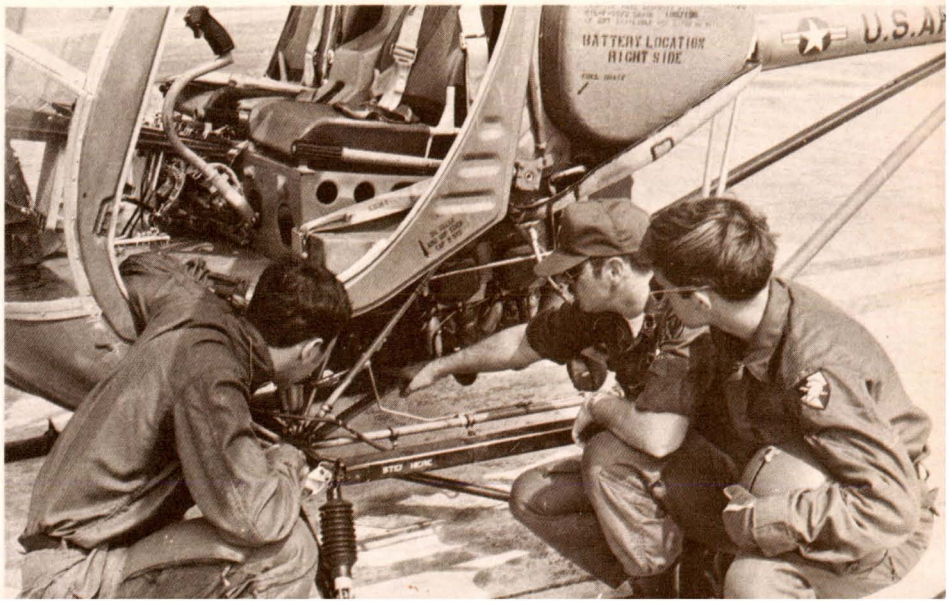
"AVCAD" or aviation cadet long has been the title of the U.S. Marine Corps and U.S. Navy initial entry enlisted flight student similar to our candidate. Dissimilarly, a portion of the Army's elite future officers corps, at the conclusion of their sophomore year at West Point, may undergo flight training, as well as airborne, ranger, etc., as part of the Cadet Military Specialty Training (CMST) program.

This is the project's fifth year since the Department of the Army directed the Continental Army Command (now Training and Doctrine Command) in December 1971 to institute a flight training program for the United States Military Academy. In 1972, the first class of 49 cadets reported to the United States Army Primary Helicopter School at Ft. Wolters, TX, for an 8-week, 320-hour (40 flight hour) course. It culminated with a Federal Aviation Administration checkride and, upon its successful completion, a rotary wing private pilot's license. Since then, 240 cadets have attended and 239 have completed the course. Nine of the original 49 have been assigned to the Aviation Center to continue in aviation and have enrolled in rotary wing flight training here. (The cadets must spend 2 years finishing the Academy and then complete their 2-year branch obligations prior to pursuing aviation.)

As with many other military endeavors, the CMST-funded program has fallen victim to budget constraints and consequently had to be modified. It soon was learned from after action reports that it was impractical to pursue the rotary wing private license. It just wasn't cost effective. The importance of orientation to Army aviation far outweighed any advantage of having the rating.

Additionally, cadets not only had found civilian companies unwilling to rent helicopters to pilots with only private licenses, but also the cost was found to be prohibitive. Consequently, even though they gained insight into the offerings of Army aviation, their newly acquired proficiency waned. Thus evolved the present 4-week course headed by the Department of Resident Training Management and administered by the Department of Undergraduate Flight Training.

**The importance of a thorough preflight is explained and demonstrated by a military instructor pilot**



**Captain Richard D. Butcher**

Department of Undergraduate Flight Training
U. S. Army Aviation Center
Ft. Rucker, AL

Introducing as many aspects of Army aviation as possible in the limited time available, the course provides a general, but comprehensive, overview and realistic picture through actual participation in flight and selected classes.

The highly refined curriculum is designed to expose the commissioned officer aspirant to the current and future role of Army aviation in the high threat environment of tomorrow's battlefield. Additionally, the cadets encounter an indepth "feel" of the training that prepares the initial entry rotary wing student for assignment into a tactical unit after departing Ft. Rucker.

The course is comprised of 15 flight hours (14.6 dual, .4 supervised solo) and 40 academic hours with the students and staff of 13 military instructor pilots organized into 2 flights—1 flying mornings, the other afternoons—with each attending academics during nonflying periods. Imparting the operation and uses of rotary wing aircraft in the military environment, the flight instruction with the training objective of the student's successful solo of a TH-55 is almost the same as the Initial Entry Rotary Wing (IERW) student's. The cadets, using the syllabus flight training guide with some slight augmentations, perform the same maneuvers as the typical primary student in the pre-solo training stage. The traditional student "hose-down" or dunking is even observed upon successful solo.

Academics, encompassing the gamut of the school, covers 3 main areas—*preflight, inflight* and *employment*. Initially, cadets attend basic airmanship classes on subjects ranging from flight controls and instruments to weight-and-balance and aerodynamics.

Communications and wake turbulence follow. Even with orientations and demonstrations occurring in the employment phase, cadets are still participants rather than observers which affords them a realistic and meaningful training experience. Here, realizing the role of aviation in the combined arms team, they investigate the threat and undergo training on target identification and electronic warfare. Ensuing is material on aviation missions including attack helicopter missions and employment, day and night NOE (nap-of-the-earth) and low level flight and air cavalry missions. Next comes organizational capabilities including unit training, safety, aeromedical and life support instruction. Tactical instrument training using the SFTS (synthetic flight training system) and a tactical training exercise are included.

Participation in survival, evasion, resistance and escape training follows a briefing on the tactical laboratory facilities. A tour of the test and aviation developments being fostered at Ft. Rucker finalize their academics.

Preparation for the next cadet program begins soon after the last one is completed. Following the review of after-action reports for

***Continued on page 12***

**While waiting their turn to fly, cadets rehearse the cockpit and runup procedure in the yet unfamiliar TH-55**

# REFLECTIONS

**Robert R. Williams, LTG, USA Retired**
President
Bell Helicopter International

THE INFLUX OF West Pointers to the Army aviation program has been sporadic. It has been strongly influenced at various times by the attitudes and policies of the Army toward West Pointers becoming involved in the program, and by the individual officer's perception of what the future might hold in Army aviation.

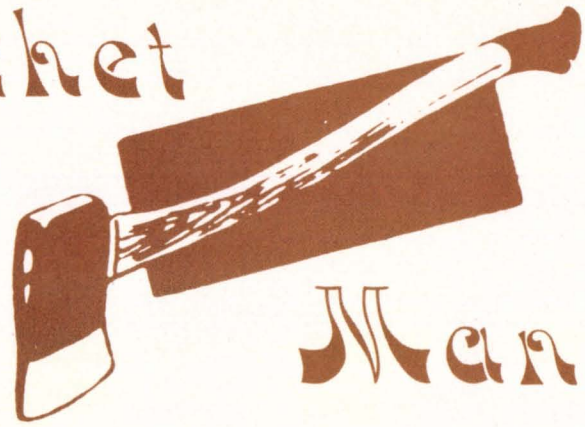
For example, when the Test Group for Army Aviation was being formed in 1942, I was fortunate enough to be at Ft. Sill, OK, and personally known to then LTC W. W. Ford. I had flown with him frequently in his privately owned Rewin Cloudster. He requested I be loaned from the 18th Field Artillery to help set up the program. Although I was already deeply involved in the program, I submitted an official application to Washington. Sometime later, after I was already functioning as the Chief of the Flight Division, I received a reply to my application that it was disapproved with the statement that it was not in the best interest of the Army for regular Army officers to go into the "Air O.P." (observation post) program.

Very few regular Army officers, and only three West Pointers that I know of, became liaison pilots during World War II. The three who did, Majors Cassidy, Blaha and O'Connor, slipped in under special exemptions to policy. In 1952 when I was Chief of the Army Aviation Branch in G-3 of the Army, Major General Jim Gavin, then the G-3, called me in and asked why there were almost no regular officers in the aviation program. I explained that the Army policy at that time required regular officers, upon being commissioned, to serve a sequence of tours in specific assignments that placed them beyond the normal maximum age requirement before they could apply for pilot training. He directed that I prepare a recommendation to the Chief of Staff for a change

in the policy. I did so. When I took the paper to G-1 for coordination, I received a strong nonconcurrence. A colonel informed me quite emphatically that the regulations were intended to keep West Pointers out of the program on the basis that the Army could ill afford to invest 4 years at West Point in an officer for him just to become a pilot. General Gavin personally carried the recommendation to the Chief of Staff of the Army with the G-1 nonconcurrence, and succeeded in having a new policy established whereby West Pointers, upon graduation, could make immediate selection among airborne, ranger or pilot training. The result was a major input of West Pointers into the Army aviation program during the early 1950s. The Army's attitude and policy at last had changed and the door was open. However, many still perceived that Army aviation did not offer high potential as a career. In 1955 the program was opened for a selected group of senior officers to be trained. The officers who volunteered and were selected represented a splendid group of individuals well known throughout the Army for their outstanding achievements as leaders. Many have later brought great prestige to the program not only in the eyes of the young officers who might become aviators, but also in the eyes of the many commanders who had counseled and influenced the young officers. At this point Army aviation became not only an available career for a West Pointer, but also a respected specialty.

Continuation of the program to input field grade officers and above to flight training intermittently on through the 1960s made it possible for many West Pointers to follow the advice so frequently given to become thoroughly grounded in a basic arms and then enter the Army aviation program. The result has been a major contribution by West Pointers throughout the past 20 years to making Army aviation what it is today.

# Hatchet Man



ANNUAL AWARD
Monthly Winner
CONTEST

**CW4 Frank W. Kervin**
Academic Instructor
Department of Academic Training
Ft. Rucker, AL

FIVE HEADS QUICKLY turned toward the group maintenance officer's desk when the "special" phone rang out its long, insistent ring.

"Yes sir, he's here." (Pause) "May I ask what about?" toned the gray-headed lieutenant colonel.

Four heads went back to their desk work as they saw the "Boss" was looking straight at CWO "Sharp" Hatchet.

"Hatchet! Report to the group commander immediately," spoke the Boss, "and stop back and let me know what's going on."

* * *

The group commander's office walls were decorated with charts, graphs, etc., when CWO Hatchet reported. Hatchet smiled a bit and thought an old familiar thought about such things. Charts and graphs are nice to have—but they are only as good as the people who make them.

The "Bull" was in fine form this morning as he turned away from studying one of the decorated walls. "Chief, pack your bag and get up to the 850th Battalion for a few days. I don't know what in hell is wrong but something or someone up there is crazy. Their manhour reports, equipment status, work order backlogs, MWO status, personnel utilization, and customer service reports contradict hell out of each other. Visit the headshed and spend some time in the units and find out what's wrong. Today is Tuesday. I'll expect your report next Monday. Now, get out of here!"

* * *

The group bird dropped CWO Hatchet and his warbag off and departed quickly. CWO Hatchet walked to the shack marked "OPNS" only to find the door padlocked with a small sign stating "Gone to Chow" tacked on the door. Immediately above this sign was a large sign proclaiming to the world "WELCOME TO THE 850TH. OUR MOTTO IS SERICE—WE NEVER CLOSE." Chief Hatchet grunted, picked up his bag and trudged toward the battalion headquarters about a half-mile away.

* * *

"Dammit Hatchet, your written report is a dozen pages thick. You know I like 'em two or three pages max," growled the group commander.

"Sir, the report *has to be* that thick this time in order to present the true story up there," grunted the chief. (After all, a CW4, RA, with over 28 doesn't scare too easily.)

"O.K. Chief, sit down and let's go over it quickly. Just hit the high spots for me. I have things to do."

"Sir, that unit, the whole battalion, looks bad. But the fault lies with the battalion commander and his staff. Several company commanders don't set the world on fire but they still can be saved. The company level maintenance officers are O.K.—with one exception. Captain Wayout in Charlie Company needs to go quick before he drags the maintenance effort lower than where it is now.

"Item one, operational status: Flight operations, production control, tech supply, and all shops close down for a 2-hour lunch period. Customers fly in and have to wait for service. The supported brigade commander had to wait over an hour to get his C&C ship refueled on Friday. You'll probably hear about this one during your next visit to brigade headquarters.

"Item two, supply: People up there aren't talking to each other. A prime example is lateral search for

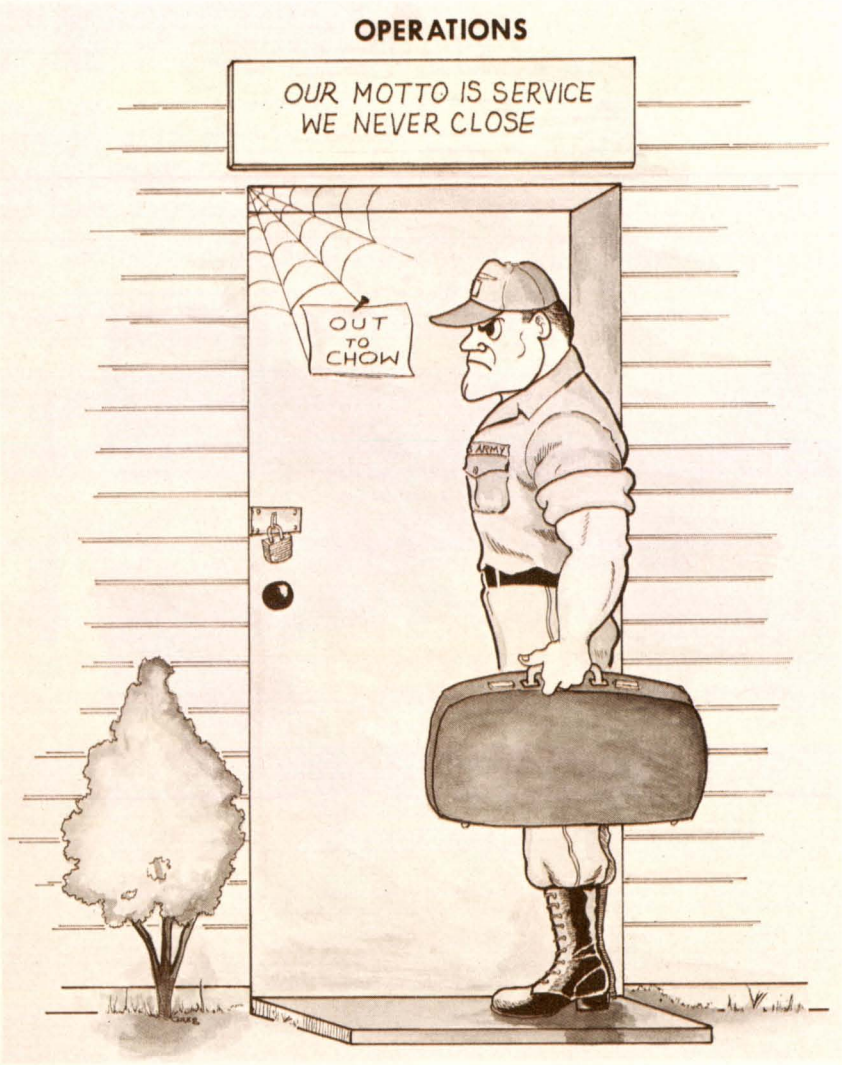
**GLOSSARY**

| | |
|---|---|
| **ASOAP** | **Army spectrometric oil analysis program** |
| **C&C** | **command and control** |
| **DS** | **direct support** |
| **DX** | **direct exchange** |
| **EDP** | **equipment deadlined for parts** |
| **FM** | **field manual** |
| **GS** | **general support** |
| **MAIT** | **maintenance assistance and instruction team** |
| **MOS** | **military occupational specialty** |
| **MWO** | **modification work order** |
| **QCA** | **quick change assembly** |
| **RA** | **regular Army** |
| **TB** | **technical bulletin** |
| **TM** | **technical manual** |

EDP items. For all practical purposes, it simply doesn't exist. A list is exchanged between the tech supplies, but if a tech supply has *one*, he reports *zero*. It's a case of each one looking out for his own interests, but when each supply reports zero on one another's requests, both end up with aircraft EDP for different items. Furthermore, the lists don't reach the shop level at all. I solved 15 cases of EDP between units simply by visiting various allied shops.

"Item three, DX program: My visits to the allied shops uncovered this little gem. Your personally directed DX reparable program ranges from superior to really poor. Let's compare several of the companies' programs. This unit has 15 items on its DX program and always has some of each item on the shelf. This next unit work orders most of its DX-listed items to the GS unit—but has the capability to do the work itself. Consequently, it has zero on hand of some items, very few of others, and its customers have hundreds of 'shoe tag receipts—which don't fly their aircraft. And by the way, I'm speaking of simple items like short shafts, scissors levers and drive shaft support bearings.

"Item four, support equipment: The people up there are lying to each other and to us. I watched one bird wait 2 days for a wrecker to lift a rotor head/blade assembly onto it. I saw sheet metal mechanics using eggbeaters to drill out rivets for lack of an air compressor. Another unit is not decontaminating its aircraft because no one can find a serviceable steam cleaner. Yet here is the battalion S-4 equipment report dated last Friday that shows four of five wreckers operative, ten of twelve compressors operative and six of eight steam-cleaners operative. The report period covers the same week I spent up there. Someone is lying to us. Another thing about equipment, sir, there's a steam-cleaner sitting outside the mess and another outside the battalion motor pool. They may have clean pots and pans and clean trucks, but the aircraft effort is hurting like hell.




"Item five, MWO program: There is no MWO program as such. Some of the companies are trying but there is no guidance or sense of direction from above. I tried to talk to the battalion maintenance officer about it, but he's more interested in his polo pony than in getting a job done. The battalion is more than 8,000 manhours behind in outstanding MWOs and no one seems to give a damn.

"Item six, ASOAP program: The battalion is collection center for all ASOAP samples of their supported units. I saw some samples dated 10 days ago lying around the headquarters. Yet, at least one of the battalion unit's ships come in here to Main Heliport almost every day. They also do not have a "follow-up" procedure when the laboratory asks for help. Incidentally, I found out that Six's personal bird hasn't had hydraulic systems samples submitted in over 60 hours flying time. Hell, they don't take care of their own aircraft, so you can guess what's happening to the supported birds.

"Item seven, personnel: They are

***Continued on page 27***

# CH-47 Chinook Flight Simulator

# Evaluator's Viewpoint

**CW3 Joe F. Sefers**
Project Officer, Ground Support Test Division
U. S. Army Aviation Board
Ft. Rucker, AL

EARLY THIS YEAR the U. S. Army plans to start using a dual first-of-a-kind simulator. It is the first tandem rotor helicopter simulator in the Army's inventory and has the first camera model visual system on any helicopter simulator. As the designated pilot/evaluator from the U. S. Army Aviation Center, Ft. Rucker, AL, I have been closely involved in the progress of this device. I believe it is a superior training device that will enable the CH-47 Chinook instructor pilot (IP) to produce a better trained student, while also being an economical windfall for the Army.

Except for the initial conferences on establishing the requirement for this device, I have been the designated pilot for all the evaluation trips to the contractor's factory and technical advisor at the conferences held at Ft. Rucker and Orlando, FL. From all the material I had collected and the conferences I had attended, I knew before I saw the device that it was not intended to be a "blue box." Instead it is a very sophisticated "fly-like-the-actual-bird" type simulator. This is a new approach to building and accepting a simulator brought about by the credibility aspect that is so important to the Army's flight simulator program. As LTC Bob Catron, former project director, SFTS Program, explained in his article in the April 1976 ***DIGEST*** [see "A New Approach To Flight Simulator Acceptance," page 2], the data obtained by the contractor and developed into a mathematical representation of the CH-47C would not be the data that would cause the simulator to react as a finished and flight-tested CH-47C. All the available data was collected, submitted to the procurement agency for approval, developed into a math model, fed into a computer and then the CH-47 IPs were called in for the initial evaluation.

The first evaluation sessions were conducted without the visual system operating. The TM 55-1520-227-10 amplified checklist was used to provide an orderly start for evaluating configuration and systems of the simulated CH-47C. Several discrepancies were noted in both areas but an excellent start was evident.

During the flying qualities sessions, we evaluated all aerodynamic aspects but in particular the differences of a tandem rotor helicopter versus a single rotor. Differential collective pitch, differential collective pitch speed trim and longitudinal cyclic speed trim were definitely simulated but very difficult to properly evaluate without a visual reference. We found several major discrepancies in these areas which the engineers noted and on the engineers' trips to Ft. Rucker, we showed them in an aircraft exactly what we were saying at the plant.

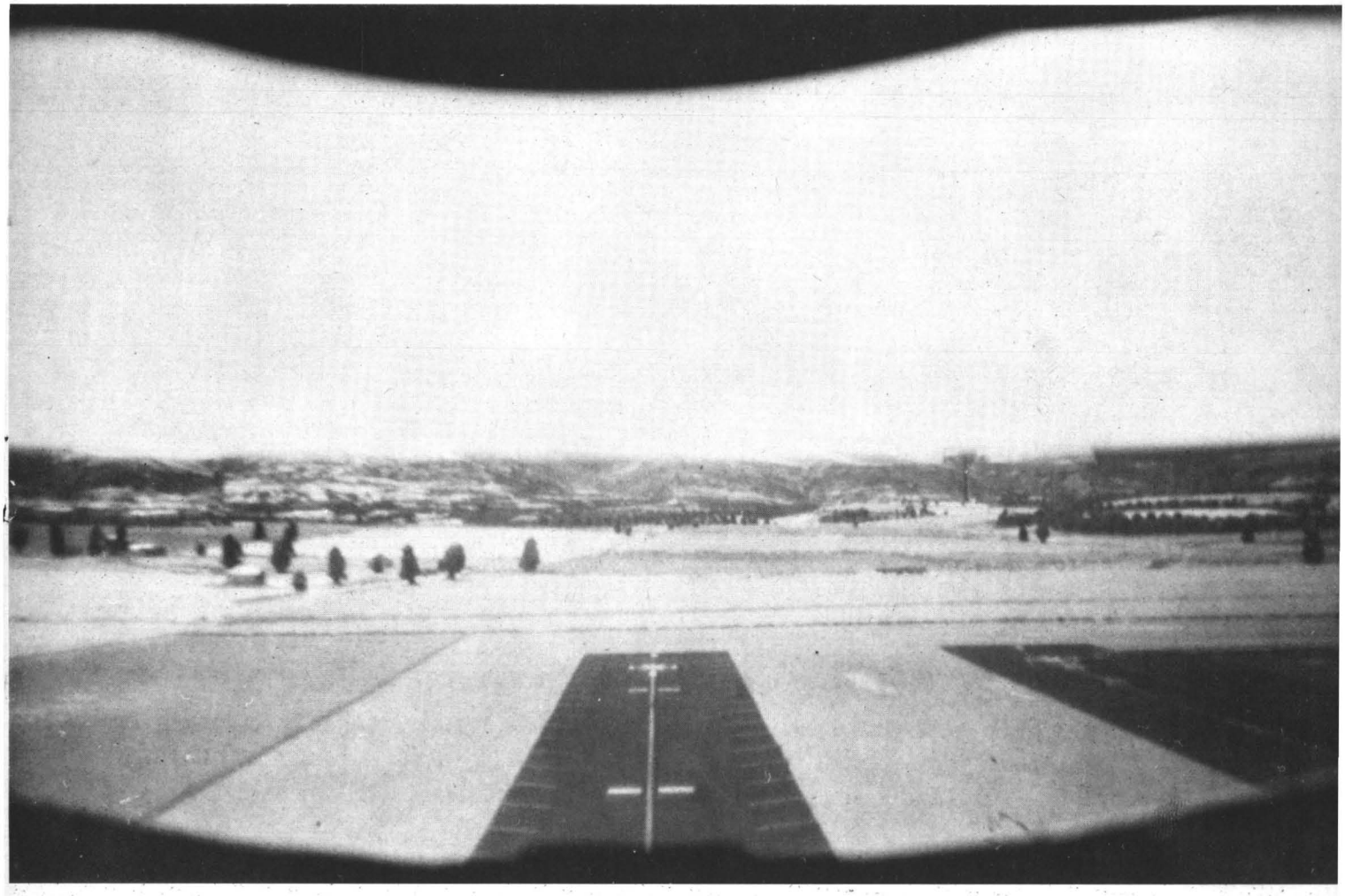
**The CH-47 flight simulator should markedly improve and accelerate student training in the Chinook. The simulator provides ultra-realism through introduction of malfunctions; hands-off flight demonstrations; playback of voice and control procedures; selection of weather and time of day for "flights"; complete mission practice from engine start checklist to park and shutdown; and more**

Most of the flying qualities areas to be evaluated were extremely subjective, although some good data was found. My job during these evaluation trips was to provide the continuity to ensure a continuous program and solicit a different CH-47 IP's comment or subjective evaluation and put it on paper so the engineers could know what we desired.

I always extensively briefed the "other" pilot on what we would do, discussed previously written discrepancies and requested him to look into some areas while flying that probably would be beneficial to him while evaluating the simulator. This worked well, particularly in that it saved discussion or debate time when we were inside the simulator.

These trips to the factory were beneficial to everyone concerned. The engineers asked us questions that seemed ridiculous—"How much does the turn and slip indicator move when you're making turns using power steering, or aft wheel taxiing?" or "How much lateral cyclic for a standard rate turn?" or "What does SAS [stability augmentation system] squeal sound like?"

**Trainee's view through the front visual of the CH47FS. The scene is on short final to Goldberg Stagefield**



After a trip to the plant, I would fly a training mission and notice things that I never noticed before. Of course, I was equally ignorant of the engineers' plans, processes and technical thought at that time.

We all had a lot of fun—particularly the day the motion system gave us an unprogramed ride. Actually, the motion system cannot do much in the way of "crashing" or causing anyone injury but it sure makes you think so when it goes berserk! The things you see from your peripheral vision during these excursions are indescribably hilarious!

The day came for the first "flight" with the visual system operating. The 400 to 1 scale model board is a replica of the eastern side of Hanchey AHP (Army Heliport) and this was the scene when we entered the device. We had anticipated problems trying to hover the simulator because all adjustments had been made subjectively in an instrument meteorological conditions' (IMC) environment and the only visual scene is out the windshield directly in front of the pilot and copilot. We hovered it though, and I suppose this was a first in the U. S. Army.

From this point, several evaluation trips were conducted to allow the engineers to correct deficiencies noted by the pilots and to look at additions in software and hardware. A system of squares, or synthetic terrain generation, was later added for a reference in the chin bubble. This added a degree of ground movement information that allowed a pilot to hover more meticulously and execute approaches more accurately.

How the device will be integrated into the training programs at Ft. Rucker will be determined as a result of testing early this year. I will list an overview of the general layout and capabilities of the device.

The cockpit forward of station 95 is identical to a CH-47C with a few exceptions on hardware which, if simulated, would have no training value. The forward windshield is not installed and a small control panel is installed at the aft end of the lower console. Aft of station 95 is the instructor station at which a CH-47 IP will control the total training situation and environment. There are numerous controls along with two CRTs (TV screens) to monitor the training situation. I have worked with the station a great deal and believe it will be learned and operated easily when an IP has the opportunity to use it on a regular basis. There is an instructor operator's course scheduled that will teach and explain some of the technicalities and peculiarities of the station.

Some of the capabilities the IP will have are:

- Selecting any of 148 malfunctions
- Causing any of 45 circuit breakers to pop out
- Selecting any of ten prerecorded demonstrations that will allow two students in the pilot's and copilot's seats, in a handsoff situation, to observe and listen
- Recording the movement of the controls along with the conversations for later playback and critique of the students (ideal for methods of instruction courses)
- Adjusting the ceiling, cloud tops and visibility
- Option for day, dusk or night flight
- Selecting the larger scale model board for better visual detail or the smaller scale for more operating area—for such maneuvers as SAS off flight.
- Selecting either an aerodynamic or high density external load and acting as the flight engineer to guide the pilot over the load and hook him up
- Storing up to 20 pictures of the information presented on the forward CRT for later printout and used to critique students
- IP can freeze the device during a visual maneuver for discussion and clarification of points

The instructor has an adjustable seat to manipulate the controls at the instructor station or move forward to converse with or supervise the pilot and copilot. There is also an observer seat just aft of the pilot's seat. The cockpit has its own air conditioner unit.

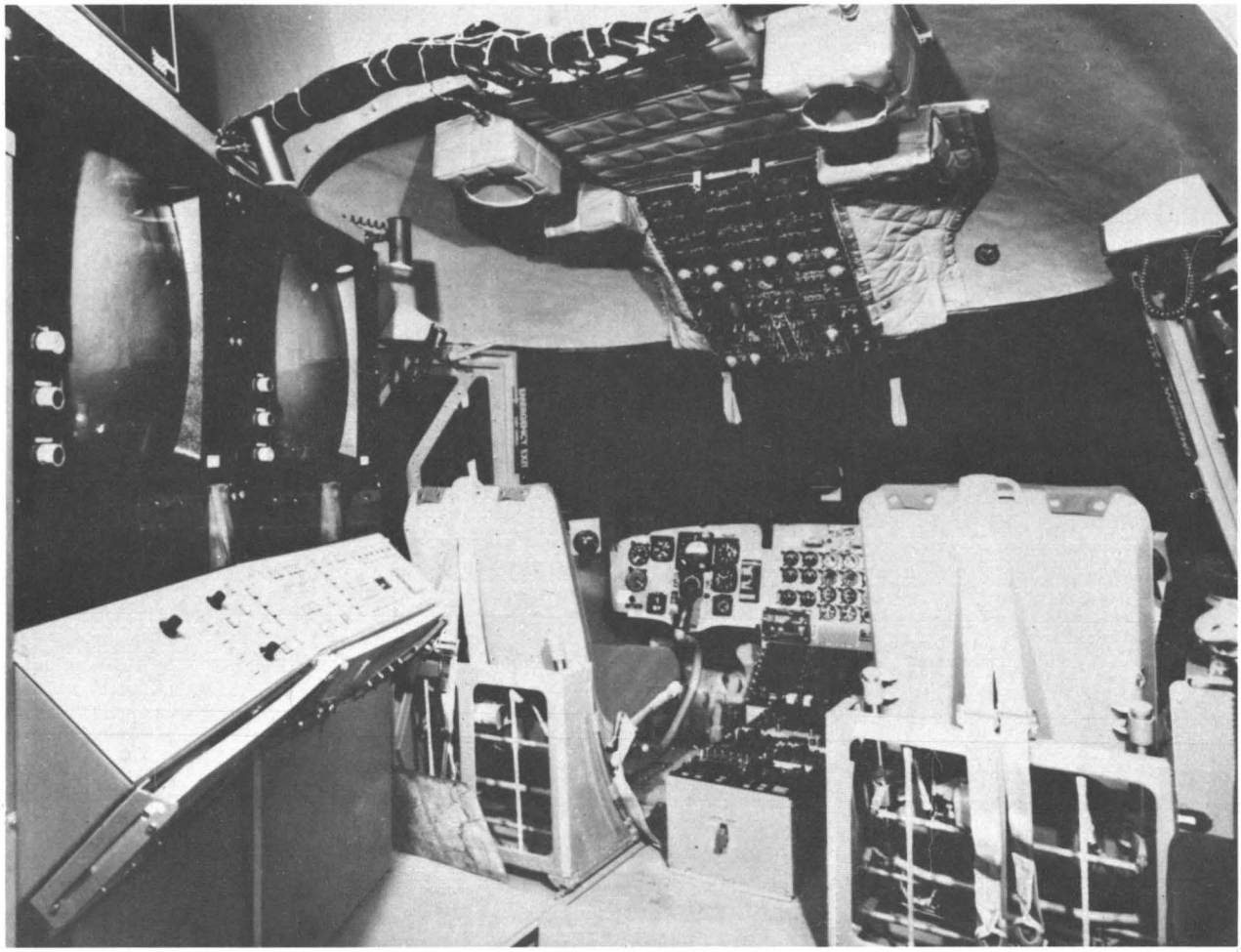
The cockpit looks like a big olive drab, rectangular box on the outside, with a facsimile of a Cargo Branch patch on each side connected by a stripe. This sits atop the 6-degree freedom-of-motion system. A walkway connects the simulator to the briefing room and computer complex.

The light bank, moveable gantry with the camera probe and model board are in an adjacent room. The light bank has 174 metal halide lamps (1,000 watts each) to illuminate the model board. Half of these are turned off for dusk flight and all are off for night flight.

The model board consists of 4-by-8-foot panels, 42 of them, and has a total measurement of 24 by 56 feet. It is mounted vertically to minimize floorspace. The board features two areas of the world in different scale factors. The 400 to 1 scale is the eastern side of Hanchey AHP and measures 1.579 NM (nautical miles) by 0.526 NM. This board was designed to use in the early stages of training a student in the more delicate maneuvers, such as taxiing, takeoff to and landing from a hover, etc.

The 1,500 to 1 scale is an area similar to that just north of Dothan, AL, and measures 5.92 NM by 11.84 NM. Goldberg Stagefield is constructed with an external load area adjacent to it, two specially contructed confined areas and a 500-foot pinnacle is available. The absence of side visual presents some problems in flying the traffic pattern but after a few times around, you learn some ground reference points to start the turns.

A building is being constructed at Ft. Rucker to house the CH-47 and AH-1Q HueyCobra flight simulators. In September 1975



**Instructor's station and cockpit of the simulator. The flight station is identical to the "C" model with minor exceptions which have no training value**

Hurricane Eloise caused considerable damage to the partially constructed building which delayed completion by a few months. I recommend the building be named Eloise Hall!

A training mission in the CH-47 flight simulator can be oriented to whatever the IP wants for a particular flight period and is not hampered by adverse weather or maintenance problems. A typical combat readiness flight mission could be to get in the device with it sitting on H-row at Hanchey AHP, use the checklist for start up, taxi to the takeoff pad, conduct a hover check, set the simulated aircraft on the ground for an instrument takeoff into 300/½, conduct an instrument flight to Lawson AAF, make a full instrument landing system approach, break out with a runway in sight for a visual approach, taxi to parking and shutdown—just as you would in a real aircraft! During a mission of this type, malfunctions that are not normally practiced on an instrument flight rules flight could be practiced.

The first time I "flew" the device with all systems operating—visual, sound, motion, seat shaker, wind and turbulence—I was impressed and thought it was much like being in a real aircraft. I have had my heart in my throat a few times when pilots not CH-47 qualified or knowledgeable tried to hover; overcontrolled the aircraft; or did something to cause it to "crash." When a dual engine failure was initiated from the instructor's station, lack of engine noise and the ground rushing up was very realistic!

An initial acceptance test was conducted in mid-1976, the device approved for teardown and shipment by the Army Training Device Agency and installation at Ft. Rucker initiated in October 1976. Plans call for a final acceptance test to be conducted early this year and then approximately 6 months of operational testing conducted.

Although this has only been a quick look at the Chinook flight simulator, it does show it is a windfall for the Army that will enhance training and save money.

## "AVCAD"

*Continued from page 3*

improvement possibilities are the normal coordination, staffing and planning efforts. Agencies responsible for administering the training and instructor pilots must be selected; training goals, programs of instruction (both flight and academic), and even cadet social activities must be devised or tailored and approved; instructor MOI (military occupational information) training must be conducted; and, finally, facilities must be appropriated and made ready.

Despite all this preparation the instructor pilots, mostly from Primary Flight Division's Flight Evaluation Branch, look forward to the additional mission with a real sense of purpose and dedication. Knowing they are the vehicle for conveying the Army aviator as an integral professional filling an otherwise void in the overall Army effort, they are excited that they are able to be part of it.

After finally being able to get here (unfortunately of 120 applicants, 38 were able to overcome the flight physical, class standing and flight aptitude obstacles), what do the cadets think of all this? One view pretty well sums it up after realizing the "white-scarfed-celebrity" image invalid. Considering the extent of the training, planning, proficiency, judgment and knowledge demanded of this flyer, Army aviation's romanticism and beauty in the eyes of its beholder is now more than skindeep.

Cadets enhance their knowledge with a tour and briefing of control tower functions

While observing cadet training, LTG Sidney Berry, West Point Superintendent (left), confers with MG James C. Smith, Commander, U.S. Army Aviation Center

Between flight periods, cadets take advantage of the "ground time" to review maneuvers from their Flight Training Guide

# Hand-held Aerial Photography— A Forgotten Tool?

**Major Ballard M. Barker**
***Student***
***Command and General Staff College***
***Fort Leavenworth, KS***

THE AMERICAN Soldier and the commanders and staffs which direct his efforts have in their hands today the most advanced military hardware available anywhere in the world. Associated with that hardware is a sophisticated body of technique and technology which is advancing at what seems an immeasurable rate. Although these tools are often invaluable aids to mission accomplishment, it is foolish, dangerous and uneconomical for the modern Soldier to become so dependent on and engrossed in new developments that he forgets how to employ older, proven techniques. The use of hand-held aerial photography (HHAP) for information gathering and mission planning is one such tool which has not been fully exploited in recent years.

Hand-held aerial photography was first used successfully in military operations during the American Civil War when Union photographers went aloft by balloon to report and record enemy dispositions. Great advances in photographic capabilities allowed extensive use of HHAP during World War I, when it proved to be much more efficient than visual reconnaissance. Years later, the technology of both aerial photography and aviation progressed so rapidly that during the World War II and Korean War eras it became possible to routinely plan and execute large area, preplanned photographic missions using high performance aircraft and automatic camera systems. These developments were necessary and beneficial, but they soon became so readily available and widely used that they overshadowed HHAP and contributed to the latter's general decline. Perhaps much of the disinterest in the use of HHAP is a result of ignorance of its employment, a condition which is perpetuated by the lack of training or mention of its use in present day combat arms service schools curricula. The intent here is to illustrate the continued value of HHAP and to advocate its reemployment in combat, training and administrative operations.

One of the primary responsibilities of a commander is the development of intelligence which will facilitate his particular mission in any type environment. Inherent in that task is the collection of information, and the S2 (G2) is normally the director of those collection ef-

forts. In order for intelligence to be useful to the commander and staff, it must be specific and timely to the mission at hand. Any means which will enhance the accomplishment of those two goals is a valid tool which should be understood and used.

Aerial photography has long been one of these accepted tools and there has evolved a standard procedure for requesting conventional photographic coverage through the joint air-ground operations system. If, for example, a battalion commander wanted to see photographs of possible crossing sites along a river to his front, his S2/S2-Air would inform the Air Force tactical air control party (TACP) which in turn would pass the request directly to the corps direct air support center (DASC). Any intermediate command level may modify or disapprove the request, however, and the mission is flown only if resources are available after a review of all other requirements and priorities. If the mission were approved it would probably be assigned to an Army surveillance airplane company or an Air Force or Navy reconnaissance squadron.

This procedure works fairly well during periods of actual combat when large units are operating over substantial pieces of terrain, but it has serious shortcomings with regard to requirements of small units such as companies and battalions which need only point or small area coverage, nice-to-know information or want to go on a "fishing" recon of an interesting area. Typical missions in this category might be submitted by a brigade S2 wanting photographs of planned assembly areas or battle positions; the aviation commander preparing to brief his unit on landing zones and foward rearm and refueling points for an upcoming operation; or the mechanized Infantry S3 requesting a photo recon of a convoy route. In all cases the conventional procedure is time consuming, the resources are generally beyond actual or practical control of Army commanders, the dollar costs are high and in combat there is often a high risk involved for aircraft and crews. In addition, the peacetime staff officer finds himself hard-pressed to justify any type of photographic mission for either administrative or training purpose. Hand-held aerial photography offers a solution to many of these problems.

HHAP employs any type of suitable camera which can be manually operated and flexibly controlled by an aircraft observer or crewman. For most practical purposes commercial 35 mm, 120 roll film or 4 by 5 inch negative cameras are suitable as long as they can meet the required exposure limitations which will be discussed later. Perhaps the most common, flexible and familiar camera to potential HHAP users is the 35 mm single-lens reflex (SLR) camera. It is a very popular, personal camera and it is an item of issue to many staff sections, signal companies and military intelligence detachments. Advantages of the 35 mm SLR camera are:

- It is fairly simple and quick to operate.
- There is a wide range of available lens and filter options.
- It uses film which is inexpensive, easy to obtain, available in many types and speeds and generally easy to process.

The primary disadvantage is the small negative size (24 by 36 mm) which results in some loss of detail in large format enlargements such as 8 by 10 inch prints. For the sake of brevity this article will deal exclusively with 35 mm SLR techniques, although the principles are obviously applicable to other cameras.

The hand-held camera can be effectively used to take both oblique and vertical photographs, the usefulness of each type depending largely upon the photographer's ability and the user's imagination. Obliques are generally most useful for imaging large areas of terrain and adjacent photographs can even be spliced to form panoramic depictions. The more familiar angle

## CORRECTION

**The author of "New Horizons Revisited," November 1976 *DIGEST*, was incorrectly listed as Major Clifford Thomas instead of Major Bob Thomas.**

of view of oblique photographs makes them especially useful for such tasks as briefing aircrews on low level penetration missions over unfamiliar terrain and for audiences not experienced in interpreting vertical imagery. Oblique photography is also useful for imaging areas which cannot be overflown by reconnaissance aircraft. The foremost limitation of obliques is the distortion of spatial and angular relationships which makes it unfeasible to measure accurate distance, direction or scale directly from the photographs without elaborate equipment. They are therefore best used in conjunction with topographic maps which can provide the essential spatial data after orientation of the photographs.

Truly vertical photographs are virtually impossible to obtain with a hand-held camera, but with proper planning and care an observer should be able to regularly produce near-vertical photographs which will give very satisfactory results for field purposes. Although the precision and quality of 35 mm photographic equipment is far less than that of automated aerial camera systems, the photographs can be similarly used. Most notable is their value in constructing uncontrolled mosaics of small areas, forming strip mosaics of linear targets, approximating measurements and occasionally establishing acceptable quality "pinpoint" stereo pairs. It is the careful use of these latter techniques which clearly takes HHAP out of the realm of happenstance and snapshot and makes it a useful field expedient.

Operationally there are a number of fundamental factors which make HHAP somewhat different from ordinary ground photography and which must be taken into consideration for optimum results. The first of these factors is the relative speed of the ground target passing under the airborne camera. This, of course, varies directly with the speed of the aircraft and inversely with its altitude. In order to "freeze" the relative motion on the film to produce usable photos, the camera lens and film combination must be "fast enough"; i.e., the camera must have an adjustable shutter capable of very short exposures and the film must be capable of forming a satisfactory image during the fraction of a second the lens is open. Although Army aircraft are slow moving, the low altitudes of most flights will necessitate shutter speeds of 1/250th to 1/1,000th of a second.

The film's speed is indicated by an ASA rating which will range from 25 to 400 on commonly used commercial films. The higher ASA ratings denote "faster" films which need progressively less light during exposure. These fast films are therefore suitable for high exposure speeds or low ambient light conditions or some combination between the two extremes. Neither the camera nor the film speed considerations will be frequent problems to the field user however, since most cameras and film generally available meet the requirements.

Obscuration of the target by foreign particles in the atmosphere is another problem which is more pronounced in aerial photography. At any given time the atmosphere contains varying amounts of such things as smoke, dust, pollen and moisture which may be imperceptible to the human eye or may form visible barriers in the forms of smog, haze or fog. Since the largest percentage of the impurities are suspended in the first few hundred feet above the earth's surface, their adverse effects *are* significant to most aerial photo missions. The major problems encountered are the scattering of light passing through the layer of foreign particles and the reflection of sunlight off the top of an atmospheric obscuration.

The scattering problem is most often manifested in the form of a bluish haze which causes a reduc-

| Lens Focal Length | Imaged Area Dimensions (Ft) | Negative Scale |
|---|---|---|
| 35mm | 690 x 1,040 | 1:8,800 |
| 55mm | 440 x 660 | 1:5,600 |
| 135mm | 180 x 270 | 1:2,280 |
| 200mm | 120 x 180 | 1:1,540 |

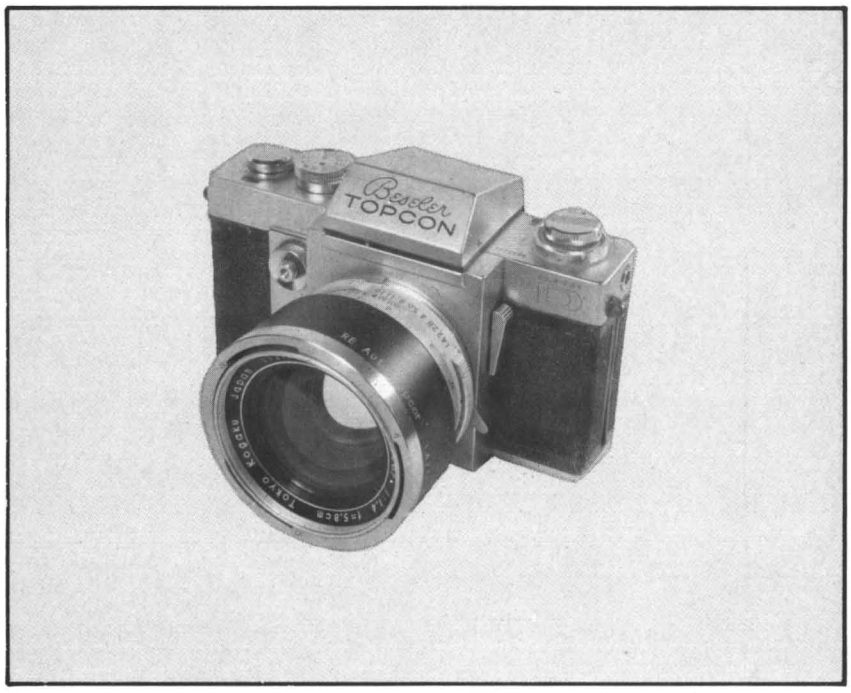
Dimensions of Areas Imaged on 35mm Negatives

**Four frequently used lenses for the 35mm SLR camera image the given areas from an exposure altitude of 1,000 feet above ground level (AGL). Dimensions for other altitudes are in direct proportion and can be easily calculated. For example, if a 55mm lens images a 440 by 660 foot area from 1,000 feet, it will image an 880 by 1,320 foot area (2X) from 2,000 feet. The resulting negative scale at the higher altitude will be half as large, or only 1 to 11,200. It must be emphasized that the negative scale applies only to the film negative and that working prints can be made to any practical scale by enlargement. A 10X enlargement of a 55mm/1,000-foot exposure will yield a print scale of 1 to 560**

tion in contrast and an apparent loss of detail in black and white photos. This detrimental effect can be largely blocked by the use of an appropriate lens filter. For black and white photography a series of progressively darker yellow (sometimes called "minus blue"), orange or red filters are used to neutralize increasing amounts of blue light produced by denser or thicker haze layers.

There are three ways of avoiding much of the haze-reflected light problem. The first is simply to take photographs during high sun periods of midday when the angle of incidence of sunlight on the obscuration is so steep that less light is reflected from the top of the layer. Second, position the aircraft and camera "up sun" over the target so that the sun is located somewhere in the 180-degree arc behind the camera. This keeps most of the reflected light from entering the lens and reduces the haze effect. Finally, since much sunlight is reflected from the top of haze layers in mirror-like fashion, flying the photo mission slightly beneath the top of the layer substantially will improve photo quality.

Military HHAP requirements may not always allow a great deal of flexibility in mission planning, but whenever possible one should take advantage of the best natural lighting conditions available during the day. Generally speaking, the late morning and early afternoon hours provide the greatest amount of light and high angles of incidence. High incident sun angles produce sufficient shadow to give perspective to the photos and aid in their interpretation, but do not shade such large areas that other surface features are hidden. Early morning or late evening missions may often be desirable for tactical reasons, but it should be kept in mind that in addition to low ambient light levels and greater shadowing these periods offer better than average conditions for the formation of fog and haze obscurations.




The middle of the day, when the sun's rays are nearly vertical, is generally considered a poor period for aerial photography because the shadowing effect is absent. It is, however, an excellent time for taking photographs of confined areas surrounded by some sort of masking feature. Jungle trails, small forest clearings, wooded stream crossings and ravine or canyon bottoms are examples of targets which can often be photographed only when the sun is directly overhead. Lastly, if the photographer has the opportunity he should position the aircraft with the sun generally behind and to one side so that shadowing will ease the interpretation of the finished photos.

The person wishing to use HHAP has several types of film to select from and his choice depends on a number of practical considerations. These include the purposes of the photography, existing environmental conditions, and the availability of film and processing facilities. In a continental United States or European peacetime assignment the HHAP user may not be unduly restricted by these considerations, but under less favorable conditions a single type of film and processing may be the only feasible choice. Perhaps the most universal film, and that which will be the mainstay of most HHAP programs, is black and white (panchromatic) film such as Plus-X, Tri-X or other commercial equivalents. It is the same film which has been used for snapshots, pressphotos and aerial photography for decades. Its popularity stems from the ability to record satisfactory images over the widest range of exposure conditions, ease of use and low cost. This is important to the user because he can easily have the film processed by any commercial or military facility, to include local craft shop darkrooms.

Two other familiar films are negative color which is used for making color prints, and color reversal which is processed into

slides. Neither of these are extensively used for tactical aerial photography because of their additional expense and restrictions, but they are useful when it is imperative to show actual colors or when the aesthetic effect is desired for displays of briefings. Somewhat more care must be taken in the exposure of these films since processing facilities are seldom available in the field. One advantage of using negative color film lies in its suitability for the production of black and white as well as color prints from the same negatives.

Infrared (IR) films are less familiar to the amateur photographer but they have great potential for specialized uses in the field of HHAP. Black and white IR film is sensitive to a different portion of the electromagnetic spectrum and therefore images features differently from panchromatic or standard color films. Black and white IR film is not affected by haze so it can clearly image surface features which are obscure to the human eye or are nonrecordable on other films. This quality makes it invaluable when photography through dense or extended haze layers is necessary. It is also especially sensitive to radiation from water and living plants and is frequently used for recording locales characterized by these features. Color IR film was originally called camouflage detection film because of its unique capability and military role. It too is sensitive to IR radiation from live vegetation and images it in different visible colors from nonliving objects which appear the same color in the visible portion of the light spectrum. Both black and white and color IR film are difficult to obtain and process in many places and it takes practice and care to consistently produce good photographs. Where the resources permit, however, these films can be invaluable tools for specialized reconnaissance.

Cameras with interchangeable lenses offer another dimension to planning the HHAP mission. Without getting into a discussion of lens geometry and characteristics, one should understand that increasing the focal length of a lens enlarges the scale (i.e., makes objects appear larger) and also increases apparent relative motion, while at the same time this decreases the field of view and the amount of light entering the camera. For these reasons one should never select a longer lens than necessary to place the primary subject in a usable scale on the photographic negative. To do so results in a tradeoff of other more valuable factors. An example is the case of a battalion S2 who wants photo coverage of an unoccupied bunker complex for simple map plotting purposes, but lighting is marginal because of a late afternoon overcast sky. A 1,000-foot pass over the target with a 55 mm lens might image the entire area in three or four shots with barely sufficient natural light. Trying to do the same mission at the same altitude with a 135 mm lens would require at least eight or nine times as many exposures. The higher apparent relative speed would also require a faster shutter setting to freeze aircraft vibration and motion. That, in addition to the inherent reduction in light transmission of the longer lens, might make the resulting photographs unusable because of insufficient light. Regardless what lens is finally

*Continued on page 26*

| | TARGET NO. | | TARGET NO. | |
|---|---|---|---|---|
| | Planned | Used | Planned | Used |
| **Target Coordinates** | | | | |
| **Aircraft Unit** | | | | |
| **Pilot's Name** | | | | |
| **Camera Type** | | | | |
| **Flight Altitude (AGL)** | | | | |
| **Flight Direction** | | | | |
| **Aircraft Ground Speed** | | | | |
| **Number of Exposures** | | | | |
| **Pattern of Exposures** | | | | |
| **Azimuth of Exposures** | | | | |
| **Time of Day** | | | | |
| **Lens Focal Length** | | | | |
| **Filter Type** | | | | |
| **Film Type** | | | | |
| **Film Speed (ASA)** | | | | |
| **Exposure Setting** | | | | |
| **Remarks** | | | | |

HHAP Mission Worksheet

**Similar forms can be locally reproduced. They should be completed during the mission and filed for reference during film processing and photo interpretation**

# HELICOPTERS in Combat Training Exercises

**. . .each of them was burning with the desire to accomplish the combat/training mission in the best way possible**

**Lt. V. Usol'tsev**
Commander
of a (USSR) Helicopter Crew

Translated From The
**Red Star, Moscow**
By the
Joint Publications Research Service
1000 North Glebe Rd.
Arlington, VA

THE HELICOPTER personnel were called out on alert at dawn. And the airfield came to life at once. The subordinates of Capt Tech Serv V. Fil'chenkov were among the first to arrive at the apron. In socialist competition, they assumed the obligation to reduce the times to prepare the helicopters on the alert signal and also for repeated takeoff. The score was kept in minutes. But if you consider that the normative times themselves are compressed to the minimum, it becomes obvious: these minutes can be "found" through high technical intelligence and the clear organization of labor. Therefore, it is not by chance that officer Fil'chenkov sees that his subordinates work smoothly always and in everything.

So it was also this time that the master of combat qualifications, Ensign (Praporshchik) N. Gavzov, was the first to report the readiness of the helicopter for takeoff. On board the helicopter which he services he, the son of a frontline fighter, has shown off the proud badge—"expert"—for a long time. The report of his competitor in the socialist competition, Ensign B. Koptsov, arrived second.

There was a time when Koptsov's service was not going along well. He had difficulty in mastering the equipment. And when Gavzov challenged Koptsov to competition, many were surprised: a first-class specialist and a backward specialist. . . But the competition proved to be useful for both of them: Koptsov learned from a more experienced comrade and Gavzov, helping the backward one, went further in acquiring firm skills. They studied the equipment together and worked at the airfield side by side. Ensign Koptsov was gradually seized by a selfless attitude toward the matter of a competitor and by his romantic elation in service. As a result, Gavzov became a master of combat qualifications and Koptsov—a first-class specialist. His work was recently presented as an example for all personnel.

. . .In expectation of the command for takeoff, the fliers assemble in the classroom for preflight training. Spreading out maps, they "strolled up and down" the impending routes again and again and refined the necessary data. It was felt that each of them was burning with the desire to accomplish the combat-training mission in the best way possible.

"Let me remind you, comrades," sounded the voice of the subunit commander, MAJ N. Semenov, "that the tank unit with which you are to coordinate on the exercise is a famous unit. It was awarded three combat orders. Eight of its soldiers were awarded the title of Hero of the Soviet Union. Strong combat friendship linked the tankers with the aviators in the years of the battle against fascism. And now this friendship is being multiplied on joint exercises. Therefore, I should like each one to evaluate the significance of military comradeship and to render assistance to the tankers in the attack by the exemplary accomplishment of the assigned mission."

And here the helicopter piloted by the squadron commander is the first to rise into the air. The crew must land the machine in the mountains, take a group of soldiers on board and land it in the "enemy" rear.

MAJ Semenov is the same age as the Great Victory. He did not have the occasion to accomplish combat raids. But he accomplishes his training flights in a frontline manner—with enviable precision and high skill.

The sun had already climbed high. Bumpiness dominates above the spurs of the forested mountains. It is difficult to adhere to a flight mode under such conditions: for the route lies at the lowest possible altitude. Now and then glancing at his flight chart, MAJ Semenov orients visually. Now the pilot and the rotor machine have merged into a single whole. Neither a strong gusty wind nor haze will be able to prevent accomplishment of the mission.

Having picked up the group of soldiers, the helicopter again rose into the air. . . . The "front line" was crossed. Now the group must be delivered to a draw between the mountains. Observing safety measures the flight technician, Ensign N. Gavzov, accomplishes the landing of the group.

Nor is the tension of the flight lowered on the return path. The skillful actions of the crew permit the successful overcoming of the opposing side's air defense.

"A new 'enemy' antiaircraft missile battery has appeared," MAJ Semenov notes. The pilot plots its position on the map.

When they returned to the airfield, the pilots began to surround the commander and began to inquire about the situation on the route. CPT S. Klopin was especially curious. He is an experienced pilot. He has more than 10,000 hours of flying time behind him. When MAJ Semenov took over the subunit, the badge of a third-class specialist shone modestly on the officer's breast. Now he has become a second-class military pilot and flies confidently under all weather conditions. And this is to the great credit of the commander.

No less "meticulous" was CPT V. Kulev, long a competitor with Klopin in socialist competition. Their interest in training is understandable: neither one wants to concede superiority. Well, this is a good sign. The people are attuned to combat harmony. And this is one of the main conditions in the attainment of new successes.

The sky above the airfield shudders from the rumble of the engines. The intensity of the flights is increasing and the crews are accomplishing their training missions in an outstanding manner. The technicians and mechanics prepare the combat machines for repeated takeoffs quickly and with high quality. They work in an inspired manner, with the vim which is inherent to people who love their profession.

**The U. S. Army Missile Command will present the second Department of Army Materiel Readiness Command (DARCOM) Maintainability Engineering Symposium, 23 through 25 February 1977. This symposium. . .will be held at the Orlando Hyatt House, Orlando, FL. For more information contact Lynda S. Locke, ATTN: DRSMI-NOL, U. S. Army Missile Command, Redstone Arsenal, AL 35809**

# Improved IR Protection for Army Aircraft

**Robert C. Miller**

**Project Manager, Research and Development Department**
**Hughes Helicopters Division of Summa Corporation**
**Culver City, CA**

LOW ALTITUDE, slow moving aircraft such as helicopters and utility fixed wing aircraft have been highly vulnerable to heat-seeking missiles. Infrared (IR) seeking missiles use radiation from hot metal surfaces on an aircraft as guidance for targeting but protective thermal insulations of conventional design have been employed to eliminate this IR source.

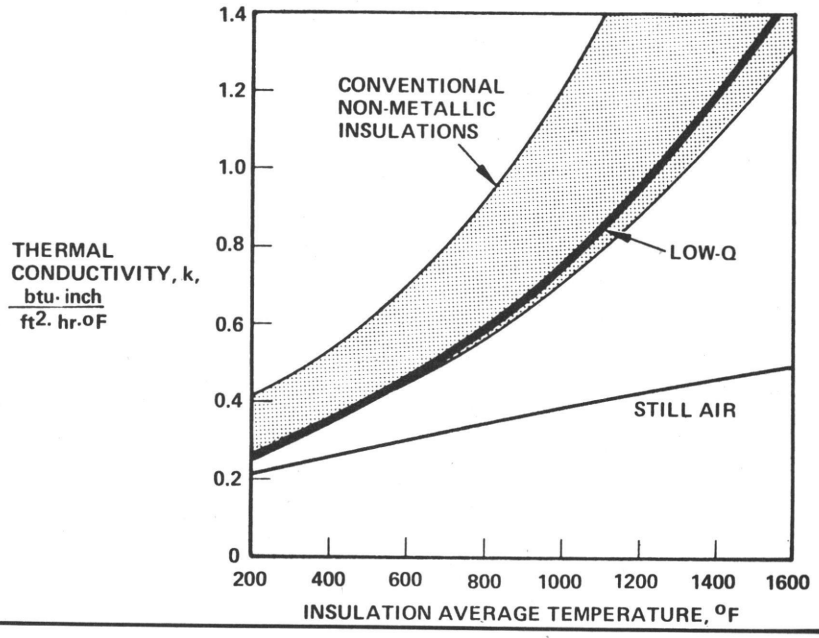
Improvements in insulation characteristics have become a technical goal in the development of IR suppressors. Primary goals for any IR suppression system are *low initial cost and low maintenance.* These initial goals are firm requirements for any "second generation" IR suppression hardware.

"First generation" IR suppressor design understandably did not provide optimum solutions to the heat-seeking missile threat; however, progress was made toward the achievement of the following general requirements:

- Low cost and maintenance
- Attenuation of both metal and exhaust plume heat radiation
- Aircraft protection from any direction (full sphere protection)
- No auxiliary blowers
- Minimum weight and power penalty
- High reliability
- Retrofitable as a kit

Army research and development (R&D) programs verified the thermal and structural performance of an all-metal thermal insulation, LOW-Q [registered trademark, Hughes Helicopters, Division of Summa Corporation]. This new insulation material is fabricated from stainless steel and was developed by Hughes Helicopters in support of a company-sponsored heavy lift helicopter design employing tip jet propulsion. LOW-Q combines excellent thermal performance with the structural properties of stainless steel to provide an insulation system that may be installed directly on exhaust ducting.

**Figure 1**
**Thermal Conductivity of Low-Q Compared to Conventional Nonmetallic Insulations**



**Emphasis has been placed on the survivability of Army aircraft operating in environments where heat-seeking missiles represent a prime threat. The trend in missile homing device sophistication is reflected in penalties to aircraft higher performance in order to achieve protection and system cost based on first generation infrared protection designs.**

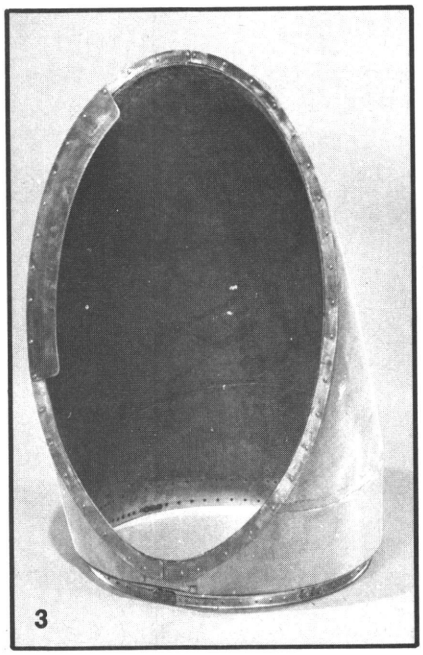
**Army research and development programs have been oriented to reduce or eliminate the trend toward increased cost and complexity of new infrared protection systems. The achievement of these goals with significant results is represented by the Black Hole Ocarina system developed by Hughes Helicopters.**

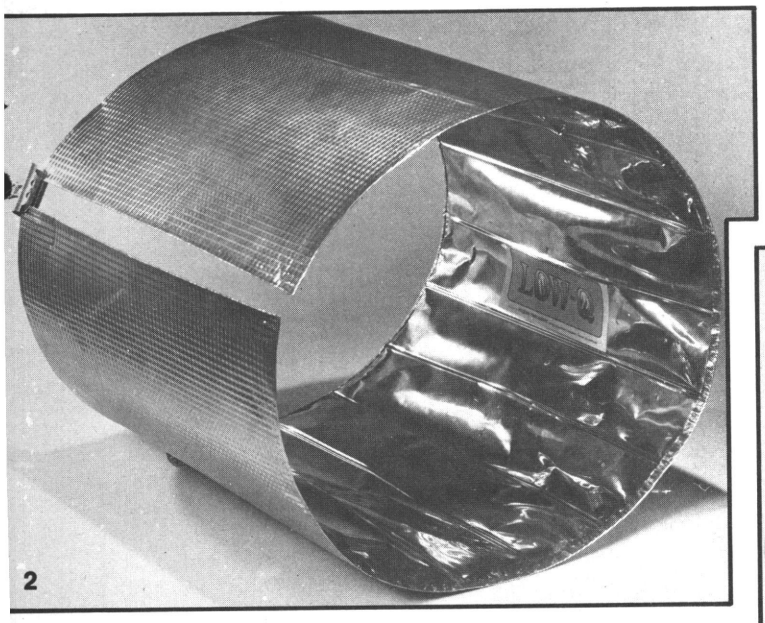
The thermal conductivity of LOW-Q insulation and fibrous nonmetallic insulations, both of which have good thermal properties, is shown in figure 1 for a range of temperatures. The nonmetallic insulations exhibit good thermal performance but generally have little resistance to vibration and fluids and they must be extremely well packaged to be useful in such environments.

The unique properties of metal insulation have been successfully demonstrated under a National Aeronautics and Space Administration (NASA) contract. Metal insulation for the external protection of hypersonic airfoils is being evaluated in a current program.

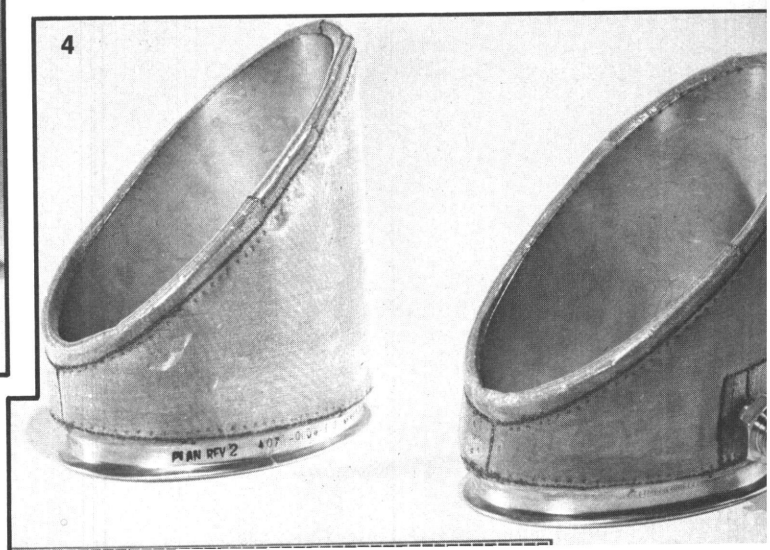
Federal Aviation Administration (FAA) approved tests are in progress to qualify metal insulation blankets for use on turbojet engines in commercial passenger aircraft. Blankets have been in service for more than 18 months without structural degradation or any measurable loss in their original insulation performance (see blanket design, figure 2).

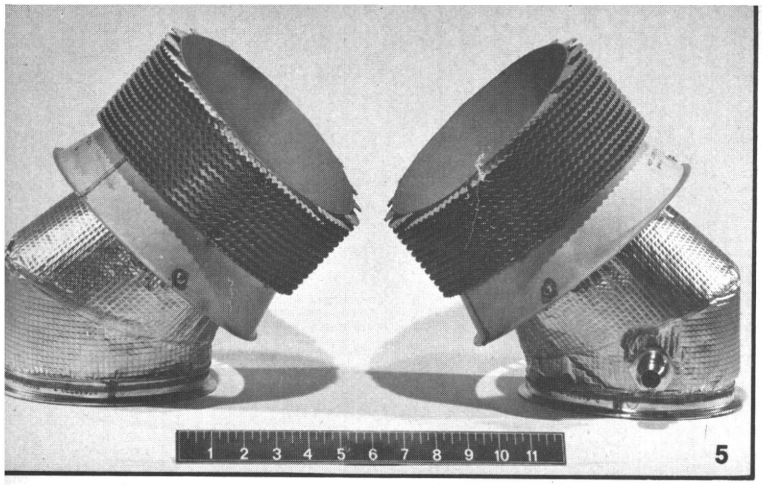
Thermal studies at Hughes Helicopters resulted in the successful development of the Black Hole Ocarina (BHO) [patented system, Hughes Helicopters] IR suppressor. The system employs multiple exhausts to reduce plume intensity and the external surfaces of hot ducting are kept at low temperatures with LOW-Q insulation. Visible internal and external surfaces are maintained in the 200-degree Fahrenheit temperature regime by precooling the exhaust

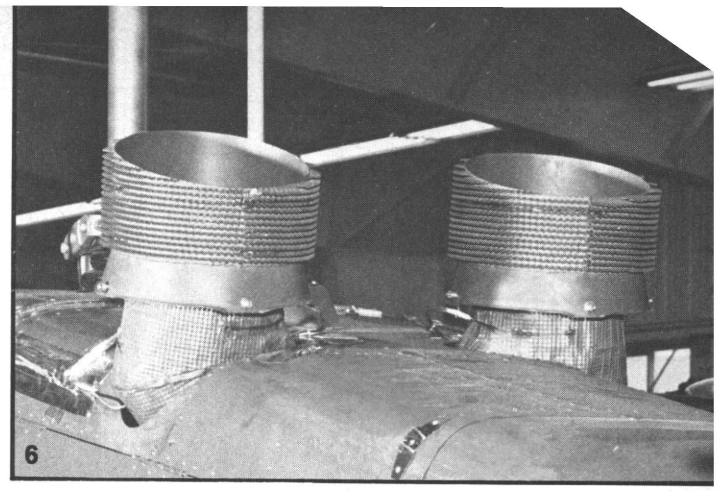



(2) Metal insulation blankets have been in service for more than 18 months without losing their insulating performance. (3) The Insulated exhaust extension for the AH-1G reduces the hot metal IR signature and deflects the discharge upward improving vulnerability to ground-launched heat-seeking missiles as do the (4) exhaust stacks for the OH-58





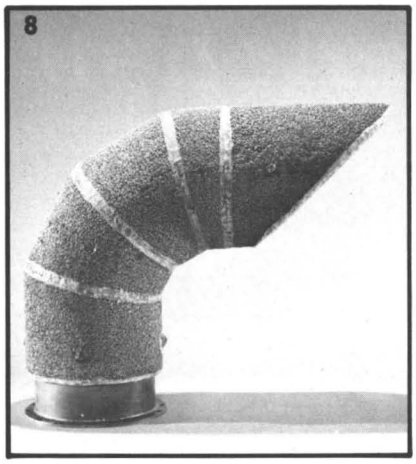

(5) Black Hole Ocarina IR suppression exhaust stacks designed for the OH-58 helicopter. (6) BHO system installed on the OH-58. (7) Black Hole Ocarina stacks in flight test provide full sphere protection

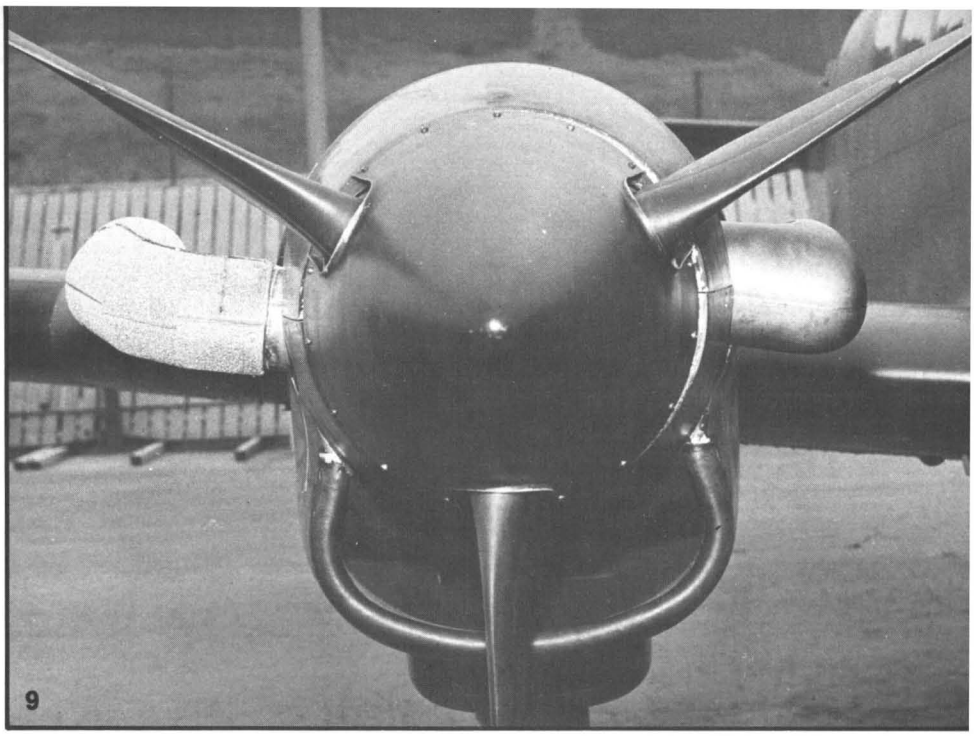
gas and by surface heat rejection to the slipstream.

The BHO system provides full sphere IR protection at a minimum demand on the aircraft power system. Engine exhaust gas pumps ambient air via nozzle ejectors to cool the hot gas, thereby eliminating the need for auxiliary blowers. The power loss imposed varies from nearly 0 to 1.3 percent, depending on the installation. The exhaust IR suppressors employing LOW-Q insulation and/or the Black Hole Ocarina are summarized in the table at right.

**Exhaust Infrared Suppressor Applications**

| Item | Aircraft | Type of IR Protection | Program Status | Contracting Service |
|---|---|---|---|---|
| 1 | AH-1G | LOW-Q insulated exhaust duct | R&D | Army |
| 2 | OH-58A | LOW-Q insulated exhaust stacks | Production | Army |
| 3 | OH-58A | BHO + LOW-Q | R&D | Army |
| 4 | U-21 | Black Hole | Limited Production | Army |
| 5 | AH-1J | Black Hole Ocarina | R&D | Navy |





(8) Black Hole IR suppression production stack for the U-21 aircraft. (9) BHO stack installed, left of photo. (10) Tests of the stacks show they eliminate the need for thermal insulation. (11) AH-1J Seacobra is modified for IR suppression in test at Hughes Helicopters for the U.S. Navy

The AH-1 insulated exhaust extension (figure 3) attaches to the engine exhaust duct and reduces the IR signature of the hot metal. The duct also changes the exhaust discharge to an upward direction, thereby reducing aircraft vulnerability to ground-launched heat-seeking missiles. Upper hemisphere protection is not provided by this system.

Insulated stacks currently in production at Hughes Helicopters for the Army OH-58 helicopters (figure 4) provide good lower hemisphere protection. The BHO system for the OH-58 (figures 5, 6 and 7) is oriented to full sphere protection; this system, still in the R&D phase, is expected to replace the insulated stack as a production configuration due to its improved performance.

The U-21 Black Hole stack currently in production (figures 8, 9 and 10) eliminates the need for thermal insulation and metal temperatures are so low that aluminum is used in the stack construction. This use of uninsulated aluminum for exhaust ducts is judged to be a "first" in its application.

A U. S. Navy IR suppression program is also in progress and an AH-1J SeaCobra under modification at Hughes is shown in figure 11.

# Inadvertent IFR

INADVERTENT IFR procedures! Why, I can't see how anyone would let himself get caught in a situation like that.

These were the words of an aviation company commander and senior aviator in response to a question from a new aviator at an airmobile briefing on a cloudy morning. Like most experienced aviators, he had never been caught in that situation. For those who have (and are here to tell about it) the experience was probably chilling at first.

If you are not on an airway, you have no minimum enroute altitude or minimum obstruction clearance altitude. Your first impression is to climb or perhaps descend if you think you know where you are and can get under it. If you are in formation you will probably want to stick with the aircraft you have been following unless told otherwise.

But what altitude should you be at? Who do you call and what should you say? Do you have enough fuel to get home? Do you have your approach plates with you? Can you get GCA (ground controlled approach)? All these questions are important and you need answers quickly. The price of a wrong decision could be more than you are willing to pay.

A little forethought will go a long way toward answering your most immediate questions. In flight school everyone had to know the inadvertent IFR (instrument flight rules) procedures before going solo in the UH-1 Huey, but those procedures won't necessarily work where you are. The first thing is to level the aircraft, maintain constant heading, adjust to climb power and establish climb airspeed.* Next, you need to recall the approximate location and height of all obstructions in your area. Determine the highest and add at least 500 feet as a buffer. Try to round to a 500-foot interval. It is easier to remember than an odd 100-foot altitude and it should separate you from IFR traffic.

If you have an obstruction rising much higher than the surrounding countryside, always keep yourself oriented to it. If you get into the clouds turn away from the obstruction and climb to an altitude which would clear all other obstacles. Examples of this are an extremely tall mountain peak, or a range or restricted area. While you are thinking ahead, make sure you have an approach plate for your area in the cockpit with you. I know an AH-1 Cobra pilot caught VFR (visual flight rules) on top with his flight information publications in his helmet bag in the ammo bay. A call on Guard got the approach control frequency, but a commo failure would have been total disaster.

During your mission planning take a look at the obstacles along your route. Knowing how high the obstacles are on each side will give you some idea of when you are safe immediately after an unforeseen encounter with the clouds. If you are planning a formation flight, now is a good time to think out a simple procedure for your flight. Look at FM 1-51 for details. With all this preparation you probably won't ever get caught inadvertent IFR, but let's suppose you are returning home from a tac site on a rather nasty night. You know you probably will need special VFR to get in, since the tower says it is 800 feet and 3 miles in light rain. Perhaps you are a little edgy about the weather, but the comforts of home are calling.

Suddenly, you are in a heavy downpour and you can't see anything but raindrops on the windshield. The countryside is dark. A glance at the attitude indicator shows a slight bank and a quick look around shows your airspeed is slowing and a slight climb. While trying to get a crosscheck started, you notice the cockpit suddenly brighten in green and red lights. Your copilot has the presence of mind to turn off the anticollision light and switch the outside lights to dim.

By now you realize you are in the clouds above moderately wooded rolling terrain with only a general idea of where you are. The aircraft is about 1,000 feet AGL (above ground level), the range area is to the north, and there are a couple of radio towers in this area, the tallest about 1,900 feet MSL (mean sea level). With the lightning speed which has characterized your aviation career, you turn south and start climbing to 2,500 feet. Your copilot recalls your briefing before the flight and calls clear of the tower and contacts approach control. The 600 pounds on the fuel

*Reference DA TWX, 20 OCT. 1976. (to be carried in February Digest)

# (or how to live with your mistakes)

**CPT Stephen E. Martin**
Department of
Undergraduate Flight Training
U.S. Army Aviation Center
Fort Rucker, AL

gauge adds up to about an hour before burnout.

After radar contact, the controller advises that the GCA at your airfield is down. . .would you like an ILS (instrument landing system) approach? The weather is down to 600 feet and 1 mile in rain. There is an Air Force base with a GCA about 20 minutes away and since you don't have a glide slope receiver, a localizer approach will only take you down to 400-3/8. But, home is where you want to be.

After requesting the localizer approach and receiving vectors to final you ask how many aircraft are in front of you and find you are fourth in the pattern to follow a DC-9 arriving in about 15 minutes. Another look at the fuel gauge, a quick thought about not reaching MDA (minimum descent altitude) or a missed approach and suddenly you aren't so sure that you want to wait for 15 minutes to begin the approach. After all, aren't you suppose to land with a 45-minute fuel reserve?

Right now is where most of us hesitate. Simple arithmetic says there are 15 minutes before initiating the approach, plus 5 to 10 minutes to the missed approach point. If we are down, fine! If not, it is 20 minutes to the Air Force base plus time for the approach—or go back and shoot the localizer and hope for the best. Thus there are two alternatives. One is to proceed directly to the Air Force base; the other is less attractive to any aviator. Declare your low fuel state and get immediate clearance for the localizer approach. This should save you at least 10 minutes of your now very valuable time. If that isn't enough to ensure that you will have enough time to reach the alternate airfield, then request direct routing to the Air Force base and get on the ground.

While you are making these decisions, ensure that your copilot has all available NAVAIDs (navigational aids) tuned in. If your aircraft has only UHF (ultra high frequency) and FM (frequency modulated) have the FM tuned to someone who can talk to approach control in the event of a UHF radio failure. Since you are IFR you should ask approach control to forward your new IFR flight plan or contact Flight Service yourself. But quite honestly, this is far less important than planning for the approach.

By now you have made your decision. Remember, a little forethought and planning together with common sense can turn your inadvertent IFR misadventure from a horror story into a war story.

*Continued from page 17*

used, it should be complemented with a lens hood whenever possible to exclude random light from the lens opening.

The primary difference between an HHAP mission and recreational photography is *planning*. An HHAP mission follows a preplanned sequence of steps to obtain information of an anticipated nature for an established purpose. The number and complexity of the planning steps will vary with the situation, but as a minimum the photographer must answer five questions:

(1) What is the target?

(2) What information is needed?

(3) What type of final photographic product is desired?

(4) When is the information needed?

(5) What general flight, terrain, weather and tactical conditions can be expected?

Using this information the photographer should then fill out a mission worksheet to ensure that detailed planning is as complete as possible. This latter step is best done with the pilot's advice and concurrence, but if not then it constitutes a good checklist for giving the pilot a preflight briefing. This briefing is absolutely necessary for safe and successful photo missions. It is also a good opportunity for the pilot to reciprocate with instructions of his own pertaining to such things as inflight emergencies, flight limitations and, all importantly, the location of sick bags.

As with so many other tasks, the execution of the mission is rendered a simple job when it is preceded by proper planning. Once at the aircraft and in the air, there are three things which must be done. Prior to takeoff some means of communication must be established with the pilot. A crewman's helmet or headset is obviously the best solution, but hand signals or a small chalkboard can be used if necessary. Second, a suitable place for positioning of the camera must be found which will give the necessary angle of view and isolate the camera from airframe vibrations. The position chosen inevitably seems to also be the most uncomfortable one. Isolation can usually be achieved if the photographer keeps his camera and upper body from resting against any part of the aircraft. The pilot can also reduce vibration in most cases by manipulating the power setting or aircraft attitude. The camera position and view may also be governed by the location of open doors or windows. The use of open areas is necessary to avoid glare and distortion, but for safety and procedural reasons their use must be coordinated with the pilot *before* takeoff. Last, once over the target area the photographer should make sure he has a workable camera-film-lens combination and all settings are correct.

Whenever conditions permit, all targets of unusual importance or timeliness should be rephotographed on repeat passes using slightly different exposure settings, lenses or camera angles in order to ensure the "capture" of a good set of pictures. A few extra minutes of aircraft time and a few frames of film are cheap insurance against mission failure.

During transport or between periods of use the loaded camera should not be left in bright sunlight or near sources of heat since both can cause film to deteriorate very rapidly. For the same reason both unexposed and unprocessed exposed film should be stored in a cool, dark place such as a refrigerator. At the completion of a mission it is good policy to immediately process the film even if the roll is only partially exposed. Even though the photos may not be needed soon, it is another example of cheap insurance against loss of the information through inadvertent camera opening, loss of the film and other accidents. The probability and degree of film image deterioration increases with the length of time the film remains unprocessed.

What then might be the *minimum* amount of equipment and camera instructions to attempt a routine HHAP mission? Satisfactory photographs can be taken across a wide range of conditions by simply using a common camera such as the 35 mm SLR with a more or less standard 50 or 55 mm lens. Black and white panchromatic is the choice of film for the reasons earlier given. Whatever film is selected, the ASA rating should be noted from the film container and the proper adjustment made to the camera. The focus should be left in the infinity (oo) setting for all aerial photography, and it may even be taped to avoid accidental movement from that setting. Neither is the depth of field a factor, so the aperture may be kept in a wide open position (f-stop of about 4, 2.8 or less). With that done the photographer need only adjust the shutter speed to keep the light meter needle in the proper position. From then on it is a matter of following a logical sequence of mission planning and execution steps as suggested earlier.

It is probably apparent that the conduct of both peacetime and wartime military operations would be substantially hindered by the absence of modern aerial photographic resources. Hand-held aerial photography is not suited to the role of rising phoenix-like to replace or even challenge conventional reconnaissance techniques, but it does have contemporary value. It is a useful and inexpensive substitute when conventional photo coverage cannot be obtained, and it can be a timely and flexible supplement to increase the scale or to update other information. Most important is its accessibility—there are few situations where field expedient aerial photographs cannot be routinely taken and advantageously used.

# Hatchet Man

*Continued from page 7*

screaming about lack of personnel in certain MOSs. Yet they have no cross-training or on-the-job training programs. They make no effort to balance overages against shortages. The hell of it is that some companies have overages of MOSs and another is short of the same MOS—and vice versa. No one can explain that one away very easily.

"Item eight, field support: Two of the four companies are doing a good job in this area. They have prepacked support packages and augment the DS sections with people from allied shops when they go to the field with their supported operational companies. One company is outstanding and two fair, but the remaining company is unsatisfactory. No allied trade people go to the field; consequently, many aircraft are flown in from the field to get minor shop work done. It is fine for a crew to get back for a night at home, but it's also a waste of blade time and fuel.

"Item nine, MAIT program: Once again the staff up there is paying "lip service" to your directive about MAIT visits. There is a team on paper but it hasn't been out to any supported units in 3 months. Several of the supported units really need help and have requested a MAIT visit now and then. Some of the team members act as spies around the DS companies instead of being out where they belong.

"Item ten, publications: The battalion consolidates and forwards its unit's requests for TMs, FMs, etc., but when the publications come in, they break them down in such a haphazard manner that no one gets his fair share, or in some cases, never gets a single copy of what he ordered. Blank forms requests are handled the same way. The situation isn't much better in the units. I saw outdated pubs being used in the shops and on the flight line. The excuse is that they order the manuals but never get delivery. Anyway you look at it, it's a mess and needs straightening out.

"Item eleven, calibration: Sir, those people don't know the meaning of the word. The DS companies can't even check their customers torque wrenches because the calibration of their own torque wrench testers isn't up-to-date. TM 38-750 and TB 750-931-10/1 adequately outline how the program works, and there is no reason for the mess up there. Here again, the responsibility is that of command.

"Item twelve, QCA program: Once again, the quick change program is one of your pet projects and one that really pays dividends if used correctly. Some units are trying and making some headway. Some just give the program lip service. Only one is really doing the job. The biggest problem is they will not hold back the parts they requisition for QCA buildup. Your directions not to start assembling a QCA 'til 90 percent of all parts are on hand is being misconstrued in that the units use the QCA parts on hand in normal maintenance and to avoid EDPs. Consequently, they'll never reach the 90 percent milestone and will never have an effective QCA program. This particular company's personnel are superior. They have two engine QCAs, two mast/swashplate/stabilizer bar QCAs, and one main transmission QCA ready for immediate swapout. They follow directions to the letter and make the system work.

"That, sir, just about winds it up. I've hit the high spots for you. My recommendations follow each item and then are summarized at the end. By the way, I gave a good exit briefing to the battalion maintenance officer and some of the other staff interested enough to accept my invitation to attend the meeting. And frankly, they seemed to care very little about what I told them my report would contain. The situation up there isn't hopeless yet, but it's well on its way. I could assemble a 'remedial' training team out of our group staff and the other battalions and go up there for 30 to 60 days and get them on the ball. But, you must have a good base to start with, and that outfit hasn't got it. Fire the commander and half the staff; infuse some new blood; and give them a chance. Then you'll see marked improvement on some of those charts and graphs on the wall over there."

"O.K. Hatchet, you've done a job for me, and a job on some people up there. On the way out, tell the sergeant major to alert my crew. I'm going up there tomorrow unannounced and raise some hell. You might as well come along and help stack some of the deadwood you've used your "hatchet" on. Takeoff will be 0500 so we'll catch them unprepared. I also want to brief you on another problem I discovered today so don't put your "hatchet" away yet. You're dismissed."

* * *

As Chief Hatchet walked down the hall toward the group maintenance office, his thoughts wandered to the who, what, where and why of the next problem. And he wondered why some people never, never learn, even when you provide guidance; give them books; send them to school; and show them the errors of their ways. He also wondered how late he would have to work that night to clean out his "in" box. It was always full after one of his "hatchet" trips.

OPMS CORNER

## Officer Personnel Management System

# Transition/Saved Pay Provision Terminated 31 May

THE TRANSITION/saved pay provision of the Aviation Career Incentive Act (ACIA) will end on 31 May 1977. After 31 May 1977 only those aviators with less than 12 years aviation service or those who meet the requirements for the 12- and 18-year "gates" will be entitled to continuous flight pay, regardless of the position they occupy. Aviators who fail to meet the gate requirements will be eligible for monthly flight pay only while occupying an operational flying position. Entitlement to flight pay for officers with more than 25 years service and warrant officers with more than 30 years service also terminates on 31 May 1977, irrespective of their duty position.

The ACIA is designed to achieve a more equitable distribution of flight pay while increasing the services' ability to attract and retain officer/warrant officer aviator crewmembers on a career basis. The provisions of the act apply to aviators of all services. Section 301a of Title 37 changes flight pay from hazardous duty incentive pay to aviation career incentive pay, thus shifting the emphasis from pay for performing hazardous duty to pay for selecting a career in aviation. The following paragraphs review the major requirements for entitlement to aviation career incentive pay.

**Definitions:** There are a few key definitions that must be fully understood in order to comprehend the law and to determine eligibility for incentive pay.

- *Aviation Service Entry Date (ASED):*
  - √ For commissioned officers, ASED is the initial day, month and year the officer was placed on flying status as a student officer at the flight training facility.
  - √ For warrant officers, ASED is the date of appointment as a warrant upon the completion of flight training. If the individual was a warrant officer upon entry into flight school, the ASED is computed in the same manner as for a commissioned officer.
  - √ Once the ASED has been established, time credited toward aviation service shall run without interrruption.
- *Total Operational Flying Duty Credit (TOFDC)*—Flying performed under competent orders by rated or designated members while serving in assignments in which basic flying skills normally are maintained in the performance of assigned duties and flying performed by members in training that leads to the award of an aeronautical rating or designation.
- *Total Federal Officer Service (TFOS)*—All periods of commissioned/warrant officer service, active and reserve, creditable for basic pay (time since base pay entry date), minus any period(s) of enlisted service creditable for basic pay.
- *Continuous Flight Pay*—Incentive pay authorized to qualified commissioned/warrant officer aviators while serving in other than operational flying positions.
- *Monthly Flight Pay*—Incentive pay authorized to commissioned/warrant officer aviators while serving in operational flying positions who do not otherwise qualify for continuous flight pay.

**Eligibility:** Upon graduation from flight school the commissioned/warrant officer(s) are authorized continuous flight pay until 12 years of aviation service (the first gate) have been accumulated. If at that time the individual has accrued 72 months of operational flying credit, eligibility for continuous flight pay will remain until accumulation of 18 years of aviation service. If there are less than 72 months of operational flying credit, eligibility for monthly flight pay will be valid only while serving in an operational flying position. There is no makeup provision for a missed gate; however, an aviator may qualify for the 18-year gate even though the 12-year gate was missed if requirements for the 18-year gate are met.

The second or 18-year gate occurs when 18 years of *aviation service* is accumulated. This gate has two windows. The first window

**LTC James P. Hunt**

Aviation Management Branch
U. S. Army Military Personnel Center
Washington, DC

provides that if the individual has accrued 108 months of operational flying credit, eligibility for continuous flight pay remains through 22 years of *total federal officer service (TFOS)*. The second window provides for continuous flight pay through the 25th year (30th year for warrant officers) of *total federal officer service* for those individuals who accrue 132 months of operational flying credit. Again, there is no makeup provision for those who missed the gate.

Entitlement for flight pay ends when a commissioned officer completes 25 years, and a warrant officer completes 30 years, of *total federal officer service*. An individual cannot receive flight pay beyond this point even though occupying an operational flying position.

**Transition Saved Pay**: The bill contains a save pay clause which states that officers' flying pay will not be terminated as a result of not qualifying for the 12th or 18th year aviation service gate, or attaining 25 years TFOS, for 36 months from the effective date of the bill. These provisions of the clause terminate *31 May 1977*. Flight pay will be terminated for the following categories on 31 May 1977:

- Commissioned officers with 25 years or more TFOS.
- Warrant officers with 30 years or more TFOS.

Continuous flight pay will terminate 31 May 1977 for:

- Commissioned/warrant officers who failed to meet the gate requirements established by the law.

Exceptions:

- Commissioned/warrant officers with more than 12 years but less than 18 years of aviation service on 1 June 1974 will be presumed to have met the 72-month operational flying duty requirement and will be entitled to continuous flight pay until their 18th year of aviation service.
- Officers with 18 years aviation service on 1 June 1974 will be presumed to have established eligibility for continuous flight pay until completion of their 25th year of TFOS.

**Administration of the Act**: Currently, military personnel officers report the number of months operational flying time accrued during the past fiscal year to MILPERCEN (Military Personnel Center). This information is compiled by MILPERCEN and is published in DA Circular 600-6. The mechanics of inserting this information into the finance and accounting system currently is under study and will be announced during the 2nd quarter fiscal year 1977.

## Keep It Coming To You

**To keep getting the *DIGEST* you must submit the *new* DA Form 12-5 dated February 1976.**

**The Adjutant General Publications Center has stipulated that all pinpoint accounts must be renewed now, or else the subscription will be cut off.**

**Check with your unit administrative staff for the DA Form 12-5. The mailing address and basis of distribution for publications are shown on the form.**

**This article, adapted from a presentation by the author at a recent Professional Pilot Safety Workshop, carries a valuable lesson for all Army aircrewmen**

USAAAVS

Gerard M. Bruggink

# THE UNUSED TALENT IN THE COCKPIT

DURING A RECENT safety workshop, one of the speakers suggested that what this country needs most now is not safer, but less expensive air travel. He based part of the rationale for his suggestion on social equity: The cost of air travel relegates the average American to travel by car, a form of transportation that is 15 times as dangerous as commercial air travel. Therefore, why should additional expenditures be made so that the more affluent can travel by air at some insignificantly smaller risk? The speaker postulated that for each 100 air travelers whose lives are saved by costly safety measures—and correspondingly higher air fares—1,000 people may be "condemned" to death on the highways. He concluded that society would be served best by solving the problems of cost and constraints imposed by preoccupation with safety, while trying to maintain the current exceptionally high level of safety.

I present this thought-provoking opinion only to highlight the complex role of safety in the balance between risk and benefit. There is no easy solution to the question: How can air travel be brought within reach of a greater portion of the population without jeopardizing the current level of safety? Even the question itself may introduce a hazard since it is based on the assumptions that the safety record is adequate and that it can be stabilized. Widespread acceptance of these assumptions might lead to satisfaction with "second-best"—the most destructive element in aviation. The short-term economic gains realized by settling for a less-than-perfect record would be more than offset by the economic impact of a worsening safety record.

Admittedly, there is a direct relationship between expenditure and the level of safety that can be achieved through perfection in engineering technology. The Apollo project is a good example in that regard. However, there are obvious financial limitations when it comes to ensuring perfection in the performance of those who design, build, maintain and operate an economically viable aviation system. On the other hand, it can be shown that the failure to prevent some of the most catastrophic losses in aviation had nothing to do with the price of the hired talent or the price of the tools to do the job. Therefore, the assumption that the safety record can be improved only by additional expenditures is not necessarily valid. I hope to prove that air travel can be made more economical—and safer—by better utilization of talent that has already been paid for.

## The Atmosphere in the Cockpit

As pilots you are at the receiving end of all the threats to safety. If you perceive these threats in time, you are often the last one who can do something about them. This puts you in the unique position of being

**Mr. Bruggink is employed by the National Transportation Safety Board on the Accident Inquiry Management Staff, Bureau of Aviation Safety, Washington, DC. He helped initiate the first systematic accident investigation and prevention program in Holland's Tactical Air Command in 1952. Before joining the NTSB in 1969, Mr. Bruggink was an air safety investigator with the U. S. Army Agency for Aviation Safety, Fort Rucker.**

aviation's last line of defense. How well do you play your defensive role as a qualified member of a qualified crew?

For an answer to this question we have to study a few instances where the cockpit defenses broke down. Most of the resulting mishaps had one common denominator: Capable individuals failed to combine their talents into a unified crew effort, fine-tuned to the first signal of potential trouble. And whenever the collective sensing mechanism did not provide full protection, there appeared to be something wrong with the atmosphere in the cockpit.

I cannot define cockpit atmosphere. It is something I sense after spending about 10 minutes in the jumpseat and I can only tell whether it is good or bad. It involves the manner in which command is exercised and accepted; the degree of cooperation and mutual respect; the sense of individual responsibility and involvement; the level of discipline and integrity in executing routine chores; the collective reaction to delays and other frustrations. In short, I judge cockpit atmosphere by how it affects me: Either I feel comfortable because I sense that I am on a well-run ship, or I feel uncomfortable because I have the impression that the individual crewmembers happen to be traveling to the same destination in the same cockpit.

Although it is difficult to define a cockpit atmosphere that brings out the best in each crewmember when it counts the most, it is easy to demonstrate how failure to use available talent can lead to accidents.

### Case No. 1

You are the junior man in the cockpit, with less than 2,000 hours. The two pilots up front are making a localizer back course approach. As the flight passes the final approach fix, the tower advises that a snowstorm is moving across the approach end of the runway. About the same time, the aircraft runs into the snow. The first officer calls out 1,000 and 600 feet above touchdown. You feel confident that the aircraft will be leveled off at the minimum descent altitude (MDA) of 360 feet if the runway is not in sight. But the descent continues through MDA without a callout and you notice that both pilots are looking outside. The altimeters, including the radar altimeter, are approaching zero height above touchdown. The aircraft should be over the runway now and you are waiting for the familiar thud of the landing gear. But suddenly you hear excited talk about trees and you realize that the two up front have bungled the job. There is a loud roar of engines followed by a sharp change in aircraft attitude. For a few seconds you feel the chilling uncertainty about what is going to come next, until the instruments tell you that all is well. The flight makes a

go-around and lands successfully on the second attempt.

When you learn later that the aircraft struck trees 15 feet above airport elevation and 1 ¼ miles short of the runway, you begin to wonder about your role in this brush with disaster. Would things have been different had you called out MDA—and subsequent altitudes? Would the captain have appreciated the unsolicited help or would it have annoyed him? What was it that kept you from speaking up when the altimeters unwound and you saw no runway? Was it your misplaced confidence in the airmanship of your colleagues up front? Or was it the seniority barrier? Or was it an underdeveloped instinct for self-preservation? Or was it fear of being accused of being a noncomformist?

The need to ask these questions proves that you were not a working part of the cockpit team. Somehow, your talent was wasted. The fail-safe features of the crew concept did not operate.

After the dust had settled, you were confronted with another dilemma: the choice between loyalty to your profession and belated loyalty to your colleagues. How did you feel when you claimed, with the rest of the crew, that you did not know that the MDA callout was a required procedure? Even if it had not been a requirement—through some incredible oversight—the logic for it is so overwhelming that your denial makes one wonder whether you grasp your responsibilities in the cockpit.

Nevertheless, I hope that this sobering experience taught you one thing: True loyalty means speaking up at the first suspicion of trouble or compromise. There is no room in the cockpit for servility. *Pretending that all is well, or going to be well, may be the most fashionable killer in aviation.*

### Case No. 2

The two pilots have flown the 30-minute trip hundreds of times. There is hardly a need to get out the approach plate or to tune in the nondirectional beacon (NDB). Why check the two intersections on the VOR radial, 20 and 10 miles from the destination airport, when approach control will give them radar vectors and line them up with the ILS runway? The flight is operating in IFR conditions; the aircraft is not equipped with distance measuring equipment (DME).

When the controller tells them that they are approaching the second intersection they have no reason to question his statement and they accept the familiar vectors for the ILS. Actually, the controller saw them approach the first intersection but he identified it as the second one. Shortly thereafter, the controller loses the aircraft's primary radar return in rain. He gives the flight an identification turn that leads it straight into a mountainside.

What went wrong? There was an obvious ATC error. For the purpose of this article, let it suffice to say that the controller was operating well beyond his stress tolerance and without proper supervision. The stresses that affected his performance capability were chronic, and outside his personal control. He should not have been controlling traffic in the first place.

However, as important as this error as a cause of this accident is the question: What could the crew have done to prevent this accident despite the breakdown in the ATC system? This question is not only reasonable, it expresses recognition of the pilot's unique role in the aviation system.

It appears that this crew missed two opportunities to prevent the accident by questioning ATC's handling of their flight: (1) The controller told them they were approaching the second intersection 6 minutes before their own ETA for that intersection, and (2) had they taken the trouble to crosscheck their position, using the NDB, they would have discovered the controller's error.

I do not mean to introduce, with hindsight, the element of crew error in this accident. An airspace system cannot operate without mutual trust between pilots and controllers. However, this interdependence does not mean that you forego the opportunity to keep track of your own whereabouts when you know that you are being vectored below the obstruction height of nearby terrain. In such a case, you show blind faith in the man at the other end who is also entitled to his good and bad moments, just as you are. You must cultivate your protective skepticism if you want more immunity against chance and the human variable.

## The Parable of the Timid Crewmember

Hiding your talent has always been considered a foolish thing to do. You may remember the 2,000-year-old parable that illustrates this.

A man who had to go on a long journey trusted his money to his servants, in accordance with their abilities. To one servant he gave five talents, to another two, and to a third only one.

And many days thereafter the master of these servants returned and reckoned with them. The man who had received five talents stepped forward and said, "Sir, you gave me five talents; here are five more that I gained by trading with them." Likewise, the man who had received two talents returned four.

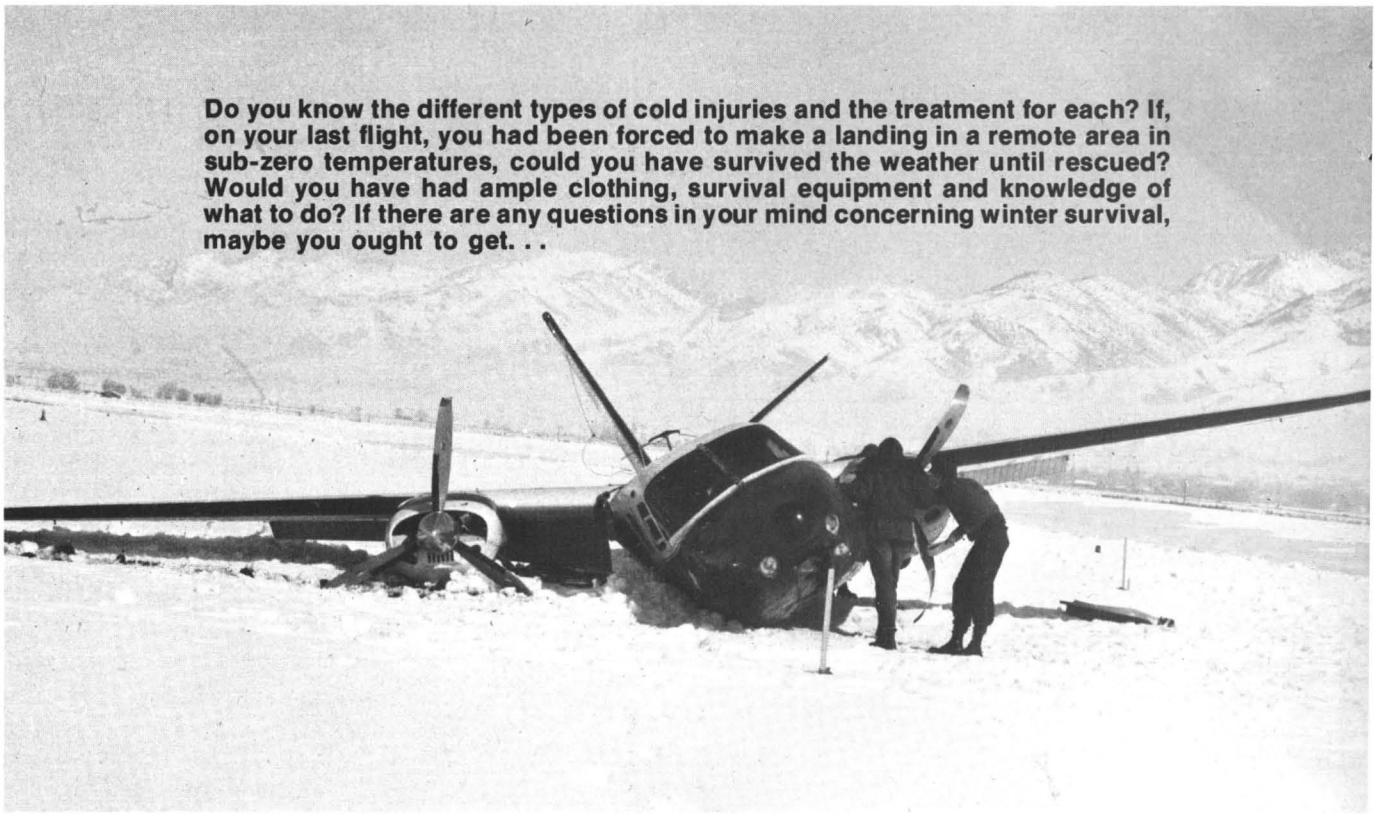
And the master said to these two, "Well done, you good and faithful servants. Since you have shown that I can trust you with a few things I will place you over many things."

And last came the man who had received one talent. "Sir," he said, "I had heard that you were a hard man, who reaps where he has not sown. Therefore, I was afraid to lose the one talent you gave me and I buried it in the ground. I still have it and I return it now to you!"

But the master refused to take it and said, "You lazy and timid man. You knew what I expected from you but you did not even have the sense to let my money draw interest. Give that talent to the man that has ten talents. For to every man who has shall be given, and from him that has little, even what he seems to have shall be taken away!"

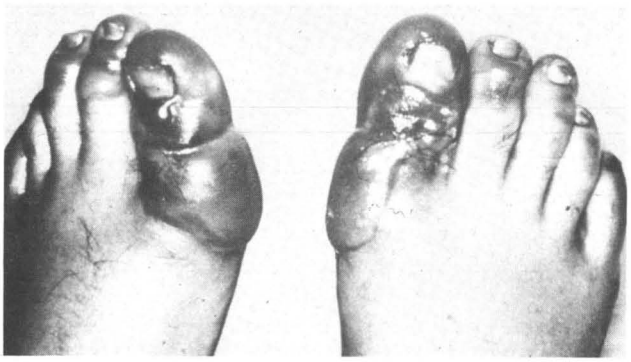
And in great anger he ordered that servant thrown into the outer darkness where there is weeping and gnashing of teeth.

This is more or less how Matthew wrote the story. I took some liberty with the title so that it now conveys the basic message of my own sermon. If you don't want to be buried with your talent, you have to use it. And in order to recognize opportunities that others have missed, study accident reports with the thought: How could I have prevented that accident under similar circumstances? In the long run, this attitude will do more for your profession than preoccupation with factors that might exonerate an accident-involved colleague. To stay away from places where there is weeping and tearing of metal, you have to put your talent to work and stand up for yourself and your crew.



**Do you know the different types of cold injuries and the treatment for each? If, on your last flight, you had been forced to make a landing in a remote area in sub-zero temperatures, could you have survived the weather until rescued? Would you have had ample clothing, survival equipment and knowledge of what to do? If there are any questions in your mind concerning winter survival, maybe you ought to get. . .**

# the cold facts



USAAAVS

YOU DON'T HAVE to go to Alaska or to the wastelands of the Far North to sustain cold injuries. Chances are excellent that you can do a pretty good job right where you are. During a single winter in one Army area in the "Sunny South," 75 men were either hospitalized or confined to quarters because of cold injuries. And this figure does not include those individuals who experienced minor frostbite but did not report for medical treatment.

The three most common types of cold injuries are hypothermia, frostbite and trench (immersion) foot. When the entire body is exposed to cold to the point that vital functions cease, it is called hypothermia. Frostbite is local tissue death from exposure to cold at temperatures below the freezing level. Trenchfoot is local tissue death from exposure to cold and dampness at temperatures above the freezing level. Of these, minor frostbite is most common, and can be likened to sunburn. It is preventable and usually results from personal negligence. Since, in most instances, it is considered a non-line-of-duty injury, many individuals suffering minor frostbite do not report for treatment.

Although some people can tolerate cold better than others, no one is immune to cold injury. An individual's ability to withstand the cold depends, in part, on the amount of fat that lies beneath his skin. The greater the thickness of this layer of fat, the greater the insulation against heat loss—one of the few advantages a fat man has over a thin one. A per-

**Lieutenant Colonel David H. Karney, M.D.**
Medical Division
and
**Ted Kontos**
Publications and Graphics Division
U. S. Army Agency for Aviation Safety

son's susceptibility to cold injury is also affected by his medical history. If he has previously suffered some type of cold injury, such as frostbite, his chances of sustaining cold injuries under conditions of extreme exposure are greatly increased. However, an individual's tolerance to the cold is not affected by his moving from a warm climate to a cold one or by a sudden change of the seasons, although it may require a period of two or three weeks before his body becomes acclimatized to the cold.

A person suffering from hypothermia usually connot help himself and must be assisted. He must be warmed immediately if he is to survive, preferably by exposing him to temperatures of about 120 degrees F. This may be accomplished by using warmed water (feels warm to the skin on forearm) or a warm room.

In the case of frostbite, the patient can help himself and should do so as quickly as possible. The affected area should be warmed to about 90 degrees to 140 degrees F. This can be done in front of a fire or possibly by placing the injured extremity against or between other parts of the body. The affected area, however, should *not* be rubbed as this may cause further tissue damage.

First aid for trenchfoot is similar to that for frostbite except that the injured part should be warmed to 70 degrees to 80 degrees F. After warming, it should be protected with dry dressing and the patient treated as a litter case.

Obviously, a downed aviator is not likely to find a warm room, hot bath, water, fire or any kind of prepared shelter awaiting him after he lands his aircraft or ejects over snow-covered wilderness. If he is not prepared to cope with the elements, his chances of making it back to civilization alive are about the same as those of the proverbial snowball in that hot place. All preparations must have been completed *before* takeoff, but deciding what preparations are in order is not always a simple matter.

It is pretty hard for an aviator in an area of relatively mild winter weather to envision what he should wear in 4-foot snowdrifts and a -20 degree temperature. Yet this may be exactly what he must do. In some parts of the Southwest, for example, he may be in a desert area where the thermometer registers a sultry 90 degrees, while 10 minutes away, the temperature may be below freezing. Nor should he forget the chill factor. The higher the wind velocity for any given temperature, the lower the equivalent temperature. At 5 degrees F. under no-wind conditions, a person can remain reasonably comfortable with normal precautions. With a 2-mph wind, he will experience discomfort, particularly on overcast days. If the wind velocity reaches 8 mph, it becomes bitterly cold and uncomfortable even on clear sunny days. At 16 mph, the wind can cause exposed human flesh to freeze and life in a temporary shelter to become highly disagreeable. Should wind velocity rise to 35 mph, exposed flesh will freeze in less than one minute and stringent survival efforts will be required to sustain life. *All preparations for winter survival should be based on the worst weather conditions that can be expected along the proposed flight route.*

| Estimated wind speed (in mph) | Actual Thermometer Reading (° F.) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 40 | 30 | 20 | 10 | 0 | —10 | —20 | —30 | —40 | —50 | —60 |
| | EQUIVALENT TEMPERATURE (° F.) | | | | | | | | | | | |
| calm | 50 | 40 | 30 | 20 | 10 | 0 | —10 | —20 | —30 | —40 | —50 | —60 |
| 5 | 48 | 37 | 27 | 16 | 6 | —5 | —15 | —26 | —36 | —47 | —57 | —68 |
| 10 | 40 | 28 | 16 | 4 | —9 | —24 | —33 | —46 | —58 | —70 | —83 | —95 |
| 15 | 36 | 22 | 9 | —5 | —18 | —32 | —45 | —58 | —72 | —85 | —99 | —112 |
| 20 | 32 | 18 | 4 | —10 | —25 | —39 | —53 | —67 | —82 | —96 | —110 | —124 |
| 25 | 30 | 16 | 0 | —15 | —29 | —44 | —59 | —74 | —88 | —104 | —118 | —133 |
| 30 | 28 | 13 | —2 | —18 | —33 | —48 | —63 | —79 | —94 | —109 | —125 | —140 |
| 35 | 27 | 11 | —4 | —21 | —35 | —51 | —67 | —82 | —98 | —113 | —129 | —145 |
| 40 | 26 | 10 | —6 | —21 | —37 | —53 | —69 | —85 | —100 | —116 | —132 | —148 |
| (wind speeds greater than 40 mph have little additional effect.) | LITTLE DANGER (for properly clothed person) Maximum danger of false sense of security. | | | | INCREASING DANGER Danger from freezing of exposed flesh | | | GREAT DANGER | | | | |
| | Trenchfoot and immersion foot may occur at any point on this chart. | | | | | | | | | | | |

Extreme operations in arctic areas have given man much valuable experience in cold weather survival. *Armed with initiative, knowledge, proper clothing and necessary survival equipment, he can survive almost indefinitely in the most frigid climate.* Yet, a downed aviator generally needs only to manage to survive for a relatively short time to be rescued. Even in the most remote geographic areas of the world, the average time lapse before being found is 5 days.

What should you do if you are downed in freezing weather? Heading the list are four big DO's. Stay near the aircraft, get out of the wind, build a fire and keep dry. Having the capability to build a fire is most important.

Although you will have to survive the elements, you also want to be rescued as soon as possible. It is generally much easier to locate an aircraft than to spot individuals. So stay with the aircraft unless you *know* you can reach help. But *don't* stay *in* the aircraft. It will be like a deep-freeze unit.

Next, get a fire going—before your hands and fingers get so numb you can't even strike a match. Standing dead trees make the best firewood because they are reasonably dry. They also produce less smoke. Once you get a fire started, you can use damp wood, if necessary. To get maximum benefit from your fire, you should make some sort of reflector to radiate the heat toward you. One can be fashioned from trees, logs, metal from the aircraft or from virtually any material that is available.

A shelter is another necessity. It is needed to protect you from both wind and rain. It does not have to be elaborate. A simple lean-to will do the job. You can also use snow to build three walls adjacent to each other (as if building an igloo) and then stretch your parachute, if you have one, over the structure. If the snow is deep, you can fashion a wall of snow, as described, then dig down below it—anything to get you out of the wind and keep you dry.

With a fire going, now is the time to dry off. Getting dry and staying dry are important in preventing cold injuries—and death—from freezing temperatures. But don't lie on bare ground. You need insulation beneath you as well as above you. Line the ground with plenty of boughs and place your sleeping bag on top of them. Also, deep snow makes an excellent insulator. Bear in mind that pine and spruce, which are most abundant in northern climates, will cast an abundance of sparks a distance of 5 or 6 feet when burned. Also the smoke produced from a fire in a closed shelter can cause severe headaches and swollen and inflamed eyes. Headaches, however, will disappear after a short time outside. Unless you are alone, it's a good idea to always have someone awake to tend the fire and act as fire guard.

You may also be faced with other problems. Statistics show that in survivable crash landings, approximately half of the aircraft's occupants will sustain some type of injury. Broken bones and shock are common to crash victims. Don't attempt to set broken bones. Instead, immobilize them by fashioning splints. Keep an injured person warm to protect him from freezing as well as to treat or prevent shock. Here, again, the sleeping bag or a facsimile (rolled up parachute) can be a real lifesaver. Remember, also, that a person in shock will require more water than he would normally need. Unless a supply is available, always melt snow to get water. Eating unmelted snow not only will cause chapped lips, faces and tongues, but since snow contains little water, it will actually increase thirst and bring on parched and burning throats. If you have no utensils, one way of melting snow is to heat a flat rock that has a depression in it, then pile snow on top of it.

Snow blindness can also present a problem. Chute webbing or any kind of fabric can be used to fashion snow goggles by simply slitting a 2-inch-wide strip to fit over the eyes and then tieing it around the head. Should snow blindness occur, remember, it is a temporary condition. Heat packs will help, but complete darkness is required, usually for two or more days.

Obtaining food may be another problem, especially if you are not rescued soon. If you have a firearm, good. If not, you can fashion snares and traps to catch small animals. Weakness from exhaustion and lack of nourishment is a common occurrence. To help minimize it, avoid walking or working in deep snow as much as possible. If the snow is deep and you must move about, fashion some type of snowshoes. Trying to walk through deep snow without them will require a great expenditure of energy, promoting exhaustion.

Despite your best efforts, your chances of surviving may hinge on one important factor—your mental attitude. Its importance can be dramatically shown by briefly reviewing the case history of an aviator forced to bail out over frozen wastelands. This man landed safely, and did everything right. He established a campsite, built a fire, etc. All he had to do was wait to be found. Instead, from despair, loneliness and possible thoughts of the futility of his predicament, he used his .45 to commit suicide. Rescuers reached him within 24 hours after he had bailed out of his aircraft.

With proper *knowledge, clothing and survival equipment,* chances are overwhelmingly in your favor that you can survive the most bitter cold. But the time to make preparations is NOW!

Class visits actual crash site during accident investigation phase of ASO Course.

# aviation safety officer course at usaaavs

USAAAVS

THE AVIATION safety officer (ASO) is an important member of every aviation unit and his duties vary in form and complexity. Individuals selected for ASO duty must be well trained for their jobs as well as being experienced aviators.

For about 20 years, Army ASO's received their initial safety training at the University of Southern California. However, a new ASO course has been developed and is being presented at the U.S. Army Agency for Aviation Safety (USAAAVS) at Fort Rucker, AL. The move to Fort Rucker will result in considerable dollar savings to the Army as well as provide the most relevant and up-to-date aviation safety instruction available.

The course is taught at USAAAVS on a scheduled basis. Each class consists of 30 students and lasts about 10 weeks. Included in the course will be instruction in mishap investigation and reporting, aerodynamics, structures, physiology, safety programs management, psychology, law, and other safety-related subjects. The course also addresses operations, maintenance, and facilities and all other areas related to aviation safety.

The objective of the Aviation Safety Officer Course is to give prospective ASOs a working knowledge of aircraft accident prevention techniques and the motivation and abilities required to conduct an effective accident prevention program and aircraft accident investigation. When the ASO completes this course, he will be able to organize and administer an accident prevention program at the unit level.

The course is intended primarily for rated Army aviators but civilian personnel may attend. All personnel selected to attend should meet the following criteria:

**ELIGIBILITY REQUIREMENTS:**

- A rated Army aviator assigned or to be assigned the duties of an Army aviation safety officer, additional skill identifier (ASI), Suffix "IS," or warrant officer flight safety technician, ASI, Suffic "B"; currently serving in an aviation assignment.
- A civil service Army flight instructor; or
- A contract civilian Army flight instructor; or
- A safety director, or assistant, of a major command or an installation having assigned Army aircraft.

**PREREQUISITES:**

- High school level mathematics and physics or equivalent is required. A review of these subjects just prior to attendance would be wise.
- Maintenance and/or instructor pilot background is desirable but not mandatory.

**SERVICE OBLIGATION AND UTILIZATION TOURS:**

An obligated tour of 1 year active duty service for officers and warrant officers computed from the date of course completion or termination of attendance for academic reasons, whichever is earlier. Civil service personnel should agree to a minimum of 2 years in a utilization assignment in the GS 1815/1825 job series involving Army aviation safety after course completion.

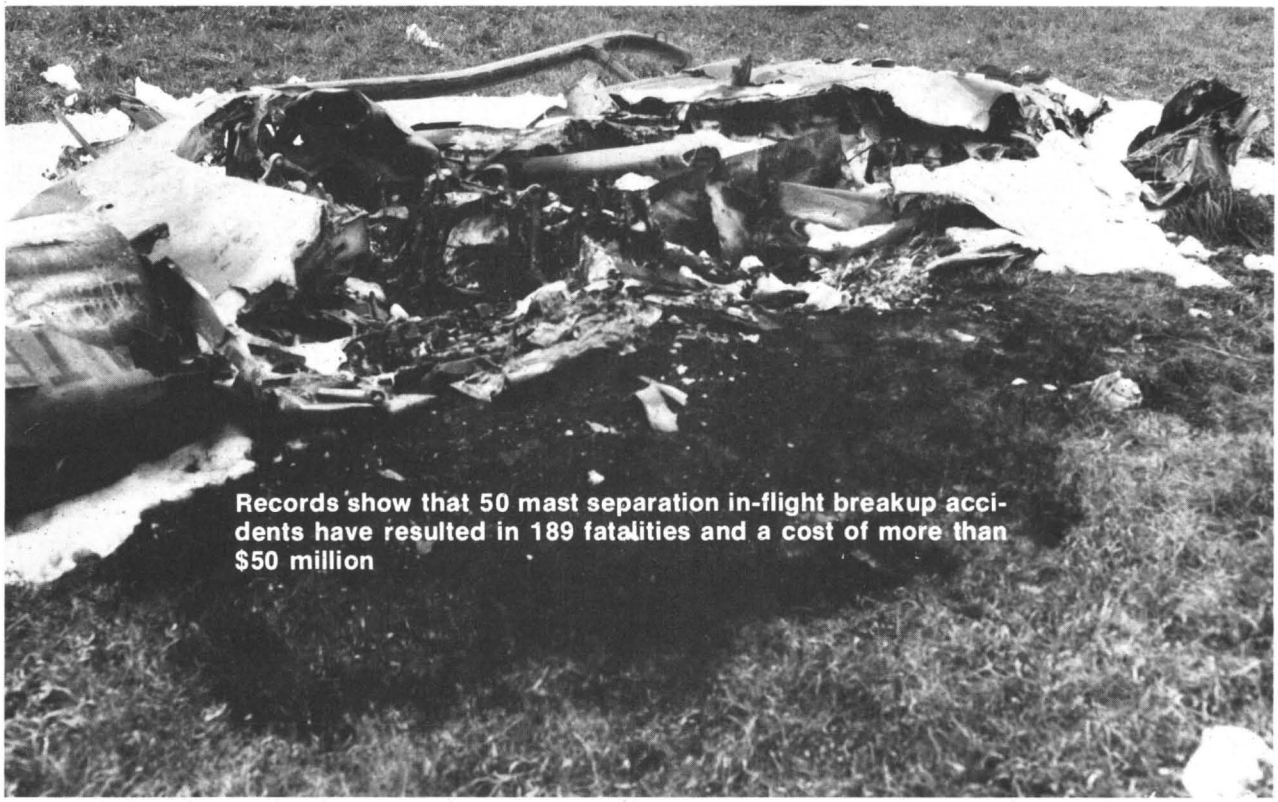
**QUOTA ALLOCATION:**

An Army quota allocation of 30 students per class is maintained by the Deputy for Professional Development. Course quotas will be suballocated to appropriate career branches and Aviation Warrant Officer Branch based on worldwide aviation safety officer requirements.

Schedule of Classes for FY 77

| Class | Report | Start | Close |
|---|---|---|---|
| 77–2 | 5 Jan 77 | 10 Jan 77 | 18 Mar 77 |
| 77–3 | 23 Mar 77 | 28 Mar 77 | 3 Jun 77 |
| 77–4 | 8 Jun 77 | 13 Jun 77 | 19 Aug 77 |
| 77–5 | 24 Aug 77 | 29 Aug 77 | 4 Nov 77 |

After being officially selected for attendance, students should phone AUTOVON 558-4510/3493, commercial 205-255-4510/3493, for a student information packet.



Records show that 50 mast separation in-flight breakup accidents have resulted in 189 fatalities and a cost of more than $50 million

**Recent field evaluations conducted by USAAAVS and the Directorate of Evaluation & Standardization, USAAVNC, have disclosed an alarming number of errors in the computation of aircraft weight and balance records. In some instances, these errors resulted in out-of-limits c.g. locations actually being entered on the 365F, yet the aircraft were routinely flown without the condition being challenged. We are reprinting this article, which originally appeared in the August 1974 *AVIATION DIGEST,* to reemphasize the critical nature of c.g. location by pointing out *only one* of the disastrous consequences of ignoring this aspect of aircraft operation.**

# A Close Look At MAST BUMPING

**Lieutenant Colonel James A. Burke** USAAAVS

**LTC Burke, a senior Army aviator, is currently assigned to the Aviation System Division, Deputy Chief of Staff for Research, Development and Acquisition. He was assigned to the U. S. Army Mobility Research and Development Laboratory as R&D coordinator at the time this article was written. LTC Burke holds a graduate degree in Aeronautical Engineering from Texas A&M University.**

A CRITICAL condition can exist on helicopters having a teetering rotor design when the rotor hub makes inadvertent dynamic contact with the rotor's mast. This applies to all UH-1, AH-1 and OH-58 helicopters. If contact is sufficient to cause an indentation of the mast, the driving torque of the engine can ultimately twist or sever the mast. So let's take a closer look at the mast bumping phenomenon so that, as aviators, we can understand the ways to avoid conditions which contribute to excessive hub flapping leading to mast separations.

Accident data shows that 50 mast separation in-flight breakup accidents have resulted in 189 fatalities and a cost of more than $50 million. Although in most cases the accident investigation efforts were plagued by uncertainties, lack of eyewitnesses and postcrash fires, the one common trend of occurrence was severe mast bumping, followed by mast separation in the static stop area of the main rotor hub. Admittedly, materiel failure of critical components may have in-

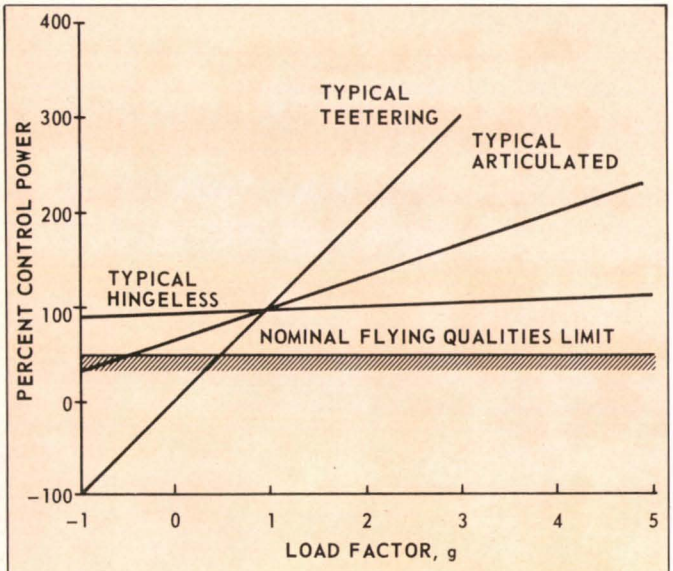



FIGURE 1

itiated the sequence, but the cause of each catastrophic mishap was truly separation of the main rotor mast due to severe mast bumping.

Realizing that mast separation can occur, the purpose of this article is to help operators understand the major contributing conditions which "set the scene" for mast bumping. The following discussion concern-

TABLE 1

| GROUP | CONTRIBUTING CONDITIONS | TYPICAL FLAPPING VALUES |
|---|---|---|
| I | High forward airspeeds<br>Low rotor rpm<br>High density altitudes<br>High gross weights | 1°-2° |
| II | Turbulence | 2°-3° |
| III | Sudden trim changes<br>Center of gravity offsets<br>High sideslip velocities–rightward direction | up to 9°-10° |
| IV | Low g loading | up to 12°-13° (or greater) |

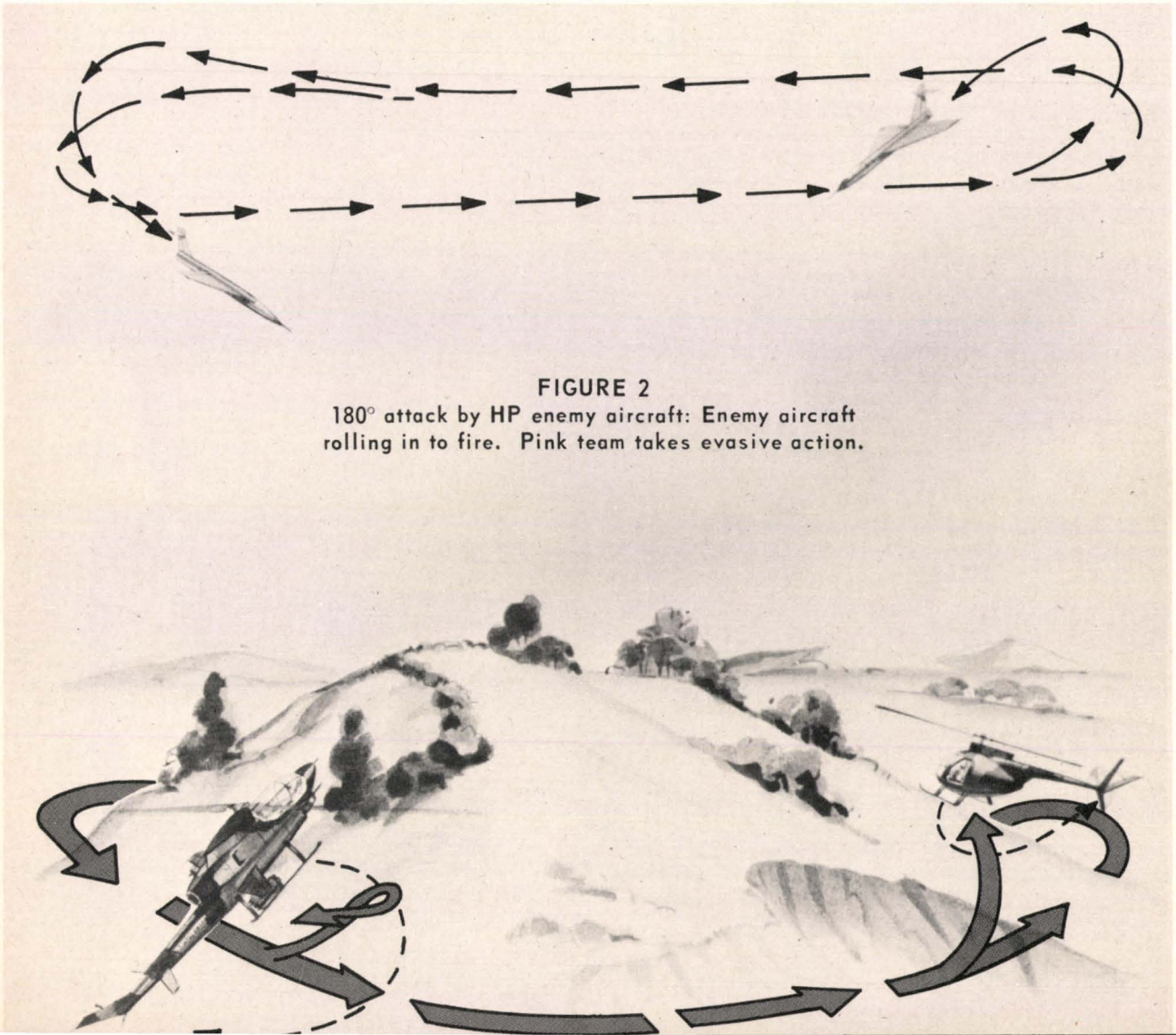


FIGURE 2
180° attack by HP enemy aircraft: Enemy aircraft rolling in to fire. Pink team takes evasive action.

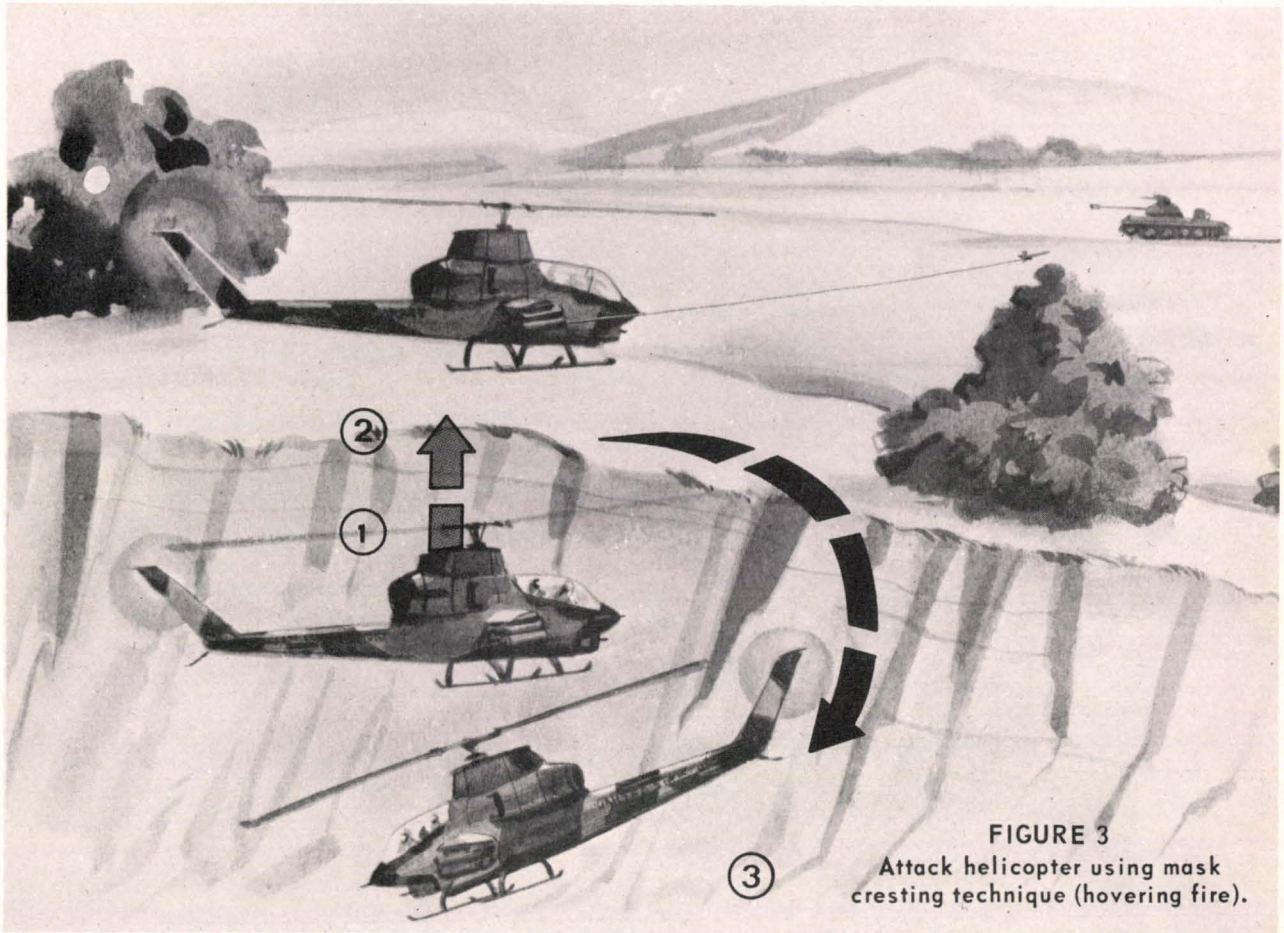



FIGURE 3
Attack helicopter using mask cresting technique (hovering fire).

ing mast bumping was taken from a technical assessment of the problem by the U.S. Army Air Mobility R&D Laboratory in which the author participated.

Figure 1 is a schematic version of a simple teetering rotor. The rotor's design allows the main rotor blades to flap about a common pivot point to compensate for dissymmetry of lift. Typically, the 12-degree flapping is quite adequate for normal operations and has been conclusively proven by instrumented test flights and many years of production flight operations to be quite reliable and relatively trouble-free. However, it is important to note that the rotor hub can contact the rotor mast if the main rotor hub flapping is of the order of 12 degrees. So our job as aviators is really quite simple, mainly to operate our helicopters in such a manner that the rotor hub's deflection is well behaved to flapping values considerably less than 12 degrees.

Without dwelling on the exact technical details of the analysis, certain conditions contribute to excessive flapping. We can expect flapping to increase by values shown in table 1.

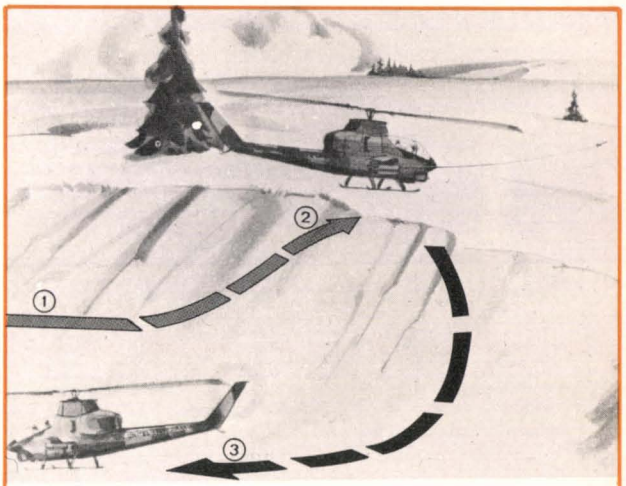



FIGURE 4
Attack helicopter using mask cresting technique (running fire).

For reference, typically, a fully loaded teetering rotor helicopter operating at maximum gross weight, full forward c.g. at 90 knots cruise on a standard day, 2,000 feet, is characterized by rotor flapping values of 2 degrees to 3 degrees. However, should other conditions like those listed in III and IV of table 1 be present, a rapid buildup in flapping can develop. For example, a simulation experiment of a UH-1H has verified that a simple engine failure followed by an abrupt autorotation entry with a c.g. offset of 6 inches forward of allowable limits caused flapping values in excess of 12 degrees. While this unlikely flight configuration is an extreme example, flights were made in Vietnam under these conditions. Had this experiment been an actual flight situation, severe mast bumping could have destroyed the aircraft.

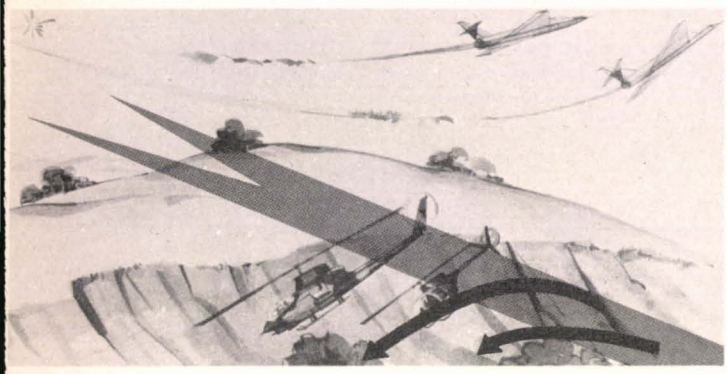


**FIGURE 5**
**Enemy aircraft terminating firing run. Pink team diving under firing line.**

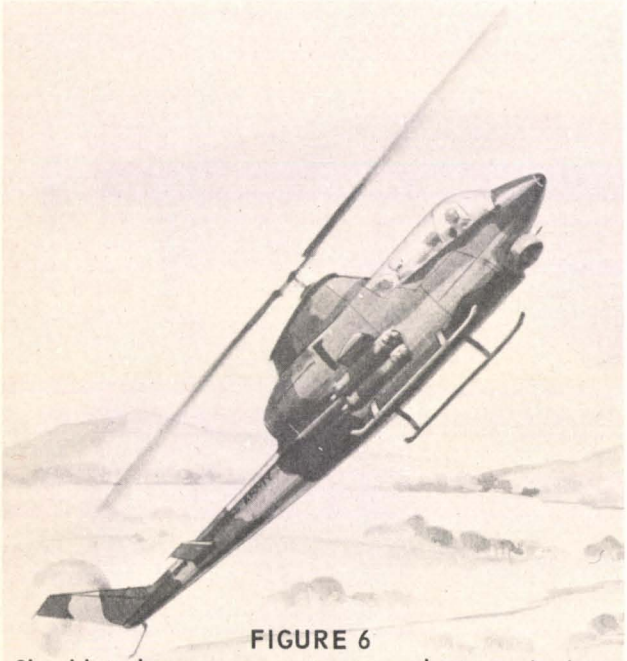


**FIGURE 6**
**Should it become necessary to abort a mission, CAUTION must be exercised to limit low g regimes and cyclic excursions while applying evasive maneuvers.**

It is not commonly known that sideward velocities of approximately 30 knots *to the right* cause much higher flapping angles than sideward flights to the left. Specifically, right sideslips can develop as much as 9 degrees flapping as opposed to 4 degrees to 4½ degrees of flapping under the same condition when hovering or sideslipping to the left.

Category IV operations with low g-loadings seem to impose the greatest operational restraint to teetering rotors from a mast bumping standpoint. By design, this rotor requires positive values of g-loadings for cyclic control. Flight tests have generally confirmed that anytime we operate at g-loads less than 0.5 g the aircraft will start to show adverse signs of control response, and as the g-loading is reduced to approximately 0.2 g's, functional loss of effective cyclic control is fully developed. Hence, we must refine our techniques to ensure that our flight regimes sustain a positive g-load of no lower than 0.2 g. (The OH-58 flight handbook carries a warning that prohibits flight below 0.2 g.) This may be somewhat challenging in view of integrating advanced helicopter tactics into operational use. In looking at the advanced concepts of employing aerial scout vehicles and armed helicopters, certain tactical maneuvers like the ones shown in figures 2 through 6 should be prudently conducted with the thought in mind of retaining positive rotor control by flying with a reasonable positive g-load.

One way aviators can help prevent mast bumping is to operate within the c.g. envelope of the aircraft. For example, every inch the c.g. is displaced forward, the flapping values are increased by approximately 0.5 degrees. So, logically, a teetering rotor helicopter whose loading is such that the c.g. is displaced forward by 6 inches can expect an increase in flapping of 3 degrees. Consider the case of the c.g. located at 6 inches forward of normal limits (perhaps a typical combat-loaded situation for a UH-1H). Should the aircraft be subjected to an abrupt trim change (like a tail rotor failure), the flapping values related to tail rotor failure combined with those of the c.g. offset may lead to mast bumping. A preliminary simulation study conducted by the Air Mobility R&D Laboratory at NASA-Langley indicates that mast bumping will occur under this situation. Conclusion: Keep the c.g. within limits!

Mast bumpting is real; it can occur if we operate teetering rotors incorrectly; and it must be prevented. The lesson to be learned from this discussion is this: Operate your aircraft within its design envelope.

# briefs that teach

## critical point

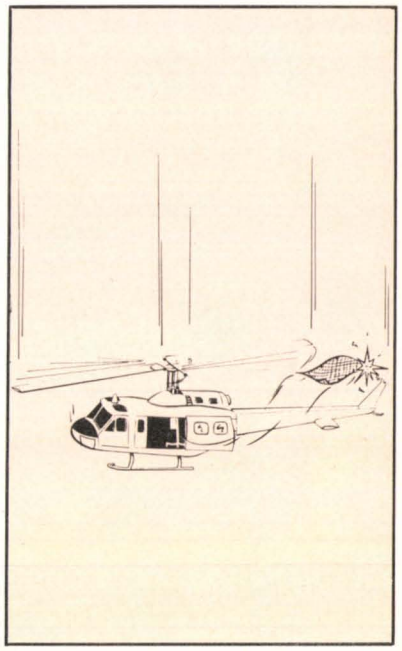
During the late afternoon a T-42 crew departed on a cross-country training mission. A flight plan was filed and indicated a VFR route of flight over two other cities before arriving at their destination in about 2½ hours.

After reporting over the first city, the pilot advised he was departing the area and was en route to his destination. At least two eyewitnesses saw the aircraft depart and climb in a southwesterly direction. One witness, an expert mechanic and pilot of many years, noted that the engines sounded normal for the type while at climb power.

The aircraft was next seen over a lake climbing southwesterly along the axis of a canyon. The observer was at 11,300 feet and estimated the aircraft to be 500 to 1,500 feet above his position. While passing overhead, the aircraft made a slight course correction to the right and flew on toward a pass in the mountain. The observer continued to watch as the aircraft approached the pass and did not detect any change in the sound of the engines. Just before the T-42 reached the pass, its left wing dropped as if to make a left turn and almost simultaneously hit the mountain at the 12,580-foot level.

**The pilot's decision to fly the aircraft into a box canyon at insufficient altitude caused this accident.** It was suspected that the left engine stopped delivering full power at a critical point of the flight path and **the pilot had selected a flight route which offered no opportunity for executing a 180-degree turn and no suitable crash-landing site.**

## loose panel



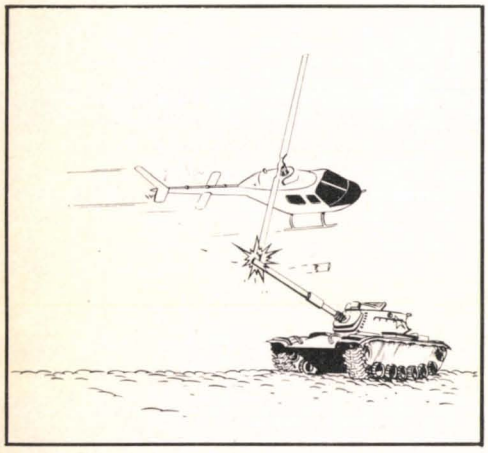
A test pilot and crew chief began a preflight inspection on a UH-1H in preparation for a test flight. The test pilot carefully checked the tail rotor since the assembly had recently been installed and was part of the reason for the test flight. The soundproofing in the transmission wells was checked by the test pilot and was, in his judgment, properly secured.

The test pilot flew to the test flight area. The tail rotor rigging check was made and the tail rotor was determined to be functioning in a normal manner. The test pilot then climbed to 2,200 feet to make the autorotation rpm check. He selected a forced landing area and entered autorotation at 80 knots. Almost immediately after entering autorotation a loud noise was heard from the rear of the aircraft and the nose pitched down slightly. A cross check of the instrument panel showed everything normal with 78% $N_1$. A check of the pedals indicated total loss of tail rotor control.

The test pilot managed to control the aircraft and landed with no ground run. Inspection revealed total in-flight loss of the tail rotor assembly, 90-degree gearbox, FM antenna and mount.

The soundproofing panel in the right transmission well, which appeared to the test pilot to be secured, **was not adequately secured for flight with the doors open.** It came loose, flew out of the aircraft, and struck the tail rotor, resulting in separation of the tail rotor and 90-degree gearbox.

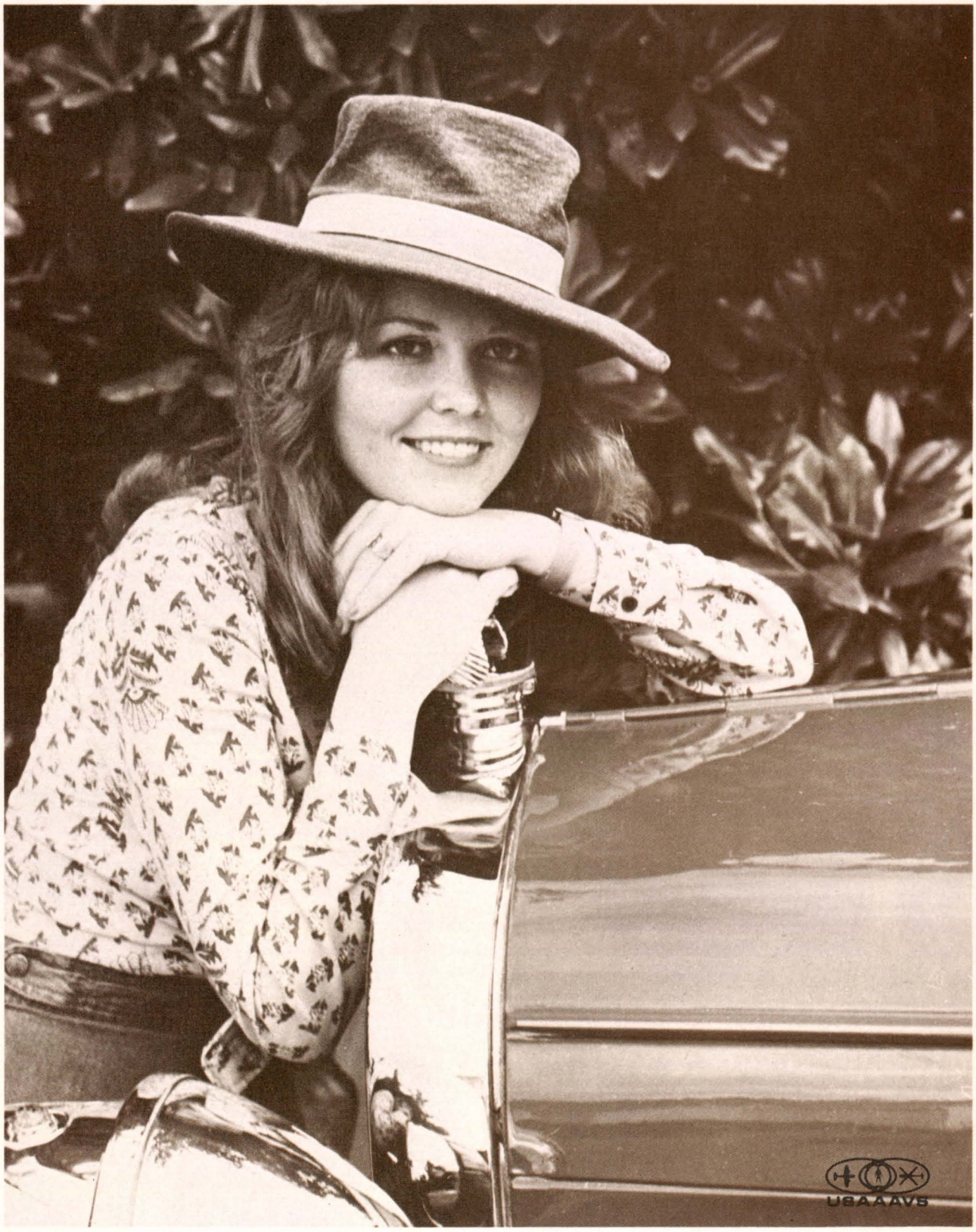
## reckless operation



An OH-58 was being used as an aggressor aircraft in a training exercise. Personnel of the forward recon element saw the aircraft make a very low, high speed pass over their position at an altitude estimated at 50 feet or lower. Visual contact was lost behind a hill mass for several minutes and then the aircraft was seen approaching from the northeast, flying very low and fast. As the aircraft approached the top of the hill mass, it banked to the right in an attempt to fly between a tank and an armored personnel carrier (APC). The distance between the tank and the APC was 50 feet. While in the right bank, the main rotor hit the gun tube muzzle of the tank and separated from the aircraft. The OH-58 continued down slope and crashed.

**This accident was caused by the pilot's lack of discipline and reckless operation of the aircraft.** Supervision also played a part. Tactical mission planning was inadequate and there was no written guidance or procedures for mission operation when detached from the parent unit.

In the September 1976 issue of Briefs That Teach, the brief titled "Too Little Light" stated: "The crew of the crashed UH-1 consisted of a pilot with a total of 755 hours and a brand-new school graduate on his first mission." The flight time used omitted 263 hours as copilot for the pilot and 2,300 hours of fixed wing civilian time for the copilot. This brief dealt with Army experience only in the duty positions occupied at the time of the crash.


USAAAVS

# PEARL'S

Personal Equipment & Rescue/Survival Lowdown

*If you have a question about personal equipment or rescue/survival gear, write Pearl, USAAAVS, Ft. Rucker, AL 36362*

### Survival Radio Batteries

If your unit is short of survival radio batteries, they may be ordered using the following information: URC-10 series radios, BA-1387, NSN 6135-00-889-1485; URC-68 radios, BA-1112/U, NSN 6135-00-935-5241; PRC-90 radios, BA-1568/U, NSN 6135-00-838-0706.

Information from Electronics Command indicates these batteries are in stock and no serious shortages have been reported.

### Winter-weight Coveralls and Rubber Galoshes

*It's getting to be that time of year again when the chill is in the air, the frost is on the blades and the pilots have the cold bods and feet when in the field. The problem is how to keep these magnificent specimen of human technology warm and in the best of health.*

*Everyone knows that pilots are actually a frail lot and that at 3,000 to 10,000 feet (even NOE) it gets very cold in an OH-58. AR 95-1, page 3-7, par. 3-32, specifies that protective apparel to be worn in flight will consist of protective helmet, leather boots and fire retardant clothing. This paragraph does not designate what a pilot may wear to keep his body and feet warm. On the other hand, this paragraph does not restrict the wearing of any piece of clothing over the protective gear.*

*Obviously the Army does not intend for pilots to continue to wear nylon or any other synthetic over-wear over their Nomex since they are issuing Nomex jackets. However, there are no guidelines that I know of covering the wearing of winter-weight coveralls or rubber galoshes over the protective gear. Could you help us out with an answer?*

There is no specific winter flight uniform in the Army inventory that is adaptable for worldwide use.

CTA 50-900 lists items of extreme cold weather uniforms. However, many of these are not compatible with the cockpit environment. Tests conducted at both Natick Laboratories and the U.S. Army Aeromedical Research Laboratory (USAARL) have indicated there is no problem with wearing winter-weight coveralls or rubber galoshes as long as they are worn *over* the protective uniform and leather boots.

Plans are underway for extensive development and testing of a winter flying ensemble. As each little bit helps, suggest you send any EIR direct to Commander, U.S. Army Aviation Systems Command, ATTN: DRSAV-WL, P.O. Box 209, St. Louis, MO 63166, with an information copy to USAAAVS.

### UH-1 Jump Seat Lapbelt

*I am presently stationed in Germany in a unit that has UH-1 aircraft. We are having a problem with the safety lapbelt, NSN 1680-00-447-9504. When the belt is installed in the jump seat and connected to the floor, it will not go around my larger personnel. My smaller individuals have a problem in tightening the belt to the recommended tightness. The only alternative we have found is to attach the belt to the jump seat. This is a hazard because the belt attached to the seat offers no protection to an individual in the event of a mishap. I have heard that there is a new belt in the Army system that will enable the user to connect to the rings in the floor and still be able to use the safety belt. Could you send me that NSN and tell me if and when they will be available for issue.*

USAARL and USAAAVS conducted tests on the UH-1 cargo tiedown fittings and the seat frame/transmission bulkhead rings. These tests showed the cargo tiedown rings are approximately one-half the strength of the seat/bulkhead fittings. Previous tests conducted by USAARL on the jump seat, including the lapbelt attaching points, were not conclusive. However, based on the recent tests, USAAAVS recommends the jump seat lapbelt be attached to the seat.

USAAAVS is aware of the inability individuals small in stature have tightening their lapbelt to the recommended level. An interim solution to this problem is described in figure 1, a drawing by Page Aircraft Maintenance, Inc. It shows attaching the lapbelt to the floor, with all hardware fittings and their NSNs. This installation is the only exception recommended to restrain those people small in stature.

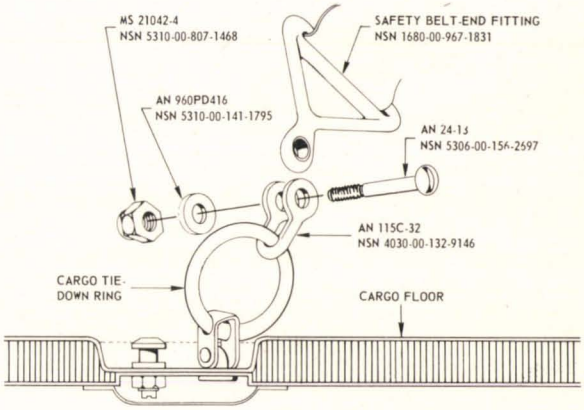



**FIGURE 1** Jump Seat Belt Installation

# ATC action line

UNITED STATES ARMY AIR TRAFFIC CONTROL ACTIVITY

**I RECENTLY TOOK off from the William B. Hartsfield Atlanta International airport. During flight planning I observed the T symbol on the approach chart and referred to the IFR takeoff minimums and departure procedures tabulation contained in the front of the FLIP Terminal publication. I expected to find a ceiling or visibility restriction on some finite route description but instead found that "FAR 135 applies." Why must I go through this drill when FAR 135 applies only to selected civil aircraft and operator?**

The DOD FLIP contains both civil and military procedures. The procedure in question is an FAA procedure drafted and printed by the Department of Commerce. The chart is reproduced by the Defense Mapping Agency Aerospace Center and inserted in the tailored DOD FLIP publication for military use. Any restriction to any user is contained on the chart or tabular listing. The cost of tailoring this type selected user caveat from the system is not justified—then too, certain civil users are authorized to purchase the DOD FLIP for their use. These operators may be performing direct support to the military. They need the complete information picture just as you do for both civil and military airports. The caveat is not applicable to an FAR 91 civil or military operator. Army operates under FAR 91 as amended or further restricted by AR 95-1. If a published takeoff restriction applies to you and your operation, consider it carefully. To not do so can cause hazardous operations.

**What are we supposed to do when given an ATC frequency change?**

The AIM, Part 1, page 60 and the FLIP General Planning, chapter 5-22b(1), read the same except for one sentence. The AIM adds *unless otherwise indicated by ATC, the pilot should change to the new frequency without delay.* This sentence appears to be creating some confusion among pilots. To explain what is expected of pilots let's look at the following example:

> Army 12345 is on an IFR flight from Davison AAF to Lawson AAF and being controlled by Washington Center. While enroute on V-222, 30 miles southwest of LYH VORTAC, you are told to contact Atlanta Center on 360.7 at Henry Intersection. ATC expects you to change to 360.7 after acknowledging and to call Atlanta Center at Henry. However, if told by Washington Center to remain on or monitor its frequency, then changeover to 360.7 and contact with Atlanta will be done at Henry.

Action to revise the FLIP General Planning is underway.

Readers are encouraged to send questions to:

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

## Museum Receives First T-41

THE U.S. ARMY Aviation Museum at Ft. Rucker, AL, recently added to its display area another historical aircraft—the first T-41 which was acquired in 1967.

The Cessna T-41 or "Mescalero" is a fixed wing, single engine airplane used to train Army aviators from early 1967 through September 1976. The one displayed at the museum is the first of 225 ordered by the Army in August 1966.

Retired with 7,583 flight hours, the museum's display T-41 was last used by the U. S. Army Aviation Center's Department of Graduate Flight Training. When single engine, fixed wing training ended Armywide last September 28th, the plane was transferred to the museum with approval of the U. S. Army Aviation Systems Command, St. Louis, MO.

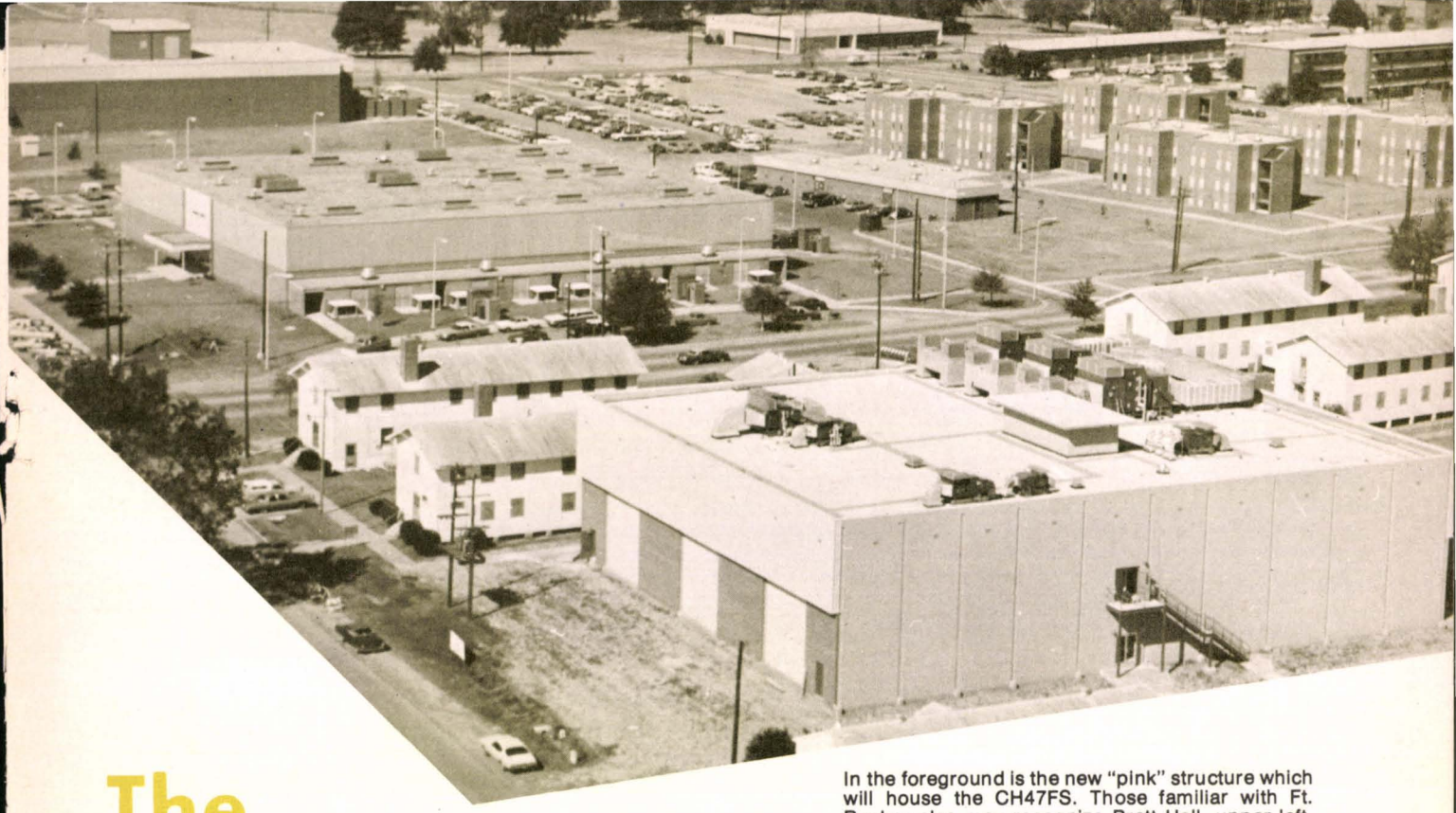
The last T-41 flight commander in the Army and the aviator instrumental in the museum's acquisition of the plane is Chief Warrant Officer (W-3) Robert M. Blanchfield of Ft. Rucker.

The T-41 has a maximum airspeed of 138 miles per hour and a cruise speed of 130 mph. Its service ceiling is 13,000 feet and it has a range of about 95 miles.

The T-41 was gradually phased out of Army stock and was replaced by the two engine T-42 when the Department of the Army deemed the single engine airplane obsolete for Army purposes.

## GLOSSARY

| | |
|---|---|
| AAF | Army airfield |
| AIM | Airman's Information Manual |
| AR | Army Regulations |
| ATC | air traffic control |
| DOD | Department of Defense |
| FAA | Federal Aviation Administration |
| FAR | Federal Aviation Regulations |
| FLIP | flight information publication |
| IFR | instrument flight rules |
| LYH | Lynchburg |
| VOR-TAC | very high frequency omnidirectional range |
| TACAN | tactical air navigation |



In the foreground is the new "pink" structure which will house the CH47FS. Those familiar with Ft. Rucker also may recognize Pratt Hall, upper left, and the USAAAVS building at the extreme left

# The "Pink" Lady

**See related article on page 8.**

**William L. Ruf**
Training Instructor
Department of Academic Training
Ft. Rucker, AL

HOLLYWOOD HAS its "Pink Panther." Flight instructors have their "pink" slips and now there has been a touch of "pink" added at the U.S. Army Aviation Center, Ft. Rucker, AL.

The "pink" we are talking about is the hue reflected by the new flight simulator building of the Department of Academic Training, Flight Simulator Division. The building is to be used to house the latest addition to the flight simulation field. The first parts of the CH47FS have arrived and are being placed in the building. The CH47FS is the first full visual system to be bought by the Army and should prove to be an invaluable means of totally training the CH-47C flight crews. If everything goes according to plan, the CH47FS should be installed, checked and accepted for training by the end of this month.

The flight simulation building is a very large and versatile unit that will serve as the nucleus for the most modern flight simulator complex in the Army. The AH1QFS TOW (tube-launched, optically-tracked, wire-guided) missile also is to be installed in the same building with the CH47FS. Future flight simulators, such as the Scout (advanced scout helicopter), UTTAS (utility tactical transport aircraft system) and other new aircraft have been taken into account and additional rooms for them will be attached to the present building.

The "pink" building (5101) is the culmination of a long and patient wait by the Flight Simulator Division. The original building construction was well underway when, in September 1975, a lady by the name of Eloise arrived on the scene and proceeded to add a year's delay to construction. The destruction was so severe that it required starting the building anew.

The contractor has done an outstanding job rebuilding and is well ahead of the projected completion date. This will allow for the CH47FS to be installed much sooner than anticipated. Although the building will not be released totally until late November 1977, the contractor has released the terrain board room to allow for the initial storing and installation of related equipment designed for this room.

*"THE UNUSED TALENT IN THE COCKPIT"*

USAAAVS

See page 30