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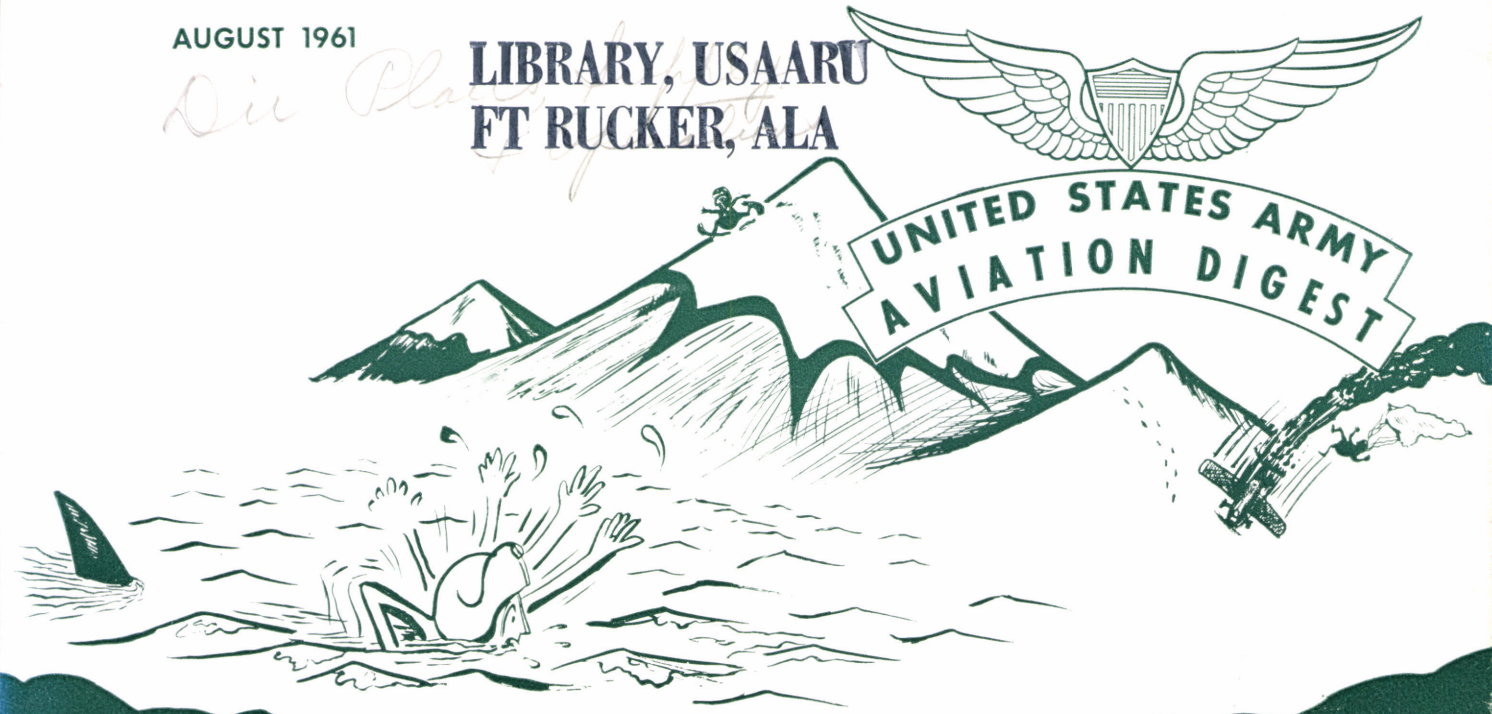

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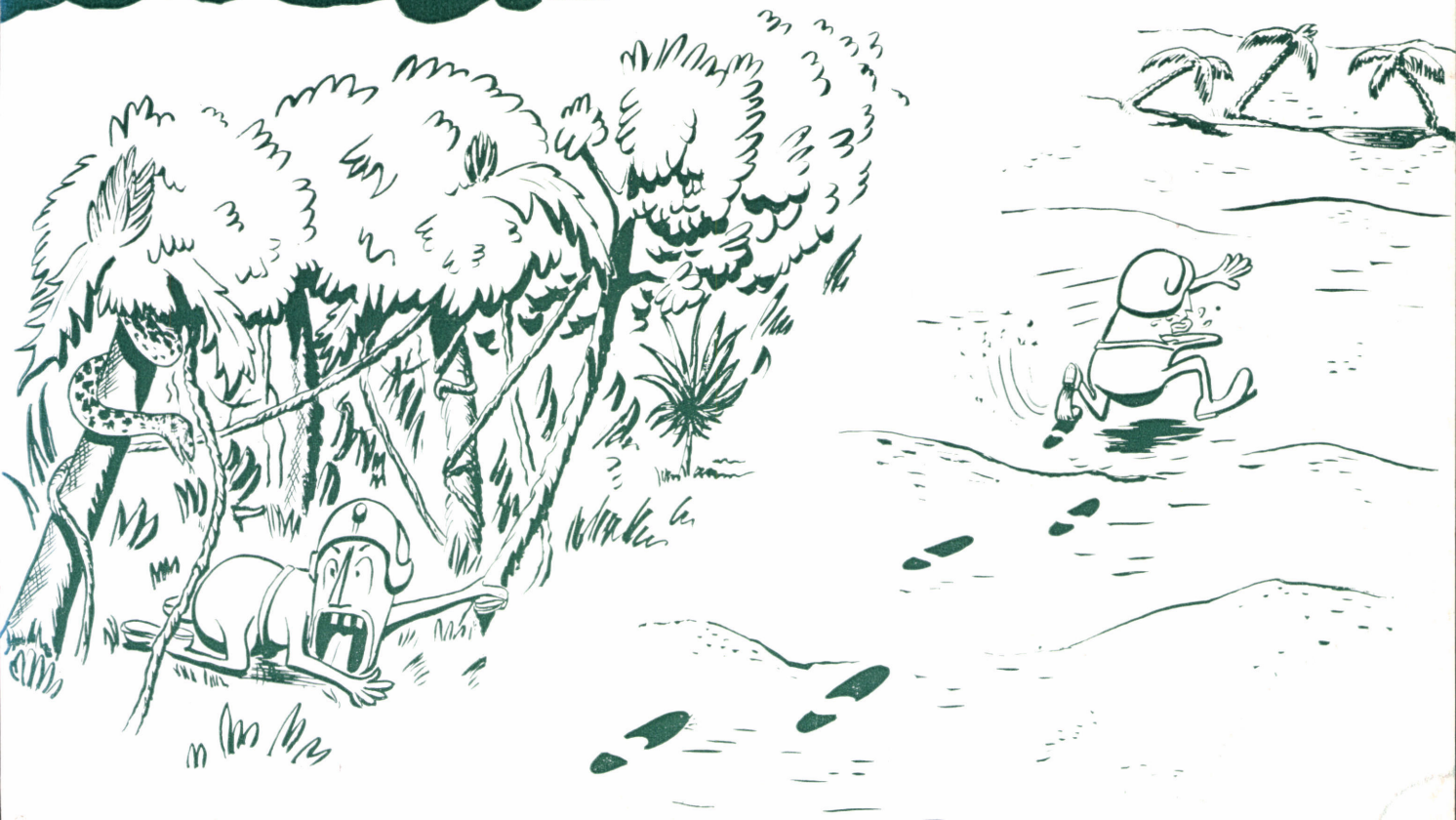

United States Army

AVIATION DIGEST

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Let's Take A Look At Survival . . . I

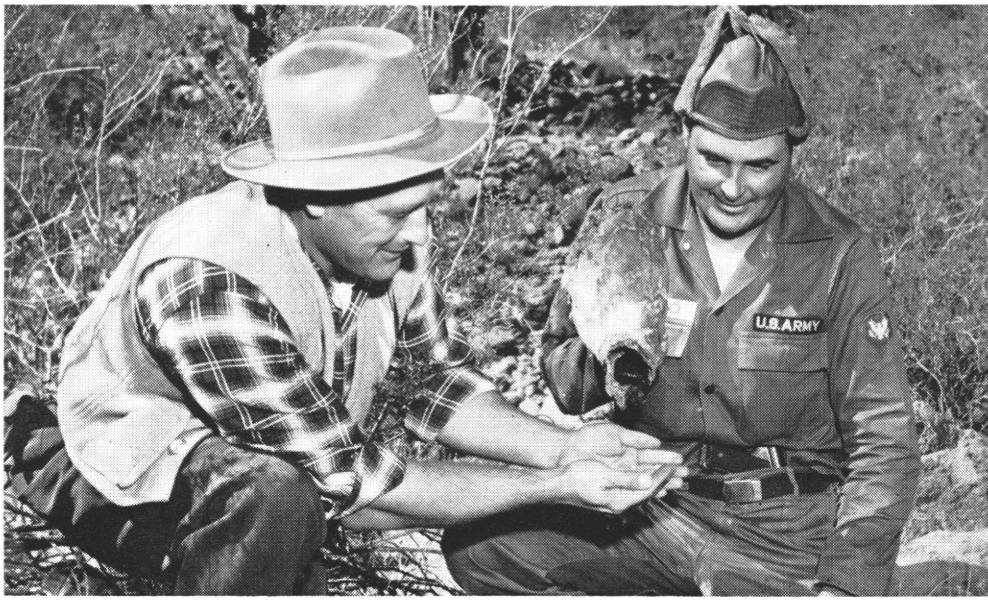
Lieutenant John Wallace

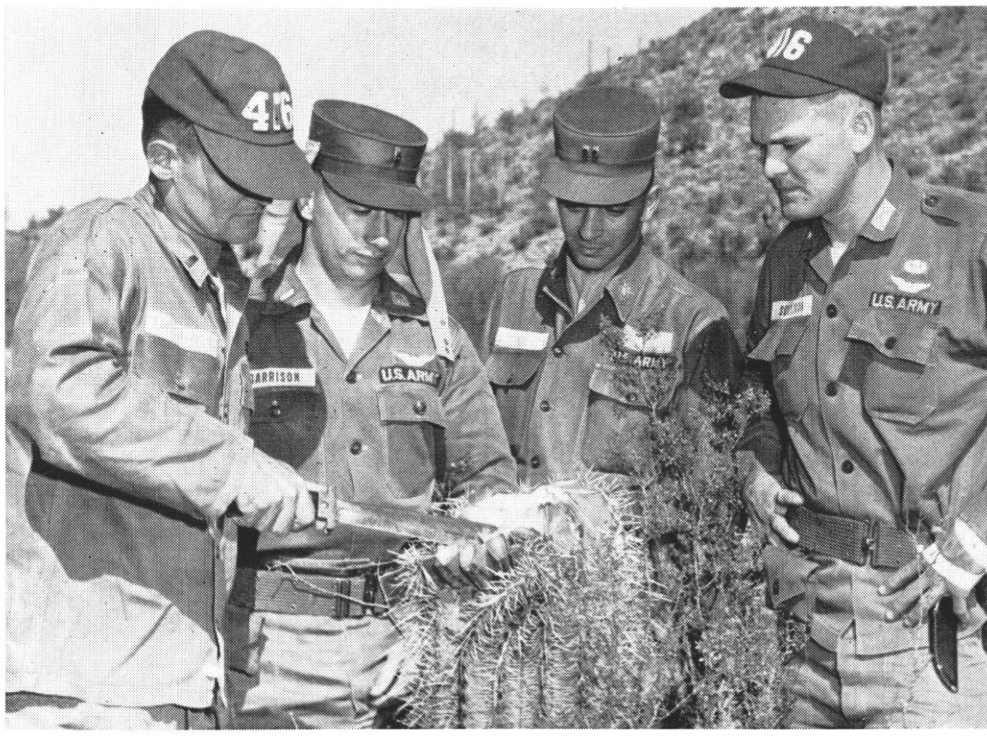
THE ARMY AVIATOR flying in the Southwest can at any time be minutes away from going down in an unpopulated, semiarid country. Until he finds help or help finds him, his successful survival depends on his ingenuity, training, and will to survive. This is true with anyone travelling in the desert who becomes unexpectedly lost or isolated.

For this reason, members of the 416th Signal Aviation Company at Fort Huachuca have a great interest in desert survival. Members of this unit asked Mr. Lee Kelly of Phoenix, one of Arizona's best desert survival experts, to instruct them in survival techniques.

A group of volunteers attended his course, which included a day of classes and a survival trip to the Batamote Mountains near Ajo, Ariz. Before departure, the made up their own personal tobacco can sized survival kits, designed by Mr. Kelly. Easily carried by the pilot or crew member at all times, it is helpful if the airman becomes separated from the aircraft. Each item in the kit has many purposes. Generally, the items cover first aid, fire starting, signalling, water purification and storage, animal trapping, and many other uses.

Mr. Kelly pointed out the im-





Cactus supplies water (top) and food (bottom) for desert survival trainees

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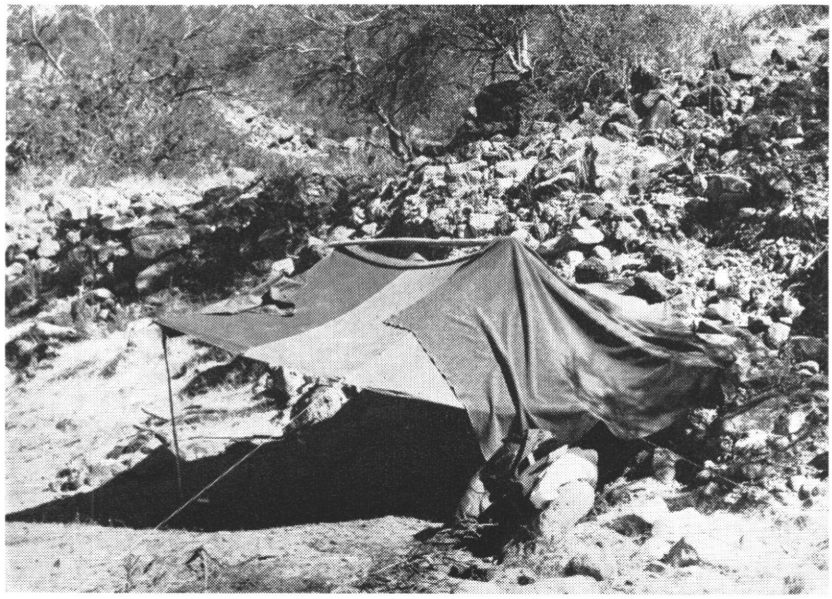
Lt Wallace is with the Public Information Office, U. S. Army Electronic Proving Ground, Fort Huachuca, Ariz.



Shelter from the sun made from shelter halves and blankets

portance of overcoming initial panic, and guarding against dehydration, the biggest concern in the desert. He explained the effects of heat and exercise on the body's water requirements, and how to conserve body fluids. He indicated ways to find water in the desert, and instructed on ways to travel, keeping oriented, and overall planning. Mr. Hubert Earle, director of the Arizona Botanical Gardens, gave instruction on edible plants and food. Both he and Mr. Kelly emphasized that food is more of a morale factor and shouldn't concern the survivor until he finds sufficient water. Food without water leads to further dehydration.

The men were taken into the desert with one canteen of water, their survival kits, and other items they would likely have with them on a flight. They were divided into groups of four and taken to different locations in the area. The next day Mr. Kelly flew from group to group checking their progress. Late the second day the groups were picked up.

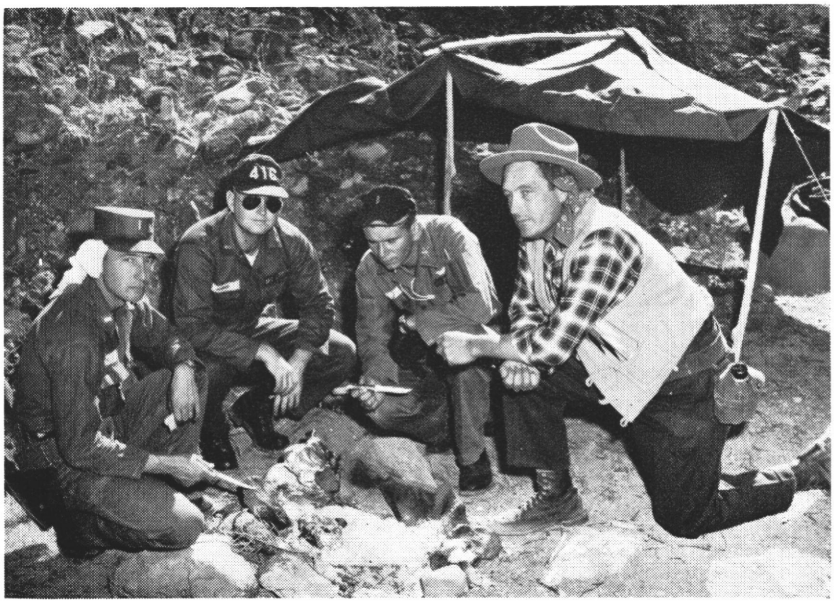
Each group did some travelling in their search for water. At the end of a day and a half several groups had found water, one group going 12 miles to a waterhole. The other groups did not find water; but would have found it shortly thereafter. All of the groups realized the extreme difficulty in finding water even though free water existed in abundance in the area. The groups realized that lack of sufficient water, fatigue, and walking greatly multiplied their obstacles in just one day. All of the groups successfully signalled the helicopter from up to 10 miles away, a factor that is very important to any survivor.

During the 3-day period, all of the men learned problems that are misunderstood or unknown to the average person. They learned their own needs and shortcomings, and gained a greater respect for water, rough terrain, and distance. They learned that survival can be very difficult, but not impossible if you are prepared.

Mr. Kelly emphasized the importance of "planning your own disaster." If you plan for the worst, you have a better chance to survive. If taking a trip or flight into an isolated area, someone should know your intentions so searchers can look for you if you do not return. All aviators should adhere to their filed flight plans. Even then no potential survivor should expect help immediately. He must be ready to adapt himself to his new environment with whatever means and knowledge he has with him.

He should remember that

A lesson in stewing the fruit of barrel cactus is given during desert survival course



man survives, with few exceptions, in all areas of the world. No matter where he is the means for his livelihood are nearby, if he knows how to recognize them. The potential survivor should plan to have whatever provisions he thinks necessary with him, and he should have adequate knowledge of survival to make up for provisions he doesn't have.

In unusual cases, the "will to survive" has been an overriding factor for lack of preparation or knowledge. But the risk is too great for anyone to depend on this alone. If a person is prepared mentally and physically to cope with this situation, his morale will be higher and then his "will to survive" will bring him through. □

...II

Captain Robert G. Elton, Inf

MAYDAY! MAYDAY! MAYDAY! This is Army 2345 forty miles southeast of Reno . . . engine quit . . . bailing out!

STOP! THINK! How well equipped are you to cope with a survival situation? Would you be properly dressed and equipped for the climate and terrain? Is your parachute properly fitted?

I know you're thinking, " I don't have the occasion to cross mountains. Even if I did, I wouldn't have to bail out." Could be, my friend. But how would you react if you found yourself in any of several survival situations? Actually, the Continental United States has many areas in which an aviator can experience unusual survival conditions. The southwestern desert area, the mountainous areas which cover a good portion of the East and West, the swamp area of the southeast—all are potential survival areas. How well you have planned and trained for survival will determine the outcome of your survival experience.

If you bailed out in mountainous terrain would you be caught wearing low quarter shoes? "Low quarters" are not designed for walking in rocky terrain; nor are they designed for jumping out of aircraft. Frequently, "low quarters" are loosely tied and are lost on opening shock of the parachute, causing much discomfort if walking is attempted and downright cold feet in snow-covered areas.

An improperly adjusted parachute is conducive to injury. Loose straps have caused broken bones, a decided deterrent to survival. Are you familiar with bail-out procedures in each type aircraft? Do you have any type of survival equipment — knife, food, matches, etc?

The rapid growth of Army Aviation during the past few years has been directed towards training aviators, procuring additional aircraft and equipment, and creating doctrine and concepts for their use. Many problems associated with flying had to be relegated to a secondary position during this phase. Survival equipment and survival training have not been stressed in the past, partly because of the heretofore limited range of Army aircraft.

WHAT HAS BEEN DONE?

Even though a lack of standard survival equipment existed, many Army Aviation units locally fabricated survival kits. These kits ranged from a few cans of water for desert flying to elaborate aircraft kits for Arctic flying. Unfortunately, most Army Aviators had little or no survival training or equipment and consequently were not prepared for survival encounters. With some exceptions, this situation exists to-

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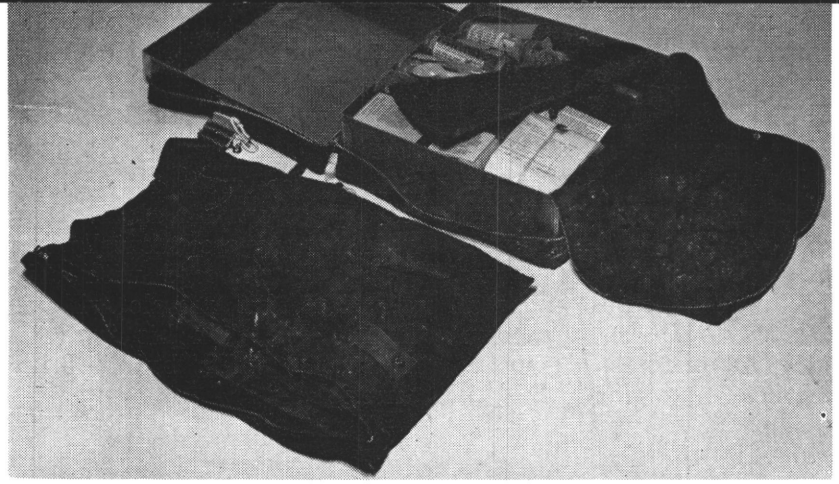
Capt Elton was assigned to the U. S. Army Aviation Board, Fort Rucker, Ala., when this article was written. He is now attending helicopter school at Camp Wolters, Texas. He has over 1,200 flight hours in fixed wing aircraft.



Individual 25-lb overwater survival kit

Individual 30-lb hot climate survival kit

day. However, in Alaska, not only is equipment provided, but survival training is given to each newly assigned aviator.

The USA Aviation Board has recently tested Individual Hot Climate Survival Kits and Individual Overwater Survival Kits which were developed by the Quartermaster Research and Engineering Command (QMR&EC). During testing, modifications were accomplished by this Board in conjunction with QMR&EC. However, for various reasons, the kits were not suitable for all Army aircraft. The major cause of this dilemma is the "off-the-shelf" procurement of Army aircraft, which results in nonstandard seats. Since the kits are designed to fit the seat well of the aircraft and attach to the aviator, it can be easily seen why one kit design will not suffice for all Army aircraft.

WHAT IS BEING DONE?

USCONARC has initiated a re-evaluation of the problem and new Military Characteristics are being prepared in an attempt to resolve the present dilemma. Meanwhile, the USA Aviation School has included a 3-hour general course of instruction on survival. Of necessity, the scope of the course is limited. SURVIVAL can hardly be covered in 3 hours. However, the importance of the course lies in the fact that we in Army Aviation are awakening to the realization that we can no longer completely ignore the disastrous effects of a nonsurvival conscious Army Aviator.

WHAT COULD BE DONE?

It would require a great deal of time and money (which is scarce, to say the least) for the Army to establish survival schools and to train survival

personnel. For economy's sake, it would appear more feasible to work with the other services and to utilize their facilities. For example, upon completion of flight training at Fort Rucker, aviators could be sent to a Navy or Air Force basic survival training course (usually about two weeks duration). After this course has been completed, the aviator should receive advanced survival training or area survival training in his area of operation, again using the Navy or Air Force survival training facilities.

When this training has been accomplished, the Unit Survival Training Officer, using AR 95-1 as a guide, should set up a program for continuation of survival training and proficiency. In addition, Army Training Programs should include phases of survival problems. In short, a program of survival instruction adequate to meet the needs of the Army could be established or coordination affected with the Navy and Air Force to utilize their facilities for promotion of survival training.

Through a lack of emphasis on survival training most Army Aviators are not particularly concerned with survival training or equipment **until such time** as they are faced with the requirement to conduct flights over long stretches of water, jungle, or in the wastelands of the Arctic. We can't expect a man to be an expert marksman simply by handing him a rifle. We must train him in the use of the equipment. Similarly, we must indoctrinate our pilots on the requirements for survival; introduce survival equipment to them; and train them to survive with or without that equipment.

WHAT CAN YOU DO?

Until positive action is taken by the Army to prepare each of us individually, the following personal action can be taken. First, develop a healthy mental survival attitude. You can accomplish this in part by studying FM 21-76, the survival manual. Try to read some of the survival experiences of the past wars. Look for survival stories in such magazines as ARMY AVIATION DIGEST, the Air Force FLYING SAFETY, and U. S. Navy APPROACH. If you are in a position to review the Navy Personnel Equipment Crossfeed sheets, do so. They contain a great deal of information on survival, particularly comments from units in the field. In addition, the Arctic, Desert, Tropic Information Center, Air University, Maxwell Air Force Base has several publications relating to survival. Some of these are as follows: "999 Survived," "Afoot in the Desert," "Sun, Sand and Survival," "Survival Training in the USAF." If you are interested in testing, try "The Desert Survival Field Test." Movies can be obtained to further your education and develop confidence in your ability to survive. For further information, write to the above agency on this subject.

The psychological aspects of developing a healthy mental attitude can be accomplished by equipping yourself with a few pieces of basic survival gear. Since survival kits are not normally available, get in the habit of carrying a few pieces of equipment such as a knife, matches, candy bars or other food items, perhaps a small first aid kit, and other useful items you can conveniently carry. Probably the most important single item is the knife. It takes a strong set of sharp teeth to do the work of one small blade.

Survival kit in modified L-19 seat.

Armed with the confidence and knowledge obtained thus far, your next step is to do something within your own organization. Take the initiative and set up a realistic survival training program. Perhaps you cannot establish an elaborate program, but the important thing is to instill in your fellow aviators the need of survival confidence.

Finally you can request TDY to an Air Force or Navy survival school. There are interservice survival schools in most major commands throughout the world, and from what can be determined, the other services are more than willing to accept Army aviators for survival training.

To sum up, if you don't have a really healthy survival attitude, do something about it now, before it's too late! □

Morale was a vital factor in assuring survival of POWs. Flags, unit badges, shoulder patches, etc., were produced by the POWs under difficult conditions. Above are two aviation badges made from bed slats at Barth. Morale is important in peacetime survival, too.

Tin cans were used to fabricate a multipurpose stove at Stalag Luft I.

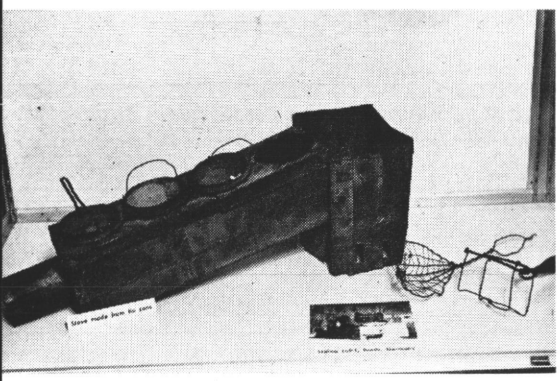
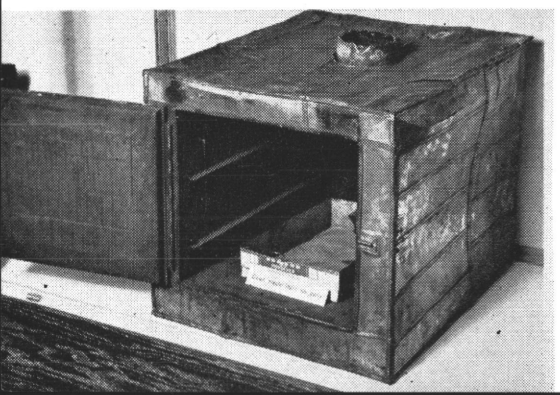


Photo credit: Air Force Museum, Wright-Patterson AFB.

Below. This oven was made from powdered milk cans by American fliers held at Stalag Luft I, Barth, Germany, during WW II. POWs adopted the can-do spirit and organized group food procurement and preparation, sanitation, etc. Each man was his brother's keeper.



...III

Lieutenant John A. Hurley, USAF

THE GROWTH of Army Aviation has intensified interest among Army personnel in basic techniques of survival and escape and evasion. In many respects these techniques are the same as those employed by ground personnel. The wartime mission of Army Aviation necessarily dictates that aircrews will be frequently exposed to hostile action and poor weather conditions. Similarly peacetime training is often conducted in a simulated combat environment. In spite of improving search and rescue procedures, downed fliers are often not located for days, even within the United States, particularly in mountainous or forested terrain. Similarly large inland bodies of water pose a survival hazard quite often as acute as that of the ocean. Too often aircrews point to the proximity of "civilization" (roads, farms, towns, etc.) without realizing that an injury may make it impossible to reach a point further than a few feet from the point of landing.

Therefore, the aircrewman must be constantly reminded of the need for survival know-how. Self-preservation would seem to be an adequate motivating factor, but many personnel have had their early enthusiasm blunted by uninspired training. Realistic survival training increases the combat efficiency of a unit by ensuring that downed personnel are returned quickly to effective duty; it increases individual proficiency by building confidence. Aircrews occasionally view escape and evasion as a talisman which will magically extricate them from any emergency without recourse to survival fundamentals. However, the best way to utilize escape tactics is to never be in position to need them. Thus, comprehensive knowledge of survival methods will enable the trained crewman to adopt a can-do spirit and scorn the shortcuts that lead to capture and imprisonment.

To supplement issue survival gear, which may become lost or prove too bulky to carry, aircrews owe it to themselves, their families, and units to develop **and** carry a personal survival kit. This essential step is of course not exclusive of the many other measures which will improve the chances of safe return, including good physical conditioning, firearms proficiency, familiarity with compass, first-aid knowledge, etc.

The personal survival kit should be designed to ensure that it is capable of being comfortably and securely carried in the flight suit, preferably in lower trouser pockets to avoid interference with flight operations and to prevent injury during bailout or forced landing. The container should be strong, flexible, and water tight so it can be used as a water carrier after landing. The pocket must be reinforced with rows of stitching and the kit surrounded with an extra pair of socks.

In choosing items for the personal survival kit, there will be

Lt Hurley is assigned to Headquarters, Dept of the Air Force, Washington, D. C.

differences depending on the type of mission, type of aircraft, terrain, climate and season, availability of search and rescue forces in area, likelihood of enemy action, etc. It is advisable to scrounge both military and commercial sources to obtain items that are as flexible and lightweight as possible. For example, there are commercial plastic waterproof match cases which have a compass and steel striking bar attached. Crewmen will quickly become attuned to the survival potential of new sporting goods items. To capitalize on this interest, and also to provide for cross-fertilization of ideas, it is advisable to hold occasional exhibits of sample kits. This also ensures that perishables (such as antibiotics) are replaced periodically.

For the convenience of aircrew and survival personnel, a representative listing of items in a personal survival kit is appended. Optional items such as dye marker, shark repellent, day-night signals, candles, etc., may be carried in other lower trouser pockets. □

SAMPLE CONTENTS FOR PERSONAL SURVIVAL KIT

Fishline (invisible, high-strength)	50 feet
Flies	2 each
Net, Gill (roll-up)	1 each
Fishhooks	4 each
Split Shot	4 each
Rotenone, 12% (fish poison) in opaque bag	1 oz
Needles	2 each
Matches, waterproof	50 each
Tablets, heat	4 each
Compass	1 each
(The above three may be combined in a plastic waterproof container which has a striking edge and compass integral with the case.)	
Knife, scout	1 each
Wire, snare	1 roll
Saw, metal-cutting, spiral, folding	1 each
Pins, safety	3 each
Canteen, plastic roll-up	1 each
Mirror, signalling	1 each
Miniature flashlight (preferably with flasher switch) w/batteries	1 each
Sugar, cubes	4 each
Compressed food bars	3 each
Chapstick (cut in half)	1 each
Discs, Penicillin	4 each
APC Capsules	10 each
Calcium EDTA (for use after radioactive attack) tablets	4 each
Ointment, antibiotic (Bacitracin or equivalent)	1 tube
Tablets, water purification	50 each
Tape, adhesive	10 feet
Signal and code card	1 each
Bandaids or equivalent (waterproof)	3 each
Prophylactics (for compass and watch cases, water bags)	3 each
Whistle, plastic	1 each
Can Opener, GI	1 each
Benzalkonium Chloride or Iodine	1 vial, 2cc

TATSA Tests Cherry Picker

Larger aircraft have created a need for a type of adjustable, high level maintenance platform in Army Aviation. Currently, the U. S. Army Transportation Aireraft Test and Support Activity, Fort Rucker, Ala., is testing a platform which is mounted on the rear of the M-37 truck and has an elevation range of from 11 to 30 feet.

The platform is designed to perform under all environments encountered by field units and is operated with power supplied by the truck's electrical system. Made of aluminum, the rig is credited with the ability to lift a 500-pound live load with a 60-knot wind load.

The work area is 4 x 4 feet and can be raised or lowered from the platform. It is actuated by a wire cable drive and winch, which are driven by a DC motor through a 60:1 gear reducer.

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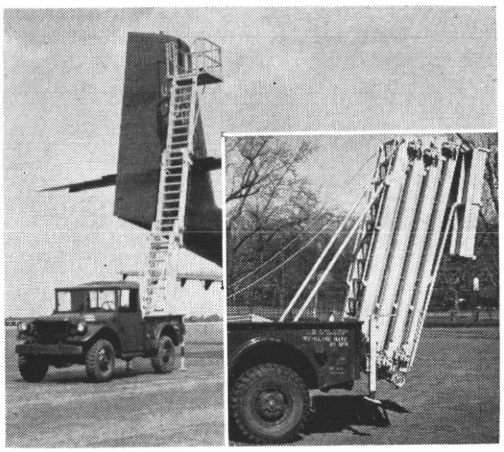
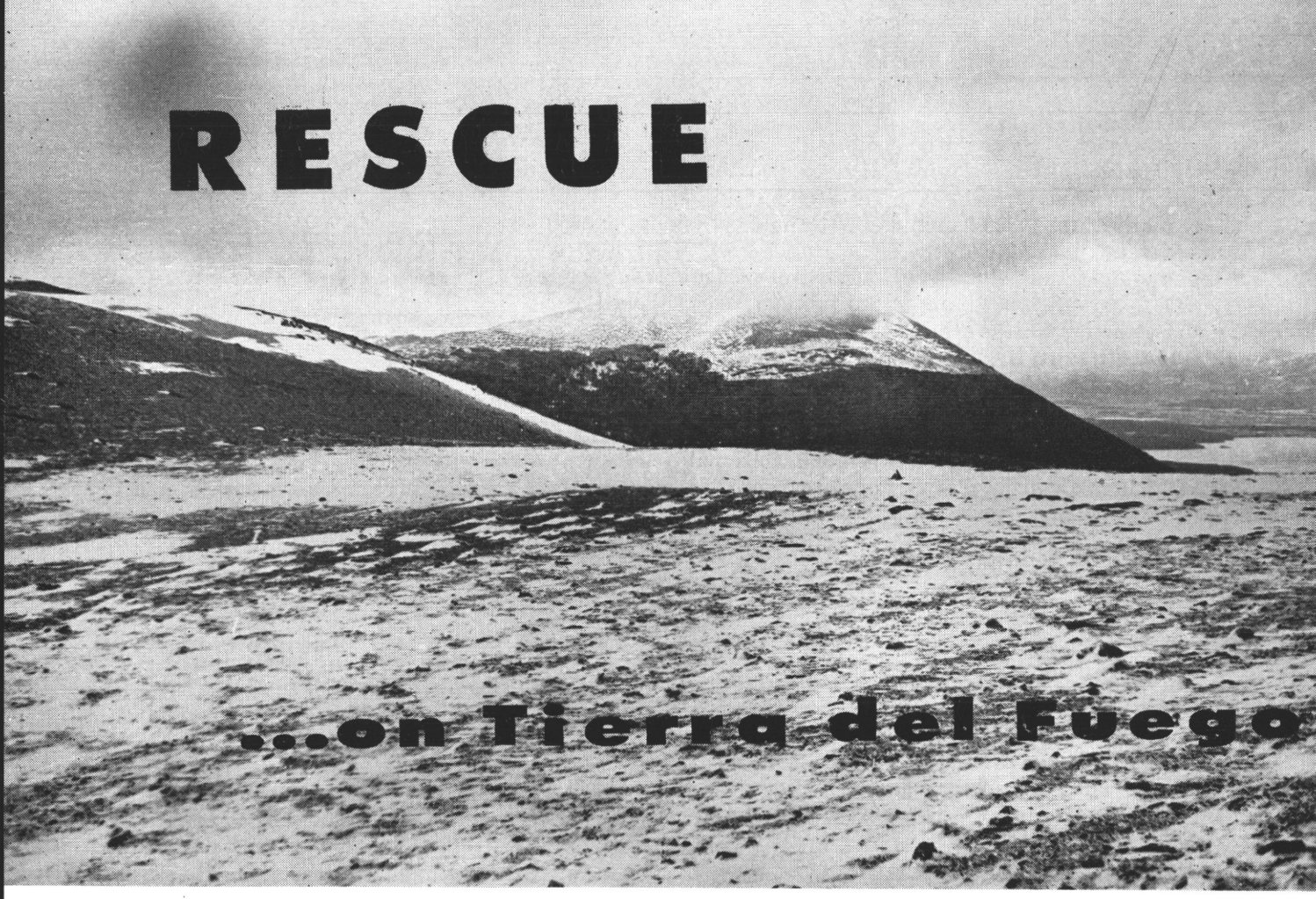


RESCUE



...on Tierra del Fuego

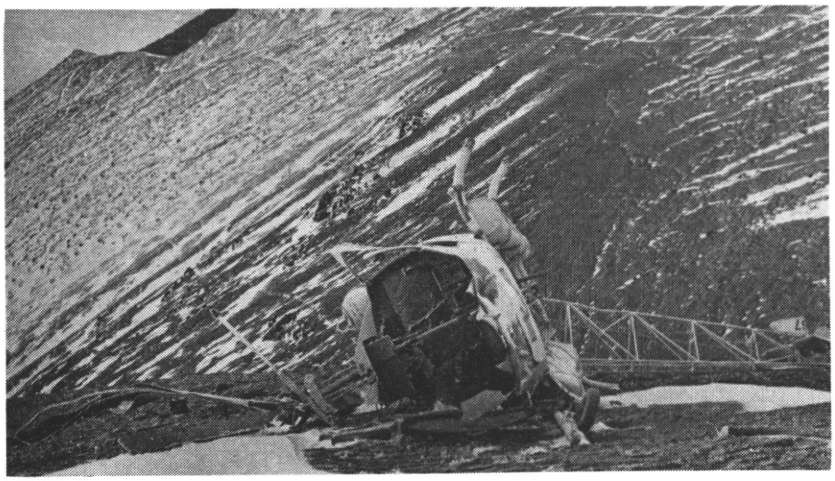
AT 0445 ON THIS island off the southernmost tip of the South American continent, two Army Aviators got up as usual, breakfasted and were going about their normal day's work, preflighting their H-13s.

"Let's hit it at 0600," one pilot shouted to the other in the chill dawn, and soon they were airborne over this bleak "land of fire," heading for the mountaintops over untracked country. To IAGS teams (Inter-American Geodetic Survey), unchartered lands are their daily traffic pattern. These two aviators, their helicopters, two mechanics and one tech inspector were on loan for a period of 90 days to the Chilean government, which was mapping the island of Tierra del Fuego.

Winter appeared to be advancing early in this topsy turvy land. Already the March mornings were raw. The mission this a.m., flown from a campsite known simply as Evans, was to transport personnel and equipment to several mountaintop surveying stations located slightly north of the Admiralty Strait. Landing at a sheep ranch known as Estancia Vicuna, the pilots loaded cement and 5-gallon cans of water into the cargo bags and then off-loaded this cargo at another mountaintop, Intra Lago.

So far, so good; the mission was going according to plan. Over steaming cups of coffee, a few minutes of good natured

Prepared by the United States Army Board for Aviation Accident Research.



joking went the rounds on the subject of the weight of each pilot. They took on a passenger each, but it was decided that the lighter of the two aviators would pick up extra cargo that was needed.

At 0800 they took off, heading back toward Estancia Vicuna where the H-13s were landed again and one aircraft took on 26 pounds of cargo. With this accomplished, they headed for another mountain peak, Media Luna, with the H-13 carrying extra cargo in the lead. On final approach into Media Luna, the lead helicopter experienced trouble. The following portions of this account are taken from the accident report.

The pilot: "I started my approach from about 50 feet above the point, at about 45 knots IAS. When I was about 10 or 15 feet above the point and just short of my intended landing site, indicating 10 knots, the helicopter started spinning to the right and the rotor rpm went from 3100 to about 3400 or 3500. By this time I was directly over the point and elected to crash on top of the mountain rather than fall off the steep slope and crash farther down.

"Before splitting the needles I pressed the mike button to warn the other pilot and said 'I'm crashing,' as I didn't want him to get any closer for fear of flying pieces hitting his helicopter. My aircraft was still spinning to the right when I split the needles and hit. The left skid failed and the helicopter bounced, spun and rolled down the slope to the right, stopping on its right side."

(Note: The Army helicopter crashed on a 2,800-foot peak 20 miles north of the Strait of Magellan at 54° latitude. Temperature was 3° above freezing.)

"As soon as I felt the helicopter came to a complete stop I asked the passenger if he was O.K. He could not speak English, but indicated he was all right, but didn't want me to touch him. I released my safety belt and fell down and out of the helicopter. Gasoline was spraying out from numerous ruptures in the lines and tanks, so I crawled back into the helicopter and, in spite of the passenger's protestations, I released his safety belt and got him out because of the danger of fire.

"Once out of the helicopter the Chilean seemed in a state of shock and wouldn't take his hat and jacket; so I put them on him, led him down the mountain to the tree line to build a fire. By the time we arrived at the tree line I heard the other helicopter coming up the mountain and soon the pilot was running toward us . . . we climbed back up to the wreck, recovered the first aid kit and bandaged the three cuts on the passenger's right hand.

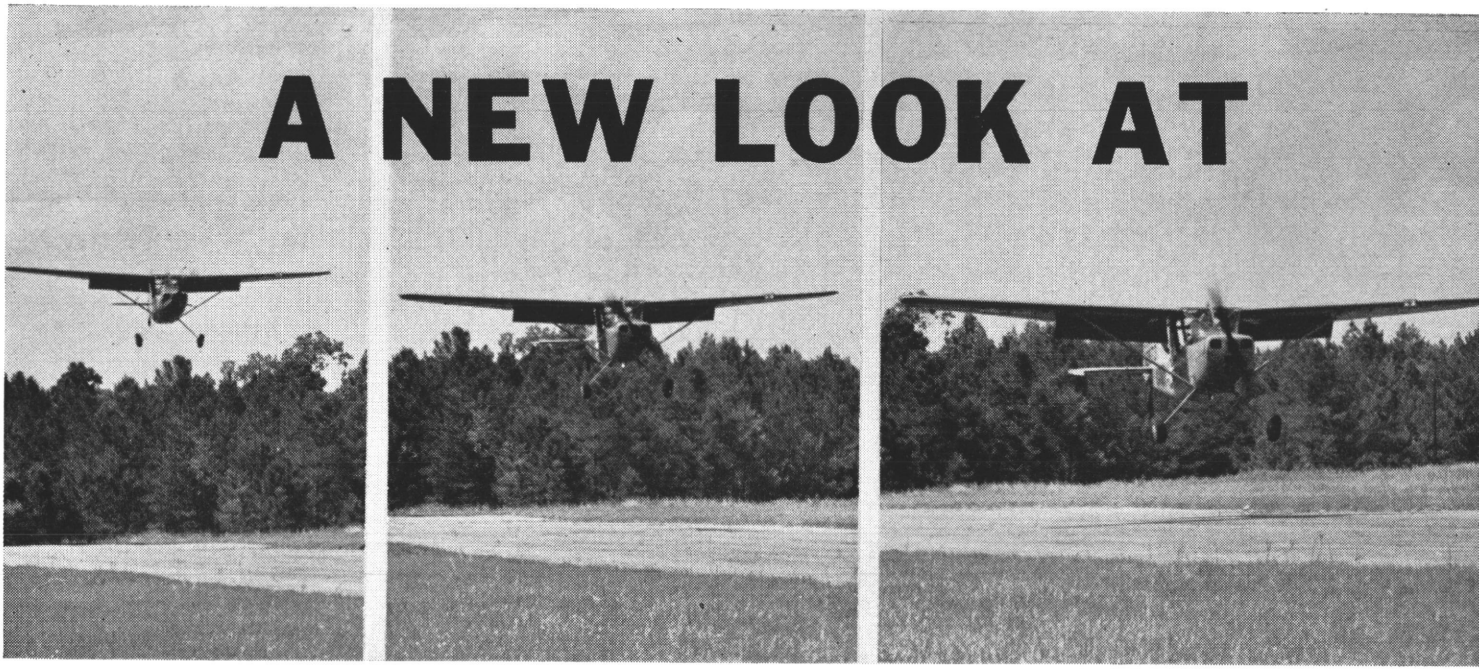
"At the time of the accident there was little or no wind and the visibility was excellent under a scattered cloud condition which was approximately 300 feet above the landing area. By the time we reached the top of the mountain, however, the wind had risen, the cloud deck lowered and conditions were zero-zero.

"After tying down the rotor blades on the rescuing H-13 we all got into it to wait out the weather. At 0930 it started to snow, changed to freezing rain and then just rain, stopping about 1230. After a 5-hour wait the weather improved enough for the other pilot to evacuate the Chilean. Knowing the helicopter could not come back to the mountaintop because of high winds, I walked down to a clearing where we had agreed to meet.

"The temperature was dropping and I built a fire. At daylight I started walking out of the mountains, and at about 0630 I heard a helicopter, but being in dense woods could not see it. I climbed a mountain, found a clearing and proceeded to it, built a large fire and waited. The helicopter returned at about 0720."

Continued on page 14

A NEW LOOK AT



William R. Gaines

A 16-POUND TAILWEIGHT has been credited with helping to reduce the L-19 groundloop accident rate by 61.5 percent for primary solo flight students.

A recent study conducted by the Safety Division of the U. S. Army Aviation Center, Fort Rucker, Ala., indicated that the L-19A's center of gravity (c.g.) is sufficiently forward to result in a light-tail condition which adds to directional control problems for a primary student during the first 250 feet of landing roll. The tailweight moves the aircraft center of gravity aft, thus facilitating directional control. The 2,100-pound gross weight limit of the L-19A in solo configuration is not exceeded.

The L-19E model presents a similar problem. The c.g. does not exceed the forward limit in solo configuration, but it is too far forward to enable beginning students to achieve good directional control in the early phases of the landing roll. The E model has excellent landing characteristics when flown dual. But when the second person leaves the aircraft, the c. g. moves forward about 4 inches to within approximately 1 inch of the forward permissible limit. This creates a light-tail condition which the School compensates for with the tailweight.

Students experience the majority of L-19 groundloops in Army Aviation. As they progress in training the directional control accident rate decreases. Upon graduation students have the "feel" of the aircraft and only a minimum of trouble with directional control problems. However, when the new pilots leave the school, the groundloop threat tags along and increases if an individual allows his proficiency in the L-19 to retrogress.

Loss of directional control in the L-19 is an Army-wide problem. USABAAR statistics show that in calendar years 1959 and 1960, 143 L-19A & E model

Figure 1

L-19 A AND E MODEL GROUNDLOOP DATA ON NONSTUDENT PILOTS AND INSTRUCTORS

	1959		1960	
	A Model	E Model	A Model	E Model
Major	25	24	15	17
Minor	3	12	2	1
Incident	4	6	9	17
F/L (No damage)	0	4	0	3
Other	1	0	0	0
TOTALS				
By Nonstudent Pilots	28	38	19	28
By Instructors	5	8	7	10
	33	46	26	38
TOTALS BY YEAR	79		64	

directional control accidents were committed by **nonstudent** pilots (fig. 1). Note that 30 of these mishaps were experienced by instructors, who generally are current in the aircraft.

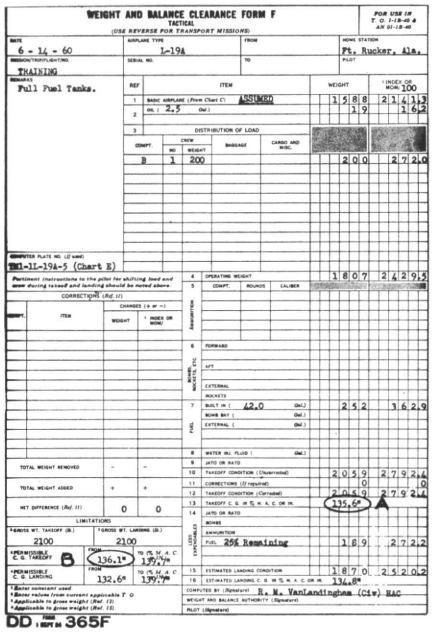
Many Army Aviators go lengthy periods without flying the L-19. When they do their technique is often a bit "rusty." With the center of gravity too far forward, they have two strikes against them. Army Aviators in the field can compensate for this disadvantage by anticipating and preparing for possible directional control difficulties while landing the L-19 solo. **A little extra diligence by the experienced pilot should avert a groundloop accident and save a lot of time, money, and embarrassment.**

In the spring of 1960 the commandant, U. S. Army Aviation School, authorized the Center Safety Division to undertake a detailed study of directional control problems encountered by solo students in the L-19. It was determined from Weight and Balance Form F (DD Form 365F, fig. 2) that the forward c.g. exceeded the permissible limit from ½ to 1 inch on various L-19A's when flown solo. Point A, fig. 2, is the actual c.g. at takeoff on a particular L-19A flown solo. Point B represents the permissible c.g. at takeoff. Note that the c.g. on this aircraft is one-half inch forward of the permissible limit.

Figure 3 also illustrates

Mr. Gaines is Safety Director for the U. S. Army Aviation Center, Fort Rucker, Ala. He has over 15 years experience in aircraft accident prevention.

Figure 2



WEIGHT AND BALANCE CLEARANCE FORM F
TACTICAL
(USE REVERSE FOR TRANSPORT MISSIONS)

FOR USE IN T. O. 1-1B-40 & AN 01-1B-40

DATE: 6 - 14 - 60	AIRPLANE TYPE: L-19A	FROM	HOME STATION: Ft. Rucker, Ala.
MISSION/TRIP/FLIGHT NO.: TRAINING	SERIAL NO.	TO	PILOT

REMARKS: Full Fuel Tanks.

REF	ITEM	WEIGHT	INDEX OR MOMENT/100
1	BASIC AIRPLANE (From Chart C) ASSUMED	1588	2141.3
2	OIL (2.5 Gal)	19	16.2
3	DISTRIBUTION OF LOAD		
	COMPT. B; CREW NO. 1; WEIGHT 200	200	272.0
4	OPERATING WEIGHT	1807	2429.5
5	COMPT. / ROUNDS / CALIBER		
6	EXPENDITURE: FORWARD		
	LIFT		
	EXTERNAL		
	ROCKETS		
7	FUEL: BUILT IN (42.0 Gal)	252	362.9
	BOMB BAY (Gal)		
	EXTERNAL (Gal)		
8	WATER INJ. FLUID (Gal)		
9	JATO OR RATO		
10	TAKEOFF CONDITION (Uncorrected)	2059	2792.4
11	CORRECTIONS (If required)	0	0
12	TAKEOFF CONDITION (Corrected)	2059	2792.4
13	TAKEOFF C. G. IN % M. A. C. OR IN.	135.6*	
14	LOAD CHANGES: JATO OR RATO; BOMBS; AMMUNITION; FUEL 25% Remaining	189	222
15	ESTIMATED LANDING CONDITION	1870	2520.2
16	ESTIMATED LANDING C. G. IN % M. A. C. OR IN.	134.6*	

CORRECTIONS (Ref. 11)			
COMPT.	ITEM	CHANGES (+ or −) WEIGHT	INDEX OR MOMENT
TOTAL WEIGHT REMOVED		−	−
TOTAL WEIGHT ADDED		+	+
NET DIFFERENCE (Ref. 11)		0	0

LIMITATIONS

*BASICS WT. TAKEOFF (lb.)	*GROSS WT. LANDING (lb.)
2100	2100

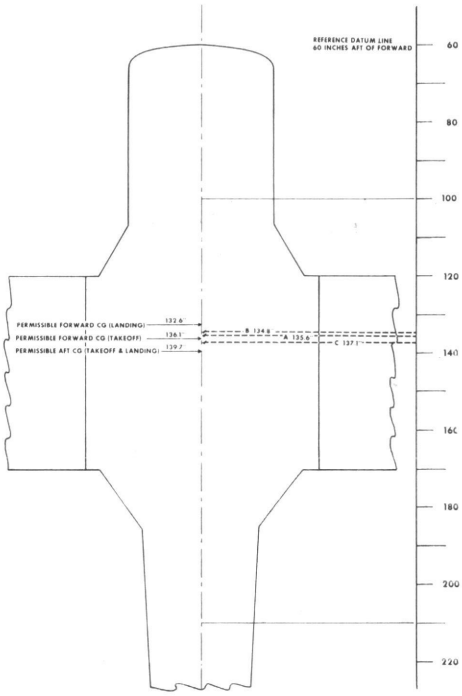
		FROM	TO (% M. A. C.)
*PERMISSIBLE C. G. TAKEOFF	B	136.1*	137.1
*PERMISSIBLE C. G. LANDING		132.6*	139.7

*Basic moment used
†Basic value from current applicable T. O.
‡Applicable to gross weight (Ref. 12)
*Applicable to gross weight (Ref. 12)

COMPUTED BY (Signature): R. W. Vanlandingham (Civ) HAC
WEIGHT AND BALANCE AUTHORITY (Signature)
PILOT (Signature)

DD FORM 1 SEPT 54 365F

Figure 3



this. Point A (fig. 3) is the actual c.g. at takeoff (135.6 inches aft of the forward reference datum line). This exceeds the permissible c.g. at takeoff by 1.5 inches. As fuel is burned, the c.g. moves forward. After 75 percent of the fuel is used the estimated landing c.g. is at point B (fig. 3, 134.8 inches aft of the forward reference datum line). Although within the forward c.g. landing limit, it is too far forward and makes the aircraft tail-light. It is in this configuration that beginning students experience great difficulty in keeping the tail down and achieving good directional control upon landing.

The addition of the 16-pound weight moves the landing c.g. aft to point C (fig. 3, 137.1 inches aft of the forward reference datum line). This innovation on both the A and E models resulted in the 61.5 percent reduction of the student directional control accident rate. This sharp decrease was registered by four test classes using the weight during solo flights for the first 35 hours of Phase A training.

Classes utilizing the weights slashed the cost per flying hour by 82.1 percent overall. Groundloops by the test classes cost the government $.20 per flying hour. This compares with $.72 incurred by eight previous classes which used power-off landings without the tailweight, and with $1.13 for three previous classes which used power assist landings without the tailweight. (See fig. 4.)

The canvas-covered lead tailweight is fabricated by Post Ordnance for $4.50 each (fig. 5). The weight adds 5,400 in/lb moments at the tailwheel spring (station 240). Attached on top of the spring by three webbed straps at points A, B, and C (fig. 6) it can be removed or installed in about 3 minutes. The only change in configuration from the standard L-19 is the addition of a small metal strap on the tailwheel spring "U" bolt (point C, fig. 6) as a third anchor point for the weight.

The Cessna Aircraft Company, when informed of intentions to test the weight on the L-19A, replied by letter to the Center Safety Division:

"As long as the gross weight and c.g. limits are not exceeded, the addition of the 16-pound weight at Sta. 240 will not structurally weaken the aircraft. With this weight, a pilot, full fuel, and 100 pounds baggage can be easily carried; the observer or instructor cannot be carried under these conditions.

"The use of the added weight for solo operation where the c.g. is quite forward will assist in simplifying landing techniques. However, we have never identified directional control to the weight on the tailwheel and, in general, the aircraft is more susceptible to groundlooping the farther aft the c.g. The Contractor has no information on flight tests with ballast installations of this nature."

Mr. S. M. Phillips, Director of Safety for the Hawthorne School of Aeronautics, Fort Rucker, endorses use of the tailweight on the L-19 for solo students in the first 35 hours of Phase A instruction. He stated that "the tailweight allows solo students improved

Figure 4

A STUDY OF SOLO LANDING ACCIDENTS—INCIDENTS FOR TEST PURPOSES

Configuration Number one (1): The L-19 aircraft were flown solo without a weighted tailwheel and using a power-off type landing.

Classes 60-1 Through 60-8

Total Time	Total Acdt/Incd	Total Cost	Acdt/Incd Rate	Cost/Hr
60,667	33	$43,382.15	54	$.72

Configuration Number two (2): The L-19 aircraft were flown solo without a tailwheel weight and using the power-assisted landing.

Classes 60-9 Through 61-1

Total Time	Total Acdt/Incd	Total Cost	Acdt/Incd Rate	Cost/Hr
22,203	19	$25,133.50	85.5	$1.13

Configuration Number three (3): The L-19 aircraft were flown solo with a weighted tailwheel and using a power-off landing.

Classes 61-2 Through 61-5

Total Time	Total Acdt/Incd	Total Cost	Acdt/Incd Rate	Cost/Hr
24,031	8	$4,686.41	33	$.20

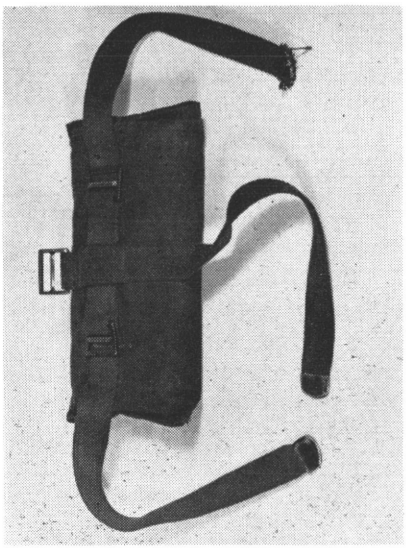


Figure 5

directional controllability. The L-19A, flown dual without the tailweight, is well within c.g. limits. However, as soon as a student flies solo without the weight he finds himself in an aircraft in which the c.g. has moved forward far enough to create directional difficulty. The aircraft no longer responds the same and is unfamiliar to the student. This also makes it difficult for an instructor to predict how a student will perform in solo flight. The installation of the tailweight eliminates this hazardous situation."

Over 100 rated aviators, with 200 to 5,000 hours in L-19s, flight tested the weight, and 98 percent stated that the weight greatly improves steerability and adds better stall characteristics.

In addition, hundreds of feet of slow motion film have been shot of students in the four test classes and others who flew the L-19 with and without the tailweight. It was easy to see from the film that even though the pilots had the stick fully aft, it was extremely difficult without the weight to get the tailwheel on the ground and maintain good directional control in the first 250 feet of landing roll. The movies reveal that with the tailweight, the aft landing gear remained down much easier — even with the forward gear still airborne.

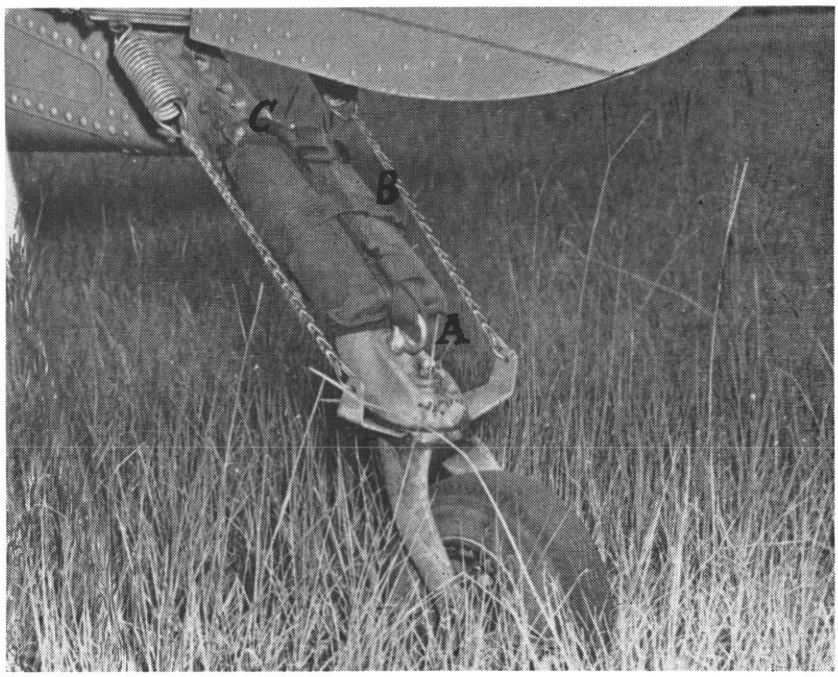
During the tests a student with 6 hours solo time was observed experiencing a great deal of trouble maintaining directional control while landing without the weight. After much difficulty and several go-arounds, he was told to try another aircraft, but was not informed that it had the tailweight. He made several good landings, with little directional control trouble.

The weight helps reduce costs and hazards of the groundloop and helps the student make good landings. This rapidly builds confidence and ability and turns out better aviators faster. The four test classes helped substantiate this point by not having a landing accident after the removal of the weight at the 35-hour level. By the time the student reaches this level his flying experience gives him the capability of maintaining directional control while landing the L-19 in normal configuration.

The U. S. Army Aviation Board also made an evaluation of the tailweight. Personnel who flew the aircraft felt that the 16-pound tailweight offers increased aircraft control during all phases of landing roll and warrants further consideration for use during solo flights.

The use of a tailweight was adopted to solve a problem experienced by primary students at the Aviation School. The groundloop is not confined to the Aviation School. The next time you're flying an L-19 solo bear in mind that you are at a disadvantage in the early stages of the landing roll— especially if you haven't flown the aircraft for some time. **You** could become the next groundloop victim! □

Figure 6



Continued from page 9

The passenger (translated from Spanish): "When we were at the moment of landing I felt a very brusque movement of the helicopter. In this moment, as we were about to cross a small opening, the machine struck sharply a nearby ridge. After this we were again airborne and the machine again struck the ridge. With this second blow the plexiglass of the cabin was almost completely destroyed; on trying to protect myself against the glass, covering my face with the hands, I received slight wounds on them. Then the helicopter commenced to skid sideways down the slope, leaving me in the side that was dragging along the ground. In these moments, most certainly my shoulder was squeezed due to some deformation of the cabin."

Rescue Pilot: "After I heard my companion in the lead aircraft say 'I'm crashing,' he then appeared to be losing altitude and disappeared over the far edge of the landing area. I immediately turned away from the point to avoid flying debris. I felt that both the pilot and his passenger were injured, or quite possibly dead, and elected to unload my passenger in the valley below and return to the scene, which I did.

"After a long wait at the scene of the wreck, the weather and visibility improved so that a takeoff could be made. I attempted to hover with the pilot and Chilean aboard but determined it was marginal, and elected to evacuate them one at a time. The other pilot and I agreed on a clearing for a meeting place down the mountain, and I took off with my passenger.

"During the course of this flight the helicopter was very difficult to control (due to winds) and I decided to land at the pre-arranged clearing and wait for the other pilot to make his way on foot. However at this time the Chilean started to cough up blood and was still in a state of semi-shock. I felt it worth the risk to continue the flight as he might have internal injuries, so we took off again and flew to Evans. Here it was decided to wait until the winds died down before returning to pick up the pilot from the crash. They lasted all night and at 0500 the next morning I took off and proceeded to the area which we had agreed upon. I saw that a fire had been made there and felt he had started walking out. I circled over the area for ten minutes and then returned to Estancia Vicuna, refueled and waited about 30 minutes. Upon returning to that same general area I immediately saw smoke and landed nearby. The pilot came walking toward me, and I helped him into the H-13 and evacuated him to Estancia Vicuna from where he was returned to Evans. I then went back and put out the fire, to preclude any possibility of forest fire."

This ends the account of the rescue at Tierra del Fuego. But the story continues, for the rescuing pilot was named president and only member of the accident investigation board. This was a reasonable decision. It would have taken a board formed at Headquarters, Fort Amador, 7 days to get to Tierra del Fuego by commercial air and 3 more days of travel by vehicle, horseback, and foot to reach the site of the accident. Furthermore, the board would have to carry its own food for 10 days, arctic equipment for camping and arctic clothing, all to be transported by air. A further complication was the weather, for winter was coming on a full month earlier than usual and delay in starting the investigation might have prevented a team getting to the accident site at all.

So the one-man investigation was underway. Questions were asked and statements gathered. Why did the aircraft crash? Why did the pilot lose control at such an inopportune moment?

The report states that an antitorque system failure caused the pilot to lose control. The terrain surrounding the landing site made it imperative that he get the helicopter on the ground immediately. Investigation further revealed that two sets of holes drilled through the aft short shaft for a retaining pin could have caused the trouble. There was also insufficient torque value on the tail rotor drive shaft lock nut.

The unique set of circumstances that made this Army captain rescuer, witness and president of the accident board would not be repeated often, but helicopter rescue operations are daily fare. Certainly the friendly whir of the H-13 motor must have made the crashed pilot, waiting on an unpopulated mountainside in Tierra del Fuego, feel a lot less lonesome. □

NOTE: Credit for this rescue and unique investigation goes to Captain Stanley E. Dressler, Armor. Also deserving applause for cool thinking and action under extremely difficult circumstances is the victim of the crash, Captain Vernon T. Judkins, Arty. Both officers are assigned to the 937th Engineer Company (Aviation) (IAGS).

Combat Intelligence

Airborne Sensors Improve Intelligence Capabilities

DURING THE Louisiana maneuvers in 1941, the Army's lack of means of obtaining accurate information of enemy movements became increasingly evident. It appeared that elevation of the observer would greatly enhance the observation capability.

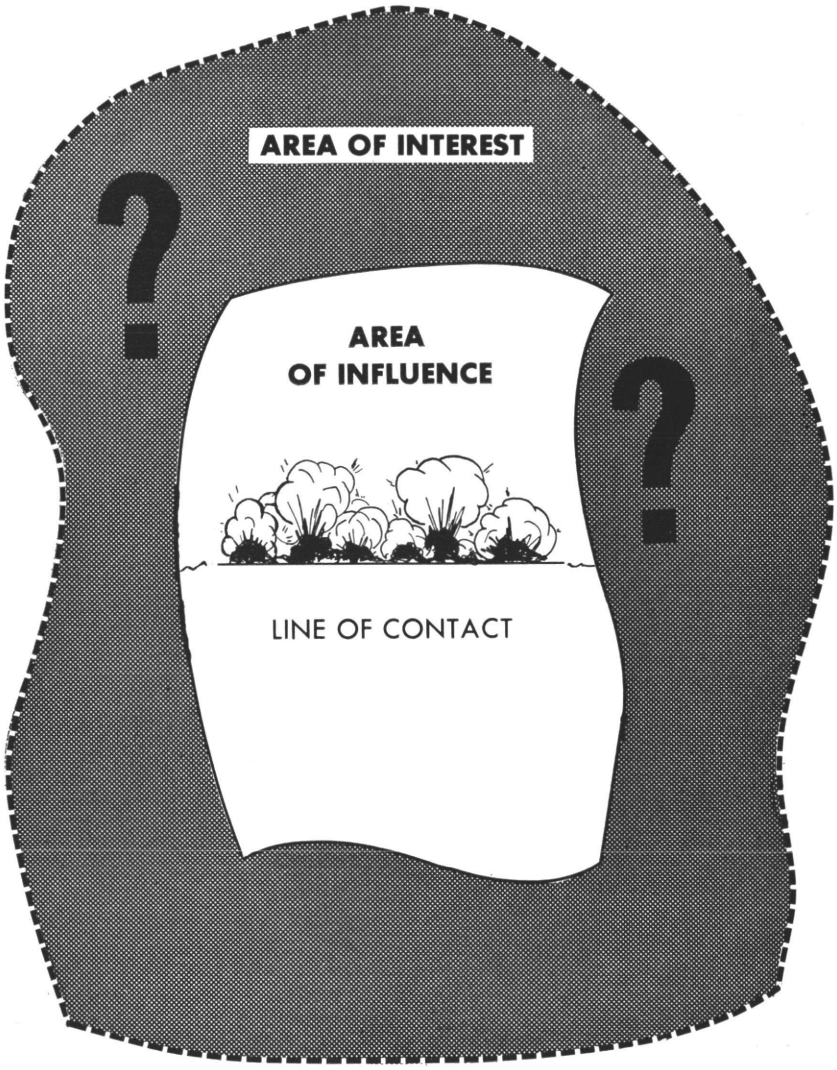
When some adventurous few suggested using light aircraft to elevate the observer and proceeded to prove their idea workable, Army Aviation was born. Since then, Army Aviation has branched out to encompass many other fields of endeavor. Observation, however, has remained one of the primary missions. Both aircraft and personnel are now ready to provide combat intelligence information to the commander whenever and wherever needed.

Before discussing how Army Aviation fits into the picture, let's define in detail some of the combat intelligence terms and requirements which delineate the problems.

Combat intelligence: knowledge of the enemy, weather, and terrain used in the planning and conduct of tactical operations within a given area. It provides the commander with information about the area of operations, enemy capabilities, and enemy vulnerabilities. The commander can then balance this information against his own courses of action to determine what effect will be obtained.

Area of influence: that portion of the assigned zone or area of operations wherein the commander is capable of directly influencing the progress or outcome of combat operations, either by the maneuver of his ground gaining elements or by the delivery of firepower from fire support elements under his control. The size and shape of the area of influence will depend on the mission and disposition of the unit, as well as the type of unit and fire support available.

Area of interest: that area in which the commander is con-



cerned. It includes his area of influence, adjacent areas, rear areas, and extends into enemy terrain beyond the objectives of the current or planned operation. It includes areas occupied by enemy forces which, if employed in the area of influence, could endanger the accomplishment of his mission.

Combat surveillance: continuous watch of the battle area under all conditions of weather, day or night, to provide timely information for tactical ground operations. The functions of combat surveillance are primarily collecting and reporting information for the combat intelligence system. The information collected by combat surveillance is processed along with that from other sources and agencies to produce combat intelligence.

Target acquisition: that part of intelligence activities involving the **detection, identification,** and **location** of ground targets in sufficient detail to permit target analysis and the effective employment of weapons. **Detection** is the discovery of the existence or presence of a target. **Identification** determines the nature, composition, size, and other pertinent information for use in target analysis. **Location** consists of the three dimensional positioning of the target area. Target acquisition results from applying information collected from all sources and agencies to a special purpose. The difference between target acquisition and other types of information gathering is one of degree, rather than kind.

There has been a growing misconception that surveillance equipment will provide commanders with nuclear targets and fulfill the target acquisition requirements. This is actually the exception rather than the general rule. Surveillance equipment will provide the staff with target information. This information could be either fragmentary or voluminous. It must be pieced together at a central focal point to develop nuclear target intelligence.

Combat intelligence information is required by the commander to obtain an overall understanding of the combat situation. This understanding will enable him to arrive at **timely** decisions in conducting current operations, **to select** targets for effective use of available weapons, **to conduct** poststrike damage assessment, **to assist** in preparation of plans and estimates for future operations, **to avoid** surprise, **to assist** in the evaluation of information subsequently received.

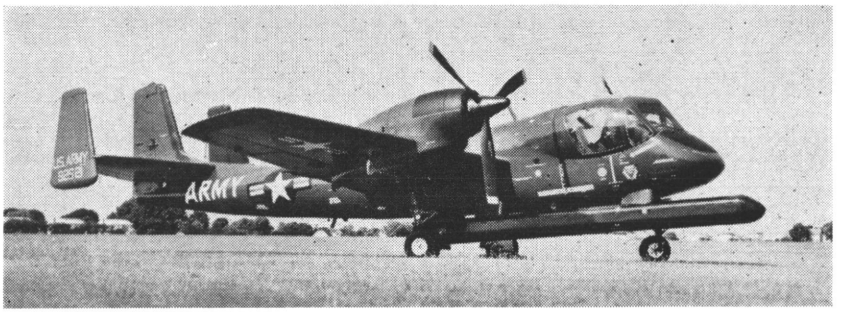
Ideally, to accomplish this, a commander needs to know the **existence, identification** and **location** of enemy targets. He also needs to know the **capabilities, vulnerabilities,** and **probable courses of action** of the enemy. The commander must obtain this information from external indications provided by the enemy, including equipment and personnel disposed about the battle area and evidence of the activity or lack of activity of these items. Information is required in varying degrees of detail depending upon the level of command and the type of combat operation planned or in progress. For instance, to bring effective fire to bear on a target, the commander needs to know the **size, shape, protection,** and **location** of the target much more accurately than for other types of combat operations.

With few exceptions, it is not possible to obtain complete information by direct observation. We do not have such a thing as a "command post detector." To detect, identify, and locate command posts, many observations of detectable items must be made. These include personnel and vehicle movements, electromagnetic radiation, road networks, breaches of camouflage discipline. No little amount of deduction is required. Similarly, it is generally not possible to detect, identify, and locate targets suitable for attack by area destruction weapons using direct observation. This again requires numerous observations, both ground and air, of various indications, plus the use of deductive reasoning.

Where does Army Aviation fit into this picture?

Virtually all ground surveillance equipment has limitations. Many devices operate on a line-of-sight basis. Intervening terrain or other objects reduce the useful area that can be covered. This limitation can be overcome by elevating the sensors above the mask. Army aircraft are ideal for obtaining this elevation. Most of the ground sensory devices can be used in modified form from airborne platforms by packaging them to fit the airborne vehicle. Currently the Army is using two types of airborne vehicles —manned and unmanned aircraft.

Will aircraft be able to live in the air in future conflicts? To be convinced that aircraft will not be able to live is to admit defeat. Aircraft are vulnerable to enemy action. So are the infantryman, the tank, and the ships of the sea. The Stone Age man was vulnerable to the



clubs of his better-equipped enemy, but that did not stop him from developing the shield and spear — countermeasures which changed the course of history.

Concerning vulnerability, there should be little significant difference between the manned or unmanned aircraft, provided both are operated in the same air defense environment over exactly the same flight path. We must remember, however, that the aircraft pilot can be logically expected to operate the aircraft in such manner and over such areas as to make it less vulnerable to enemy action. The unmanned aircraft, on the other hand, does not reason—it merely follows the path on which it has been remotely commanded, making no deviation resulting from information observed in the immediate operating environment.

The manned aircraft is responsive to the observations of the pilot. Its ability to navigate precisely is largely a function of the pilot's skill and availability of proper navigational equipment. Conversely, the unmanned aircraft requires mechanical or electrical impulses to provide control and to determine location of the information gained.

Manned aircraft also have an advantage in making information rapidly available. The pilot and observer are collection agencies with the power of reason. They can determine what additional information may be required, interpret what they see, and report information directly.

Unmanned aircraft do possess one significant advantage. Normally, a machine is much easier to replace than a man. Therefore, against sophisticated air defense environments where probability of survival may be small, unmanned aircraft will be of great use in obtaining information. Where the air defense environment is less sophisticated and aircraft have a correspondingly greater probability of survival, the manned aircraft with its superior collecting capability holds more promise.

With the everchanging weaponry and mobility of the military forces of the world, it is easy to see that areas in which information is required are constantly changing. An airborne unit 1,000 miles from the battle area could, if employed to reinforce the enemy, significantly affect the course of battle. Information on the size, location, and intentions of this unit is important to the field commander. Likewise, enemy missile units capable of delivering weapons over distances of many miles in a matter of minutes can have a direct and vital bearing on the situation. There is a continuing need, also, to determine what the enemy is doing with his forces just on the other side of the ridge.

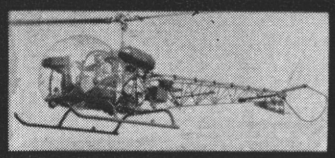
The field commander's need for information runs from constant surveillance of the enemy to his immediate front, to obtaining information on weapons and possible reinforcements at great distances from the immediate battle area. This information is required at all times under all conditions. It must be collected using all means available to man.

You can see where industry fits into this picture. The Army's critical need for combat intelligence requires that we continue pursuing all efforts to obtain accurate and timely information by whatever means at our disposal. Our aircraft must be able to avoid or neutralize the enemy's aircraft locating devices, navigate more precisely, and have the performance required to get both aircraft and sensor back for reuse. Our sensors need to become more accurate and present more precisely and concisely the information needed by the commander. Above all, our systems must be mobile, able to live with the Army, relatively invulnerable, able to operate from minimum size areas under all weather conditions.

American industry has been very adept at providing devices and mechanisms far beyond those visualized as being necessary to perform the job. No doubt industry will in the future continue to provide us with equipment that will enable us to accomplish our mission with the speed and accuracy never before thought possible.

L-19 BIRD DOG

H-13 SIOUX



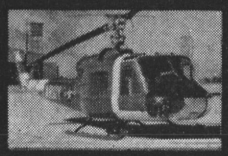
U-1A OTTER

THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

TWX

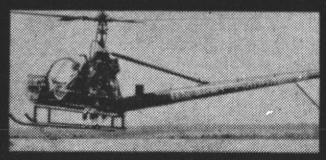
Ex

HU-1 IROQUOIS



H-34 CHOCTAW

H-23 RAVEN



HU-1A ANTENNA BRACKET mounted in reverse. Bracket broken and incident damage to tail rotor when aircraft was flown.

H-23D STRUCK WIRES during power recovery from simulated forced landing. Incident damage to main rotor blade tip assembly. No injuries.

L-19A STRUCK BARRIER POLE during takeoff. Minor damage. No injuries.

HU-1A CRASHED AND BURNED. Pilot, copilot, and crewchief killed. Aircraft destroyed. Accident caused by materiel failure of collective pitch sleeve lock.

L-20A STRUCK TREES during night landing approach to unlighted strip. Field landing lights were inoperative and ground vehicles were driven to approach end to light strip with headlights. Incident damage to right gear strut fairing and horizontal stabilizer. No injuries.

H-21C CHIP DETECTOR LIGHT came on during flight. Engine oil temperature rose to 150° and engine oil pressure dropped to 20 psi. Aircraft completed autorotation landing on runway of Air Force base. No damage. No injuries. Cause of engine malfunction undetermined pending analysis.

H-13H SETTLED during reconnaissance of hillside. Aircraft struck ground, bounced and rolled into ravine. Passenger sustained lacerations. Major damage to main rotor blades, tail rotor, gas tank, bubble, transmission and left skid.

H-34A ENGINE FAILED during landing approach. Aircraft completed autorotative forced landing with no damage. Engine failure caused by carburetor malfunction.

H-13G STRUCK TREE during maximum performance takeoff. Incident damage to main rotor blades. No injuries.

L-19E CRASHED in mountainous terrain. Pilot killed. Observer suffered broken ankle, deep lacerations and contusions. Aircraft destroyed by fire. Cause of accident undetermined pending investigation.

H-23C STRUCK WIRES. Major damage to canopy assembly, windshield assembly, and VHF receiver. No injuries.

H-34A TAXIED INTO corner of hangar. Major damage to main rotor blades and tail rotor blades. No injuries. Damage cost estimated at $29,000.

H-34C MAIN TRANSMISSION oil pressure warning light came on in flight. Aircraft completed forced landing with no damage. Suspect failure of main transmission oil pump.

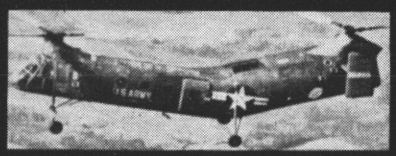
H-34 TAXIED INTO hangar door. Major damage to main rotor blades, tail cone and power train. No injuries. Damage cost estimated at $69,700.

H-13G ENGINE FAILED during landing approach. Aircraft completed forced landing with no damage. Suspect carburetor malfunction.

U-1A STALLED during practice short field landing. Aircraft dropped on left landing gear. Major damage to left landing gear and bulkhead. Weather (temperature 90°; dewpoint 70°; wind calm) considered a factor.

L-19A STRUCK GUY WIRE during simulated bombing run. Minor damage to right wing. No injuries.

AO-1 MOHAWK H-21 SHAWNEE L-20 BEAVER



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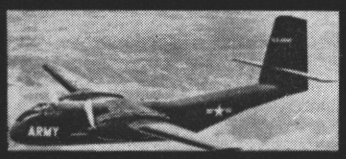
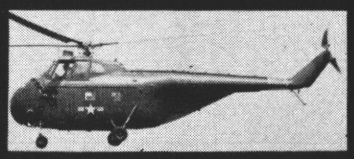




L-23 SEMINOLE H-37 MOJAVE AC-1 CARIBOU H-19 CHICKASAW

L-19A STRUCK HAYSTACK during takeoff. Aircraft destroyed. Passenger sustained minor scratch. No injuries to pilot.

AO-1 FLEW THROUGH TREES during low-level flight. Incident damage to left wingtip, navigation light and slat. No injuries.

H-13H HIT WIRES, then pole and rolled on its side. Aircraft destroyed. No injuries.

H-34C ENGINE FAILED during flight. Aircraft was autorotated into field of high grass. Incident damage to tail rotor blades. Suspect carburetor malfunction as cause of engine failure. No injuries.

H-19C ENGINE FAILED in flight. Aircraft completed autorotative forced landing with no damage. Suspect materiel failure of No. 4 cylinder.

H-13H PITCHED DOWN and to the right from hovering flight. Aircraft struck ground with front of right skid and turned on its right side. Aircraft destroyed. Pilot and passenger sustained minor injuries. Suspect materiel failure.

L-19E STRUCK TREES during attempted go-around from tactical strip. Aircraft crashed into river. Instructor pilot and student pilot sustained minor injuries. Aircraft destroyed.

H-13H STRUCK TREE during pinnacle approach in mountainous terrain. Major damage to main rotor blades. No injuries.

U-1A RIGHT BRAKE FAILED during landing roll. Aircraft veered to left and knocked over taxiway light. No damage to aircraft. Suspect incorrect installation of cotter pin in brake linkage.

H-13G LANDED ON HEEL of right skid atop a bank and pitched down into ditch during night landing on unlighted portion of field. Major damage to main rotor, tail boom, bubble, and radio pedestal. No injuries.

L-20 TAXIED INTO runway marker. Minor damage to oil cooler, left wing, landing light cover and propeller. No injuries.

H-13H SETTLED INTO WATER after takeoff. Major damage to all components. Passenger sustained minor injury. Suspect fuel contamination.

H-34A LOST POWER in flight. Black smoke came from exhaust. Aircraft completed forced landing with no damage. No. 3 cylinder split open, causing engine failure.

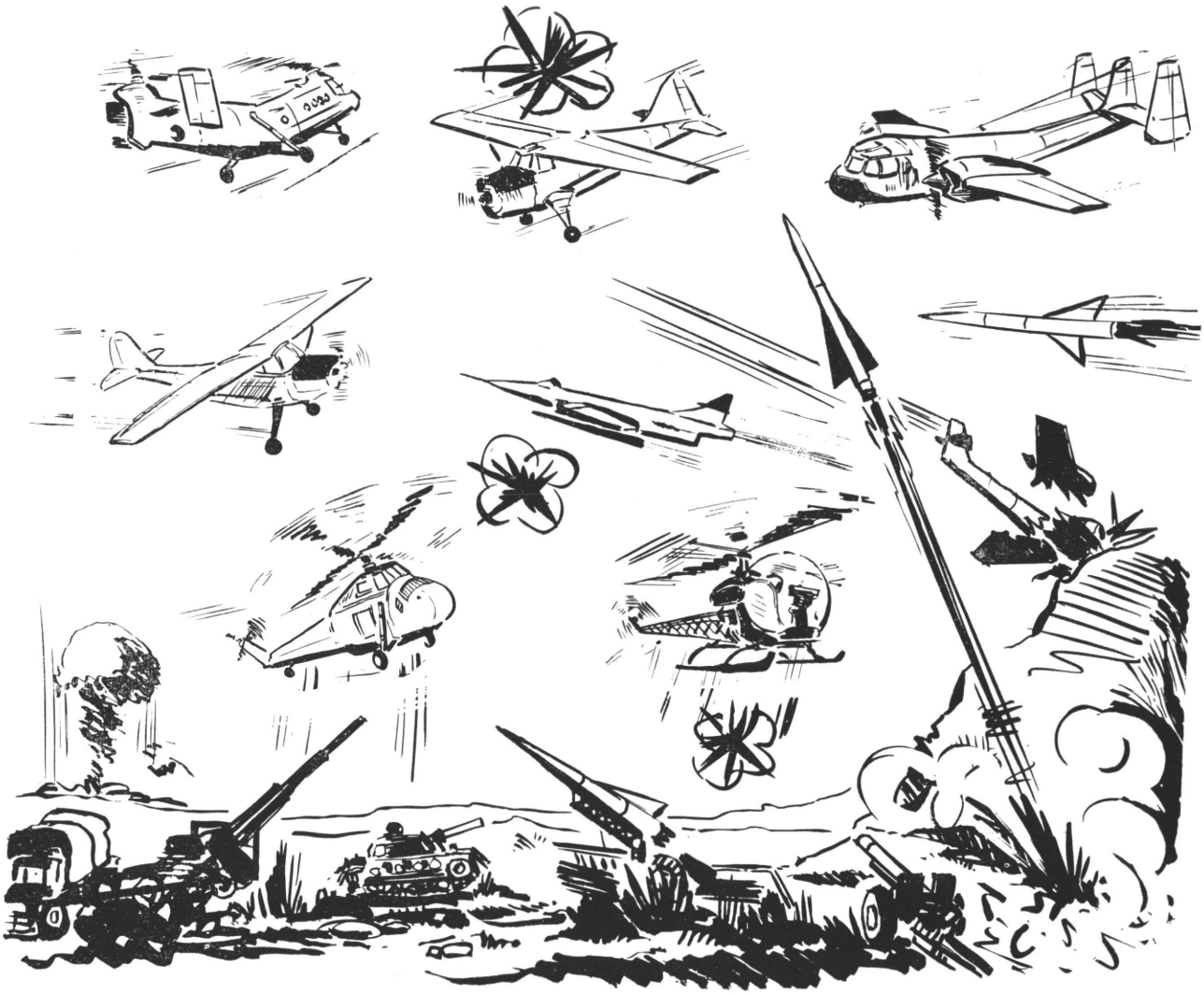
H-23C CRASHED shortly after it was taken off by unauthorized and unknown person. Major damage to skids, tail boom, main rotor drive shaft and engine.

H-13G STRUCK WIRES during landing approach to confined area. Minor damage to bubble and one main rotor blade. No injuries.

L-19E STRUCK WIRES during simulated forced landing. Minor damage to left wing, aileron, propeller and cowl.

H-37A ENGINES FAILED during flight. Aircraft completed autorotative forced landing with no damage. Suspect internal sand damage to engines. Aircraft was returning from 30-day mission at White Sands, N. Mex.

H-34C STRUCK TREE during takeoff for demonstration flight. Incident damage to main rotor blade tip caps. No injuries.



Why Low Frequency Navigational Aids?

Major Martin V. McInerney, USAR (Retired)

- How to coordinate and expedite the safe and orderly flow of Army air traffic.
- How to facilitate Army air defense operations.
- How to provide air warning and inflight assistance to aircraft using the system.

These are elements of "The Problem" as it exists for Army Aviation in a combat situation. To solve these problems many factors must be considered, but in this discussion only the organization and equipment required to provide a tactical capability will be mentioned. No attempt is made to solve the many and varied problems currently afflicting the common user system within the continental United States.

The organization handling the en route traffic problem is the Army Aviation Operating Detachment, TOE 1-207D. This unit is made up of a Flight Operation Center (FOC), a ground controlled approach radar section (GCA), and a mobile element (tower) for air traffic handling. It also has a service element charged with establishing and operating a base field such as can be expected at army and corps level. This section provides the beacon, lighting, and aircraft servicing capability for such a field. These many jobs create a problem for any organization

Recently retired from active Army duty, Major McInerney is an Equipment Specialist with CDO, Fort Rucker, Ala. Dual rated and instrument qualified, he is a Master Army Aviator with approximately 5,000 flight hours.

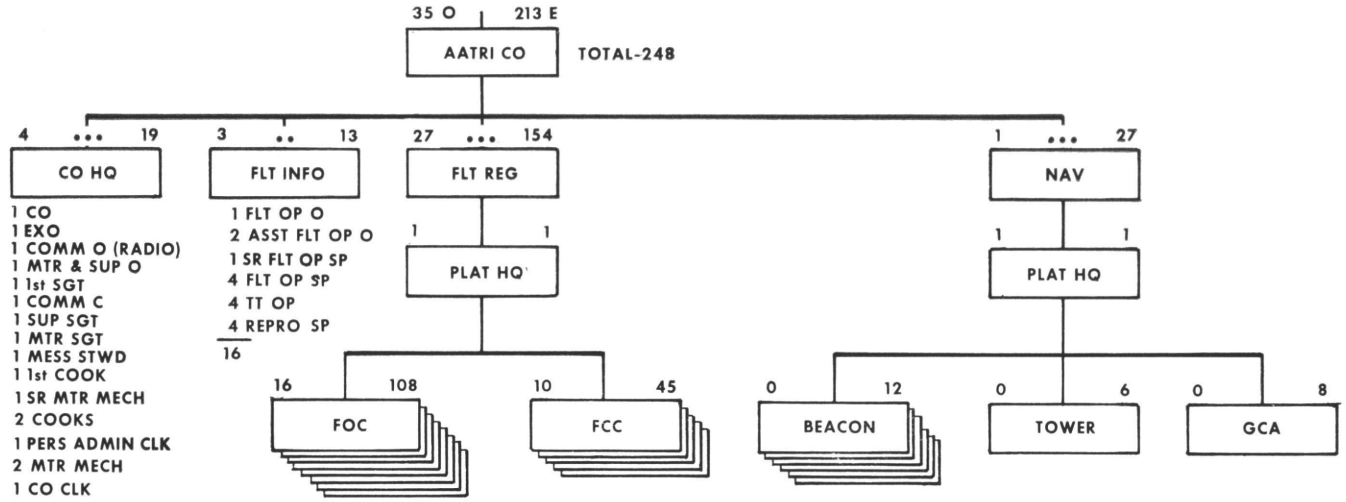
charged with Air Traffic Regulation. To alleviate this and to permit carrying out the primary function a new organization has been proposed.

Known as the Army Air Traffic Regulation and Identification Company (AATRI), this unit provides a single unit operating under the direction of the field army aviation officer and providing the required support throughout the army area. It is made up of cells which can be positioned as required. The general pattern of assignment follows.

- **The Headquarters Platoon** with the Flight Information Section (also the Operations element) would be assigned at field army level to coordinate requirements of the entire system. This element would also assist in implementing the airspace utilization plan of the army commander, would reproduce and distribute en route and approach charts, and disseminate tactical or operational directives to its operating elements.
- **The Flight Regulation Platoon,** consisting of four each main and alternate FOCs and five Flight Coordination Centers (FCCs) would be assigned on the basis of one main and one alternate FOC to the army and each corps. These elements are primarily concerned with the mechanics of en route traffic regulation, efficient use of available airspace and provision of required identification data to the Army Air Defense Command Post (AADCP). This assignment of main and alternate facilities provides an immediate replacement capability if the primary FOC is rendered inoperative and also permits leapfrog displacement.

The FCC is normally assigned to the division area of operation (or areas of similar size and traffic density). Its primary function is to provide a reliable communication link between the forward areas and the FOC operating in the corps sector. This element can also regulate traffic in its assigned areas for limited periods of time in case of communication breakdown or other loss of contact with the FOC.

- **The Navigation Platoon** with its six beacon teams, one tower, and one GCA element provides additional en route capability where those beacons organically assigned to aviation units might leave gaps due to tactical deployment. It also has a complete terminal capability for one additional airfield, either in a replacement role or to meet any special requirements.



So much for the organization. Now comes another problem that must be discussed whenever equipment requirements are considered: compatability with the FAA common user system. This runs the

gamut from the minimum of two-way radio with appropriate channels to completely dual instrumented aircraft using all possible aids. In determining this ability for Army aircraft to operate in both systems we have to consider mission requirements, aircraft capability, and navaids available. Numerically the largest slice of Army aircraft have VFR mission requirements with a bonus of being able to operate in marginal weather conditions with relative safety. This group includes the observation fixed wing and all helicopters. Many current helicopters have an instrument capability, but they are seriously restricted when flying the federal airways because of slow speeds and lack of a good high altitude capability. However, at lower altitudes, using low frequency aids, they can handle both CONUS and tactical missions during periods of low ceilings and visibilities.

Other aircraft in the Army inventory need more refined equipment because of mission and capability. These include the command, cargo, and utility types which are capable of operating at speeds and altitudes more commensurate with the FAA system. These aircraft fly IFR habitually and should have equipment in addition to the low frequency capability. However, the basic equipment mentioned here will provide the capability to operate in both systems as they currently exist.

By this round-about method we return to the original question of why low frequency. Obviously, most of the equipment currently in use in the federal airways system is an improvement of the standard low frequency system of some years ago. So why not adopt the same approach for combat and solve all our problems? The reasons for not taking this approach are numerous but some of the primary ones follow.

First is the Very High Frequency Omni Range (VOR). This is an excellent aid which provides accurate azimuth information and—with appropriate additional equipment—excellent distance measurement. Airborne components of this system are currently installed in many Army aircraft and most pilots are familiar with its operation, so this appears to be the way to go.

With this thought in mind a feasibility test was conducted in the mid-fifties. A TVOR was mounted on a trailer for mobility and selecting various sites to determine speed of emplacement and accuracies of signals transmitted once installed. This test revealed that a large cleared area devoid of trees, wires, buildings, and vehicular traffic was required initially and that when rapidly emplaced the information provided was not the best, with errors of up to 40° in heading a common result. Sufficient time to install the equipment for accuracy ranged from weeks to months. This time element, when coupled with altitudes of 1,000 feet and upward required for reliable reception, negated VOR as the solution.

One of the requirements stipulated by the FAA in VOR installation and quoted in their Airways Operations Bulletins reads as follows: "For dependable operation, it has been found necessary to locate VOR sites on 'high ground' and remove nearby obstructions." So it is obvious that for a highly mobile and rapidly responsive system we have to look elsewhere.

Radar was also considered at length as a possible solution. While radar has great capabilities, altitude is also the key to its success where any extended coverage is desired. A system designed to cover the field army at all flight levels would be prohibitive in men, materiel, and money. Even assuming radar could provide constant and reliable air traffic regulation, then why not use the air defense radars already installed in the field army? On the surface this appears as a reasonable and cheap solution, but the prime mission of these radars is to discover, track, and direct engagement of hostile aerial intruders. The additional duty of keeping a tally on many friendly tracks would seriously impede if not negate this primary mission. So this approach was also ruled out.

Self - contained navigators? This is another good item, available in two primary forms, Doppler radar and inertial systems, both of which are receiving constant attention from the military and numerous manufacturers. At present this type of approach is discouraging because of cost per item, weight, and complexity which makes it impossible to adopt this as an "across the board" solution for Army aircraft.

After study of the above devices and some others perhaps not so well known, it still appears that the low/medium frequency navaids are the Army Aviators' best friends in tactical operations, particularly where low-level flight is contemplated or required. The present system of corridors and

low frequency homers and the techniques outlined in FM 1-60 "Army Aviation Air Traffic Operations—Tactical" while an interim solution does provide us a capability of operating anywhere TODAY. These beacons together with lightweight GCA at terminals and the ARA-31 homing device (another item with considerable capability which is often overlooked in our search for the bigger and better) provide the Army Aviator with a high degree of assurance for mission accomplishment.

Naturally with the present capability considered only an interim measure the search continues for something better. In this light a low frequency hyperbolic system is being investigated. One such system consists of four ground transmitters and a map correlating unit all mounted in helihuts which permits movement by standard army 2½-ton truck or by any light cargo helicopter. This system provides a large area coverage by transmitting hyperbolic lines of radiation which can be received by properly equipped vehicles or individual soldiers on the ground and by aircraft from ground level to 25,000 feet. The security of this system and its resistance to jamming and spoofing is much higher than any low frequency proposal yet investigated by the Army.

The present airborne components of the system are rather weighty (45 lbs) when compared to most low frequency airborne equipment of today; however no attempt has been made to "transistorize" as yet. When solid state techniques are applied it can be reasonably expected to approximately halve this weight which will then make it comparable to the present standard ADF installed in Army aircraft. The information provided by this unit is much greater than available from an ADF. It plots actual position of the aircraft pictorially, using a map overprinted with the hyperbolae as generated by the ground stations with a further position indication available in digital form in a series of "windows" along the bottom of the chart holder.

This digital presentation opens the road for possible future improvement of the system. By applying automatic data processing techniques, this digital information could be transmitted on call to an interrogating ground station, then fed automatically to a computer which would update the original flight plan already stored in the computer memory. With this technique and interrogating at least once a minute, position information never more than one minute old could be made available to the Army Air Defense Command Post (AADCP) to aid in identification of aircraft not equipped or with inoperative IFF.

These ADPS techniques, now being standardized for use in the field army, permit handling of masses of data that would completely inundate **any** manual system, thus permitting handling of airspace utilization data, flight data, and other items of tactical importance. It would also permit the retrieval of data on aircraft position well within the reaction time of the air defense weapon systems.

With this look into the crystal ball of possible things to come, it appears an appropriate time to close. So I leave with this observation, the problem is real and a lasting solution is urgent. To this end, the Aviation School is constantly working, using the experience and studying the requirements of all branches assigned aircraft.

Caribou on Skis

THE CARIBOU will undergo one of its most severe operational trials this summer in the Arctic supporting operations of the U. S. Army Polar Research and Development Center, operated by the Corps of Engineers.

Two Caribou are on loan to the PR&DC Aviation Section for 120 days.

Making infrared soundings of Arctic surface temperatures for the Army Corps of Engineers, the Caribou will fly at well over 20,000 feet. They will also be used to gather high altitude data for the U. S. Army Signal Research Laboratory, and move personnel and supplies from the base camp at Tuto to remote ice cap bases, including Camp Century.

The two aircraft are equipped with specially developed skis to enchance their capability for support of this mission. This represents the first operational use of skis on an Army aircraft of this size. □

Lieutenant General Garrison H. Davidson, Commanding General, Seventh U. S. Army

User Report

Army Aviation Fully Exploited By Its Largest Tactical User

Seventh Army

SEVENTH ARMY is the largest user of tactical Army Aviation today. There are approximately 800 aircraft and 1,050 aviators assigned to perform the many missions which only integrated aviation support can accomplish.

The charged atmosphere along the Iron Curtain creates an alertness, a sense of purpose, and a comradeship which is seldom seen short of combat. Units and personnel train with the realization that a threat is not far removed. This sense of urgency leads commanders to exploit every resource to its maximum.

The use of Army Aviation is a prime example of this zeal to do things better. The capabilities of aviation to perform in the roles of observation, surveillance, fire adjustment, logistical support, medical evacuation, command, communication, and liaison have been exploited fully.

The border area is actively patrolled by Army reconnaissance aircraft flying slowly at low altitudes. Surveillance of this area can be accomplished in such detail as to greatly lessen the requirements for surface observers and patrols. The communications equipment installed in these aircraft provide a capability for the almost instantaneous alerting of responsible commanders.

Commanders and their staffs use Army aircraft to keep in touch with widely dispersed commands. Commanders have found that in many instances, when all other means have failed, they can get into a reconnaissance helicopter and communicate with their subordinate commanders by radio, as well as observe the situation firsthand.

Army aircraft are used extensively in maneuvers to seek targets for nuclear and nonnuclear fires. The results of fires, especially nuclear strikes, are quickly assessed by trained aviators with nuclear sensory devices. The versatility of the helicopter makes it especially suitable for this mission. The new KA 20

Flown in by helicopter, infantrymen form a perimeter defense while additional men and supplies are landed during training exercises

camera has given the Army an excellent photographic capability.

Although the above missions are not radical changes from the traditional roles of Army Aviation, it is the alertness of commanders to the value of aviation which has increased. On a recent Seventh Army winter maneuver, Exercise WINTER SHIELD II, one combat command commander remarked, when asked about his Army Aviation support, "I don't know how I've ever gotten along without it. I need more to ensure adequate support for my battalion commanders."

Enthusiasm among commanders for "helimobility" has led to the conduct of intensive training, resulting in the development of a great deal of heliborne know-how and a potent capability within Seventh Army. Light and medium helicopters have been used in support of patrolling actions, to shift reserves in the defense, to life assault forces of up to battle group size in offensive operations, and to secure open flanks — to name but a few methods of employment.

Commanders are constantly developing additional concepts and techniques as they meet new situations in training. The potential in Seventh Army for heliborne operations is growing almost daily.

Looking back on the progress which Army Aviation has made in the past 10 years, then projecting this into the future, the prospects are tantalizing:

- Aircraft must become increasingly more rugged.
- Their maintenance must become simpler to permit their **integration to the lowest level** which can regularly exploit their capabilities.
- Navigational systems which operate without benefit of ground-based aids are essential to realization of an all-weather capability.
- High energy, easy to handle fuels are important to ease the load on heavily-taxed logistical systems.
- Radios must become more reliable and much simpler to operate.

The development of a practical ground-effects vehicle will signal the beginning of a transition from wheeled and tracked vehicles and conventional aircraft as we know them today. Complete integration can then be realized. With these and other "hardware" improvements, the roles we now perform can be accomplished with greater facility. The development of new roles will be paced by the development of new and more capable equipment.

It is to the industry-combat developments team that the field looks for the "hardware" of the future. Seventh Army is vigorously exploiting its present aviation resources to ensure that the maximum capability is realized. By pushing at the upper end of the capability spectrum of present equipment, we will be prepared mentally and by training to integrate quickly and employ fully new equipment as it is received.

Infantrymen unload ammunition and supplies from helicopter during training exercises

During an air supply operation mechanics work to keep helicopters in top condition

Improved Aircraft Accident Prevention Through MACHINE ANALYSIS

TO THE UNINITIATED, the mass of data which pours from the sorter, collator, and accounting machines of an automatic data processing system appears more complicated and confusing than the instrument panel of a modern jet. In a matter of minutes, these machines can more accurately produce information which used to require weeks and months of hand sorting and analysis of individual accidents. Labor saving advantages of this new system and its speed are easily demonstrated.

Let's say you are assigned to analyze major Army aircraft accidents involving violations of air discipline for the period 1 July 1957 to 31 December 1960. Under the old system, you would have to hand sort, analyze and record some 1,259 accidents. One man, working at top speed, may have accomplished this task in two or three weeks. Then he still faces the job of assembling his data and putting it into usable form.

Under the new system, you submit your requirements to the Automatic Data Processing Section. Less than one hour later, the automatic data machine operator will hand you a single sheet of paper containing all available data on your subject.

What information does this data sheet contain? First it gives the log number of the accident in case you wish to refer to an individual accident report. It tells the date of the accident and type of aircraft. It tells whether the accident resulted in total loss of the aircraft or substantial damage. It tells if there were injuries caused by the accident and whether the injuries were fatal, critical, major or minor. It tells whether the accident occurred during dawn, daylight, dusk or night. It tells the hardware cost of each accident (total cost of hardware for major accidents involving violations of air discipline for this period was 3½ million dollars). It tells what human and materiel factors were involved in the accident.

Violations of air discipline include such factors as violation of flight regulations, local policies and SOPs; attempted VFR flight under instrument weather conditions; failure to follow instructions from flight leader, tower, ground controller, etc.; reckless operation (coded only when there is specific evidence of reckless performance); overconfidence in a particular maneuver; and others.

Under materiel failure or malfunction, we find our information broken down to include airframes, brakes, flight controls, ejection seats and canopies, electrical and communications systems, fuel systems, hydraulic systems, instrument systems, oxygen systems, landing gear, auxiliary equipment,

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Prepared by the United States Army Board for Aviation Accident Research.

throttle controls, oil systems, powerplant (reciprocal or turbo jet), propellers, ground handling equipment, transmissions, main or tail rotor systems, etc.

Our information includes unsafe conditions of operating area facilities and terrain at crash sites. For instance, if we find this column coded with the number 16, it means that the accident occurred in mountainous terrain on rocky soil.

From another column, we learn what type of weather may have been a cause factor in the accident. This column codes such items as rain, fog, dust, sleet, hail, turbulence, thunderstorms, low ceilings, density altitude, etc.

From still another column we learn whether the accident involved collision with another aircraft, other objects or terrain, stall or spin, fire, wheels-up landing, overshooting or undershooting, nose-over, aborted takeoff, etc. We learn the phase of operation, such as taxiing, takeoff, inflight, landing, go-around, autorotation, and others. The code tells us whether the mission of the flight was training, administrative, test flight, or other.

Still another code tells us whether the accident involved design factors of pilot equipment, aircraft components, or special equipment. Additional factors are coded under a special data column.

All of the information described to this point for each accident is included on a single card. In addition, there are presently five other cards on each accident to code other specialized data such as personnel information on each individual involved in the accident, maintenance information where maintenance was a factor, complete information on part failures and human factors cards which tell what aircraft components or safety equipment caused or prevented injuries.

How do we put this information to work? First, let's separate rotary wing accidents and fixed wing accidents and list them by calendar years. This gives the following table:

VIOLATIONS OF AIR DISCIPLINE

	F/W	R/W	Both
1957 (½ year)	5	4	9
1958	19	18	37
1959	4	5	9
1960	5	2	7
Totals:	33	29	62

We see immediately that there was a dramatic drop in this type of accident between 1958 and 1959. While rotary wing accidents involving violations of air discipline continued to decrease in 1960, fixed wing accidents of the same type increased slightly. Next, let's list these accidents by aircraft type:

L-19	28
L-23	2
L-20	3
H-13	11
H-34	3
H-21	9
H-23	4
H-19	1
H-37	1

This shows that L-19, H-13, and H-21 aircraft are most often involved in this type of accident.

What injuries result from accidents caused by violations of air discipline? Another column lists this information:

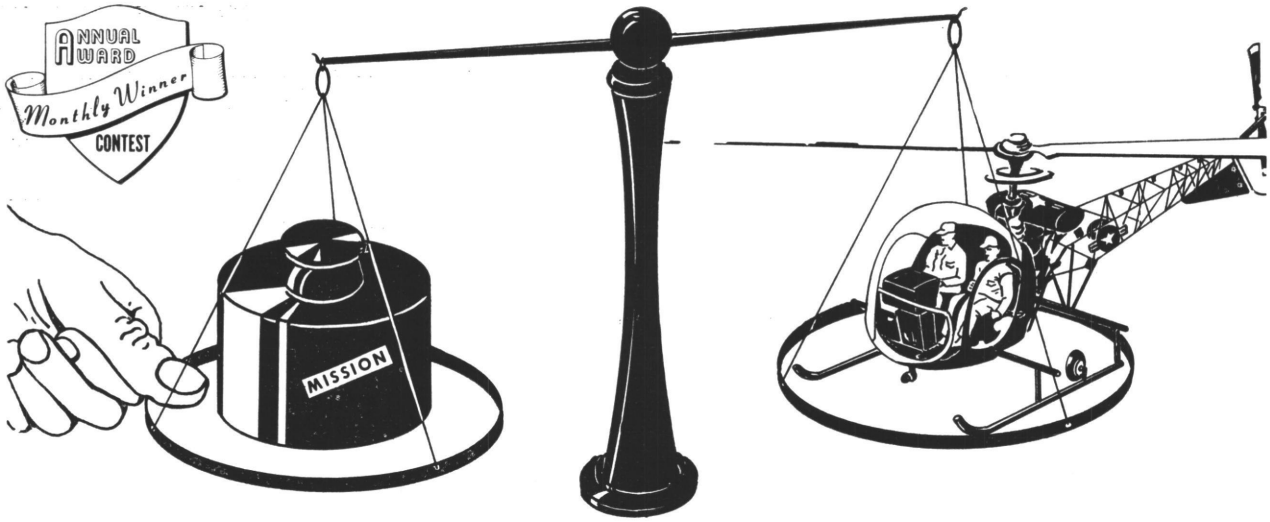
No Injury	33
Temporary Disability	6
Permanent Disability	1
Fatal	22

From this, we learn that more than 35 percent of major accidents resulting from violations of air discipline cause fatal injuries. For all major accidents (1,259) during this period, less than 13 percent caused fatal injuries. This is an indication of the severity of this type of accident.

These are but a few examples of the types of data that can be extracted instantaneously from the automatic data processing system. There are many more. You may wish, for example, to identify the aviators who have accidents involving violations of air discipline by age, by training, by total hours of flying time, by hours of flying time in the type and model of aircraft involved in the accident, by duty status, etc. The operator runs personnel data cards through the machines and your information is assembled and printed, ready for use.

Examples of recent studies completed by the U. S. Army Board for Aviation Accident Research, using the automatic data processing system are: Fatal Army Helicopter Accidents, Helicopter Accidents Involving Fire, Physiological Factors in Army Aircraft Accident Causation, and Rotary Wing Operations in Mountainous Terrain. Some of the studies in process at this writing are: Injury Patterns in Army Aircraft Accidents, Army Aviator Helmet Experience, An Analysis of Human Error Accidents, Army Fixed Wing Accidents Involving Fire, and Disorientation in Rotary Wing Pilots.

Information from these studies and others like them has provided impetus and direction for the aircraft accident prevention program. As an end result, the automatic data processing system may someday help to prevent YOUR accident.



TO GO OR NOT TO GO

CWO John H. Green, TC

AS AN EAGER, young "birdman-to-be," Frank had haunted the local airport watching the hero types preparing to defy gravity with a bravado that was theirs alone. The war had just ended, and in this year of 1946 he was an impressionable 14 years young. He could easily recognize the real pilots, for they were invariably dressed in leather flight jackets, faded pink trousers, wore large sunglasses, and always sported a timepiece that more closely resembled his "Big Ben" at home. The aircraft they flew thrilled his imagination, the PT-17s, 19s, 23s, 26s. Open cockpits, goggles gleaming in the sun, white scarfs trailing in the wind—this was the life he dreamed of daily.

The stories they told were worth the 5 miles he pedaled on his bicycle. He understood most of their "clank" stories, as they called them, but didn't understand their women-talk. He had a sister and knew all he needed to know about women. They were nothing but trouble and always in the way.

He, of course, was almost a veteran pilot by virtue of several rides with his hero. But he had to admit that fear gripped him on those few flights with the aerobatics and buzzing but was sure this would pass.

* * *

Ten years later and half a world away, Frank sat on his bunk and thought of those days and the intervening years. He felt bad this morning, plagued by a sense of failure. The general was scheduled for an inspection tour of the DMZ and he was assigned as flight leader. The CO had made it plain yesterday that he placed a great deal of importance on this mission. Several poorly conducted missions and a rash of minor accidents plagued the unit. They had to make good this time and the CO was emphatic.

Frank opened a fresh pack of cigarettes and cursed the weather. Korea in December was no playground. He had flown in this type of weather before and vowed never to do it again. Though young in years, he considered himself a mature pilot, a professional, but his confidence was shaken. The weather this morning was typical of Korea at this time of year. Glancing out the window of his Jamesway, he noted that the old familiar ridgeline, a scant mile distant, was not visible through the steady drizzle. He checked the weather carefully at 0600 and even called several line units at the DMZ. The situation was dismal. Freezing rain was falling intermittently at the higher levels; low stratus and drizzle frequently reduced visibility to a half mile. The forecaster could offer no improvement in sight for 24 hours.

In desperation, he flew a short distance up the valley, but quickly gave up as ice formed on the H-13 bubble. Executing a quick 180, he returned and reported to the CO. This meeting was not pleasant but, despite his desire to please, he could not accept the respon-

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Mr. Green is a rotary wing project officer with the Flight Operations Div., TATSA, Fort Rucker, Ala. Dual rated and instrument qualified, he is a Senior Army Aviator with over 4,660 flight hours.

sibility, VIPs or not.

Two hours had passed and the general's party was on its way. Was he wrong? Should he have tried? After all, they were VIPs. But if he had, what use was all the training invested in him? His daredevil friends of the past proved in later years to be a group of cowboys, not to be trusted with an airplane and the lives of passengers. Safety lectures had been drummed into him and safety pamphlets passed around.

How many aircraft, crews, and passengers have been lost to flights into marginal weather conditions by pilots with either a "no sweat" attitude or too much pride to admit an error. The days of the glamour boys have passed. Hadn't this point been made repeatedly? He wasn't sure of anything now. The other pilots in operations had looked at him with raised brows. Did they think him a coward, fool, or both?

Bill, flying the lead Sioux, felt sorry for his friend but decided that Frank was just a little too cautious to make a good Army pilot. He accepted this flight eagerly for here was a chance to prove his ability. After all, it was normally only a 20-minute flight. Reduced visibility and the occasional icing of the bubble required all his attention. He wasn't sure of the other H-13's position.

Bill was sweating now and thought of turning back, but a glance at his stern-faced passenger changed his mind. Flying barely above the road, he approached a cut through the ridgeline and applied right pedal to see better through the door. The cyclic flew out of his hand and he was conscious of being brutally flung about the cockpit. The silence that followed was frightening.

The cold drizzle shocked him, and opening his eyes he could see the smashed rotor head encased in wire. He tried to move but was pinned in the wreck and the strong odor of fuel drove him even harder. As Bill struggled to break loose, he saw the general lying on the ground. The seat belt had separated from the frame and the general had been thrown through the bubble. One leg twisted grotesquely under him, but he appeared to be alive.

Frank stood looking out the window. The weather had deteriorated to nothing. His decision not to fly the mission was the only one he could justify. He might suffer a poor efficiency rating, but he could live with that.

The operations office was anything but quiet. Two H-13s were down in a rice paddy waiting for a break in the weather for the return trip home. No report had been received of the general's Sioux.

The CO stood alone by the window. He cursed the weather and his bad luck. Why did these things happen to him? □

Caribou Training Aid In Use

When the largest fixed-wing Army aircraft, the AC-1 Caribou transport, made its debut in operational units in mid-May, one was purchased for use as a training aid by the U. S. Army Transportation School for its AC-1 Aircraft Repair Transition Course already in session.

The 5-week, 175-hour block of instruction will provide the Army with personnel thoroughly familiar in the performance of AC-1 field maintenance.

Instruction is provided in aircraft structure, fiberglass parts and repairs, heating and ventilating systems, flight controls and rigging, weight and balance, etc.

Functional training aids of the electrical system, engine, ramps, de-icer and complete cockpit, and other systems are used in the course.

Prerequisites for the course include:

Active Army or Reserve component officers or warrant officers whose actual or anticipated assignments require knowledge of the aircraft.

Enlisted men must be qualified as a fixed-wing or multiengine repairman, must have 12 months experience in Army Aviation maintenance, 9 months of active service after course completion, and a score of 100 or better in Aptitude Area MM.

Civilians must be GS-7 or above, whose assignment as an aviation maintenance instructor requires transition to this type of aircraft, or in the grade of W-6 or whose actual or anticipated assignment requires knowledge of the aircraft and who possess sufficient knowledge to provide reasonable assurance of completion of the course. □

Inflight Weather Advisories

ON 1 JUNE the Weather Bureau began issuing inflight weather safety advisories in two categories: SIGMET and ADVISORY FOR LIGHT AIRCRAFT. Experience with the "flash advisory" service since its beginning in 1957 has shown the need for two categories of flight weather advisories, one applying specifically but not exclusively to the multiengine, over - 12,500 pounds gross transport, and the other applying to the lighter, less rugged aircraft. The new procedure is designed to meet this need and will replace the "flash advisory" procedure.

The effect of the change will be to identify, under the heading SIGMET, weather phenomena of significance to the safety of transport (multiengine over 12,500) and other aircraft, and to identify, under the heading ADVISORY FOR LIGHT AIRCRAFT, weather phenomena of less severity than that covered by the SIGMET but still important to the safety of light aircraft (single and twin-engine of 12,500 and less). Actually, both SIGMET and ADVISORY FOR LIGHT AIRCRAFT messages apply to the operation of light aircraft.

SIGMET

This is an advisory concerning significant meteorological developments of such severity as to be potentially hazardous to transport category and other aircraft in flight. SIGMET advisories will cover:

Tornadoes.

Lines of T-storms (squall lines).

Hail—¾" or more.

Severe and extreme turbulence.

Heavy icing.

Widespread duststorms/sandstorms lowering visibilities to less than two miles.

ADVISORY FOR LIGHT AIRCRAFT

This is an advisory concerning weather of such degree as to be potentially hazardous to light aircraft but not necessarily hazardous to transport category aircraft. This advisory will cover:

Moderate icing.

Moderate turbulence.

Initial onset of phenomena producing extensive areas of visibilities of less than 1,000 feet, including mountain ridges and passes.

Winds of 40K or more within 2,000 feet of surface.

The purpose of this advisory service is to make available to any aircraft inflight information on weather which may be hazardous to the flight. Whether or not the weather described is potentially hazardous to a particular flight is for the pilot himself to evaluate on the basis of his own experience and qualifications and the operational limits of his aircraft.

SIGMET and ADVISORY FOR LIGHT AIRCRAFT messages will be broadcast on FAA navigational-aid voice channels in a manner similar to that now in effect for flash advisories. As an additional service to IFR traffic, an alerting broadcast will be made on traffic control frequencies to alert IFR flights whenever pertinent SIGMET information is being broadcast on navigational-aid voice channels. — Flight Safety Foundation, BPSB 61-203. □

There's Just One Catch!

GCA operators must complete 100 GCA training approaches (live aircraft) to be certificated to handle IFR air traffic. To retain certification, each operator must complete 20 actual or practice approaches monthly.

This means that DA is concerned about your safety. When you're caught up there and can't see down here, but you want to be down here, the man operating GCA will be well qualified to assist you.

There is just one catch! You're going to have to help GCA help you. Each GCA operator must complete his 20 runs per month, and you're the only one available to provide these runs.

Next time, give GCA a call when you're coming home. They'll be happy to work you.—Army Aviation Flight Information Digest, 31 May 61. □

How's Your
Instrument Training Program?

Sp-4 Robert M. Grant

A VITAL COG in today's instrument training program is the well known synthetic instrument (sweat box) trainer. In recent years Army Aviators who lean toward the foolhardy have looked upon the accident-free training with dismay. Some Army Aviators feel the monthly visit to the trainer section is a duty roster type chore. Sadly enough and with no punches pulled, a small percentage of aviators would prefer to let their instrument proficiency slide in favor of more ready room bull sessions.

Don't misinterpret the writer and assume that he feels that most Army Aviators have a negative attitude toward synthetic instrument training. Luckily, a majority of Army Aviators see its proper value. A professional type Army Aviator recognizes his weaker points as an instrument flier, wants to improve, and will find his way to the trainer section each month.

A topnotch synthetic instrument training program should be available at all times. A well equipped, supervised, and organized synthetic training program is necessary to create interest among the less experienced pilots as well as the highly proficient instrument pilot. It is the Army Aviator's privilege to have access at all times to an excellent training program, including appropriate instrument flight and radio navigation syllabus.

If your unit's synthetic instrument training program is lacking in depth and scope, attempt to bring these weaker areas to the surface. Insist on and take full advantage of your program and it will build confidence for you and your fellow Army Aviators.

All commands should develop a synthetic instrument training program capable of producing all the potential value stored within the trainer. An honest evaluation by all concerned must be carefully made to generate this fine training potential. Such a survey should include the following questions:

- Is there adequate coordination among the instrument flight instructors, examining board, and the synthetic instrument trainer section?
- Does the trainer section have qualified instructors and functioning trainers?
- Is the trainer section capable of giving aviators high-density area checkouts as well as the basic letdown procedures?
- Does the section have a training program for its assigned instructors?
- Is the section capable of giving instruction to the newly rated Army Aviator as well as the Master Army Aviator?

Remember synthetic instrument trainer instructor proficiency, like instrument flight proficiency, can diminish. It must be kept at a high level at all times.

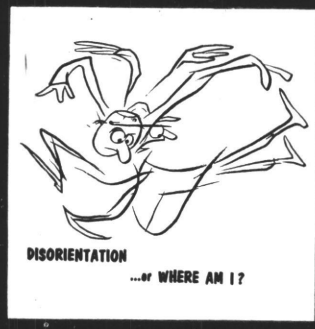
Probably this survey will confirm any opinion that you have about the quality of your unit's trainer program.

Now that the synthetic instrument training program is in high gear, we need business and we are in business for Army Aviators. Each pilot should survey his own ability by asking himself the following questions:

- Does my basic instrument and partial panel flying meet all standards?
- Are my en route navigation and letdown procedures up to par?
- How is my voice procedure?
- Do I understand all phases of ATC procedures?
- How would I manage an IFR code trip into a high-density area?
- Am I proficient in all phases of radio navigation applicable to VFR flying?
- If I ever get caught IFR could I control the aircraft long enough to make a 180° turn?

If the answer is negative to any of these questions, do your loved ones and fellow taxpayers a big favor by making a visit to the unit synthetic instrument trainer section TODAY.

Sp-4 Grant is a synthetic instrument instructor at the Pentagon. He has an FAA Commercial Pilot License with instrument rating, Instrument Flight Instructor Certificate, FAA Ground Instructor Certificate, and has accumulated 750 flight hours.



CRASH SENSE

PREPARED BY THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

DISORIENTATION—FATIGUE NIGHT VISION

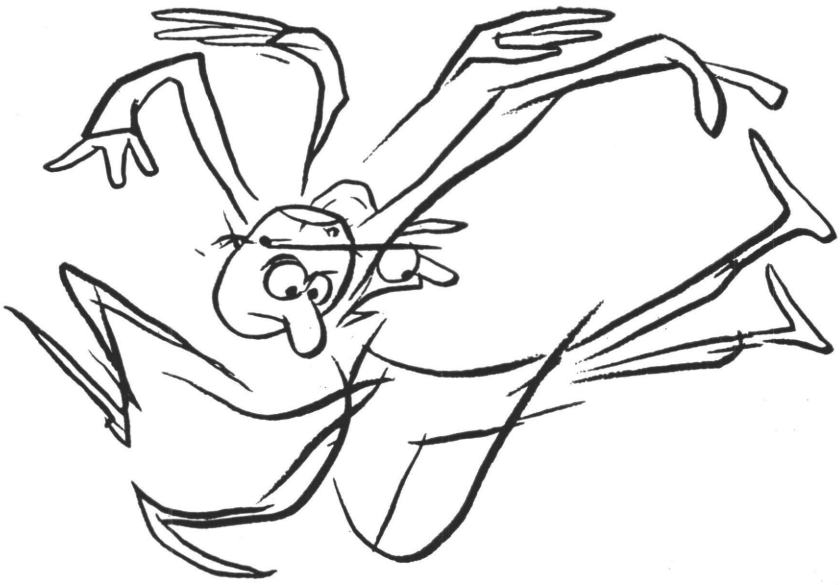
HELICOPTERS MAY lack the contrail etched drama of high altitude, high speed flight, but chopper pilots fall heir to three times as much disorientation, fatigue and visual difficulty as do conventional jockeys steering fixed wing planes. Aviators who are aware of physical problems encountered in rotary wing operation, and who take care to avoid overexposure are a joy to their command and family alike. Too often it is the insignificant act that does a man in . . . watching the late, late show . . . overindulging in food and drink . . . or careless flight planning leading to "—and there I was!"

A recent study of 1063 major Army aircraft accidents established that 90 percent—or 961—of these accidents were caused by people: operators, supervisors or maintenance personnel, with the highest proportion going, you guessed it, to pilots. Physiological causes were implicated in 8 percent of all the majors and 10 percent of all those involving pilot factors.

While these numbers may not grab you, they do drum out the message loud and clear: physical distress in pilots can result in aircraft accidents. More to the point is that often the distress could have been avoided with proper planning or an awareness that such a problem might develop.

Discounting our speedier aircraft, such as the Mohawk, Army operations are normally low and slow. Because our aviators are not regularly subjected to stresses of high altitudes, high speed flight nor the effects of extreme g forces, it is all the more remarkable that physical factors are so often apparent.

Highly suspect as accident causes, but seldom proven, have been carbon monoxide, hypoxia, and drug effects. Three SOLIDLY ESTABLISHED weaknesses in prolonged heli-



DISORIENTATION

...or WHERE AM I?

copter flight are disorientation, fatigue and visual problems. Fixed wing aircraft are inherently stable. They can be trimmed up and flown over long periods without excessive mental or physical strain. The reverse is true of copter flying, which requires constant vigilance and alert manual control. Also, fixed wing aircraft are better equipped with basic instruments.

DISORIENTATION — OR WHERE AM I?

Disorientation is a state of confusion regarding true position or attitude in space. In an Air Force study on helicopter instructor pilots, ALL reported experiencing one or more episodes of disorientation occurring at night, in weather, or under the hood. Ideal conditions for a case of disorientation are darkness with visual references obscured by clouds, fog, dust or rain. Simple inability to determine his position in space is the most common problem for the aviator with disorientation. Some sensations, however, are more specific. When the aircraft is in a bank, correctly indicated by the attitude indicator, the pilot may feel a false sensation of tilt in the **opposite** direction and increase his true angle of bank to a dangerous degree.

A pilot who is warned beforehand on the possibility of these phony feelings may be able to cope with the situation if it arises, for often it is anxiety that makes him react improperly. A pilot able to recognize the early stages of disorientation may be able to save the situation by prompt action. This was not true in the following account.

EXPERIENCED "UNUSUAL" POSITION

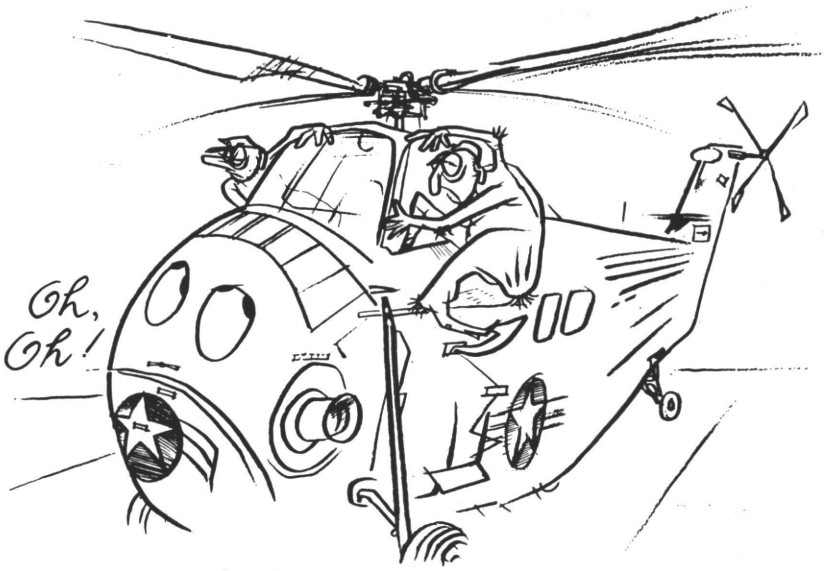
A combination of lowering ceilings and rising terrain caused three pilots of Shawnee helicopters to become disoriented and lose control of their aircraft. Twenty minutes out on a daylight cross-country, the platoon of seven H-21s encountered lowering clouds. Climbing to avoid hills, they lost all visual reference and decided that a 180° turn was imperative. None of the pilots was instrument qualified.

Three of the helicopters went out of control. Aircraft A managed to regain partial control just before ground contact but hit hard enough to cause major injuries. Aircraft B and C crashed and burned, killing pilots and crew members. Investigation showed no evidence of mid-air collision. The pilot of aircraft A made this statement: "I was fighting the controls. I felt like we were in a nose-high position. The artificial horizon was inoperable. I nosed the helicopter forward. We came out of the clouds in a nose-low position with the aircraft tilted sharply to the left and zero airspeed. I leveled the helicopter and made ground contact."

Perhaps even more significant is the statement of the copilot. "I assisted the pilot in an instrument check. Everything appeared normal, except the artificial horizon indicated an unusual position during descent. It appeared to me we were in a level position but I could not tell if we were going to the right or left."

The wreckage distribution, flight instruments and gouge marks in aircraft B indicated it was in a nearly level attitude with negligible forward speed and a high rate of descent. Similar examination of aircraft C indicated ground contact was made in a grossly abnormal attitude—diving left turn, with right bank.

Commented the flight surgeon: "Noteworthy is the fact that his [pilot's] disorientation



FATIGUE ... least understood

probably occurred during a transfer from visual to instrument flight while performing a 180° turn, thus evoking Coriolus effect." The Coriolus effect in man is a type of severe dizziness.

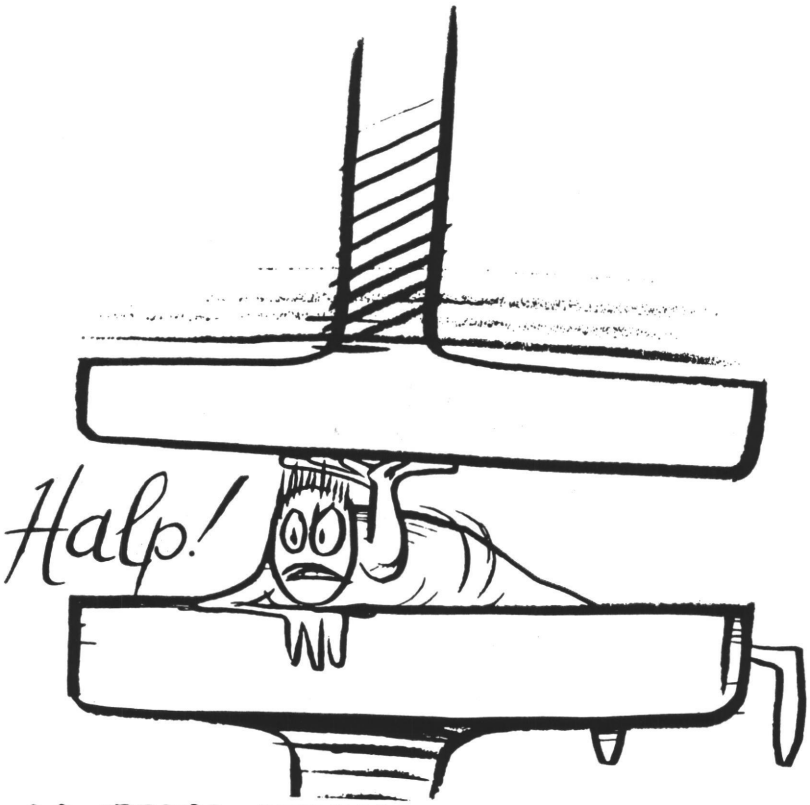
Movements responsible for this stimulation arise when the body is in rotation with the airplane, and the head is moved voluntarily out of the plane of rotation. The motion is strongest when the head movement is at right angles to the plane of rotation. Such a situation may arise during a spin when the head is moved up or down, or from side to side.

The study of disorientation is lengthy, complicated, and studded with unsolved riddles. According to a Navy report, the dominant cause is reduction of visual cues by darkness, rain or fog, and the inexperienced pilot, without instrument training, who may refuse to believe his instruments. There is the inevitable conflict between visual and gravitation cues, but mainly conflict between the senses and the instruments.

Prolonged constant-speed turns at night can mislead the aviator, particularly with rapid recovery to straight and level flight. These conditions are ideal for the illusory effects associated with the semicircular canals of the ears.

The Navy study goes on to say that unusual maneuvers at night predispose the pilot to disorientation, due to effects on g receptors and the semicircular canals. Under these conditions, it becomes easy for the pilot to lose his position or attitude in space.

Fictitious horizons are another booby trap. Whether due to visual or other causes, the fictitious horizon is bound to confuse the pilot. Gradually entering a turn without the pilot's knowledge of it may contribute to disorientation and to his dependence upon this fictitious horizon. Sudden accelerations and decelerations at night produce g in unusual directions and failure of the pilot to keep track of his three-dimensional position may cause disorientation. Thus, the whole bag of possibilities are tied up.



LOWERING CEILING

... RISING TERRAIN

FATIGUE, LEAST UNDERSTOOD

Fatigue reduces perception, coordination, reaction time, planning, and judgment. As yet, no truly satisfactory method has been devised to measure or study fatigue. We all react differently. Generally speaking, flying is not heavy muscular work. But the flight characteristics of helicopters necessitate continuous muscular tension. A great deal of concentration is required without adequate chance for relaxation. Mental fatigue results from constant muscular tension associated with sustained attention.

An insidious change which often occurs following prolonged periods of flight is a tendency to forget. You may forget to switch fuel tanks, forget to monitor certain instruments, or forget to change radio channels.

How to combat fatigue in the helicopter pilot? The obvious

solution is to avoid overexposure. DA Circular 95-1 recommends 20 hours weekly and 70 hours monthly as maximum flying time for helicopter pilots.

A review of the flight time records of pilots involved in accidents brings to light cases in which flying time was grossly in excess of reasonable levels. In one of these, the pilot

FLEW 214 HOURS IN 51 DAYS

A rotary wing aviator had three accidents during a 51-day period. The last of these accidents took place during a hovering takeoff. The main rotor blades of his H-13 Sioux struck a tree stump and the aircraft crashed to the ground, a total loss. Fortunately, there were no major injuries. Dates of the three accidents were 2 June, 20 June, and 22 July. Flying hours accumulated by the aviator during the period from the date of his first accident to the date of his third accident were:

19 day period	2 June-20 June	63.4 hrs
7 day period	13 June-19 June	47.3 hrs
30 day period	22 June-22 July	150.5 hrs
7 day period	16 July-21 July	48.4 hrs
51 day period	2 June-22 July	213.9 hrs

"MOVING" LIGHT

Just as the sight of a well filled Bikini can lead to trouble, visual misperception can mislead the chopper pilot. Approaching a single light of low intensity without other visual reference points, the pilot may feel he is following a moving light. This is autokinesis, a phenomenon resulting when the muscles which are normally continuously adjusting the position of the eyes cause an image to move about on the retina. A helicopter hovering at night, using one small light as a reference, may guide his aircraft toward the "moving" light and strike the ground or some object.

An H-37 Mojave pilot was practicing night takeoffs and landings in a sparsely lighted area. There was an IP aboard. On several approaches before the accident, the pilot had a tendency to drift toward the left. Each time, the IP made the correction. As the pilot attempted to hover at the end of the last approach, the aircraft was in a left bank and drifting. The IP took control and managed to level the helicopter just before ground contact, but not soon enough to prevent a major accident. The pilot stated that he was fixing his gaze on a distant red light as a reference point. As it appeared to "move," he made erroneous corrections.

CONCLUSIONS

A review of major Army aircraft accidents during the past three years indicates that physiological factors may play a more significant role than was previously suspected. These factors were present, suspected, or established in 88 of 1,063 major accidents (approximately 8 percent of the accidents during this period).

Disorientation, fatigue, and visual misperception were the most frequent conditions noted. Accidents in which these physiological factors were involved can, in most all instances, be prevented.

HOW?

To combat physiological accident cause factors, we need:

- Greater recognition of potential physiological factors by commanders, flight surgeons, and rated personnel.
- Thorough indoctrination of student pilots and rated personnel concerning various physiological conditions as related to accident prevention.
- Periodic re-emphasis of these factors by unit flight surgeons, informally and during required local safety meetings.
- Improved instruments which will more accurately indicate the various movements to which helicopters are subject.
- More ground school instruction, including actual demonstrations in such training aids as the Barany chair (a device in which a person can be spun around with his head in various positions so the three sets of semicircular canals can be stimulated), dark room demonstrations of visual illusions, tests of psychomotor performances before and after fatigue, etc.
- Command influence to ensure recognition of pilot fatigue and adherence to DA Circular 95-1 as far as practical. □

IT COULD HAPPEN TO YOU

Lt Joachim A. Crognale

PARACHUTES IN HELICOPTERS — why? The standard answer is that you would not have time to bail out anyway. The recent emphasis on helicopter instrument flying has caused this statement to be echoed many times by old and new helicopter pilots alike. The feeling is that if an actual inflight emergency did arise there would not be sufficient time to abandon the helicopter. As an instructor at the Seventh Army Helicopter Instrument School, I am required to wear a parachute on all instrument training flights. I had pretty much the same feeling toward the wearing of the parachute until, if you'll pardon the expression, "I learned about flying from that."

It was the usual winter morning at Stuttgart, Germany, existing weather 0.4 visibility with ground fog. The only available alternate was the old standby, Hahn Air Force Base. My student and I received a weather briefing for a 2-hour local IFR flight. We were briefed on the existing weather and received a forecast for our ETA to be 500 and 1.

We pulled pitch at 0730A; it was a routine training flight and at 0900A we were cleared to hold over Herrenberg at 4,000 with an expected transition time of 0940A. The fog bank topped off at 3,300 (2,000 absolute). As we approached Herrenberg, the oil pressure gauge began fluctuating and a noticeable drop in the oil pressure was observed. It is quite a sensation to look down for a place to go, and see nothing but the top of a fog bank.

Stuttgart approach was notified of the situation and they asked if we wanted to declare an emergency. We were about to give them an affirmative when a hole was spotted 10 miles to the northwest. We elected to attempt a landing. The helicopter was landed safely in a field in the middle of the Black Forest. The ship was checked and found to be completely out of oil. It was later determined that an engine change would be necessary prior to flying the ship out.

All of this leads up to one question: Suppose that the hole had not been there, what would have been the course of action? Two possibilities were open: autorotate with a possible zero-zero ground condition, or bail out. It was estimated that we had another 10 minutes flying time before the engine would cease. We would have had time to abandon the ship if necessary. An autorotation would have been possible if there had been a definite ceiling with the probability of breaking out at 300 to 400 feet above the ground. With a zero-zero ground condition, and I am sure you will agree, a silk approach would be more feasible. A point to remember here is that the statement "hilltops are obscured" often given in weather briefings could, depending on the terrain, indicate a zero-zero ground condition. Incidentally, after the above landing the hole closed up and ground visibility was estimated to be 0.2 mile.

How would you abandon a helicopter in this or a similar type emergency? The passengers, crewchief, and copilot would have no difficulties; they could exit through the cargo door (H-34). How about the last man to leave, the one left hanging onto the cyclic? After much hangar talk around the coffee cup it has been decided that the best possible solution would be for the pilot or instructor pilot to put the stick trim on and trim for a descending turn opposite the direction toward which he is jumping. The consensus of opinion is that by diving out and down he would avoid striking the ship. This possible solution pertains to the H-34 only and to the best of my knowledge has yet to be tried.

I believe that an improvement could be made in the type of parachute being utilized. Presently we are using the standard back pack. A large man would have difficulty bailing out the window without completely upsetting the helicopter. In lieu of the back pack, why not utilize the chest pack? Each man involved with helicopter instrument flying would eliminate the bothersome and time consuming task of fitting the parachute every time a new ship is flown. This, being very frank, is one of the main factors that discourages the use of parachutes. The chest pack would not be as uncomfortable to fly with and would not be such an obstacle when bailing out.

This incident is one of a multitude of inflight emergencies that could occur, but it surely disproved the old wives' tale that parachutes are impractical in helicopters. Actually there is hardly an inflight emergency in which it would not be possible for at least the passengers and crewchief to bail out. If only one life is saved it is well worth the effort of wearing the parachute—especially if it is your life. □

From The USAAVNS

DOI

AC-1 Caribou Pilot Training resumed 10 July 1961. Since the last AC-1 class graduated 7 October 1960 the POI has been revised, extending the course length to 6 weeks to include aerial delivery and parachute drop of personnel during the tactics portion of the training. The first class 62-1 will participate in Third Army's Exercise SWIFT STRIKE during the period 4-20 August. For Fiscal Year 1962 there will be nine classes with eight students per class.

After a 1-year lapse of student inputs to Course 1-R-671.2, U1A and 1-R-672.1, L-23 Maintenance, USAAVNS has been directed to resume this training. It is programmed that 15 classes of 24 students each will attend the L-23 Maintenance Course and 10 students per class of 17 classes will be scheduled for U-1A instruction.

DEPT OF MAINT

Army Reserve or National Guard aviation units desiring to be tested after completion of the maintenance courses offered by the Army Aviation School should procure their examinations as follows:

(1) Notify the active duty aviation advisor of the number of personnel to be tested. The advisor will write to the Director, Department of Maintenance, United States Army Aviation School, Fort Rucker, Ala., and request the correct number of examinations by course and examination number.

(2) The examination and machine record score cards will be sent to the unit aviation advisor, who will administer the examination. At the completion of the test, all score cards and test booklets will be returned to the Department of Maintenance. The score cards will be machine graded and a test roster will be returned to the unit. This roster will indicate the Army Standard Score received by each individual. The score sheet will be divided by a red line. Those personnel with a score above the red line will be considered passing students; those below the line will be failures.

This administrative procedure is necessary to lessen the possibility of compromise of examinations.

Any request for sets of 35mm slides for support of instruction should be submitted to the Book Department at the United States Army Aviation Center, Post Office Box 548, Fort Rucker, Ala. The Department of Maintenance has recently completed the 83 (670) Series, which is now available. This set consists of 272 slides and costs $82.72. Sets of slides for the other courses will become available in the near future and the availability dates will be announced in the DIGEST.

Money for these slide sets should be requested from the individual State Property and Fiscal Officer or from corps area training aid funds. Requests should be submitted with the purchase order on DD Form 1155, Order for Supplies or Services, if possible. Units are urged to use these slides if at all possible. Your training will be much more effective and efficient. The slides have been

coded according to the block of instruction in which it is to be used, i.e., 83-3400-1 is the first slide in the 83 series and corresponds to the first slide required in this instruction.

It should be noted that each course, in itself, was not designed for MOS qualification. The course lengths run from 61 hours to 107 hours. They were purposely divided into individual aircraft courses so that personnel can be trained for minimum qualification in the maintenance of a particular piece of equipment for mission accomplishment.

Each course is of such length that it is adaptable to a yearly training cycle using drill periods and summer camps. Because of the rapid rate of turnover in enlisted personnel we considered this capability to be of prime importance. Units may have difficulty in securing material to support the practical exercises, therefore the practical exercises have been designed in most cases so that units may use the actual aircraft.

If you have personnel in various stages of training we suggest that you use the procedure described above and give all your personnel a 670 proficiency test first. Depending upon the outcome of this test, personnel should be allowed to continue their training and advance to more complex equipment or take the 670 training course. □

The Latest Thing . . . for Hooded Flight

AN OLD FASHIONED sunbonnet used by Lt John A. G. Klose as an instrument flight training hood brought many good-natured chuckles when first noticed at the U. S. Army Aviation School, Fort Rucker, Ala.

However, a second look reveals that this hood (or bonnet) has many advantages over other types of hoods experimented with at the school (see DIGEST, March and September 1960).

Lieutenant Klose hit on the idea of trying the bonnet in hooded instrument flight in the L-20 during Phase C instruction of Advanced Fixed Wing Training. It satisfactorily channelized vision and Lieutenant Klose's instructors okayed its use. They also gave highly favorable comments on the potential of such a type of instrument training hood.

The biggest advantage of the hood is that the visor folds back easily and holds its position—allowing rapid transition from IFR to VFR with a flick of the wrist. (Many previously tested hoods are either not removable or extremely bothersome when pushed up.)

This bonnet-type hood can be made in a short time from about a yard of cotton cloth. Its cost depends on the type of cloth used (the lace shown is an added luxury).

The visor is 5 inches long, but could be modified as desired. It is double thickness, stitched cotton and is not affected by wind blowing through the cockpit. It is not as firm as the bill on a baseball cap, but is about the same as the bill on the old Army fatigue cap.

To date, the cloth hood has been used only in the L-20, but indications are that it would satisfactorily channelize vision in any Army aircraft (with employment of necessary panels in various helicopters).

Lieutenant Klose has completed 54 hours of flight in the L-20 with the hood, wearing it either over or under the standard headset. He has not flight tested the hood with the APH-5 helmet; however, ground tests indicate it would be practical to wear it under the helmet. If the hood were made larger, it is conceivable that it could be worn over the helmet. It is attached by simply tying the cloth straps under the chin.

The hood weighs only a few ounces and has been worn 4 consecutive hours without any discomfort. Other advantages are that it can be easily folded and placed in a Jepp case or pocket; it absorbs sweat and eliminates the nuisance of sweat running down the neck; it is flexible and allows unrestricted movement of the head in the cockpit (a problem which harasses many tall aviators); and it does not involve any complicated attachments or modifications to use.