UNITED STATES ARMY AVIATION DIGEST

FEBRUARY 1964

UNITED STATES ARMY AVIATION DIGEST

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

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Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U. S. Army Aviation Digest, Fort Rucker, Alabama.*

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LETTERS

Sir:

Thank you very much for your letter and the enclosed copies of the AVIATION DIGEST. Somehow, between my rewriting of the article ("A System," Dec 63) and our correspondence on it, two errors have crept into the final draft.

First and most important, the entire system described in the article is the brainchild of M/Sgt James Preskitt. My small contribution was only writing the article. Second, the article was written while I was a member of KMAG in Korea; I have never served in Vietnam.

Thank you very much. I would greatly appreciate it if you would give these two corrections space in your next issue. Thank you very much.

JERRY R. CURRY
Captain, Infantry
Ft Lewis, Wash.

• *Our appreciation to Sgt Preskitt for his ideas on revamping the aviation publications system. We goofed on your address.—Editor.*

Sir:

Your article "Concentrations That Can Kill You" on page 7 of the November 1963 issue was very interesting. Only sketches were used, however, to indicate how the stress concentrations can result in failure. I am inclosing photographs of two types of concentrations that actually resulted in failure of the part, with a brief history of each.

Case history number one concerns an R-985 crankshaft. An operating activity began having difficulty with an oil leak in the vicinity of the crankshaft thrust nut. When their efforts failed to correct the condition, the aircraft, with the engine still installed, was flown to a depot activity.

The engine was removed and sent to ARADMAC for a teardown analysis, where the crankshaft was removed from the engine, magnetic particle inspected, and found to be cracked. To determine the cause of the crack, the section of the crankshaft with crack indications was cut off and the pieces separated at the crack line.

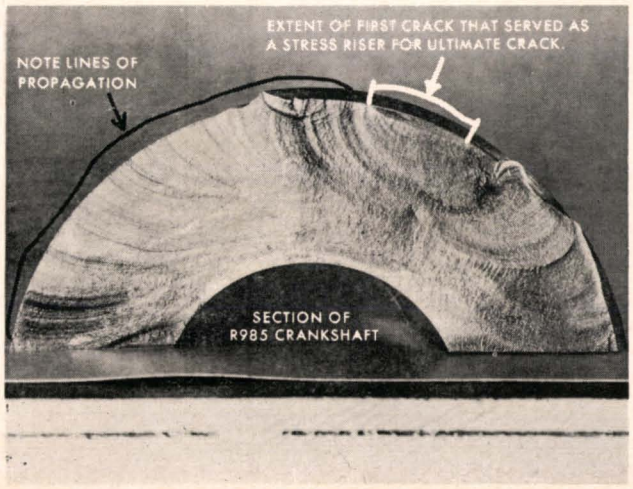
The photograph sent as inclosure one is a view showing the surface of the crack. The first crack, believed to have started from a stress concentration caused by a scratch or tool mark, acted as a stress concentration for the ultimate crack (marked on photograph). The lines of propagation are clearly visible and indicate that the full extent of the crack was a progressive type failure.

Case history number two concerns an O-470 crankshaft removed from a Navy engine received by ARADMAC for overhaul. The reason for removal was shown as metal contamination. When the engine was disassembled the crankshaft was found to be broken between No. 2 main bearing journal and No. 3 connecting rod journal. Upon closely examining the ends, it was found that the failure resulted from a stress concentration caused by an inclusion slightly below the surface, shown in inclosure two. This crankshaft was removed from an engine that had operated for an unknown period of time after the failure occurred, the pieces of crankshaft having been held together by the main bearings. The inclusion probably would be noted when examined by a thoroughly experienced magnetic particle inspector.

A "well done" to Captain Bagwell for a very fine article that was well written. I would appreciate more articles of this type in your publication.

RAYMOND S. FARLEY
A/C Quality Control Specialist
U. S. Army Aeronautical Depot
Maintenance Center
Corpus Christi, Texas.

Inclosure 1



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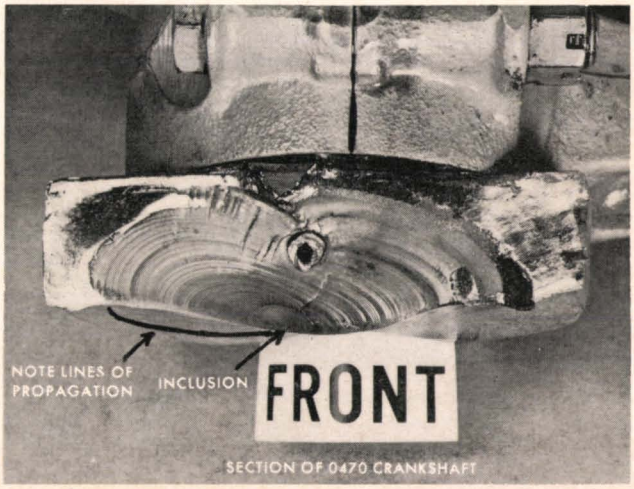
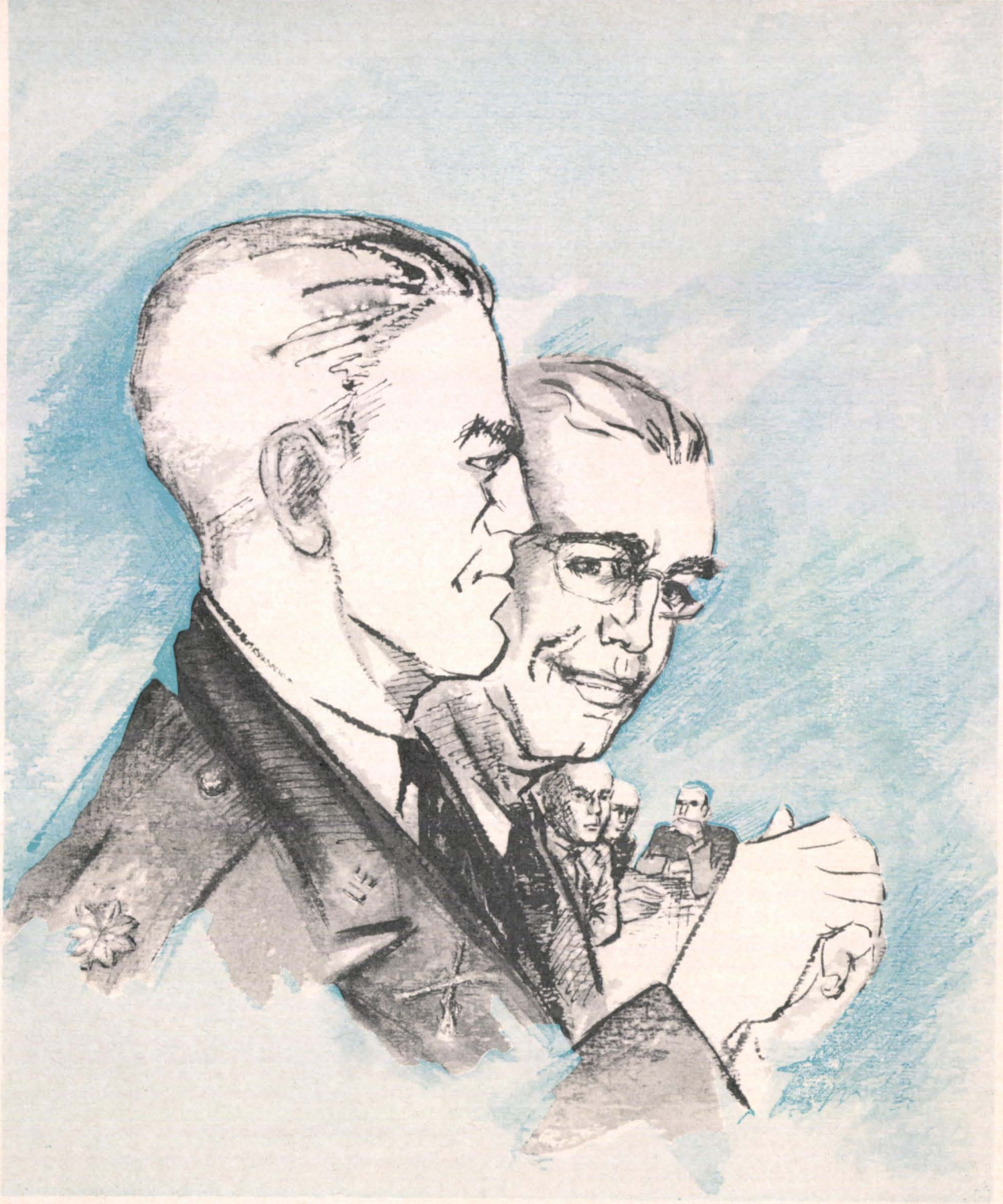




THE DIFFERENCE between a boxer and a slugger is well known. The boxer uses his agility to move quickly, surprise, deceive, stay flexible, capitalize on the vulnerability of his opponent and ultimately attack and violently defeat him. The slugger is slow, methodical, ponderous, and relies on the weight and power of his position to defeat his enemy.

At Fort Benning, Ga., the Army is now developing a boxer. We call it Air Assault.

I would like to outline my concept of what the Army can do with Air Assault and to challenge industry to assist us in realizing the optimum advantages which the Air Assault concept

Industry and Air Assault

Major General Charles W. G. Rich, USA
Commanding General, U. S. Army Infantry Center, Fort Benning, Ga.

and technology can provide.

Armies throughout history have searched and experimented with means of increasing mobility, for it was early found that the force which could react quickly, "get there fustest with the mostest," had a decided advantage over the opponent. Until this century commanders were limited to the speed of the walking soldier for the movement of troops, augmented by horses, elephants, camels, etc. in his forward movement. The motor vehicle since the early part of this century has increased the mobility of armies from eight- to ten-fold over that of all preceding centuries. For the past 40 years the Army has been developing use of the motor vehicle to attain maximum potential from it.

We find in our divisions today over 3,000 motor vehicles, ranging from jeeps which are fast and light to tanks which weigh up to 50 tons. Our engineer effort has been increasingly geared to provide the capability of assisting the movement of this equipment, particularly the 50-ton tank. Weight and, to a large extent, bulk have not had to be of significant importance under these conditions.

The development of the aircraft set the military dreamer aflame with imagination. It has provided the military commander with resources which tax his vision and resourcefulness in exploiting the tremendous potential which the aircraft offers. The Army has used the capabilities thus provided as well as it could conceive at a particular point in time. It developed the use of the parachute to allow troops to land where they are needed; however, once on the ground the Airborne Division must again rely on truck and track transport, normally in the form of a ground link-up, to sustain itself and to move from the drop area.

In 1946 the helicopter was introduced into the Army, and the capabilities of this remarkable machine have been exploited on an ever-increasing scale to enhance Army mobility. Our current divisions are authorized over 100 aircraft, more than 90 of them helicopters. However, they can provide mobility to only small segments of a division force. They are still limited by maintenance and supply support elements which are moved by wheels.

Files throughout the Army are filled with studies which have been made to determine how aviation can increase the mobility and striking power of the Army. This has been an evolutionary process, as it should be. As a result of intensified studies in the mid-fifties, an aviation program was developed; requirements for aircraft, organizations, research and development of aircraft and related equipment, and for the procurement of aircraft were incorporated. In late 1959 the Rogers Board was established. This board formalized the aviation program with emphasis on research and development and resulted in a firm program for a family of Army aircraft.

The process of evolution continued, and in 1962, based on a request from the Secretary of Defense, the Army established the Army Tactical Mobility Board, commonly called the Howze Board, to determine how aviation could be used to provide a quantum jump in mobility for the Army. The Howze Board reaffirmed the basic aircraft development established by the Rogers Board and provided new guidance for the inclusion of aircraft into units and for the employment of these units to provide much larger advantage in mobility.

One of the recommendations of the Howze Board was that an air assault division should be organized. In February 1962 the 11th Air Assault Division was organized at Fort Benning for testing its organization and capabilities. Along with the division was organized the 10th Air Transport Brigade to operate an air line of communications to the division.

What is Air Assault? How does it differ from airmobility, or even from airborne, and what does it mean to industry? Briefly stated, air assault can be considered the complete reliance on aircraft operating with the troops for the movement, employment, and support of large combat forces and the maximum elimination of reliance on ground transportation. The air assault force carries with it all the elements it needs for employment on the ground, communication, maintenance, support and supplies. It is resupplied and reinforced by air-landing troops and supplies where they are needed, reducing to the greatest degree the need for ground transportation.

To be truly effective the air assault force must be able to move on short notice (in minutes) to operate in an objective area, preferably behind enemy lines or in enemy or neutral territory. It must be able to fight and sustain itself for an almost indefinite period, and then it must be able to move again on short notice without having to be joined by a land tail of any type.

This freedom from the ground provides the greatest potential for mobility and presents a tremendous challenge to the imagination and the capacity of industry to provide the equipment we now need. For years weight and bulk have been of relative unimportance. Now with the advent of air assault they are primary factors, second only to the basic use intended for a particular piece of equipment.

We might say that the Rogers Board established research and development goals for aircraft and related equipment. The Howze Board organized these equipments into units for the greatest advantages to Army mobility. The organization of the 11th Air Assault Division and the experience which we have had to date clearly indicate the urgent requirement for study, experimentation, and development of other equipment and organizations now existing in the Army to make them compatible and useable. Then the mobility and flexibility of the aircraft and the responsiveness which it can provide can be fully realized.

We are searching the Army inventory for equipment which can be used to optimize the efforts of the air assault organization. Light weight, reduced bulk, and responsiveness have become all important and, where necessary, must be achieved even at the expense of ruggedness and long life. While these qualities are still desirable, we are rapidly finding in our air assault exercises that light weight and the ability to be moved by Army aircraft, normally with a capacity of about 1½ tons, have become paramount.

Let's take an apparently simple problem: providing water for our troops. Heretofore, we have been able to establish water purification points in rear of our advance units and move this water to the troops for cooking, hygiene, and drinking by trailers, trucks, and cans. Early exercises under the air assault concept pointedly illustrated that these normal means were too heavy. We must have a means of getting water to our forward troops in lightweight containers. We must reduce the requirements for water as much as possible and must provide a lightweight means of purifying the water in objective areas far into enemy territory.

A more vital problem is supplying fuel for aircraft. Truck-mounted tankers and 55-gallon drums are much too heavy for use in air assault operations. The 55-gallon drum and 5-gallon container now commonly used

throughout the Army are too slow for filling aircraft fuel tanks of several hundred gallon capacity. About 440 tons of fuel a day will be required to operate an air assault division of about 450 aircraft for one *full* day of combat.

The development of a fuel supply system which can be transported forward and broken down into small components for refueling in forward areas with minimum or no repackaging is an urgent requirement and one of our greatest problems. As an expedient we are using 500-gallon collapsible rubber tanks, carrying them forward in Caribou and Chinook aircraft, then sling loading individual 500-gallon collapsible drums under our UH-1 helicopters to the forward units. To date this is the best system we have been able to devise. We hope that through the combined efforts of the Army and industry we can vastly improve this somewhat jury-rig operation.

I think industry should give considerable thought to the development of engines of smaller fuel consumption or the development of fuel with lighter weights and less volume. The advantages are clear.

I would also like to insert a thought on the problem of noise. Besides its obvious effect on civilian communities surrounding large airports, we are concerned about noise for another reason: its effect on tactical operations. Noise from aircraft telegraphs our position and warns the enemy of our approach. Reduction of noise level from aircraft is required to enhance the surprise and shock effect of air assault operations. Eliminating the enemy's reaction time will also materially reduce our vulnerability to its fire.

Let us get back to equipment which is not purely or directly connected with aircraft. We have had considerable trouble finding a forklift of sufficient weight-lifting capability and of small enough weight and size to be carried in our aircraft to expedite materiel handling. This is an apparently small problem but one which we have not adequately solved. Coupled with this is the requirement for reducing weight and volume of food and ammunition and the containers in which they are packed. Ease of handling to afford rapid distribution is another factor required to exploit to the fullest the flexibility and mobility which air assault provides.

Aircraft armament and the equipment for supporting it have become lost arts in the Army. The armament systems we are using on our aircraft are, in almost every case, merely the adaptation of weapons designed for ground employment. Though a credit to the ingenuity of those who adapted and developed them so that they can be used, these systems are at best jury-

rigged expedients. They provide us with a firepower capability which we vitally need, but they have the obvious disadvantages of excessive weight of both weapon and ammunition.

The means by which most of them are attached to the aircraft has increased drag, resulting in reduced speed and maneuverability. We need a weapons system which will enhance our ability to move and strike the enemy force from any direction. We are particularly interested in the development of a fast reacting antitank capability which does not require our aircraft to be operating close to enemy tanks to be effective. In other words, we want to be able to stand off and hit him from distances from 2,000 to 3,000 meters then duck behind a hill to protect ourselves from retaliatory fire.

The communications systems within the Army have increasingly provided better communications and greater reliability, operating over great varieties of ranges. We still need the reliability and the means to communicate; however, our systems must be redesigned or developed with emphasis on light weight and less bulk and, of equal importance, with a requirement for far less power. By jury-rigging and to some extent reducing certain capabilities, we can reduce the weight of communications equipment in the Air Assault Division to a small percentage of the weight of the equipment authorized in other divisions of the Army.

This has been accomplished by eliminating the large, heavy, truck-mounted vans and similar devices, mounting our equipment on small trailers and having them operate from tents. As an example, a 2½-ton truck van weighing 20,000 pounds has been replaced with a 1,200-pound sled. Again, an expedient, but it works.

To be truly effective, we consider the ability to operate at night and to the maximum extent under all weather conditions to be probably the primary requirement of the Air Assault Division. We are not satisfied with our capability at the present time. What is clearly indicated is a navigation system that will allow us to operate without reference to the ground, yet flying close to it to remain out of the radar vigilance of the enemy. We need a system which will let the pilot know at all times where he is and will allow him to land in enemy-held territory under minimum conditions of visibility in the exact spot where he should land. The navigation system should also provide us a means of clearly identifying locations of objects seen or sensed on the ground to enhance our intelligence gathering capabilities.

If industry is to help solve the equipment problems unique to the 11th Air Assault Division, an exchange of information must be accomplished. First, industry must have an appreciation of the specific problems posed and be able to evaluate the application of their products and capabilities to the airmobility tests. The next step is for our personnel at Fort Benning to become aware of those products and capabilities. Such an exchange of information, as well as the follow-up action to obtain items of equipment deemed desirable for employment in the tests, is the responsibility of the Test, Evaluation and Control Group now established at Fort Benning. This group is formalizing procedures for briefing industry on our activities and requirements and for receiving proposals from industry.

We need the ideas and contributions of industry to provide the specialized equipment necessary to full exploiting of the air assault concept. A cooperative effort will truly benefit both industry and the Army.

Landing on Ice

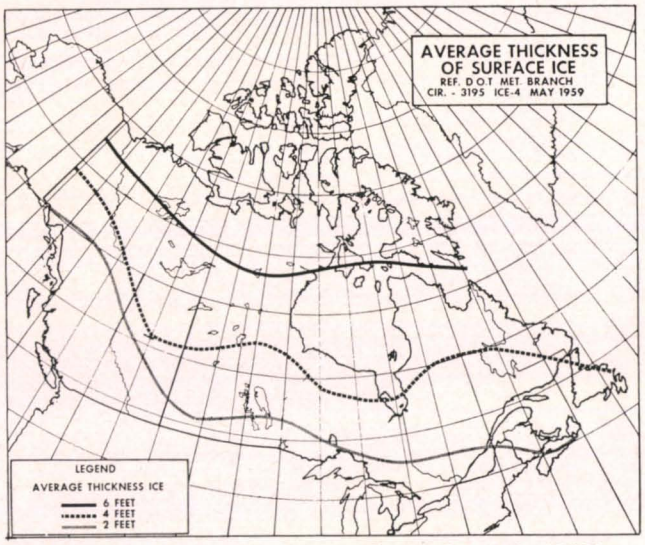
THE LIEUTENANT eased himself back into his chair at the conference table. Two soldiers stranded north of this Alaskan training site needed help. As aviation operations officer, the lieutenant was one of those trying to find the best way to rescue them.

The possibility of flying them out had been discussed and discarded because there was no place to land an airplane in the heavily wooded area. Helicopters could not be brought into the area in time. The only way out was on foot and the officers at the conference table were making plans accordingly.

But the lieutenant believed one other possibility existed: a landing on ice. A quick check of some charts in his office convinced him that it was possible to land on one of the several lakes in the area near the soldiers. The ice landing and rescue was accomplished so easily that few newspapers bothered to mention it.

* * *

The lieutenant had recently read several articles by Canadian military and civilian pilots on ice landings. The Canadians have found that the depth of ice on rivers and lakes may vary from



Average thickness of ice in latitudes 45°- 80°N.

approximately 1 foot to 6 or even 8 feet and that ice can make excellent landing strips.

They point out that ice surfaces are more durable than is often imagined. The sound of cracking ice is not necessarily cause for alarm, unless it is accompanied by noticeable sagging under the load. Ice can safely carry greater loads than are likely to produce the first crack, and ample warning is usually given before failure occurs. Where danger signals are evident, the problem can be alleviated by moving the aircraft periodically or unloading it.

The load bearing capacity of ice or its resistance to bending under a load involves such factors as thickness, pressure exerted by the water under it, elasticity, shape and concentration of the load, and Poisson's Ratio.* With these considered, a relationship can be established between the thickness of the ice and the radius of influence of loads upon the floating ice. These distances are important because of their relationship to resonance waves and safe distances to be observed between static loads, such as parked aircraft.

Resonance waves are one of the phenomena associated with the movement of aircraft or heavy loads on ice of marginal safety thickness. At times heavy moving objects have broken through a frozen lake surface, even when the ice cover was theoretically strong enough to have carried them. Such failures are sometimes attributed to these resonance waves generated by moving objects.

The depth of the water and the rate of movement of the object on the ice above it is important. On shallow water the critical failures of a moving load depend primarily on the depth of the water and to a lesser degree on the thickness of the ice. The major concern in the case of aircraft is the taxiing operation. For instance, if a hot rod pilot should taxi in at 15 to 20 mph on ice of marginal thickness and water about 20 feet deep, there is a good chance of the aircraft breaking through. At 5 mph, the same pilot would be perfectly safe.

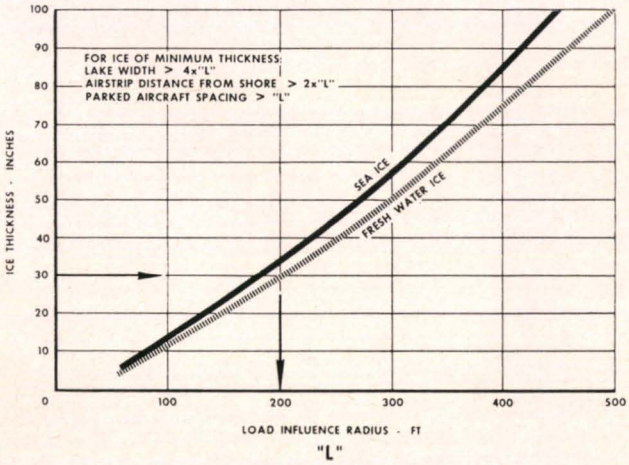
When taxiing on an ice surface over very deep water, the critical resonance velocity depends almost entirely upon the thickness of the ice. Fortunately, taxiing speeds of aircraft are normally below velocities which might be termed critical.

Aviators with some experience in landing and taking off from frozen lakes know that the most dangerous portion of the ice is that adjacent to the shore. The ice along the edge of the lake seems to be softer than that in the middle. Near the shore, complex resonance waves may occur which cause the ice to break up easily.

Thus a very poor choice for an ice landing strip would be one which parallels the shore, in fairly shallow water, and located within one radius of influence distance from shore. This distance is known as "L" and varies with the thickness of the ice. Figure 1 shows this L distance per inch of sea and fresh water ice.

When only the minimum thickness of ice is available, the width of the lake should never be less than 4 L. Thus, on a fresh water lake where the ice is 30 inches thick, the lake should be 800 feet wide. The landing strip should not be closer than 2 L or 400 feet to the shore at any point to avoid resonance wave effects. Narrow bodies of

Figure 1



* The ratio of transverse to longitudinal strain in a material under tension.

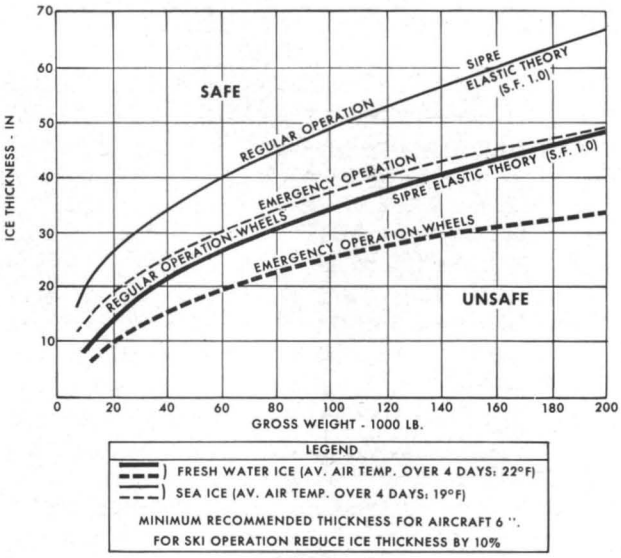


Figure 2

water are thus unsuitable for landing unless the ice is extremely thick or an emergency exists.

Ice surface on lakes of medium size is usually preferable to large lakes, and is less likely to have surface irregularities caused by thermal expansion, contraction, and wind action. Large lakes, however, often have inlets or bays which are suitable for landing. In regions where geologic oil formations are prevalent, natural gas rising from the bottom of the lake can produce porous ice, which results in local weakening of the ice sheet.

River ice is usually thinner than lake ice and is likely to be less uniform in thickness due to the presence of water currents. This condition is particularly pronounced where the river bends or narrows. River ice should be given a safety factor of 10-12 percent above that thickness required for lake ice under otherwise identical conditions.

As a general rule the surface ice on fresh water lakes is smoother than that on salt water bodies. Fresh water ice, however, should never be used after it has begun to candle (to separate into long vertical needles).

The best location for a landing strip on sea ice is in a bay or behind a point where ice is not subject to horizontal pressure from ice floes of the open sea. Unprotected ice landing strips can be carried away by changes of current or wind. "Active" cracks, caused by the movement of ice in the vertical and horizontal direction, should be avoided. Such cracks often separate the bay ice from ice cover in the open sea. If the bay selected is long enough, active cracks can usually be avoided.

Pack ice in the open Arctic is sometimes suitable for airfield purposes. The usual runway length limiting factor is, however, the distance between pressure ridges. Ice fields of 1 mile in diameter are fairly numerous, but larger ones are seldom seen.

When white snow ice, a sort of frozen slush, is encountered on top of clear blue, fresh water ice, its effective thickness is only half that of the fresh water ice. Thus if an ice surface has a layer of blue ice 10 inches thick and is covered by a layer of snow ice also 10 inches thick, the effective ice thickness, in terms of blue ice, is only 15 inches.

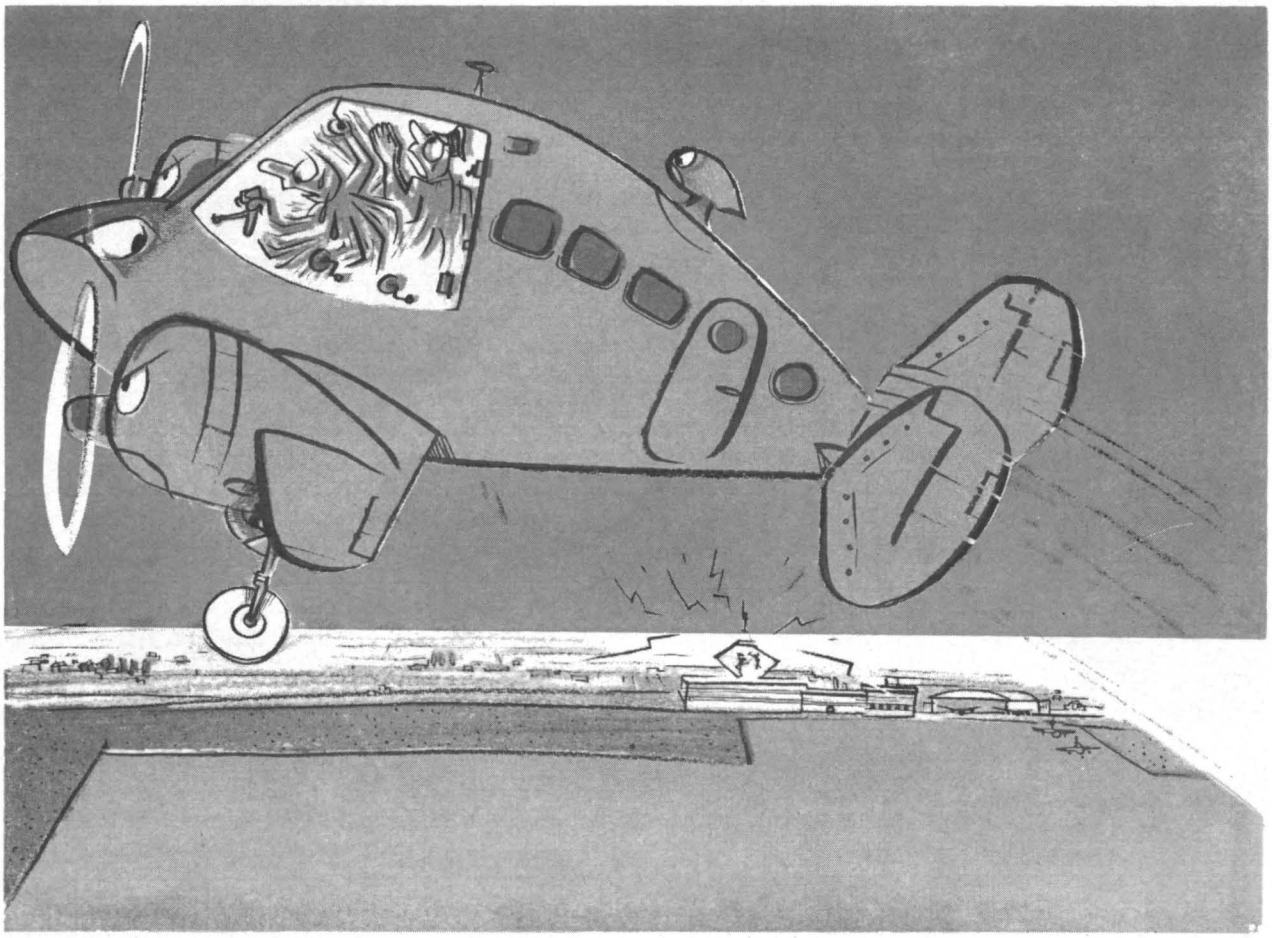
Figure 2, developed by the Canadian Snow Ice and Permafrost Research Establishment (SIPRE), indicates the thickness of ice required for regular and emergency landing of various sizes of aircraft on fresh and sea ice. The emergency curve involves some risk of the wheels breaking through after the aircraft has stopped. Nevertheless, under most circumstances, it is considered advisable to make an emergency landing on ice rather than on land. If the landing has to be made on ice which is known to be of marginal strength, the landing gear remains up.

In ice landing operations, some data is skimpy and techniques are still theoretical. Further research is necessary. In the meantime, these frozen assets can be used in the interest of safety and strategy in winter flying and in increasing our expanding efforts toward true mobility in all environments.

* * *

Adapted from Institute of the Aerospace Sciences Paper No. 61-217 and from the article "Considerations for Landing Aircraft on Floating Ice" by T. G. Dunkin, M.C.A.S.I., Canadair Limited, Canadian Aeronautics and Space Institute, Vol. 8, No. 5, Canadian Aeronautics and Space Institute, Commonwealth Building, 77 Metcalfe St., Ottawa, Canada.

Skis increase flotation (see figure 2)



A Bucket of Worms

Captain Joseph R. Koehler

WE WERE KICKING around hypothetical situations—hangar flying. Each of the aviators in turn embellished his favorite hairy tale or instrument flight problem and offered it for discussion in the Happy Hour haze. His cohorts gleefully dissected the situation in terms of their own experience, "I'd have done it this way," or added further complications, "What if your whatzit went out?"

For a couple of days I had been mulling over a question. Davison Army Airfield, Fort Belvoir, Va., just outside Washington, D.C., has only one instrument approach—a GCA. Loss of voice radio communications at 7,000 feet holding over Ironsides intersection (your clearance limit) while awaiting radar hand-off to Davison GCA would seem to present the pilot with a bucket of worms. Adrenalin consumption would rise further

---

Capt Koehler is an instrument examiner and is assigned as aide-de-camp to the Commanding General, USAAVNC, Ft Rucker,

"YOU'RE IN THE *soup at 10,000, both engines out, no parachute, just 6,000 silkworms and a sewing machine. . . .*"

if you had not filed an alternate airport.

During a lull in the conversation, when the bartender announced 30 minutes left of Happy Hour, I tossed my tidbit to the troops. The ensuing procedural debate swiftly turned into a babel. Responses varied from, "Let me get another bourbon," to, "I'd drop back 20 and punt!"

We discussed what Washington center would expect the pilot to do; what Washington approach control would expect; what the pilot could do. Most of the aviators agreed that they would proceed to their alternate if one had been filed with the flight plan. But, bear in mind that your alternate is not normally included in transmittal of your DD 175. Wouldn't there be some scrambling around in approach control while center was calling back to your point of origin to determine the alternate and you were scooting for somewhere nearby, Baltimore or Andrews AFB? Concern for the mental well-being of approach controllers prompted the aviators to pause, sip, and reflect on this point, but final opinion was that if you had an alternate, you would head for it.

I reminded the group that my real question was what you would do if you had filed no alternate. With scowls, they attacked the problem again. The first solution was, "I would start flying the triangular pattern for lost radio communications."

"You're lost in the fog of frivolity," another pilot answered, passing his companion a drink. He stated that you might as well stay in the holding pattern, because approach control would realize soon enough that you had lost your radios. "And either way," the aviator continued, "there you are in the soup, zipping around corners, and waiting for some bird to come up, tap you on the aileron, and lead you down." A few in the group shuddered at this thought.

A suggestion was made to continue holding at Ironsides, tune your ADF to the Washington range, and wait for instructions from approach control on the omni or range frequency.

"What if you're already into your fuel reserve?" I asked, further complicating the problem.

The answers started flying. Each was "cussed" and discussed. One aviator, a bold type, suggested improvising an approach to Davison using the Springfield radio beacon. He was quickly reminded of the possibility of a mid-air meeting with traffic holding over Springfield. "And approach control would never forgive you for littering the airways with flying debris," he was told.

We reached no final solution. We did agree on an answer based on the assumption that fuel state would not allow waiting for approach control instructions on a navaid frequency. If you had not included an alternate airport on your flight plan, then the ceiling at Washington would have to have been 5,000 feet or higher, with 5 miles visibility, and forecast to remain so for 2 hours after your ETA.

With this in mind, we decided the best bet would be to intercept a bearing off the Springfield beacon which would take you to

Exchange between aviators and air traffic control personnel can be mutually beneficial. While discussing the problem outlined in this article, Washington center pointed out this error: many pilots of transponder equipped aircraft, noticing that mode 3, code 01, is listed for en route navigation, are setting up this code and flying with the transponder on *normal.* The transmitter should be on *standby* unless otherwise instructed.

Center stated that if all the transponder equipped aircraft flying into the Washington area were transmitting simultaneously, the radar screen would show nothing but one big blip. The transponder should be on *standby* until you are instructed to reply *normal* or *low.*

Davison and descend to VMC below 5,000 feet once clear of the holding fix. A caution was added, "If you feel a hard bump on the way down, jump!"

The group broke up, not really feeling that we had solved anything. One aviator vowed there must be a better answer. He headed for the bar. "On your way home tell my wife that I'll be late," he mumbled. "Gotta solve a problem!"

* * *

During my next trip to Washington I figured the best way to get an answer would be to go to the source. I called Washington center and stated the problem. They didn't have an immediate solution and said they would call back.

Thirty minutes later an FAA executive at Washington National Airport called. "No sweat," he said. I smiled. e explained that a letter of agreement between Davison and Washington National covered the situation. Aircraft based at Davison would execute an ILS approach at Washington National in the event of lost communication.

I frowned. "I'm not based at Davison," I told him. "How would the transient pilot know of the letter, and does it cover him?"

"Hmmmmm," he answered, perceptively. "You've got a problem. Call you back."

The bunch at FAA are very cooperative and were eager to solve the problem. They arranged a conference call with Washington center, approach control, and the flight check branch district office in Richmond, Va., and called me back. We discussed the problem. They shrieked in unison when I explained the approach our group of aviators had taken to the situation. All agreed that, with the congested Washington air traffic, proceeding to an alternate or descending to visual conditions would send the pucker factor soaring at center and approach control.

Finally, the FAA flight check branch came up with a logical solution. "Let all aircraft flying IFR into Davison Army Airfield execute an ILS approach to Washington National in the event of lost communications." We cheered.

The word will be spread to Army Aviators by publishing a change to the Davison GCA approach plate. Watch for it.

Checklist for Annual Writ

THE FOLLOWING Department of the Army publications are required as references with Study Guides and Examination Booklets for the 1964 Army Aviation Annual Written Examination:

AR 95-1 w/C 1 and 3, AR 95-2 w/C 2, AR 95-4 w/C 2, AR 95-16 w/C 1 and 2, AR 95-32 w/C2, AR 95-63 w/C 1, AR 95-67 w/C 1 and 2, TM 1-215 w/C 1 and 4, TM 1-225 w/C 1, 2, and 3, TM 1-260 w/C 2 and 3, TM 1-300 (July 1963 edition).

Note: TM 1-300, METEOROLOGY FOR ARMY AVIATION, is a new edition. The old (April 1958) edition cannot be used.

The U. S. Army Aviation School will distribute all printed examination materials required by examiners and aviators except the DA publications listed above. Examiners will require 1 copy of the new TM 1-300 plus 1 copy of each of the other items for each Examination Booklet used in administering the examination. Each aviator will require convenient access to all references listed while using the Study Guide. The examiner must obtain his publications through normal AG publications supply channels. It is the unit commander's responsibility to initiate requisitions to obtain sufficient copies of the Study Guide references to afford each aviator convenient access to them while using the Study Guide.

Study Guides from the U. S. Army Aviation School should have reached the headquarters of major overseas commands, ZI Armies, and the Army National Guard Examining Facility in each state during January 1964. The Examination Booklets and other required materials should arrive at these same headquarters by the end of February 1964.

Avoid last minute "crash actions" and accompanying anxieties by submitting your requisitions now! DA Form 17 is commonly used to requisition DA publications. If you can't obtain the form, try a letter request through AG publications supply channels listing each item, including changes. Over 12,000 copies of the new TM 1-300 were printed, so there should be no difficulty in getting requisitions for this item filled.

Just how far should the Army Aviation School go in training student aviators in tactical operations? How much training should remain a unit responsibility? Do you agree that an added requirement should be

An Aviator Tactical Mission Proficiency Test?

Major Norman P. Jacobs

SECOND LIEUTENANT Platoon Leader entered the company commander's office. He saluted smartly and reported with confidence for his first troop duty. The experienced captain shook the lieutenant's hand, welcomed him to the company, and began to talk over his background.

"You've joined us at a particularly good time," the captain continued. "Next week the entire division will move into the field for 3 weeks on Operation REFLEX. The maneuver will emphasize quick reactions and mobility by the small units. There should also be a lot of tactical play from the division's aviation battalion. Effective now, the Second Platoon is yours, and you can expect some long days, starting next week.

"Right now I want you to meet the other officers of the company and your platoon sergeant.

Major Jacobs was assigned to the Instrument Division, Dept of Advanced Fixed Wing Tng, USAAVNS, when he wrote this article. He is now attending the USACGSC, Fort Leavenworth, Kansas.

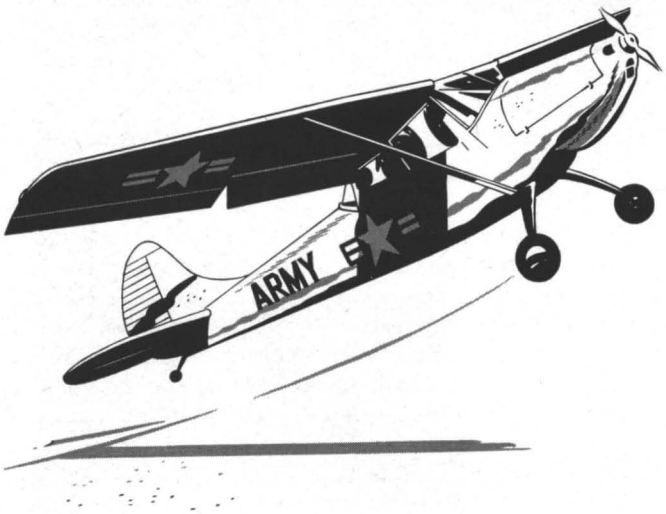
Then take a couple of days off for personal matters and getting settled in the BOQ. Also you'd better bone up some on your troop leading procedures and review the highlights of platoon operations, especially attack, defense, night and day withdrawal, raids, and patrolling. Did you get much training in these areas in the Basic Course at Fort Benning?"

"Yes, Sir," Lt Platoon Leader quickly answered. "Our tac officers graded our performance in all of those platoon operations. However, I'll take your advice and do some homework before we move out next week."

While Lt Platoon Leader was getting acquainted in his first outfit, another new officer, 2/Lt Army Aviator, was reporting for duty at the General Support Company of the Division Aviation Battalion. Lieutenant Aviator was senior to Lt Platoon Leader by nearly a year—the time it takes to complete the Officer Fixed Wing Aviator Course.

Lieutenant Aviator was proud of himself as he reported for his first real tour of duty. His new Army Aviator badge above his left breast pocket still felt a yard wide. After his initial report, Lieutenant Aviator and his new company commander, Major Jones, went to the mess hall for a cup of coffee. Lieutenant Aviator had graduated from college ROTC, the Basic Infantry Officer Course, and from Officer Fixed Wing Aviator Course.

While stirring his coffee Major Jones commented, "In your briefing at battalion you were probably told about Operation REFLEX which begins next week. This will really be our first exercise since the ROAD changeover. Even though we are laid out under the new TOE, we don't have all of the equipment we are supposed to have—particularly aircraft. We've had to spread the existing aircraft throughout the battalion to give each of the companies the best operational capability possible under the circumstances.



"I'm assigning you to the General Support Platoon commanded by Captain Chopper. I'm sure that he will be putting you to work in the Tactical Support Section. Do you recall what aircraft the Tac Support Section is authorized?"

Before Lieutenant Aviator answers, Major Jones says, "Ten LOH. But we have only three OH-13s and four O-1s. Since you're fixed wing rated only, you'll be doing a lot of the Bird Dog flying during Operation REFLEX. This afternoon and tomorrow you can get settled on post and in the BOQ. The day after that, Captain Chopper can start on your local checkout—he's an IP in the O-1. By the way, are you pretty sharp on the basic mission work?"

Hesitantly Lieutenant Aviator replies, "What exactly do you mean?"

The major quickly added, "You know—visual observation such as route reconnaissance, aerial delivery, aerial photography, radiological survey, and low-level navigation."

Lieutenant Aviator replied, "In school I adjusted artillery fire pretty well from 4,000 feet and also did some aerial delivery work which I enjoyed. I never got to fly one of the photo missions with the pod-mounted camera, but I flew one radiological survey. Let me put it this way: I feel confident about my ability in short fields and roads, and reasonably sure of my instrument flying, but I must honestly admit I'm least proficient in the basic missions you mentioned."

Major Jones interrupted with, "I'm really not surprised. I discuss these matters with each new aviator assigned to the company, and their feelings are essentially the same. Also, I've seen the proof of this proficiency lag in previous field exercises. For some time now I've been thinking about how the folks at Fort Rucker could better prepare young officers like yourself to take on the duties you will or should start performing next week. Are you interested?"

"Yes, Sir," nods Lieutenant Aviator while sipping coffee.

"Well, the first thing to do," began Major Jones, "is to determine the missions in which training is not on a par with the rest of the fixed wing course. We must provide additional training time for each of these missions to ensure that every student gets more than just one try at them.

"... I think that our young Army Aviators should be given a performance type test, conducted under realistic tactical conditions, on low-level navigation, route reconnaissance, aerial photography, and radiological survey while still at Rucker. A satisfactory grade should be mandatory before being assigned to a unit." -- Author

"As you are probably thinking, additional training itself is not the complete answer. It must be followed quickly with a performance type test conducted under just as realistic tactical conditions as you will be flying next week. I'd call it the 'Aviator Tactical Mission Proficiency Test.' Achieving a satisfactory grade on such a test should be mandatory before the student aviator is permitted to continue his training, and certainly before he participates in the field exercise that culminates the tactical training at Fort Rucker. What do you think of this idea?"

"Sounds great," said Lieutenant Aviator as he refilled the coffee cups between them. "But what missions should be included in the test?"

"The way I see it," Major Jones continued, "the test should include the items already mentioned. They are the primary events. Certainly such things as adjustment of fire, radio security, aircraft camouflage, and identification of friendly and aggressor aircraft, ground vehicles and weapons could easily be integrated into the test.

"Let me elaborate a little on the primary aspects of the test and the training that must necessarily precede the test. All Army Aviators should be capable of navigating for distances up to 40 miles while not getting higher than 50 feet above the terrain and taking advantage of the terrain to conceal his movement. Yet, that same aviator must maintain orientation and continue navigation. He should be able to recognize terrain features from a horizontal line of sight, since that is the angle from which he will view them.

"Another important aspect of low-level work is becoming familiar with variable and gusty winds and their effect on groundspeed and aircraft control. In training, the student pilot should be required to make several practice flights, varying from 15 to 40 miles. On the test he should be required to accomplish about 25 miles. When he can pass that test, he has the basic ingredient to accomplishing most of our tactical jobs."

"Sir, that sounds quite hazardous," Lieutenant Aviator injected.

"Well," said Major Jones, "it does introduce some additional hazards to the training but I think it is necessary if we are to get qualified aviators. We can't leave all the training for the combat zone or the field exercise. Cigarette?"

"Thank you," replied Lieutenant Aviator, furnishing the light.

"The second part of the test," Major Jones continued, "should be a visual observation mission. With the increased emphasis on mobility, I believe the test should be a visual route reconnaissance run against time. The examiner should brief the student pilot on the route to be checked, the urgency of the need for the information, and on all other facts normally provided in a mission briefing. He should then give him a time limit beyond which any information collected would be worthless. In other words, we would be pressing the aviator for haste, thoroughness, and accuracy.

"In training for this phase of the test, the student must have reconned several routes over different terrain and with a variety of existing limiting factors along the routes. You see, if the student can pass this sort of test, he is equipped, through the use of code, to inform the ground mobile commander immediately of any restrictions or limitations along the route. Do you think you will be able to handle a mission like that next week?"

"Well, Sir, when you put it that way—no, I don't," Lieutenant Aviator replied.

"You're not alone," the company commander offered. "I've been flying Bird Dogs for ten years, and I don't think I could run a good route recon myself. And the reason is the proper emphasis on the proper aspect of training. Ready to leave?"

Lieutenant Aviator looked down at the cold coffee in his cup and said, "Yes, Sir."

On the way back to the office Major Jones said that he would like to see aerial delivery as the third portion of the test. Actually he felt all of his

young aviators were well qualified in the flight techniques of freefall delivery, paradrop, and high velocity loads. As he settled himself in his swivel chair he added, "What they are not well qualified in is rigging the loads and securing them to the aircraft. The proficiency level in the rigging need not be as high as that of the flight techniques for their delivery, but I do think that the young aviator should have this specific training and then be tested on it. What do you think about aerial radiological survey missions?"

"Well, Sir," began the new lieutenant, "I believe the rad survey is the most difficult mission you've mentioned. The trick of maintaining a constant *absolute* altitude by eyeball contact with the ground over irregular terrain, maintaining a constant indicated airspeed, making good the prescribed ground track, and ensuring that the monitor is continuously coordinated with the progress of the mission—well, that's a tough one. What new aviators need is more flight technique practice, and some of that time should be dual time with an IP. A little dual time with some solo practice, and I think we would be ready for the proficiency test you are shooting for."

Major Jones commented, "If there is ever anything a commander needs to know in a hurry, it's radioactive contamination information. So let's test the aviator and his monitor on their ability to transmit their findings concurrently with the conduct of the mission. With such a communication requirement added to the pilot technique you mentioned, the student in the cockpit has a challenge! But it can be done, and done well. It just takes the training, and some repetition."

Captain Chopper entered the company commander's office and was introduced to Lieutenant Aviator. Major Jones filled in Captain Chopper on Lieutenant Aviator's background, his assignment to the General Support Platoon, and the checkout to be completed. He also gave him a quick verbal sketch of the proficiency test they were discussing.

Major Jones continued, "We just reached the last element of the test: the aerial photography mission. Here's another mission that takes flight practice in addition to ground school. Most of our new officers appear to be familiar with the details of mission planning for the KA-20 and the KA-39 cameras, but to achieve good results we must see a fine blend of mission planning and the flight techniques. If either is slighted, the desired results of this mission will not be within the reach of the student aviator. Again, if the student pilot has had as thorough training in flight techniques as he has had in mission planning, he should be able to complete the tactical mission proficiency test in good style. As a result, he should be fully qualified for nearly immediate employment in a tactical unit. Captain Chopper, what do you think of the test we've described?"

"Sir," Captain Chopper started slowly, "I think you are hitting dead center. Unit training is one thing, but I don't believe we have the capability to train the young officers from scratch, particularly in tactical missions. That should be drilled into the student aviator while he's still in school, in the same manner and with the same thoroughness as, say, the barrier approach is covered. If we could receive new officers capable of satisfactorily completing your test, I think that we could better and more quickly integrate them into our team, appreciate a larger return from their capabilities sooner, and then maintain their proficiency in the missions simply by continuing our annual training cycle."

"Nicely wrapped up, Captain Chopper," said Major Jones. "After Lieutenant Aviator gets settled and you start his checkout of the area, see if you can't find some time to squeeze in some of the flight techniques we've mentioned. That's the most we can do before next week. You can accomplish some more during REFLEX, but the bulk of it will have to come after the operation."

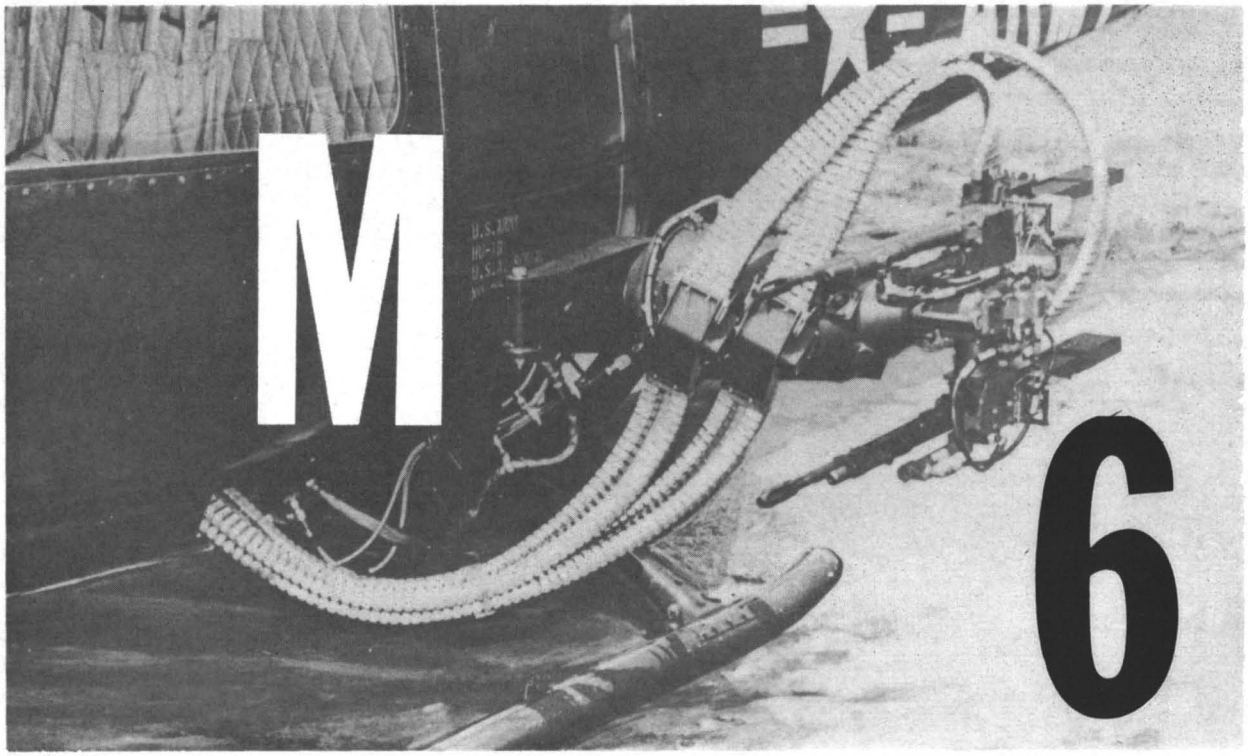
Captain Chopper answered, "Very well. I'd like for Lieutenant Aviator to meet some of the other platoon officers and then I want to give him a cook's tour of the company."

"Fine—go ahead," replied the company commander.

Lieutenant Aviator thanked Major Jones, said that he was glad to be in the company, and left the office with Captain Chopper to learn more about his new team and the part he would have to start playing on it.

After they had gone, Major Jones sat quietly musing this last hour's conversation, "Yes, I believe such a test would really solve most of our problems. I'd like to see it included in future training programs. Then perhaps Army Aviator replacements would fit into their unit assignments more easily. . . ."

This article is not meant as a panacea for all training needs. Nor is it explicit in requirements and standards. The author presents his thoughts toward improving the present product.



Lieutenant John E. Ham, Jr.

ARMY PERSONNEL are one of the most skeptical groups in the world in regard to new ideas and equipment. They seem to accept no new idea as good just because someone says that it is the greatest thing since the helicopter. This is not a particularly bad trait because, in the end, we get a truer picture of our capabilities and the product at hand.

The M-6 machinegun system is in this stage now. Developed by the Emerson Electric Corporation, the system was tested by the Aviation Test Board as the XM-6E3.

The M-6 Armament Subsystem is issued as three separate kits, a weapons kit (C) provided by the U.S. Army Weapons Command and two aircraft kits (A and B) provided by the U. S. Army Aviation and Surface Materiel Command. The weapons kit is issued complete with two gun mount assemblies, four M-60C machineguns, a cylinder charger assembly, and ammunition feed group, armament circuit control panel box, a sighting station, and the shipping kit.

The aircraft A kit includes the external stores support kit and the electrical and hydraulic components furnished as part of the basic helicopter. The aircraft B kit consists of the necessary hydraulic and electrical lines to connect the A and C kits together. The B kit also includes an ammunition box base plate which secures 12 ammunition boxes in position under the UH-1B five-man troop seat.

The most important questions of the pilot or ground commander are: What are the sys-

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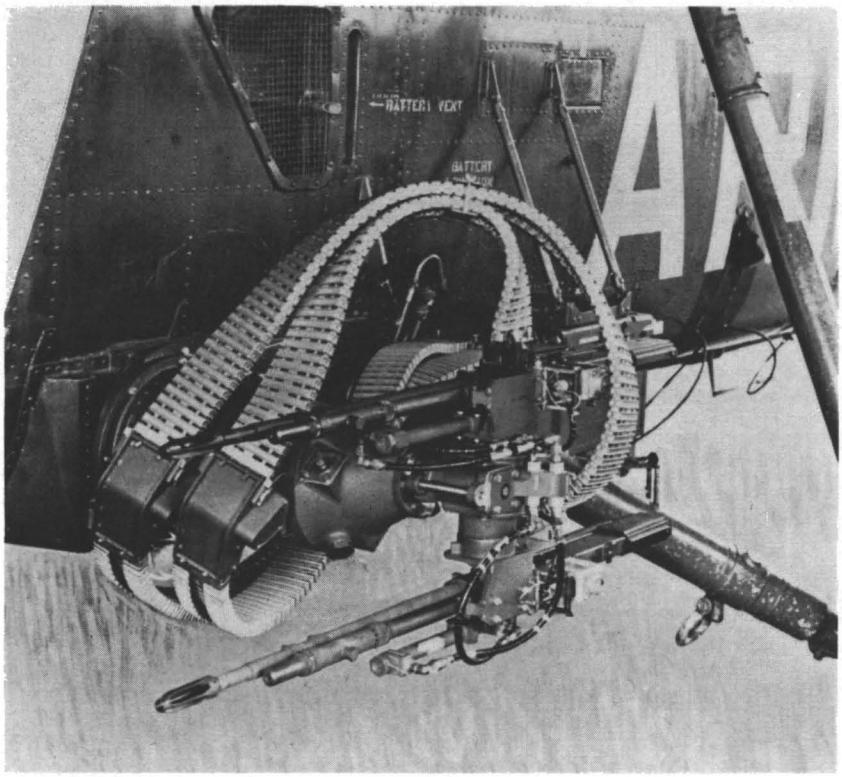
Lt Ham is Asst Section Chief, UH-1 Branch, Dept of Maintenance, USAAVNS, Ft Rucker, Ala.



M-6-1E mounted on CH-34

tem's capabilities, and what can it do for me? Each gun has a cyclic rate of fire of approximately 600 rounds per minute with a maximum range of 3,200 meters. The present practical ammunition load is set at 6,600 rounds. Pilots who have used the system operationally state that this is sufficient for most missions. The guns have a maximum of 12° inboard deflection and 70° outboard and the capability of 15° elevation and a —60° depression. (Elevation and depression limits are expressed with reference to a line drawn perpendicular to the center line of the rotor mast. Limits will vary for different aircraft. On the UH-1B the rotor mast is tilted 6° forward, giving an elevation limit of 9° and a depression limit of 66° with reference to the aircraft level line.)

The positive mechanical stops are set at these limits. An electrically operated fire interrupter switch is set 3/32″ before each inboard mechanical stop, causing the right or left gun to stop firing prior to reaching the stop. This feature prevents ammunition waste and allows the copilot/gunner to control his fire on one point at a time. It also prevents accidental firing into the cockpit and prevents excessive wear on the guns.

If the copilot/gunner desires to take a target on his far left under fire, as the guns swing to the left more than 12°, the right guns will shut off as they hit the stop. This is an excellent feature as the right guns would be useless in taking the target under fire. The copilot/gunner or pilot also has three choices as to gun selection. All guns may be fired simultaneously or the two upper or two lower guns may be fired, depending on the amount of firepower desired.

The system may be fired by either the pilot or copilot/gunner. The copilot/gunner directs the guns by depressing a "deadman" switch on the sighting station. With the "deadman" switch depressed, the gun mounts receive electrical commands from the sighting station and follow the sight orientation within the system's flexible limits. When fire is desired upon selected targets, the copilot/gunner, with the "deadman" switch depressed, presses the firing switch immediately above the "deadman" switch. As long as he has the "deadman" switch depressed, he has complete control of the guns and the pilot cannot fire. When he releases this switch the guns return to a stow position.

With the "deadman" switch released the pilot may fire the guns from the stow position. The pilot has the same choice of guns as the copilot/gunner, but he can only fire with the guns in the stow position. Since the pilot has no sight or cannot move the guns he must be very well schooled in the gun's line of fire from the stow position. He must also have some reference as a guide for sighting when firing. This reference is left to the pilot's discretion. The two most popular methods are making a grease pencil mark on the windshield or using the FM antenna at the nose of the aircraft.

Who is going to maintain this system, and how hard is it to maintain? Present thinking along this line divorces the overworked crewchief from the gun system. His responsibility for maintaining the aircraft remains the same. Each unit that has this system will have authorized school trained armorers who will be trained through the fourth

echelon of maintenance on weapons systems. These armorers' sole responsibility will be maintaining the system.

New courses are being started in the Department of Maintenance, United States Army Aviation School, which will familiarize the crewchief with the M-6 system and the various other weapons systems. Armorers will also be given a brief familiarization on the UH-1B, which will be the basic gun platform. With this system we will have a high degree of skill on both the aircraft and the system, and the workload should not be overpowering on any of the individuals concerned.

The system is relatively simple to maintain. The weakest point has been materiel failure of several of the small moving parts in the gun. This problem has been corrected by several MWOs on the M-60C, one of the easiest weapons to maintain in the Army inventory. The system itself has experienced no major difficulties. It is reliable and the complex parts are replaceable.

The Army will mount new machinegun kits on its armed light observation helicopters in the near future. Plans call for XM-2 kits with 7.62 mm (M-60C NATO) machineguns to replace currently used XM-1E1 kits which mount M-37C .30 caliber machineguns.

All XM-1E1 kits are to be converted to XM-2s as soon as sufficient quantities of the latter become available, according to information received from the U. S. Army Weapons Command, Rock Island, Ill.

The XM-2 kit consists of twin 7.62 mm machinegun armament subsystems designed for use on the E, G, and H models of the OH-13 and on the OH-23D. One machinegun will be mounted on each side of the helicopter and secured to the landing skid cross tubes. The guns are pneumatically charged from nitrogen-filled charging systems on each mount. They are elevated or lowered from the cockpit, are interchangeable and easily installed and removed.

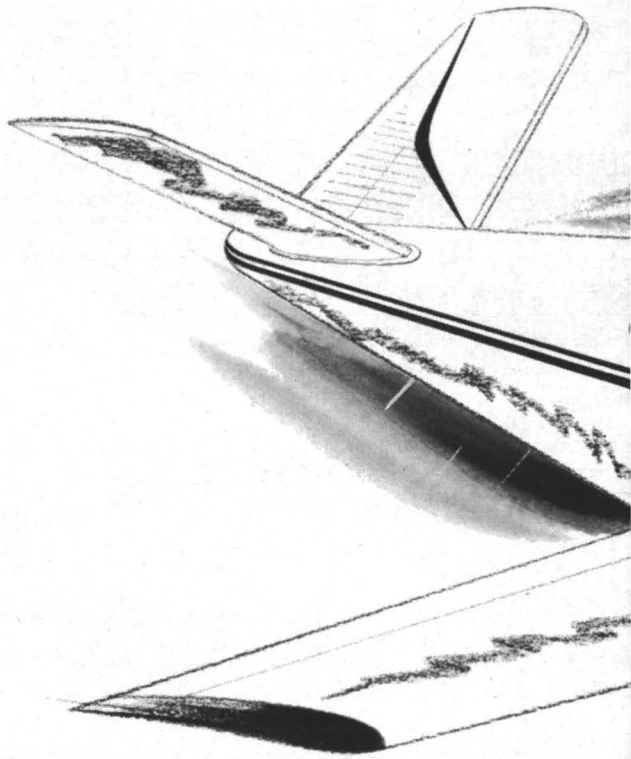
The U. S. Army Aviation School, Fort Rucker, Ala., anticipates revising its subcourse of instruction on the XM-1E1 kit to cover installation and maintenance of the XM-2. Currently OH-13 crewchiefs who are graduates of the 675.1 Single Rotor Observation Helicopter Maintenance Course are qualified to service and maintain XM-1E1 armament equipment for the Sioux.

With experienced crews this weapon is deadly to enemy ground troops with its high rate of fire which can place 30+ rounds per second in a small area. I'll admit that I was a bit skeptical the first time I heard about the M-6, but after being around the system for awhile I have become a believer.

CH-47 Sets R/W Ferry Flight Record

An Army CH-47A helicopter lands at Fort Greeley, Alaska, after completing a record ferry flight of about 4,500 miles (3,900 nautical miles) from Morton, Pa. The Chinook completed the flight in 33 hours and 50 minutes elapsed flying time.

I'll Take The Train



A NUMBER OF years ago, I was chief pilot of a civilian fixed base operation in Ohio. We were engaged in the usual type operation of flight instruction and charter flying. For charter we were using the Beechcraft Bonanza, a sleek 4-place aircraft. I had 600 hours in the Bonanza, a total of 3,000 hours, and an instrument rating.

My schedule called for a trip to Pittsburgh, Pa., to pick up a paying passenger at 10:30 a.m. and bring him back to Ohio. I discussed the flight with our general manager, who was an experienced aircraft and engine mechanic—and my boss. He also held a private pilot certificate and had 600 hours flying time. But he only had 20 in the Beechcraft and no instrument rating. He decided to go along for the ride. At 9:00 a.m. we departed, with the boss at the controls.

Our Beechcraft did not have dual controls, but the wheel could be moved from pilot's to copilot's side by pulling a release on the pilot's control column, and it had dual rudder pedals.

The weather was beautiful with a few puffy cumulus at 3,000 feet. I tuned in our low frequency radio and caught the scheduled weather broadcast at 0915. Pittsburgh weather was 2,000 feet with smoke and haze. Nothing unusual about this for Pittsburgh.

The aircraft was functioning fine and we were enjoying the flight. As we approached the Pennsylvania line, the ceiling lowered to approximately 1,200

This article was prepared by a member of the Communicative Skills Class, Army Aviation Safety Course, University of Southern California.

feet and became solid. Visibility also lowered to about 3 miles. Underneath, we could see signs of small rainshowers beginning to form.

I turned the radio to Pittsburgh frequency. At 0945, the weather was 1,500 feet, visibility 3 miles in smoke and haze. As we approached the small town of Toronto, Ohio, I suggested to the boss that we land and catch another weather sequence so I could decide if we would have to file an instrument flight plan. Interested in paying passengers, he objected slightly but added he could use the landing experience on a small field such as Toronto.

After landing, we taxied to an old wooden hangar and shut the engine down, only to find the office locked (I had planned to call the weather station by phone). I told the boss I would catch the 1015 weather on our radio to determine if we'd file an instrument flight plan.

He countered that this could cause a delay and we might keep our passenger waiting. I explained that it would be safer to check the next sequence and file if necessary, even though Toronto was only 40 miles from our destination.

The 1015 sequence gave the weather at Pittsburgh as 1,000 feet, visibility 3, smoke and haze. My boss was champing at the bit to get underway so we would not keep our paying client waiting too long. He also asked if I couldn't get a controlled VFR clearance in the event the weather came down as we approached Pittsburgh. I advised him I had used this clearance before, but in a busy area such as this, we might not be able to obtain one. I also told him it would be safer to file an instru-

ment flight plan after we became airborne and, even though we might have to hold, it would ensure us an altitude and keep us from violating any regulations.

He said, "O.K., but let's get going! It looks good to me here, and we are only 40 miles from the airport." As we entered the aircraft, he asked me if he could continue to fly and let me work the radio and computer in case we had to file an instrument flight plan. Reluctantly, I agreed and we started the aircraft, checked it out, and took off.

As we reached an altitude of 1,000 feet indicated, we were just under the clouds. He leveled off and I took the microphone so I could file an IFR flight plan, if it proved necessary.

When we were approximately 20 miles from the airport, I contacted Pittsburgh radio and asked for their present weather. With a low frequency radio, noted for static conditions in bad weather, I had difficulty in receiving clearly. I noticed a few light raindrops now and felt this accounted for the poor reception. I asked for a repeat and he gave 1,000 feet estimated, and 3 miles visibility, smoke and haze.

Again I contacted Pittsburgh radio and advised we were just under 1,000 feet and asked for a controlled VFR clearance. We were given the clearance and let down to 800 feet, heading toward the airport. I told the boss that the field elevation was 1,252 and we would have to watch our altitude because of the Allegheny mountains. He acknowledged and set the altimeter with the setting Pittsburgh had just issued. I gave him the range heading to fly and advised him I was going to tie up the range leg so we would hit the range station just east of the field.

He said, "I don't see why we have to, but we are late now, so I guess a few more minutes won't hurt."

As we continued, he dropped down another 100 feet. We were then 700 feet above the ground. I noticed the visibility didn't look quite like 3 miles, but made no comment (Pittsburgh smoke and haze). A few minutes passed. The range leg narrowed and we passed the station. I looked for the airport and didn't see it.

The boss asked, "When are we going to get there?"

I told him to turn to the reciprocal heading and we would see the field when we hit the station again. As he started the turn, he applied too much back pressure and we went into a cloud fringe. He abruptly lowered the nose. I cautioned him to go easy. At this moment, Pittsburgh radio called and asked for my position. I said we were almost over the radio station. He came back immediately, advising he had an airliner coming in from the west in 3 minutes and to please expedite.

I acknowledged and told the boss to slow down and we would lower the gear to start our letdown as soon as he hit the range station. Suddenly, we passed the station and I told him to proceed and we would see the field shortly, even in the smoke and haze. We continued and he slowed the aircraft slightly, but did not lower the gear.

"Where is the field?" he mumbled.

Pittsburgh radio called again and I told them I didn't have the field in sight, but that I had just passed the range station on a westerly heading. He came back immediately and said he was holding the airliner west until we hit our downwind leg. He also asked my heading and asked if I was sure of my position.

Before I answered, I told the boss to turn 180° again, as we should have seen the field by then. He started the turn, applied too much back pressure, went into a solid cloud bank, and allowed the bank to steepen.

I yelled, "Take it easy!" At this point, everything went able sugar.

We were in a graveyard spiral, airspeed building, and only 700 feet off the deck! I saw my life go by. Everything! At this point, he released the wheel—literally threw it over to my side and yelled, "You got it!" How he completed this, I'll never know. But I got the wheel, stomped the rudder, leveled the wings, and pulled out at approximately 300 feet above the terrain. Pittsburgh radio was screaming, "Beech 57 Victor, where are you."

I continued on an easterly heading.

We were both badly shaken and damp with perspiration. I still hadn't answered Pittsburgh radio.

As we passed over a golf course, my boss said, "Put the damn thing down there."

I said, "No, we'll try and find a small grass field to the east that I've been in before."

I finally answered Pittsburgh radio, advising I would call them on the telephone as soon as we landed. I located the field, remembered to lower the gear, and landed. As we rolled to a stop by the gas island, neither of us could muster the strength to climb out of the aircraft. When I was finally able to open the door, knees still shaking, and climbed to the ground, I looked at the boss and he was as white as I must have been.

He climbed out, all thoughts of the paying passenger gone, and said, "I'll take the train home!"

MANY AIR TRAFFIC controllers and instrument instructors secretly wish the world would suddenly run out of tetanus serum and half of their aviator acquaintances would get lockjaw.

This would provide a drastic but effective countermeasure to the waves of garrulity they feel engulfing them.

The time of the two-pound tongue, tough and resilient from constant exercise, is upon us. And what better place to exercise it than the cockpit of an aircraft, immune from a silencing clout on the headbone.

Flight is uplifting (no pun intended); makes an aviator feel good, productive. Throw in a radio transmitter and he's in Blissville. "They're down there; we're up here—conversation's what we need!" Grab that mike. Talk to anyone.

The unnecessary or misdirected radio transmissions cluttering the ozone are increasing daily. This is a vexing problem for air traffic control people, particularly with the recent increase in military IFR operations.

And who are the culprits with the triphammer tongues? Are our fuzz-faced fledglings, making their initial gropings along the airways, to blame? No! Some recent flight school graduates may stutter, stammer, or be stricken dumb when they bang that mike button. But with the lessons of training still in mind, a tendency to soliloquize on the radio is not among their faults.

Larry Larynx and his buddy Pete Prattle, with their fair weather instrument tickets and years of boring holes, are the rascals who bend the ears of all within range. Recently, an Army Aviator with eight years of experience was overflying a large midwestern terminal, VFR at 6,500. He reasoned that it would be nice to let approach control know he was in the area. The ensuing discourse would have made Castro envious. His oratory was timed at a flat 2 minutes and 15 seconds.

Another aviator, rated four years, was "lectured" by FAA because he insisted on giving en route position reports to airport control towers.

Read the ATC portion of the Jepp? "Not since I ripped my knickers, pal. I learned how to use the radio years ago!"

Fortunately, troops of this type are in the minority.

Regulations and manuals cannot cover every conceivable aspect of radio-telephone procedures. Opinions often vary over what is "correct" in a given situation. But the following two articles urge knowledge of the directives available and a common sense approach to radio transmissions. Know what you're going to say and say it briefly.

Talking Too Much

Captain Russell F. Pool

HOW OFTEN HAVE you waited patiently for some overly enthusiastic pilot to give a long winded position report?

Today's congested airspace and even more congested frequencies require that we limit our communication procedure to a minimum. Many times these verbose reports or requests give much unnecessary information and omit the essential.

Capt Pool is assigned to the Multiengine Division, Dept of Advanced Fixed Wing Training, USAAVNS.

Direct Communications

CONTROLLERS / PILOTS

Captain Linus Fiely

HOW DO YOU initiate contact with an ATC facility at a noncompulsory reporting point? What constitutes a mandatory reporting point? Is it necessary to vary the radio contact procedures depending on the type of ATC facility being contacted?

These are just a few of the usual questions

Capt Fiely was an instructor in the Dept of Advanced Fixed Wing Training, USAAVNS, when he wrote this article. He is now attending his advanced course at Fort Sill.

TALKING TOO MUCH

Ground Control is one frequency that really gets crowded at busy airports. In fact, at many busy terminals a different frequency is used for clearance delivery in an attempt to alleviate the frequency congestion.

Now what is required in a taxi request? Nothing more than aircraft identification, location, type of operation, and the point of first intended landing. Example: "Cairns Ground Control, Army 76160, ramp 13, ready to taxi; instrument flight, New Orleans; over."

We already know that the callup probably will be heard without difficulty. The message may be transmitted following the callup (Cairns Ground Control, this is Army, etc.) without waiting for a reply or invitation to go ahead. Also, after contact has been established with an ATC facility, communication may be continued without further callup.

In answer to the previous callup, Ground Control will give the runway, wind, altimeter, time, and any other pertinent information. This reply should be acknowledged with a "roger" but no readback. If you miss some portion, such as the time, ask for a repeat of that item, but be concise.

A short time later Ground Control issues us our ATC clearance, which we read back verbatim. He acknowledges our readback and instructs us to contact the tower for departure. Again be concise and to the point. Example: "Cairns Tower, Army 76160, ready for takeoff; IFR New Orleans; over."

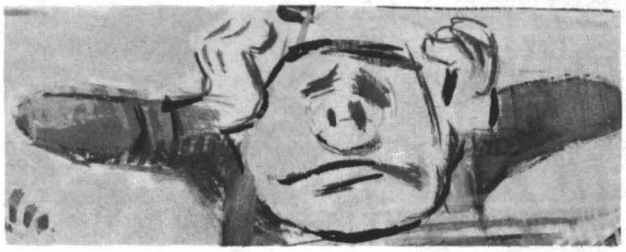
We acknowledge takeoff and climbout instructions and receive radar vector on-course. After contacting Jacksonville Center over the Hartford Intersection, you are told to contact New Orleans Center at time 1937. At 1937 you contact New Orleans as follows: "New Orleans Center, Army 76160, estimating Crestview at 50, 6,000; over." New Orleans will acknowledge and issue appropriate control instructions. Always give your altitude; it prevents Center having to call you to verify it.

Now passing the Crestview VOR, a compulsory reporting point, and remembering that initial contact has been established, your report can be: "New Orleans Center, Army 76160, Crestview 51, 6,000, Pensacola 16, Brookley; over." Of course the argument may arise that you may have to repeat the report occasionally because the controller was talking on another VHF or UHF frequency. (See accompanying article.) To avoid

DIRECT COMMUNICATIONS

asked when aviators hash over ATC procedures. A casual observer overhearing such a conversation and listening to the wide range of answers and personal opinions would probably assume that no official radio communications guide is available. This is not the case. All Army Aviators have at their disposal navigational publications such as the *Airman's Guide, Flight Information Manual,* and *Jeppesen Manual.* These reference manuals list the standard communication procedures and techniques which should be used by all pilots.

Transfer of control on IFR flights is an area of pilot controller communications which has given Army Aviators particular trouble. Standard phrases and terminology have been adopted to eliminate confusion and cut down on the number



of necessary radio transmissions, thus allowing smooth handling of IFR air traffic.

How can a pilot on an IFR flight determine where he must render a full position report? This question must be answered before any discussion on initial contact procedures used in transfer of control. Compulsory reporting points may be defined as follows:

shaded-in triangles on published airway routes which are not marked with a bypass symbol;

fixes used to describe a direct flight;[1]

airway fixes specifically requested by ATC;[2]

a clearance limit which is in effect.[3]

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[1] A direct flight is defined as a flight off published airways. A direct flight may begin at, terminate at, and cross the published airway routes.

[2] A typical example of the phraseology used by a controller which would make a fix a mandatory reporting point would be "Army 12345, report Eufaula to Columbus Approach Control on 360.8 mc; over."

[3] When a clearance limit, which is otherwise a noncompulsory reporting point, is eliminated by an amended clearance, it is no longer a reporting point.

TALKING TOO MUCH

this, monitor your frequency and remember that Center will transmit on both the primary UHF and VHF frequencies they monitor. So if you hear a controller giving a clearance on another frequency (VHF), wait until the pilot has had time to acknowledge his clearance before giving your report.

The transferring of control procedures outlined can be used between centers, sectors within a center, or between center and approach control. Remember that air traffic control *facility* means any facility providing air traffic control service, such as a center, tower, or approach control.

When contacting a Flight Service Station (FSS), the phraseology should also be short and to the point. After the initial call, cut down your number to the last three digits, omit such superfluous words as the complete name of the facility,

this is, at, roger, out, etc. Remember that after contact has been established, it may be continued without further callups.

Too often a student is told to always read back all clearances and instructions. This is poor procedure and does not prove a thing. Contacts should be kept as brief as possible. You are required to read back only when requested. Often it is good practice to read back clearances that are preceded with "ATC clears." When a clearance is preceded with "ATC clears," it is not being delivered by the originator. Although the person passing it on (usually Ground Control or a FSS) may neglect to request a readback at the end of the clearance, he will want a readback to satisfy his requirements. Otherwise the clearance can be rogered if understood.

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DIRECT COMMUNICATIONS

When transfer of control of an IFR aircraft is to take place, the transferring controller will instruct the pilot as follows: (aircraft identification), CONTACT (facility name) ON (frequency) AT (time or point). NOTE: The ATC facility with which the pilot is to make contact will normally be an Air Route Traffic Control Center or an Approach Control; however, it may be an FAA en route radio serving in a relay capacity.

Examples:

"Army 12345, contact Atlanta Center on 353.9 mc, now; over."

"Army 12345, contact Montgomery Approach Control on 307.8 mc at 45; over."

"Army 12345, contact Jacksonville Center on 353.5 mc at Dothan; over."

When contact is to be made at a specified time or at a *noncompulsory* reporting point, the pilot will wait until the specified time or point, change to the appropriate frequency, and make the following initial contact. "(Name of facility), THIS IS (aircraft identification), ESTIMATING (next reporting point) (time) AT (altitude/flight level); OVER," or "(name of facility), THIS IS (aircraft identification), ESTIMATING (next reporting point) (time) AT (altitude/flight level), CLIMBING DESCENDING TO (altitude/flight level); OVER."

Examples:

"Jacksonville Center, Army 12345, estimating Tallahassee 39, at 7,000; over."

"Cairns Departure Control, this is Army 12345, estimating Crestview 1420Z, 3,300, climbing to 6,000; over."

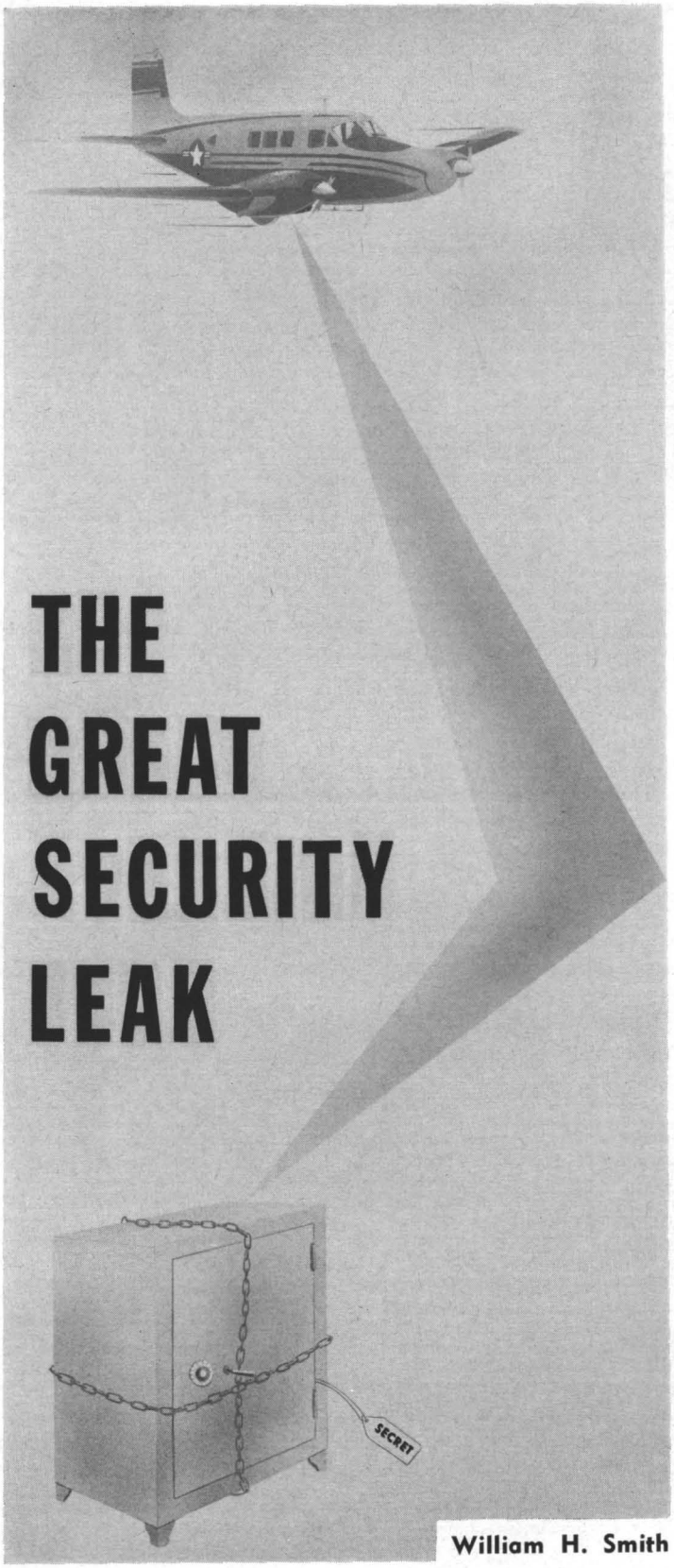
In using this type of initial contact, realize that no position report is desired by the air traffic controller. The controller merely wishes to establish radio contact, verify altitude, and get the pilot's estimate to the next reporting point. Therefore the pilot will normally receive a "roger" on the initial contact.

If initial contact is to be made over a *mandatory reporting point,* the following technique is used by the pilot to alert the controller that a position report is forthcoming: "(name of facility), THIS IS (aircraft identification) (position); OVER."

Examples:

"New Orleans Center, Army 12345, Crestview; over."

Continued on page 28



THE GREAT SECURITY LEAK

William H. Smith

Midville, Tenn., 25 September. A check of the Midville Municipal airport reveals that 27 private airplanes have arrived as of two o'clock this afternoon, carrying over a hundred persons to attend the 40th Annual Midville Chicken Festival. Fourteen additional aircraft are expected before the festival begins tomorrow.

In addition to the 27 private airplanes, one U. S. Army U-8F Seminole arrived, refueled, and left 20 minutes later. While the sleek military airplane was being fueled, Capt J. B. Goods the pilot, was asked by a reporter of the Midville Times if he intended to stay over for the festival.

At first Captain Goods seemed interested in staying but said, "Well wait, let me check."

Followed by the reporter, he climbed into his aircraft and looked into the cockpit at a small box-like object hanging there. Shaking his head he said, "Better not. There's some bad weather coming this way and the festival will probably be rained out. I really should get back to my unit today anyway."

He was reminded by the Times reporter that Midville had been celebrating its Chicken Festival for 39 years and during this time it had not rained even once. "And besides," the reporter said, "there is not a cloud in the sky today."

Nonetheless, Captain Goods insisted that it would rain during the festival and left a few minutes later.

Among the prominent visitors to arrive at the field is Mr. . . .

* * *

Midville, Tenn., 26 September. Three inches of water fell on this little Tennessee town today, completely raining out the 40th Annual Midville Chicken Festival. This is the first time since the festival began 39 years ago that it has rained.

The surprise storm hit 15 minutes before the kick-off of the festival. It caused flooding of eight basements, undetermined damage to several roofs, and uprooting of numerous trees. Twelve of the 38 aircraft on the ground at the municipal airport were damaged by high winds. Three other aircraft flying to the festival escaped the storm by diverting to airfields out of the storm path.

An Army U-8F Seminole airplane arrived yesterday but took off after only 20 minutes. The pilot of the twin-engine aircraft had declined to stay after he had checked some sort of forecasting machine in his airplane and announced that there would be very bad weather in the area. This machine apparently gave the Army pilot information not available to others.

In view of the fact that it had not rained in 39 years on Chicken Festival day, the reporter who interviewed the pilot discounted his word. Fifteen minutes before the festival was to begin, the full impact of what the pilot had said was understood. Three inches of rain, accompanied by heavy winds, drenched the area.

Considerable damage. . . .

* * *

IT'S A FACT

By JOHN SNEEKUM

It's still an official secret, but man is on the threshold of solving one of his greatest problems —accurate, instant weather prediction.

The secret has been so closely guarded that your columnist did not know that research was being conducted in this field until recently. The day before the famous Midville Chicken Festival, an aviator flew a U-8F Seminole into Midville (Tenn.) Municipal airport. On board his plane was a small box containing a "Weather Forecasting Machine." When asked by a local newspaper reporter to stay over for the festival, the pilot checked with the box and promptly announced that a storm would hit the area the next day.

In view of the fact that it had not rained in 39 years on Chicken Festival day, the reporter did not pay much attention to the pilot's remark. Fifteen minutes before the festival was to start, the significance of what the aviator had said was forcibly brought home to the reporter. A deluge accompanied by heavy winds hit the area. The reporter then realized that he had stumbled onto an official secret.

Considerable damage. . . .

* * *

Moscow, 28 September. (CP) —After a period of comparative calm, Bravda today lashed out at the United States for having perfected a machine for accurate, pinpoint weather prediction. The official Communist newspaper called the United States an imperialist warmongering nation that would use this discovery to enslave the peoples of the world.

The story was based upon an incident that occurred in Midville, Tenn., when a military aviator let slip the secret of pinpoint weather. . . .

* * *

Washington, 29 September. (CP)—Senator Walter B. Heeler (D., Tenn.) announced today that he had sent a letter to the Secretary of Defense asking for immediate information regarding the controversial weather security leak.

Senator Heeler said that the secret was so closely guarded that even Congress did not know that the Defense Department was conducting research along this line. He said that he also wanted to know why the Defense Department was spending money for this type research without permission of the Congress.

Another senator, a Republican, said that he too wanted to. . . .

* * *

The Honorable Walter B. Heeler
United States Senate
Washington 25, D. C.

Sir:

I was as mystified as you were when I first heard that an accurate weather prediction machine had been perfected. I was not aware that such research was being conducted.

Consequently, I ordered an immediate investigation into the matter and have found that nothing of the kind has been going on. No one in the defense establishment has conducted research with pinpoint weather prediction machines; nor has a method of instant weather prediction been perfected.

To further clarify the matter, I personally interviewed Capt J. B. Goods, the U. S. Army Aviator who supposedly leaked the secret. Captain Goods is not and has not at any time in the past been connected with such research. Nor has he ever been in a position where he would know about such research.

When asked how he knew a storm would be in Midville the next day, he said that when flying he paid close attention to the Weather Bureau's station forecasts, which he always wrote down on his kneepad. At Midville he hung his kneepad on the airplane yoke and got out to supervise the refueling. When asked by the Midville Times reporter to stay over, he had climbed into the aircraft to look at his notes and confirmed that a front was moving into the area and was expected to bring rain and heavy winds the next day.

The kneepad used by the Army looks very much like a shallow metal box with a face

on the front. It is easy to see how the reporter confused it with some sort of instrument.

The Army aviator was simply doing what all good pilots should do—know the weather, plan the flight, fly the plan.

As Secretary of Defense I know our needs for good aviators and I have asked the Army to assign Captain Goods as. . . .

*** * ***

TALKING TOO MUCH

Continued from page 25

Example: (again on our flight from Cairns AAF to New Orleans) you have been cleared to the Dog Intersection, via Victor 20. After you make your position report over the Brookley VOR, New Orleans Center acknowledges, gives you the current altimeter, and states, "Cleared to the New Orleans VORTAC, via Victor 20, New Orleans; maintain 6,000; over." This clearance is the same as the flight planned route, contains no change of altitude or clearance limit, and need not be read back. It only has to be acknowledged it is understood.

Radar, which now covers a large sector of our airways, has cut down on a large number of reports formerly required in congested areas. Generally, in Army aircraft without transponder equipment, radar identification is established over an intersection inbound, and the report should be made right over the intersection. Positive contact can then be made without the requirement for an identifying turn. Once radar contact and radar vectoring is begun, only heading or altitude changes need be read back. All other information can be rogered.

Information now available from the FAA, Systems Research & Development Service, in a booklet titled "Design for the National Airspace Utilization System," dated September 1963, is that in the future voice position reports will not be required on an IFR flight. A ground data processing subsystem will obtain three-dimensional position information from the radar beacon subsystem. In the initial clearance each aircraft will be assigned a transponder code assignment and will be observed throughout the flight.

But that's for the future—right now let's do the best with what we've got. Give everyone a break; keep your transmissions short and to the point. Remember, those frequencies are crowded—and talking too much disrupts everybody's communications.

DIRECT COMMUNICATIONS

Continued from page 25

"Columbus Approach Control, Army 12345, Columbus; over."

In the examples above, the controller will acknowledge the initial contact and instruct the pilot to "go ahead" with his full position report. Or the controller might simply acknowledge: "Radar Contact."

Transfer of control of an IFR aircraft from one ATC facility to another is normally accomplished with very little difficulty. However, if a pilot finds that he is unable to establish contact with the new controller on the assigned frequency, he should use the following plan. First attempt to reestablish contact with the transferring controller; tell him of the situation and request alternate instructions. If the pilot is unable to contact the previous controller, he should attempt to contact the nearest FAA en route radio on 272.7 mc. As a third choice, the pilot should attempt to contact the nearest FAA en route radio on 255.4 mc.

Must a pilot always reestablish contact with a controller, using the callup and reply method, when transmitting subsequent messages to the same controller on the same frequency? The answer to this question may be found on page 61 of the *Flight Information Manual:* "When a message is short or when it is probable that the callup will be heard without difficulty, the message may be transmitted following the callup without waiting for a reply or invitation to go ahead." We can see that the pilot is the judge in the situation; therefore no hard and fast rule can be made. After initial contact has been made with a controller, the pilot must decide whether or not he will make a callup and wait for a reply before transmitting messages such as position reports.

Army Aviators have earned the respect of Air Traffic Controllers the world over with their knowledge and diligent application of good radio communication techniques. Each aviator has a personal responsibility to maintain and improve upon this high standard. This can be accomplished, if all Army Aviators will stay abreast of the current procedures through study and application on actual flights.

WALK

away from that forced landing

Captain Gary V. Dennison

INSTANT FAILURE of an aircraft engine is a rare occurrence. Aside from ignition failure, it is usually the result of fuel starvation. Even though rare, the inability to keep a single engine aircraft in flight is a constant source of worry to the aviator (as it should be). For that reason, forced landing techniques are stressed even during the first ride in an aircraft.

Actually no set rules exist for what the pilot should do after the cockpit procedure has been completed. Of course obvious physical hazards such as powerlines, gullies, buildings and the like are discussed, but skill level and just plain experience are still the crucial factors in completing a successful forced landing.

The brain is many times more complicated than the most intricate computer, but, alas, entirely susceptible to what is called human error. For this reason the pilot must constantly review that information vital to his safety.

Capt Dennison wrote this article while attending the Infantry Officer Career Course, Ft Benning, Ga.

He must be suspect of smooth, wide roads and superhighways when fields and pastures are available. It is much more flattering to the ego to taxi your U-6A down the road into the nearest filling station and say, "Fill her up" than it is to stand ankle deep in a muddy field staring at an aircraft which just happens to be somewhat of a mess. But it is also much more dangerous. A damaged plane and a few scratches are still preferable to a burning heap of men and metal caused by striking unseen powerlines.

When choosing the best of several landing areas the right choice must be made, it must be made quickly, and except in unusual circumstances the choice must be final. However, the "best"—in this case the smoothest—isn't necessarily the correct choice.

For example, the aviator has a choice of two pastures. One is small and appears to have an excellent landing surface, while the other, though much larger, has several dips and rises which could make a good landing difficult. Which one will it be? Obviously it is the pilot's choice, and in a few seconds he must decide which field. This decision will be based upon obstacles, wind, etc., but, most importantly, upon the amount of possible error he might make in trying for his touchdown point. Therefore, the choice could logically be the larger field with rougher terrain.

If the landing area is cultivated, the pilot should land the aircraft with the furrows. The wings should be level, or parallel with the terrain if it is a slope landing. It is better to drive neatly between two trees than it it to strike them one at a time in a cartwheeling fashion.

Light aircraft are no more stressed for cartwheel crashes than humans are stressed for vertical decelerations.

Restarts are always possible if there is time, but in most cases they must be forgotten at 400-600 feet above the ground. There is too much else to do. Familiarity with emergency procedures, knowing best glide angles, practicing only over good area, and an always present knowledge of the wind will increase the chance of a successful forced landing.

a by-product of

LOOKING BACK on Slim's flight, it's easy to pick out his unsafe acts. He was tired and hungry. He hadn't slept for 36 hours, and had eaten only one and a half sandwiches during this time. Yet, Slim did have a few things working for him. During his five years flying experience, he had logged nearly 2,000 hours first pilot time and 500 hours in the type of aircraft he was flying that day. He was first in his class when he graduated from the Army flight program three years earlier. His university studies in engineering at Wisconsin and two years civilian flying experience gave him an edge over most of the other flight school students. Most of all, Slim loved aircraft. He was just one of those rare birds born to fly.

You may recall his mid-air collision that won him membership to the Caterpillar Club. It was during a simulated strafing run with Lieutenant McAllister as wing man. After pulling out of a dive, he kicked rudder for a chandelle-like maneuver and found himself practically in McAllister's lap. It was too late to recover; their wings collided and locked. The aircraft began a spiralling flutter to the ground. Slim forced his way out of the cockpit, freefell until clear of the wreckage, then popped his chute. He and McAllister were still 2,000 feet above the ground when the planes crashed.

Slim's talent for getting out of tight spots was surpassed only by his ability for getting into them. It's almost unbelievable to imagine a whip-stall at 1,200 feet, IFR, by a 3/3 pilot, in an aircraft not equipped for instrument flight—a flight that was not filed with FAA. But that was Slim. Then there was that landing he made one dark night, in an unlit and unfamiliar pasture, without landing lights. But not a scratch on the aircraft. You might say that Slim was an accident searching for the right location; but there are those who prefer the more optimistic perspective that dangerous acts, which don't lead to an early grave, often leave lasting impressions. In later years, through more mature eyes, these become invaluable experiences. Call them the by-products of hazards, if you will.

Such was Slim's past as he readied his craft for takeoff that day. Engine warmup was accomplished with the power check indicating 30 rpm low. And taking off to the east meant clearing the telephone wires at the far end of the strip—a muddy strip that would slow his takeoff roll. He hadn't bothered to complete a DD Form F. But in his own inimitable way, he had mentally computed his weight and balance. Now, as he taxied into position, he considered all the factors: overgross weight, light tailwind, muddy runway, 30 rpm low, and wires at the end of the strip.

Easing the throttle forward, the aircraft gained speed slowly. A thousand feet of the clay runway already lay behind him, and still there was no characteristic stiffening of the controls. Another 500 feet rolled by. The controls tightened; the engine strained. The tail finally lifted and, with each second, the earth rushed by more swiftly. At last, at long last, he was off. He cleared the wires by 20 feet and throttled back for the climb.

As the minutes drifted by, he marveled at the beauty of flying. In the time it would take a man to walk a mile, he would cross Rhode Island. As his eyes scanned the tree-studded coun-

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Capt Hart wrote this article as a student in the Communicative Skills Class, Army Aviation Safety Course, University of Southern California.

HAZARD

Captain Rufus R. Hart

tryside below, he automatically found himself picking out likely spots in the event of a forced landing. A survival kit lay behind his seat. In the kit were five cans of Army emergency rations, a hunting knife, cord, string, a large needle, flashlight, one hacksaw blade, and matches in a waterproof container. Since he anticipated an overwater flight, four red flares sealed in rubber tubes and a liferaft with pump and repair kit had been placed in the fuselage compartment.

Slim had not filed an IFR flight plan. This was understandable considering he did not possess an instrument ticket. Nor was the aircraft, by Army standards, equipped for instrument flight. No deicing equipment was aboard; and the instrumentation consisted of an altimeter, airspeed indicator, magnetic compass, needle and ball, and an artificial horizon along with the various engine instruments. Not enough for serious IFR work.

As the last trace of daylight left the sky, Slim could see the cumulus formations beginning to build up on the horizon. In daylight, picking your way through these towering clouds posed no particular problem. But on a dark night like this, you could be in one before you knew it. Slim added 100 rpm and pointed the nose upward. The stratus haze, barely visible, began to grow under him as he climbed. At 10,000 feet, he leveled his wings. The ocean below gave no reference of light and the only horizon was the comforting glimpse of an occasional star.

The weather forecast had been for clear skies, but this now 24-hour old weather briefing had not been rechecked. It was Slim's opinion that any professional aviator who didn't stand ready to test his skill against the elements had chosen the wrong profession. Slim was ready. Somehow he had packed a great deal of experience and skill into his 2,000 hours—more than most people do in 4,000.

It wasn't long before Slim's vision was restricted to the cockpit as he felt the first telltale bump of a turbulent thundercloud. After that it was needle and ball—bump—airspeed, altimeter—bump—bump, compass—bump . . . and suddenly the cables on the express elevator were cut. There was sweat inside the cockpit, but ice on the wings. It was building up fast at 10,000 feet. Should he go up? Down? The airspeed indicator showed 80 mph. Should he lower the nose? Or was the pitot tube icing up? His compass swinging wildly, Slim put the aircraft in a slight descending bank to the right. He held his turn for an estimated 180°. It seemed like an eternity.

He thought back to the day he had climbed to 14,000 feet while working on basic maneuvers. That had been a beautiful day. And he remembered the compulsion to do something worthy of it. Fifty turns in a power spin seemed appropriate for that moment. Now he was fighting for his life to avoid such a spin. Suddenly, the turbulence stopped and a star peeked at him from his left. He flew south for a while, then turned back on course. Somehow, he picked his way past the next cumulus formation, and the next, until he was clear of the squall line. The air was warmer now. As the compass slowed to a few gentle oscillations, Slim settled back to the business of flying. He computed heading, wind direction and velocity. A 20-knot tailwind left him with ample fuel. His computations indicated destination at 2200 hours.

The lights of the city cast a welcoming glow in the sky as he checked ground references for orientation. He picked out, to

the north, what he felt to be his field, but his fatigue was great and he could not be certain. There was no revolving beacon, no boundary lights. He made a low pass over the field and caught sight of the windsock. He estimated a 10-knot wind and noted the flood lights on the approach end of the field. He angled off to set up his downwind pattern. He was still uncertain as he turned final and began descent. His flight nearly over, he slowed to approach speed.

Was the primary unsafe act yet to happen? Or was it already listed in the dozens of times he had beaten back death with skill? With hope, born of courage and determination, Charles (Slim) Lindbergh eased back on the stick. The wheels of the *Spirit of St. Louis* groped for the ground. Thirty-three hours after takeoff, he settled on the Paris runway . . . and was lifted to fame.

Lindbergh, Charles A. *The Spirit of St. Louis*. pp. 181-492. Charles Scribner's Sons, New York, 1953.

A CHECK IN TIME

ON TAKEOFF the pilot of a light-twin detected "an unusual vibration or sound," he wasn't sure which, just prior to rotation. He aborted the takeoff and turned off the runway for further runup. During the full-power engine check, he discovered the static rpm on the right engine was 400 low. Suspecting a prop or prop governor failure, he taxied back to the line. Much to his surprise he was met by an excited line crew pointing fire extinguishers at the aircraft's right nacelle which by now was emitting a great cloud of smoke. The engine was quickly shut down, but since no flames were visible foam did not have to be used.

Upon inspection, the generator was found to be completely gutted, and all that remained in the case was the shaft and a handful of shredded wire-like material. The armature had completely disintegrated, and the case had broken an inch from the flange and rotated a full quarter of a turn. Evidently the rear bearing had failed and allowed the armature to contact the side of the case. The shaft had not sheared, as it had been designed to do, with the result that during runup this heavy friction had drained off enough horsepower to reduce the rpm by 400.

Had the pilot continued his takeoff, he would have been in trouble. A serious emergency could not have been avoided. The moral here is that all changes in sound, feel of the controls or vibration level should be investigated even though instruments indicate normal operation.

—*Flight Safety Foundation Bulletin.*

FAMILIARITY BREEDS...

ON A RECENT trip to Fort Rucker, Alabama, I noticed something new had been added—a sign in front of the operations building at Cairns Field. It was large enough to see from some distance away, and its message was stark, emphatic. It had been some years since I had last traveled to Cairns, and the sign was new to me. But it reminded me, quite vividly, of a lesson I relearned almost four years earlier.

It was spring several years ago that I arrived in Korea on my first overseas tour. And I was welcomed with the words, "If I had as long a time in front of me as you have, I'd shoot myself." Still pondering the wisdom of these words, I inquired about my assignment. My hopes of staying in the "Magic City" of Seoul were dashed as I heard that I was to travel to a remote detachment to replace the one-man aviation section.

This detachment nestles against a small hill in the Chun Chon Valley, east-southeast of Seoul. My responsibilities were varied: Care for my airfield—1,600 feet of pierced steel planking runway, a small operations shed, a canvas hangar, and a small POL dump; fly my aircraft—a worn-out O-1A; and command my section—two sergeants (one, a maintenance advisor; the other, my crewchief) and one Korean mechanic named Shin.

Life there was relaxed. And after a few days in

This article was prepared by a member of the Communicative Skills Class, Army Aviation Safety Course, University of Southern California.

the new surroundings, I dropped easily into the tempo of our little compound. Each day I flew personnel—officers, civilians, and enlisted men—to many places. Most of my flights were back and forth to Seoul. Everyone had some business to transact there—official or otherwise.

Seoul was 35 minutes away and, on a red-letter day, I might have to travel to Pusan on the southern tip of Korea. This was a 4-hour round-trip flight. By flying my O-1A five hours a day in an area as small as South Korea, I soon came to recognize every valley, mountaintop, stream and road. I became so familiar with the beautiful countryside that I could even tell whether Pak, the woodcutter, was working on the east side of Saddle Peak or the west side. I established bad weather routes to my most common destinations, and kept a continuing check on whether or not any new wires had been strung between peaks.

Usually the weather was good. But we all knew it could change to low clouds and poor visibility in a matter of minutes. When this happened, we took to the valleys, flying at treetop level up the winding rivers to our destinations along routes we continually reconned.

A pattern leading to near disaster became established as the days turned into months. The number of trips to Seoul climbed past the 500 mark, and my time in the Bird Dog soared past 1,000 hours. As each flight became a memory, I began to know every bolt and nut in my ship. Instead of being tired-out, she became the best-running Bird Dog in Korea. The sergeant and Shin kept the engine singing sweetly and maintained a high polish on the fuselage.

Flying became automatic. There was no need to preflight—the sergeant would handle that. Just climb in, start up, run up, and take off. I became so familiar with the routine, I could almost tell what the tower operator would say before he said it. The repetition of flying to Seoul and returning sometimes made it seem as if the airplane was just going along for the ride, that I really didn't need it. Soon, I wasn't flying—I was riding. The checklist became a long-forgotten requirement.

Morning dawned, clear and fresh from the evening rain. The usual haze was absent, presenting the rare experience of being able to see almost from coast to coast at flight level. My schedule was heavy: four trips to Seoul after two short hops across the 38th parallel to the DMZ (demilitarized zone). A total of almost 6 flying hours.

By noon, the DMZ trips and one hop to Seoul had been completed. After refueling and eating a heavy lunch, the remainder of the trips to Seoul commenced. Climb, level off for 35 minutes, land. Climb, level off for 35 minutes, land. Three trips were now completed. As I lifted off for the final trip home, I sighed and thought, "What a long day this has been." I leveled off at 3,500 feet and pointed the nose toward home.

"Thirty-five more minutes to a scotch and water. I wonder what George is going to do in Seoul tonight? I'll have to remember to schedule him for pickup the first thing tomorrow morning. There's Detachment A. Shall I buzz the field and say hello to Bill? No, only 10 more minutes to home. I'll just save it for next time. I hope the jeep is waiting for me.

"Hmmm, I see Pak has cleared the rest of that field today. I imagine he'll be planting soon. There's the last ridgeline. Visibility sure has been good today. Doesn't seem to be any aircraft in the area, and the wind is calm; so I'll make a straight-in approach to save time. Might as well start my glide now. Add a little power to clear those hills and rice paddies just off the end of the runway, and don't forget that new fence. Good! I see the jeep is there. It won't be long now. There we go. Power off. Over the fence, and roundout."

It was one of the best landings I ever made. I let the aircraft roll out and watched the sergeant run the jeep out to the hot spot near the operations building at the other end of the runway. As the ship slowed, I automatically added a little throttle to maintain a nice crisp taxi speed. But no power. Startled, I looked at the prop. It was still. The engine was stone dead. "What the devil happened? Does my carburetor need adjusting? Did I have an engine failure?" Rapidly, I scanned the cockpit. Mixture—full rich, carb heat—cold, fuel selector—on fullest . . . Shaken, I switched the fuel selector from the empty tank to the full one. A punch at the starter and the engine roared to life again.

After I parked and shut down, the crewchief looked my way with a grin and asked, "Anything wrong, Sir?" I shook my head, walked to the jeep, and headed for the compound. While driving, I mused over the past few moments.

Since that day, I've logged many more hours in a variety of different aircraft. Although the aircraft I fly now are more sophisticated, I've never forgotten the lesson I learned that day in Korea with my simple O-1A.

What does the sign at Fort Rucker have to do with all this? It contains a short but meaningful phrase—one worth remembering:

USE YOUR CHECK LIST!

MISERY *loves* COMPANY

HAVE YOU EVER gone into a library and found yourself standing all alone between long towering rows of shelves filled with books? Remember that feeling as you searched for a title from among the hundreds of volumes? The calmness that prevailed? The perpetual silence you were afraid you might disturb? Suddenly that silence was broken as you heard the distinct sound of feet shuffling nearby—from behind the shelf. And you knew you were no longer alone. Recall the change that swept over you? Just knowing that someone was there made the difference.

It's the same in flying. There is that unmistakable difference when someone is along—even if it's just for the ride. There is a second, more distinct feeling experienced when two *rated* aviators fly together. This feeling is one of unconcern. Of course a pilot likes someone to talk to on a long flight. But when that someone is another pilot, and not just a body, an unexplainable atmosphere of assurance prevails. I wonder how many accidents and near accidents this feeling has caused.

I must confess that I have never been in a thunderstorm nor had a forced landing. And for these blessings I knock on wood, cross my fingers, pull the pucker string a little tighter, sincerely appreciate Bird Dogs and Beavers, and thank the Lord. Nevertheless, a number of examples come to mind from my own limited experience.

The automatic rough engine condition we often experience over water or at night is a well known phenomenon. On a local flight, I flew backseat while an instructor pilot gave me a night 0-1 checkout. We took off and climbed out to traffic pattern altitude. The engine did not run rough. It actually coughed.

Before a low-level flour bombing mission, two events happened: One—I had to convince my nonrated Reserve Second Lieutenant observer-bomber to leave the flour sacks with the rocks inside on the ground. Two—I talked with the other aviators about the tendency for pilots to become obsessed with bombing results

This article was prepared by a member of the Communicative Skills Class, Army Aviation Safety Course, University of Southern California.

during low-level missions and consequently stall and crash. I know that during the flight all of my attention had continually been on flying. Yet, when I glanced at my airspeed indicator as we pulled out from the fourth pass, the needle was unwinding through 60 mph.

For a 70-nautical mile trip in Colorado, I failed to check weather. The sky contained a few cumulus as I roared off. A ceiling soon formed and halfway home over the low, east-west ridge called Black Forest, I flew into a snowstorm. With no forward visibility through the windshield and about a quarter of a mile straight down, I glued my eyes on the highway below I had no idea of the weather conditions at my destination And just before I looked for a clear stretch of highway to land on, I broke out of the storm and into an absolutely clear sky. Under me sprawled Colorado Springs and home.

During another return trip, the weather deteriorated. A stratus ceiling forced me lower and lower. About 5 miles out I still had terrain clearance, but I was at the same elevation as the airfield which sat on a mesa. I could not see the field, but I had not begun to worry much until I felt an unexplainable tugging on the stick. I glanced over my shoulder and realized my passenger, who was an instructor pilot, was casually but rapidly erecting the rudder pedals and attaching the rear stick.

A week before a local night flight, winter air dropped a foot of snow to within a few miles of the field. Because the post had no snow, I forgot about the weather to the south. As I circled the county airport before making my approach, someone turned the runway lights off and on again quickly. The airfield had no tower. I ignored the signal and casually talked to the crewchief aboard as I lined up on final. I usually do not use the landing light, and I did not use it then. I never did see the 6-inch blanket of snow and ice.

When I later analyzed my reactions and thoughts during these five flights, I realized how much I like to have the company of another aviator. Especially when the cheese gets binding. Yet the situations would be no less critical with no one aboard but the pilot.

On the night flight when the engine coughed, the instructor pilot and I were startled, naturally. *As a matter of fact, neither of us spoke for about two minutes.*

On the flight home under a lowering ceiling, I was uneasy when we landed with clouds nibbling at the wingtips. *The action of my passenger spoke for him.* But had I been alone or with a nonrated type on either of these flights, I would have been at the panic-button stage.

During the flour sack mission, I applied full throttle to recover from the near stall at low level. My heart jumped into my mouth and I shook inside for several minutes. If an aviator had been aboard instead of the would-be rock bomber, I am certain we would have shrugged the incident off—like the pilot whose last words before he flew into the mountain were a resigned, *"Whoops, screwed up again . . ."*

I was panic stricken in the snowstorm. Even so, one of my feelings was disgust toward my passenger because I knew he did not know that we were shortly going to crash.

At the county airport, I jammed the throttle through the firewall just as my wheels touched the ice and snow. Somehow the aircraft staggered into the air after lurching off the runway. In a split second I marveled that we were not upside down and that the gear had not wiped out a runway light as we skidded off the runway. During the climbout, I finally managed to recover my composure. I also managed to frown at my passenger's inability to comprehend our near disaster. If another pilot had been along, I am sure the tense atmosphere would have melted sooner.

One final tale supports the *misery-loves-company* philosophy. Had I been alone, I am positive my actions would have been different. On a return flight to my home station, my copilot figured out a shortcut. He was an old timer in the area and knew the terrain like the palm of his hand. The U-6 had two leaking intakes, so we wanted to return home as quickly as possible. We flew a couple of hours at 12,500 feet, which was no problem without oxygen. After all, the field elevation was 6,000 feet. So we had a built-in safety factor. Two aviators would never admit they were lost; but later we realized we had crossed the Continental Divide over the highest pass and surrounding terrain possible. Visibility was poor with no moon, so we had some difficulty threading our way through the Pass. We were climbing through 14,500 feet and still could see mountains above us. But, what the hell, there were two aviators aboard. As we leveled off at 15,200 feet, with no oxygen, I acted according to the theory; *I casually lit a cigarette!*

SHARE IT

EXCERPTS FROM the initial influx of SHARE-ITs were published in the January CRASH SENSE. As the stack rises, these hairy accounts show one thing in common: all demonstrate the deceptive ease with which the unexpected can strike.

Sharing experience is the most valuable contribution anyone can make to the accident prevention program, whether you're an aviator, a passenger, a mechanic, a tower operator, or what-have-you. It only takes a few minutes of your time to jot down your experience and SHARE IT. It's a two-way street—the experience you share may prevent someone else's accident, and the knowledge of someone else's experience may well prevent your accident. Experience and knowledge are the two best weapons against the unexpected. Let's all SHARE-IT.

U-8D "I had just entered my downwind leg for landing at an Army airfield in Germany, when a jet fighter came at me on a head-on collision course. I had to make a violent left turn to avoid a strike.

"This jet was flying at 1,000 feet, through an airfield traffic pattern, in controlled airspace. The pilot had not contacted the tower to report his entry or intentions.

"This problem with low flying jets is becoming more and more serious here in Germany. When the weather is good, jets constantly fly through controlled airspace and traffic patterns without

crash sense

PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

calling the towers or ATC. It is not unusual for 10 to 20 of these aircraft to fly through the area at an altitude of less than 1,000 feet on a clear day. I feel it is only a matter of time before we have a mid-air collision unless positive steps are taken to control this situation.

"I believe that one of the problems is that the jets are using UHF radio frequencies while the Army uses VHF. If this is the case, the jets should be instructed to stay out of controlled airspace if they cannot make contact with the proper controllers."

UH-1B Because of the weather forecast—800 feet, overcast, dropping to 200 by 2400 hours, with light rain—I recommended that my scheduled low-level night photo mission be cancelled. My recommendation was disregarded.

"Together with the copilot and the crewchief, we lifted off at 2030 hours. At this time, the sky was overcast and visibility was limited.

"After making three PIREPs en route, I became disoriented. I was on a 160° heading, 60 knots airspeed, at an altitude of 700 feet indicated. I was unaware of the ground fog until I lost all visual references.

"I began a left turn. During the turn, my altitude dropped to 500 feet and my airspeed to zero. The crewchief shouted, 'Pull pitch!' I did.

"The increase of power stopped the turn to the left. By this time, the artificial horizon was level and visual reference was re-established. The mission was cancelled."

OH-23B "I was on downward after having received an airport advisory from an uncontrolled airport. As I turned base, I noticed a civilian aircraft so close behind me that I was forced to take evasive action.

"I called the flight service station and asked if this other aircraft had been informed of my presence in the pattern. The answer was affirmative; he had been told in an advisory subsequent to mine.

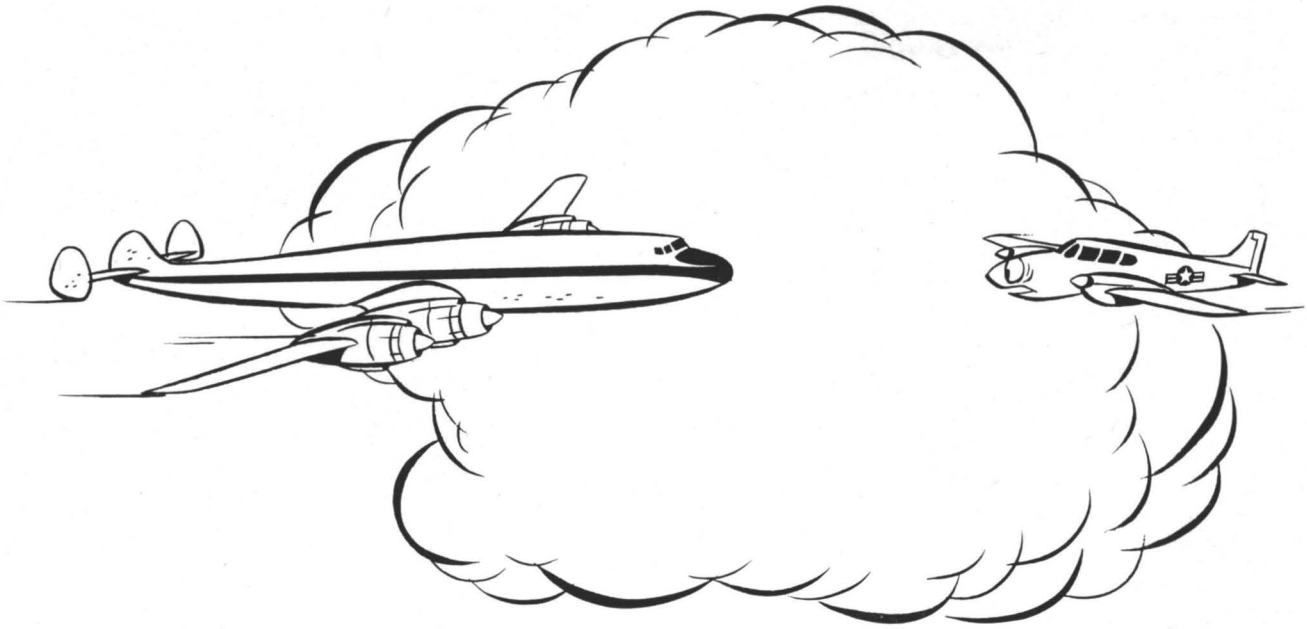
"The landing afterwards was normal, although somewhat wobbly.

"The advisory to the civilian aircraft had been made on another frequency and I had been unaware of his presence until visually contacting him at very close range."

UH-1B "I was flying in a control zone in Germany, at an altitude of approximately 1,000 feet, when I encountered two jets on a head-on collision course. Only through extreme evasive tactics was I able to avoid colliding with them. The jets had not contacted the tower or any control agency.

"This problem is becoming more and more acute here in Germany. Jets constantly fly low level through control zones and airfield traffic patterns without making any attempts to contact the towers or control agencies. On other occasions, I have been literally driven out of the traffic pattern by low flying jets at altitudes below 500 feet.

"Most Army towers here in Germany try to advise aircraft of low flying jets in their area.



But this is a visual warning, as the towers have no contact with these aircraft. I feel this is a very dangerous situation and may result in a mid-air collision if no improvement is made."

U-8F "During a daytime GCA final approach, I was at an altitude of approximately 1,100 feet, flying at 120 knots indicated when an F-105 cut in front of me at a distance of 100-150 feet. He was in a sharp, banking turn to the left—apparently on left base for another runway.

"I asked the GCA controller if he had radar contact with the F-105. He did not.

"I was then turned over to final controller and I completed a low approach—after which, I cancelled my IFR flight plan."

U-8F "At about 1935Z, we were inbound to the Martinsburg VOR on V-44 at 8,000 feet on an IFR clearance when we experienced a near-accident with a Constellation. When first sighted, the aircraft appeared to be leveling off from a right turn. He passed to our left at our altitude on a heading of 290° at less than 1/4 mile. The center reported no knowledge of an IFR aircraft near our location."

U-9D "At 1523Z, I was crossing Nottingham VOR at 5,000 feet SE bound on V-16. Washington approach control reported traffic at two o'clock, south bound. I observed a T-33 jet about two miles away climbing in a left turn. It appeared to be climbing into us. We went into a dive, and the jet passed over us by approximately 500 feet."

OV-1B "I was complying with an IFR clearance and was passing through 8,500 feet in a climb to 10,000. I was south bound on V-140 to the Casanova VOR when the number 2 propeller ran away. Realizing what was happening, I went through single engine procedure, shut down the No. 2 engine, and notified center. Declaring an emergency, I requested clearance back to point of takeoff. (I had full fuel and classified equipment aboard.) The landing was uneventful."

O-1A "During a VFR approach to the Linden airport at an altitude of approximately 1,500 feet, I observed another aircraft flying toward the same field. I continued to observe this aircraft while I called Linden Operations for landing and traffic advisory. This is an

uncontrolled airport with radio advisory in operation only.

"The other aircraft continued toward the airport for a straight-in approach to runway 09. Linden Operations advised that runway 27 was active, and this coincided with the windtee on the field. As I was receiving this advisory, I observed another aircraft taking off on runway 27. At this time, the first aircraft was crossing the field boundary on final approach for runway 09. This placed both aircraft on a collision course at a critical time. The aircraft taking off made a turn to the right as soon as it became airborne, while the other aircraft completed the landing on runway 09.

"Conversation with the pilot of the landing aircraft disclosed that he had based his landing direction on radio traffic information overheard on another frequency from a nearby airport."

OH-23 "I was flying from a stage field in Texas. On downwind I glanced down to check my instruments. When I looked up, I saw a buzzard dropping toward me from 12 o'clock. I shoved the collective pitch down, hoping to avoid it. The buzzard passed through my main rotor and disappeared below."

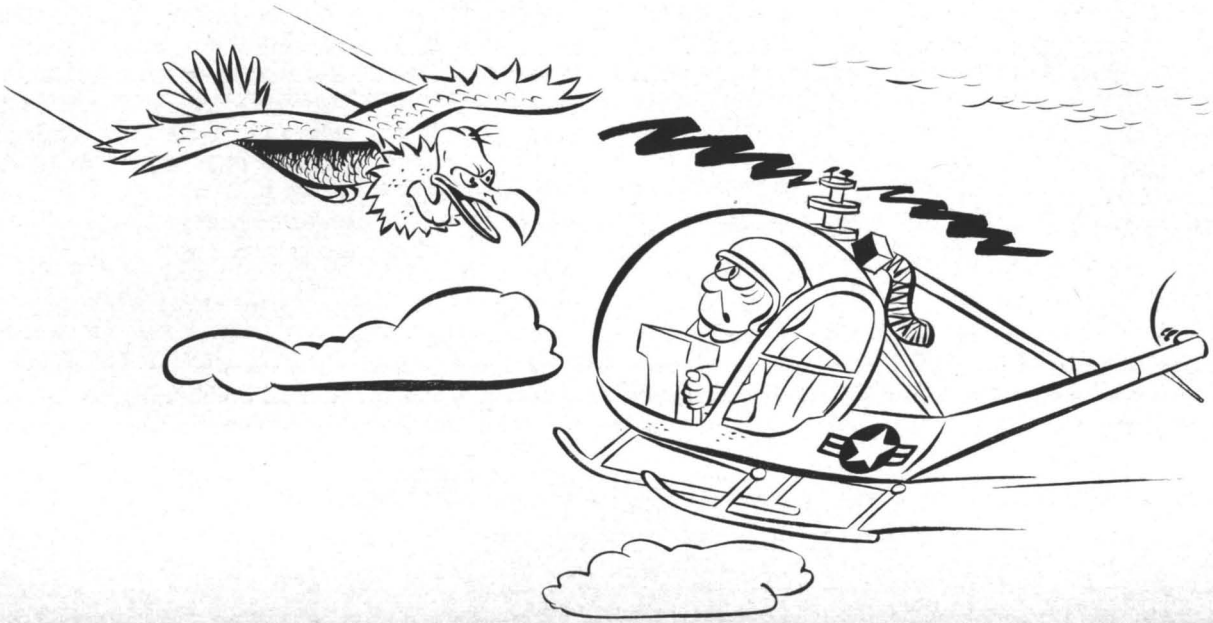
U-8D "I was a passenger on a cross-country flight. The weather given the pilot was marginal VFR. I thought he should have filed an IFR clearance, but he was in a hurry to get started and filed out VFR. As we took off, the ceiling was broken at 4,000 feet and looked solid in the direction we were going.

"I expected him to level off below the clouds, but as we reached the clouds, he continued climbing. He dodged around the sides of several puffy cumulus clouds, then we were boxed in. He went on instruments and bored on through, with no call to our point of departure and no apparent regard for any IFR traffic that might have been on the airway we crossed. Fortunately, we were only in the clouds for a few minutes before we broke out on top of a solid overcast. Still, the pilot did not call for an IFR clearance.

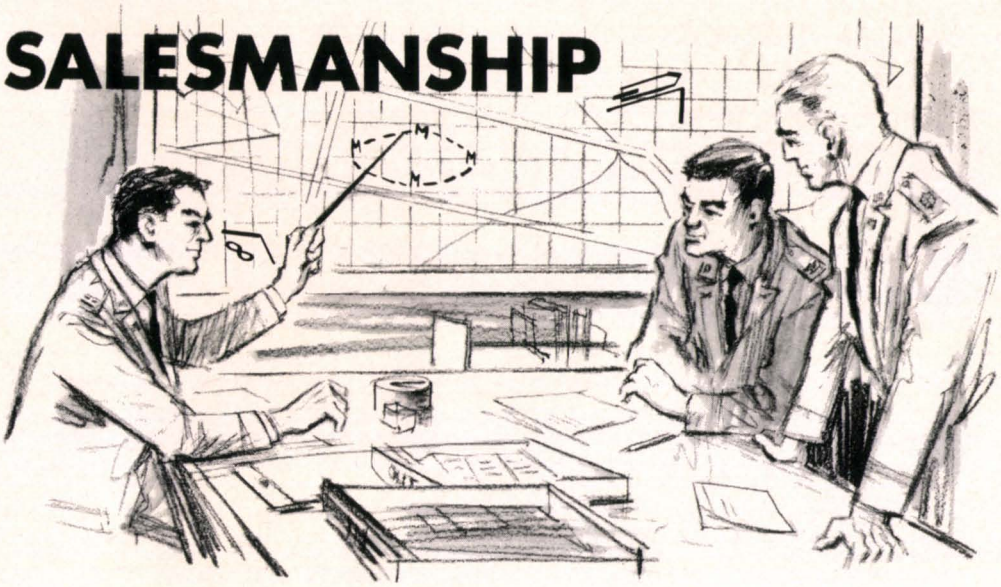
"As we flew, the cumulus began to build up past our altitude and we dodged around the edges. Our wingtips were frequently in the clouds. The flight took three hours. Thanks to the gods of chance, there was a hole, the only hole I'd seen, when we reached our destination. We went down through it and made an uneventful landing.

"I know a passenger has nothing to say about flight planning, but those of us who have done much flying soon learn to judge pilots on the basis of planning. If I'm asked to fly with this particular pilot again, I'm going to do some planning—some serious planning about how to get out of going!"

OH-13 "I had contacted the tower as I entered the control zone for landing instructions. It was beginning to turn dark, and I had just switched on my navigation lights. I was on a heading of 115°, at an actual altitude of 500 feet. At 1546Z, a delta wing jet aircraft passed directly below me, heading south. The aircraft was OD in color and bore red markings. Clearance was less than 50 feet."



SALESMANSHIP



Lieutenant Raymond J. Puknys

ON A RECENT trip, I found myself spending the night at a large Air Force installation. I have grown accustomed to curious stares from personnel of other services and I usually manage to ignore them. I was startled, however, to receive the same inquisitive look from three Army field grade officers. A later conversation with these officers left me completely startled. Their curiosity about Fort Rucker was expected, but their complete ignorance of Army Aviation was a surprising revelation.

Here were three people, in relatively high command positions, completely unaware of the aviation support available to them as unit commanders. Having enlightened these officers on the subject, I began to wonder why this lack of knowledge was allowed to exist. A manufacturer's existance is directly proportional to the demand for his product. The larger the demand, the more he supplies and the more he prospers. Army Aviators should take heed of the law of supply and demand, for in the long run it is the requirements of the ground commander which will completely sell Army Aviation to our tacticians and policymakers.

Where, you might wonder, does the young Army Aviator fit into this picture? The answer is SALESMANSHIP. He is the one who must go out and sell by demonstrating the effectiveness and reliability of his product to the user.

Outstanding salesmanship brings to mind the case of a unit commander I knew overseas. It was a known fact that this commander used his helicopter only as a last resort. Two months after his new pilot arrived, the commander and his Sioux became inseparable friends. The young aviator was directly responsible for this bit of salesmanship.

To further expand my point, this same unit had an aviation company whose primary function was to support this headquarters. Without going into detail on the quality and quantity of support furnished by this section, I would like to mention that within a short period of time, pressure was put on the aviation company to detach these personnel and relocate them near the supported unit. Salsemanship made this request possible.

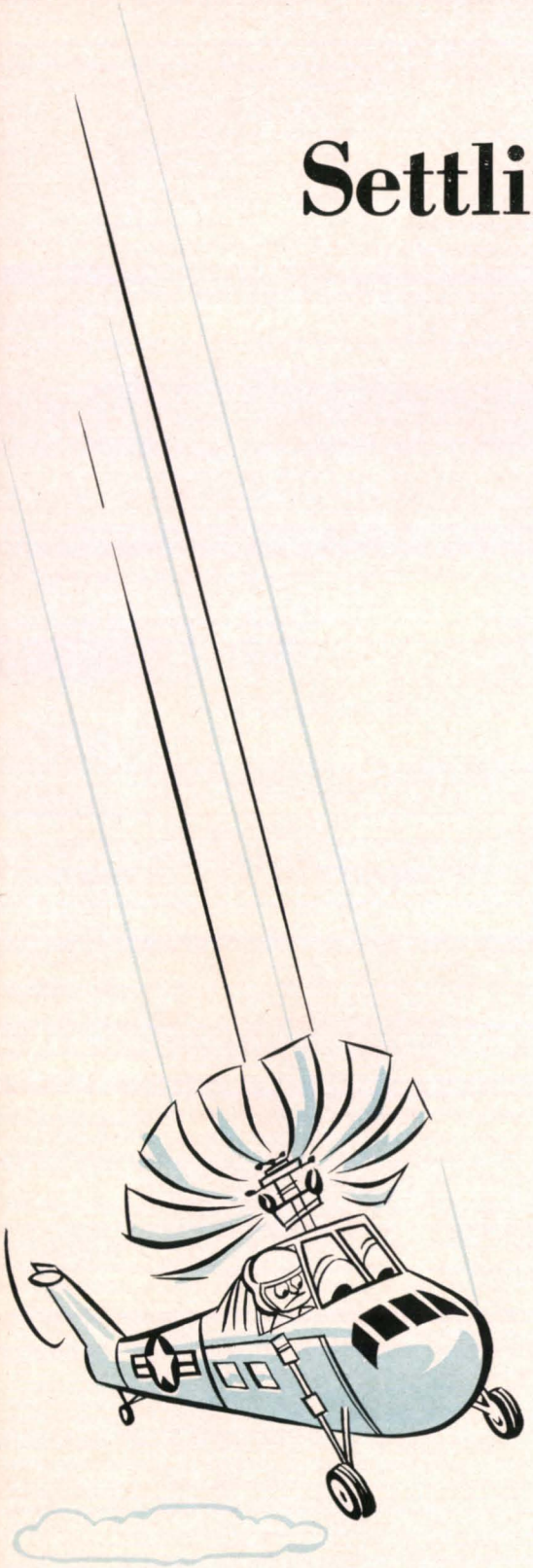
It might be interesting to note that this was not in a combat zone. All of this was accomplished in a garrison type operation, coupled with numerous field problems, by advising, initiating and performing missions with a dependability that could be counted upon by the supported commander. This is the best type of SALESMANSHIP.

In Vietnam, Army aircraft and pilots are again demonstrating their ability to cope with challenging situations. That the ground commander can rely on Army Aviation is no longer a dream; it is a fact. Why must we wait, however, to prove ourselves on the field of battle? The garrison aviator should and must achieve the same goal through SALESMANSHIP.

Lt Puknys is assigned to the Dept of Advanced Fixed Wing, USAAVNS, Ft Rucker, Ala.

Settling with Power

Captain R. W. Newton



SETTLING WITH POWER is a familiar expression. It has been used for many years and should be understood by all Army Aviators. Yet there seems to be a lot of confusion concerning its meaning. This is evidenced by the findings of several recent accident investigation boards. Although the term is not found in the -10, or in any textbook, it represents a condition which is usually demonstrated to the student pilot during school training.

A genuine danger exists in using this or similar expressions, such as "the back side of the power curve," during accident investigations. The danger lies in the fact that if no attempt is made to trace the sequence of events further back, the real accident cause factors may be lost.

The U. S. Army Aviation School at Fort Rucker teaches that three conditions must simultaneously be present for a helicopter to *settle in with power:*

- The airspeed must be less than 12 knots.
- At least 20 percent power must be applied.
- The rate of descent must reach at least 300-400 fpm.

A look at a few diagrams will illustrate the type of vortex systems present during conditions of zero airspeed climb, hover, settling with power, and autorotation.

Air flows downward through the rotor system during a climb. Despite the fact that there are three distinct vortex systems in the wake of any propeller or rotor, the system can be simply depicted as shown in diagram A, during a climb, or during the *Propeller Working State.*

The airflow is still downward through the rotor system when the helicopter is hovered. But this air is picked up from a lower level, as shown in diagram B.

The usual vortex systems are altered when the aircraft *settles with power.* A separate one emerges. It lies in the plane of the rotor and is a continually recirculating one. This condition, referred to as the *Vortex Ring State,* can cause severe turbulence. It is shown in diagram C.

The final situation occurs during autorotation, also referred to

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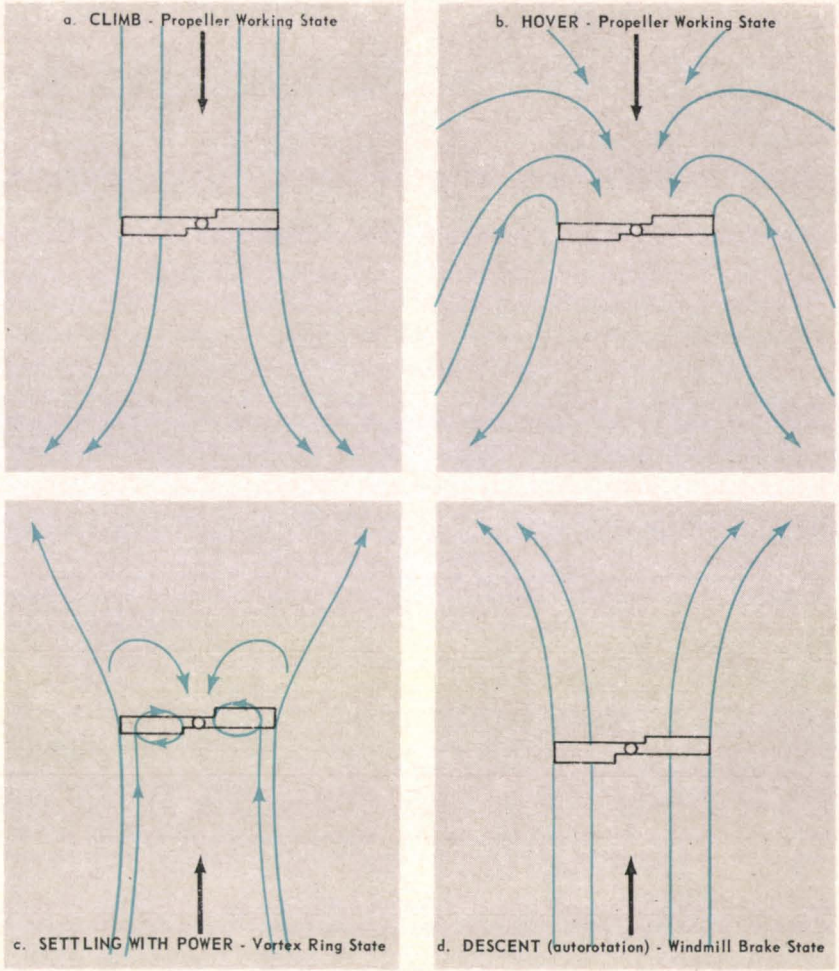
Capt Newton, an aeronautical engineer and Army Aviator, is a member of the Human Factors and Engineering Division, USABAAR.

as the *Windmill Brake State*. In this condition, the airflow is upward through the rotor system, shown in diagram D.

Let's review some recent accidents. In each of these, the accident investigation board listed *settling with power* as the cause.

An OH-13, operating at a gross weight of 2,610 pounds, took off into a 20-knot headwind on the lee side of a slope. After reaching an altitude of 50-75 feet and attaining an airspeed of approximately 50 knots, the pilot began a 180° turn. As he completed the turn, the aircraft began to lose altitude. Airspeed was reduced and full power applied, but the aircraft continued to lose altitude until it finally struck the ground.

In analyzing this accident, we find that the aircraft executed a sharp turn in a known downdraft area (lee side of a hill with a 20-knot wind). During a turn more lift is needed to maintain altitude. This can be done either by sacrificing airspeed or by increasing pitch. The pilot tried both, but he was unable to maintain altitude while operating in a downdraft.



From these facts, we can logically conclude that the cause of this accident was poor judgment. The pilot should not have attempted a turn before reaching a safe altitude and building up sufficient airspeed while operating in a known region of a downdraft. This was not a case of the aircraft *settling with power*.

Another OH-13 was on a test flight to check the effectiveness of the tail rotor. The pilot zeroed the airspeed and entered autorotation at 1,000 feet above the airfield. At this time, the aircraft was heading into a 15-knot wind. For this reason, the pilot elected to make a series of small turns while traveling backward across the ground, instead of making 360° turns. At 400-500 feet, he sensed that he was falling too fast, and joined the needles. He started to apply pitch about 150 feet above the ground. At 25 feet, sensing that the aircraft was still descending at an excessive rate with zero airspeed, he applied full pitch and power. The aircraft crashed.

What were the facts? At an altitude of 500 feet, the rate of descent was 2,400 fpm. At 150 feet, the rate was the same. This meant the aircraft would reach the ground in 4 seconds. It is doubtful if any pilot could have made a successful autorotation or power recovery under these circumstances. One thing is apparent: It was poor judgment to start this maneuver at an altitude of only 1,000 feet. It was also poor judgment to delay the power recovery and not regain airspeed prior to reaching a minimum of 500 feet. Here again, the true cause was not *settling with power*.

Accident number three involved an OH-23 operating in a dead end canyon. The wind was 20 knots at right angles to the ridgelines, and the aircraft was on the upwind side of the canyon (updraft) as it approached the dead end. The pilot made a turn which placed him on the downwind side of the canyon (downdraft). While still in the turn, he felt the aircraft sinking. He made a cyclic climb and ap-

plied full power, but the aircraft lost airspeed and crashed into trees.

In essence, this accident is similar to the first one—a turn and a downdraft. Obviously, poor judgment was used in turning into a known downdraft.

Did these aircraft actually *settle with power?* It's probable they did just prior to contact with the ground. This is true because the three requirements for settling with power were there in each case. But these requirements were not evidenced until immediately before contact with the ground. Settling with power *was not* the cause of these accidents.

For comparison, let's review an accident that happened in Australia (Royal Australian Air Force). This pilot was making an approach to a pinnacle. It was not a normal one, as planned. Instead, it was more of a steep approach. The airspeed was allowed to drop below 10 knots while the aircraft was still 30 feet in the air. At this time, it began to settle to the ground and no amount of power could prevent further settling.

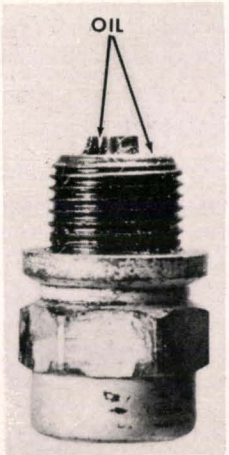
In this instance, two conditions conducive to settling with power were present during the first part of the approach. The rate of descent was more than 400 fpm and more than 20 percent power was being applied. When the airspeed dropped below 10 knots, the aircraft actually *settled with power.* In summation, the following is quoted from this accident report:

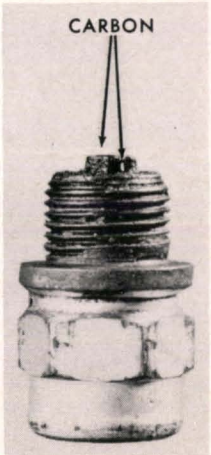
"The phenomenon of settling with power manifests itself under the conditions applying at the time and involves high vertical rates of descent and reduced cyclic control effectiveness. This condition is entered following a low speed partial power descent where the airspeed is inadvertently zeroed. The characteristics of settling are very similar to the feel of stall in a conventional aircraft. The recovery procedure is also approximately the same, i.e., drop the nose and accelerate into forward flight. If this cannot be done, recovery can also be made by reducing collective pitch to a minimum, which results in considerable altitude loss."

Spark!

or

S-p-u-t-t-e-r





SPARK PLUG fouling is often due simply to low-power ground operations. But, it pays to check *all* fouled plugs closely, because fouling *can* be caused by severe engine trouble. And, the plug's condition can usually tell you what the trouble is.

For example, heavily fouled plugs can be a warning of piston failure. When pistons start to fail, they often cause small amounts of molten metal to spray onto the plug nose. These deposits frequently short out the plug and allow oil deposits to accumulate. So, if plugs are abnormally oil-fouled and show evidence of metal spray, be sure to check the combustion chamber for piston condition.

Fouled plugs can also alert you to the presence of small loose parts in the combustion chamber. Such parts bounce around and often travel from one cylinder to another through exhaust and intake ports. These objects can cause serious engine damage. And they often damage spark plug electrodes as well. If you find an oil-fouled plug with a damaged electrode, always check the combustion chamber carefully for foreign objects.

When tracking down engine troubles, be sure to follow all steps listed in your company's "Operations and Maintenance" manual or engine manufacturer's instruction manual.

Champion Spark Plug Company
Toledo 1, Ohio

How important is the helicopter maintenance pilot to your outfit? He can increase your unit's aircraft availability and he can reduce maintenance and spare parts requirements. Yes sir! He's a

VERY IMPORTANT PILOT

Elton J. Smith

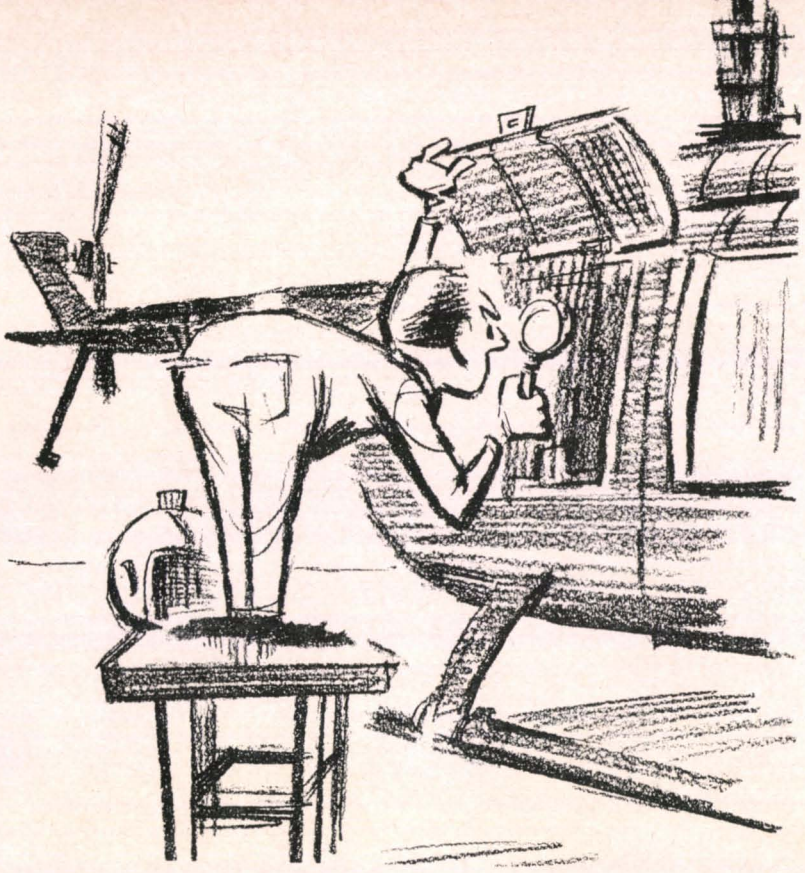
THE MAINTENANCE officer and his maintenance test pilots enjoy very responsible positions in Army Aviation. The importance of the maintenance officer's job is second to none. With him rests the responsibility of keeping his helicopters in the best possible condition, capable of performing according to -10 handbook data, and, through diligent effort, he keeps the instructors and unit pilots cognizant of all pertinent procedures, etc., to maintain more effectively high availability and top performance.

The helicopter maintenance test pilot is not the pilot who walks out to the helicopter after a crewchief changes an antitorque pitch change link, looks to see if it's properly secured, flies the ship around the pattern checking proper antitorque control responses, and returns to the desk for another assignment. His is a much more complex business.

● The helicopter maintenance test pilot is completely familiar with not only the pilot's handbook but with all of the maintenance publications. He must know about many things, such as data on special high-tensile strength bolts, proper torque for these bolts, where they go and how often they are replaced, etc. His knowledge of maintenance publication procedures qualifies him to interpret the proper flight procedures spelled out in the pilot's handbook. In other words, he not only must know what the helicopter should do but he must also know why and what to do to keep the machine up to the standards set forth in the various publications.

● The test pilot conducts

Mr. Smith is Chief Flight Operations Engineer, Bell Helicopter Company, Fort Worth, Texas. This article is reprinted from ROTOR BREEZE.



spot line checks on his helicopters, both ground and flight, to determine in an analytical manner the condition of the helicopter. In this way he offers an invaluable service in preventative maintenance, whereby he catches minor discrepancies, initiates corrective action before the part wears beyond limits, and also, by eliminating the problem, in many cases prevents damage to other airframe parts. For example, an out-of-balance antitorque rotor causes worn pitch change links, but also the high frequency set up by the out-of-balance antitorque tail rotor can in due time cause tail boom cracks, excessive elevator bearing wear, etc. This is a very important phase of maintenance test work and one in which the factory technical representative offers invaluable service to the customer. The technical representative is much more effective here than if he were not on location until after the trouble has occurred. One of the technical representative's most important functions is in the area of preventative maintenance. Parts cost money, down time, and if allowed to deteriorate, can cause a serious safety of flight condition.

● The test pilot is familiar with how the helicopter flew when it was new and strives to keep it in that condition. He, through technical experience, will categorize this function into four general areas: rotors; controls; engine; airframe, electronics, and instruments. He checks them systematically. Here are a few examples of what he will check when test flying a UH-1.

Rotors—Are the rotors in track and balance? Is the ride as good as when the helicopter was new? If not, is it 1/rev, 2/rev, or high frequency that is causing the substandard ride? Does the ride deteriorate with a change in gross weight and rpm and/or cg? What are the effects of turbulence, tight turns and autorotation? Do sudden changes of power affect rotor behavior, etc? By checking these areas, he will know the proper corrective action to take.

Controls—Are the control, cyclic, collective and rudder riggings set to specifications? Is the minimum collective friction adequate? Is the spring on the collective servo set so that the same pressure is required to raise and lower the collective pitch control when operating boost on? Does the helicopter have adequate cyclic control in all conditions of gross weight, cg and rearward flight? Are the antitorque control pedals neutral when flying at 100 knots IAS with no yaw? Are boost-off forces normal and are the collective counterweights performing their duty? This is only a brief list of the many checks to be made.

Is the *engine* start normal, after checking battery condition? Do the igniters fire properly? How does the emergency system function? Will the engine accelerate to power in the prescribed length of time? Does the engine produce test stand calibration power? Is the droop cam functioning properly? Is the EGT normal? Etc?

Radios—FM-UHF, VHF, RMI, OMNI: Emergency channel checks, instrument checks, security of doors, windows, seat adjustments, safety belts, and seat ventilators. How are these items? Etc?

The well-informed maintenance test pilot runs through these and MANY other checks systematically and rapidly. Probably, the flight didn't require more than 15 minutes. With proper technical training, he analyzes the problems accurately and is able to make the correct entry on the form so the crewchief can initiate proper correc-

tive action. In this area, the maintenance test pilot must tell the mechanics what is wrong with the helicopter in simple, precise terms, and outline what maintenance is required.

This pilot must not generate maintenance by giving the crewchief vague and/or contradictory flight comments which will confuse the crewchief and result in either inadequate or improper corrective maintenance. For example, a pilot's comment of "heavy collective" will confuse the crewchief because he did not indicate whether he was flying the helicopter with the hydraulic boost "on." Consequently, the crewchief would not know if he should make an adjustment to the collective counterweights, the spring on the collective boost cylinder, or the minimum friction device on the collective control.

The maintenance test pilot must have natural ability and such personal traits as inquisitiveness, thoroughness, and an analytical and logical mind coupled with sound mechanical ability and understanding. He must maintain good judgment on what is and is not acceptable, and have strength in his convictions. He not only must be a good pilot, but must have the inherent desire to be an outstanding maintenance test pilot.

To accomplish the aforementioned test flight, the maintenance test pilot must have a full understanding of the performance aspects of the helicopter. For instance, he must know the effect of altitude, temperature, and humidity on the helicopter performance. He must understand the procedures to check the engines' performance against the historical records which accompanied the engines from the factory. With this background of information it is not difficult to determine if the helicopter is or is not performing according to specifications.

In addition to being able to conduct the inflight tests mentioned above, the maintenance officer and/or a member of his staff must:

- Be constantly alert to detect and analyze flight maintenance problems and offer constructive suggestions through channels to improve the product. He can be especially valuable here as his technical background enables him, by knowing the why's, to offer intelligent constructive suggestions on product improvement.
- Constantly check parts usage, check their supply of line items and initiate requisitions on a timely basis to insure adequate supply.
- Keep time studies of manhours required to perform various maintenance duties such as component replacement, inspection, etc. He then helps schedule manpower in a manner to accomplish most efficiently this work, thereby providing good availability of the equipment all of the time and almost 100 percent availability in time of alerts, maneuvers, etc.
- Establish ways to perform all duties with minimum equipment in the field and under adverse conditions.

The success of the unit does largely depend upon the maintenance officer, his pilots and crewmen. Performance here is directly in proportion to the unit's performance. Nothing is more worthless than an aircraft that will not fly. The reason is immaterial, the lowly 15 cent 0 ring clips the bird's wings as effectively as a thousand dollar item and in many cases requires more time to acquire. The lowly 0 ring is just as responsible for the big red X in the form #2408-13 and on the commanding officer's availability list. To him the machine is, in essence, absent and, consequently, worthless as an effective vehicle.

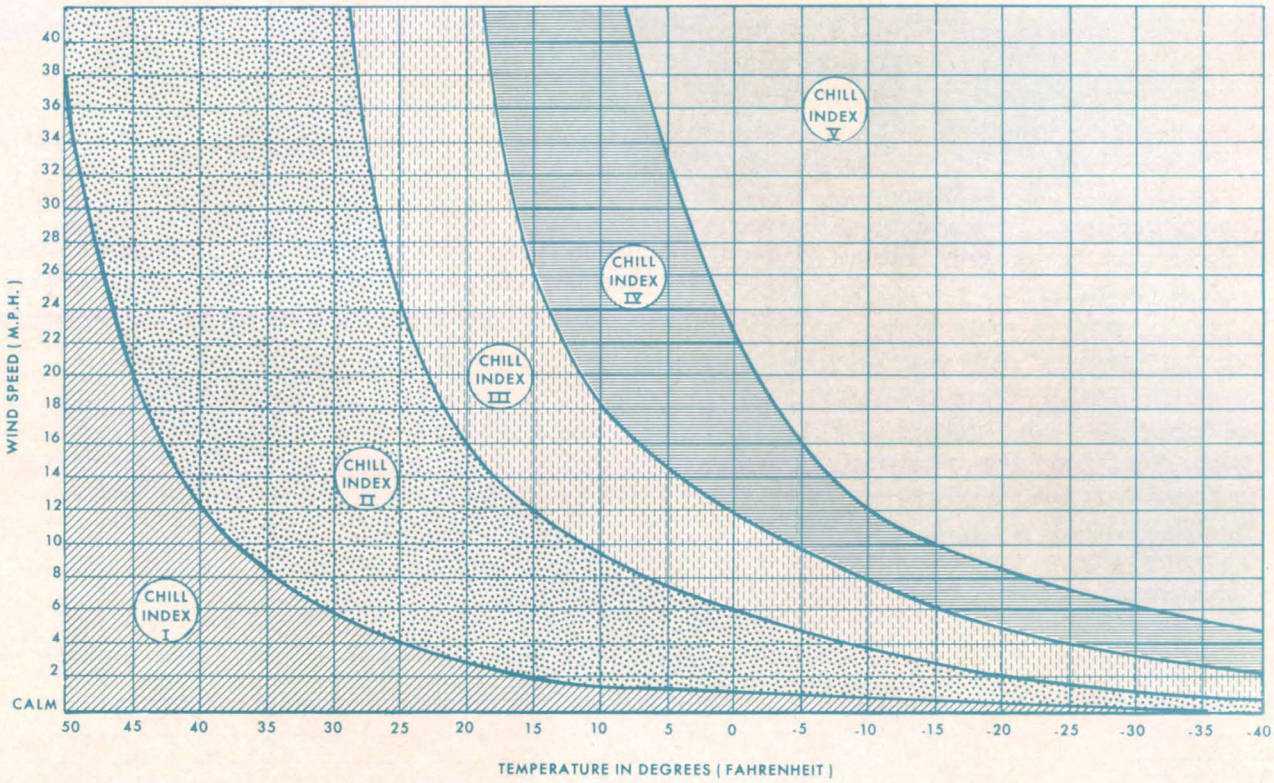
The maintenance test pilot must have thorough knowledge

that is attained only through training and experience. The rapid growth of Army Aviation, depletion of experienced maintenance test pilots through attrition and promotions, have resulted in a severe shortage of this type man. With the ever-growing Army helicopter production program, much emphasis must be placed on maintenance management and maintenance test flight requirements. The maintenance test pilot is a specialized pilot and requires specialized experience to supplement his normal pilot training background, maintenance background, and field operational experience.

The maintenance officer as a maintenance test pilot along with his test pilots and crew not only maintains the equipment and performs normal line functions but is greatly responsible for reducing maintenance through preventative maintenance procedures. THIS IN TURN GREATLY REDUCES SPARE PARTS REQUIREMENTS WHICH IN TURN REDUCES COST AND INCREASES AVAILABILITY. THE MORE EFFICIENT HIS TEAM THE GREATER ARE THE REWARDS IN THE OVERALL SUCCESS OF THE UNIT. THERE IS NO SUBSTITUTE FOR TECHNICAL EXPERIENCE IN THE MAINTENANCE TEST FLYING FIELD.

THE REWARDS ARE EVIDENT IN COST OF OPERATIONS, AVAILABILITY, AND ABOVE ALL—SAFETY.

TEMPERATURE/WIND CHILL INDEX



I — COMFORTABLE WITH NORMAL PRECAUTION.

II — VERY COLD TRAVEL BECOMES UNCOMFORTABLE ON OVERCAST DAYS.

III — BITTERLY COLD TRAVEL BECOMES UNCOMFORTABLE EVEN ON CLEAR SUNNY DAYS.

IV — FREEZING OF HUMAN FLESH BEGINS DEPENDING UPON DEGREE OF ACTIVITY, AMOUNT OF SOLAR RADIATION, CHARACTER OF SKIN, AND CIRCULATION TRAVEL.
LIFE IN TEMPORARY SHELTER BECOMES DISAGREEABLE.

V — SURVIVAL EFFORTS ARE REQUIRED.
EXPOSED FLESH WILL FREEZE IN LESS THAN ONE MINUTE.

Three UH-1Bs Help In DEEPFREEZE

SCIENTISTS IN Antarctica are this year doing much of their probing from three UH-1B helicopters of the 62d Transportation Detachment from Fort Eustis, Va. Fourteen officers and enlisted men maintain and fly the Iroquois which shuttle scientists to remote areas of Antarctica.

The 62d provides aerial support for geologists from the University of Minnesota, at Camp Gould in the Sentinel mountain range of West Antarctica. The Hueys, capable of carrying six passengers, transport the geologists to areas of scientific interest. It is hoped, largely through the use of the aircraft, that the geologic work in the Sentinel Mountains can be completed this season.

This is the third year the Army has sent helicopters to Operation DEEP FREEZE. The UH-1B has proved especially valuable in high altitudes. Last year, three Army UH-1Bs were the first helicopters ever to land at the South Pole.

First LOH Arrives at Rucker

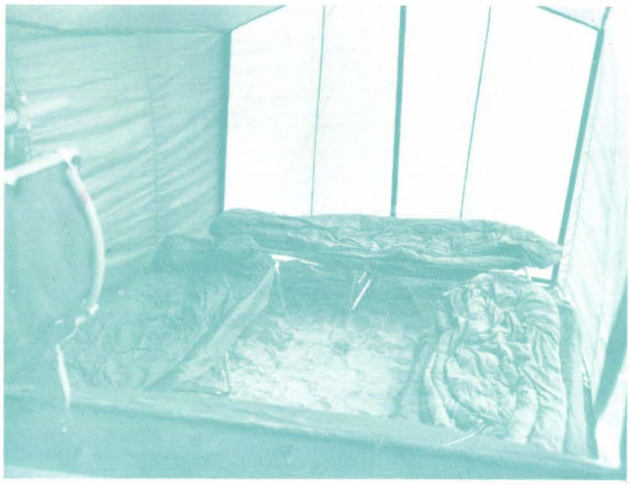
Hiller Aircraft Company's OH-5A is the first of three competitive LOH aircraft to arrive at the U. S. Army Aviation Test Board, Fort Rucker, Ala., for a 6-month evaluation program.

The OH-5A arrived at the Test Board in January, following a 2,300-mile cross-country flight from Palo Alto, Calif., at an average groundspeed of 155 mph. It is powered by a 250 hp T63 Allison gas-turbine engine that weighs 134 pounds.

The Hughes OH-6A and Bell OH-4A are both scheduled to arrive at the Test Board by the end of this month.

Lightweight CP Tent Designed for UH-1D

THE 227TH Assault Helicopter Battalion, 11th Air Assault Division, Fort Benning, Ga., has designed a lightweight tent for use with the UH-1D helicopter. The tent can be used as a personnel shelter for aircraft crews, a command post, or a tactical operations center when aircraft are on the ground under operational field conditions.

The lightweight tent is portable in an aircraft, and easily erected by a small crew of men in a few minutes. The 227th is authorized tentage that weighs about 19,500 pounds. One hundred of these lightweight tents, which are necessary to the battalion, weigh less than 1,500 pounds.

The tent is made of a lightweight material which has been approved for use by the Quartermaster Laboratories of Natick, Mass. The official nomenclature of the specific material used is Cloth O. G. 106, 4.31 ounces per square yard.