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ARMY AVIATION SCHOOL
FORT RUCKER, ALABAMA

NOVEMBER 1956 VOLUME 2 NUMBER 11

ARMY AVIATION SCHOOL

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ARMY AVIATION
DIGEST

VOLUME 2 NOVEMBER, 1956 NUMBER 11

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This copy is not for sale. It is intended for more than one reader.

PLEASE READ IT AND PASS IT ALONG

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The printing of this publication has been approved by the Director of the Bureau of the Budget, 15 March 1956.

The ARMY AVIATION DIGEST is an official publication of the Department of the Army published monthly under the supervision of the Commandant, Army Aviation School. The mission of the 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.

Manuscripts, photographs, and other illustrations pertaining to the above subjects of interest to personnel concerned with Army aviation are invited. Direct communication is authorized to: Editor-in-Chief, ARMY AVIATION DIGEST, Army Aviation School, Fort Rucker, Alabama.

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THE COMMANDANT'S COLUMN

Brigadier General Carl I. Hutton, *USA*
Commanding General, The Army Aviation Center

The views expressed in this article are the author's and are not necessarily those of the Department of the Army.—The Editor.

A Lack of Variety

THE ELECTRICALLY TRANSMITTED preliminary accident reports have been in effect since January 1, 1956. They have served a minimum purpose of focusing immediate command attention upon aircraft accidents, and this may well be partly credited with some of the recent success in rate reduction.

The mere process of reading the TWXs every day creates some personal impressions which may or may not help analyze the basic factors in accident prevention. The principal impression is that we have a surprising lack of variety in our accidents. A large proportion of L-19 accidents involve loss of directional control on landings and take-offs, and misuse of brakes. Helicopters feature accidents in practice autorotations and striking objects with the rotors. If these were eliminated from our accident list, our rates would be sensationally improved.

Autorotations were covered in this column in the April 1956 issue. There appears to be nothing to add to the suggestions in that column.

Two suggestions are offered to improve the record on striking objects with the rotors. For operation around the home airfield, guide lines should be painted around buildings, fuel pumps, and in front of hangar doors to indicate the safe taxiing limits. For training operations involving confined areas, use can be made of a training aid consisting of strings stretched between four poles. Areas of all sizes can be built, and skills can be developed continuously without risking damage from errors in judgment.

Cross-winds are frequently involved in accidents resulting from loss of directional control. It is all very well for aviation

officers in the field to place the blame upon the Army Aviation School for poor training in cross-wind techniques. The fact is, however, that cross-wind skills are about the most difficult of aviation skills in our type of aircraft and with conventional gears. Winds can be strong enough to upset a pilot no matter what his skill.

There are basic principles for cross-wind work which it will do no harm to review.

On the take-off run, the danger is in getting the tail up too soon. When this happens, the tail surfaces are stalled. Control must be by braking. This delays the build-up of speed and continues the need for brakes. It is a vicious circle which can easily result in a ground loop. The principle is—keep the steerable tail wheel on the ground an extra amount of time in cross-wind take-offs.

The ground loop upon landing quite frequently results from a poor landing, and poor landings usually follow poor approaches. Doctor August Raspet of Mississippi State College is our authority for the knowledge that with 60° flaps the air flow over the outer portion of the L-19 wing has a tendency to separate, and stall that part of the wing. This could be more pronounced on the downwind wing, causing it to drop. As the pilot corrects for this with rudder, there will be a tendency for the airplane to land in a skid with the nose pointing slightly upwind, and with the tail wheel canted into the turn. This will set up conditions which are ideal for a ground loop. The principle is—use the degree of flaps called for by the situation, and in cross-winds this is almost never 60°.

When disaster strikes Army aviators are

Ready, Willing and Able

William E. Vance

WHILE THE SWIRLING flood waters caused by Hurricane Diane surged beneath their hovering helicopter, Warrant Officers Carter Syme, Jr., and Guy D. Benoit, both of the 506th Transportation Company at Fort Benning, Ga., made a hasty reconnaissance of the situation. Television aerials and high trees made the job of rescuing a couple and their three children a hazardous proposition.

"Keep this altitude," Syme said, "and I'll go down the line and look things over."

The intrepid Warrant Officer acted quickly, sliding down a 125-foot rope to the second story and kicking in the window. He explained to the frightened family that they would be hoisted to safety since the helicopter could not get down to the roof because of the television aerial and trees.

It took almost an hour to get that family of five to safe ground. The woman with tears in her eyes threw her arms around Benoit's neck. "God bless those wonderful, comforting and beautiful little donkeys of the air," she sobbed, "and you Army men, too!"

Hurricane Diane proved a point. Army aviators are not only ready at all times but they are willing and able to help in times of

Willing hands help unload vital food supplies.

Mission completed, H-21 waits for next trip.

emergency. The stories of rescue operations of Army pilots, flight personnel, and ground crews could fill a book many times the size of the ARMY AVIATION DIGEST.

Many persons are sometimes surprised to learn that all of Army aviation's missions are not wartime missions. Army aviation, they find, is serving a vital need in making available to the nation all its facilities in times of disaster. The jobs performed by Army pilots and aircraft during emergencies and disasters have never been adequately recorded, nor has recognition always been forthcoming. In spite of this, Army flight personnel continue to risk their lives helping those in distress. The most recent incident in which Army aviation played a major role in peacetime was the airliner collision in Arizona last June. That amazing operation was perhaps the turning point in national awareness of a new and vital part of the United States Army—Army Aviation.

Hardly a day passes that doesn't see a call go out for Army aviators and Army aircraft to come to the aid of people in distress. Perhaps it is a lost survey party in the jungles of some small Central American Republic, or a missionary who must be flown to a hospital.

It doesn't take an act of Congress to get this help, either. Ferrying an H-19 back to California from Exercise SAGEBRUSH, Capt Carl E. Rhodes saw a car run off Highway 60 in Banning Pass near Cabazon, Calif. Landing his craft on the road, Capt Rhodes discovered that the driver of the car suffered a broken leg and numerous cuts. Capt Rhodes administered first aid. Shortly after a State Highway Patrol car arrived, the injured man was placed on a stretcher and flown to a hospital.

From one end of the globe to the other, Army mercy missions are becoming more and more numerous. Pilots of the 521st En-

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The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

gineer Company (Topographic Aviation) have more than a lion's share to their credit, both in Alaska and in California, where they base while in the States.

During the violent Christmas floods in northern California, pilots of the 521st were almost constantly in the air for approximately two weeks, flying under the most difficult conditions throughout the area north of San Francisco and east to the stricken cities in the vicinity of Marysville and Yuba City and as far south as the San Joaquin Valley.

Danger to the pilots and their aircraft was constant because of the unceasing torrential rains. In addition they were often flying over mountains and heavily-wooded terrain with little or no possibility of effecting a safe emergency landing, if necessary.

During this time, 1st Lt Brooks Homan, flying an H-23, spotted two boys trapped by rising water in the Healdsburg-Geyserville area. He radioed 1st Lt Don Coggins, in an H-19, with the information. While Lt Coggins hovered over the frightened boys,

Flood victim ready for helicopter evacuation.

More food for stricken families.

Sp-3 James F. Hatcher jumped from the aircraft and waded and swam the swift current to reach the youngsters. Sp-3 Hatcher made two trips from the helicopter to the boys, rescuing both lads. They were then flown to an evacuation point.

During the same emergency, Maj Phillip Melzer, his co-pilot Capt Story C. Stevens, and crew chief Sp-3 Howard Kuni, flying an H-19, were diverted to an area marked by the Civil Defense patrol. Unable to land on a small island because of trees and brush, Maj Melzer hovered the craft over water while Sp-3 Kuni plunged into the water and swam to the island, bringing a 60-year-old refugee back to the hovering helicopter. Suffering from exposure, the victim was hauled aboard and rushed to a hospital.

Army service to the nation is not confined to areas where a national emergency has been declared. A light plane was missing on a flight from Monmouth County Airport in New Jersey to Forty-Fort, Penna., and the Army Aviation Section at Fort Monmouth was asked to assist in locating the airplane. Capt John E. Manthei and Lt John McGregor made the search in an L-19 and discovered wreckage on a high plateau 14 miles southeast of Wilkes Barre, Penna. Capt Manthei notified a helicopter in the area and the rotary-winged craft landed near the wreckage and identified it as the missing plane. After spotting the wreckage, rescue operations were turned over to Air Search and Rescue.

The Fourth Helicopter Company stationed at Lawson Field, Fort Benning, Ga., is regularly called upon to perform mercy missions, although the Fourth's primary mission is tactical. Only a short time ago, a pilot and crew chief along with a member of

the 37th Medical Detachment, were assigned special duty making an aerial survey in Florida in the fight against the Mediterranean fruit fly which was threatening damage to millions of dollars of Florida's fruit crop.

This spring a helicopter crew from the same unit rescued a Phenix City, Ala., couple, their 19-month-old daughter and a small puppy from a rock in the middle of the raging Chattahoochee River. The couple had been stranded for more than two days after water rose over rocks where they had walked during an outing.

Warrant Officers James P. Ervin and William F. Fette airlifted a sailor seriously injured in an automobile accident, landing their helicopter on a golf green adjacent to the Fort Benning hospital.

During the northeastern floods, aircraft were stranded in the overcast because of a malfunctioning range station. Maj John Gray, in an H-13, flew a CAA repairman to the radio range station. Repairs were made enabling the holding aircraft to make a letdown. He also transported a doctor to an emergency case and then patrolled power lines with a member of the Connecticut Power Company as passenger. Before returning to his home station he flew cargo hauls until he was exhausted.

The Army Aviation Group at Fort Eustis, Va., rendered yeoman service during the floods. A total of 794 missions were flown by this group, during which 403,000 pounds of equipment, supplies, food and serums were delivered. Almost 800 civilians were evacuated from danger areas, and 42 search and reconnaissance missions were flown. Statistics cannot convey the nature of this mercy operation, but the thoughts of the many thousands of persons who have come in contact with Army aviation in its peacetime mission, help to bring the recognition this group so richly deserves.

Efficiency and progress in aviation have been made by people like Mitchell, Lindbergh, Byrd and the countless lesser known and sometimes anonymous figures who fly Army airplanes. It can be said without danger of contradiction that Army aviation is instrumental in guaranteeing "life, liberty and the pursuit of happiness," through its mercy missions.

Land Where You Want to Land

Capt George S. Kent, *Arty*

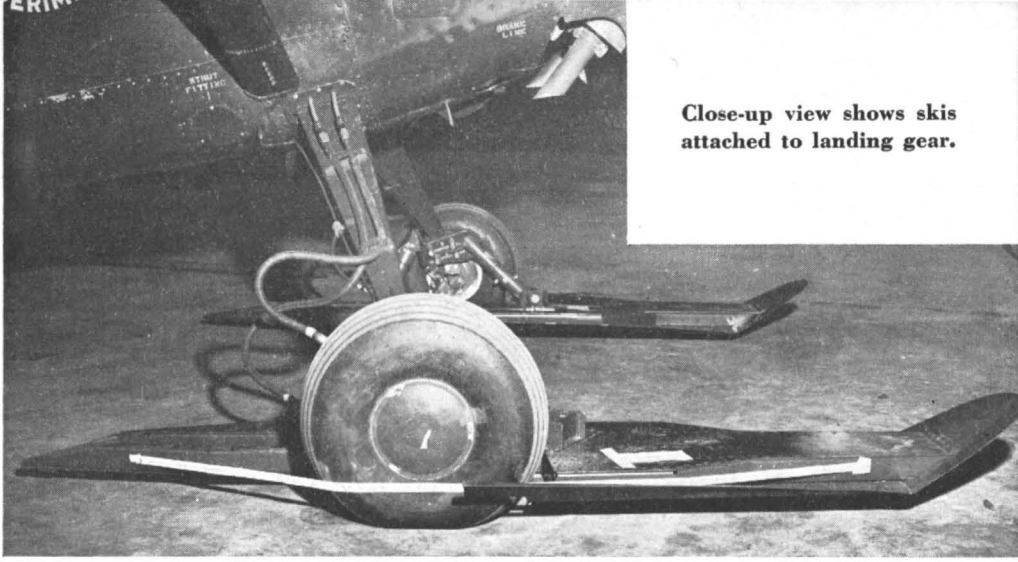
THE L-19 ENGINE coughed once, then stopped. The nose began to drop and the pilot automatically pulled back on the stick. Feeling the approach to a stall, he hastily jammed the stick ahead and established a normal glide. Several thousand feet altitude gave him a comfortable feeling as he checked the gas tank selector valve, mixture control and ignition. Everything seemed to be in order and he attempted to start the engine again, while looking around for a clearing large enough to land an L-19. The only spot visible was a plowed field with the wind blowing across the furrows. Faced with the choice of a cross-wind landing parallel to the furrows or landing into the wind and across the lines of plowed earth, the pilot smiled, touched a lever and headed into the wind. Seconds later, the L-19 slid to a stop.

With conventional landing gear, the plane would probably have ended nose-up or ground-looped. However, equipped with Universal Landing Gear, the pilot was able to land his plane in the plowed field with confidence.

Consisting of two flat-bottomed landing skis attached to the main landing gear struts of the L-19, ULG is the latest step in the Army's continuing campaign to operate observation airplanes in and out of unprepared fields with safety and ease.

One of the earlier devices came into existence back in 1942 when a young Artillery Lieutenant, Jim Brodie, developed a cable device for launching and recovering light planes which could be set

L-19 lands in field with ULG.



Close-up view shows skis attached to landing gear.

up on board a ship, in the jungle, desert, or practically any place.

The Brodie device eliminated the need for prepared landing strips, substituting a wire cable on which the plane landed or took off by means of a hook attached to the top of the aircraft. Tested in amphibious training, the Brodie device was used effectively on LSTs in the Okinawa campaign.

However, with the end of the war, no further need existed for operation under conditions for which the Brodie device was invented and the system is only remembered today by older pilots.

One of the answers to this problem of landing on unprepared fields is ULG which makes operations on snow, ice, water, and uneven ground surfaces feasible and provides increased flotation on surfaces which would not support an aircraft equipped with conventional landing gear.

Wheels protrude a short distance below the skis, permitting operation on solid surfaces while the skis provide flotation on other surfaces. The two skis are actuated hydraulically from the cabin by the pilot using a hand pump and pre-charged accumulator to supply the required pressure of approximately 1,000 psi. Angle of the skis to the aircraft leveling line or "trim" is controlled by the hydraulic selector valve on the control panel. Up-trim places the skis 3° above the line; down-trim drops them 13½° below the line, making them parallel to the ground when the L-19 is in a three-point position; free-trim cuts off the pressure, allowing the skis to seek their own "trim" individually when landing or

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Captain George S. Kent, *Arty, is a project officer with Test Division, Board Nr. 6, CONARC, Ft. Rucker, Ala. The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor*

Beach to water transition, flotation pod attached.

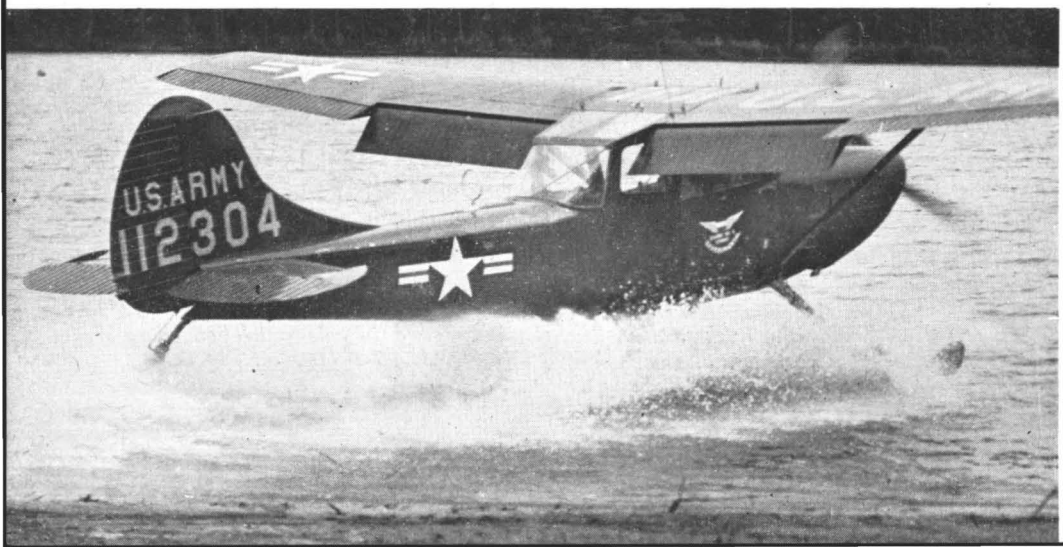
taking off. While in the free-trim position, sufficient line pressure exists to hydraulically dampen the skis when landing.

Water and Beach Operations

A section of beach at Lake Tholocco, near Fort Rucker, Ala., was selected for water and beach testing operations. Beachings were confined to a 100-foot strip on which a beach gradient of 1 to 14 was maintained. The terrain was a heterogeneous mixture of sand, mud, clay and earth which combined to hinder consistent acceleration on beach runs. Water operation required that a minimum taxiing speed be maintained since the ULG is not buoyant while at rest. Static flotation as a safety device during portions of the tests was obtained by attaching a large styro-foam pod to the underside of the fuselage.

Operating in water varying from glassy to choppy with waves as high as 10 inches, runs were started on the beach into the water with good effect. Transition from ground to water was normally smooth, once ground acceleration reached a speed that assured

Beach to water transition, skis in free trim.



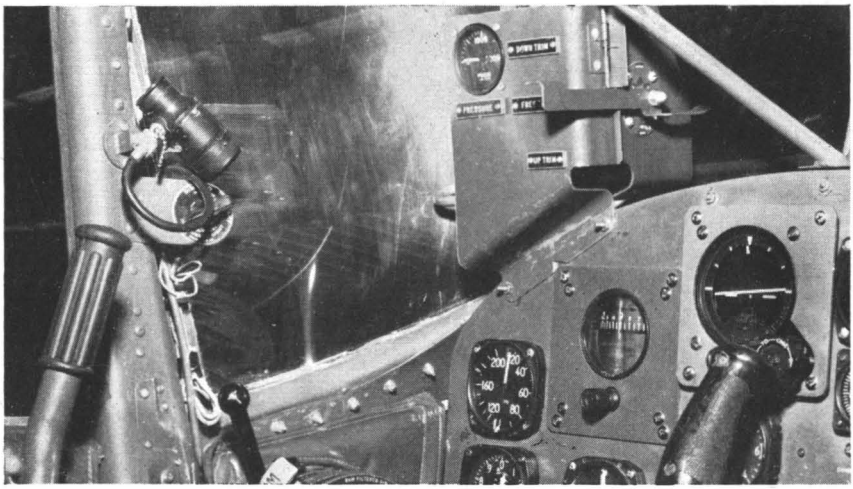
Smooth touchdown tests ULG equipment on sand.

planing to prevent a water stall. Slow, medium and fast taxiing on water was feasible but required developing specific techniques. Transition from beach to water and vice versa were readily accomplished both into the wind and in cross-wind conditions. Tests determined that short approaches to the beach could be made from various angles up to 50 degrees. Transitions from beach to water made at minimum angles to the beach achieved best results. Because of spray around the air intake, the engine was operated with "carburetor heat on" to avoid engine stoppage.

Water Landing and Takeoff

The technique used for landing the ULG-equipped L-19 on water is approximately the same utilized for landing a float plane. Landing approach was usually made with up-trim pressure on the skis, 30° or 45° flaps, 60 knots airspeed, between 1,200 and 1,300 rpm, carburetor heat on and the auxiliary fuel pump turned on. Upon contact with the water, care was exercised to keep the ski

Water to beach transition, skis in free trim.



Interior of cockpit shows hydraulic handle and ski trim control system.

bow tips out of the water. Once on the water, it was found necessary to apply power within two seconds to maintain good taxi control. Takeoff runs averaged between 300 and 500 feet, with shorter distances possible under proper wind and water conditions. Experience soon developed the necessary "feel" for successful water takeoffs.

Water Taxi Control

Providing the plane did not decelerate too rapidly upon landing, 1400-1500 rpm was the approximate range at which a lower rpm resulted in deceleration and increasing the rpm resulted in acceleration in a properly trimmed L-19 with 30° flaps and skis in up-trim position. A safe rpm for taxiing in up-trim skis was between 1700 and 1800 if the aircraft did not decelerate too much prior to application of power. Best point at which to change from up-trim to free-trim in a taxi run was approximately 1300 rpm with a waterspeed of 15 to 20 knots. Faster entry rpm and higher speeds resulted in a sucking down of the skis and subsequent porpoising. When this occurred, switching back to up-trim and increasing power alleviated the condition. Upon successfully switching to free-trim, a power increase was usually found necessary, with an increase to 1700 or 1800 rpm providing the smoothest run.

When turning on the water with skis in up-trim position. a loss of directional control was felt at times, necessitating either slowing down, going into free-trim or a combination of the two. Combining a slowdown with free-trim was the most satisfactory remedy, particularly on beach approaches. Variations in aircraft loading, condition of wind, beaches and water and air temperatures affected ULG performance to some extent. Need for a device to indicate water speed was definitely established.

Stalls

Four water stalls occurred during the course of the tests. Two were caused by water entering the air-intake duct resulting in engine stoppage. Operating with the "carburetor heat on" while on the water prevented recurrences, although a loss of 100 to 200 rpm resulted. Modification of the air intake may eliminate this. The third stall happened during a beach-water transition when the left ski entered the water prematurely. The aircraft water-stalled 10 feet from shore. It was pulled back to the beach and operations resumed. Stall four took place during a turn with the flotation pod attached and was attributed to lack of power application to overcome this unfamiliar increased resistance. Presence of the pod caused excessive drag on water necessitating higher rpm to maintain safe taxi speed. Water operation became more critical with the pod attached.

Normal Flight Operations

Tests were flown in calm and turbulent air, in rain and at night. A slight oscillation of the landing gear occurred when flying near cumulus clouds, or when thermals and turbulence were encountered. This oscillation was not serious and usually ceased after a brief period. No other indications of instability were found and the aircraft responded normally to the controls.

For cross-country flights, the up-trim position of the skis proved to be the best. During the night landings, vision was partly restricted by the respective positions of the selector control panel and the landing light, both located on the left-hand side of the plane. The flotation device (styrofoam pod) was found to restrict performance. Bulky and weighing 145 pounds, it produced adverse effects on the flight performance of the aircraft.

Maintenance

Relatively little maintenance was required on the ski assembly. The single grease fitting on each ski was lubricated and the skis carefully inspected after each flight. Tension on the four clamping bolts was checked after each day's operations.

A hand-tailored modification was required before the ULG could be installed on the L-19. Following this modification, only 20 minutes were required to install or remove the external ski assembly.

The cabin accessories and hydraulic system which remain in the aircraft required about 30 man-hours to install. The hydraulic hand pump operation was found to be cumbersome and tiresome. Tests proved the need for improvement on this system.

Extensive testing of the Universal Landing Gear under all conditions determined that it was suitable for landing, taking off and taxiing on water, sod and standard runways. The addition of ULG will increase the versatility of the L-19.

While ULG might not be the answer to all Army fixed-wing landing problems, it is quite evident from the tests conducted that a step is being made in the right direction. As one Army aviator remarked, on seeing ULG operate for the first time: "Considering its usefulness, I think I may even get accustomed to those things hanging there."

Aeronautical Engineer Graduate Schooling

Three spaces for January, 1957, and three more for June, 1957 are still available to Combat Arms officers who can qualify and are interested in aeronautical engineer graduate schooling. Applicants selected may attend either Georgia Institute of Technology or Massachusetts Institute of Technology for two years of study, leading to a master of science degree. Full pay and allowances, plus tuition and books are provided. In addition to the present demand for these graduate engineers, requirements for the future are expected to increase the number needed.

AR 350-200, 9 December 1955, outlines eligibility criteria for the course. Procedure for application is contained in AR 350-205, 19 January 1956.

The author, right, briefs WO-2 Merrill Stevens prior to an evaluation flight.

WHO INSTRUCTS THE INSTRUCTOR?

Ralph B. Greenway

WHAT'S YOUR PROBLEM, Mr. Anthony? In this case, Mr. Anthony is the person who turns Army aviators into what are locally known as IPs—Instructor Pilots—who in turn train some 3500 flight students each year at The Army Aviation School.

The big problem is the person who knows he can fly better than anyone else but is not interested in passing that knowledge on to students. This question, which looms almost as large as finding enough teachers for an expanding program, is the instructors' biggest headache.

The chance of an Army aviator becoming a flying instructor is about 50-50 in the course of his career, what with the rapid expansion of Army aviation. As of now there is a steady stream of regular Army aviators and civilian fliers being "standardized" by Methods of Instruction, headed by Major Edgar N. Anderson, an Artilleryman with wings who has had twelve years of Army flying experience.

Being an experienced Army aviator, or a top notch civilian flyer, is not enough for The Army Aviation School. The potential instructors must become teachers as well. Turning a pilot into a flying professor is the chore of MOI, Academics and Flight. Standardization of flying and instructing technique is the essence of a day's work at MOI. There is a saying down below "Tank Hill," where MOI is located, that, if you don't love your work, you just don't stay.

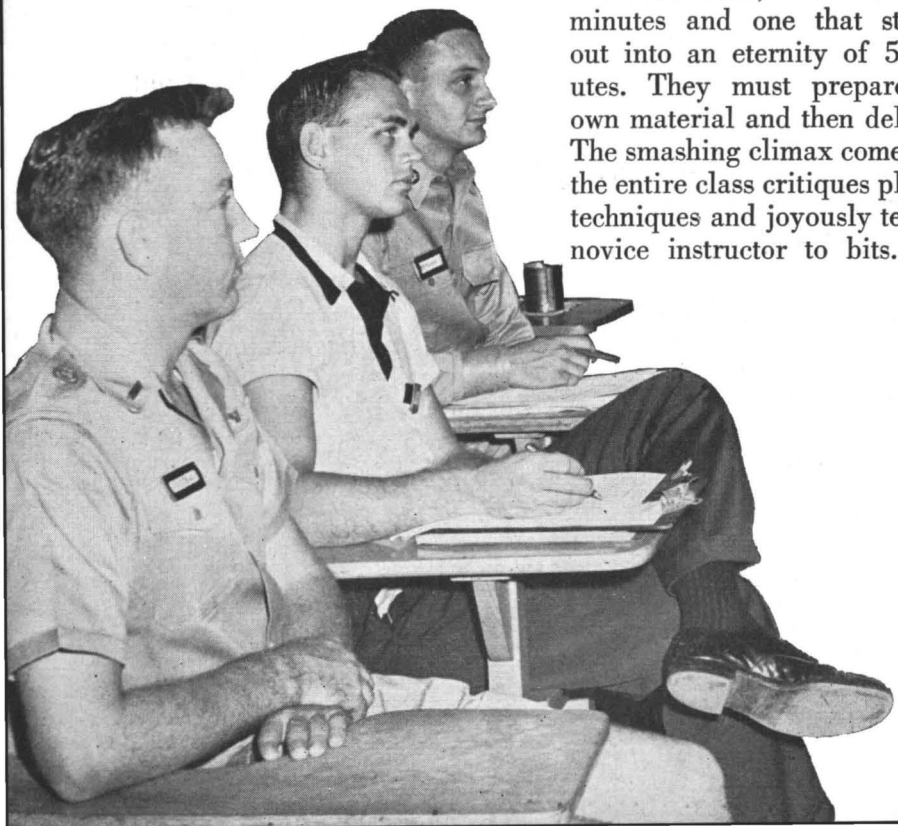
Mr. Ralph B. Greenway was a civilian flight instructor with The Army Aviation School from 1946 to 1956. His most recent assignment is with the Chief, Army Flying Safety, Washington, D. C. The views expressed in this article are the author's and not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

As in other professions, there are many "tricks of the trade" developed through plain experience. There are also as many opinions among pilots on certain phases of flying as there are pilots. MOI does not attempt to teach each IP how to fly but they do show them what must be standardized, so that instructors will (with some leeway) teach in such a manner that the student will not be confused when he changes instructors.

The pressure is on prospective IPs from the time they arrive at The Army Aviation School to build them up to the instructive period ahead. The first step is MOI (Academic), Captain Charles B. Badgett's bailiwick, where learned ex-professors with impressive scholastic records teach them how to teach.

"Whether it is a lecture platform or an L-19 cockpit," Capt Badgett (whose branch is CE) likes to say, "it's still teaching. We want them to be effective and this is how it's done." His staff proceeds to show the prospective IPs, and then watch them do it.

The next three weeks see the ex-professors putting future IPs through their paces. They receive orientation, fundamentals of instruction, instructional psychology, and principles of oral instruction. The by-then horrified IPs learn that their training calls for four talks, three of twenty minutes and one that stretches out into an eternity of 50 minutes. They must prepare their own material and then deliver it. The smashing climax comes when the entire class critiques platform techniques and joyously tears the novice instructor to bits. When



they get through this period, MOI (Flight), headed by Capt Leland H. Willard, takes over.

Army aviators who have spent the past few years bending a throttle have their problems in converting to instructors. The big hurdle is learning to talk while taking a student through a maneuver. MOI (Flight) takes care of this admirably by letting the potential IP go through maneuvers on an evaluation ride. If the prospective teacher does not come through, the evaluating pilot suggests a few maneuvers be performed, while explaining them. Is this difficult? The answer is that fifty percent of the civilian applicants wash out on the evaluation ride. Some of these highly skilled fliers have 5,000 to 10,000 hours but they "haven't got it" for instructing.

One "hot" applicant buzzed into MOI Flight Section one day for an evaluation ride. He made it pretty obvious that this was a mere formality. After the check ride he wanted to know his score.

"You just got in," the instructor said, "by the skin of your teeth."

The pilot took such violent exception to this that he walked off in a huff. "It's just as well. He'd have probably been among the small percentage we wash out after accepting them as IPs." Due to the process of careful screening on the evaluation ride, and enforcing the high standards of The Army Aviation School, the number of washouts after acceptance is startlingly low.

I have been through several flight instructor courses, CAA, Air Force and others. Their mission was to teach standardized performance of flight maneuvers. After the maneuvers became polished and met the standardization requirement, the new instructor was launched upon his flight instructor career. Therefore the

A knowledge of platform technique is important to future instructors. 1st Lt J. A. Cox, a prospective instructor, presents his second 20-minute lecture.

new instructor did not become fully productive for many months.

The Army Aviation School took a new approach to an old problem.

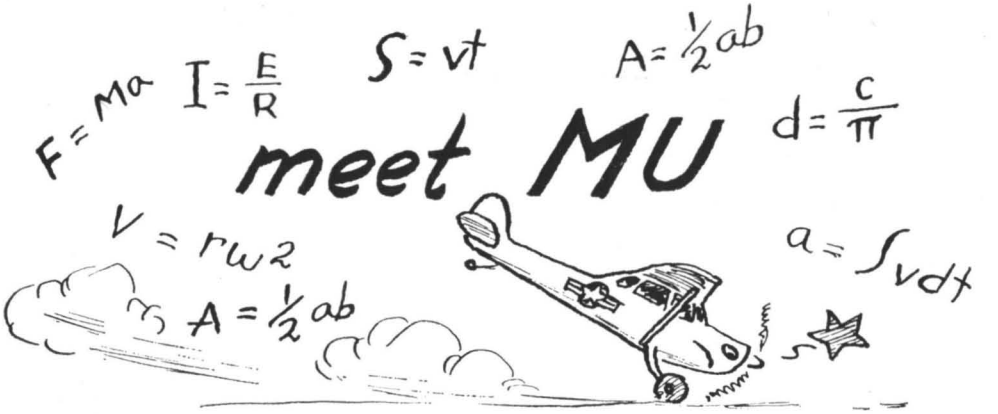
In the MOI Flight Course teaching standardization of maneuvers is not enough; it is just the beginning. The new instructor is taught the basic fundamentals of methods of instructing; he is taught the qualities that are required of a good flight instructor; he is taught to analyze and break the maneuvers down into their component parts, in order that the student may have a logical and thorough understanding of each maneuver. This system enables the new flight instructor to attain maximum productivity in a minimum period. Consequently, the student does not suffer from the "Break In" period of the new flight instructor.

The quality of the instructor pilots graduating from MOI attest to the quality of that brief period of taking an Army aviator or a civilian instructor and turning out a qualified fixed- or rotary-wing instructor.

The flight syllabus for prospective IPs is divided into five stages, but can be broken down into familiarization and proficiency, and principles of instructing. The fixed-wing instructor receives about 35 hours of dual and 21 hours of solo time. During this time he gets information and procedures and teaching techniques that will make him a well-rounded instructor in five short weeks. The course is designed for five weeks, but a student can graduate at any time the instructor feels he is ready. The rotary-wing instructor gets more flight time, 47 dual and 23 hours solo.

Ordinarily a flight instructor is not considered fully qualified until he has "broken the ice" on a few students. Under the system at MOI, the instructor is ready to go when he is assigned to a flight. MOI still "keeps in touch" and checks with flight commanders on the progress of their graduates.

The men who come to MOI for standardization have varying shades of experience. Some of them are reluctant about the approaching period of teaching. After going through MOI, where the importance of their job is made plain, a gradual change comes about. The fledgling instructor realizes the importance of his task and he knows it is no place for an amateur. Suddenly he realizes that working with human material can make for more pride in accomplishment than any other job he could possibly do. He is producing Army aviators for the best Army in the world. He would not have any other job.



Lt. Col. W. H. Byrd

Nolen G. Howell

FLYING COULD BE SAFER if the aeronautical engineer and the pilot spoke the same language. The engineer will delve into mathematics and come up with an answer to a problem which is perfectly clear to him. On the other hand, the pilot may lack a complete understanding of that problem. By translating the engineer's thinking into terms which the average Army aviator will appreciate would clarify the situation. One important example illustrating this point is the coefficient of braking friction which the engineer refers to as "Mu" (μ).

Mechanical friction is the resistance to relative motion between two solid surfaces in contact. The friction force which one surface can exert upon another is directly proportional to the perpendicular force pressing the two surfaces together. The coefficient of friction is a number which describes this relationship. A braking coefficient of one could apply brakes hard enough to throw the pilot against the instrument panel with a force of 1g. Obviously this much decelerating force is not experienced when braking a landing roll. According to the engineer:

$$1.\ \mu = \frac{F}{W} \qquad \text{or}$$

$$2.\ F = \mu W$$

when μ = Coefficient of friction
F = Force in pounds tending to reduce speed
W = Perpendicular force (weight) in pounds

Mr. Howell, former flight advisor to the Director of Instruction, The Army Aviation School, Ft. Rucker, Ala. is now Director of Training of the Army Aviation Training Detachment, Edward Gary AFB, San Marcos, Texas. The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

The coefficient of *static* friction between rubber and concrete is approximately .5. The actual value used by different manufacturers varies extensively. In this article we will use .35 which may be a bit low, but this will provide some compensation for the fact that the following computations are based on the assumption that the entire weight of the aircraft is placed on the tires immediately when the aircraft lands. Static friction is friction on the verge of sliding. Sliding friction is much less than static friction. The coefficient of *sliding* friction between rubber and concrete for the purpose of this discussion will be considered to be .20.

What force is available for stopping a 1500-lb. airplane if the coefficient of friction is .35? Formula 2 shows that 35% of the weight can be converted into a decelerating force.

$$F = .35\ (1500)\ \text{lbs.}$$
$$F = 525\ \text{lbs.}$$

Does it help to slide the tires if you need to stop quickly? The answer is no.

$$F = .2\ (1500)\ \text{lbs.}$$
$$F = 300\ \text{lbs.}$$

Obviously a decelerating force of 525 pounds will stop an aircraft quicker than one of 300 pounds. To stop in the shortest distance, use maximum safe brakes just short of sliding the tires.

The coefficient of friction between rubber and other runway surfaces will not be the same number as between rubber and concrete, but the same theory applies.

Another way the engineer would look at this problem is to consider it in relation to Newton's second law of motion.

3. $F/W = a/g$

where F = force in pounds
W = weight in pounds
a = acceleration or deceleration in feet per second per second
g = constant of gravity (32 feet per second per second, approximately)

since $\mu = F/W$ and $F/W = a/g$
$\mu = a/g$

or 4. $a = \mu g$

For an airplane with a μ of .35

$$a = .35\ (32)$$
$$a = 11\ \text{ft. per sec. (approximately) per second}$$

So this aircraft could reduce its speed 11 feet per second every

second under maximum braking conditions.
Suppose the pilot slides the tires:

$$a = .2\ (32) \text{ ft. per second}$$
$$a = 6.4 \text{ ft. per sec. per second}$$

Deceleration is 6.4 feet per second. Of course, the coefficient of friction would change when the tires blew out.

Next, consider stopping distance. It does not take an engineer to reason that somehow the distance to stop must be related to the touchdown speed and the rate of slowing down. Again the engineer would revert to mathematics to explain this relationship. Any high school physics text will prove the formula.

$$5.\ S = \frac{V^2}{2a}$$

where S = distance covered in feet
V = velocity or speed in feet per second
a = acceleration or deceleration in feet per second per second

Formula five says that the distance covered is equal to the velocity required (speed multiplied by the speed) and then divided by twice the acceleration, or deceleration in this case.

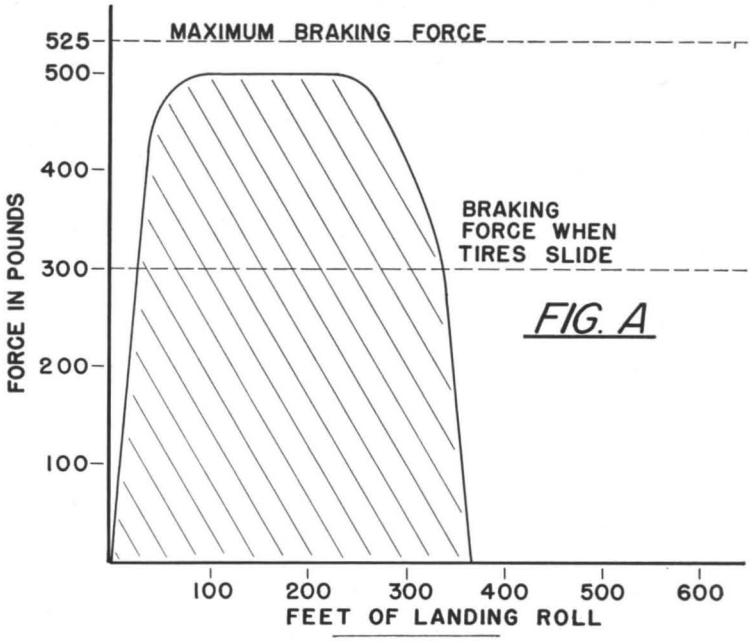
Formula four determined that the aircraft could decelerate 11 ft. per second. If it touches down at 60 mph, what is its theoretical stopping distance?

$$1 \text{ mph} = 1.467 \text{ ft. per sec.}$$
$$60 \text{ mph} = 88 \text{ ft. per sec.}$$
$$S = \frac{88x88}{2(11)} = 352 \text{ ft.}$$

This assumes absolute maximum brakes throughout the landing roll, and does not consider aerodynamic drag. The L-19 airplane does not lend itself to this type braking because of the possibility of nosing over. Nevertheless the figures computed here have good comparative value. The distance required to slide to a stop would be 605 feet, provided the tires would last that long.

If ideal maximum brakes cannot be used, when and how should the brakes be applied? It takes energy to make an airplane go and it takes energy to make it stop. Braking then is a matter of absorbing the energy of motion.

Since the application of a force through a distance requires energy for braking action:
Loss of kinetic energy = retarding force x distance through which



the force acts. In an earlier example, 525 pounds of force were applied for 352 feet. This represents 184,800 ft. pounds of energy which must come from somewhere if the airplane is to stop. Aerodynamic drag supplies some of this energy which will be disregarded in order to keep the problem simple.

The engineer will not talk long before utilizing a curve of some kind. The following graphs are sketched to illustrate comparative braking action, and are not necessarily mathematically exact. The vertical distance equals the braking force in pounds, and the horizontal line to the right of zero represents the distance of the landing roll in feet.

In figure A, the pilot applied almost maximum brakes within the first few feet of the landing roll. Maximum brakes were held steady just short of sliding the tires until near the end of the roll. At this point brake pressure was rapidly reduced. Note the area under the curve. This represents force times distance which is energy. The hatched area represents the energy required to stop this aircraft. No matter how the brakes are applied, the area under the braking curve must be equivalent to this area if the aircraft is to stop.

How were the brakes applied in Figure B? This pilot applied no brakes the first hundred feet. He then slowly applied brakes until the tires were sliding. He immediately released brakes. The curve would have dropped from point a to point b with his holding hard brakes and sliding the tires. The fact that the curve dropped

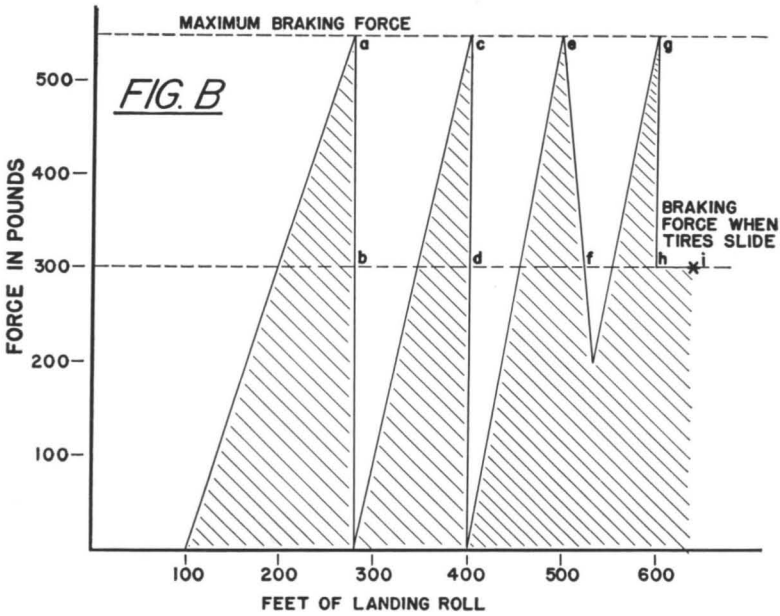
down to zero force shows that the brakes were completely released. This performance was repeated at c-d. The only thing done differently at e-f was that brakes were not completely released. Hard pressure was again applied (point g) which resulted in the tires sliding (point h). This time pressure was not released and the aircraft slid to the crash (point i).

Visually compare the area under the curve in Figure A with that in Figure B. They are about the same. Note the difference in landing roll.

The above curves show clearly the proper braking technique when maximum brakes are necessary to shorten the landing roll. These techniques are seldom needed, but when they are, there is no time to consult the engineer.

In conclusion, always remember these three points if you must reduce the landing roll:

1. Apply maximum safe brakes immediately upon touchdown.
2. Use continuous maximum safe brakes throughout the landing roll. Don't forget that maximum safe pressure in an L-19 decreases as the speed of roll is reduced.
3. Do not slide the tires.



Temperature and Humidity Govern Power Output

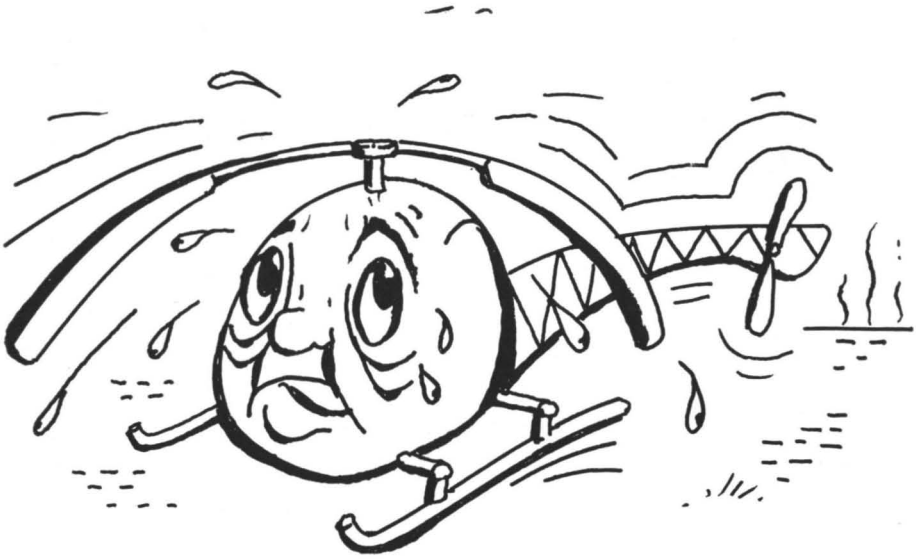
T and H Affect Your Takeoff

Sp-3 Joe D. Gault

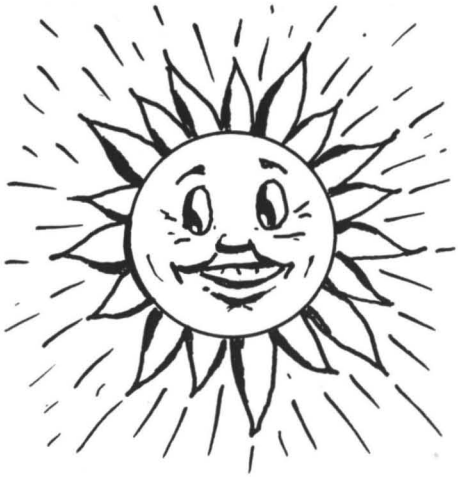
"HOW WILL MY TAKEOFF be affected on a hot, humid day?" This is a question frequently asked, and the answer normally received is one of aerodynamic nature where lighter air provides less lift. But is this the whole story? Power drop-off *also* is a natural consequence of high atmospheric temperature and/or humidity and should be given due consideration. With the relatively high payloads at which current Army aircraft operate, takeoff performance can tolerate little, if any, drop-off in engine power during emergencies.

The Problem

A reciprocating engine needs two elements for the production of power: fuel in the form of vapor and oxygen which is present in the volume of air that is drawn into the engine. If this is standard dry air, it will contain 21% oxygen by volume and maximum oxidation or burning will take place. Naturally, if either the



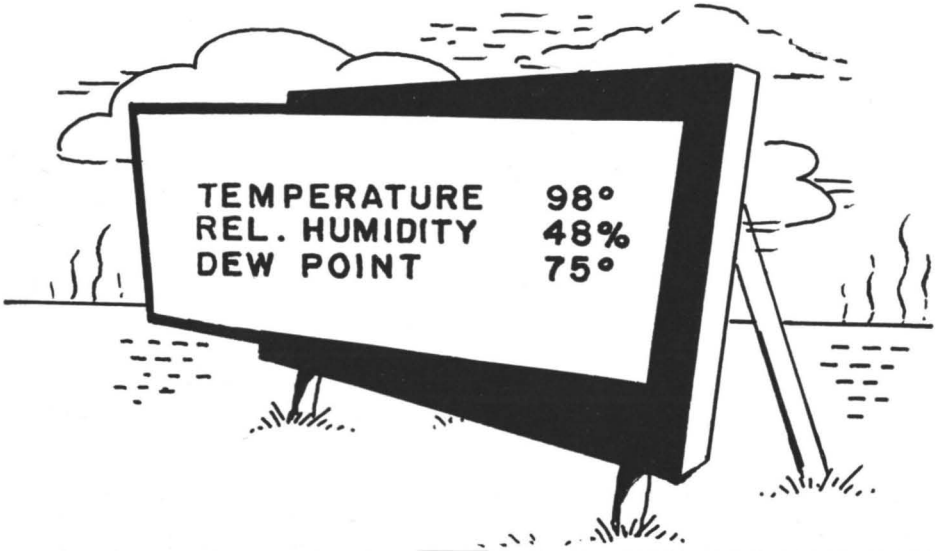
Illustrations by Sp-3 George T. Birch



fuel or its oxidizing agent is reduced, combustion will be hindered. The breathing characteristics of the engine limits the quantity of air that can be supplied, and hence the amount of oxygen available for combustion. Basically then, the maximum power produced is dependent primarily upon the percentage of oxygen in the air, and this problem will revolve about those factors which reduce this value. Since temperature and humidity are the prime factors affecting the oxygen content of air and therefore engine power, it is important to know these variations, and their approximate magnitude.

Temperature

First consideration is the effect of atmospheric temperature. A decrease of approximately 2% in air density accompanies each 10° temperature rise above standard which is 59°F. Since air density is a direct indication of oxygen content, it can be seen that combustion could be hindered a great deal. This appreciable loss, however, is partly compensated for by the fact that *warm air flows more freely* through the carburetor, manifold, valves, etc. Consequently, during the short time that the intake valve is open, the decrease in power is only about one-half of what would be expected.



Theoretical considerations confirmed by dynamometer tests show that the power drop-off is approximately 1% for each 10°F. rise above the standard temperature. This, at first glance, may not seem greatly significant, but it will be pointed out later that while the effect is not as great as that for humidity, it does play an important role in power losses.

Before leaving the subject of temperature it should be noted that the tendency for engine detonation increases rapidly with rising temperatures. To alleviate this condition the throttle must be backed off slightly, which in turn lowers available power. The magnitude of this factor varies with the particular engine, fuel used, etc., and therefore no general evaluation can be applied. However, a 1% power drop for each 10°F. temperature rise, (above the standard 59°F.), is definitely a conservative figure for expressing the power loss.

Humidity

Water in the air in the form of rain or fog is not considered to be humidity and does not of itself cause power losses. In fact, water in concentrated forms can be utilized under certain conditions to increase power. This process, called water injection, controls burning of the fuel-air mixture at high manifold pressures. Our concern is with water in the gaseous state or water vapor.

Only a certain amount of water vapor can be present in the air under any given set of conditions. This quantity increases as temperature rises. One way to indicate the amount of water vapor present at any one time is by the term "dew point." This is defined as the temperature at which the existing air would be completely saturated by the water vapor prevailing in the atmosphere. It would be well to note that if a ratio were taken of the existing temperature to the dew point temperature where complete saturation occurs, the resultant figure would be the percentage of saturation. This ratio will be used in a later calculation.

Specialist Third Class Joe D. Gault *is assigned to the Department of Academics, The Army Aviation School, Ft. Rucker, Ala. Sp-3 Gault has been assigned the special MOS of Class A, Scientific and Professional, by the Adjutant General. A graduate of the University of Wichita with a degree in aeronautical engineering, he was an analysis engineer with Boeing Airplane Company's Experimental Flight Test section prior to entering the service. The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor*

Most important is the fact that incombustible water vapor displaces oxygen and available power drops off appreciably. As a general rule this causes power losses which vary linearly from 0% at the no vapor condition to about 7% at the saturated condition. Another loss is caused by water vapor absorbing energy during combustion. This adds approximately a 4% loss to the saturated condition, giving a total of 11% for the two effects. Since the function is linear for all practical purposes, a good rule-of-thumb to use in calculating the loss is to multiply 11% by the ratio of dew point to temperature.

Again there is an additional minor effect for which a general rule can not be formulated. This is excessive enrichment of the fuel-air mixture. During takeoff, the mixture is usually increased to a value richer than the "best power" mixture for cooling purposes. When the displacement of oxygen brings about a further richness, a small amount of power is lost, depending upon the engine used, pilot technique, etc. This is well within the tolerance of our general rules and is mentioned only to point out the conservative nature of the above formula.

Conclusion

Let us determine the approximate loss for an H-34 on a day when the temperature is 99°F. and the dew point 70°F. Takeoff power for the H-34 is 1425 H.P.

I. Temperature:
   1% per 10°F. = 4% or 57 H.P.
II. Humidity:
   11% (70/99) = 7.8% or 111 H.P.
III. Combined loss:
   Approximately 168 H.P.

This article is not designed to provide an exact method for computing the power drop-off associated with temperature and humidity, but rather to point out its significance. Since all calculations have been kept on the conservative side, it can readily be seen that temperature and humidity merit considerable consideration when power losses can be critical.

FLY HIGH AND LIE LOW

DURING INSTRUMENT WEATHER conditions an unscheduled DC-3 appeared in the flow pattern between Salt Lake City, Utah, and Rock Springs, Wyoming. All aircraft operating in the area, except the lone stranger, were on instrument flight plans. Unusually heavy traffic was being positively controlled at the time.

The pilot was thoroughly frightened, as he should have been. His fright was evident in his radio transmissions asking for instructions. Air Route Traffic Control personnel could do little at the moment, other than shuttle him up to the 16,000 foot level to hold and permit urgent traffic to flow normally. At this altitude the blundering pilot lost his fright and became talkative and carefree. He wasn't sure of his position and wasn't very concerned about it.

During a lull in traffic, the DC-3 was brought down to 12,000 to make a holding pattern until something could be planned in his case. At this altitude he again evidenced fright bordering on hysteria. When another flow of traffic sent him to 16,000 he again became a man without a worry in the world. Later, safely on the ground, he remembered vividly his fright, but had no recall of events or his emotional state at 16,000. Therein can be found the basis of the lack of knowledge—pilots who have been physically impaired by hypoxia (oxygen-want) are not aware of it. The most dangerous effect is that the pilot is lulled into a false sense of well-being. This mental condition might be compared to intoxication. The subject "feels good," and doesn't have the slightest notion that his judgment or coordination is affected. In extreme cases of hypoxia, he suffers from a lack of memory and his reasoning processes slow considerably.

Oxygen is as necessary for human engines as for those of an aircraft. Oxygen starvation in a human being is like fuel starvation in an aircraft engine. Without life-giving air, a state of emergency soon exists. Some pilots brag about being able to "stand altitude." They will not hesitate to fly above 10,000 feet and even to 15,000 feet without oxygen. A general feeling of complacency has resulted over the years about the use of oxygen in the danger zone. As

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pointed out above, this complacency stems from ignorance.

The effects of high altitude flying on the human body are known to most pilots. These include hypoxia, expansion of gases in the body, need for equalizing pressure in the middle ear and nasal sinus, escape of dissolved blood gases in the form of bubbles (divers call it bends), and increasing cold from altitude.

In flight, oxygen-want begins at about 5,000 feet, but is not noticed appreciably by the pilot, except for decreased vision in dim light, until 10,000 feet is reached. Without oxygen, physically fit individuals become unconscious at 18,000 feet after short exposure; and unfit persons may collapse at lower altitudes. The more complicated functions of the body are most quickly affected. The most sensitive organ is the retina, and decreased vision begins at 5,000 feet. The chief manifestations of oxygen-want are loss of insight and lack of realization of danger, as well as an early false sense of well-being. A lessening of judgment, inability to think clearly, and a tendency to make errors are also apparent. The field of vision is smaller and the subject does not hear as well, grows sluggish and clumsy and lacks emotional balance.

There are numerous means of living in comfort at high altitude. Air carriers, the military, and a few business concerns use pressurized aircraft. Military pilots who engage in frequent high altitude flights use a pressurized suit which provides a relatively high barometric pressure both inside and outside the body.

Other pilots must use a pressure oxygen system with masks to obtain an adequate supply of oxygen. This pressure oxygen system which supplies oxygen to the lungs at a pressure slightly higher than that outside the body permits ascension to about 42,000 feet.

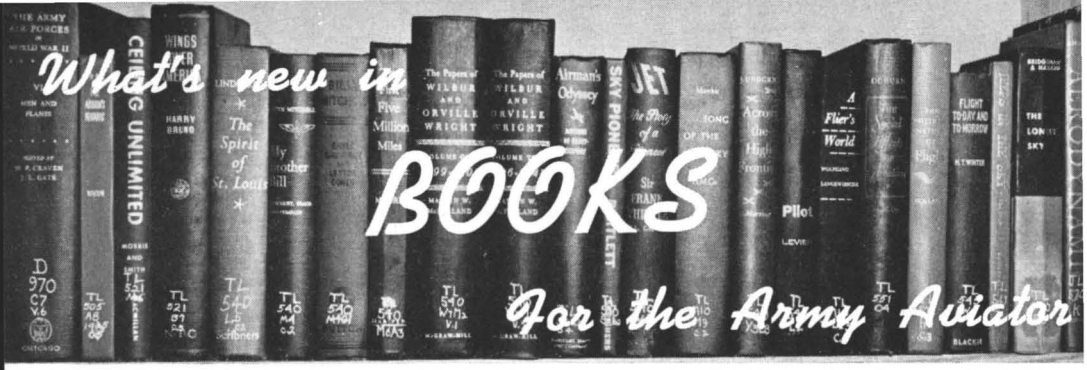
Flight Surgeons recommend the following:

Don't

Fly over 10,000 feet without oxygen in your aircraft.
Fly with a hangover. Altitude flying is a poor cure for one.
Fly after taking sulfas, aspirin and coal tar derivatives, antihistamines and motion sickness pills.

Do

Use oxygen on all long flights when cabin altitude is near 10,000.
Use oxygen from the ground up on long night flights.
Judge your need for oxygen by your altimeter and not your sensations.
Check your oxygen equipment frequently.



SATELLITE—*Bergaust, Erik and Beller, William (Hanover House, 575 Madison Ave., New York, N. Y., 1956. $3.95)*

Reviewed by Sp-3 Frank J. Jandrasi

The inside story on the birth of Project Vanguard, man's initial attempt to launch an artificial satellite, is presented for the first time to the public in this book. The far-reaching significance and the reason for the project are clearly stated.

It is interesting to note that while many chapters of this book seem to be clippings from science fiction stories, the problems encountered and the scientific information sought by Project Vanguard's scientists and military personnel are not so fantastic. This information is a necessity for future high altitude and high speed aircraft design.

The presentation of facts and the insight into the near future is well presented by Bergaust and Beller. The book goes into detail on the events leading up to Project Vanguard and the people responsible for creating the project. It also describes in detail the benefits expected to be derived from the project, such as new data on aerodynamic heating, air-drag effect at orbital altitudes, atmospheric density, cosmic ray intensity, ultra-violet radiation and more accurate determination of intercontinental distances.

The book also delves into such fields as rocket technology, space medicine, zero gravity and orbital studies.

There is an interesting discussion of the future aspects of satellite science, along with a step-by-step progress analysis of future events.

FLYING FRONTIERSMEN—*Potter, Jean (The MacMillan Company, 60 Fifth Avenue, New York 11, N. Y., 1956. $3.00)*

Our last frontier, Alaska, is a land where airplanes are more important than almost anywhere else in the world. The foremost

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Sp-3 Frank J. Jandrasi, *is an aeronautical engineering assistant in the Projects Division, Department of Academics, The Army Aviation School, Ft. Rucker, Ala.*

frontiersmen of the Far North have been the pilots of these small, battered, single-engine craft which were often pieced together with parts of other old planes. The pilots of these ships, as could be expected, cracked up with a difference. They knew cagey ways of "cracking up easy." They were all explorers in the early days. "We discovered the country," one of them said, "because we had to learn to read it—or else."

Nothing could stop these rugged young airmen. Cramming people and freight into the narrow cabins, they got the planes off the ground somehow, flew them through uncertain skies above the forbidding land and brought them down in the wilds wherever they could.

This book is their wild, dangerous and sometimes heroic, sometimes ludicrous, story.

SECRETS OF SPACE FLIGHT—*Mallan, Lloyd (Arco Publishing Company, Inc., 480 Lexington Ave., New York 17, N. Y., 1956. $12.50)*

Here is a picture-story of the past struggles, present achievement, and future probabilities of man's great surge toward outer space. Nowhere before has the subject of rocketry and space flight been covered by such a wide variety of photos—almost all of them exclusive, drawn from the private files of research centers throughout the nation or made by the author himself during his 18,000-mile trip under military auspices to collect material.

The list of subjects covered by this book is impressive: Ships that probe the unknown; space medicine forges ahead; men, mammals and gravity; escape capsules and rocket sleds; development of the space suit; spaceship in the basement; launch into the stratosphere; searching through space; school for future pilots; checkout in a rocket ship; research rocket takeoff; engines of tomorrow; giant step into space; from "Mouse" to the Moon to Mars; men who make spaceflight possible; spaceflight in history, fiction, and film; flying saucers brought up to date.

This book is a worthy contribution to the literature of spaceflight.

Book reviews appearing in this department do not necessarily reflect the opinions of the Department of the Army or The Army Aviation School.—The Editor

The Gray Hair Department

IT HAS BEEN SAID that if a device could be perfected to keep an L-19 on a straight line during takeoffs and landings that 60 per cent of Army aviation accidents could be prevented. It is a known fact that more airplanes are wrecked during the landing run than during any other maneuver. Why is this so and what can be done to prevent it?

To tell the pilot to play it safe is to tell him nothing he doesn't now know. He'll immediately reply that he doesn't want to crash an airplane, any more than he wants to wreck his automobile.

Colonel Frank E. Forrest, *Inf., the very senior Army aviator pictured above is Chief of the Sixth Army Aviation Section, Presidio of San Francisco, Calif. His military career began at the early age of 16 when he enlisted in the 1st Virginia Infantry of the Virginia National Guard. A few years later, in 1934, he enlisted in the Regular Army as a private, and a year later entered the United States Military Academy at West Point, graduating in 1939. He is also a graduate of the basic and advance courses at the Infantry School, the Airborne School, and in 1953, the Command and General Staff College at Ft. Leavenworth, Kansas.*

During World War II, Col Forrest served with the 37th Infantry Regiment in Alaska and subsequently was assigned as Commanding Officer of the Alaskan Mountain Training School on Adak Island. Among the many other interesting and challenging assignments in Col Forrest's career occurred in 1946 when he was assigned as the U.S. Army observer-member with the Canadian Army's "Exercise Musk-Ox," and traveled 3000 miles across the

He is right about it. A considerable part of flying accidents are not related to lack of piloting technique but to carelessness or lack of judgment. No one knows this better than the pilots themselves or the operations officers.

In the ground loop this is what takes place: after touchdown, some force causes the nose of the aircraft to deviate from a straight line. It is at this point, when or before the aircraft swerves slightly, that corrective action must be taken, because the forces involved at that time are small. If the turn is allowed to progress, another force takes over and the situation is out of the pilot's hands and the groundloop is inevitable.

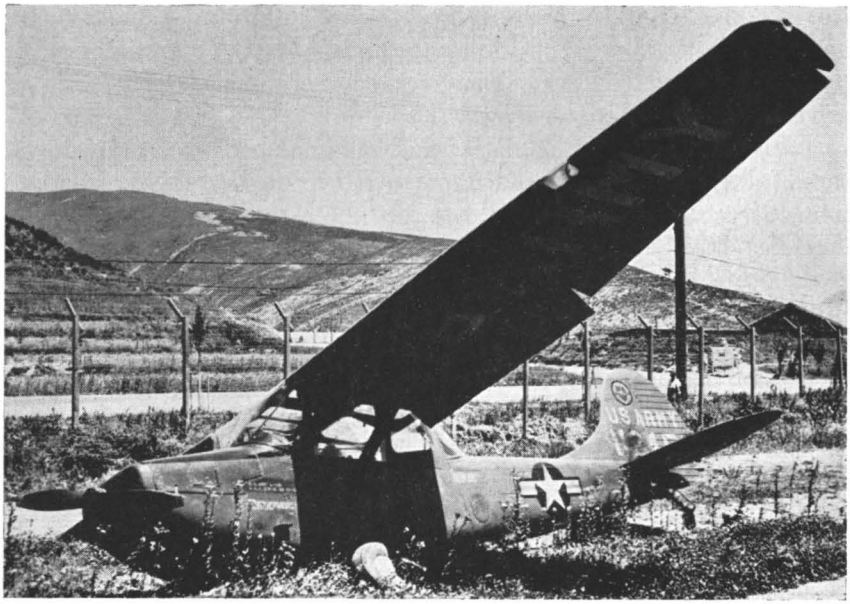
Centrifugal force is the cause. The center of gravity of an airplane equipped with conventional landing gear is located behind the main gear; therefore, if the aircraft swerves slightly, the center of mass tends to continue in a straight line, while the nose and main gear are trying to go in the direction of the turn. Centrifugal force builds up, tightening the turn and the tighter turn builds up more centrifugal force, which tightens the turn, building up more centrifugal—and so on, until the airplane stops, wrecked. There is only one solution. The pilot must touchdown with the axis of the aircraft pointed in the precise direction of travel and must keep it on a straight line until slowed down enough to turn off the runway. Usually, the groundloop is the result of carelessness—and ignorance. If the pilots understood more clearly what causes a groundloop, they would find it easier to prevent them.

Gust Balloons Aircraft

In Korea, a pilot was returning from an administrative flight;

Arctic Circle on an expedition that was designed to test equipment for Arctic Operations. In 1947 he served as an instructor in Mountain Climbing and "Over Snow Movement" courses of the Army's Mountain Training Center at Ft. Carson, Colo. In 1948 he was assigned as supervisor of flying training in the Department of Air Training at the Artillery Center, Ft. Sill, Okla., where he remained for 2 years until being assigned to Headquarters Sixth Army, as G-3 for aviation.

During the Korean conflict, he served as aviation officer for X Corps, and subsequently was a battalion commander with the 25th Infantry Division. After his return to the ZI and graduation from the Command and General Staff College he was assigned as the aviation officer, G-3 Section, Headquarters, CONARC, where he remained until receiving his present position at Sixth Army Headquarters.—The Editor



he entered left traffic with 700 feet for a landing to the east. He turned final with 30-degree flaps. A crosswind was blowing approximately 90 degrees from his left. He lowered the left wing and applied top rudder to keep lined up with the runway. The wheels were about to touch when a gust of wind raised the aircraft about ten feet. The pilot applied power and eased his airplane to the ground in a smooth three-point landing. The aircraft began to veer to the left. The pilot pressed hard on the right brake. The aircraft continued to veer and skidded 132 feet; the pilot's corrective action had no effect. The airplane turned 90 degrees to the direction of landing and the right gear tucked under. The propeller struck the ground several times and the aircraft turned abruptly, 180 degrees from the landing direction, sliding on its right wing into a ditch.

This accident probably would not have happened if it had not been for the gust of wind which ballooned the aircraft. Apparently the pilot was doing a good job on the approach. He had the proper

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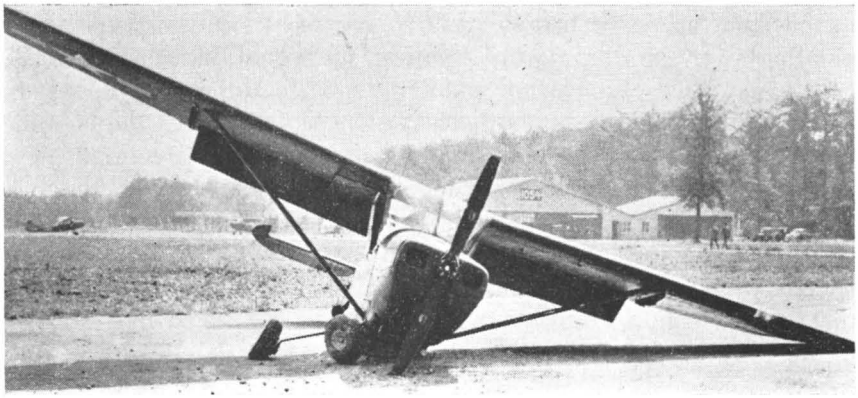
The Gray Hair Department is prepared by the ARMY AVIATION DIGEST staff with information obtained from the files of the Army Aviation Safety Board. The views expressed in this department are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

crosswind correction and seemed to be exercising good technique until the gust. His error came on the recovery when he applied power to ease his airplane down in three-point attitude. He relaxed his crosswind correction and the aircraft touched down, drifting slightly to the right. This sideward load caused the beginning of the swerve to the left. Under the crosswind condition this was enough to start the cycle of events which took over during the groundloop. The thing to understand clearly is this: the groundloop is not caused by the sideways drift, nor is it caused by pressure of the crosswind on the ship's tail surfaces. These things merely cause the first mild swerve. The first swerve is only the trigger releasing the bigger and more vicious effects of centrifugal force.

What makes a slight swerve tighten itself into a smashing spiral then, is the landing gear itself; the wheels are forward of the ship's center of gravity and any swerve will always set up forces that will make this swerve worse. The groundloop feeds on itself.

Crosswind Correction

A similar accident happened in Germany. The conditions were almost identical except this time the crosswind was from the right. The pilot made a satisfactory approach with 45-degree flaps, slipping into the wind to compensate for drift. He rounded out, still keeping the crosswind correction, and touched down on the right wheel and tailwheel. After rolling a short distance in this attitude, the left wheel made contact with the runway and the aircraft continued straight ahead for about 20 to 30 feet. But it became airborne again. The pilot later said, "I added a slight burst of



power to cushion the next touchdown. However, when I touched down the aircraft weather-vaned to the right, into the wind. I immediately applied full left rudder, which did not alleviate the problem. Then I applied full left brake and also slight pressure to the right brake to prevent a groundloop to the left. This action did not help; the airplane went off the right side of the runway and started skidding on the sod and turning to the right. The left gear folded under the fuselage; the left wing tip struck the ground and the airplane spun almost 180 degrees to a stop."

To keep the airplane rolling straight ahead, the pilot must work at it. He must perform, with his feet on the rudder and brakes, a sort of juggling trick similar to keeping a straight stick balanced on the end of your finger. This may seem elementary because the business of landing an airplane is done by the average pilot without conscious effort. Rolling at high speed, the pilot does have to think and work fast. The centrifugal force of any given swerve increases "as the square of the speed" at which the swerve is taken. Increase the rolling speed from 40 to 60 mph and the same swerve will produce twice the centrifugal force, that is two times as powerful a tendency to groundloop.

Crosswinds Not Necessary

Crosswinds are not necessary for groundloops. This pilot made a 180-degree side approach, power off and with 60-degree flaps and landed into an almost calm wind. The touchdown was smooth and straight for about 100 feet, then the aircraft swerved slightly to the right. The pilot applied left rudder and brake, correcting the turn. He rolled 100 feet more, then the aircraft began turning to the right again. It turned rapidly and as it swung around, perpendicular to the direction of landing, the wheels skidded over the runway surface and ran off onto the sod shoulder. The left gear folded under the fuselage; the left wing scraped over the surface until the aircraft stopped, headed in the opposite direction.

This incident emphasizes the fact that the rolling path of a landing airplane with conventional landing gear must be kept straight with superhuman accuracy. This is what limits the landing speeds which the average pilot can handle; it is not the length of the landing run resulting from faster landings, but the difficulty of keeping the aircraft straight enough.

"Going Around" May Help

Many times a groundloop resulting in an accident could have been avoided by "going around." One pilot landing on a 650-foot strip began an approach and set up to land within the first third of the runway. He flared out approximately 250 feet down the runway and floated about 50 feet more before the wheels touched. The aircraft rolled along in a tail-high attitude before the pilot could get the tail down. Realizing he was too far down the strip for a go-around, he applied full brakes but calculated he would not be able to stop before running into trees at the end of the runway. He started a groundloop to the left but the right main gear folded and the right wing and elevator struck the ground.

The best correction for groundloops is prevention. Careful correction for wind drift, proper use of flaps and power and prompt control of any deviation from a straight line on the landing roll is the only solution. If a groundloop does become fully developed it is best to let the airplane turn until its energy is expended, attempting only to keep the outside wing from dragging the ground. Violent application of brakes during a groundloop, particularly if the wing tip is in contact with the ground, can only make bad matters worse.

Straight and Level

TO: Editor-in-Chief

During my recent overseas tour as Aviation Officer of a small unit, I found the ARMY AVIATION DIGEST to be very interesting and helpful. I feel, though, that more articles are needed which supply information for the non-rated commanding officers who have aircraft within their command. The capabilities and limitations of Army aviation are not fully understood by commanding officers; and, as a result, the utilization of Army aircraft in many cases is improper and inadequate. The aviation officer, as a staff member, has a responsibility of assuring proper and adequate utilization of the aircraft under his supervision. This can be done by both formal and informal methods through contact with the commanding officer and his staff.

The problem of control is serious due to non-rated personnel quite often being in complete control of priority and scheduling. A lack of knowledge at this level concerning aircraft can result in hazardous missions due to sending aircraft not suited for the particular job or a loss of time and money for the same reason. Articles on this subject can be very helpful to the aviation officer who will bring them to the attention of the commanding officer and his staff if applicable to his particular situation.

Many missions compatible to an aviation unit are now being accomplished in the same manner as in the years before the aircraft and know-how were available. The aviation officer should watch for these and when necessary, prove by time and cost comparison the value of utilizing aircraft for these missions.

Ideas presented by the many readers of the ARMY AVIATION DIGEST would be of great assistance to those individuals responsible to assure the utilization of Army aircraft to their maximum. An extensive increase in the utilization of Army aircraft can be realized at a definite reduction in cost and time involved through determined effort on the part of aviation personnel, through the AVIATION DIGEST, and personal contact with the command personnel involved.

Another point that could bear study and discussion is the ever present stand-by aircraft for the commanding officer. Many times a personal call from the aviation officer will result in releasing this aircraft for necessary missions if it is not to be used by the commanding officer in the interim.

FRED G. HARRIS
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Letters of constructive criticism are welcomed by the ARMY AVIATION DIGEST. *To appear in this column they must be signed.—The Editor*

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For explanation of abbreviations used see SR 320-50-1.

WO Walter S. Catlow hovers the H-13H for refueling during the 60-hour flight at the Air Show which unofficially established a new endurance record.

CONGRATULATIONS to the Army officers and men responsible for the splendid showing made by Army aviation at the recent National Air Show in Oklahoma City.

Quoting from Maggi Mallman's article in CROSS COUNTRY NEWS, "Trailing at the end of each day's program, the 'Mighty Mites' gave the taxpayers a compact picture of their effectiveness in support of ground troops. From the H-13 helicopter to the fixed-wing 'Otter', all the aircraft currently employed by the Army gave a terrific demonstration of their capabilities, proving beyond a doubt their worthiness to become an increasingly important part of the Army."

One of the big hits of the show was the H-13H endurance flight with six Fort Rucker aviators combining to keep the helicopter in the air during the entire show. In addition to Mr. Catlow, shown above, others included Capt. Charles A. Walts, and Warrant Officers Alva Anderson, Joseph A. Pfluger, Bert E. Ratliff and George W. Cox, Jr.