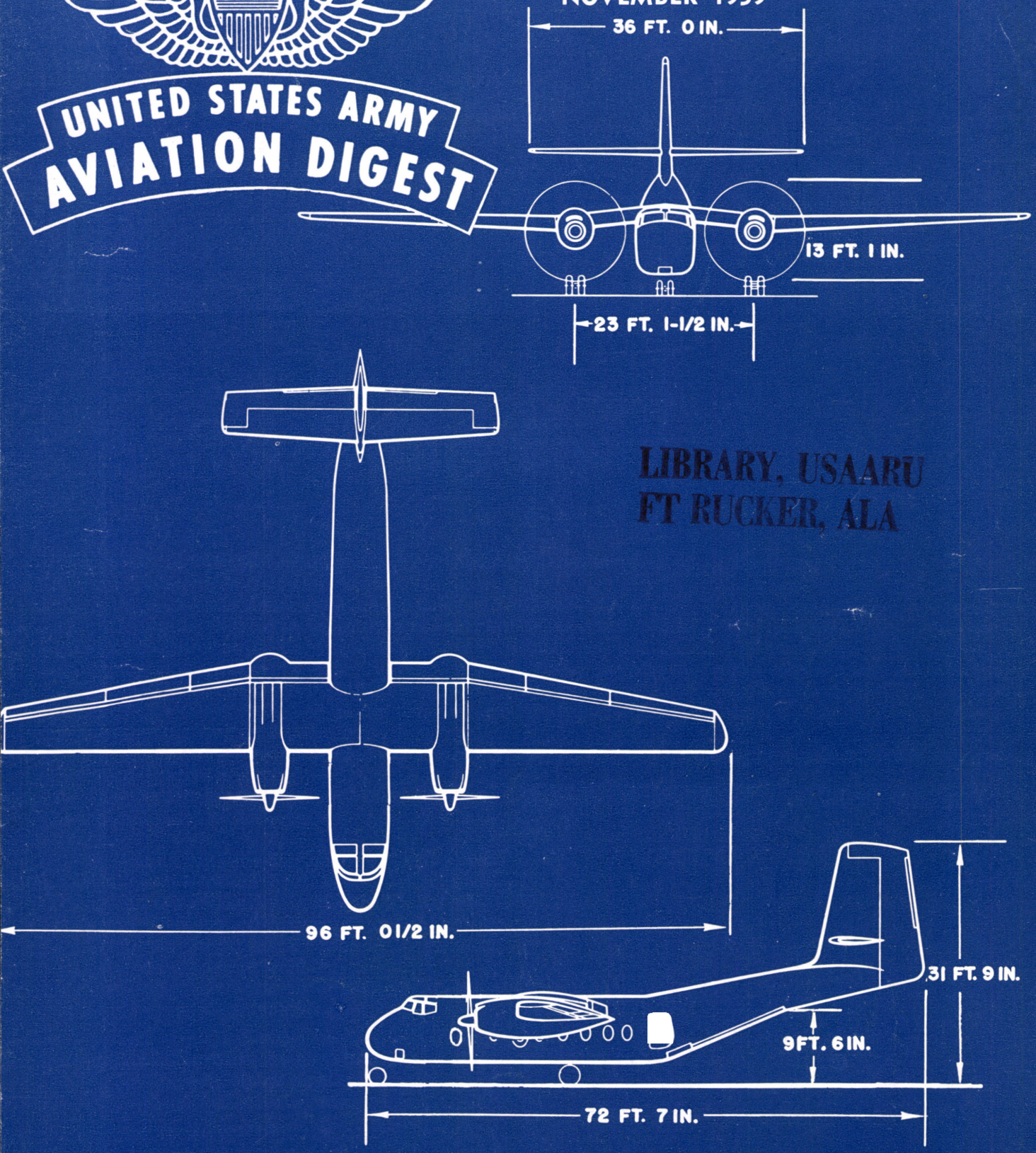
UNITED STATES ARMY AVIATION DIGEST

NOVEMBER 1959



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CARIBOU ARRIVES AT FORT RUCKER

(SEE PAGE 1)

United States Army

AVIATION DIGEST

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NOVEMBER 1959
VOLUME 5
NUMBER 11

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

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.

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 U. S. ARMY AVIATION DIGEST, U. S. Army Aviation School, Fort Rucker, Alabama.

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The printing of this publication has been approved by the Director of the Bureau of the Budget, 22 December 1958.

Views expressed in this magazine are not necessarily those of the Department of the Army or of the U. S. Army Aviation School. Unless specified otherwise, all photographs are U. S. Army.

Distribution:

To be distributed in accordance with requirements stated in DA Form 12.

CARIBOU DEBUT

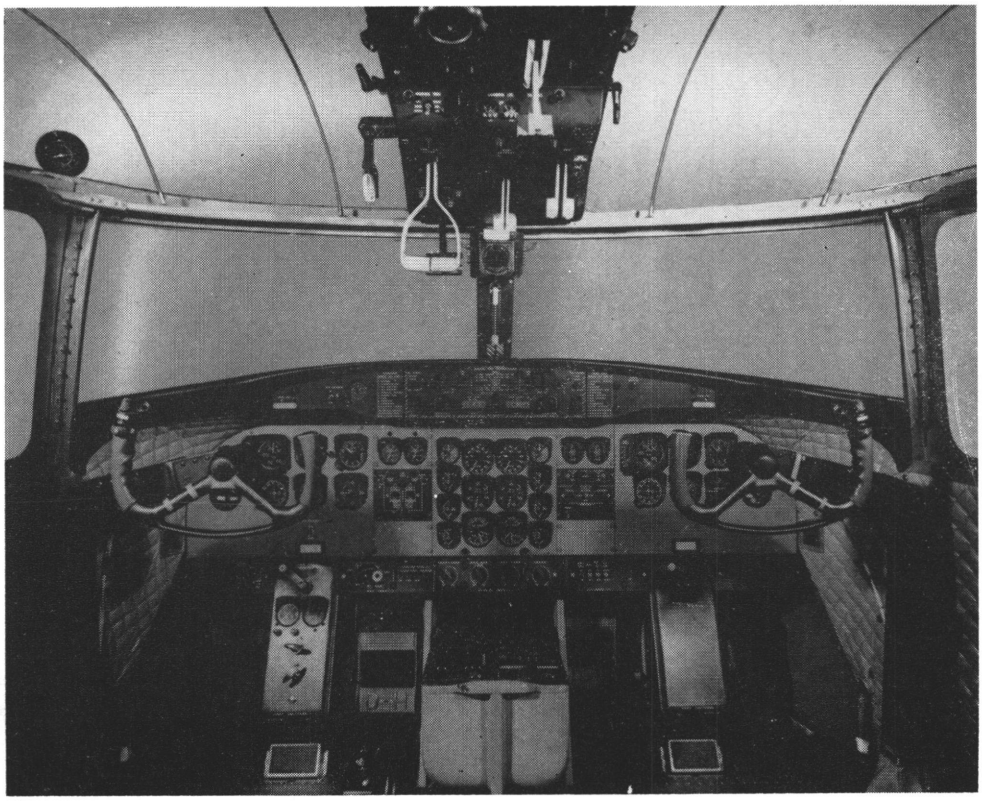
IN 1958 the U. S. Army purchased five DHC-4s (Caribou) from the DeHavilland Aircraft Company, makers of the Beaver and Otter. In October 1959 the United States Army Aviation Board at Fort Rucker received its first Caribou (Army designation YAC-1) and user tests were started immediately.

The Caribou is expected to play a major role in Army Aviation. By providing rapid mobility for troops and supplies, aerial supply drops, and casualty evacuation, the Caribou will expedite tactical operations and furnish logistical support in forward battle areas. The STOL characteristics of the Caribou enable it to operate in and out of tiny jungle landing strips, from beachheads, or from improvised military landing strips as short as 850 feet in length. It is designed to take off and clear a 50-foot obstacle in a distance of 1,040 feet with zero wind. With a 20-mile headwind, the takeoff distance over a 50-foot obstacle is just 460 feet. Landing distance over a 50-foot obstacle is 590 feet. (Sounds like a Bird Dog, doesn't it?)

THE NEW CARIBOU

Let's take a detailed look at the Caribou, a brand new aircraft that is not classified as a high performance aircraft, but one which will help bring the air unit alongside the ground unit.

The nerve center of the Cari-



The nerve center of the Caribou is simple and functional

bou, though comprehensively equipped, remains simple and functional. Army Aviators will find that comfort is achieved without sacrificing valuable safety instrumentation. The Caribou has standard electronic configuration with a modified "T" panel presentation. (ASW-12 universal autopilot will be tested in an early model.) Engine controls are mounted on an overhead console in the cockpit roof. Throttles are conveniently shoulder high and travel their full movement without awkward reaching by the pilot. Pitch and mixture controls are in the same "bank" with the throttles. The gear level falls conveniently to hand at the end of the throttle travel, allowing the gear-up cycle to be made smoothly and by touch .

Aft of the engine controls on the overhead console, the pilot finds the aileron trim, ignition switches, flap control lever, and carburetor air temperature control levers. The rear section of the overhead console contains a simple three-cock fuel control system. The system permits fuel from either tank to be supplied to its adjacent engine, or both, but prevents one engine from being supplied from both tanks simultaneously.

Overhead engine controls offer twin advantages of maximum pilot convenience in operation and leaves the instrument panel uncluttered.

All radio equipment is conveniently located on a console between the pilot's and copilot's seats when in use. When not in use on the ground or in flight, the console slides forward on runners into the instrument panel, allowing maximum room for crew movement and convenience.

Pilots may feel as if they are sitting in a glass house while in the cockpit of the Caribou. No less than 32 square feet of glass area allow the pilot a 265° arc of visibility from wingtip to wingtip and 183° from nose to tail. This additional visibility offers an advantage that becomes more important in high density traffic areas. Excellent forward and side vision enables the pilot to use minimum clearances between aircraft and approach obstacles.

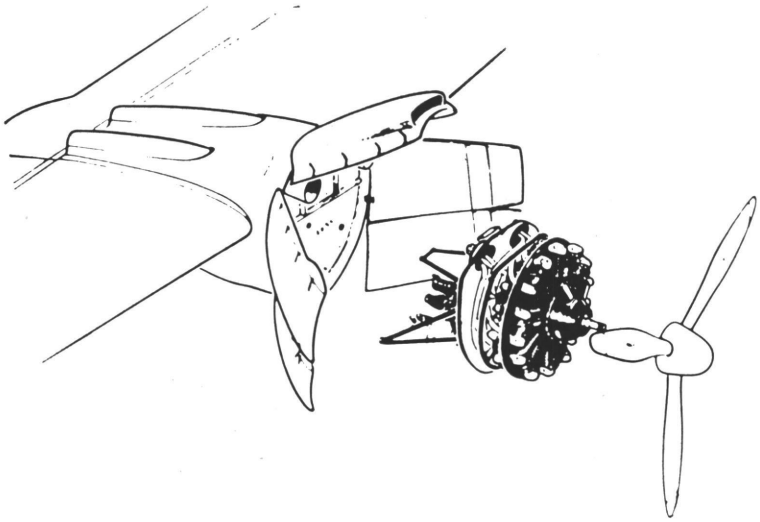
The nosewheel of the Caribou is powered over 124°, allowing the aircraft to turn in a radius of 27 feet. Pilot and copilot have a clear view of the ground 15 feet in front of the aircraft. This, too, gives maximum safety in taxiing over rough terrain and landing strips and simplifies airfield ramp parking.

MAINTENANCE FEATURES

The Caribou, its systems, and equipment have been designed to permit routine inspection and maintenance where limited facilities may exist. Components may be easily removed and replaced. The aerodynamically clean, straight lines of the all-metal airframe are designed to offer rigorous economy in maintenance and servicing costs.

An electric pump powers a 3,000 psi hydraulic system that operates the flaps, nosewheel steering, landing gear, and brakes. All hydraulics are independent of engine-driven pumps. This electric pump is in an easily removable power-pack assembly.

The Caribou is powered by



Engines are fully interchangeable

two dependable Pratt & Whitney R-2000-7M2 engines which are fully interchangeable. The powerplant forward of the firewall is identical on each side; thus a spare engine can be installed on either side. The propeller, reduction gear, accessories, and main gear legs are also interchangeable.

All fuel is carried in the outer wing panels outboard of the propeller discs as a safety measure. Walkways are provided on the upper fuselage and wing surfaces. Access and inspection panels are provided on the mainplanes, tailplane, and rudder. All major components, flaps, ailerons, elevator, etc., are produced from "mastered tooling" to ensure easy replacement of spare parts.

Requirements for special tools have been kept to a minimum. Quick disconnects on electrical and fluid lines are used extensively to aid maintenance personnel, and as a safety factor.

OPERATIONAL FEATURES

The gross weight of the Caribou is 26,000 pounds, payload 6,989 pounds, with fuel for 174 nautical miles. It is 72 feet, 7 inches long, has a wing spread of 96 feet, carries 32 troops, and uses about 90 US gallons per hour for two engines. The large rear loading door provides access to the cabin and also permits rapid jettisoning of cargo in airborne operations. The door may be left open in flight for paratroop (or paradrop) operations.

Pilots in the all new Caribou will find that trim change with flap lowering is compensated for automatically. With a 10-mph headwind the landing distance is a short 300 feet, made possible by large flap surfaces and power assisted hydraulic brakes. Added landing safety is "built in" the rugged landing gear which is capable of absorbing a rate of descent up to 14.5 fps. Such features, plus a 50-knot landing speed, make year-round operations possible from unimproved jungle, bush, or desert landing strips that may characterize future nuclear battlefield operations.

Flying controls are mechanically linked to the pilots' controls: rudder trim is mechanical, aileron and tailplane trim is electrically operated

Left: view showing 32 wall-type seat for troops

Right: Seats fold neatly against walls to provide 1,150 cubic feet of clear cargo space

with an emergency mechanical system in reserve. Control gust locks are engaged by one cockpit lever designed so that it is impossible to take off with the control surfaces locked. External control locks are not required. Emergency extension of the main gear, which lowers backwards, is achieved by manually releasing the up latches and allowing the slipstream and gravity to lock the gear down.

SAFETY FIRST

The fuselage is of rugged construction, intended to afford a high degree of safety in the event of an emergency landing. Low touchdown speed provides just one important safe-guard. Others not previously mentioned are:

a. The beams on which the cargo compartment floor is carried serve as longitudinal skids in the event of a belly landing.

b. Vertical and side crash loads are absorbed by the bulkhead at Station 138, by massive frames located at the front and rear wing spars, and at the rear of the cabin.

c. Emergency escape hatch is provided in the roof over the pilots' heads in addition to the entry hatch in the belly of the cockpit compartment.

d. The upper part of the rear door is jettisonable.

e. The brakes, served by the main hydraulic accumulator, have an additional emergency accumulator which can be manually recharged to operating pressure, plus a manually operated emergency air bottle.

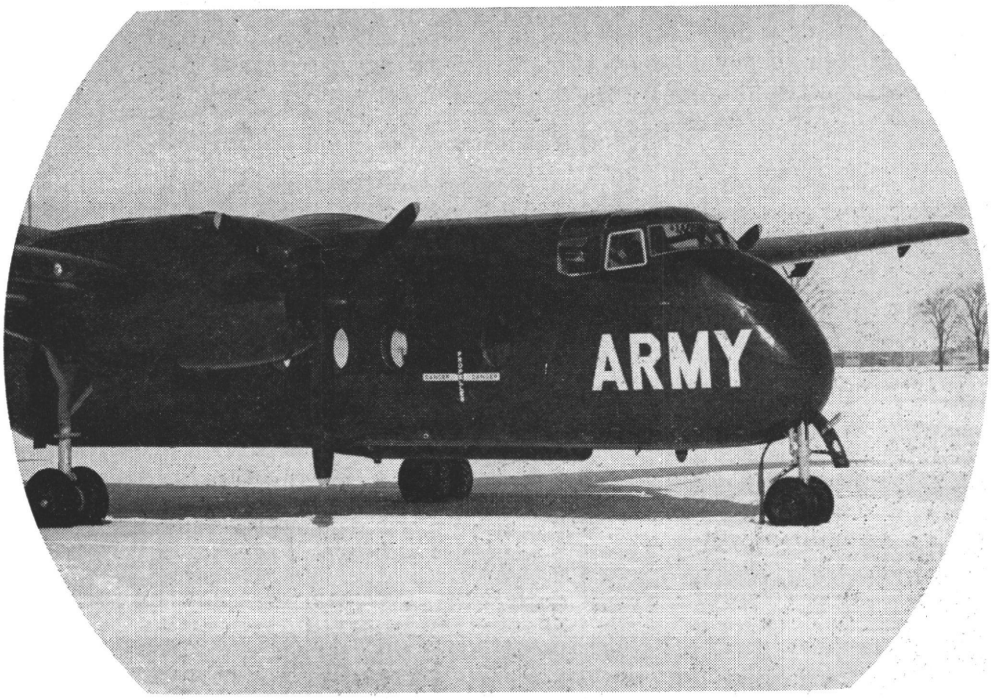
f. The Caribou will climb out on one engine with takeoff flap and landing gear extended.

g. It has reversible props (only on production model No. 4 to be tested by United States Army Aviation Board).

h. Automatic fire detectors and extinguishers are in each engine and wheel well.

i. Provision has been made for installation of a monorail as optional equipment.

Caribou will help intra-Army support missions



SUMMARY

If the Army buys more than the initial five Caribou it now has on order, it is envisioned by Combat Development Office at Fort Rucker that they will be integrated into 1-TO&E type battalions at field army level. It is possible that a fixed wing battalion would contain two companies equipped with Otters and two with Caribous. Under such a TO&E battalion, commanders could use this unit to accomplish mission requirements.

In the expanded field army areas that will develop in future battlefield concepts, there will be requirements for intra-Army support transports. The Caribou is part of the answer.

Have you a new method, device or system which would be of interest to others in the Army Aviation program?

It only takes a few minutes to jot it down and mail it to the DIGEST.

Handle With Care When

Fueling With JP-4

Bruce Frazer

THE ARMY'S NEW utility HU-1A helicopter is powered by a gas turbine engine requiring a relatively new hybrid type of fuel called JP-4, which is essentially a mixture of aviation gasoline and garden variety kerosene.

This is a thoroughly proved fuel used successfully by the Air Force for more than a decade. Yet, some of the physical properties which make JP-4 ideal for use in gas turbine engines make it hazardous to handle unless proper precautionary measures are observed.

Fuel in the liquid state will not burn; however, its vapor, an atomized mixture of fuel and air, may very readily ignite. Thus, the flash point and vapor pressure of a petroleum product are of utmost importance from a fire safety standpoint.

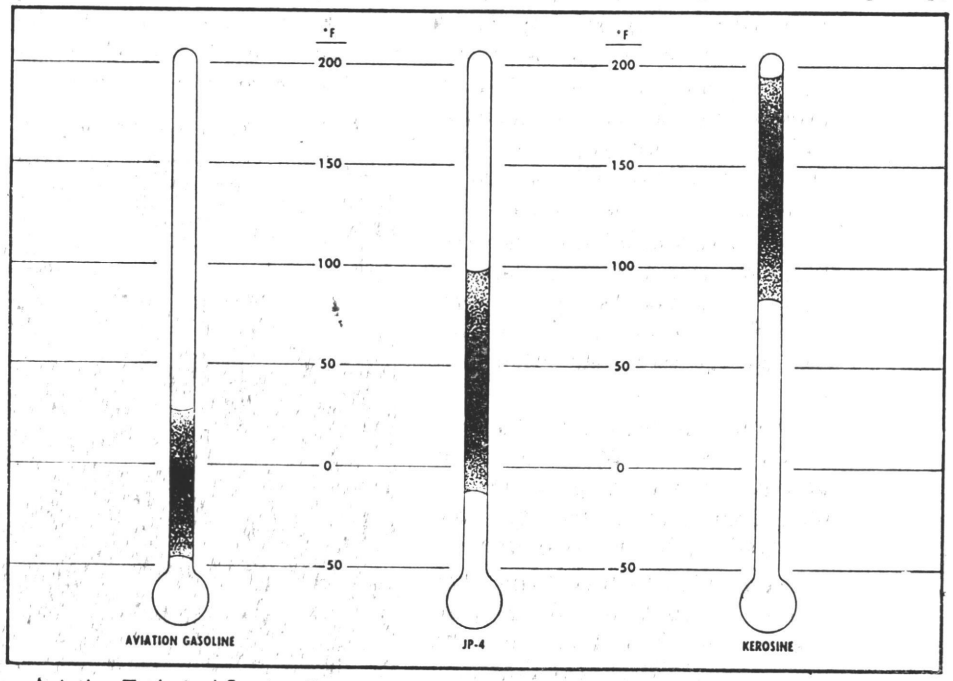
The flash point of a petroleum product is the temperature at which it gives off sufficient flammable vapor to ignite, while all petroleum products exert vapor pressure to an extent determined by their volatility (tendency to evaporate).

JP-4, with a flash point of 0°F. (Flash point —35°F. Ref table VII, Ch. 1, TM 10-1101) and vapor pressure of 2-3 psi, would at first appear to be less critical to store and handle than Avgas, which has a —30° F. (—40°F.) flash point and vapor pressure of 6-7 psi.

However, the flammability range of JP-4 in a storage tank or tank truck runs from 0°F. (—10°F.) to 100°F. as contrasted with a range of —40°F. to +30°F. for Avgas under the same conditions. If either of these fuels is held at temperatures below these limits, too little vaporization takes place for a flammable mixture to form. At temperatures above these limits the resultant mixture would be too rich to burn.

It should be noted that the

Temperature Ranges In Which The Vapor Space Of Storage Tanks Located at Sea Level May Be Within The Flammable Range (Shading intensity indicates frequency).



—Aviation Technical Service Committee Bulletin 1503, AMERICAN PETROLEUM INSTITUTE

Mr. Bruce Frazer recently joined the contracts administration department of Bell Helicopter Company, having previously been with the Sinclair Refining Company's aviation sales office in New York.

He has logged more than 1,400 hours in helicopters and fixed wing aircraft as an Army pilot.

flammability range of JP-4 brackets practically all of the ambient temperatures which we would expect to find during the course of normal fueling operations.

A small amount of Avgas spilled on the ramp or in the hangar would probably not be a matter of great concern as it would evaporate quickly. But JP-4 spillages are residual because of this fuel's low volatility, and small accumulations can become major hazards in time because of lingering combustible vapors. Absorbent cleaning material or clothing that becomes saturated with JP-4 must be cleaned or disposed of well away from the hangar area or aircraft on the line.

The enforcement of no-smoking regulations becomes doubly important in areas where JP-4 is stored or transferred, and it is axiomatic that aircraft should not be fueled or defueled inside hangars.

Although not actually a safety consideration, JP-4 spillages cause deterioration of ramp and runway surfaces to a much greater degree than Avgases in common use today, particularly where these surfaces are made from asphalt or macadam.

In its pamphlet entitled **The Storage and Handling of Jet Fuels at Airports**, the American Petroleum Institute has this to say about static generation:

"Aviation fuels are relatively poor conductors and static generation will largely depend on the amount of turbulence associated with fuel transfer.

"It is also believed that the tendency toward static generation is increased by the presence of finely divided conductive materials such as water or rust.

"Since the more viscous fuels (such as JP-4) are apt to hold such impurities, there has been a tendency to report that jet fuels are more susceptible to static generation. It is not evident that adequately settled and filtered jet fuels will differ markedly from aviation gasoline in their susceptibility to static generation. . . .

"Turbulence can cause the separation of positive and negative charges. One charge will accumulate on the liquid surface whereas the opposite charge will find its way to the tank. In such instances, the magnitude of the accumulated charge on the liquid surface will depend upon the rate of generation minus the rate of leakage or dissipation (such as from the edge of an oil surface to the tank shell).

"The larger the liquid surface between grounded points, such as metal posts and shell, the greater will be the magnitude of the charge. Grounding a tank cannot prevent the formation of a charge which can produce sparks along the surface of the fuel. The rate of generation can be minimized by avoiding excessive surface agitation. . . ."

It has been determined that a potential of 12,000 volts or more is necessary to supply sufficient energy to explode a JP-4 vapor mixture. But we also know that this amount of potential can accumulate in a very short time unless adequate safety measures are observed.

The following precautionary JP-4 handling procedures have been excerpted from current Air Force and Navy directives and should serve to minimize the danger of accidental static discharge during transfer processes.

1. Avoid surface agitation.

a. Do not use "splash" filling. Fill at slow velocities while the fuel level is low and attempt to immerse the fill nozzle in the fuel whenever practicable. Long, flexible, conducting nozzle extensions are commercially available and should be utilized.

2. Minimize the entrance of air into fuel lines.

3. Avoid pumping mixtures

Avoid surface agitation — immerse fill nozzle when practical

of fuel and water.

a. Drain receptacle tanks daily and test for the presence of water in storage tanks often.

4. Avoid the storage of JP-4 in tanks constructed of concrete or other poor electrical conducting material.

5. Do not gauge or sample JP-4 tanks during filling.

6. Do not allow servicing personnel to wear metal "taps" on their shoes.

7. Before removing the aircraft fill cap, ground the truck fill nozzle to the aircraft, thus equalizing the electrical potential between both vehicles. Truck to ground and truck to nozzle grounds should also be effected.

8. Do not fuel or defuel during electrical storms.

9. Do not fuel or defuel while aircraft or ground radar sets are operating within 300 feet.

10. Position ground power on auxiliary units on the windward or upslope side of fueling operations.

The petroleum industry and armed services are attempting to develop antistatic additive agents which will completely eliminate static buildup in JP-4 and other types of fuels.

Development of these agents will spell a significant advance in jet fuel engineering, but even with such a product improvement caution should be the byword in handling JP-4.

Simplified maintenance and vastly improved weight-to-horsepower ratios make gas turbine powerplants such as the Lycoming T-53 ideal for use in helicopters. However, to achieve maximum and safe performance from these engines, utmost care must be taken to ensure that they are fueled with clean, dry JP-4.

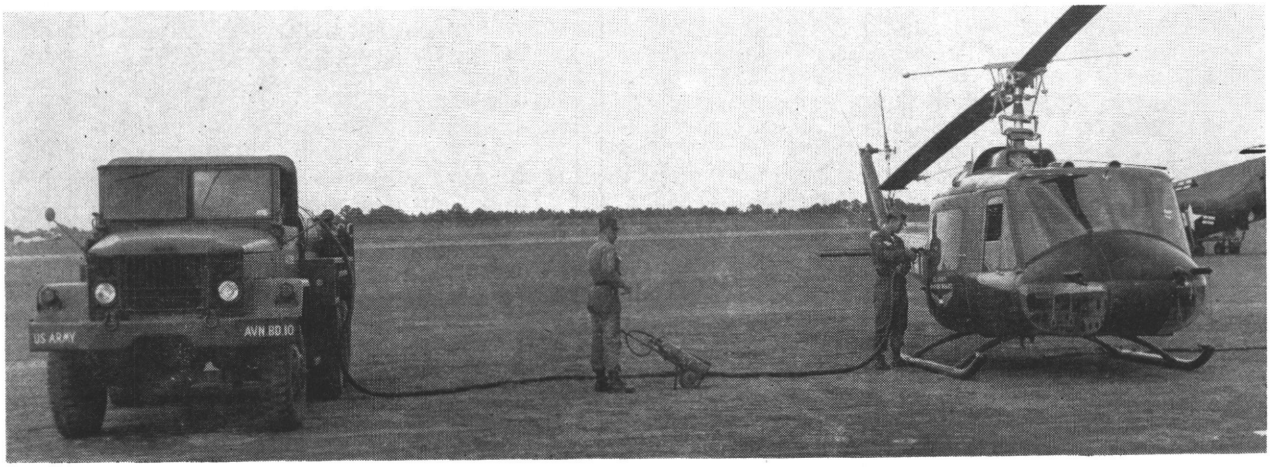
Reciprocating engines are able to cope with small amounts of sediment, but jet fuel controls are far more susceptible to clogging than conventional carburetors because of their integral minute clearances. The relatively small gas turbines under discussion consume approximately a third more fuel per unit of horsepower than their conventional counterparts. The resultant higher rate of consumption causes sediment to pile up on filters, restricting fuel flow.

Water in suspension (emulsified water) in jet fuel is a problem because decreases in temperature might cause ice formation which could clog the filter.

Free water in fuel can also cause this phenomenon. This is obviously more of a problem in high performance jets which are subjected to tremendous temperature disparities during rapid climbs to high altitudes than it is in helicopters operated at relatively low altitudes in temperate climates. Nevertheless, filter icing and subsequent clogging might occur at any altitude in cold environs, especially if aircraft are stored in warm hangars prior to operation.

We know that power is directly proportional to fuel flow and that water-soaked fuel will cause an unwarrantable loss in performance. In one instance, the pilot of an HU-1 experienced sudden engine failure just prior to takeoff. Investigation later revealed that the failure was caused by water contamination. While being transferred from storage tanks to the refueling tender and into the helicopter, the fuel had been filtered with conventional Avgas equipment, which proved totally inadequate. (NOTE: Specification

Ground truck fill nozzle to the aircraft — truck to ground and truck to nozzle



MIL-F-8508A — sets forth filter/separator requirements for Army, Navy and Air Force. Filters meeting these requirements will correctly filter not only Avgas but jet fuels as well.)

Having established the need for dry, clean jet fuel, it should now be pointed out that these requirements are not easy to come by. Turbine fuels have an inherent affinity for water and will carry dirt longer than conventional Avgas. The settling rate for micronic particles in JP-4 is approximately one-fourth that in Avgas. For example, a 5-micron particle will settle approximately 1½ feet per hour in Avgas but only 4 inches per hour in JP-4.

Military specification MIL-J-5624D, which covers JP-4, does not appear too explicit in prescribing minimum standards of cleanliness. It simply states that: "The fuel shall be free from undissolved water, sediment, and suspended matter. No substances of known dangerous toxicity under usual conditions of handling and use shall be added." Oftentimes local commanders prescribe their own fuel cleanliness standards and these are written into procurement specifications.

Chemical analysis and time honored visual inspections at refineries ensure that fuel is dry and well within cleanliness standards when it is delivered at the refineries—**prior to handling and storage.** Unfortunately, contamination of one sort or another is often introduced while the fuel is in transit or storage.

JP-4 tends to get behind rust particles on tank sides, loosening them and holding them in suspension. Also, turbine fuels will actually absorb water from tank bottoms.

Vehicles of the petroleum transportation system — pipelines, tankers, tank cars, and tank trucks — cannot be kept antiseptically clean, and all such exposures are possible sources of contamination.

Ground filtration equipment intended for use with Avgas will provide a limited degree of filtration for JP-4, but filter/separators capable of removing micronic sediment particles and emulsifications are highly recommended.

At this point one might ask, "Why not design fuel systems capable of handling greater amounts of contamination?" First of all, the size and weight of such installations would probably rule them out. Second, the reliability of such a system would be questionable, and a malfunction could cause engine stoppage. Aircraft fuel screens and filters are, and must remain, last chance safety devices.

It is incumbent upon petroleum suppliers to set forth maximum effort to guard against fuel contamination. To this end, one major oil company has evolved a philosophy of turbo fuel handling, the substance of which follows:

1. The fuel must be kept reasonably clean and dry throughout the entire handling system. It is not practical to deliver a contaminated turbo fuel and suddenly clean this fuel up to specification as it is loaded into an aircraft.

2. It is essential that no dirt or water be added at any point throughout the handling system.

3. No one item or any particular type of filtering equipment should be relied upon to do the job. Settling time and mechanical devices must be worked together so that insurance items are built into the handling system.

4. Fuel delivered from the final storage points at the airport should be on specification. It must be maintained in this condition and given a final clean-up on the refueler just before it goes in the aircraft. A desired goal for this system is to deliver a product with less than one milligram of dirt per gallon and less than 2.5 parts per million of water.

The foregoing philosophy presupposes into-plane delivery by the supplier. Quite often the military services take delivery of the fuel at the refineries or break-out points, and they should accept responsibility for their part of the handling cycle. This is primarily a logistical problem but it does have lower echelon implications.

Periodically, storage tanks and refuelers should be inspected for cleanliness. Field commanders can prescribe minimum settling time before allowing JP-4 to be "thieved" from the tops of storage tanks; a good rule of thumb is to allow 6 hours for each foot of tankage (Sec III, Para 15d, Ch 1, TM 10-1101 recommends 2 hours per ft.). Fuel samples can be taken by fuel handling personnel, who should be familiar with visual inspection and sampling procedures as prescribed by Air Force Tech Order 42B-1-1 which is published under the auspices of the Military Petroleum Supply Agency.

It has not been our intention to recommend specific fuel handling or inspection procedures. However, we hope that the foregoing discussion will be of some value to those of you who are or will be involved with JP-4.

UNIT IP

THE MAJOR, who is a hard-boiled artilleryman from the old school, let me have it easy. He invited me up to the club for a drink after duty hours.

"Captain, I've got a problem," he said, when the suds were halfway down on the cool wet glass.

I figured I had one, too, and I waited for him to spring it on me. It didn't take long.

"You used to be an instructor at the school," he said. "I need a unit IP. Orders will be cut tomorrow."

That was it. Maybe the orders had already been cut.

Not that I don't love instructing. I was an instructor in the school for two years and racked up 1,500 hours riding the IP's hot seat. Instructing is a lot like mowing grass: you can see where you've been. But I'd dreamed of getting out to a unit and getting in some time without the responsibility of making certain a student was getting the right word. Now I had it again, except for a slight difference.

Some of my students wouldn't know they were still students. That can complicate matters.

The major was thinking about it, too. He wasn't finished. He went right into the business. "We're not a large section but we're important. We're not short of pilots, but we have two who are fresh from school. I want them progressively trained in everything we have. I want every pilot in the unit checked out in everything we have."

"That shouldn't be hard," I said. "After all, we just have 2 Seminoles, 3 Beavers, and 5 Bird Dogs. And 10 pilots."

"Eight pilots," he corrected me. "These two lads from the school aren't pilots yet." He fixed me with that piercing stare. "But don't let them know I said that. You get the idea."

This article was prepared by the U. S. Army Board for Aviation Accident Research.

I got the idea, but quick. "Yes, sir," I said, "and now let me buy you a beer."

He thanked me and reminded me that he was fighting his weight. I changed my mind about another and we parted outside the club, still good friends.

Myrtle, my wife, senses every nuance in my day. She met me at the door of our MCA housing and took my cap. She pecked my cheek and said, "All right, Mike, what's the thundercloud hanging on your brow for?"

She knows almost before I do that I have a problem. I explained it to her. She said, "You're a good instructor, Mike. You can take care of it just fine."

That's my baby. She thinks I'm top man on the totem pole. Maybe that's what it takes. She fed me a steak and all the trimmings, and I played with the kids for a spell and then helped Myrt tuck them in. Afterward I sat down with my pencil and paper and drew up a program of instruction. In fact I drew up two — one for the pilots fresh from school and the other a checkout in models.

They differed slightly. For the new pilot I drew up the number of hours I thought he should fly before being turned loose: 10 hours. Too much? Well, when you tie in orientation in the local flying area, radio aids, local area checkout before clearance to solo, it all adds up.

The next day I got the raised eyebrow from Lt McCloud. "Clearance to solo?" he echoed. "Man, I been soloing since 200 hours ago."

I explained as diplomatically as I could that the area was new, the aircraft modified from school aircraft and that it was my policy to have him fly dual for 10 hours before clearing him for operational flights.

He sulked about it for a little but it didn't last. McCloud was a real Tiger and he loved to fly. I could hardly hold him down, especially on the weather side.

"Got me a ticket," he said laconically. "When am I gonna fly me some weather?"

"I've got to take the old man to an Army meeting tomorrow," I said, "Chances are we'll do a little cloud flying. You want to copilot?"

His eyes glistened. "In that Seminole Dog model? Wow, man, yes!" I love that sort of thing in a young pilot. Reminds me that this is a pretty critical stage of the business for him. A few bad moves by an older pilot at this point can make the young Tiger lose a lot of his steam.

The next morning the clouds were low and we had to go IFR all the way. Sitting on the end of the runway, I got a little uneasy. The general understands a lot about flying, but he doesn't like to wait around. Neither do I. The controller came on with, "I got a 240 departure for you, Army 1234, do you acknowledge or are you ready to copy?"

I knew the 240 as well as the other established departures, but I wanted McCloud to get his feet wet. I said, "Ready to copy, tower." I told McCloud to copy the clearance.

He was lost after "ATC clears Army 1234—" but I let him go on. He looked at me with sad questioning eyes.

I said, "All right, go ahead and acknowledge. I got it."

"You didn't write anything down," he said.

"The departures are all standard," I said, "except when there's a variation. Then all you have to remember is the mickey they slip in. There are six different departures for this field and you'll have to memorize them all."

He was all smiles when we got the word to go. We were in the clouds a few minutes after takeoff. It was a pleasure watching McCloud enjoy it. He was a natural instrument flier if I ever saw one.

Flying in a cloud is somewhat different. It seems to me to be quieter and safer. You don't have to watch out for other aircraft. It is orderly. You drone along and everything fits in place.

McCloud was busy studying the approach chart for our destination. We reported over our first check point (McCloud on the radio) right on the nose. McCloud enjoyed talking to the ground station and I could see he had to hold himself in to keep from sounding like a kid on Christmas morning.

We hit our first snag at destination. Traffic was stacked and we checked the omni, set up a holding pattern, and called for instructions. RAPCON said they had us on radar, directed us to the secondary fix, and gave us a heading to fly.

"All right, McCloud," I said, "can you give me letdown poop from the secondary fix?"

He was still fumbling with the charts. "Gosh, RAPCON has us on radar," he mumbled. "All we gotta do is fly the headings and relax."

"RAPCON thinks we know what we're doing," I said. "He knows we wouldn't — or shouldn't — be up here if we don't."

"Mike, I've had it. I can't even find the approach chart."

I got the chart for him; he

picked up everything quickly and ran through it as we made each step. He caught on quickly.

Later, in the snack bar drinking a glass of orange juice, he said, "Mike, you sure handle that Dog model in the clouds. Man!"

Well, I liked it, just as you would if you had been in my place.

We made it back to the home field and the weather was clearing. We filled out the forms and I gave him 4 hours copilot time. "That doesn't count on your 10 hours," I said.

He got red and I could see him getting mad. "You mean I still gotta fly 10 hours before I'm cleared for solo?"

"That's right, Lieutenant."

His jaw ridged. "Sir, you gonna be free the rest of the day?"

I nodded.

"Well, sir, I want to become operational as soon as possible. I'll check out a Bird Dog."

I was tired somewhat but I wouldn't let him know. "Right."

At 1800 hours we called it quits. I was dog tired. When I dragged in that evening, Myrtle said, "Honey, you look pooped."

"I am," I said. "I got a Tiger by the tail. Young McCloud's about to work me to death."

"We'll fix him," she said. "There's a dance at the club tomorrow night. Invite him to dinner and then he can babysit for us. That'll take care of that Tiger."

The second new aviator reported the next day. Lieutenant Timmitt was a smooth-faced youngster who looked as though he'd never shaved. Pink-cheeked and yellow-haired he appeared much too young to be in the Army. After I'd given him the rundown on checkout in the local flying area prior to solo clearance, he asked anxiously, "You think I can learn all I should in 10 hours?"

"No sweat, Lieutenant," I told him gravely. I thought, "Here's one who is 180° from McCloud."

As an aviator, Lt Timmitt was the opposite of McCloud, but I enjoyed him, too. It was a big kick for me relaxing him on IFR.

One day he said, "Maybe I'll get some IFR time, solo."

I felt as though I'd succeeded in getting Timmitt over the hump. Maybe too good. "I don't fly IFR alone if I can help it, I told him. "Not unless it's just a climbout through some stuff and then VFR on top. In a high-density area it's not allowed."

"Just think, Mike," he said, "when I first reported to the unit I was a little scared about flying IFR. Now I like it."

After both new aviators were cleared for solo and were thoroughly familiar with the area, we began a checkout in a Beaver.

Both of them were shocked to learn they had to make a formal checkride. "We've been flying the Beaver," they chorused. "We've got about 50 hours."

"Okay, Tigers," I said. "You got about 50 hours—all under the hood. It looks a lot different VFR, so let's get on with the check."

The checkride in the Beaver didn't provide anything to write about. They both clued me right and made me proud.

All that remained was keeping them current in the Bird Dog. So much time had been spent on instrument flying, the Beaver, and Seminole that they hadn't actually kept current in the most important piece of equipment in Army Aviation—the fixed-wing observation airplane.

It was tough but I required them to get 5 hours in the Bird Dog for every hour they'd spend in the Seminole.

"For a long time," I told them, "you'll be riding the right seat of the Seminole. But when you get that Bird Dog out you're the man."

They moaned, and groaned, and cried but that was the way it had to be.

The POIs for the cross-checkout and new aviators were fine as far as they went. I found that I had to re-evaluate my instrument training program. It had to be improved to help the new aviators; it helped the old ones, too. As we did most of our operational flying in support of headquarters, it meant administrative flying. I had to make them use this to the fullest, planning en route changes they knew they'd never make or breaking off for short strip work after dropping a passenger or en route to pick one up.

The improvement was noticeable in all respects.

Oh, yes, I got them all cross-trained. The day after it happened the major called me in.

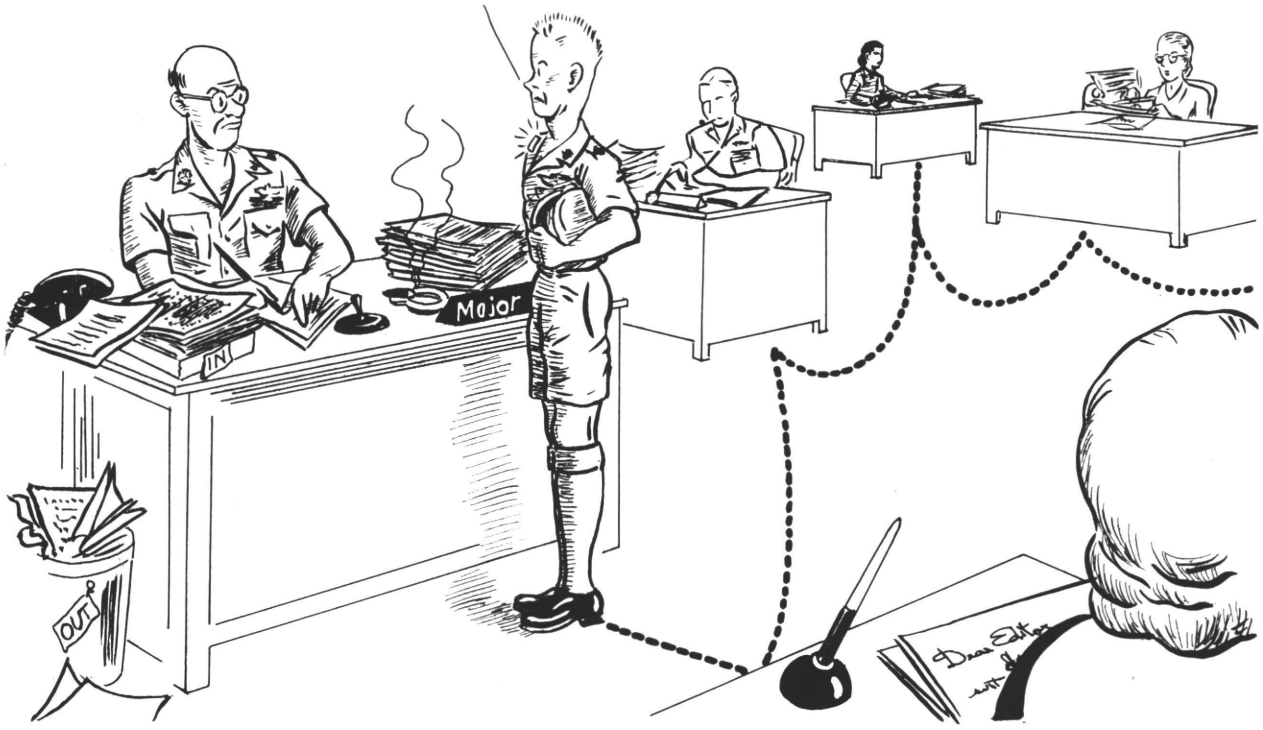
"Mike, McCloud and Timmitt are going to an aviation company. Get set to train two new aviators from the school."

I groaned out loud and he sympathized with me.

But that night, griping to Myrt, she set me straight. "You know you like it," she said. "I've never seen you so happy as when you're getting those young Tigers on the right track."

She knows me, that girl. I had to admit she was right.

Sir, Where Can I Find---?



Major C. B. Sinclair, Armor

SEARCHING for information and reference material is a toilsome task. On any particular duty day at any Army installation there will be one or more officers seeking the written word. The officers' quest will usually take the form of inquiries directed to several people in various offices. After lengthy discussions the problem should be isolated and with any luck an individual found who knows the exact source location. If not, the officer trudges off to yet another office and more discussion to find an answer. Avoid these time-consuming visits and questions and go directly to the best source. Do you know where to look?

There are many frustrations encountered during a search for timely information. Unfortunately, many of these frustrations are created by the searcher. We all realize that Army publications are numerous and span many subjects. The first step then is to determine just what information you need. Are you looking for information in the training field? Supply? Communications? Tactics and doctrine? Publications are available which cover these categories for the Army Aviator. So how do you get them?

It is a little surprising to find that very few officers are acquainted with the Department of Army Pamphlet 310 series, **Military Publications.** This series of DA pamphlets is the Army's catalog for official military information. These pamphlets of the 310 series should be filed in your unit right now.

Each pamphlet in the series is indexed with a title and a more descriptive subtitle. The subtitle indicates the type information contained in that particular pamphlet. Knowing **where** to look is the key to the data collection problem. The full title names of the DA pamphlet 310 series are itemized below:

Major Sinclair is a recent graduate of the Command and General Staff College. He is presently a student at the U. S. Army Aviation School.

301-1, Military Publications: Index of Administrative Publications (Army Regulations) Special Regulations, Department of the Army Pamphlets, Commercial Traffic Bulletins, Military Traffic Management Bulletins, General Orders, Bulletins, and Circulars).

310-2, Military Publications: Index of Blank Forms.

310-3, Military Publications: Index of Training Publications (Field Manuals, Reserve Officers' Training Corps Manuals, Training Circulars, Army Training Programs and Mobilization Training Programs, Army Subject Schedules, Army Training Tests, War Department and Department of the Army Posters, and Firing Tables and Trajectory Charts).

310-4, Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrications Orders, and Modification Work Orders.

310-5, Military Publications: Index of Graphic Training Aids and Devices.

310-7, Military Publications: Index of Tables of Organization and Equipment, Tables of Organization, Type Tables of Distribution, and Tables of Allowances.

310-21, Military Publications: Index of Supply Manuals; Signal Corps.

310-22, Military Publications: Index of Supply Manuals; Transportation Corps.

310-23, Military Publications: Index of Supply Manuals; Chemical Corps.

310-25, Military Publications: Index of Supply Manuals; Corps of Engineers.

310-29, Military Publications: Index of Supply Manuals; Ordnance Corps.

310-30, Military Publications: Index of Supply Manuals; Quartermaster Corps.

Changes are published periodically to keep these pamphlets up-to-date.

What general classification covers the area of your question? Is it the TO&E of a supported unit? Is it a technical material problem? Or is it a regulation or directive that you must follow? The pamphlets listed above will start your search toward a specific Army publication which will answer your question.

For instance, DA Pamphlet 310-3 lists under **Army Training Programs:** ATP 1-7, **Army Training Program for Aviation Company, TOE 1-7, 1-17, and 1-57,** dated 29 July 1958. The existence of this publication is probably not new to you. However, have you seen ATT 1-7? This same pamphlet lists the **Army Training Test 1-7 for Division Aviation Company,** dated 10 November 1958. Other ATPs listed include: ATP 1-107, **ATP for Aviation Fixed Wing Light Transportation Company,** 20 October 1958; ATP 1-207, **ATP for Army Aviation Operating Detachments (TOE 1-207),** 26 September 1958.

Although these publications are revised and published annually, there are interested Army Aviators who have not yet seen them. If the pamphlets are over a year old, you should check for a newer edition. The local Adjutant General Publications Office can verify this information and also provide you with a copy of the AG Publications Center Bulletin. This bulletin is necessary, as an additions and deletions sheet, to keep your publications file currently posted.

Keep your eyes on the appropriate sections of the **Army Times** and service magazines for listings of newly published Department of the Army documents. Though not official, **Army Times,** 18 July 1959, indicated the publication of Change 5, 24 June 1959, to AR 95-67, which covers detailed instructions for implementation of the Army Aviation instrument program and conduct of written examinations. Interested persons knew the existence of this official document three weeks after publication—before distribution could be effected.

Army Service Schools originate much of the data catalogued in the DA 310 series pamphlets. The U. S. Army Aviation School is no exception and is continuously organizing information for publication through various media. Almost every Army Aviator has seen and used TM 1-250, **Principles of Fixed Wing Flight,** and TM 1-260, **Principles of Rotary Wing Flight,** which were published in September 1957.

These basic texts were prepared by the Literature Division of the Department of Publications and Nonresident Instruction. A more recent accomplishment was writing new manuals which superseded TM 1-215, **Instrument Flying — Theory and Procedures,** December 1955. The new manuals are of particular value to every Army Aviator and should be procured if not already on hand. These three TMs are the compilation of that basic data which is in the NEED TO KNOW category for every Army Aviator:

TM 1-215, **Attitude Instrument Flying,** December 1958;

TM 1-225, **Navigation for Army Aviation,** December 1958;

TM 1-300, **Meteorology for Army Aviation,** April 1958.

Superseding FM 20-100, 25 February 1952, and TC 1-9, 29 August 1958, is FM 1-100, **Army Aviation,** April 1959. This manual should have been distributed to the field units by now.

FM 1-5, **Army Aviation Organization and Employment,** May 1959, is also fresh from the presses with distribution listed for each Aviation unit. These manuals will be a big help to Army Aviators concerned with unit training and tactical employment.

DA Pamphlet 95-5, **Handbook for Aircraft Accident In-**

vestigation, August 1959, was published as a guide for a member of an accident investigation board. Get a copy of this pamphlet now and avoid the desperate scramble for information when orders arrive assigning you as a board member. The subject of accident investigation should also be included in your training program. Each aviator certainly should have general knowledge of the problems involved in an accident investigation.

Five brand new training circulars released by Department of the Army for distribution are:

TC 1-10, **Transition Training in the HU-1 Helicopter,** 10 June 1959;

TC 1-11, **Transition Training in the H-21 Helicopter,** 10 June 1959;

TC 1-12, **Transition Training in the H-34 Helicopter,** 10 June 1959;

TC 1-13, **Transition Training in the H-19 Helicopter,** 10 June 1959;

TC 1-14, **Transition Training in the H-37 Helicopter,** 29 June 1959.

A revision of the current training circular, TC 1-5, **Army Multiengine Airplane Qualification (REVISION)** is soon to be published.

The Army Aviation School is presently busy preparing additional data in various type publications. A draft field manual entitled **Aerial Observation** is nearing the field review stage. Another FM entitled **Army Air Traffic Operations—Tactical** is being submitted to USCONARC for final approval before printing. This FM will supersede TC 1-8, 4 October 1957 and rescind (C) TC 1-6, 20 October 1956. FM 1-( ) **Army Aviation Organizational Aircraft Maintenance and Supply** is scheduled for submission to USCONARC in the winter of 1959.

A technical manual, TM 1-( ), **Float, Ski, and Tandem or Universal Landing Gear Operations,** is in draft form nearing the field review stage. In the training circular field, TC 1-4, **Transition Training in the U-1 Aircraft,** 27 June 1957, is being revised.

Another very meaningful project of the Army Aviation School is the drafting of Army subject schedules. Like other publications, they are coordinated through innumerable interested agencies and edited many times before publication. That takes time. However, sometime during FY 60 you can expect to see Army subject schedules on the following topics: Aerial Observation; Establishment and Security of Army Airfields; Tactical Flight Training, Fixed Wing Aircraft; Tactical Flight Training, Rotary Wing Aircraft; Tactical Employment of Army Aircraft; Flight Operations Activities; Aircraft Maintenance.

Subject Schedule 1-1, **Aerial Navigation,** was published on 29 June 1959. The others should follow soon.

The Army Aviation School is not alone as an information source for Army Aviators. Most branches of our military service have a definite interest in Army Aviation as a means to better fulfill assigned missions. These service branches develop information and data dealing with utilization, techniques, organizations, and employment doctrine of Army Aviation. The following manuals contain information pertinent to the use of Army Aviation in support of Armor:

FM 17-1, **Armor Operations; Small Units** (August 57), includes Army Aviation support for small armor units.

FM 17-35, **Armored Cavalry Units, Armored and Infantry Divisions** (December 57) is being rewritten and includes Army Aviation support of the Armored Cavalry Troop and Armored Cavalry Squadron.

FM 17-50, **Armor Logistics** (May '58), includes logistical support of Armor units by Army Aviation.

FM 17-95, **Armored Cavalry Regiment and the Armored Cavalry Reconnaissance Battalion** (September 51), is being revised and will include Army Aviation support of the Armored Cavalry Regiment.

FM 17-100. **The Armored Division and Combat Command** (May '58), includes Army Aviation support of the Armored Division and Combat Command.

In addition, the U. S. Army Armor School is currently producing a school reference entitled **Army Aviation Handbook.** This handbook includes aviation organizations and doctrinal concepts for organic and transport aviation in support of armor.

The U. S. Army Infantry School's recent accomplishments in the field of Army Avi-

ation publications are FM 57-35, **Army Transport Aviation, Combat Operations,** June 1958; TM 57-220, **Technical Training of Parachutists,** December 1958; and Training Circular 20-1, **Airmobile Operations** in May 1959. The Infantry School is also preparing FM 7-40, **Infantry and Airborne Division Battle Groups;** FM 7-24, **Communications in Infantry and Airborne Divisions;** ATP 7-52, **HQ and HQ Co. Infantry Brigade Separate;** and ATT 7-168, **Pathfinder Team.**

These documents are to be distributed within the next six months. In addition, TM 57-210 and TM 57-210A, **Air Movement of Troops and Equipment,** February 1957, will be revised during FY 60.

The U. S. Army Artillery and Missile School training literature applicable in part to Army Aviation is as follows:

TT 57-6-1, **Division Artillery, Airborne Division,** October 56;

TT 6-20-2, **Division Artillery, Armored Division,** February 57;

FM 6-40, **Field Artillery Gunnery,** April 57;

FM 6-21, **Division Artillery, Infantry Division,** August 57;

FM 6-20, **Artillery Tactics and Techniques,** December 58.

FM 6-( ), **The Division Artillery,** is expected to be published in December 1959. TC 6-( ), **Helicopter Transported Field Artillery Tactics and Techniques,** is also being compiled for future publication.

The U. S. Army Transportation School will publish within six months the following training literature:

TC 14, **Transportation Corps Army Aircraft Maintenance and Supply Units in a Field Army;**

TC 55-( ), **Transportation Aircraft Maintenance Detachment (Division) (TOE 55-79);**

TM 55-403, **Fundamentals of Army Helicopter Maintenance;**

TM 55-404, **Fundamentals of Army Airplane Maintenance.**

Is there an Army Aviator (alive) who can ignore communications equipment? The 11 series of technical manuals contains the technical information needed for the care, maintenance, and operation of avionic equipment.

SIG 680-54, **Employment of Army Aircraft for Signal Communications and Photography,** March 54, was published by the Office of the Chief Signal Officer, the forerunner of a field manual with a similar scope. This document indicates guidelines for current communication practices and procedures. Incidentally, this publication and similar ones contain a note inviting comments from the users as to the publication content. In this manner the Army Aviators employing the concepts and procedures outlined in documents are presented an opportunity to comment on the validity of the subject material.

The U. S. Army Signal School utilizes a school text for its resident and nonresident instruction. School Text SIG 660-84, **Army Aviation in the Signal Corps,** July 55, contains current facts of importance to each Army Aviator.

The Army Medical Service School is not idle in getting information to the using units. Changes to FM 8-35, **Transportation of the Sick and Wounded,** enumerate the types of Army Aircraft to be used in air evacuation and the patient loading methods for these aircraft. Two field manuals pertaining to the Medical Service and to Army Aviation are soon to be published. FM 8-5, **Medical Service Units, Theater of Operations,** and FM 8-10, **Medical Service, Theater of Operations,** will contain the most current doctrine relating to the employment of Army Aviation in support of Medical Service missions.

The publications discussed up to this point have been primarily Department of the Army publications. This type of material is associated by necessity with a rather lengthy time lag from concept to distribution. The delay is understandable and tolerable when objectively examined. Each document published has previously been subjected to intense study by many interested agencies, service schools, and field units to produce material that is sound, pertinent, and beneficial throughout the Army. Duplications in scope and extraneous publications are avoided by this system.

INSTRUCTIONAL MATERIAL CATALOG

This is true, you say, but the fact remains that you still need information and you need it now, All right, let's go back to the service schools for additional assistance. Each service school publishes a catalog of instructional material available for issue to units in the field. The distribution of this catalog varies but is normally found on battalion-battle group levels. The Army Aviation School, for instance, is sending its Instructional Material Catalog to all aviation units, major headquarters, armies, and commands throughout the world. These catalogs are available upon request to the appropriate service school.

A great assortment of training literature, aids, and refer-

ences are listed in these catalogs. As a typical example, the Army Aviation School catalog includes a vault file list of current lesson plans utilized in the school programs. Any unit may order any of the lesson plans by submitting DA form 17 directly to the school. Personal copies of the same material may be secured from the Book Store at a small cost. The Instructional Material Catalog will be revised semiannually with monthly errata sheets listing additions and deletions.

The importance of the training material gained by use of the Instructional Material Catalog cannot be overemphasized. Timely information, the latest thinking, is available in a concise and usable form. The same material which ultimately appears in new or revised DA publications makes its Army debut from the instructor platforms in the service schools. The service schools also incorporate the latest thinking in their nonresident instructional programs. Complete courses or individual lessons are again readily available to any interested Army officer on active or reserve status.

EXTENSION COURSES

Army Extension Courses are administered by the branch service school having primary interest in the subject matter. The exception to this occurs in Army Aviation. The Artillery and Missile School, Fort Sill, Oklahoma, offers three subjects that are of direct interest to Army Aviators: CS #42, **Air Navigation;** CS #43, **Meteorology for Army Aviation;** CS # 44,**Employment of Army Aviation.** All Army extension courses are announced in DA Pamphlet 350-60, November 58, with instructions pertaining to application, enrollment, and conduct of the extension courses.

AVIATION SCHOOL LIBRARY

If the information sources described thus far have not satisfied your need, then try two more sources. The Army Aviation School Library has a most complete file of references concerning all facets of Army Aviation. Standard reference material together with compiled bibliographies of Army Aviation happenings throughout its history are available there. For a specific question concerning Army Aviation, the library will produce the reference list for you.

The second source is most obvious and as such it is often overlooked. The so-called professional trade magazines are rich in material and receive wide distribution. You can find them on your local newsstand. Service magazines, such as your U. S. ARMY AVIATION DIGEST, carry information of the past, present, and future, as well as thought-provoking articles written by individuals who care.

ARMY AVIATION DIGEST

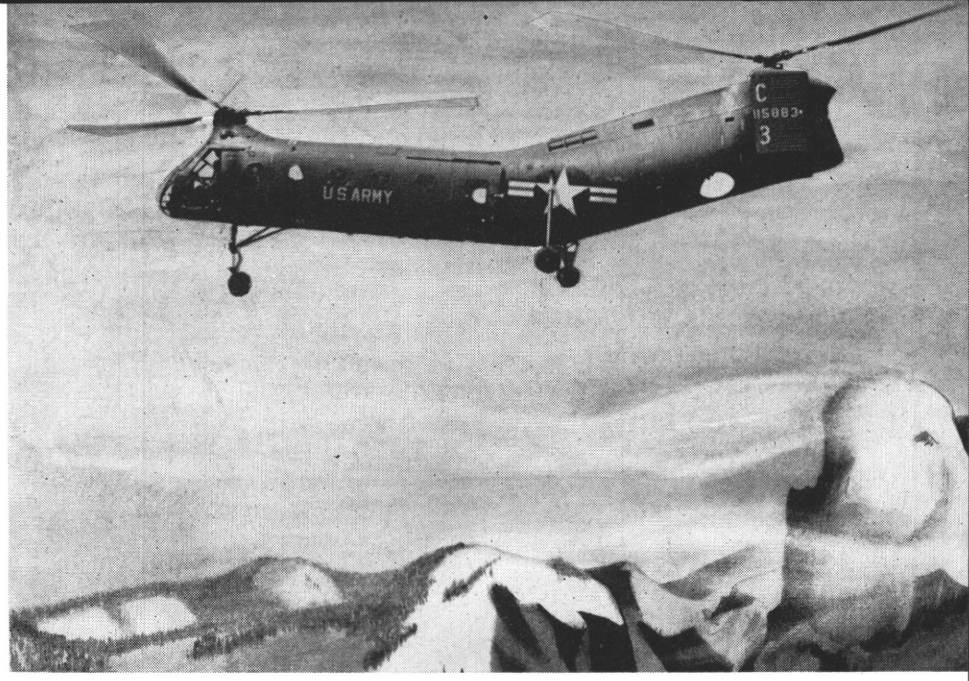
The U. S. ARMY AVIATION DIGEST belongs to Army Aviators. Here you find articles about safety, tactics, and techniques pertinent to Army Aviation. In fact, it is only through the active participation of Army Aviators that the DIGEST can fulfill the mission for which it is intended. Individual experiences published so that others may gain have proved very valuable. Comment on a dubious point in an article might save a life. Could anything be more important to the recipient? If you have an article or comment for publication send it to the Commandant, U. S. Army Aviation School, Fort Rucker, Alabama, ATTN: ASSPI.

Is your unit receiving a sufficient number of copies of the AVIATION DIGEST? A proper request for regular distribution must be made. Your local AG Publications Officer will submit, through publication channels, a DA form 12 to a publications depot. The depot consolidates the distribution requirements and forwards a request to the Adjutant General. Sufficient copies of the AVIATION DIGEST are readily available to aviation units provided the correct steps are taken to obtain it.

The information sources included in this article exist just to satisfy your needs. They are there to support you in your quest for facts, regardless of your branch of service and job title. First, isolate the problem; then refer to the DA Pamphlet 310 series which lists the latest Department of the Army official publications. Nothing there? Then dig deeper.

Follow the hints covered above and utilize the service schools' instructional material catalogs, their periodicals, and their libraries. A wealth of data dealing with Army Aviation is easy to obtain if you know where to look or who to ask.

Shawnee On Snowshoes



CWO George F. Beaston

ON 28 MARCH 1958 the 33d Transportation Company, Fort Ord, California, received word from the Yosemite National Park Ranger Headquarters that four skiers were stranded on the snow-swept slopes of Mount Lyell at approximately 12,000 feet. Could an H-21 Shawnee pick the skiers off the slopes before the snowstorms and bad weather set in?

The rest of the day and most of the night was spent at the National Guard Air Terminal in Fresno, readying the ship for the rescue attempt. The pilots, CWO John J. Cooney of Marlboro, Mass., and CWO William J. Williams of Binghamton, N. Y., stripped the aircraft of every item not essential for the mission. Weight was an important factor. At that altitude, every ounce of power would be called into play to keep the 5-ton helicopter in the air. Even the seats in the cabin area were removed.

Then the thought hit the crew: deep snow. Landings made in snow the previous day had made the crew acutely aware of the need for more stability. How could they land this unwieldy bird in the deep blowing snow without its tipping over and beating itself to death with its own rotor blades? True, the Shawnee had been landed in snow before, but not in depths in excess of 3 or 4 feet. These mountain drifts ran 15 to 20 feet deep. Some type of snow flotation gear or stabilization device would be necessary — but what? and how?

Several factors were considered in fabricating this flotation gear. The gear should be large enough and strong enough to serve its function, subject to the materials available. It must be able to move up and down independently. It must be removable in the event the aircraft was left in a position long enough for it to freeze to the snow or ice. The effect of the flotation gear on the flight characteristics of the Shawnee had to be considered.

After looking around the terminal, some ¾-inch plywood was found and reinforced with aluminum strips. This served two purposes: it supported the plywood and kept it from splitting; and it gave a more solid backing for the "U" bolts used to secure it to the landing gear. Wind and weather had started deteriorating the plywood; had the flotation gear been slated for longer use, the leading edges would have required reinforcement.

A separate piece of plywood was used for each gear, rather than one piece across the entire gear area (see photo). The "U" bolts were installed from the bottom with the retaining nuts secured to the top. Using this method of installation, the nuts could be removed along with

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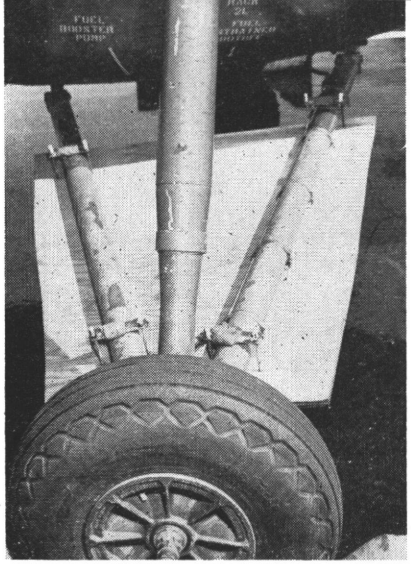
CWO Beaston is presently assigned to the 33d Transportation Company, Fort Ord, Calif.



Snow gear effective

the top retaining bracket. The aircraft could now take off, leaving the improvised gear behind if necessary. Care had to be taken in placing the "U" bolts to prevent damage to the hydraulic brake tubing on the rear struts. The tubing also had to be bent slightly and taped.

The manufacturer's aircraft technical representatives were called concerning the flight characteristics with the gear installed. Their comments were, "Flight and/or control characteristics would not be affected, only an additional amount of drag would be noticed." This was later proved at airspeeds up to 100 knots.

Finally, everything was in readiness. The pilots were briefed the evening of the 30th. The guide was an experienced Civil Air Patrol pilot named Robert Symons (now deceased) of Bishop, Calif. He would lead the way to the campsite in a ski-equipped Super Cub. The skiers, students of Stanford University, were suffering from the high altitude and cold. One had pneumonia and was unable to walk.

Time was important. Bad weather was closing in, fast. At 0830 on the 31st, the "web-footed" helicopter took off. Twenty-five anxious minutes later, it returned to the Ranger Headquarters in the Yosemite Valley with the four skiers safely aboard.

The snow flotation gear, though crude and improvised, proved very effective. It allowed landings in the soft snow, estimated to be 16 feet deep. The flotation gear sank on the outside edges from 6 to 8 inches, but the entire gear supplied the needed support. Although the nose gear was not supported at any time, it sank no more than 10 to 12 inches and felt quite solid. Because time was a major factor, the gear was not removed during the takeoff.

Thus, a Shawnee on snowshoes provided a safe and expeditious means to successfully complete a dangerous rescue mission.

PUZZLER

EN ROUTE TO Jackson, Miss., in an L-20 under VFR you encounter instrument conditions and change to IFR. Approaching John Intersection on V-9E you receive the following clearance from Jackson Approach Control:

"Cleared to the ILS outer marker, maintain 3,000, no delay expected. The Hawkins weather is 500 overcast, visibility 2 miles, surface wind south at 7 knots, altimeter setting 29.94."

You elect to proceed northwest on V-9E to the intersection of the back course of the ILS localizer and then west on the ILS course to the outer marker. With your ADF tuned to the ILS compass locater at the middle marker (there is no compass locater at outer marker), you note upon passing that neither the visual nor aural signal was received. A quick check with the marker beacon ON-OFF switch indicates that no current is being drawn, and you realize that your marker beacon equipment is inoperative. Knowing that you will be unable to use the marker beacon receiver to identify your position over the outer marker, you should:

- ☐ Continue outbound on the ILS course, fly for 1 minute and 45 seconds (3.2 nautical miles at 110 knots) and report outer marker outbound. Continue using time estimates to fix your position over the outer marker inbound on the approach.
- ☐ Continue outbound on the ILS course, retune your ADF receiver to the Jackson Low Frequency Range, and fix your position over the outer marker, using the west leg of the range and the intersection of the ILS course as outer marker passage. After reporting outer marker inbound, you will tune your ADF equipment to the compass locater in the middle marker and use it to precisely identify the point at which a missed approach should be executed should you fail to break out of the clouds.
- ☐ Estimate safe minimums and use the compass locater at the middle marker as if it were a terminal facility and make an ADF approach.
- ☐ In the event the holding fix is not received and the pilot has not received clearance for final approach, the last assigned altitude will be maintained to the radio range station and the pilot should request further clearance.

The recommended solution to the PUZZLER may be found on page 25.

Torquing

Fenton M. Dimmick

INFORMATION on torquing and use of torque indicating wrenches may sound elementary to you experienced hands. But day after day, it is the so-called experienced hand who goofs up the job by using the wrong tool or by improperly using the right tool. Reports from the field indicate that some maintenance personnel are not properly torquing spark plugs, fasteners and fittings installed in Army Aircraft during modification and periodic servicing. An appreciable percentage of service failures of aircraft components is directly attributed to lack of proper torquing and the improper use of torquing equipment.

Proper use of torque wrenches is an important accident prevention factor. In fact, improper torquing of threaded fasteners and fittings is a big headache in Army Aviation today.

A recent study revealed that improper torquing of threaded fasteners and fittings was responsible for an appreciable percentage of service failures of aircraft components. To prevent similar failures, it is important that inspectors check to see that personnel of their organization are familiar and comply with pertinent technical publications. The following irregularities are most frequently found:

Mr. Dimmick is an Aircraft Equipment Specialist in the Office of the Transportation Officer, Headquarters, First U. S. Army.

(a) Threaded fasteners and fittings are

overtorqued to values higher than specified in the pertinent technical publications (small threaded fasteners are commonly overtorqued, even to the point of static failure of the fastener);

not torqued to the specified values, with a smooth application of torque to the torque handle;

not being lubricated before installation in accordance with pertinent technical publications.

(b) Clevises are fitted by overtorquing of the clevis bolt, rather than by proper fitting of clevis parts.

(c) Motor-driven import wrenches with capacities higher than the desired torque values are used in preliminary tightening of threaded fasteners and fittings.

(d) Threaded fasteners and fittings, and fittings which have been overtorqued to values higher than specified, are "backed off" and then retorqued to the specified values.

(e) Specified torque values are not used to obtain preloads in bearings.

(f) Wrenches other than torque handles are used to torque threaded fasteners and fittings which have torque values specified.

(g) Extensions are used on the drive ends of torque handles without compensating for the increase in effective handle lengths, which results in overtorquing.

(h) Shop-made adapters are used with torque handles, thereby destroying the accuracy of the torque readings.

(i) Torque handles are

used as hammers, crowbars, and other purposes for which they were not designed;

not thoroughly inspected and recalibrated after they have been inadvertently dropped, and before they are used again;

not periodically inspected, repaired, and calibrated in accordance with existing technical publications;

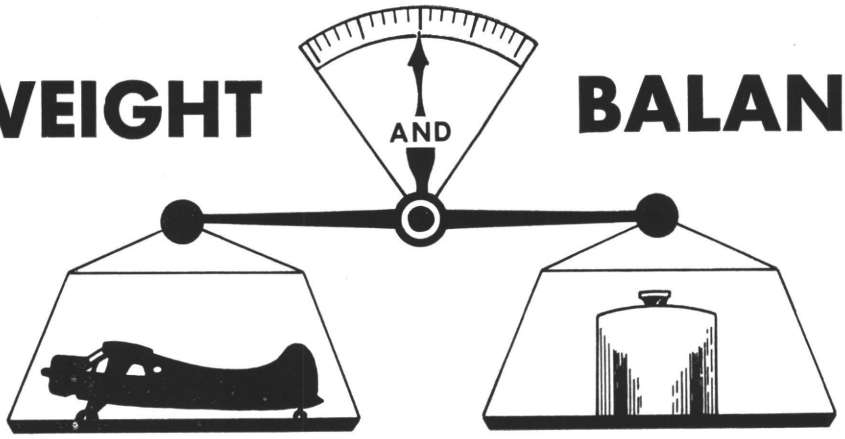
not readily available to personnel at all echelons of maintenance (personnel often use torque handles of incorrect size).

(j) Beam type torque handles are marked on the beam, thus destroying the accuracy of the torque readings.

(k) Technical publications are incomplete.

Aircraft maintenance supervisors should check to determine what methods are used locally, to tighten threaded fasteners, spark plugs, and fittings, and to determine procedures for using torque handles (wrenches). Prompt corrective action should be taken on the irregularities noted. Mechanics and inspectors should have pertinent publications readily available, such as TOs 32B14-3-1-101, 32B14-3-1-501, 32B14-3-3-3, 32B14-3-3-13, pertinent maintenance and overhaul manuals (TMs, TOs, TB AVNs, etc.), and required modification technical manuals and technical orders.

WEIGHT AND BALANCE



Major Warren P. Pauley, Inf

DURING THE PAST several months, the words "weight and balance" have been considered as nasty words, not only here at the Army Aviation School but also at lower and higher echelons. These words have become nasty because many fail to see or care whether a requirement exists for weight and balance control of Army aircraft. Generally, all pilots of Army aircraft are content to go along with the Department of the Army letter published on 18 May 1954 which authorizes completion of the DD Form 175 (Aircraft Clearance) without having to complete that portion of the 175 regarding weight and balance.

Many have heard the story and many know that the Beaver will fly with any load you can close the door on. Beavers have flown with gross weight conditions of from 6,000-8,000 pounds. Many have flown the Beaver with full fuel tanks, tip-tanks or long-range tanks included, along with all seats occupied, the baggage compartment full and baggage piled between seats and under legs and seats. Granted, the Beaver will pack such a load, but have you ever considered safety of flight when flying such a load? When one stops to think of flying such a load it makes you wonder, "How does this Beaver beast perform under such conditions?" In theory and design it shouldn't perform as it does. For the sake of illustration of such a problem of a load mentioned above, note the following figures:

Beaver allowable gross weight	5,100 lbs
Empty weight	3,195 lbs
Weight of oil, 5 gallons	38 lbs
Weight of fuel, 138 gallons	828 lbs
Weight of pilot	200 lbs
Weight of passengers (5) @ 200 lbs	1,000 lbs
Weight—total load, less baggage	5,261 lbs

You will readily see from these figures that the aircraft is already 161 pounds over allowable gross and you still haven't loaded any baggage.

Let's look at a standard UIA Otter to further illustrate requirements for weight and balance control of Army aircraft. You will find this one hard to believe, but you can't dispute fact and figures.

Otter—Empty weight	4,918 lbs
Pilot weight	200 lbs
Copilot weight	200 lbs
Fuel weight (210 gals)	1,260 lbs
Passenger weight (9)	1,800 lbs
Oil weight (10.8 gals)	81 lbs
Total gross weight	8,459 lbs
Allowable gross weight	8,000 lbs
Overweight	459 lbs

Here again, this beast will pack this load and fly 7½ hours in the shade of the same tree with such a load. But is such a load safe?

If you want a good scare, the next time you fly a Beaver under, close to, at, or over gross-load conditions and in light to moderate turbulence, look out and watch your wings flex and flap like a big bird. It isn't your imagination, friend; those wings **are** flexing up and down.

Thus far we've discussed weight only. Now let's use the same illustrated problems and apply them to the balance side of this story.

Let's take the Beaver again. The figures used in computing balance for this aircraft are taken from TO 1L-20A-5 and from weight and balance data maintained on an actual aircraft.

	Weight	*Moment/ 100*
Basic aircraft	3,195	3,191
Crew: Pilot	200	186
Copilot	200	186
Oil (5 gals)	38	24
Fuel (138 gals)	828	945
Passengers (4)	800	1,104
TOTALS	5,261	5,636

Takeoff c. g. limit from 93.4″ to 107.7″.

For the above load c. g. is 109.02″, or 1.32″ aft of allowable aft c. g. limit. By adding a 25 pound piece of baggage in the baggage compartment, the

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Major Pauley is Deputy Director, Department of Maintenance, USAAVNS. He has approximately 3,000 flight hours in Army aircraft.

c. g. of this load is moved aft an additional inch.

The old Beaver will fly under these conditions with additional power, but you just try keeping the nose down without the use of some flaps.

Now let's take the Otter and figure the c. g. for the same load as previously illustrated:

	Weight	*Moment/ 100*
Basic aircraft	4,918	6,777
Crew (2)	400	392
Oil (10 gals)	75	75
Fuel (210 gals)	1,260	1,912
Passengers (9)	1,800	3,424
Baggage	500	1,535
TOTALS	8,953	14,115
c. g. limits from	135.80″	to 150.62″

For this load c. g. is 157.6″ or 7″ aft of the aft c. g. limit. In addition an overload condition exists.

Your passengers have to decide to leave their baggage, except for shaving kits, behind. So by deleting the 500 pounds of baggage from the baggage compartment, the c. g. for the load is moved forward to 150.1″ which is within the allowable c. g. limits. But here again comes the overload condition to be reckoned with. Drain 500 pounds of fuel and you're okay on weight and within c. g. limits, too.

It's nice to feel that the aircraft we fly can perform so well under overloaded and out of c. g. conditions. Don't think for one minute that they will perform this way in icing conditions, on one engine in the case of L-23s, L-26s, and other twin-fan outfits entering the aircraft inventory. Too, don't think that you can make a practice of operating under such conditions in and out of short unimproved airstrips.

These sample problems illustrate the weight and balance problems concerned with fixed wing aircraft only. The same principles apply to rotary wing aircraft to a greater degree; too, the illustrated problems do not take into consideration density altitude.

The day is past when a pilot flies by the seat of his pants. One by one the decisions that were made by intuition or hunches have been taken over by organized systems based on knowledge and understanding. The invariable result has been greater safety and operating efficiency.

The loading of an aircraft is no exception. At first, the correct amount and placement of a load was determined by the old-time pilot, whose good judgment and experience served as a loading guide. But aircraft have continued to grow in size, and take on new shapes and configurations. It has become apparent through accidents and other indications that the hit-and-miss principles of loading are not satisfactory.

Recent Army aircraft accident experience indicates a sharp increase of a causative factor being either that accurate weight and balance data for that particular flight was not known or was completely ignored by operating personnel. At the present time we can assume that additional accidents will occur due to neglect of weight and balance requirements and that future aircraft development will result in equipment wherein weight and balance will be inherently critical.

Army Aviators, let's face it. Weight and balance control of Army aircraft is on its way into the picture. We have to realize this fact and prepare now for the day when Army Regulations will direct that such control be exercised. Get into practice now on computation of weight and balance data, familiarize yourselves with DD Form 365F, TO 1-1B-40, and the -5 technical manuals entitled "Basic Weight Check Lists and Loading Data" for those aircraft you are qualified to fly. If these steps are taken now, you will not be left cold when faced with the problem of having to compute weight and balance data when filing a DD Form 175.

The paragraph above is not meant to frighten anyone. Weight and balance problems are simple to compute after a little practice.

Let's work a simple weight and balance problem, completing a DD Form 365F for L-20A, serial number 56-6967.

Before starting this problem let's review some forms you should be familiar with and will use in working a problem.

First there is the DD Form 365 (fig 1), "Record of Weight and Balance Personnel." This form is located in TO 1-1B-40 for L-20A serial number 56-6967.

Next is DD Form 365C (fig 2). These charts are a continuous history of changes in aircraft structure and equipment affecting aircraft weight and balance .

Finally, there is the Chart E (figs 3-7) from the -5 for the type aircraft. This handbook is TM or TO 1L-20A-5, "Handbook Basic Weight Check List and Loading Data." This chart consists of a series of tables and graphs where data is added arithmetically for various load items. Using these tables and graphs you can easily locate the takeoff c. g. of the aircraft.

RESTRICTED (When filled in)

RECORD OF WEIGHT AND BALANCE PERSONNEL — FOR USE IN AN 01-1B-40

AIRPLANE MODEL: L-20A — SERIAL NUMBER: 56-6967

NAME	GRADE	STATION	DATE ASSIGNED	DATE RELIEVED
Jack B. Quick	Civ	DeHavilland	1 July 48	
R. U. Ready	Civ	Hayes, Ft. Rucker, Ala.	1 Jan 59	
STEP 18. USE NAME, GRADE, AND STATION INDICATED IN LAST ENTRY FOR WEIGHT AND BALANCE AUTHORITY ENTRY ON FORM "F".				

DD FORM 1 AUG 50 365

RESTRICTED (When filled in)

Fig 1

These same tables and graphs are used to locate the landing c. g. after fuel has been consumed and other loads disposed of.

Now that we've reviewed the forms, let's get to the problem at hand on 56-6967. Let's go slowly, step by step.

Step 1. Consult Chart E-11 (fig 3), "Maximum Gross Weights," for allowable gross weight. You'll find 5,100 lbs to be the answer. This figure is entered in "Limitations" block of Form "F."

Step 2. Consult Chart E-10 (fig 7), "Center of Gravity Table," for forward and aft c. g. limits. Since we're on wheels we'll use 93.4″ for our forward c. g. limit and 107.7″ for our aft c .g. limit. These figures are entered in "Limitations" block of Form "F."

Step 3. Since we're not using a slip stick for this problem the block "Computer Plate Number" on Form "F" will be left blank.

Step 4. Consult the last entry on the last used page of DD Form 365C. The figures appearing in the columns headed "Running Total Basic Airplane" and opposite the remark "As Weighed" will be used as the aircraft "Basic Weight" and "Basic Moment." We find these figures to be: basic weight — 3195, and basic moment—3191. These figures are entered on Ref 1 line on Form "F."

Step 5. We've only got five gallons of oil aboard so we consult Chart E-5 (fig 4), "Oil Moments." We enter the figures from this chart on Ref 2 line of Form "F." Those figures are 37.5 lbs and 24. Round off the 37.5 to 38 and then enter 38 and 24.

Step 6. This flight is going to be rather long and tiresome so we'll take a copilot. Now consult Chart E-7 (fig 5), "Internal Cargo Moments." Using the constant figure 200 for crew and passenger weights read down the left column of this chart to 200, read right to column headed " 'B' Pilots." Here we find the figure 184. Since there will be two people in the compartment, we double the 200 and 184 and find a total weight of 400 lbs and a total moment of 368. These figures 400 and 368 are entered on Ref 3 line of Form "F."

Step 7. You and your copilot are going to return to your home station after refueling; therefore, no baggage or other equipment will be taken. Consequently, no entries are required on Ref 4, 5, 6 and 7 lines on Form "F."

Step 8. We now total the entries in the "Weight" and "Index or Moments" columns of the Form "F," and totals are entered on Ref 8 line of Form "F." These figures constitute the aircraft operating weight.

Step 9. Since we don't want to refuel en route, all fuel tanks are filled including tiptanks. Consulting Chart E-4 (fig 6),

Fig 2

CHART C—BASIC WEIGHT AND BALANCE RECORD
(CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT AND BALANCE)

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

AIRPLANE MODEL: L-20A — SERIAL NO.: 56-6967 — PAGE NO.: 7

DATE	ITEM NO. IN	ITEM NO. OUT	DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE ADDED (+) WEIGHT	ADDED (+) ARM	ADDED (+) MOMENT[1] 100	REMOVED (−) WEIGHT	REMOVED (−) ARM	REMOVED (−) MOMENT[1] 100	RUNNING TOTAL BASIC AIRPLANE WEIGHT	RUNNING TOTAL BASIC AIRPLANE MOMENT[1] 100	INDEX[2]
4-13-55			DELIVERY									
4-15-55			AS WEIGHED							3195	3191	
			STEP 4 ALWAYS USE LAST LINE ENTRY FOR BASIC WEIGHT AND MOMENT ENTRY ON FORM "F".									

[1] Enter constant used below line. [2] Balance computer index.

DD FORM 1 SEP 54 365C — PREVIOUS EDITIONS OF THIS FORM MAY BE USED UNTIL STOCKS ARE EXHAUSTED.

"Fuel Moments," we must total up weights for each fuel tank and moments for each fuel tank. Having done this simple addition we find the total fuel weight to be 828 lbs, total moments 945, and total fuel aboard 138 gallons. These figures are entered on Ref 9 line of Form "F."

Step 10. We now find the total aircraft weight and moment by adding the fuel weight and moment to operating weight and moment. These totals give us "Total Airplane Weight" and are entered on Ref 11 line of Form "F." Also enter in appropriate block under "Limitations." In the "Limitations" block, subtract total airplane weight from allowable gross weight to find allowable load and enter allowable load in its proper blank.

Step 11. We have four passengers for this flight, so here again we consult Chart E-7 (fig 5), "Internal Cargo Moments." Since the cargo compartment is divided, in theory, into compartments "C" and "D," each compartment carrying two passengers, we read down the left column of this chart to the figure 400 and right to the column headed "'C' F. Cabin" and find the moment for the two passengers to be 476. The weight figure 400 and moment figure 476 are entered on line "C" of the block headed "Distribution of Allowable Load (Payload)." This same procedure is used for the other two passengers. Read down the left hand column of the chart to 400, read right to the column headed "'D' Aft Cabin" and find moments for 400 pounds in this compartment to be 628. These figures 400 and 628 are entered as we did for the other two passen-

Chart E-11 Maximum Gross Weights	
For Landing lb. 5100 *	For Take-Off lb. 5100 *

*Service Activities shall insert, or substitute current figures from latest applicable Technical Order covering Operating Restrictions.

STEP 1

Fig 3

Fig 3 — Maximum Gross Weight

Fig 4 — Oil Moments

Fig 5 — Internal Cargo Moments

Fig 6 — Fuel Moments

Fig 7 — Centre of Gravity Table

CHART E-7 INTERNAL CARGO MOMENTS				
Compartment	"B" Pilots	"C" F. Cabin	"D" Aft. Cabin	"E" Baggage
Arm	92.0 *	119.0	157.0	194.0
Load lb.	Moment /~~1000~~ 100			
25	23	30	39	49
50	46	60	78	97
75	69	89	118	146
100	92	119	157	(Limit)
200	184	238	314	
249	229	296	390	
300	(Limit)	357	471	
400		476	628	
500		595	785	
600		714	942	
700		833	1099	
800		952	1256	
900		1071	1413	
1000		1190	1570	
1100		1309	1727	
1238		1473	1944	
1267		1508	(Limit)	

STEP 6 STEP 11

Fig 5

CHART E-5 OIL MOMENTS		
Gallonage		MOM./~~1000~~ 100
U.S. Gallons	Weight lb.	Arm = 63.0
1	7.5	5
2	15.0	10
3	22.5	14
4	30.0	19
5	37.5	24
6.25	47.0	30
Tank Capacity		6.25 U.S.Gal.
Weight of Empty Tank		5.25 lb.
MOM/~~1000~~ 100 of "		3

STEP 5

Fig 4

STEP 14 STEP 2 STEP 17

CHART E-10 CENTRE OF GRAVITY TABLE

MOMENT/~~1000~~ 100

Gross Weight (Pounds)	17.4% MAC (93.4)	20.0% MAC (95.0)	23.0% MAC (96.9)	26.0% MAC (98.8)	29.0% MAC (100.6)	32.0% MAC (102.5)	35.0% MAC (104.3)	37.8% MAC (106.1)	40.2% MAC (107.7)	42.0% MAC (108.8
3200	2989	3040	3101	3162	3219	3280	3338	3395	3446	3482
3300	3082	3135	3198	3260	3320	3383	3442	3501	3554	3590
3400	3176	3230	3295	3359	3420	3485	3546	3607	3662	3699
3500	3269	3325	3392	3458	3521	3588	3651	3714	3770	3808
3600	3362	3420	3488	3557	3622	3690	3755	3820	3877	3917
3700	3456	3515	3585	3656	3722	3793	3859	3926	3985	4026
3800	3549	3610	3682	3754	3823	3895	3963	4032	4093	4134
3900		3705	3779	3853	3923	3998	4068	4138	4200	4243
4000		3800	3876	3952	4024	4100	4172	4244	4308	4352
4100		3895	3973	4051	4125	4203	4276	4350	4416	4461
4200			4070	4150	4225	4305	4381	4456	4523	4570
4300			4167	4248	4326	4408	4485	4562	4631	4678
4400			4264	4347	4426	4510	4589	4668	4739	4787
4500				4446	4527	4613	4694	4775	4847	4896
4600				4545	4628	4715	4798	4881	4954	5005
4700				4644	4728	4818	4902	4988	5062	5114
4800					4829	4920	5006	5093	5170	5222
4900					4929	5022	5111	5199	5277	5331
5000					5030	5125	5215	5305	5385	5440
5100						5227	5319	5411	5493	5549

*Forward C.G. Limit **Aft C.G. Limit - Water ***Aft C.G. Limit - Land, Ski
****Aft C.G. Limit - Land, Ski if ECP123 embodied

Fig 7

Fig 6

CHART E-4 FUEL MOMENTS						
Gallonage		Moment /~~1000~~ 100				
U.S. Gals.	Weight lb.	Front Tank Arm = 95.5	Centre Tank Arm = 119.6	Rear Tank Arm = 140.0	Belly Tank Arm = 108.0	Wing Tips Arm = 110.0
5	30	29	36	42	32	33
10	60	57	72	84	65	66
15	90	86	108	126	97	99
20	120	115	144	168	130	132
25	150	144	179	210	162	165
30	180	172	215		194	198
35	210	200	251		227	231
40	240				259	264
43	258				279	284
Tank Capacity		35 U.S. Gal.	35 U.S.Gal.	25 U.S.Gal.	43 U.S.Gal.	43 US. Gal.
Weight of Empty Tank		14 lb.	14 lb.	11 lb.	21 lb.	11 lb(2tank
Mom./~~1000~~ 100 of "		13	17	15	23	13

STEP 9 STEP 13

gers except that the entry is made on compartment "D" line of the same block. Also enter the number and total weight of passengers in the appropriate columns in this same block of the Form "F."

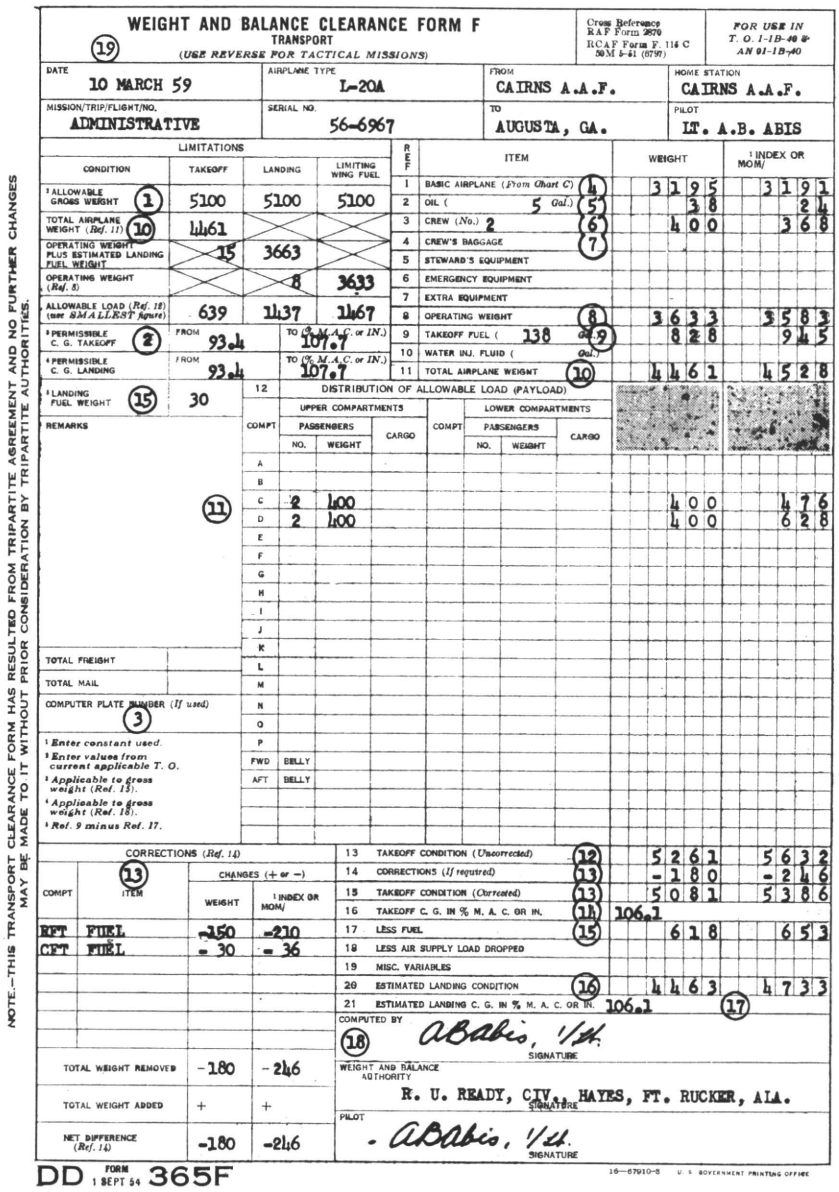
Step 12. In this step we find the takeoff conditions, i.e., total weight and total moments. To arrive at these figures we add the 800 lbs for the four passengers to the total airplane weight (Ref 11 line) and enter on Ref 13 line the figures 5,261. Next, add the moments created by the 800 pounds to the total airplane moments and enter the total, again on Ref 13 line. This figure should be 5,632.

Step 13. TILT. You are over the allowable gross weight. Your passengers have to go, and there isn't 161 pounds of baggage to kick off. Well, your only alternative is drain some fuel. So you drain 150 pounds and 210 moments of fuel from the rear tank and 30 pounds and 36 moments from the center tank. Using these figures, totaling them, complete block headed "Corrections." Carry the figures from line headed "Net Difference" of the "Corrections" block to Ref 14 line. In this case the figures entered on Ref 14 line will be —180 and —246. Subtract these figures from those on Ref 13 line and enter the results on Ref 15 line. The figures on Ref 15 line should be 5,081 and 5,386. These figures constitute your takeoff conditions.

Step 14. In this step we find the c. g. for this load in Chart E-10 (fig 7), "Center of Gravity Table." Reading down the left column of this chart we can't find a figure 5,081, so we use the next larger figure or 5,100. Now read right from 5,100 to 5,386. What, no 5,386? Well let's take the next larger figure appearing on the chart, or 5,411. Now read up this column to the head of the column and we find the c. g. for this load to be 106.1 inches. Ignore the 37.8 MAC as we are not dealing with percentages of mean aerodynamic chord. Enter the c.g. figure of 106.1 on Ref 16 line. This is your takeoff c. g. and by checking the c. g. limitations block we see that the c. g. for this load is within limits.

Step 15. After computing your times en route and fuel consumption you determine how many pounds and moments of fuel you will use for the flight by consulting Chart E-4 (fig 6), "Fuel Moments." You find after consulting this

Fig 8



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

Cross Reference: RAF Form 2870; RCAF Form F. 114 C; SOM 5-41 (8799)

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

DATE: 10 MARCH 59 | AIRPLANE TYPE: L-20A | FROM: CAIRNS A.A.F. | HOME STATION: CAIRNS A.A.F.

MISSION/TRIP/FLIGHT/NO.: ADMINISTRATIVE | SERIAL NO.: 56-6967 | TO: AUGUSTA, GA. | PILOT: LT. A.B. ABIS

LIMITATIONS			
CONDITION	TAKEOFF	LANDING	LIMITING WING FUEL
[2] ALLOWABLE GROSS WEIGHT (1)	5100	5100	5100
TOTAL AIRPLANE WEIGHT (Ref. 11) (10)	4461		
OPERATING WEIGHT PLUS ESTIMATED LANDING FUEL WEIGHT	15	3663	
OPERATING WEIGHT (Ref. 8)		8	3633
ALLOWABLE LOAD (Ref. 12) (use SMALLEST figure)	639	1437	1467
[3] PERMISSIBLE C. G. TAKEOFF (2)	FROM 93.4	TO (% M.A.C. or IN.) 107.7	
[4] PERMISSIBLE C. G. LANDING	FROM 93.4	TO (% M.A.C. or IN.) 107.7	
[4] LANDING FUEL WEIGHT (15)	30		

REF	ITEM		WEIGHT	[1] INDEX OR MOM/
1	BASIC AIRPLANE (From Chart C)	(4)	3195	3191
2	OIL (5 Gal.)	(5)	38	24
3	CREW (No.) 2	(6)	400	368
4	CREW'S BAGGAGE	(7)		
5	STEWARD'S EQUIPMENT			
6	EMERGENCY EQUIPMENT			
7	EXTRA EQUIPMENT			
8	OPERATING WEIGHT	(8)	3633	3583
9	TAKEOFF FUEL (138 Gal.)	(9)	828	945
10	WATER INJ. FLUID (Gal.)			
11	TOTAL AIRPLANE WEIGHT	(10)	4461	4528

[2] REMARKS (11)

DISTRIBUTION OF ALLOWABLE LOAD (PAYLOAD)

COMPT	UPPER COMPARTMENTS PASSENGERS NO.	WEIGHT	CARGO	COMPT	LOWER COMPARTMENTS PASSENGERS NO.	WEIGHT	CARGO	WEIGHT	INDEX OR MOM/
A									
B									
C	2	200						400	476
D	2	200						400	628
E									
F									
G									
H									
I									
J									
K									
L									
M									
N									
O									
P									
FWD	BELLY								
AFT	BELLY								

TOTAL FREIGHT
TOTAL MAIL
COMPUTER PLATE NUMBER (If used) (3)

[1] Enter constant used.
[2] Enter values from current applicable T. O.
[3] Applicable to gross weight (Ref. 13).
[4] Applicable to gross weight (Ref. 18).
[5] Ref. 9 minus Ref. 17.

CORRECTIONS (Ref. 14)							
COMPT	ITEM (13)	CHANGES (+ or −) WEIGHT	[1] INDEX OR MOM/				
RFT	FUEL	-150	-210				
CFT	FUEL	- 30	- 36				
TOTAL WEIGHT REMOVED		-180	-246				
TOTAL WEIGHT ADDED		+	+				
NET DIFFERENCE (Ref. 14)		-180	-246				

13	TAKEOFF CONDITION (Uncorrected)	(12)	5261	5632
14	CORRECTIONS (If required)	(13)	-180	-246
15	TAKEOFF CONDITION (Corrected)	(13)	5081	5386
16	TAKEOFF C. G. IN % M. A. C. OR IN.	(14)	106.1	
17	LESS FUEL	(15)	618	653
18	LESS AIR SUPPLY LOAD DROPPED			
19	MISC. VARIABLES			
20	ESTIMATED LANDING CONDITION	(16)	4463	4733
21	ESTIMATED LANDING C. G. IN % M. A. C. OR IN.		106.1	(17)

COMPUTED BY (18) aBabis, 1/Lt. SIGNATURE

WEIGHT AND BALANCE AUTHORITY: R. U. READY, CIV., HAYES, FT. RUCKER, ALA. SIGNATURE

PILOT: aBabis, 1/Lt. SIGNATURE

NOTE.—THIS TRANSPORT CLEARANCE FORM HAS RESULTED FROM TRIPARTITE AGREEMENT AND NO FURTHER CHANGES MAY BE MADE TO IT WITHOUT PRIOR CONSIDERATION BY TRIPARTITE AUTHORITIES.

DD FORM 1 SEPT 54 365F

16—67910-8 U. S. GOVERNMENT PRINTING OFFICE

chart that you'll burn out 618 pounds and 653 moments of fuel. These figures are now entered in Ref 17 line of the Form "F." Also subtract the weight of fuel drained, 180 lbs, before the flight and the 680 pounds burned off in flight from your original fuel weight entry on Ref 9 line and enter the difference in "Landing Fuel Weight" block under "Limitations" on Form "F."

Step 16. To find your estimated landing condition subtract the weight and moment of burned fuel from takeoff weight and moments. Enter on Ref 20 line the results: 4,463 pounds and 4,733 moments.

Step 17. Next you find the landing c. g. by again consulting Chart E-10, "Center of Gravity Tables." Read down the left column to 4,500, right from 4,500 to 4,775, up the column from 4,775 to the top, and here again we find the c. g. for landing to be 106.1 inches. Here again we ignore the 37.8% MAC. Enter the figure 106.1 on Ref 21 line of Form "F."

Step 18. You are Lt A. B. Abis. Your signature is required in two spaces in the lower right corner of the Form "F"; those spaces are headed "Computed By" and "Pilot." Apply your signature and consult the DD Form 365 for the weight and balance authority and place his name in the space provided between your two signatures.

Step 19. Fill in the heading now and you're all finished. Attach the Form "F" to your DD Form 175, and hand it to the Operations people; you're ready to motor.

One parting shot. If you're under gross, forget about correction computations and entries associated therewith.

Figure 8 is an illustration of the completed Form "F" in which the figures used throughout the 19 steps of this problem have been recorded in their proper spaces. Circled numbers indicate the steps in proper sequence for completion of the Form "F" for Beaver 56-6967.

Solution to This Month's Puzzler

On the basis of the factual information contained in the PUZZLER on page 18, the recommended solution is as follows:

The first selection is inadequate since it fails to provide a sufficiently accurate indication of your position in relation to the outer marker. You must begin the approach descent on final over the outer marker. Even though the winds were pinned down precisely at cruising altitude, their direction and velocity at procedure turn altitude and on the approach might be substantially different. Even though no delay was anticipated by the controller, holding at the outer marker, should it become necessary, would be impossible without being able to receive the outer marked with the marker beacon receiver equipment.

Choice two, while providing you with more definite information concerning your position, remains unsatisfactory since TM 11-2557-26 states in paragraph 2.0400 that for a low frequency range course to be used as a reliable approach fix, the intersection angle must be at least 45°. In this case the angle between the ILS course and the west leg of the range is only 21°.

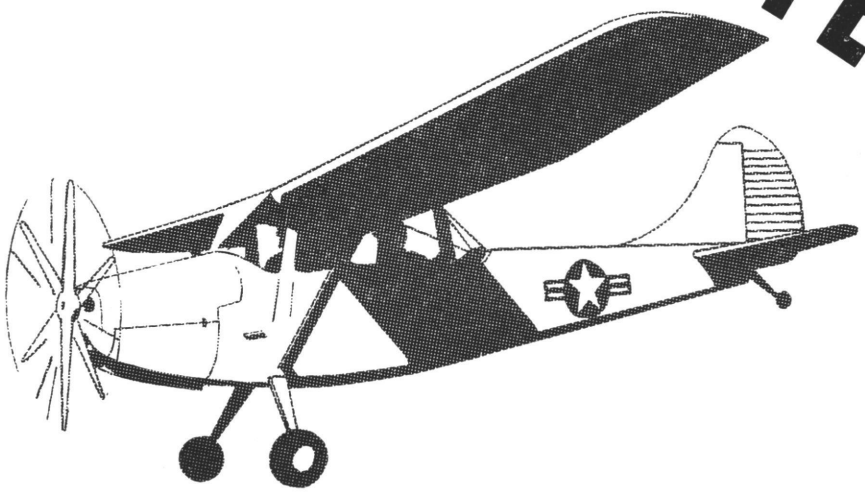
Choice three is definitely incorrect because pilot is not using published procedures.

The fourth choice might at first appear to be unsatisfactory because of the immediate right turn toward the low frequency range station, involving noncompliance with the previous clearance to the outer marker. However, separation must be provided by the controller at your altitude in the vicinity of the low frequency range as is dictated by TM 11-2557-27, paragraph 2.0502: "Fan markers may be used for control purposes provided appropriate measures are taken to insure that separation is maintained in the event of non-receipt of signals by the pilot."

Appropriate measures in this instance would specifically mean that your altitude level must be held open at the range station. TM 11-2557-27 further directs in paragraph 4.202 that: "In the event the holding fix is not received and the pilot has not received clearance for final approach, the last assigned altitude will be maintained to the radio range station and the pilot should request further clearance." Since the surface winds were reported as southerly, a low frequency range approach should be immediately requested.

Memo From Flight Surgeon . . .

FLITTER FLUTTER



COMING ONTO final approach, everything went red, as if I were in a cloud of red flame. I lost all sense of direction, my vision went haywire. A feeling of overwhelming panic seized me, and then the crash."

This is the statement made by a light aircraft pilot writing in the July issue of FLYING magazine. This pilot was describing some of the possible devastating effects of a phenomenon known as flicker vertigo. It has long been known that a steady light flicker at a frequency of 4 to 20 per second can produce very dangerous and unpleasant reactions in normal subjects. These effects vary all the way from extreme irritation to nausea, convulsions, loss of consciousness and true vertigo. The exact physiological mechanism behind this phenomenon is not really understood, but many feel that when light is interrupted or shadows cast upon the human visual apparatus at a frequency approximately identical with that of the alpha waves of the brain, flicker vertigo may occur. Susceptibility to this reaction is increased by pilot fatigue, frustration, or a mild degree of hypoxia. There are no warning signs; the onset is sudden and complete.

During World War II, the Nazis were well aware of the effects of flicker vertigo. They attempted to induce this reaction in Allied night bomber pilots and crews by systematically interrupting searchlight beams at a frequency coinciding with the alpha waves. There is no report on whether or not they were successful.

Reproduced experimentally in the laboratory, flicker vertigo is known to cause weird, sneaky, unpredictable reaction. If you experience this condition and it results in a minor accident, the Doc will probably rate you sound as a dollar; then you will spend hours wondering what happened after you cut your throttle to full idle and eased into your flareout. You'll wonder if you went completely psycho. For this reason chances are that nothing will be said to the Doc concerning your feelings just prior to the accident.

This article was prepared by the U. S. Army Board for Aviation Accident Research.

One author poses the question, "Could it be that pilot victims of flicker vertigo might be unwilling to confess that just before the crash they had been seized by sudden, violent, unexplained dizziness and a panic-inducing vision redout? Could it be that they would conceal what they might feel to be a 'secret malady' rather than risk indefinite grounding and even psychiatric scrutiny?" Very few occurrences have been reported, but the fact remains that flicker vertigo is a definite possibility. All pilots should be acquainted with it, know its cause, effects, and steps necessary for avoidance.

Flicker vertigo does not generally occur in pilots of twin or multiengine aircraft. It is more prone to seize personnel flying single-engine aircraft and helicopters. It can be induced by an idling propeller in a letdown in the direction of the setting sun, or by shadows from helicopter rotors when the sun is at the right angle. The phenomenon can occur on the highway when the bar type shadows of closely spaced trees interrupt the strong light of a low sun directly to the right or left of the automobile.

FLYING magazine reports that one of the known instances of flicker vertigo happened to a cadet who, being seized with violent nausea, nearly passed out while landing into the setting sun. He made a safe landing, but continued to feel impending nausea while taxiing until he had turned from his westerly heading. The idling rpm of his prop had been from 300 to 600. An Air Force medic reported two instances of an epileptic-type seizure induced by flicker effects. The last thing one member remembered before convulsing was staring at the sun through slowly revolving propeller blades. Another officer was standing on a ramp looking at the setting sun through the revolving propeller of nearby craft, and suddenly collapsed in a grand mal type seizure.

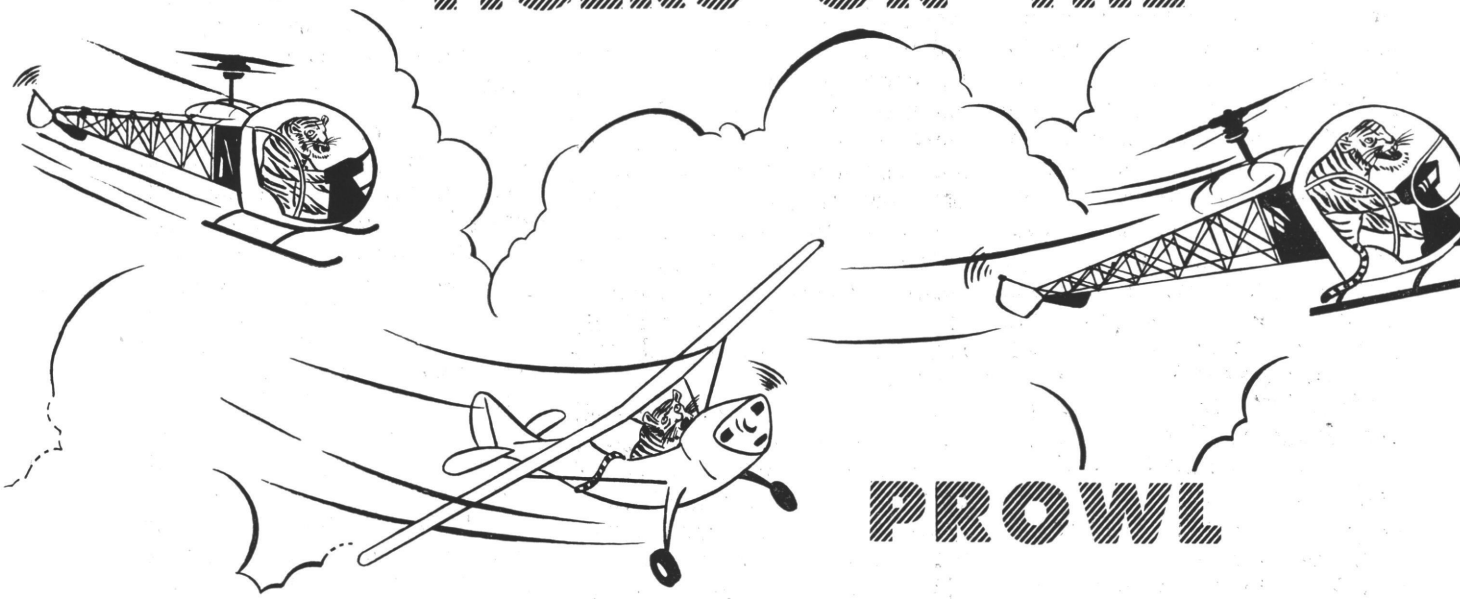
The Navy reported another case. "After flying for some time at an altitude of 16,400 feet, a pilot in a single seater propeller aircraft made a perfect landing. However, he did not taxi the plane to the hangar. Instead, the plane remained motionless, its propeller revolving slowly. The pilot was found bent over the controls unconscious. At first it looked as though the pilot had not used his oxygen mask. In this case, the pilot had lapsed into unconsciousness after making a good landing. The rays of the low-lying sun were shining on the slowly turning propeller blades. Reflected flashes of light were being thrown on the pilot's face at a rhythmic rate of about 12 per second."

In the Air Force during the phase-out period of single-engine prop aircraft, there was awareness of the potential danger from this breed of vertigo. Due to this awareness, the Air Force had instituted a program of education of its pilots as to the cause and effects of this reaction along with preventive measures. Due to this work by the Directorate of Flight Safety Research, flicker disturbances seldom progressed to the point of producing accidents.

Another possible source of flicker vertigo is the rotating anticollision light. One aircraft, flying in an overcast, was noted to come hurtling down in a tight spin from the overcast seven times. Although recovery was made close to earth six consecutive times, on the last spin, the pilot's frantic pullout overstressed the aircraft and a wing was torn off. Investigators picked weather similar to this pilot's and found they experienced serious vertigo while in the overcast and could escape only by diving out of it. From their observations came the recommendation that in the future all pilots turn off flashing anticollision lights for the duration of flights through overcast.

Although this brand of vertigo is comparatively rare, it can still occur. Most Army aircraft are of the type which are prone to produce flicker vertigo. With the exception of the L-23, all standard Army aircraft are either single engine fixed wing, or helicopters. So it would be wise for all Army Aviators to be familiar with this condition and to avoid, if at all possible, landing directly into the setting sun; and should such a landing be necessary, be prepared to "kick rudder and pour on the power." If flying in a chopper when flicker gets to you, a simple change of heading should suffice. You can probably lick it before it licks you.

TIGERS ON THE PROWL



THE VERY QUALITIES that could make you an outstanding aviator can get you into more trouble than an invasion of hornets at a nudists' convention. These are aggressiveness, daring, adventurousness and ambition.

In some circumstances the best military pilot might be a juvenile delinquent—the town bad boy who gets involved with his hot rod, the law and his girl friend. If all that drive is channeled into a career flying military aircraft, fame instead of shame frequently comes to the individual. But not always.

BY THE BOOK

Sometimes just plain flying according to the book isn't enough. There's so much drive and zeal that the aviator tends to do things that seem foolish to the old professional tiger. When that old pro happens to be the culprit's CO things can happen — and for the best in this instance.

When flying over water some aviators can't resist rolling their wheels on the rolling waves. It all seems harmless. After all, there's just the fish. And it's fun. Our hero did just that—down a broad stretch of river, and maybe he was singing ROLLING DOWN THE RIVER, too. Fortunately, he didn't run into any cables, but his CO caught the unrehearsed act.

GOT THE BOOK

The CO didn't applaud at all. He fined the zestful aeronaut $100 under Article 15. The pilot was mad enough to fly under his own power. He went around grumbling for months. "Always trying to keep a guy from practicing his profession," he was heard to mutter. "Do they want us to be airport type fliers?"

After two years of operational flying this tiger type took the trouble to look up his old CO and thank him for saving his life.

"Funny how much the Old Man picked up in a couple of years," he mused, thinking about the fine and the chewing of two years past in a different light.

WHERE ANGELS FEAR

The most dangerous time in an Army Aviator's career is during his first two years out of flight school. It is during this time that he knows he's the world's greatest pilot and is afraid others don't.

At recent maneuvers a company of Shawnees made a long night flight to pick up passengers to return to main post. All of the pilots except one refueled before departing for the home field with their passengers. A lone Hot Rock with his load of passengers arrived before anyone else, but with nearly empty tanks.

On refueling the Shawnee, the service crew stated only six usable gallons of gas were left, enough for perhaps five minutes flying.

This act was bad enough but

This article was prepared by the U. S. Army Board for Aviation Accident Research.

Our Hero seemed proud of it. "That Shawnee really hot rods," he announced, "with just enough go-juice to get you there."

FLY LOW, LIE LOW

Mistaking rapid learning for complete mastery of the art, the young Hot Rock, if unrestrained, can get not only himself but others in hot water. Like the Choctaw pilot who flew his aircraft down the middle of a lake. The copilot was seen waving to people along the bank, and the crew chief and passenger were waving from the cabin door. The aircraft flew into two telephone cables strung from ridge to ridge across the lake. He not only lost his rpm but his rotor as well. The helicopter nosed up slightly, banked left, fell into the lake and sank in 50 feet of water. Divers brought up all the bodies the following day.

Many a grizzled command pilot has blamed himself for not putting a halt to the antics of some promising young military aviator who unwittingly bought the farm.

Admittedly, these young tigers are good; yet they lack the depth of experience which distinguishes the mature pilot. Unfortunately, a few of them will never attain that maturity.

MOST ON THE POST

In the supreme confidence of his new prowess, the young pilot finds in the dangerous "800-hour period" a new freedom from the fatherly guidance of the instructor pilot. With exuberant curiosity he explores his new dimension to get answers to "How fast?" and "How close?" — the sum of which qualify him for the local title of Most on the Post.

All of the instructor pilots do not measure up to the suit that has been cut for them. The U. S. Army Aviation School maintains a close check and standardization of their instructors. The unit instructor pilot has no such check and frequently attains this distinction through fast talk or simply because he's the only man available.

Some of them are unit IPs because they're self-termed Hot Rocks like the one who was checking out another first lieutenant in short strip work in the Beaver.

"Here's how it's done," he told his audience of four. (They were actually training air observers, with checkout secondary.) He intended making a low approach and continuing on to the aerial observer's training area.

HARD, UNPLANNED LANDING

Working from the right-hand seat he entered the pattern at 1,100 feet indicated and on downwind expertly set up power to 2,000 rpm and 20 inches. On reaching 100 knots airspeed, he put down climb flaps and set up a glide speed of 75 knots. After turning base, he lowered flaps to takeoff position, still maintaining 75 knots, controlling the aircraft's speed and rate of descent with the throttle. Over the boundary he leveled the Beaver and it fell through, hitting tail first. He quickly added power and climbed out, circled and made another low pass to see if any parts were lying on the strip. Not finding any, he flew on to another strip to make a closer examination on the ground.

Damage was considerable but the payoff was in the accident investigation report: "Technique used on this power approach was not as instructed by the U. S. Army Aviation School and as outlined in TM 1-250. Changing attitude of the aircraft when in near proximity to the ground by an abrupt application of elevator control to the rear would cause an early settling of the aircraft."

How, you might logically ask, did such a Hot Rock get to be a unit instructor pilot?

STUPIDLATED ENGINE FAILURE

Another unit instructor pilot was checking out a student in the Otter. Shortly after takeoff and at an altitude of 30 feet this instructor pilot chopped the throttle to give the student a simulated engine failure.

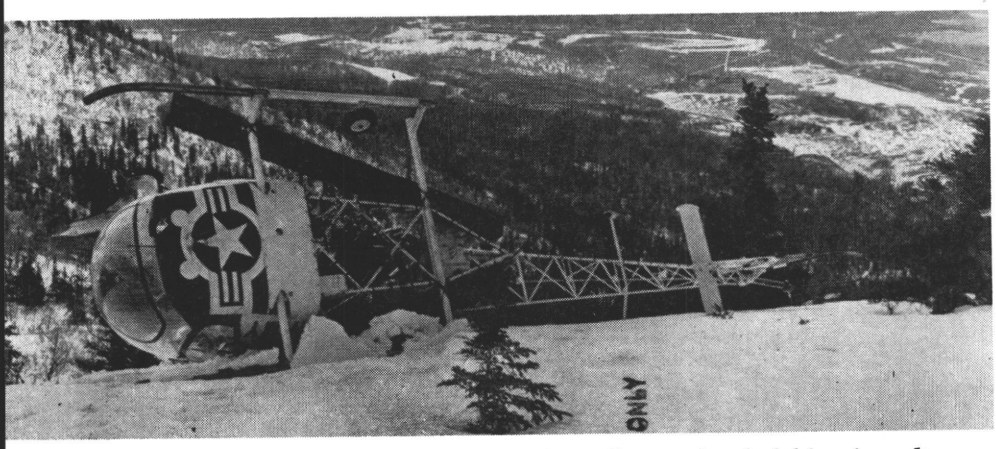
The pilot lowered the nose and attempted to regain flying speed. He rounded out about 10 feet above the runway, and the aircraft, in a crab and drifting right, landed hard. The left landing gear strut was driven up into the fuselage.

Some instructor pilots regard the designation "IP" as a license to disregard the —1 and any other rules pertinent to aircraft operation. This IP, preparing a final ride for 20-hour transition for a warrant officer pilot, loaded his Sioux with two railroad ties weighing 183 pounds each. The aircraft grossed 2,596 pounds but was able to maintain a 6-inch hover with maximum power.

The Sioux climbed to 2,000 feet MSL at which time the IP pointed out a pinnacle at the same altitude and directed the pilot to land there.

TOO LATE ACTION

The Sioux climbed to 2,300 MSL and the pilot began his approach to the pinnacle at 35



The instructor pilot habitually overloaded his aircraft

mph airspeed. During the descent, airspeed dissipated rapidly; approximately 75 feet from the point of intended touchdown the aircraft began to sink. About 10 feet above the ground the IP took over. The Sioux settled on a rounded portion of the pinnacle short of the space level enough to bottom the collective. Only the toes of the skids were on the ground and the rpm was steadily dropping. The IP directed the pilot to leave the Sioux to lighten it. The pilot exited by the left door, and the aircraft began to slide backwards and to the right. It lurched to the rear and came to rest on its side 25 feet behind the point of initial ground contact. The pilot was thrown over the aircraft as it rolled and received a cut behind his ear and a brain concussion.

The investigation brought out that this instructor pilot habitually overloaded his aircraft. He considered it a good method of instruction, since, in his opinion, a pilot who could operate proficiently under such severe conditions would be capable under normal conditions.

There are good and bad unit instructor pilots, and even the good ones have a rough go in some areas.

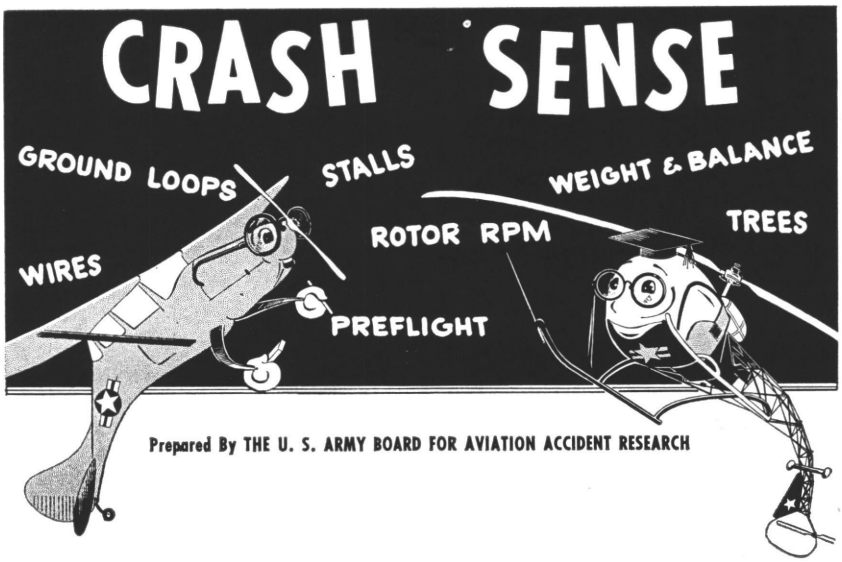
The Hot Rocks from the Boon Docks, usually in remote areas where weather and terrain present a hazard, have a built-in compensator. They have little to do other than operational flying and they get hipped on their own prowess. "We fly missions when the ducks are walking," you can hear them say, and they mean just that. Without a wise and experienced CO this type of outfit would suffer a 100% casualty rate in less time than it takes to fill out an accident form. These same tigers, when informed that a recommendation was being considered to school standardize unit IPs, were quick to point out that "these IPs can't show us anything."

Perhaps this is all part of the growing up process. Trouble is, if maturity doesn't come quickly, they may never grow up.

The World War II pilot was regarded as a reckless devil by the public—a glamorous daredevel entitled to demonstrate the dash and daring of his flying ability. Back in those days even flight commanders were prone to give a good-natured admonition to an aviator who'd fractured flying rules.

But times have changed. Showing off is growing out of fashion. The Army Aviator profession has no room for the Hot Rocks, the Aces, the Guy in the Sky. Tiger types are welcome, but there's a string attached—they must be a professional tiger.

Bush kitty or professional tiger?



THE "PRIVATE EYES" of radio and TV fame are conveniently endowed with superhuman qualities by their creators. No matter if the course of investigation ends in a blind alley, these brilliant film cops are never stumped for long. They always solve the mystery and see that the right man gets the right girl.

In real life nothing ever happens so perfectly. There are always little nagging loose ends that can't be put neatly in place. Members of aircraft accident investigating boards are average human beings with none of the extraordinary senses that frequently aid the mythical cops of TVland in completing impossible assignments. They must use their average human faculties. Some of them discharge this duty in a manner that would do justice to our brightest TV cops; others botch the job miserably.

This is the story of one of the former type — no second guessing, no help from the crystal ball, just a careful, methodical gathering of evidence and equally careful consideration of all evidence.

If that evidence failed to give a clear-cut determination, it wasn't the fault of the board. The facts were not all there. Those that were there furnished a wide-awake investigation board with firm answers.

NOTHING LEFT TO CHANCE

With the power of the United States government behind it, military aviation leaves nothing to chance. The most advanced engineering skill goes into the aircraft and associated services. Flight surgeons are eager to ensure the health of the individual flier. Electronic geniuses assure the best radar equipment to gauge weather and another corps of specialists interpret and pass on their findings to users of weather information. The best radio equipment and flight instruments that money can buy go into each aircraft. With all of this to guarantee safe passage, even over short distances, Army Aviators sometimes ignore the help and rely on their own experience, even when that experience is limited.

Accident Number One

This Army Aviator had a total of 288 hours. Needing night cross-country proficiency, he filed from his home station. Another young aviator, a personal friend, accompanied him in another Bird Dog.

Short strip work was practiced en route, and the pair leisurely flew on to their destination and landed about 2015 hours. After the aircraft were refueled, the two aviators visited in town for about 30 minutes, where they drank cokes (with a little bourbon), and

then returned to the field and preflighted the aircraft.

FILED FROM AIR

The aircraft were located approximately 500 yards from the radio station where they normally would file their flight plan; so the two got permission from the tower, took off and filed from the air.

This was an error on the part of the aviators because at that time the radar at a nearby installation gave an indication of thunderstorm activity moving toward their path of flight. Weather at the time of takeoff was reported as "high thin scattered clouds, visibility 15 miles." This propensity to consider current local weather as indicative of what's ahead is the mark of youthful thoughtlessness and inexperience. "High thin scattered" doesn't indicate what's 50 miles ahead on the ground track.

FINDS SUCKER HOLE

In the words of the wingman, "We flew towards the post for about 15 or 20 minutes at 3,500 feet. At this time I noticed that we had flown over a scattered layer of clouds which appeared to be 1,000 feet below us. At this time I contacted ——— and told him that we were over the clouds and that I thought we should return to where no clouds existed and get under the layer if possible. He said he thought this best and we reversed course. A few minutes later ——— said he'd found a big hole and was going to let down through the clouds there. I continued and after a very short time I was beyond the layer of clouds and began my letdown. At this time ——— called me and said that he was below the clouds at 2,000 feet. I let down to 2,000 and again began to fly toward the post. I told him that I was below the clouds and headed for home field. At this time he asked me if I had him in sight, and I replied negative. He said he was going to turn on his landing lights and circle and that I should tell him when I saw him."

Bird Dog struck ground with an estimated force of 83 g's

THE LAST WORD

That was the last transmission heard from the pilot. His companion flew on to the home field, landed and checked with the duty officer. The duty officer called Military Flight Service and was advised that the Bird Dog had crashed and the aviator had been killed.

FEW FACTS

These were the facts the investigators had to go on as they hurriedly assembled at the site of the crash. Proceeding in the manner dictated by DA Pam 95-5 they charted the area, made reams of notes, took pictures, and assembled as much evidence as the wreckage offered.

They found that the aircraft struck the ground on a heading of 145° in a left wing low spiral at a 40° attitude from the horizontal with an estimated force of 83 g's. This impact force resulted in multiple injuries to the pilot, one or more of which could have been fatal. The aircraft slid for 146 feet and came to rest against several small trees. It began to disintegrate upon impact. Location of parts was carefully charted by the investigators.

Fire consumed much of the wreckage, making the work of the board more difficult. An examination under ultraviolet light of the fire-damaged altimeter showed a reading of 1140

feet at time of impact, compared to a reading of 1160 feet on altimeters of the aircraft flown into the area by the board.

About 25 feet before the aircraft came to rest, the engine struck a small stump and was torn loose. The investigators believed the pilot was thrown clear of the aircraft at this point, since there were no burns on the body.

Residents in the area were questioned. The owner of the ranch on which the accident happened stated that a low-flying aircraft wakened him at about 11:00 o'clock p.m.

THE WITNESS REPORTS

"It came right down over my house, I guess about 50 or 100 feet. It sounded okay to me, but it was real low. Just a few seconds later the engine suddenly stopped. I don't remember hearing what I would call an explosion — the engine just stopped. When I got to the south window, I could see flames down in the pasture."

The ranch owner's son added what he could. "We went down to the airplane, which was on fire, but didn't see anybody in the flames. We didn't get too close because we thought the gas tanks might explode. We went back to the house, and my father called the law."

The constable in the locality was awaked by the low-flying aircraft. "The sound of the engine was normal and smooth. I then heard the noise of a crash and looking outside, saw the glow of a fire against the sky. I telephoned the highway patrol and then left to find the accident with my neighbor who lives across the road . . .

"The body was lying on its side, face down and still had the parachute on . . ."

The coroner later testified that the parachute was removed without having to "unbuckle anything." His additional testimony established very little other than the fact that it rained some time after the crash.

BOARD CONSIDERS OTHER EVIDENCE

After completing examination of the wreckage and questioning of witnesses, the board reconvened on post with all members present and took additional testimony from the aviator who had accompanied the deceased and the aviator who had flown the Bird Dog last just prior to the accident.

Second man in the flight said, "I was with him all day Friday. That morning we played Ping-pong until about 1000 hours, and he had a coke and doughnut then. We went shopping at the commissary, and he ate lunch at my house since his wife was substitute teaching at school that day. He ate a ham and cheese sandwich and had a couple of glasses of milk. That's the last thing he ate that day, I think. He had said he was trying to lose weight and had put himself on a diet."

The pathologist making the autopsy stated, "The deceased had not eaten anything for at least six hours previous to death."

Another officer from the same company testified: "I was the last one to fly the Bird Dog before it crashed. I thought it was a pretty good ship and flew well. It had three write-ups on the 781-2. These were an 80 rpm drop on the left mag; the door had come open in flight; and it had high oil temperature, but the cylinder head temperature stayed normal. I made some power approaches, and it was all right. I didn't make any hard landings.

DEFICIENCY NOT CARRIED

"The shoulder harness straps were too short. To fit comfortably and to reach the flap handle, I had to loosen the safety belt. It had been in this condition four or five months, and I had written it up before. No action had been taken however, and it was not being carried on the 781-2."

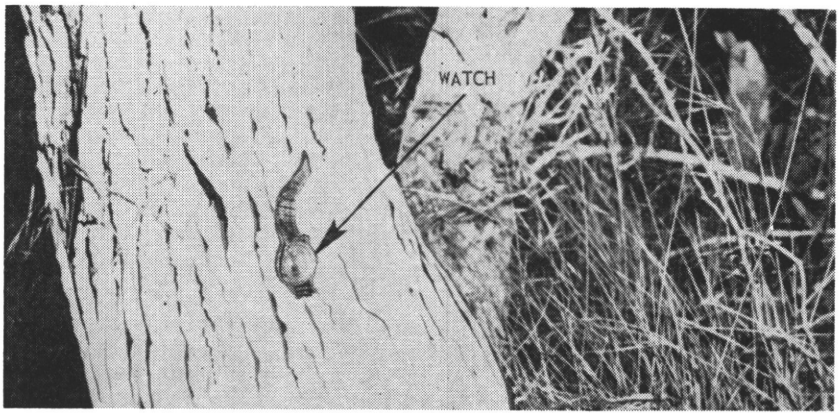
The president of the board reported on his discussion with the medics who had picked up the body. The chest strap on the parachute was buckled behind the back and the leg straps were open. The right shoulder strap was halfway between the shoulder and the elbow.

TV FILM VERIFIES

Leaving nothing undone, the board viewed the television film that a local television station had made shortly after the crash. These films showed the wreckage to be in the same position as when examined by the board the morning after the crash. They also showed the removal of the parachute from the body. The movies confirmed that the parachute had not been strapped on and the chest strap was buckled behind the back.

The ashes of the cockpit yielded separated portions of the safety belt buckle, indicating that the safety belt, and consequently the shoulder harness, were not being worn by the pilot at the time of impact. The joined portions of another safety belt buckle were found in the vicinity of the baggage compartment, tending to verify that the portions of the safety belt buckle found in the cockpit were those of the pilot.

The fact that the pilot was not using these safety devices was further substantiated by



Pilot's watch set crash time at 15 minutes after takeoff

the autopsy report which showed a lack of injury around the waist and chest that is normally present if the safety belt and shoulder harness are worn at the time of an impact of this magnitude.

The aviator's wristwatch found in the wreckage set the time of the crash at 2300 hours.

CAUSE UNKNOWN

With the great mass of evidence confronting them, members of the investigating board were of the opinion that the exact cause of the accident was unknown.

They listed weather, pilot fatigue and the decision of the two aviators to maintain sight of each other as contributing factors.

THE ANSWERS

In the summation the board made the statement: "If the pilot had filed his flight plan on the ground, he would have had the opportunity to check radar weather reports ...." (Pictures of the radar scope, taken prior to the accident, showed a thunderstorm moving across the flight path. These pictures were included in the accident report.)

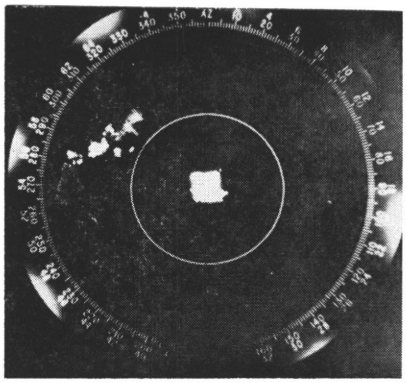
"He elected, however, to depart the field and file his flight plan in the air by radio. At best, he would only receive the latest hourly teletype sequence reports at 2245 hours as broadcast by FAA radio. These weather reports would have been observed prior to being put on the teletype circuits at 2200 hours ....

"After realizing that he was over a cloud layer and agreeing by radio to descend beneath this cloud layer ... the board feels that the pilot was actually at 1,200 feet MSL because of an error in reading his altimeter and not at 2,000 feet MSL as he believed and stated over the radio."

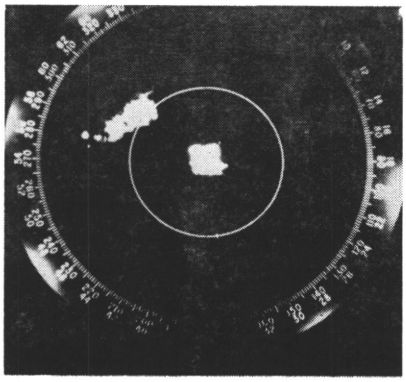
The pilot stated that he would circle and turn on his landing light. The board established that he was circling or turning at the time of impact; therefore, it was assumed that the landing light was on. This was substantiated by the fact that the landing light bulbs were found with the filaments intact. Technical experts stated that the light must have been on and the filaments hot and flexible to withstand the shock of such an impact. In turning left, or west, the pilot turned away from the only light on the ground at that time of night, a U. S. highway. At that point any one of three possibilities existed, or a combination thereof:

(1) Believing himself to be at 2,000 feet MSL when he was actually only 1,200 feet MSL, the pilot was not con-

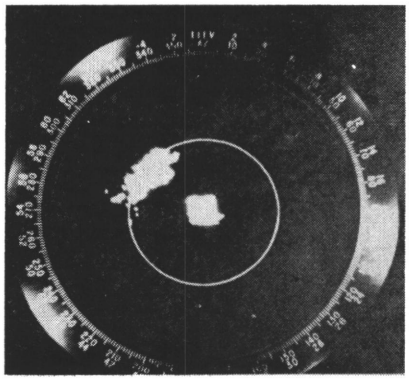
Radar showed . . .



a thunderstorm moving . . .



across flight path



Disorientation? Whatever the cause, this is the result

cerned with holding an absolute altitude. As a result he lost 60 feet of altitude in this turn and flew into the ground.

(2) While in the turn, the landing light reflected off a low cloud, thereby causing loss of night vision, spatial orientation, and reference to the instruments.

(3) While in the turn, the pilot realized that he should be wearing his parachute and, since this was his first chance after taking off to put it on, he released his safety belt and shoulder harness and attempted to put his parachute on, right arm first.

If the pilot were at 1,200 feet MSL, the natural tendency of applying pressure with the left foot while trying to get into the shoulder strap with the right arm would cause the aircraft to lose 60 feet of altitude just prior to the crash. This is the only logical conclusion to which the board would agree as being the cause of not having the parachute straps, shoulder harness, and safety belt fastened.

That's the whole story without the aid of a Hollywood script writer furnishing a synthetic brilliance to the investigators. This investigation proceeded along the lines recommended in the HANDBOOK FOR AIRCRAFT ACCIDENT INVESTIGATORS (DA PAM 95-5).

One thing the book can't do is think. That must be furnished by the aviators assigned to do the investigating. In this case the report shows that thinking. Sad but true, this isn't always so.

Accident Number Two

Army aircraft accidents are expensive, averaging $24,500 a day during FY 1959. The only possible way to benefit from these accidents is to learn new ways to improve Army Aviation and prevent future accidents. There is an obligation to learn from each aircraft accident all that can be learned, with such improvements in mind.

It is tragedy with Shakespearean undertones when an accident costing the Army $48,692 is not milked of every penny in experience to compensate for the loss.

THE MAIN EVENT

The only information turned up by one investigation board was that the aircraft, an H-19 Chickasaw, was making an authorized flight.

The Chickasaw had been engaged in a field exercise and was making a normal takeoff from the maneuver area en route to camp. During takeoff engine failure occurred at about 100 feet. The pilot entered autorotation, turning 40° right toward the most suitable landing area. Unfortunately the terrain was rocky and rolling.

Just before touching down, the tail skid contacted and dug into the ground for a distance of about 15 feet. The aircraft traveled another 11 feet before the forward gear touched the ground, damaging tail boom, rotor blades, rotor head, and engine. There were no injuries to personnel.

In the course of events, a board was appointed and began its investigation. That is, the board went through the motions of an investigation. Forms were filled out; statements were obtained from pilot, copilot, passengers, and tower operator. Pictures were made of the area. A diagram was provided of the accident area, showing the detail required in DA Form 285, all in the approved manner. This is about as far as the inquiry went.

THE KNOCKOUT

The board found that the accident was caused by engine failure. Nothing at all was said about possible contaminated fuel; not a single word about the **cause** of the engine failure. Was the engine improperly maintained? Did something fail

that a preflight should have turned up? A part on which an unsatisfactory equipment report should be submitted? Likely, we'll never know.

While the Army investigator is expected to have sufficient technical qualification to decide the need for special assistance, he is not expected to be professionally qualified for such analysis. All that was necessary here was to send a fuel specimen to the proper agency, and have the engine analyzed in accordance with DA Pamphlet 95-5, Change 1.

This board, in common with all accident investigation boards, had an obligation to do everything in its power to make this costly accident pay dividends of experience and future avoidance. This particular accident investigation failed miserably in this respect.

Accidents are expensive. Let's use them. Let's make them pay and pay for every life, every injury, every dollar. That way we'll make certain that in the next conflict it won't be an accident that aborts the mission.

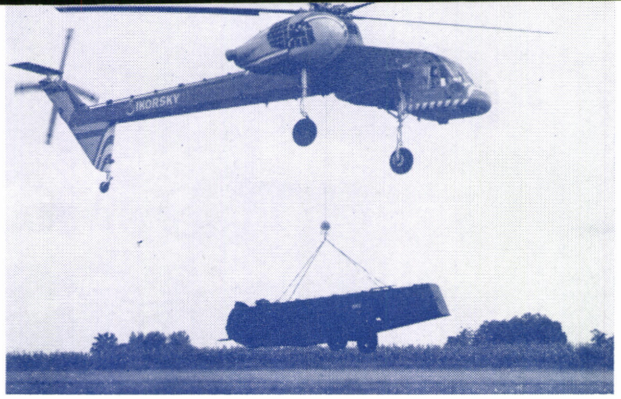
Reason for engine failure was never determined

What's the Spread?

No aviator would knowingly file a flight plan without some regard for the route he is to fly. Yet, accident evidence indicates some aviators file with little or no knowledge of en route or destination dewpoint-temperature spread. Make no mistake about it: fog will form when moist air is cooled below its saturation point. Play it safe—check the spread!

Weather is the number one killer of Army helicopter crews and passengers. In many cases, even experienced pilots have not been able to override a compulsion to go farther into weather than good air judgment dictates.

While the unique flying qualities of the helicopter must be appreciated and utilized to the advantage of the aviation mission, the tenet "I can set it down anywhere" must not be allowed to compromise the pilot's judgment, and so place him in a weather situation from which he will not have the capability to recover.



feet). Automatic Stabilization Equipment (ASE) is available at all times when the seat is in the aft position as alternative controls for easy handling under difficult loading conditions. The flying crane pilot is not blinded from the load at the critical times of loading and unloading, or by inflight obstacles.

The configuration of this aircraft testbed, combined with its built-in high capacity winch, offers operational versatility. Bulky loads can be handled either as a sling load or attached directly to the fuselage. Further, the winch permits the pilot to draw up a relatively inaccessible sling load to the desired distance from the fuselage, rather than leave the load at the end of a long fixed cable. The crane design minimizes the problems encountered with loading around the center of gravity. The winch is attached directly below the rotor transmission. Also, the fuselage attachments are placed so that the weight suspended from these points falls within the aircraft's center of gravity limitations.

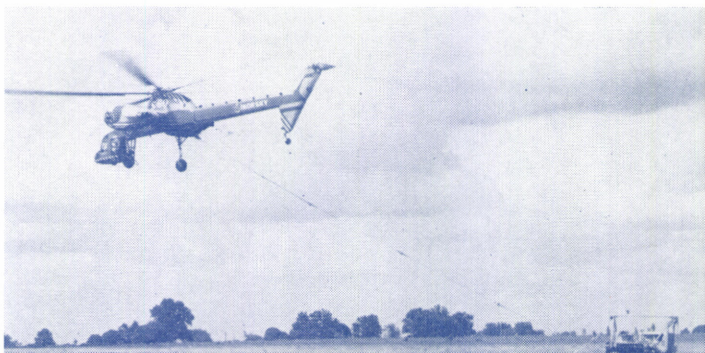
The S-60 configuration, designed primarily for lift and control, has a greater payload capacity than a similar airframe with a built-in passenger fuselage.

Two additional advantages are found in an aircraft of this configuration: speed and versatility. Time is saved not by the flying speed of the Flying Crane but by greatly reducing loading and unloading time at the terminals. The position and facilities of the pilot's cabin reduces the pickup and delivery time particularly during the hours of darkness. Preloaded packages, pallets, or personnel pods could be picked up and delivered without holding the aircraft for loading and unloading. Utilization of aircraft would become more efficient during shuttles and the aircraft combat security enhanced.

All helicopters are versatile. The Flying Crane, however, seems to offer just a little more. The advantages of the extra heavy duty winch coupled with the large space below the fuselage have been mentioned. Bulky loads do not present the complete story. For instance, many helicopters have lifted and transported the new communications van. But has the same van ever been transported with personnel and with continuous signal operations? Apply this technique to command post vans, radar shelters, or aid station pods where the basic pod may be drawn up and fastened to this fuselage. A stable, safe cabin is thus adapted to the helicopter for continuous operation while in transit.

The manufacturer plans a greater lift capacity in a later model flying crane. Today's model is basically a new airframe constructed around the heart of an H-37. In the future the aircraft will feature two turbine engines, improved rotor head and blades, and a tricycle landing gear. The lift capacity expected is in the 8-10 ton range.

Agencies at Fort Rucker put the Flying Crane through various tests to determine its military potential. Upon completion of the tests at Rucker the aircraft was flown to Fort Benning and Fort Bragg for further evaluation. It will be interesting to note additional ideas for employment of the S-60 configuration not already visualized by the manufacturer.



Med Plans + Operations Dir

The Flying Crane

ANOTHER CONCEPT envisaged for the "future" moved into the present on 17 August when a long awaited flying crane helicopter testbed was introduced to the U. S. Army Aviation School. The Sikorsky S-60 "Flying Crane" was delivered by the builder and his staff to agencies of the Aviation School and United States Army Aviation Board for initial tests for suitability of configuration.

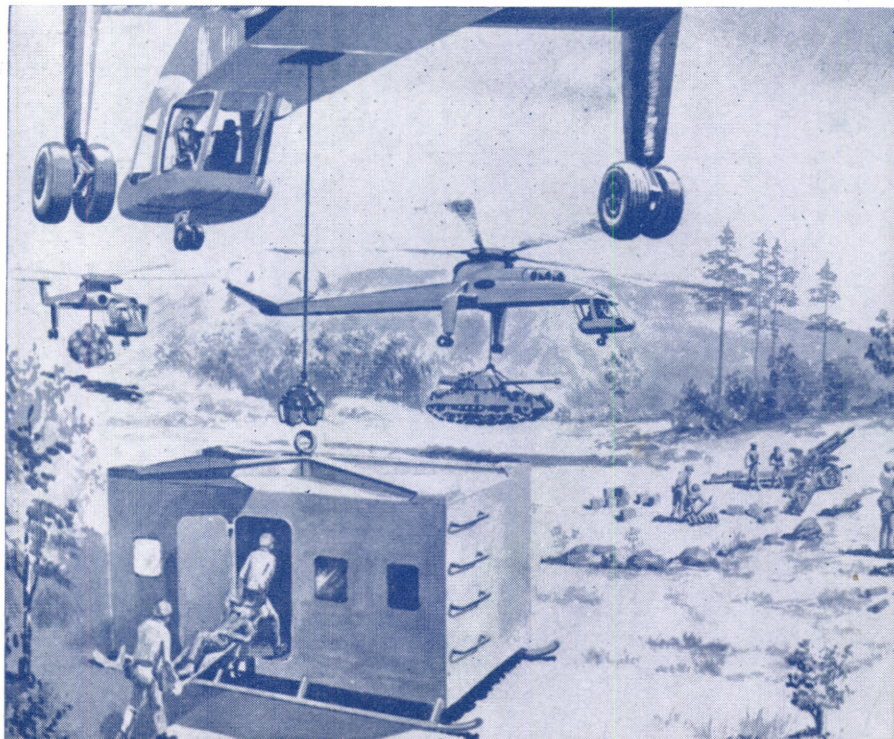
Introducing the Flying Crane to the Fort Rucker staff, Mr. Sikorsky and his staff presented a briefing complete with graphs and pictures. The manufacturer stressed three distinct design advantages of the S-60 configuration:

1. Unobstructed vision which allows the pilot to observe practically all phases of load pickup and delivery operations.

2. The large space below the fuselage permits efficient handling of bulky articles in the "as is" condition.

3. A larger payload capacity for the same size and cost helicopter.

The pilot's cabin in the nose of the aircraft is constructed so the pilot has a full 360° field of vision around the aircraft. In addition, a two-position, 180° rotatable, left seat with controls in both the forward and aft facing positions provides the pilot unprecedented vision and control during inflight pickups and deliveries (downward vision is obstructed when cable length exceeds 30

(Continued on Inside Back Cover)

Turbine configuration supplying troops, evacuating wounded