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UNITED STATES ARMY AVIATION DIGEST

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NOVEMBER 1961

SOPHISTICATED LADIES

PAGE 6

United States Army

AVIATION DIGEST

NOVEMBER 1961
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Spontaneous combustion is all we need to set Army Aviation afire—ignited by the thoughts and ideas of Army Aviators, with the ARMY AVIATION DIGEST as catalyst.

Only through sharing your thoughts with others in Army Aviation can you build your profession in fulfilling its ultimate potentialities. Everybody has a gripe about the existing system—but what is your solution to the problem? Do you know a better way of using our aircraft, an improved maintenance procedure, a new tactical idea, or a gadget to facilitate operations? Whatever you talked over in the ready room today might improve Army Aviation tomorrow—if you pass it along to other aviators or maintenance personnel.

Your communication medium is the ARMY AVIATION DIGEST. Its mission is to support you in all phases of your operations—to let you communicate with Army Aviation personnel worldwide, to exchange viewpoints and experiences, to be a better informed and safer aviator.

But this isn't a oneway street; you can give as well as receive. If you don't agree with what you read in the DIGEST, sit down and write an article saying so—and why. Maybe you don't have the answer, but perhaps the ideas you have will be just the spark to ignite the fire to a solution for someone else.

Maybe you were never good in English, but don't let that stop you. The editorial staff of the DIGEST can help correct the grammar and spelling. But we can't purloin your ideas. So sit down and write them out—pen, pencil, or typewritten.

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

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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EXERCISE SWIFT STRIKE

ARMY AVIATION IN ACTION

3d TRANSPORTATION BATTALION SUPPORT

Lt Col Donato N. Vincent, TC

EXERCISE SWIFT STRIKE, the largest peacetime military maneuver since 1941, provided Army Aviation with a golden opportunity to display its diversified potential to ground commanders.

The 3d Transportation Battalion (Transport Aviation) of Fort Benning, Ga., is proud of its part in this operation. However, the battalion also encountered some problem areas and misconceptions during the operation. Each will be discussed to facilitate planning of future exercises and to enable Army Aviation to increase its support capability of the combat commander.

SWIFT STRIKE was a joint Army-Air Force maneuver conducted over the Carolinas from 6-20 August 1961. It involved over 25,000 Army and 10,000 Air Force personnel. The principal "opponents" were the "friendly" 82d Airborne Division of Fort Bragg, N. C., and the "aggressor" 101st Airborne Division of Fort Campbell, Ky.

The 3d Transportation Battalion supported both divisions as each took its turn on the offensive. This was an extremely difficult task since the lift requirement far exceeded that which would normally be required by two **friendly** divisions.

Aircraft employed by the 3d Transportation Battalion included eight AC-1 Caribou, six U1-A Otters, twenty H-34 Choctaws, eighteen H-21 Shawnees, eleven H-37 Mojaves, five H-13 Sioux, and one L-20 Beaver. During the maneuver the battalion transported 11,084

Col Vincent is CO, 3d Transportation Battalion (T/A) and Deputy Commander, Lawson Army Airfield, Ft Benning, Ga. He is dual rated.

Supervising installation of control tower equipment in Exercise SWIFT STRIKE. Satisfactory communication facilities posed another problem during the FEX.

troops, hauled 617.3 tons of cargo, and flew 1,503.4 hours.

Two statistics achieved by the battalion are particularly impressive. A 70 percent aircraft availability was maintained and over 1,500 hours were flown without an accident. But these figures must be kept in their proper perspective. It must be remembered that the maneuvers were not conducted under actual combat conditions and that the operation lasted only two weeks. Also, favorable conditions such as good weather throughout the exercise helped to establish these marks. It was possible for all of the battalion's units to go into the operation with 100 percent of their aircraft in top shape. Two administrative breaks helped the maintenance teams stay ahead of the normal attrition rate. At night, blackouts were not enforced. The high standards established could not be maintained under less favorable conditions or over extended periods of time.

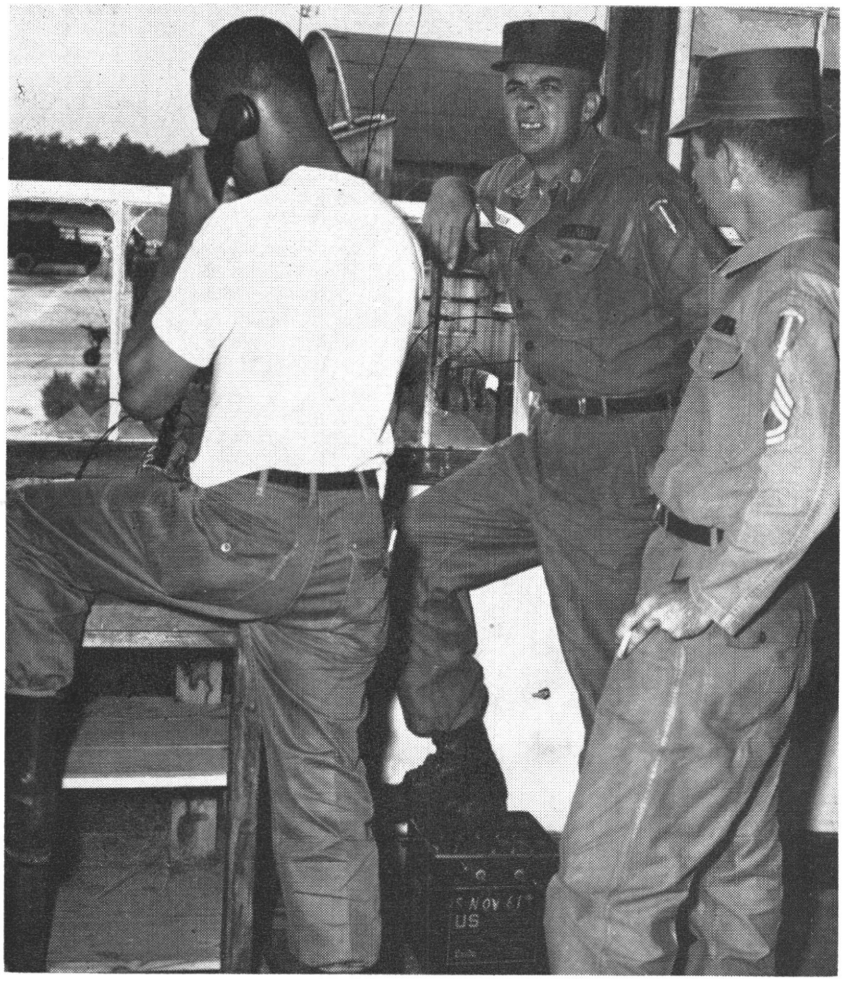
Strict adherence to ATC regulations precluded full utilization of Army aircraft and aviator capabilities. However, maneuvers of the magnitude of SWIFT STRIKE help ground commanders realize the capabilities and limitations of Army Aviation and give them an idea of how they can advantageously employ Army aircraft in future operations or combat.

Here are some of the problem areas encountered in SWIFT STRIKE and the 3d Transportation Battalion's recommendations.

EXERCISE DIRECTIVES. Some of the maneuver directives, specifically the Air Traffic Control Plan, arrived at battalion headquarters just before the maneuver. This did not allow sufficient time for planning and orientation of personnel. **These directives must arrive at the participating units in sufficient time to accomplish pre-exercise planning.**

COMMUNICATION FACILITIES. The facilities provided were inadequate. Only one line was available from 3d Transportation Battalion headquarters to XVIII Airborne Corps. Headquarters, three other units in the area, and a medical air ambulance company used this line through the battalion switchboard. This resulted in poor telephone communications with excessive delays, and unusual requirements for liaison officers to obtain essential information to accomplish required support. **In future exercises, a battalion of this type should be provided at least two land lines to the next higher headquarters.**

FLIGHT OPERATIONS CENTER. Many delays in filing plans existed due to poor telephone communications. Flight plans for about 65 aircraft were required to be filed over one line. Consequently, many flight plans had to be filed from the air. Also, FOC stopped requiring, and in many instances refused to accept flight plans for 500 feet altitude or less. This placed the burden of flight following on individual units, a near impossible task considering available communications.



Two administrative breaks helped maintenance teams achieve a high aircraft availability rate.

The 3d Transportation Battalion feels that a minimum of two FOC lines to organizations of this size should be provided in future exercises. Also, FOC should accept all flight plans and assume full responsibility for flight following.

MAP COVERAGE. Maps furnished the battalion were numerically insufficient in all scales. The 1:100,000 is essential for pilot navigational needs if the tactical plan is to be adequately supported by transport aircraft. The battalion feels that the minimum essential supply of maps 1:100,000 is one per aircraft, five to each company, and five sets to the battalion headquarters.

Combat commanders probably cannot accept a 500-1,000 meter inaccuracy for delivery of combat troops. This inevitably results when pilots are forced to use maps of 1:250,000 scale. Additionally, the tactical commander could not live with the final landing site selection being left solely with the pilot. This establishes the need for adequate maps of 1:25,000 to be used for map reconnaissance and to be available to the flight leader.

REFUELING. Fueling restrictions within the airhead on transport aircraft resulted in considerable delay in mission performance, reduced the battalion capability to support the divisions, and increased the flying time requirement for mission completion. While it is recognized that it is unrealistic to administratively place Class III A within the airhead initially, it appears equally if not more unrealistic to fly aircraft across hostile territory for the sole purpose of refueling.

In actual combat operations of this type, planned use of Army transport aircraft will require initial air delivery of minimum essential Class III A in the airhead. The lack of this supply within the airhead reduces the flexibility of Army transport aviation. At critical periods the aircraft may not be able to accomplish the mission. This situation occurred during SWIFT STRIKE when a battle group was committed to cross a river. The aircraft were available, but there was insufficient fuel to complete the mission.

EQUIPMENT SHORTCOMINGS. The refueling capability of the light and medium helicopter companies is inadequate. The 5,000-gallon tankers authorized these units are not equipped with filter/separators. This precludes their use for into-aircraft refueling and limits the filtering process normally required.

The 1,200-gallon refuelers of the light and medium helicopter companies (five and four respectively) require 30-60 minutes to refuel each unit. The proximity of two of the battalion's companies during SWIFT STRIKE allowed a centralized refueling operation, and decreased refueling time by 15-30 minutes. Tactical employment of the units would preclude this type of operation.

The 5,000-gallon semitrailers should be equipped with filter/separators, and future TOE changes should include a mini-

Photo By Bell Aircraft

An insufficient number of maps in all scales was a common problem

mum of six 1,200-gallon refuelers per light and medium helicopter company. (See Sophisticated Ladies.)

DELIVERY OF AVIATION FUEL BY COMMERCIAL TANKER. This system proved unsatisfactory because commercial tanker delivery time ranged from 12-36 hours. The time lag is excessive due to a limited storage supply capacity and a requirement that aviation gasoline resupply be responsive. As the exercise developed, the quartermaster began making deliveries and consequently gave 1-3 hour delivery. This system proved satisfactory and it is felt that it should be employed in future operations.

LOADING AND UNLOADING. Excessive ground time was consumed throughout the exercise due to a lack of personnel available to load and unload cargo from aircraft. In some instances aviators found that after delivering cargo they also had to unload it. With an already reduced aviator strength, this only added to the pilot fatigue factor.

The supported unit must become aware of the loading and unloading requirement and provide sufficient personnel to get the aircraft unloaded quickly and minimize the unproductive time the aircraft must remain on the ground.

MISUSE OF AIRCRAFT. Army aircraft were occasionally misused. In some instances aircraft were committed to move a battle group 3-4 miles when no obstacles existed to ground movement. The moves often could have been accomplished in much less time by land, and the distance could not be considered excessive.

Also, many troops 9-10 miles away had to be moved. On one occasion personnel and equipment of a battle group were moved 11 miles. The personnel lift was accomplished in less than an hour, and the equipment lift required 2½ hours. Good roads existed in friendly territory and the equipment should have gone overland. This would have provided the major objective of saving troop strength and at the same time released transport aircraft for other essential or critical missions.

Commanders at all levels must be aware of the limited numerical capability of Army transport aircraft. Use must be restricted to essential and priority lifts. To have transport aircraft available for the jobs that demand them, each mission must be carefully evaluated to ensure that other modes will not do the job satisfactorily or equally as well.

SWIFT STRIKE taught us many lessons. It pointed up the need for more liaison officers and closer coordination with the supported unit. In such fluid situations, there can be no substitute for proper liaison between Army Aviation units and the combat commander. Radio and wire communications must be considered a secondary

means of communication.

The maneuver also emphasized the necessity for the establishment of aviation unit operations in proximity to the supported division or battlegroup. The units should operate as far forward in the combat zone as security and protection of the aircraft will allow.

It also was confirmed that the present organization of the transportation aircraft battalion (T/A) at reduced strength is inadequate. The TOE indicates that the battalion at reduced strength is capable of operating under garrison conditions and limited periods of combat. Only the administrative breaks enabled the battalion to keep going at maximum efficiency during the maneuver. The present TOE structure (reduced) is considered completely inadequate (47 personnel as compared to 72 authorized at full strength). Personnel had to be drawn from attached units already understrength to accomplish the mission.

The battalion commander personally performed many tasks not normally associated with his duties and responsibilities. This resulted in distraction from other important duties.

Another lesson learned was that the transportation battalion (T/A) requires a reasonable, stable plan to provide adequate support to the combat commander. In each instance during the exercise the combat commander provided this battalion with an excellent plan for use of the available aviation units. However, in nearly every instance the plan was changed at the last minute and often after the aircraft were airborne.

It is not the intent to indicate that the commander's plan must be inflexible a given number of hours before execution, nor to indicate that aviation units are inflexible. **It is considered that as much planning leadtime for the employment of Army transport aviation must be given as is provided for other supporting arms.**

The combat commander and staff must realize that once a mission is planned, last minute changes may not be within the capability of the aircraft and may result in inadequate support or failure to complete the mission.

To obtain the maximum lift capability from Army aircraft, careful planning must precede each mission. Consideration must be given to fuel requirements, density altitude, loading areas, and landing zones. Fuel requirements are determined by the distance involved, type loads (external or internal) and the number of trips planned. Fuel requirements, to a large degree, determine allowable loads. Changes in distances or loads after the aircraft are fueled result in delays or failure to accomplish the mission. This problem will continue to exist until enough spare aircraft are available to fill the gaps resulting in changes of the initial plan.

Certainly SWIFT STRIKE pointed out that Army Aviation, **properly employed**, gives the ground commander a chance to break away from the ground barrier. It can provide him with efficient dependable mobility and minimize his logistic problems.

USATRECOM Awards Bell Contract

Bell Helicopter Company has been awarded a $491,000 contract by the U. S. Army Transportation Research Command to perform experimental research on methods of obtaining increased productivity, range, and speed of helicopters.

The HU-1 Iroquois is being used as the flight vehicle for this program. A final report will be made to the Army in December, 1962.

Bell engineers predict a modified HU-1 would fly at more than 180 mph or about 60 mph above current cruising speed of the Iroquois.

Also forecast was an extension of the HU-1 range from 1,000 to approximately 1,400 miles.

These performance increases could be achieved by redesigning the rotor, adding horsepower and reducing drag, according to Bell engineers. Experiments will be conducted with a three-bladed rotor and variable tilt pylon.

The experimental research program is based on analysis and design studies conducted by Bell's engineering research group at company expense.

Sophisticated

IT WASN'T TOO long ago that HU-1s and AO-1s could only be seen over the peanut patches around Fort Rucker. But this picture has changed rapidly in past months. Iroquois are now fanning the air over Okinawa and Korea. By the time this is published, Mohawks will be seen in European skies.

What does this mean to Army Aviation? On the plus side, it means greatly increased ability and performance. But these advantages don't come free. They bring new demands on the talents and time of operating and maintenance personnel. Make no mistake — these girls won't stand the type of treatment given truck stop waitresses. They are—and they insist on being treated as — SOPHISTICATED L A D I E S. Those who have developed a casual attitude from long association with conventional aircraft will need a mental oil change. The fond pat and playful pinch approach won't hack it with these new ladies.

Although it may be considered ungentlemanly, probably the best way to learn what kind of treatment these ladies **won't** stand is to take a look into their past. First, the Iroquois. She's been with us longer than the Mohawk and naturally her past will show more accidents. Here they are in the order in which they occurred:

ACCIDENT CLASSIFICATION AND DESCRIPTION

Forced Landing—Engine failed in flight. Caused by materiel failure of front main bearing.

Minor— Hard landing from demonstration touchdown autorotation.

Major — Engine drive short shaft assembly failed. Suspect misalignment of engine drive shaft.

Forced Landing — Tail rotor blade tip counterweight came off in flight and went through engine compartment.

Incident—Tail rotor drive shaft struck by main rotor blades. Caused by low rotor rpm and gusty winds.

Major—Aircraft entered high sink rate in flight and crashed.

Forced Landing — Fuel line quick disconnect coupling came loose in flight, causing fuel starvation.

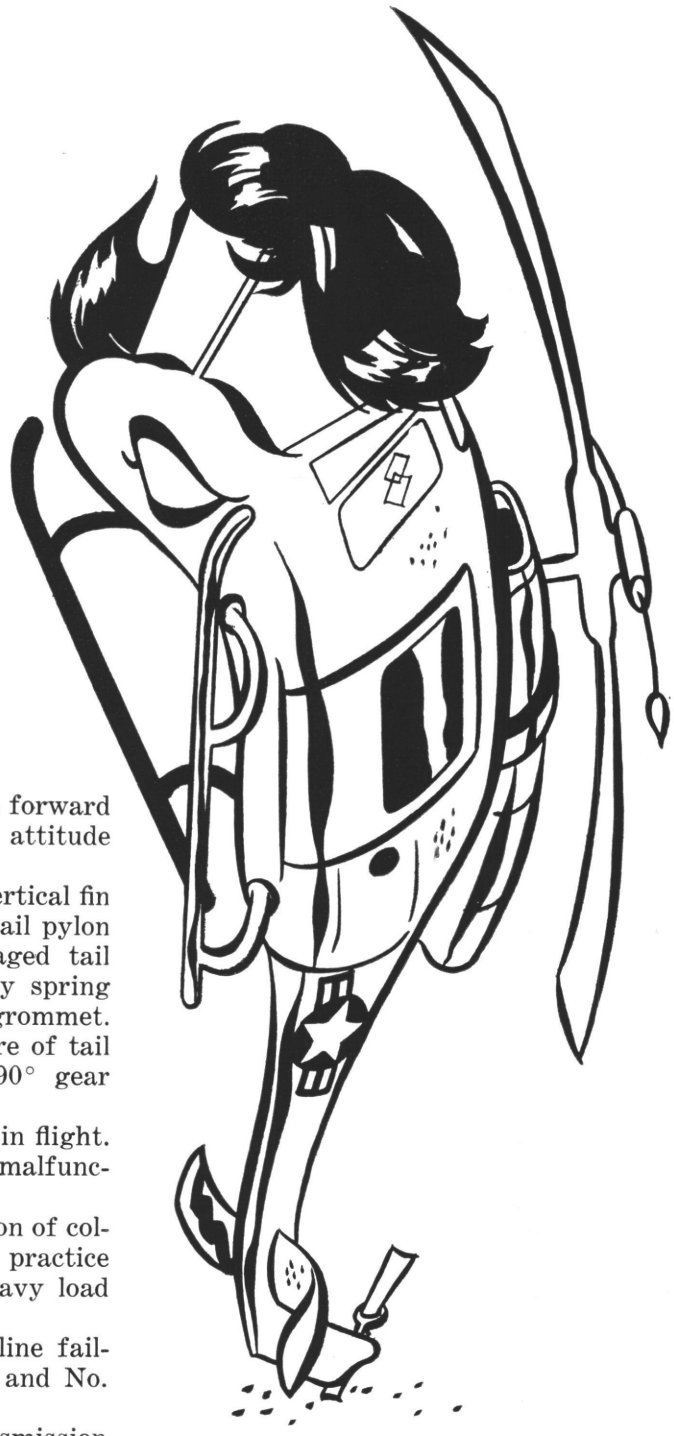
Forced Landing — Short shaft failure caused by materiel failure of short shaft coupling bolt.

Major — Heater exhaust set grass on fire under aircraft. Aircraft burned.

Forced Landing—Copilot's door blew off during hovering flight. Caused by broken door hinges.

Incident — Tail rotor drive damaged by buckling bar

Ladies



which was left in tunnel during maintenance.

Major—Engine failed in flight. Caused by icing in fuel system, fuel contamination and water in fuel control.

Forced Landing — Low engine oil pressure. Suspect materiel failure of No. 1 bearing.

Major—Short shaft coupling clamp bolt failed. Bolt was overtorqued.

Incident—Leading edge of tail rotor blades dented by unknown objects.

Major—Pilot's attention was diverted while turning off overhead heater switch during low altitude turn. Aircraft crashed.

Forced Landing—Engine short shaft failure caused by materiel failure of engine short shaft coupling clamp bolts.

Incident—Violent vertical vibrations when pitch was applied. Suspect hydraulic system malfunction.

Major — Engine drive shaft failed in flight. Caused by failure of engine short shaft coupling clamp bolts.

Incident — Engine failure. Cause undetermined.

Incident—Main rotor blade tips damaged by contact with tree.

Incident — Tail rotor blades damaged by contact with tree limbs.

Major—Delayed and insufficient pitch application while aircraft was in excessive forward velocity in tail-low attitude caused crash.

Incident—Spring of vertical fin leading edge door of tail pylon came loose and damaged tail rotor blade. Caused by spring vibrating loose from grommet.

Minor—Materiel failure of tail rotor blade tip and 90° gear box.

Major—Engine failed in flight. Suspect N_2 governor malfunction.

Major—Late application of collective pitch during practice autorotation under heavy load conditions.

Forced Landing—Oil line failure between oil filter and No. 3 and No. 4 bearings.

Incident — Left transmission cowling lost in flight. Cowling latches not properly fastened.

Forced Landing—Low oil pressure. Cause undetermined. Excessive oil found in engine compartment.

Forced Landing—Engine rpm lost in flight. Caused by fuel

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

contamination of N_2 governor.

Major—Materiel failure of tail rotor blade tip and 90° gear box.

Major—Flameout in flight caused by failure of N_2 governor.

Major—Materiel failure of tail rotor blade tip and 90° gear box.

Major—Practice autorotation to soft touchdown area. Aircraft weight suddenly shifted to right skid during correction of left skid low attitude.

Forced Landing — Micarta block missing from leading edge of tail rotor blade. Caused by materiel failure of bonding material.

Minor—Damage resulted from testing of dead man's curve.

Forced Landing—Engine failure caused by broken wire to governor rpm switch.

Forced Landing — Loss of engine rpm caused by N_2 governor failure.

Major—Loss of engine rpm caused by N_2 governor failure.

Forced Landing — Engine oil pressure lost due to broken oil drain line at oil cooler.

Incident—Copilot's door fell off in flight. Caused by materiel failure of door hinges.

Forced Landing—Engine failure. Cause undetermined.

Forced Landing—Fuel starvation caused by ice in fuel filter.

Incident—Aircraft landed short in soft field due to low rotor rpm.

Major — Tail rotor blades struck auxiliary power unit during hovering flight.

Forced Landing—Loss of engine rpm caused by fuel contamination.

Incident — Left transmission cowling lost in flight. Cowling latches not properly fastened.

Incident — Left transmission cowling lost in flight. Cowling latches not properly fastened.

Major—Aircraft touched down tail low during practice autorotation. Full cyclic and collective pitch were applied, causing main rotor blades to strike tail boom.

Forced Landing—Engine failure caused by explosion in compressor section of engine.

Incident — Tail rotor blade struck bush during approach to confined area.

Minor—Abrupt control movement caused main rotor blades to shear tail rotor drive shaft.

Incident—Aircraft was flared too low and tail skid was bent.

Forced Landing—Fuel starvation caused by partially disconnected fuel line quick disconnect coupling.

Major—Aircraft entered high sink rate and struck ground.

Major — Engine short shaft failed. Suspect misalignment of short shaft and/or lubrication problem.

Incident—Tail rotor blade damaged by contact with tree.

Forced Landing—Engine oil pressure lost in flight. Oil line from pump to No. 2 and No. 3 bearings came loose.

Forced Landing—Tail rotor gear box and blades lost in flight. Caused by loss of tail rotor blade tip weight.

Minor—Hard landing resulted from late application of pitch.

Incident—Materiel failure of No. 3 bearing.

Incident—Abrupt control movements caused main rotor blades to shear tail rotor drive shaft.

Incident — Engine failure. Cause undetermined.

Incident—Forward right cowling came loose in flight. Cowling not properly secured.

Forced Landing— Compressor stall occurred when engine was put in manual control. Suspect defective overspeed governor.

Forced Landing—Fuel starvation. Caused by loose quick disconnect coupling.

Forced Landing—Engine failure. Caused by overspeed governor going to low rpm.

Incident—Antenna bracket installed in reverse. Tail rotor struck antenna when aircraft was started.

Major—Collective pitch sleeve separated in flight. Caused by defective lock plate.

Forced Landing—Fuel starvation caused by loose quick disconnect coupling.

Forced Landing — Overspeed governor failed to low rpm side.

Forced Landing—High engine oil temperature caused by shearing retaining rivets on lower section of shaft-fan drive and joint fan drive shaft.

Major—Upper lock plate of collective sleeve assembly came loose in flight.

Forced Landing—Oil pressure fluctuated in flight. Cause undetermined. Excessive oil found in engine compartment.

Forced Landing—Fuel transfer pump became inoperable in flight. Suspect materiel failure.

Incident—Aircraft touched down in nose-low attitude from practice autorotation. Left skid bent.

Incident—Transmission rocked forward and back after stop from practice autorotation landing. Intense vibration began and aircraft was shut down. Main transmission support case broken in several places and main case assembly cracked. Suspect materiel failure.

Forced Landing—Engine oil pressure lost during landing approach. Engine oil pump lost prime. Cause undetermined.

Forced Landing—Lock plate of scissors assembly failed, allow-

ing nut to disengage from hub. Scissors assembly rose, increasing collective pitch and causing partial loss of pitch control.

Forced Landing—Engine oil pressure loss caused by broken oil line.

Incident—Aircraft landed hard from practice 180° autorotation.

Major—Piece of metal from ground was drawn into main rotor blade and rebounded into windshield.

Incident—Partial loss of power caused by scheduling unit on main fuel regulator which was out of adjustment.

Major—Initial touchdown from practice autorotation was made tail low and aft portion of skid contacted ground first. Aircraft bounced into air and main rotor blade flexed downward, severing tail rotor drive shaft and partially severing tail boom.

Major—Aircraft struck rocks and crashed into lake. (See CRASH SENSE.)

Major—Aircraft struck high tension wires and crashed.

At this writing, most of the bugs evidenced in descriptions of materiel failures have been eliminated by sound engineering fixes. One refinement which should be in the field soon is a paper barrier filter which is more effective in cleaning fuel than the screens now in use. Another calls for hard surfaced polished working parts for the N_2 governor to prevent malfunction from particles of contamination. Also, the governor will be vented to the fuel tank to eliminate airspace and prevent possible air locks.

Now, let's take a look at the Mohawk:

Major—Hard landing caused by high sink rate due to low airspeed and late flare.

Incident—Main tires blown out due to excessive braking during landing roll.

Incident—Inboard cowl of No. 1 engine came off in flight. Cowl not properly secured.

Major—Aircraft crashed during attempted low level slow roll.

Forced Landing—Right engine failed in flight. Suspect materiel failure of No. 2 turbine wheel.

Incident—Private vehicle ran across runway as aircraft was landing. Heavy braking caused both main tires to blow out.

Minor—O ring failed shortly after takeoff because of excessive brake heat. This allowed hydraulic fluid to contact hot brake and cause fire.

Incident—Left propeller failed to reverse during landing roll. Heavy braking, required to maintain directional control, caused left main gear tire to blow out.

Forced Landing—Fire reported in No. 2 engine. Aircraft completed forced landing with no damage. Aircraft was checked out on ground and no discrepancies found. Suspect compressor stall caused fire indication.

Forced Landing—No. 2 engine torque pressure surged between 20 and 60 psi during flight. Cause of surge undetermined.

Forced Landing—Fire warning light for No. 2 engine came on in flight. Aircraft completed forced landing with no damage. Hot exhaust gases escaping around seal between engine and firewall caused deterioration around fire warning system, causing it to short out.

Incident — One propeller was slow to reverse during landing roll. Two main tires blown out by heavy braking during attempt to stop swerve. Nose wheel struck runway light, blowing out nose wheel tire. Caused by malfunction of propeller reversal auxiliary motor. Inspection revealed No. 3 wire broken in pedestal.

Major. — Landing gear was retracted prematurely during takeoff.

Forced Landing—No. 2 engine failed during takeoff roll. Aft brazed joint of power shaft failed.

Incident — Aircraft flew through trees during low-level flight.

Forced Landing — Unusual noise heard from left engine during flight. Propeller was feathered and aircraft completed forced landing with no damage. Cause of noise undetermined.

Incident.—Aft nacelle cowl on No. 1 engine lost in flight. Cowl not securely fastened.

Forced Landing—One engine failed in flight. Cause undetermined.

Incident — Excessive brakes were used while aircraft was backing. Aircraft pitched up and tail cone struck ground.

Incident—Propellers were not reversed simultaneously during landing roll, causing sharp swerve to left and blow out of right tire.

Incident—Left auxiliary tank dropped off during tactical training flight. Cause undetermined.

Probably the most serious operational hazard these two ladies bring with them lies in the care and handling of JP-4 fuel. Several articles touching on the handling of JP-4 fuel have appeared in the AVIATION DIGEST during recent months. We won't bore you with a rehash of the information contained in those articles. But a brief description of the actions taken by the technical

services to provide operating procedures and necessary equipment to assure clean dry JP-4 fuel should be of interest to all.

CORPS OF ENGINEERS

● Has completed design of fixed petroleum storage and dispensing facilities for Army airfields. Drawings and specifications have been published and forwarded to all Engineer Districts performing military construction and are now mandatory for use in new airfield construction projects.

● Has initiated action to develop a family of military filter/separators for use with hand pumps, mobile refuelers and at fixed installations. Prototypes have been received and are now being engineer tested. When standardized, these military items, subject to availability of funds, will replace the military qualified commercial type filter/separators now being used within the Army.

● Is preparing Military Specification MIL-F-254C, Filter/Separator, Liquid, Fuel, Steel/Aluminum, Military Design, covering interior lined military filter/separators. This will be a procurement specification, complete with drawings for various sizes of filter/separators.

● Has prepared a new Military Specification MIL-F-8901, Filter/Separators, Aviation and Motor Fuel, Ground and Shipboard Use, Performance Requirements and Test Procedures For. Development of this new specification was the collective effort of the best minds in industry and the three military departments, and has been approved by all military departments. Primary purpose of this action was to improve, still further, the performance characteristics of military filter/separators. Filter/separators purchased under MIL-F-254C will be required to meet the performance requirements of MIL-F-8901. The requirements of MIL-F-8901 are more rigid than those now prescribed by MIL-F-8508A and will require that the coalescing and filtering elements be more sensitive and efficient.

● Has contracted with the Armour Research Foundation to develop improved filtration media for future use if cleanliness requirements for avfuels become more critical.

ORDNANCE CORPS

● Has established an R&D task to develop an improved interior lining for tank refuelers which is resistant to avfuels and water. Adequate interior lining of tank trucks will reduce the amount of rust and scale that filter/separators are required to remove and thereby decrease the malfunction incident rate of the filter/separator unit and increase the usable life span of the internal elements of the unit.

● Has developed a fiberglass reinforced plastic tank for use on the fuel servicing tank truck. The use of plastic, which is noncritical material, will eliminate maintenance and contamination problems associated with corrosion of steel tanks. Two prototype plastic tanks were procured 1 August 1961, at which time engineer tests began.

QUARTERMASTER CORPS

● Has conducted a 40-hour course of instruction in proper procedures for handling of avfuels for Army Aviation personnel. Three classes were conducted by the QM School at Fort Lee, Va., during January and February 1961, with a total of 69 students attending. The same type of instruction and training included in the three special classes is also received by QM officers and EM attending the regularly conducted Petroleum Products Supply Officer Course (10-A-4960) and the Petroleum Storage Specialist Course (10-R-552.1), respectively.

● Conducts semiannual petroleum liaison visits to all Army Aviation field activities. Airfield storage and refueling procedures are observed. Storage tanks, pumping and refueling equipment are inspected. Written reports of findings, deficiencies noted and recommended corrective actions are submitted through command channels to the commanding officer of the installations visited.

● Has established a program to determine the effectiveness of filter/separators used to dispense avfuels. Under this program samples of the effluent stream of all avfuel filter/separators are tested periodically by designated QM petroleum laboratories. Sample containers and instructions for taking samples are furnished to all Army airfields by designated QM petroleum laboratories.

● Has initiated a development project for an effluent stream tester. The successful completion of this project will provide additional assurance that only clean and water-free fuel enters the aircraft fuel tank. It will be the final check on whether the filter/separators are in proper operating condition. The lightweight tester will continuously de-

termine whether the fuel is clean and water free and will automatically terminate the flow when sedimentation or free water is detected.

- Plans to procure and distribute "Hydro-Kits" consisting of small vial type fuel testers and chemicals for checking water content of JP-4 fuel during preflight inspections. These kits will be distributed to using units within the next six months.
- An anti-icing additive for JP-4 fuel, developed by Phillips Petroleum Company, has been tested and approved by the U.S. Air Force. The military services will procure this anti-icing additive as a joint action during the latter part of 1961.

CREWS

As you will have noted from reading these accounts, air crews and maintenance personnel came in for a lion's share of accidents and incidents. Some of these are the results of a very contagious disease whose unpronounceable Latin name can be translated as **lackoknowledge.** You don't need wonder drugs to cure this malady. You need large and frequent doses of operation and maintenance TMs.

Increased performance and operating ease bring new responsibilities. The machine is still no better than the man who flies it or the man who repairs it. The old once-around-the-cockpit check might get you by in the Bird Dog or the Beaver. It won't work with these girls. You need an intimate knowledge of the aircraft and all its systems before you step aboard. Then you need standardized checklists to guide you through required procedures.

The clean design of the Iroquois gives it greatly increased performance and speed. It also makes it possible to reach a high rate of descent in a very short time.

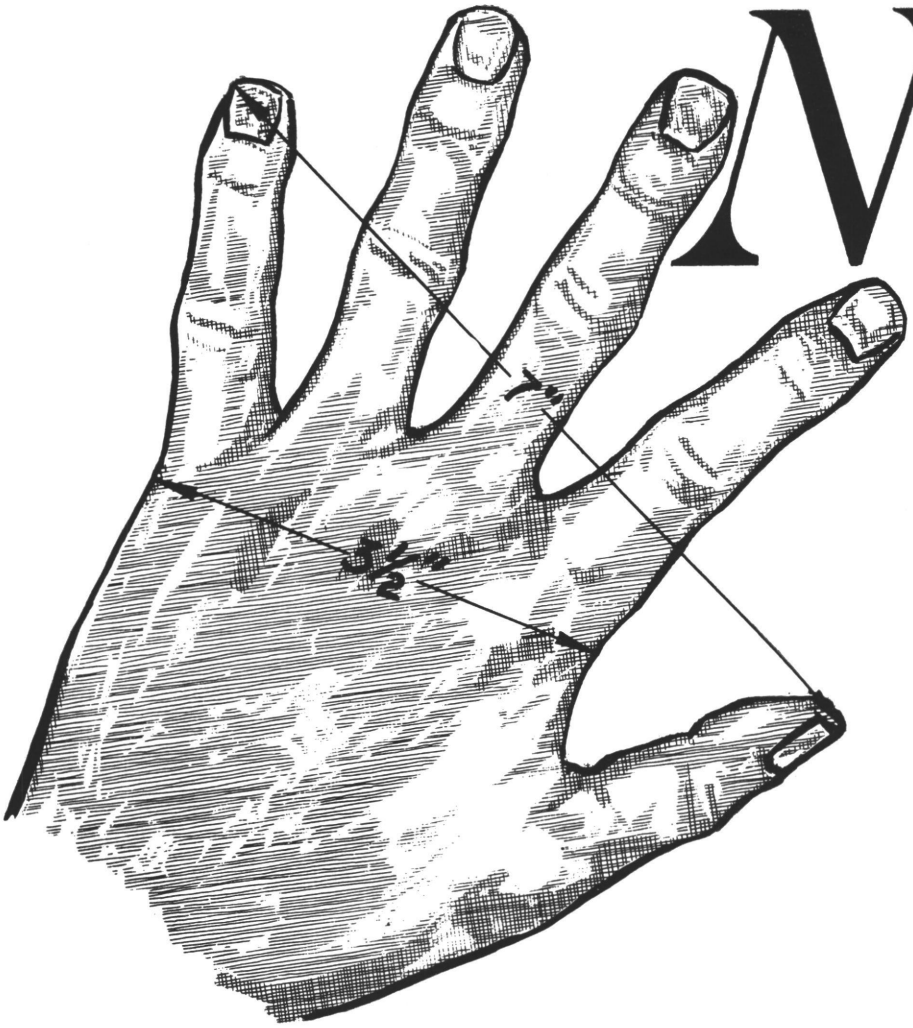
The Mohawk climbs higher and travels faster than any other Army aircraft. Because of this, you need to learn all there is to know about oxygen systems and hypoxia. You need more accurate navigation.

Carefree days of silk scarf flying are a thing of the past when you are introduced to the Iroquois or Mohawk. Flying becomes a deadly serious business, requiring 100 percent of your attention and ability. Is it worth it? Ask anyone who has dated either of our new **SOPHISTICATED LADIES.**

Chinook Completes First Hover Tests

The U. S. Army's HC-1B Chinook has successfully completed the initial hover phase of its flight test program. Weighing 12.5 tons, the new twin-turbine helicopter exhibited excellent handling characteristics during the initial 15-minute test at Philadelphia International Airport. The Aeronautical Systems Division, U. S. Air Force, is the developing and procuring agency for the Army's Chinook. Twenty-eight Chinooks have been ordered for the Army to date.

Photo by Boeing Airplane Company



Navi
WITH
A

Captain Billy L. Odneal, Inf

WOULD YOU BE SURPRISED to know that you could navigate from A to B and arrive at your destination within IFR ETA estimate limitations with a map the only aid at your disposal? Even a pencil is not required.

Dead reckoning is fundamental to all navigation, whether it be pilot, radio, or celestial. Dead reckoning problems may be solved electronically or with an E6B computer.

Consider the problem of the reconnaissance helicopter pilot or the light observation aircraft pilot in the field, without elaborate navigational aids, flying and navigating at low level, over unfamiliar terrain, and ALONE. The size of his aircraft precludes the use of electronic dead reckoning equipment at present. The lack of four hands restricts the use of the E6B computer in the air. This aviator has a serious problem flying safely and navigating simultaneously.

Consider also how much simpler his flying and navigation task would become if the aviator were able to quickly calculate in his head, while flying, his heading, groundspeed, and ETA over checkpoints and destination. He would have time to fly the aircraft more safely, time to read his map intelligently, and time to avoid the ever-present obstacles at low level. There is an extremely simple, relatively accurate method by which this pilot can navigate. It requires only two facilities, which the professional Army Aviator should already possess: a quick and alert mind and the ability to read a map accurately. This method of navigation is called MENTAL DEAD RECKONING.

MENTAL DEAD RECKONING

Mental dead reckoning is a means of quickly determining an approximate answer to a problem before it is plotted accurately. In the case of the reconnaissance helicopter pilot

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and the light observation aircraft pilot, the mental dead reckoning solution may be the only one attainable because of time and/or equipment available.

Mental dead reckoning is never a substitute for careful, accurate preflight planning IF TIME PERMITS. A working knowledge of mental dead reckoning, however, will eliminate errors in computer work and, if necessary, eliminate completely the ground flight planning in an emergency where time is of the essence.

The aim then of mental dead reckoning is to obtain an approximate answer to navigation problems based on common sense and a minimum of simple formulae. The following types of navigation problems can be solved by mental dead reckoning:

- Proportion type problems.
- Estimation of required track and distances.
- Time—distance problems.
- Triangle of velocities problems (determining heading and groundspeed, knowing the track, TAS and wind velocity).

MENTAL ARITHMETIC

Virtually all arithmetic problems in navigation are of the proportion type.

If an aircraft goes 47 nautical miles in 19 minutes, what is its groundspeed? The answer to this problem is worked out laboriously as follows by arithmetic.

In 19 minutes the aircraft goes 47 nautical miles.

In 1 minute the aircraft goes 47/19 nautical miles.

In 60 minutes the aircraft goes $\frac{47}{19} \times 60$ nautical miles.

The answer could be worked out on a slide rule, arithmetically, or on an E6B computer. The answer is 148.5 knots.

To make this calculation by mental dead reckoning, the 47 nautical miles is made 50 nautical miles; the 19 minutes is made 20 minutes.

The solution then is $\frac{50}{20} \times 60$, which is 150 knots.

The conversion from nautical miles to statute miles is also simple.

Knots to statute: add 1/7.

Statute to knots: subtract 1/8.

ESTIMATION OF BEARINGS, REQUIRED TRACK, AND DISTANCE

Estimating bearings requires practice. It is necessary to determine which quadrant the track falls in and then mentally divide the quadrant into halves and thirds. The compass rose is a great asset in estimating bearings.

To aid in estimating distances, the span of the hand, width of the fist, width of the index finger in terms of the map scale employed suffices. These figures for your particular hand should be memorized if you are to accurately estimate distances.

MENTAL SOLUTION TO TIME-DISTANCE PROBLEMS

After learning to estimate distances, the next step is to relate these distances to time and speed. This leads to a sense of rate of progress across a map, essential to good map reading.

Te relate time and speed to distance the pilot should use groundspeeds which are multiples of 60 knots (1 mile per minute). Thus if during a flight the groundspeed was 168 knots, this would be considered as 180 knots or 3 miles per minute.

For example:

1510 hrs — groundspeed is 168 knots (determined from a fix).

1542 hrs—required to find approximate dead reckoned position to aid in map reading. Using 3 miles per minute the estimated distance along track is 96 nm. (The actual error in this calculation is 6 nm.)

The accuracy of a groundspeed calculation can be increased by interpolating. For example:

Distance is 206 and groundspeed is 138 knots. Find the time required for the flight.

Time required for a groundspeed of 150 knots is 82 minutes.

Time required for a groundspeed of 138 knots is ?

Time required for a groundspeed of 120 knots is 103 minutes. Groundspeed decreased 30 knots and time increased 21 minutes. In our case the groundspeed decreased by approximately 10 and therefore, time increased by 7 minutes. The time en route then is 89 minutes which is the same as the computer solution.

Another method of revising the ETA, calculated very accurately without any knowledge of groundspeed, is as follows. If the map is marked off in distance or time marks the following method can be used:

Time from A to B is calculated at 40 minutes.

1000 hrs—set course.

1012 hrs—you are opposite time mark 1015.

Revise your ETA over B.

You are 3 minutes early at the end of 15 minutes so at the end of 40 minutes you will be 8 minutes early (3+3+2). Revised ETA is 1032 hrs. This takes longer to describe than to actually calculate.

Another method of solving the same problem:

You are 3 minutes early in 15 minutes so you gain 1 minute every 5 minutes of flight. Therefore at the end of 40 mintes you will be 8 minutes early and the revised ETA becomes 1032 hrs.

TRIANGLE OF VELOCITIES

The aim of mental dead reckoning in solving the triangle of velocities is:

To visualize the problem before solving it on the computer, and therefore help prevent error. By employing mental dead reckoning the pilot can decide whether groundspeed is greater or less than TAS and whether drift is port or starboard. Knowing these things, errors in the use of the computer will be reduced to a minimum.

To aid the light observation aircraft and reconnaissance helicopter pilots to cope with navigation problems in the air when a computer is not available.

To solve the following problems the pilot must visualize the triangle of velocities (fig. 1). Visualize north at the top and a line representing the required track. At the end of this line mentally draw the wind vector.

From this "picture" you can determine: direction of drift (port); relative size of the groundspeed with respect to the TAS (TAS—groundspeed).

The use of the concept "wind angle" may help you visualize this diagram. The wind angle is the smaller angle between the wind vector and the required track or course. For example: Required track is 246°, W/V 320/31 knots; therefore, the wind angle is 74°. The drift is port and there is a head com-

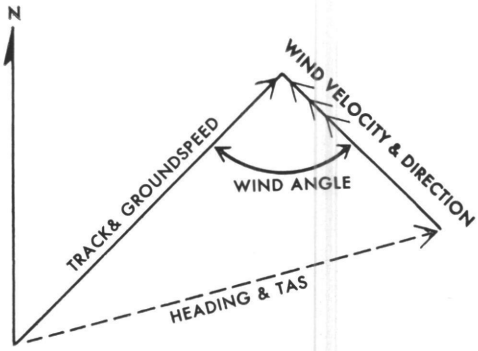


Figure 1

ponent; therefore, groundspeed is less than TAS.

As wind direction shifts from a headwind to a tailwind, groundspeed increases from TAS minus the windspeed to TAS plus the windspeed. In estimating the groundspeed the following method is employed. Groundspeed equals the TAS plus or minus the various fractions of windspeed, depending upon the wind angle. In diagram form the relationship is shown in figure 2.

After determining the groundspeed and knowing the required track or course and the wind velocity, the amount of drift can be calculated. We must however introduce a new term, MAXIMUM DRIFT — $\frac{60 \text{ x windspeed degrees}}{\text{TAS}}$

If wind angle is 15°, drift is 3/10 of the maximum drift. If wind angle is 30°, drift is 5/10 of the maximum drift. (See Fig. 3.)

The arithmetic progression in the relationship between the wind angle and maximum drift makes remembering which fraction to apply very simple.

So, armed with three simple formulas we can solve the most common of the aviators' problems: how to get from A to B in a straight line and with an accurate ETA on destination B. An example problem follows.

For the sake of clarity we will assume the required track is 090° and the wind velocity is 120/20 knots and the TAS is 90 knots. What is the heading and groundspeed and the ETA on a destination 80 miles away?

Steps in the solution:

a. Determine the wind angle and whether the wind is a head or tail component.
   Solution:
   30° Head (120 - 90)
b. Determine maximum wind drift.
   Solution:
   $20° \frac{(30 \text{ x } 60)}{90}$
c. Determine drift and direction and then the heading.
   Solution:
   10° port (20 x .5) therefore heading is 100°.
d. Determine the groundspeed.
   Solution:
   74 knots (90—.8 x 20)

With practice, these simple calculations can be made quicker than with a computer. The accuracy of the calculation is as accurate as the most inaccurate variable used in the solution, which is the low level wind velocity.

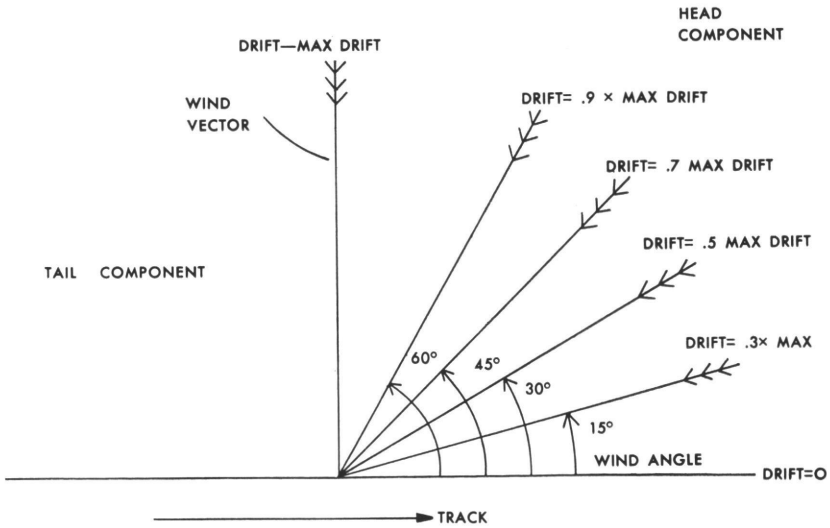
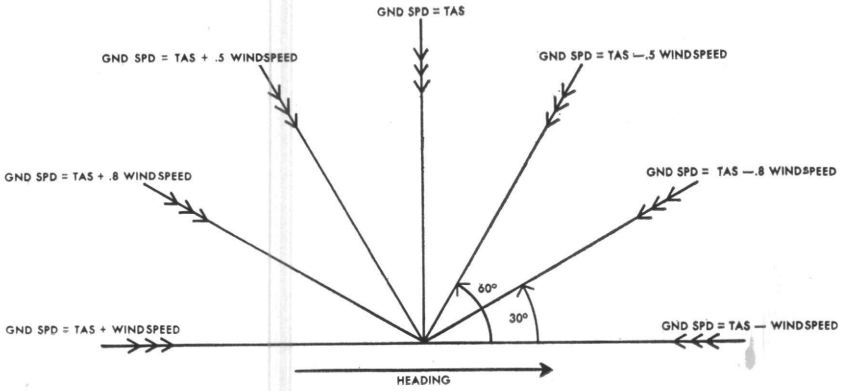


Figure 3

Figure 2



CONCLUSION

Mental dead reckoning is not a substitute for careful preflight planning, but where time is the most important consideration the pilot can plan his flight, revise his ETAs, make heading corrections while flying at low levels without any extra equipment. The value of knowing mental dead reckoning is obvious; but like any skill, practice is essential to maintain proficiency.

ANNUAL AWARD Monthly Winner CONTEST

ARADMAC

U. S. Army Transportation Aeronautical Depot Maintenance Center

Brigadier General Melvin D. Losey, USA

General Losey is Commanding General, ARADMAC, Corpus Christi, Texas.

THE VERSATILITY of Army Aviation has always been sustained by the vision and skill of Army pilots **and the efficiency of the ground crewmen who keep them flying."** Thus has General George H. Decker, Chief of Staff, reaffirmed the importance of the man on the ground—the man with the wrench—as a member of the Army's air team. Yet, until recently, the Army had no facility for the major overhaul and repair of its own aircraft.

That gap in the Army Aviation program has now been filled. The United States Army Transportation Aeronautical Depot Maintenance Center (ARADMAC) was activated on 15 April 1961 at the Naval Air Station, Corpus Christi, Texas. There the Army has taken over 800,000 square feet of space, an area equal to two-thirds of the ground covered by the Pentagon. It is a multimillion dollar plant including a multitude of shops suitable for handling all types of Army aircraft and related equipment. In fact the Navy, which originally had its own maintenance operation there, specifically tailored this facility for the care and feeding of aircraft in need of overhaul and repair.

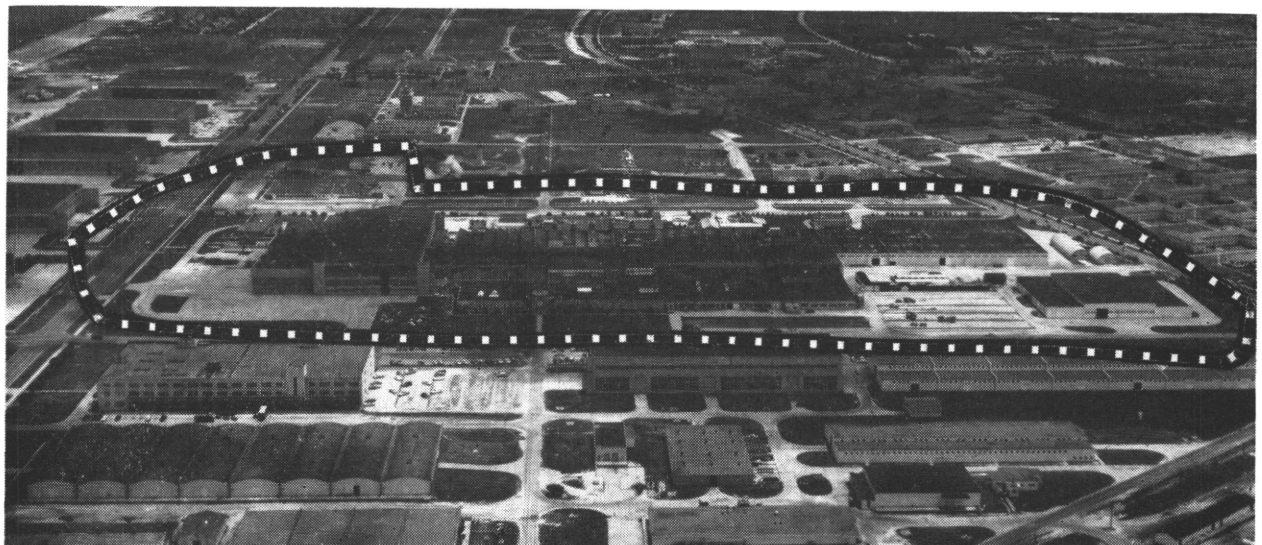
As a result, the Army has fallen heir to a nearly ideal complex. Ceilings are at the right height, overhead cranes are where they should be, and arrangements for handling materials are practical and efficient. All type of shops and services are available, ranging from basic cleaning and inspection through sheet metal fabrication and plating. When special parts are needed but are not otherwise available, the Army can manufacture them on the spot.

This happy position of the Army at Corpus Christi is not the result of chance. Many months of detailed planning preceded the move. First, the Army had to appraise its own position. Was such a facility actually needed? Were there, perhaps, other and better ways of meeting this repair and overhaul requirement? The Army's complete depot maintenance mission—the mission now assigned to ARADMAC—made it clear that some such facility was mandatory. That threefold mission is:

- to perform maintenance and maintenance support requirements normally associated with depot level maintenance, such as overhaul, repairs, modification, retrofit, modernization and fabrication;
- to train military personnel in aeronautical depot maintenance;
- to maintain a mobilization base capable of rapid expansion in the event of national emergency.

This appraisal was presented to the Secretary of Defense over a year ago. He concurred and authorized the Army an "in-house" aircraft mainte-

The ARADMAC plant at the Corpus Christi Naval Air Station. Outline shows boundaries of the plant property which covers over 20 acres in area and is about two-thirds the area covered by the Pentagon.



nance capability to support mission essential equipment, with facilities to overhaul and repair the full range of aeronautical materials, including airplane engines, components, accessories and electronic equipment. In simple language, the Transportation Corps was given a hunting license to go out and find a place where it could maintain some of its own aircraft.

The first step was to draw up a checklist of our requirements —the tools and equipment, the amount of space and types of buildings, even the technical skills that would be needed. Then the hunt began. Fifty-one sites were surveyed. Considerations ranged from an analysis of costs and labor supply to housing availability and public acceptance. Based upon information provided by industrial engineers in the military service, many facilities were dropped from the list because they were storage or industrial type activities only. It was not long before the list was boiled down to nine possible locations. Eight of these were eliminated for one or more of the following reasons: they lacked airfields, did not have proper machinery, tools and test facilities, or provided inadequate or unsuitable space. To make them suitable would have required large sums of money for alterations, repairs, or new construction. When it came to making the final selection, the closed O&R Facility of the Corpus Christi Naval Air Station won hands down.

With the selection of the site, the job was just begun. The first employee was hired on 1 March. By the beginning of this fiscal year 1 July, nearly 600 were on the payroll and by the end of the fiscal year the force will be over 1,000 employees. Eventually it will rise to over 2,200. As this is an industrial type activity, less than a score of officers will be assigned to the command.

Again, ARADMAC was fortunate in selecting Corpus Christi during this phase of building up a competent staff with the right mixture of the right skills. A large number of former employees remained in the area when the Navy closed its rebuild activity and many have come back to work on practically the same jobs they had before. Over 12,000 applications have been received, some from such far away places as Guam and Hawaii. Former Navy employees have returned from the four corners of the country and their knowledge and skill have been a large factor in speeding up the activation of the facility.

In fact, things moved so fast that on 1 July, just four months from the time the first man was hired, prototyping had begun on two radial and one turbojet type engines and similar work had started on four types of airframes. In those four months, a staff had been hired and trained, the facility had been remodeled as necessary to meet the Army's special requirements, the work flow plan had been engineered, materials had been located and moved in, and actual work had begun. Prototyping will be completed on the initial engines and airframes and full production will be underway by early fall.

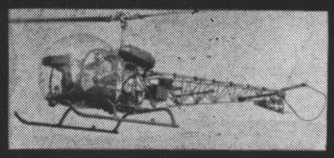
This rapid progress would have been impossible without the outstanding support given ARADMAC by the commander and staff at the Naval Air Station. By local agreement, the Army will not have to duplicate any of the facilities or services already existent on the station. The Public Works Department of the Naval Air Station is performing all of the rehabilitation to the facility by direct hire employees and by commercial contract. All local buying of supplies is being done by the station procurement personnel. These are but two of the many examples of the services and facilities being made available to the Army by the Naval Air Station.

ARADMAC also will do its share to prevent unnecessary duplication. The Army will do all the painting of aircraft for the Navy at the station, will maintain a battery shop for joint use, and the Signal Corps will perform high echelon avionics maintenance for the Navy. Such arrangements lend themselves readily to economies and efficiency of operations for both Services.

Army aircraft are becoming larger, more complex and more numerous; consequently there will be more maintenance to be done. For ARADMAC and the aviation maintenance industry supporting the Army, this means an increasing role in strengthening and improving a vital part of our Nation's defense. To the Army, it means a more effective combat force with improved readiness. It will strengthen the Nation in peace and serve as a strong mobilization base upon which to build an expanded organization in time of national crisis. In short, ARADMAC will be in forefront of the Army Aviation team described by General Decker—the part of the team that "keeps them flying."

L-19 BIRD DOG

H-13 SIOUX



U-1A OTTER

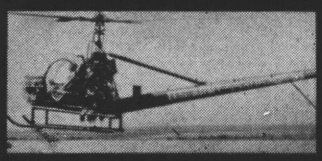
THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

TWX Ex

HU-1 IROQUOIS

H-34 CHOCTAW

H-23 RAVEN



H-34C YELLOW BLADE CAME LOOSE in flight and struck fuselage in vicinity of upper left pylon. Progressive disintegration of helicopter in air followed. Aircraft crashed and burned. Pilot, copilot, crewchief, and three passengers suffered fatal injuries. Horn lock assembly (P/N S1610-23061) was only partially engaged in the sleeve spindle assembly (P/N S1610-23050-6). Knurled knob (P/N S1610-23067) was safetied to only 1/16 of an inch engagement of locking pin in sleeve spindle assembly locking bracket. Proper assembly requires 1¼-inch engagement.

HU-1A TRANSMISSION COWLING lost in flight. Incident damage to engine cowling, left stabilizer, and aft tail skin. Estimated dollar damage $6,374.23. Cowling fasteners were **not** physically checked during preflight.

H-21C AFT ROTOR BLADE FLEXED down into fuselage when rotor clutch was disengaged and engine shut off at 75-100 rotor rpm. Incident damage to rotor blade and fuselage. Wind, gusting 20-26 knots, was a factor.

H-13H CRASHED INTO PINE TREES while aircraft was on medical evacuation flight with litter patient in right litter pod. Aircraft destroyed. Pilot and patient sustained fatal injuries. Suspect left pod came loose in flight and distracted pilot at low altitude.

H-13H SCISSORS LEVER BOLT FAILED during hover and aircraft crashed. Major damage to tail boom, tail rotor gear box, main rotor blades, transmission and main gear cross tubes. No injuries. Cause of bolt failure undetermined pending analysis.

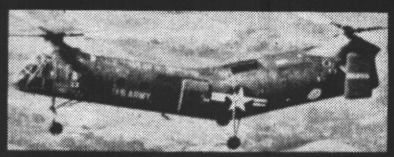
H-21 WAS PARKED beside 9-foot high insecticide storage tank after completion of spray mission. When clutch was disengaged, forward rotor blades struck the tank. Forward rotor blades demolished. Major damage to fuselage skin, rotor hub, drive shafting, and transmissions. No injuries. Weather not a factor.

H-13H DESCENDED TOO LOW during final approach to minimum lighted field site at night. Aircraft struck high ground approximately 528 yards short of intended landing site, bounced back into the air, and landed hard. Major damage to skids, engine mount, transmission, main rotor, and tail rotor. No injuries.

RL-26D CRASHED AND BURNED. Aircraft took off on IFR clearance and climbed into overcast at approximately 550-650 feet above ground. It remained in the overcast approximately 1-2 minutes, then dropped out and was seen apparently attempting to recover from an unusual attitude. Recovery was not completed in time to prevent crashing into trees and ground. Aircraft destroyed. Pilot and copilot killed. Some evidence exists that left engine may have failed, but engine was destroyed in crash and fire. Pilot had no actual instrument experience for 6 months before accident.

H-19D ENTERED GROUND RESONANCE while taxiing to parking ramp. Suspect ground resonance initiated by damper failure. Battery forced partially through right side of battery compartment. Whip antenna shredded. Tail rotor blade damaged. Boom skin buckled right and left side at station 240. No injuries.

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



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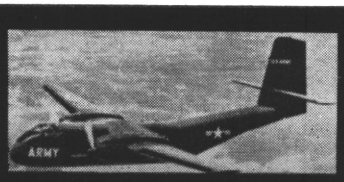
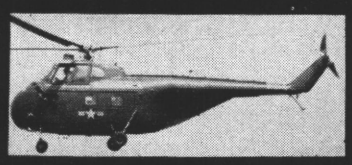




L-23 SEMINOLE H-37 MOJAVE AC-1 CARIBOU H-19 CHICKASAW

L-19A STRUCK POLE while taxiing to parking area. Incident damage to right wing. No injuries.

H-34A LOST PRIMARY SERVO during flight. Pilot completed forced landing with no damage to aircraft. O ring in T fitting on high pressure side, left lateral servo, failed.

L-19A LOST POWER during takeoff from desert strip. Aircraft struck hill and came to rest inverted. Major damage to both wings, propeller, and landing gear. Pilot and passenger sustained minor scratches. Cause of power loss unknown. Suspect fuel system malfunction.

L-19A STRUCK POWERLINE during flight. Incident damage to underside of cowling forward of main landing gear. Low visibility due to light rain and haze was a factor.

H-13E STRUCK POWERLINE during takeoff from highway. Aircraft crashed and burned. Pilot sustained minor injuries.

HU-1A STRUCK WIRE during takeoff from river bed. Wire wrapped around aircraft, causing loss of control. Aircraft crashed in level attitude. Main rotor flexed downward and severed tail boom. Transmission failed on impact and fell forward. Roof caved in. Engine could not be turned off because of damaged throttle linkage and continued to run for approximately 4 minutes after crash. Crewchief sustained minor scalp lacerations.

L-20A FLEW THROUGH CORNFIELD due to delayed recovery from simulated forced landing. Incident damage to elevator. No injuries.

H-21C BOUNCED during landing in confined area and rotor blades struck tree. Rotor blades disintegrated and fuselage came to rest against tree. Major damage. No injuries.

H-21C EMITTED LOUD NOISE a few seconds after engine was started. Engine began running rough and was shut down. Valve seat particles came out of exhaust stack. Exhaust valve seat failed, scattering metal particles throughout engine. Incident damage.

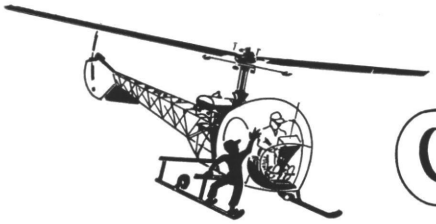
H-23C SETTLED during attempt to climb over powerlines after takeoff. Rotor rpm dropped and aircraft struck ground, causing major damage to tail boom and tail rotor. No injuries.

L-23E VEERED TO RIGHT after takeoff from runway 24, crashed and burned. Aircraft destroyed. Pilot sustained major injuries and burns. Suspect possible right engine failure due to loose fuel line. Heavy rain shower was moving across field at time of takeoff, with winds SSW, gusting 15-25 knots.

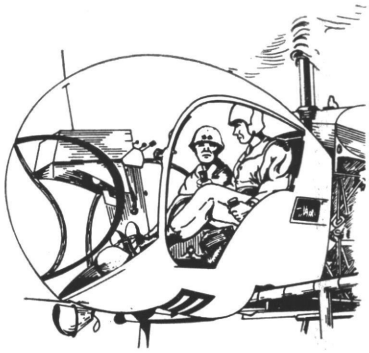
H-21C NEEDLES SPLIT during low reconnaissance of pinnacle at 1,900 feet. Aircraft was autorotated to successful forced landing with no damage. Engine malfunction caused by internal failure of No. 2 cylinder.

HU-1B ENGINE COWLING LOST during flight. Left cowl frame assembly damaged beyond repair. Suspect cowling latches were not physically checked during preflight.

L-19A CRASHED during third approach to lighted tactical field at night. Aircraft destroyed. Pilot killed. Weather was not a factor. Cause undetermined pending investigation.



THE CLANK STORY



Captain Bruce H. Gibbons, Arty

OFTTIMES EVENTS happen that are comical in later years (to others) but still send shivers down the back of the pilot who experienced them. Poor planning, lack of attention to detail, or plain stupidity cause them.

Last week, over a cup of real gone battery acid, I heard a guy tell of two hair-graying flights he made. Both happened to be in H-13s, but they COULD happen in other aircraft. Let's call him Lieutenant Stupe for short . . . and other reasons.

* * *

Stupe, eager for an early morning flight, was whistling contentedly. Completing a quick but thorough preflight he looked about for the regular crewchief. He wasn't in sight. A standby mechanic gave him needed assistance with the APU and was waved off after the Sioux started.

Adding power, Stupe brought the Sioux to a hover and began moving left, toward the runway and takeoff. Just before executing a 180° turn and pulling pitch, Stupe glanced to the right and—horror of horrors—saw the regular mechanic standing on the skid. He was hanging desperately onto the door handle and engine tubing. Hoping the mechanic wouldn't panic, Stupe quickly but gently set the Sioux down. Weakkneed, the mechanic stepped off. Stupe departed on the mission — wondering what WOULD have happened had he not glanced right until he was at 500 feet.

The next incident happened a few weeks later. A division alert was in progress. Grabbing his steel pot, Lieutenant Stupe headed for his Sioux, threw his helmet in the bubble, and climbed in. Shortly he was pulling pitch for the division helipad to pick up the division commander.

After a very short wait Stupe and the CG were making a tour of the division. Turning toward the battle group to make a ground inspection of their position, Stupe started a pinnacle approach. He attempted to add right pedal but couldn't. Looking down he saw his steel pot wedged under the pedal.

Aborting the approach and climbing to a safe altitude (much to the amazement of the group waiting below), Stupe attempted to dislodge the helmet with his combat boot—to no avail. With no usable pedal and a very small pad on which to land, what could he do? With a sheepish look on his face, he turned, pointed to his toe and asked, "Sir, would you remove my helmet from under the pedal?"

Both doors had been removed from the H-13, since it was a warm summer day. It seemed that the general quivered slightly as he looked down at the green foliage below and began unfastening his safety belt and shoulder harness. Stupe held the aircraft steady and nervously watched the general remove the helmet and plant it firmly on the floor by his side. After the general had buckled himself in, the landing was made without further ado.

Explanation of the delay to the BG welcoming party resulted in a good laugh by all. Stupe, however, was never sure whether the others were laughing with or at him. Either way, the laughter sounded very hollow and one aviator's ego was sadly deflated. It was an event he would remember for many moons— undoubtedly the general would too.

Stupid mistakes? Sure. But think of your own little store of past experiences. If you'll try, I'm sure you can recall one or more equally foolish incidents.

Clank stories seem to brew in the coffee pot, and to some are forgotten with the telling. "Good for a laugh or two," they say. But to the teller, they denote a lesson learned (if he's wise).

Profit by the mistakes of others. Sometimes a clank story has more value than a derisive grin. DON'T BUY EXPERIENCE IF YOU CAN GET IT FREE.

Capt Gibbons is with the Dept of Primary Fixed Wing Training, USAAVNS. He is dual rated and instrument qualified with approximately 2,100 flight hours.

Colonel M. H. Parson, Inf

SO WHAT'S WITH this low level jazz? Why the big noise? I've been flying low level since Orville and Wilbur got the first one off the ground. Me —need training? Why I've got more time over the trees than these Johnnies - come - lately have in the bar."

Perhaps this isn't a typical attitude but you have heard a similar statement from time to time. Some aviators believe this. Admittedly, a number of aviators have a great deal of time flying close to the ground. But how many have experienced flying over hostile unfamiliar terrain, on a multilegged flight plan, never exceeding an absolute altitude of 100 feet, and hit a target the first pass with a lateral accuracy of 38 feet? The number has lessened considerably? Why? Because it has not been necessary to do this to accomplish the mission. We formerly had a choice of virtually any altitude, with moderate risk. More accurate air defense weapons have effectively closed the middle altitudes to our use. Since the extremely high altitudes are not compatible with our mission, our choice is an obvious one. We must operate at extremely low altitudes. The words "low level" are perhaps not indicative enough of the problem. A better term might be terrain clearance. This presents us with a substantial problem in **navigation.**

The AO-1A, with its KS-61 camera system, offers the commander an excellent and immediately responsive means to acquire or confirm intelligence data. This system is capable of excellent contrast and detail in all speed ranges of the AO-1, plus an altitude of 100 to 50,000 feet. Through the use of remote control the camera may be set for various changes in flight, such as airspeeds, altitudes, and lighting. This rather sophisticated sensor has an excellent night capability as well.

Basically, only one problem is involved in using the system. It is necessary to position the camera over the target with accuracy in three dimensions. This means **precise navigation.** We must fly from a given point over hostile, unfamiliar terrain to a target. We must be constantly identified to our air defense artillery and air force, even over hostile terrain. We must avoid detection by enemy radar en route and arrive over the target the first pass with

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Col Parson was director of the Dept of Tactics, USAAVNS, before his recent assignment to the Army War College, Carlisle Barracks, Pa.

extreme accuracy. We must return by an alternate route without detection, identify ourself as we penetrate friendly airspace, and land at a preselected point. All this must be done at an altitude not exceeding 100 feet. Add to this some active enemy air activity and you have the basis for a fairly complex problem.

With the exception of the man-machine compatibility project, Army Aviation has little experience in low level, or terrain clearance, navigation. We have given lip service to this capability, but in the past we have never fully exploited its possibilities and problems. It is obvious from the factors involved in the problem that the old sectional dead reckoning method is obsolete and unusable. Another consideration involved is that flying at higher speeds and lower altitudes increases the inherent dangers of flight. For this reason we tend to avoid and/or defer this training.

We accept the fact that danger increases somewhat as we approach the earth. We must **not,** however, accept the risk as prohibitive. We must, in fact, accept some risk or surrender the capability. Neither warfare nor training are without accidents. They will never be without accidents. With the proper training, this low level environment will become as natural as airline type flying. Safety must not be disregarded. It must be the absolute maximum consistent with the mission; never the opposite. We have no other logical choice.

What is this "low level" then? It is terrain clearance: the **minimum** altitude to clear the terrain.

What is its purpose? To retain the element of surprise, to avoid detection, to minimize the enemy's air defense capability, to arrive precisely over any target at precisely the preselected time.

How is it done? By careful preplanning and detailed execution. A minimum of 2 hours of planning per 1 hour in the air.

What are some of the necessary steps in planning and executing a mission? Low level flight requires more preflight planning and more alertness during flight. Planning must be precise in all aspects. We must consider the human element. For example, research has shown that any pilot, regardless of experience, is tense and nervous to some degree during the first few minutes of low level flight.

Map preparation is the backbone of a low level mission. Information must be clear and readily available. At terrain level you can afford only an occasional glance. Cutting, cementing, folding, etc., must be done in the planning phase. To facilitate handling, it is useful to cut maps 50 miles either side of course. If this method is used a set of backup maps is mandatory. Minimum information presented on the map is course lines, headings, times, distances, checkpoints, hazards, and information applying specifically to this mission.

Like the map, the flight log requires prior preparation. It must be a handy and accurate reference, and is color coded, as is the map. The flight log will contain all times, distances, headings, and fuel computations as minimum information. ETEs for legs of the flight will be computed before the flight. Unless the winds are extremely high and 90° cross to the major portion of the flight, they will be disregarded. The winds will tend to cancel themselves out during the mission, and high-speed aircraft are subject to less error in course and time because they are exposed for a lesser time over a given distance. Another factor is that surface winds are accurate only for small areas and are not reliable for a relatively long-range mission.

In the execution of the mission the map and flight log must be reconciled at all times by a constant visual check. Most important at these altitudes is the realization that visual cues will be drastically reduced.

After the mission all relative information obtained on the flight should be recorded and filed with a report on difficulties encountered, suggestions, and a résumé of the mission.

Some devices used in the preparation are colored markers, radius of turn nomographs and computer.

To apply this technique a careful selection of the route or routes to be flown is of paramount importance. It is often possible to find usable cultural and natural features that may appear in profile in flight. Slight doglegs left and right may be advantageous rather than long straight course lines.

In special operations such as airmobile assault, aerial resupply or paradrop, the need for careful route selection cannot be overemphasized. The vulnerability of aircraft to small arms or heat seeking missiles such as redeye, plus the necessity for complete surprise, dictate proper route selection. These preplanned routes and times must be rigidly adhered to.

In special operations such as aerial resupply, paradrop, and message pickup, the need for careful route selection cannot be overemphasized.

particularly when a multiple axis approach plan is executed. No second runs are possible. If the first run is not correct the mission is a failure.

With the introduction of new aircraft into the inventory, the capabilities of Army Aviation will increase. The low level training presented must be easily transferable to an aircraft of higher performance.

Whatever our equipment, mission, or role, one thing is certain: we must live and fight in this environment. We must have the tactics before the tinware. In the not-so-distant future the unofficial motto of Army Aviation may not be "low and slow" but "blow and go."

Army Awards Ryan Design Study Contract

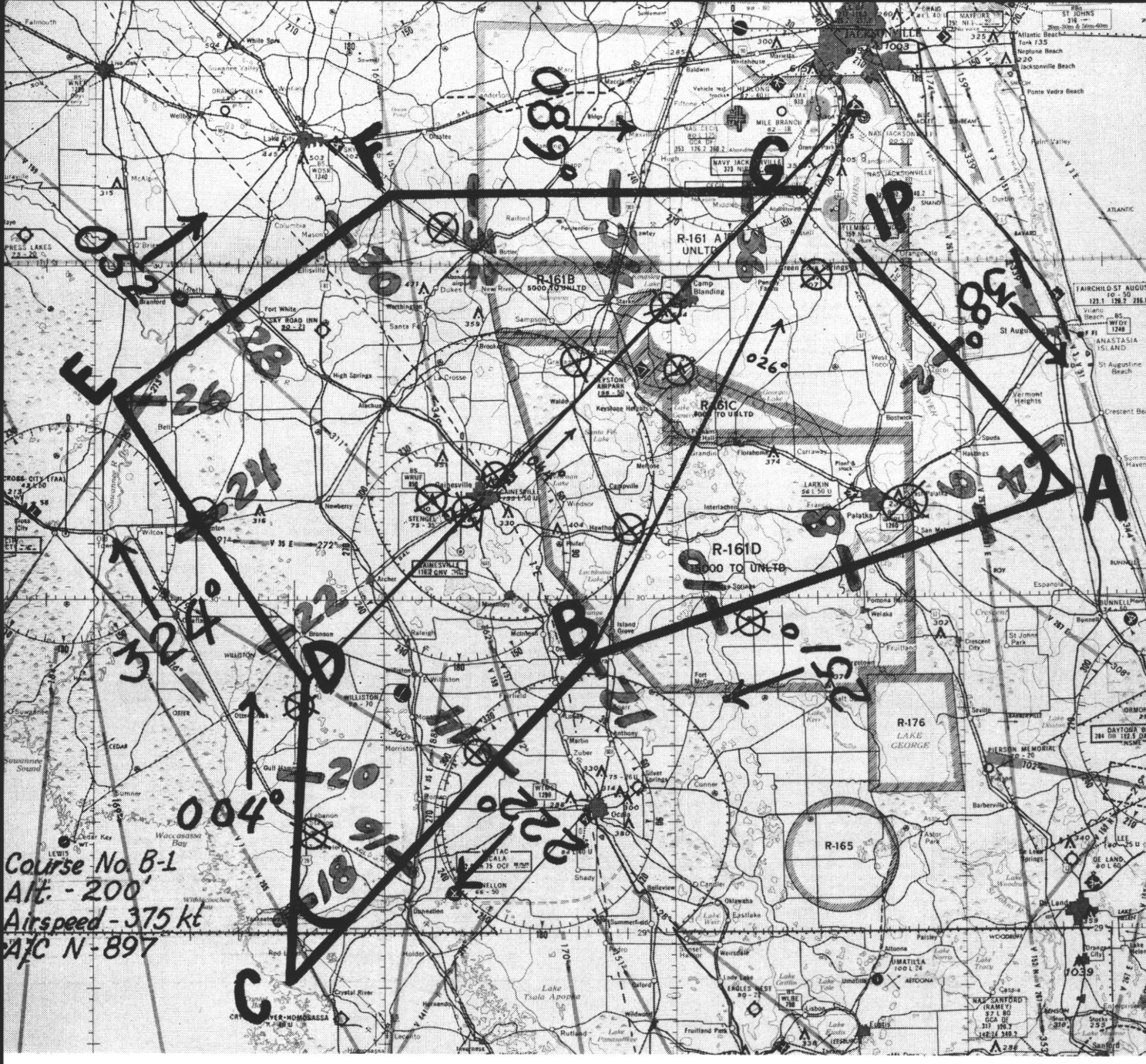
An Army study contract has been let for design of a towed logistics glider with flexible wings, employing the flex wing principle conceived by NASA. Awarded to the Ryan Aeronautical Company, the $94,000 contract calls for the performance of prototype engineering for several glider configurations. The glider concept utilizes a plastic-coated, flexible material which forms a dart shaped kite. Payloads as large as 10,000 lbs or more, towed behind Army aircraft, are envisioned.

The glider is an inherently stable vehicle and only the simplest of controls are required for basic maneuvers.

An earlier research contract with Ryan provided for the testing of a "flying test bed." This program is now underway using a powered prototype.

STAY INFORMED!

In a category II or III assignment? Not getting the DIGEST since you're not in an aviation unit? Get a DA Form 12 and have your unit placed on distribution for the magazine and stay abreast of what's going on in the program while you're pulling ground duty! It's your professional obligation to stay informed in aviation, too. Fill out that DA Form 12 today. Get your unit request into your local AG publications officer . . . stay informed!



A Typical Map for Use on a Low-Level High-Speed Flight

Heavy lines starting at the initial point (IP) represent the actual course flown proceeding to turning points A through G. The numbers with arrows adjacent to each leg indicate headings for each leg Short lines perpendicular to each leg with adjacent numbers indicate elapsed time along the flight path in minutes. Circled X's indicate possible hazards such as towers. Lines from points B and D to Naval Air Station, Jacksonville, Fla., indicate emergency return courses.

SURVIVABILITY studies indicate that low-level, high-speed flight is the best operating environment on the modern day battlefield for Army Aviation. Fortunately, almost all missions can be performed at low level. However, navigation becomes more difficult at low altitudes, especially at high speeds.

Pending development of a precise, self-contained electronic system, pilotage and dead reckoning remain the basic methods of low-level navigation.

The basic principles are the

LOW ALTITUDE HIGH SPEED NAVIGATION

Captain Donald P. Wray, CE

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same taught every student in primary flight training. A line on a map, a measured heading, and times between checkpoints are still the essential points; however, additional detail must be considered. Preflight planning takes on much greater significance; as much as two or three times the actual flight time must be spent in preparation.

The first step is to select a suitable chart. As much detail as possible is desirable, but excessive bulk and handling of the chart cannot be tolerated in the small cockpits characteristic of modern high-speed jets. Sectionals are probably most suitable of the currently available charts. A thorough map reconnaissance must be made, and the checkpoints to be used should be selected carefully. Objects that extend above the horizon as much as possible are best, since they are visible for the longest time and from the greatest distance. Many checkpoints visible from higher altitudes may be completely hidden from a pilot flying at 200 feet. In general, an airplane must pass very close to an object if the pilot is to recognize it and use it successfully as a checkpoint.

Different checkpoints give different information. For example, crossing a railroad will give an excellent progress check, but will not aid in alignment on the planned flight path. A railroad bridge or an intersection of two railroads gives a very good position fix, both in progress along the flight path and in alignment. However, one must use care if two or three bridges or intersections are within a short distance or the wrong one may be used.

The next step in planning is to draw the course line on the chart. A wide, inked line should be used so it can be found at a glance in flight. The heading for each leg should be written adjacent to the line, with an arrow indicating the direction of flight. This should be legible and large enough to be readable at a glance, thus avoiding excessive head-in-cockpit time in flight. The selected checkpoints should next be marked. Any possible hazards, such as radio towers, should be marked in red.

To give an accurate check of progress along the flight path, tick marks should be made along the line on the map. The time interval may vary, but two-minute intervals are satisfactory for speeds between 300 and 600 knots. For example, at 500 knots, two-minute tick marks are approximately 17 nautical miles apart. By using an elapsed time clock, preferably mounted on the pilot's kneeboard, an accurate check on progress can be maintained throughout the flight. This time must be read in seconds if adequate accuracy is to be achieved. At 375 knots 2 minutes represents 12.5 miles; 30 seconds represents roughly 3 miles.

Turning radius at high speed is another point which must be considered. Radius of turn at 375 knots with a 30° bank is roughly 3.5 miles (see fig. 1). When changing direction at a given point, the actual curved flight path should be indicated on the map so a new checkpoint can be selected. At this checkpoint the pilot will actually roll into the turn, so he can roll out on the new course and not overshoot it. This relatively large turning radius also becomes

important when following such terrain as a winding valley or river bed. Angles of bank greater than 45° at altitudes below 500 feet are somewhat hazardous, particularly if turbulence is present.

The final step in preparing the map is to trim and fold it. Common sense applies here. Be certain to retain adequate area coverage, removing just the excess bulk that is far removed from the area being flown over. A simple accordion fold works well and allows easy handling of the map.

A standard flight planning card (fig. 2) is then prepared which indicates turning points, distances-times en route, and an item of great importance—fuel state. Fuel consumption of turbojet engines at low altitudes is high and will normally be the factor limiting the range. For each checkpoint or turning point, the fuel state (that is, the amount of fuel remaining) is computed. A maximum range mission will normally mean returning to base at low state, enough fuel for 3 to 4 trips around the landing pattern. A calculation of an emergency fuel state for various points along the flight path is necessary.

This emergency fuel state indicates the minimum fuel required to return directly to base from a given point. If for any reason, such as fuel system malfunction or climatic conditions resulting in increased fuel consumption, the planned fuel program cannot be adhered to, the pilot will know immediately whether he can continue or if he must abort the mission. For each point at which an emergency fuel is computed, the heading and course time to base should be marked on the map, as well as listed on the planning card. For most time-distance computations, winds can be ignored since the values are

Continued on page 29

Pilot's Planning Card

Point—identifies turning points (see map)
Hdg—Magnetic heading—degrees
Mi—Distance—nautical miles
OAT—Outside air temperature—degrees cent.
ETE—Estimated time en route—minutes & seconds
ETA—Estimated time of arrival—elapsed time from the IP—minutes & seconds
Est Fuel—Estimated fuel per leg—in pounds
EFR—Estimated fuel remaining—in pounds
AFR—Actual fuel remaining—in pounds

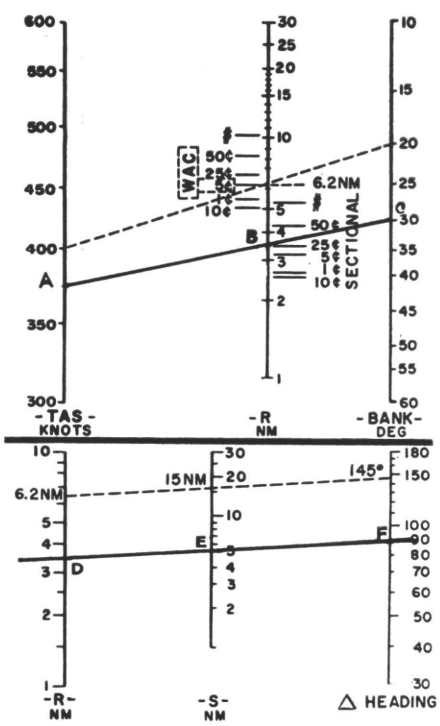
NAME	DATE	PLANE
WRAY		897

ROUTE FLOWN	FUEL T.O.
B-1	3650#
AIRSPEED: 375 KNOTS	TIME OF T.O.
	INSTRUMENTATION OFF
LCL TIME AT IP: 1305	LAND FUEL
	TIME AT CHOCKS
	TIME LOGGED

POINT	CU HDG	MI	ALT OAT	ETE	ETA ATA	EST FUEL	EFR	AFR
IP	180°	12	200′	2+0	0	250	3400	
A	138°	30	200′	4+40	4+40	260	3140	
B	251°	47	200′	7+30	12+10	420	2720	
C	222°	41	200′	6+30	18+40	380	2340	
D	004°	29	200′	4+30	23+10	260	2080	
E	324°	31	200′	5+00	28+10	280	1800	
F	052°	31	200′	5+00	33+10	280	1520	
G	084°	38	200′	6+00	39+10	340	1180	
NIP	037°	13	200′			120	1060	

Figure 2

Figure 1



Nomographs—used in preflight planning to determine radius of turn and distance traveled in turn.

A sample problem using this nomograph at turning point E is as follows:

Draw a line connecting the true airspeed (TAS) of 375 kt (point A) and the planned angle of bank of 30° (point C). Read the radius of turn 3.5 nm (point B). To draw this on the map the nomograph also indicates the denomination of a coin (in this case, 25¢) which gives the true flight path on the map.

The lower nomograph gives arc distance traveled in the turn. Connect point D (determined above as point B) with point F (the change in heading: from 324° to 052° = 088° change). Point E indicates the distance traveled in the turn, 5 nm.

Personal Scheduling of Annual and Semiannual Minimums

Captain Orville W. McNatt, Arty

WHEN NOVEMBER or May rolls around each year how do you stand toward your semiannual or annual minimum flight requirements? Are you up-to-date and only need an hour or so to complete your requirements? Do you have them completed before this time? Or are you in the same situation that I've found myself, with 6 or 8 hours of different types of flying still to do?

If you are up-to-date, it's a good feeling when you don't have to worry about cramming those final 6 or 8 hours into the last busy month. This is especially true when you think of the many things that could cut down your flying chances. For example, in December you may be considering Christmas leave, or perhaps you will have an increased workload to compensate for others taking holiday leave. Then there is weather, which is of more important consideration in some parts of the country than in others. In June the children get out of school and you may want to take your leave then. You bachelors may be thinking of time at the beach or other summer activities. Then there are the inspections that always pile up in June or December—or at least seem to. Another thing, others may also have 6 or 8 hours to fly in the last month or two. Have you noticed how your unit's aircraft are all scheduled heavily during that time of the year? And if you manage to schedule one for yourself, the traffic congestion?

This problem is not necessarily confined to those who have desk jobs. It may be true that they can get into the hole a little deeper or easier than flying personnel, but even the aviator who flies regularly could, and often does, neglect certain types of flying. He may have many hours of night or hood time but suddenly realizes it's all local, and he joins us in the fight for aircraft and airspace in June and December.

I do not think you should fly all your minimums in the first month or two of the year. This situation could be even worse, for you may tend to neglect the types of flying required by your time minimums even more than you would otherwise. I also believe that just flying the minimums is not enough, especially if you are qualified in several types of aircraft. When this is the case you must remain proficient on instruments and night flying in all the aircraft for which you are qualified. Don't do all your instrument flying in one type aircraft, for there is quite a difference in performance.

In considering the problem at hand, how can we be sure that these minimums are met? First of all, whenever the opportunity arises to fly a mission which will improve your proficiency as an aviator, by all means use that opportunity. For example, Operations may have an administrative flight that you could offer to fly. If you can arrange to take the flight, find someone to go with you, take your instrument hood along, file IFR and fly instruments. In other words, don't just "go up and bore holes." Plan ahead.

I think that planning ahead and scheduling your minimum requirements on a monthly or even a yearly basis and posting this schedule for easy reference will help a great deal. Even if you can't follow your schedule closely, it will be there to remind you to stay proficient.

In planning your schedule try to keep it simple. It will be easier to follow and will permit some flexibility. Here are two ideas that may help.

You could use your Checklist, Army Aviators Annual Flight Requirements, from the Jeppesen Manual. Put a date on the list as a target date for completion of each block of two or three hours. If you complete these hours before the date you marked, be sure to cross it out. (See example.)

Capt McNatt is Branch Chief, Fixed Wing Branch, Intermediate Maintenance Division, Dept of Maintenance, USAAVNS.

CHECK LIST
ARMY AVIATOR'S
ANNUAL FLIGHT REQUIREMENTS
(AR 95-32 1 OCT 59)

REQUIRED											FLIGHT SIMULATOR MAY BE USED W/INST
NIGHT			INSTRUMENT			CROSS-COUNTRY					
X-COUNTRY	TOTAL		X-COUNTRY	TOTAL		NIGHT	INSTR	TOTAL			
1	31 Jul	31 11 Mar	1	1	11	1	1	1	11	1 Jan	
2	31 Aug	12	2	31 2 Jul	31 12 Jan	2	2	31 2 Jul	31 12 Jan	2 Feb	
3		30 13 Apr	3	3	13	30 3 Nov	30 3 Nov	3	13	3 Mar	
4	30 Sep	31 14 May	4	31 4 Aug	28 14 Feb	4	4	31 4 Aug	28 14 Feb	4 Apr	
5		20 15 Jun	5	5	15	30 5 May	30 5 May	5	15	5 May	
	31 Oct			30 6 Sep	31 16 Mar			30 6 Sep	31 16 Mar	6 Jul	
	30 Nov			7	17			7	17	7 Aug	
	31 8 Dec			31 8 Oct	30 18 Apr			31 8 Oct	30 18 Apr	8 Sep	
	31 9 Jan			30 9 Nov	31 19 May			9	31 19 May	9 Oct	
	28 10 Feb			31 10 Dec	20			30 10 Nov	20 20 Jun	10 Nov	

1. CHECK-OFF HOURS FLOWN.
2. SEVEN & ONE HALF HOURS COPILOT NIGHT MAY BE USED.
3. INSTRUMENT CROSS-COUNTRY NOT REQUIRED FOR INSTRUMENT RATED AVIATORS.
4. FIVE HOURS OF THE ANNUAL INSTRUMENT REQUIREMENT MAY BE LOGGED AS COPILOT UNDER ACTUAL INSTRUMENT CONDITIONS AND TEN HOURS MAY BE LOGGED IN A SYNTHETIC TRAINER.
5. INSTRUMENTS NOT REQUIRED FOR AVIATORS QUALIFIED IN HELICOPTERS ONLY.
6. NIGHT AND INSTRUMENT CROSS-COUNTRY WILL BE CREDITED TOWARD THE TOTAL CROSS-COUNTRY REQUIREMENT.

Once you have made this list, place it where you can refer to it. If you can remember to check it every time you enter a revision, that's fine; but many may fail to notice it when posting revisions. If this is the case, take it out of the manual and put it under the glass on your desk or in some conspicuous place where it will remind you to fly the schedule.

You may want to use your wall or desk calendar. Using this method you could schedule it down to the week or even the day (see fig. 1). Granted, you may not know in advance what day you will be able to fly during the month but you can go through the calendar and note days to check with Operations for an aircraft as well as the type of flying you want to do within each month.

I prefer this calendar method. It gives me a definite reminder to call for an aircraft and prods me into selecting the day I want to fly. When you check with Operations, ask if they have an administrative flight you could take which would accomplish your requirement at the same time. Even if you flew enough last month to complete this month's requirements, it won't hurt to go ahead and fly this months minimums. You may need those four hours in any case.

Whatever system you use don't forget to schedule synthetic instrument training right along with your other requirements. I realize that to some of us this isn't fun, but it does improve our procedures. In instrument flying you'll never get **too** much practice in procedures.

Now that you've planned your minimums, **fly your plan.** This is the most important part of the entire operation. If you don't stick to your schedule as closely as possible and discipline yourself into flying your plan regularly, you can see that you're wasting your time in scheduling your flights. When you make the effort to plan your semiannual or annual minimum requirements you will probably make an honest effort to stick to that schedule. This seems to be the natural tendency with most people.

You may have a job where the workload is such that flying during duty hours is almost impossible. Because of this, it is our responsibility as Army Aviators to schedule our flying time for off-duty hours, nights, weekends, or possibly get out to the field and fly an hour or two before duty time in the morning.

The main concept of the Army Aviator is that the officer is first a soldier—who should perform his assigned duties first—then an aviator. He must therefore budget his time to remain proficient in his branch, accomplish his assigned duties well, and then remain proficient as an aviator—even if it requires some of his own time. Don't get caught. Plan your flying, fly your plan—and keep current!

A typical monthly personal flight scheduling

MARCH

S	M	T	W	T	F	S
Requirements this month 2 Hr HXC 2 Hr N			1	2	3 Schedule Acft for N next week	4
5	6	7	8 Acft 2 Hr N Lcl	9	10 Schedule Acft for H next week	11
12	13	14 Admin Flt JAX Hood	15	16	17	18
19	20 Schedule Link this week	21	22	23	24	25
26	27	28	29	30	31	

Spectrometer in Operation at Rucker

Transportation Aircraft Test and Support Activity recently moved into a new phase of its oil analysis program with the purchase of a spectrometer and the establishment of a spectrographic laboratory at Fort Rucker, Ala. (See DIGEST, Aug. and Dec. '60.)

By analyzing oil samples taken from aircraft engines, the spectrometer aids in determining when maintenance may be required.

All used engine oil contains minute quantities of suspended metal. By use of the spectrometer, an analysis of the oil is made to determine if there is an abnormal amount of any particular metal. Presence of a particular metal is a clue to which part of the aircraft engine is faulty.

Statistics are being compiled to establish a chart which would set the standards for the inspection and removal of an engine part. When the metal content appears high in an oil sample, an evaluation check is made on the engine. If the engine inspection confirms that a part is defective, the percentage of suspended metal in the oil is carefully noted and incorporated in a "threshold values chart." Individual "threshold values" must be determined for each metal in each engine.

One sample from each aircraft is analyzed every 10 hours of operation. The test itself requires approximately 2 minutes.

It is anticipated that by the end of next month oil samples will be analyzed regularly from all of the rotary wing and most of the fixed wing aircraft at Fort Rucker, and from 125 aircraft at Camp Wolters, Texas.

The experimental program may continue for as long as two years. If successful, a worldwide oil analysis program to include all Army aircraft may be established.

The spectrometer is effective in testing the oil of only that type of engine where oil circulates and drains into a sump. This means that only a partial test can be run on turbine engines at present. As the Army gains increased experience with this technique it may become possible to monitor the entire turbine engine.

The goal of the oil analysis program is to promote the safety of Army Aviation by the early detection of mechanical deficiencies and to save money by preventing the expenditure of unnecessary manhours on maintenance.

Continued from page 26

quite small when compared to the air speeds flown.

In the air, the aviator has little time for anything except actually flying the airplane. Therefore preparation must be thorough. Once the flight has begun the pilot will be able to make only an occasional glance in the cockpit. Making notes on a kneeboard in flight is hazardous and usually are illegible after landing.

The normal hazards to low-level flight, such as birds, towers, powerlines, etc., become even more important because of the shorter time they are visible. The time available for evasive maneuvers is short, and much greater damage can be inflicted at high speeds. Instinctive reflex action in maneuvering to avoid obstacles of this nature can in itself be a hazard in that excessive g loads may inadvertently be pulled, and overcontrolling can easily occur. Turbulence can also create a hazard by shaking or bouncing the pilot around the cockpit, making his task more difficult and, in some cases, causing him to make inadvertent stick inputs.

In general, navigation in this environment involves no principles new to the Army Aviator. Only the techniques and methods are new and must be practiced. A certain amount of experience and training are required if a pilot is to successfully complete a mission of this type. On the surface this type flying sounds "hairy"; it is not really. As experience is gained, confidence and skill also increase. A logical approach to the problem, and strict adherence to the principles outlined ensures a high probability of a successful mission.

For those with a sharp eye, the mention of SB 1-1-1 in last month's "The Army Flying Hour Program" was in error. SB 1-1-1 was rescinded by DA Circular 310-35.—Editor.

From The USAAVNS

DEPT OF ADV F/W

Since the start of the AO-1 Transition Course many Army Aviators have reported to Fort Rucker with orders, but without sufficient proficiency to complete the course.

The most serious problem areas are the lack of instrument flying proficiency and the lack of sufficient total flying time for the experience level required to transition into this more complicated aircraft.

The course is designed to provide transition training during the early phase and instrument training during the latter phase. Experience has indicated that some Army Aviators do not possess adequate knowledge of instrument procedures and are therefore unable to complete the instrument phase of AO-1 training. To prevent a waste of time and money and to more efficiently produce AO-1 pilots, the Aviation School now conducts instrument evaluation rides in the L-20 for all new students. Those students who do not demonstrate adequate instrument proficiency may be referred to a faculty board for elimination before starting the course.

USAAVNS strongly recommends that current directives pertaining to prerequisites for the AO-1 Transition Course be closely followed. This is particularly important regarding instrument proficiency. Thirty hours of intensive hood or weather flying and a successful instrument checkride within 60 days of reporting to Fort Rucker are deemed necessary.

During the course, time is available to teach the student the use of the FD-105 integrated flight system as installed in the AO-1; however, no time is available to teach a student the fundamentals of VOR, ADF, GCA, or ILS approaches.

Work hard, get sharp, and report in ready to demonstrate to your check pilot an outstanding instrument flight.

DEPT OF TACTICS

The improvised Army Air Traffic Regulation and Identification System integrated into the last OFWAC field exercise proved quite successful.

The Employment and Field Exercise Branch operated a simulated Flight Operations Center during the FEX. This FOC consisted of two controllers using one FM frequency and a plotting board to regulate flights of aircraft.

During the 3-day exercise the FOC processed 268 tactical flight plans from four satellite airfields and a simulated Division Aviation Company Airfield. The processing included checking the proposed flight routes against the simulated tactical situation to ensure that the routes would not conflict with restricted areas, air strike areas, etc.

Student aviators gained valuable experience in filing and closing flight plans, making tactical position reports, and pin pointing positions using tactical maps.

Future plans for this problem include using two enlisted flight operations specialists to operate a flight control con-

sole, enlarged plotting board, and improved wire and radio communications.

The Aerial Gunnery Course and the HC-1 Chinook programs of instruction are currently being prepared by the department. The Aerial Gunnery Course will feature SS-11 firing from the HU-1B helicopter. The HC-1 course emphasizes mission accomplishment under all weather conditions, and battlefield survival.

FM 1-100, "Army Aviation," is undergoing revision by the Command and Staff Branch. In addition, a new manual, FM 1-( ), "Army Aviation Operations," is under development.

Techniques in the adjustment of artillery fire from helicopters have been studied by the department and recommendations are being considered to integrate this training into the rotary wing programs of instruction.

CDO

The final draft FM 1-15, "Aviation Battalion — Infantry, Airborne, Mechanized and

Continued on inside back

CRASH SENSE

PREPARED BY THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

MANY READERS have expressed the desire for Crash Sense to follow USABAAR teams as they assist aircraft accident investigation boards in determining accident cause factors. This issue, Crash Sense will do exactly that for two recent accidents.

Accident No. 1

The Investigation Division of USABAAR was forewarned by the TWX crash facts message which arrived at 0900 hours on the morning following the crash. Although the crash facts message contained only the information available immediately following the accident, it was readily apparent that a call for investigative assistance could be expected.

Teams from the Investigation Division are immediately available for this assistance to commanders of major commands, Chief, National Guard Bureau, and commanders of Class II installations. These teams are usually requested for accidents of unusual significance. An accident of unusual significance is one in which

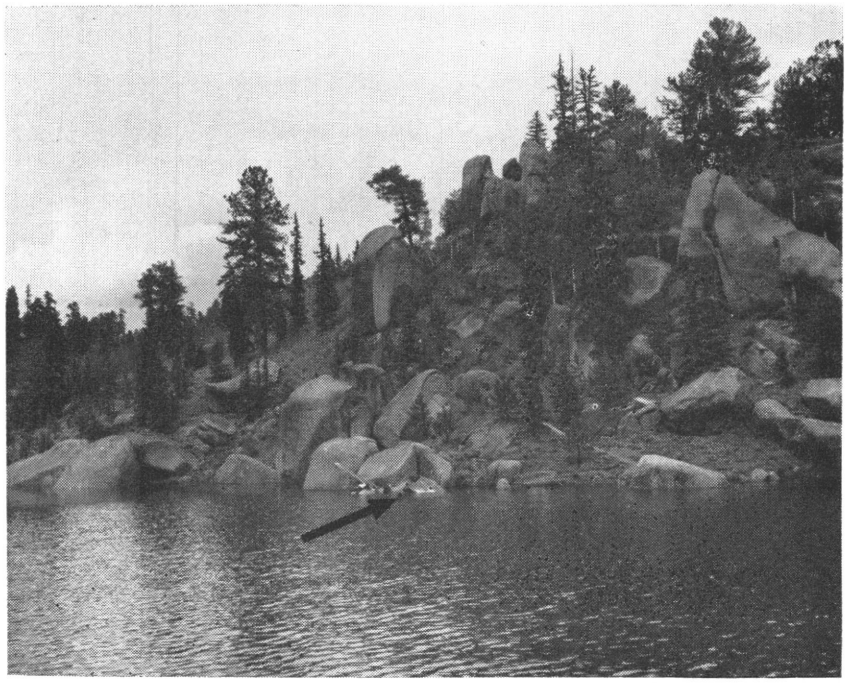
- the aerodynamical behavior of the aircraft is such that there is no known precedent, or
- the cause factors may confirm previously suspected but unconfirmed causes, or
- unusual public interest may be aroused or
- information maybe gained which would contribute to special studies in aviation safety.

The expected call came shortly after the arrival of the crash facts message and the team was soon on its way. Included were a crash injury analyst from the Human Factors Section, an air safety investigator and operations and maintenance sergeant from the Investigation Division. The team arrived at the scene late in the evening of the day the call for assistance was received. On hand, also was the local accident investigation board consisting of seven members and technical representatives of the airframe and engine manufacturers.

HISTORY OF FLIGHT

Two aviators from the local unit were to proceed to a designated spot and pick up two passengers. Using an HU-1A Iroquois, their mission was to fly the passengers to a remote site so they could observe survival training and the loading and unloading of soldiers from

Iroquois struck granite rocks and crashed into lake



helicopters during a simulated tactical operation. The crash occurred when the aircraft struck a large boulder on the east side of a lake, 5 feet above the water level. The elevation of the crash site was approximately 8,810 feet. The lake ran generally in a north-south direction, with a steep rock cliff on the east side extending approximately 100 feet above the water level of the lake. The aircraft crashed at the base of this cliff. All four occupants sustained fatal injuries.

The flight path, established through witnesses, was described as follows: The aircraft was seen to approach a command post from a southwest direction, approximately 500-800 feet above the ground. It circled to the right, in the direction of the lake, and the pilot transmitted by FM radio his intention to land in a few minutes. The Iroquois then proceeded on a southwest course, passing slightly to the west of the lake. When approximately 300 feet due west of the crash site, and 300 feet above the crash site elevation, it was seen to begin a descending turn to the left. Witnesses described varying degrees of bank, up to 80°. The aircraft continued this descending turn until it crashed on a northerly heading into a large boulder.

In previous approaches to this command post the pilot always made a straight approach to the lake and flew over it from south to north at an altitude of approximately 100 feet above the water. He would then proceed up a ravine to the landing pad which was approximately one-quarter mile from the crash site. Wind, at the time and site of the crash was estimated at 10-15 mph from the southwest.

The estimated gross weight of the aircraft was 5,800 pounds.

THE INVESTIGATION

Analysis of the power train from the engine through the short shaft into the transmission and from the transmission through the tail rotor gear drive to the tail rotor indicated that all breaks and damage were incurred at the time the aircraft crashed. Examination of fractures and gears indicated that they were under a load at the time of the crash. However, it could not be determined from these fractures whether the engine driving forward or the blades striking the water backloaded the power train to cause this driving indication.

The control systems were checked as far as practicable at the accident scene, with negligible results. The wreckage was moved into a roped off area in a hangar and the following investigation of all flight controls was made.

Each control system was removed from the wreckage and laid out on the floor for a check of its completeness and continuity. Photos were taken, showing the layout of the antitorque

Crash victim took rare photo seconds before impact — note proximity of rocks through right window

system, collective pitch system, cyclic control system, throttle-power-linkage system, and the synchronized elevator system.

All parts of these systems were found and full continuity of the push-pull rods and bell cranks was accounted for. Fractures and breaks were found in all of the systems. However, it was the opinion of the investigators that these fractures and breaks all resulted from impact damages, with the exception of one break found in the lateral cyclic control support mounting bracket (P/N 204-001-514-3). This bracket was sent to a metallurgist for analysis. The metallurgist determined that the break was caused by impact forces.

The three hydraulic servos in the control systems were not bench checked because of a lack of facilities and because it was the opinion of the investigators that they would have had no bearing on the accident due to the 500 pounds pressure fail-safe design built into the system.

Of particular interest were the following items:

Collective sleeve nuts and lock plates were inspected and found to be in place.

The short shaft indicated failure at the time of the crash.

The tail rotor gear box separated from the aircraft at the time the rotor blades struck the water and was only held by the tail rotor pitch link chain.

Transmission mounting corners were not cracked or broken, even though the two rear mounts had pulled out of the airframe.

Quick disconnect couplings at the main fuel strainer were found to be secure and intact.

Close examination of a photograph taken by a passenger in the rear seat 2-3 seconds prior to the crash, revealed the following instrument indications:

Fuel—750 pounds; engine oil pressure—70 pounds; engine oil temperature—75°C; transmission oil pressure — 50 pounds; transmission oil temperature — 75°C; heading — 355°; bank—15° left; pitch attitude — slightly nose down; rate of descent — 450 fpm; clock—0804 hours; torque pressure—26 pounds; gas producer —94.5 percent; airspeed — 30 knots; short shaft rpm—6,000-6,200; main rotor rpm—300. In addition, this picture shows that the pilot had full up collective.

THE INVESTIGATION

Impact forces when the aircraft struck the rock were primarily vertical in relation to the aircraft structure. Calculation of forces sustained by the aircraft and occupants was not attempted. However, considering the extreme collapse of the fuselage and the severity of injuries, the forces involved were considered to be in excess of human tolerance. Impact forces would therefore classify this accident as nonsurvivable.

THE PILOT

Investigation of the pilot's actions during the 24 hours previous to the accident revealed a normal duty day. Relatives were visiting in his home. However, they departed around 1800 hours and his wife told neighbors they retired early as he would have to get up early for a flight the next day. The pilot's wife got up with him on the morning of the accident around 0400 hours. She fixed him a breakfast of eggs, bacon, and toast. He left the house at approximately 0450 hours. The pilot was reported by friends as practically a teetotaler. There was no evidence of marital discord.

The pilot had a total of 1,543 flying hours; 194 hours in fixed wing aircraft and 1,349 hours in rotary wing aircraft. He received his rating as a rotary wing Army Aviator 22 December 1956 and qualified as a fixed wing aviator 18 November 1960. He was not instrument rated. The pilot had a total of 72 hours in the HU-1 and completed his checkout in this aircraft 8 March 1961. The pilot's accident history included two minor and one major accidents. One of these was due to misjudgment and the other two were attributed to disorientation.

FINDINGS

There was no evidence of mechanical failure or malfunction of the aircraft's systems.

It was the conclusion of the investigators that the pilot misjudged his turn and placed the aircraft in a position that made it impossible to recover prior to striking the boulder. Several elements contributed to this misjudgment. These were density altitude—11,000-12,000 ft; gross weight—5,800 pounds; a descending downwind turn of approximately 180° into a rock cliff. Wind velocity was estimated at 10-15 mph and it was suspected that an inadvertent high sink rate began during the turn.

There was no evidence of physiological or psychological factors which would have contributed to the cause of the accident.

RECOMMENDATION

It was recommended by the investigators that a mountain

flying training program for helicopter pilots be established, with the training to be conducted in actual mountainous terrain and conditions.

Accident No. 2

Investigation of this accident began in much the same manner as accident number one. The call came at 0600 hours and the USABAAR team was on its way by 1400 hours. This time the team consisted of the deputy director and an air safety investigator from the Investigation Division. While the Investigation Division has two air safety investigators whose main duty is to investigate aircraft accidents, each USABAAR officer is also a graduate of the University of Southern California Army Aviation Safety Course and a qualified accident investigator. Due to the remoteness of this accident, the team was two days en route. They arrived at noon of the second day following the call for assistance.

HISTORY OF FLIGHT

The purpose of the flight was to carry cargo from an Air Force base to a remote camp 120 miles away. The H-34 Choctaw took off at 1040 hours. Aboard were a pilot, copilot, and crewchief. They arrived at the remote camp at 1205 hours and remained on the ground, unloading cargo and onloading three passengers and fuel, until the departure for the return leg at 1312 hours. It was estimated that the aircraft crashed approximately two minutes after takeoff. However, it was not discovered until 1515 hours, due to poor visibility in blowing snow. The aircraft was totally destroyed in the crash and all six occupants sustained fatal injuries.

THE INVESTIGATION

The aircraft crashed on a heading of approximately 225° (85° left of intended flight path) in a nose-down attitude of approximately 35° and a left bank attitude of approximately 15°. The aircraft moved forward approximately 35 feet after initial impact and came to rest on its left side. The engine was forced back toward the cockpit area and the transmission came forward approximately 80°, crushing the cockpit. All cabin seats were torn loose and the occupants were thrown into the left forward section of the cabin. The tail boom and tail pylon were essentially intact. However, there was evidence of compression buckling along the longitudinal axis. All available evidence indicated the aircraft was intact prior to initial impact.

A complete check of the aircraft's control system and power train was impossible due to the remoteness of the accident, subzero temperatures, and ice and snow which obscured parts of the systems and could not be removed. However, all parts of the flight controls which were accessible revealed no indication of inflight failure or malfunction, and all breaks were due to impact damage.

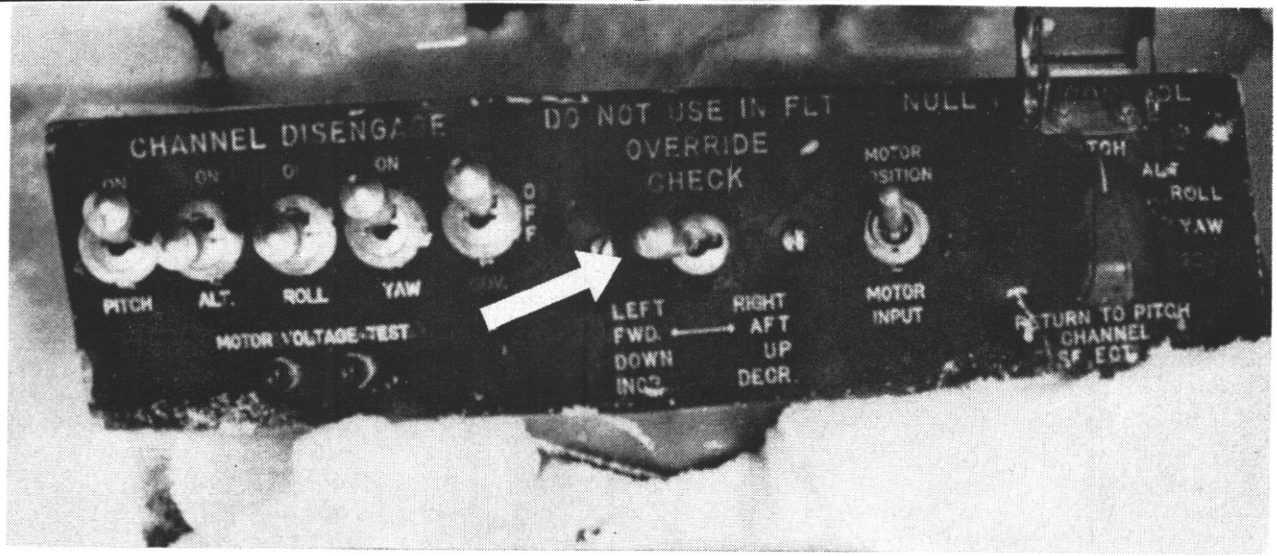
Analysis of damage to rotating parts indicated the engine was developing power at the time of impact.

The swash plate indicated a nose-down and left bank control position. Main rotor blade roots were removed and the main rotor shaft could be rotated.

Main rotor blade disintegration indicated high rotor rpm at the time of the crash.

A check of the ASE (automatic stabilization equipment) revealed the override switch in the LEFT-FORWARD-DOWN position and the pitch and yaw

Lt Col David A. Hill, Jr., deputy director (right) and Mr. Lewis A. Mills, Jr., air safety investigator, USABAAR, at H-34 crash site in frozen north



ASE control panel helped solve riddle

channels in the ON position. Examination of the tail rotor and fore and aft servo motors revealed a displacement from the neutral position at the time of impact, indicating the ASE was engaged. There was very little crash damage to the ASE motor box panel and the positions of the lock tight switches are considered valid indicating pitch and yaw signals were being applied.

Readings obtained from the instrument panel were: engine rpm—2300; rotor rpm—260; manifold pressure—23 inches; airspeed—55-60 knots; carburetor air—plus 40°C; transmission oil—60°C; attitude indicator—20° left bank — nose down. These readings alone are not considered valid. However, when correlated with other data, they become significant.

There was no evidence of failure or malfunction of the rotor system or transmission and all damage was determined to be the result of impact. One main rotor blade was broken off at the root and could not be located at the crash site. The root of the missing rotor blade was taken to a metallurgical laboratory which confirmed that the break was caused by impact forces.

A thorough check of the ASE was made and there was no evidence of failure or malfunction. An experiment was conducted to determine whether or not it was possible to have a hard-over signal in the ASE before takeoff. It was determined that following the procedures in the flight manual will prevent an inadvertent hard-over signal in flight. Further experimentation revealed that a hard-over signal could be induced in flight in two ways: One, by the movement of of the override switch while in the ENGAGED or STANDBY position. The other, by having a hard-over signal on the motor control panel before applying power to the ASE and omitting the step in the pre-takeoff checklist which requires depressing the engage button, then standby button. If the engage button is subsequently depressed in flight, a hard-over signal will result. The sequence cannot be cut out by the Auto Stab release on the cyclic control or the standby button. The override switch must be moved to the neutral position or the auxiliary servo switch moved to the auxiliary off position. The data obtained from this experiment was later confirmed by engineering and control specialists at the manufacturing plant.

THE CREW

Discussion with the pilot's associates indicated that he was an average pilot, and there appeared to be no psychological or physiological problems which could have contributed to the accident.

The pilot graduated from flying school in June 1960. He had a total of 724 flying hours, of which 206.2 hours were in the H-34. He was not instrument qualified.

The copilot, also not instrument rated, had a total of 572 rotary wing flying hours. He had only 4.3 hours copilot time in the H-34 and he was assigned as copilot on this flight to provide him with orientation of the remote camp area and further training in the H-34.

It was determined that on two previous occasions the pilot had taken off without checking the ASE on the ground and had attempted to engage the system immediately after takeoff. It was his practice to use the system frequently.

WEATHER

Weather at the time of landing at the remote camp (1205 hours) was 8,000 feet scattered, 3/4 mile visibility in blowing

snow, wind ESE at 23 knots. The blowing snow was approximately 6 feet above ground level. Investigation revealed that the pilot was notified by the weather officer of deteriorating weather shortly before his takeoff. Weather at the time of takeoff (1312 hours) was 400 feet overcast, ¼-¾ mile visibility from the bottom of the overcast to ground level.

A witness at the point of departure watched the crew and passengers arrive and board the aircraft. The aircraft was then started and after a short warmup period was seen to pick up to a hover and depart the area at an altitude of approximately 100 feet. The witness lost sight of the aircraft at a distance of approximately ¼ mile.

FINDINGS

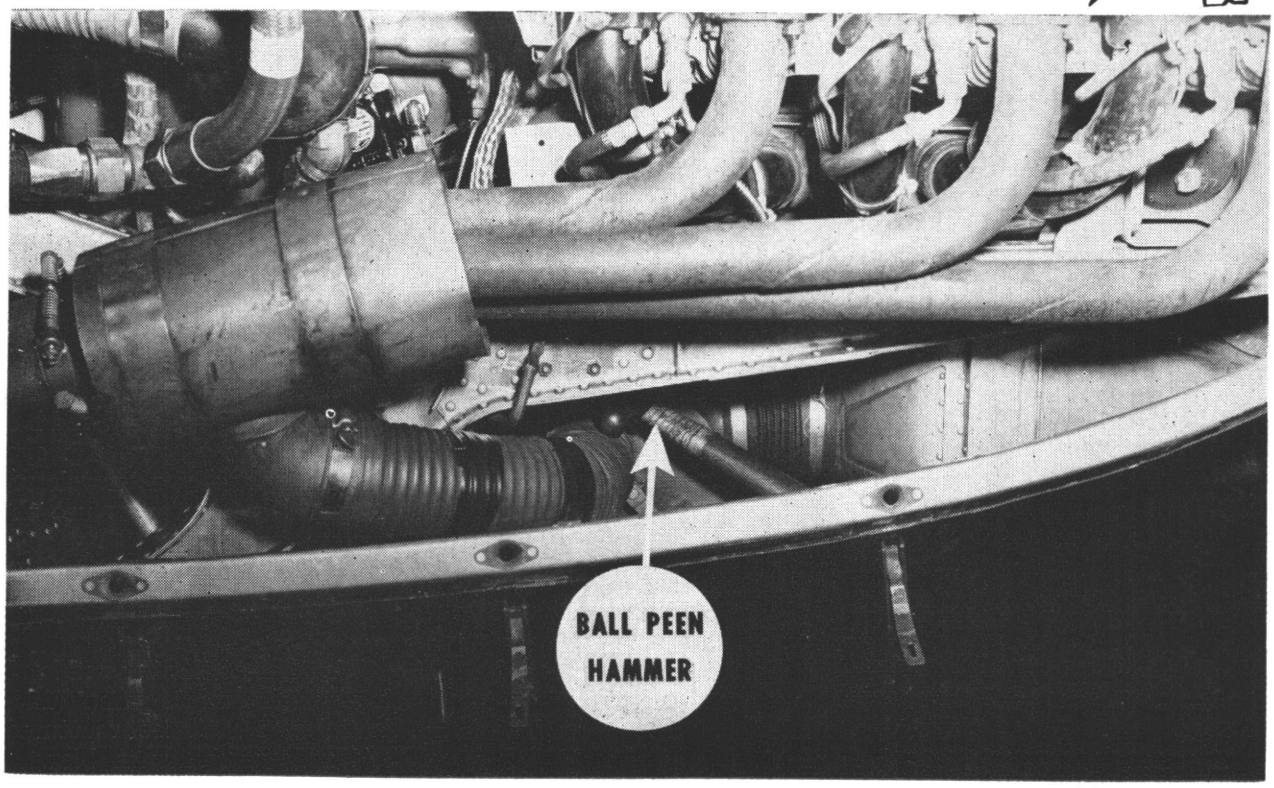
It was the opinion of the investigators that the pilot or copilot engaged the ASE shortly after takeoff at an altitude of approximately 100-150 feet. The ASE motor control override switch was in the LEFT-FORWARD-DOWN (hard-over) position. This caused the aircraft to be placed in an attitude from which the pilot could not recover prior to impact. Deteriorating weather was a contributing factor.

RECOMMENDATIONS

It was recommended that

- an evaluation of the adequacy of instruction covering ASE equipment in both the H-34 qualification course and instrument school be made;
- only instrument qualified pilots be assigned to duty in areas subject to sudden hazardous weather changes;
- units which use ASE equipped aircraft ensure that pilots have a thorough knowledge of ASE equipment.

IT COULD HAPPEN TO YOU



Continued from page 30
Armored Divisions," is in final stages of preparation. DA publication of the manual will follow USCONARC approval.

The Aviation Battalion includes TOE 1-76E, Headquarters and Headquarters Company; TOE 1-77E, Airmobile Company (Light); and TOE 1-78E, Aviation Company (General Support).

The mission of the division aviation battalion is "to provide aviation support for the division headquarters, division support command, and other divisional units without organic aircraft." It also provides "general support and reinforcement to units possessing organic aircraft and an aviation special staff section for the division."

The composition of the battalion is the same for the infantry, mechanized, and armored division. It differs somewhat for the airborne division, which possesses an FOC but no drone capabilities. Aircraft in the battalion will consist of armed utility helicopters, LOH (light observation helicopter), and sensor equipped STOL observation aircraft. This unit is organically 100 percent mobile.

The overall organization and employment of the battalion is geared for both nuclear and nonnuclear warfare. Internal communications are up-to-date. Battalion administration will be handled by the division administration company and 3d echelon maintenance will be the responsibility of the division maintenance battalion. The battalion overhead and administration is reduced to a minimum, thereby relieving the battalion commander and his subordinates of responsibilities other than a clear-cut combat role. The battalion commander also serves as the division aviation officer. In this capacity, he has an assistant who is assigned to the battalion.

The new FM 1-15 will be followed by supporting ATPs and ATTs now under preparation.

Halaby Announces Agency Codification Program

The Federal Aviation Agency's safety rules will be codified to meet the needs of modern aviation, N. E. Halaby, FAA Administrator, has announced.

Today's aviation requirements and rapidly changing developments often make it impossible for pilots and others in aviation to clearly understand their own responsibilities and the responsibilities of those who serve them.

"Our rules must say what they mean," Mr. Halaby said, "so that the people to whom they apply will have a clear understanding as to what they can legally do, or cannot do, under their operating certificates and under current civil aviation law."

The FAA Administrator pointed out that the codification program is not designed to make new regulations but rather to restate existing ones. He said the FAA is still a relatively new agency and is working with regulations inherited from predecessor organizations and other agencies—and many of these rules are out of tune with the times.

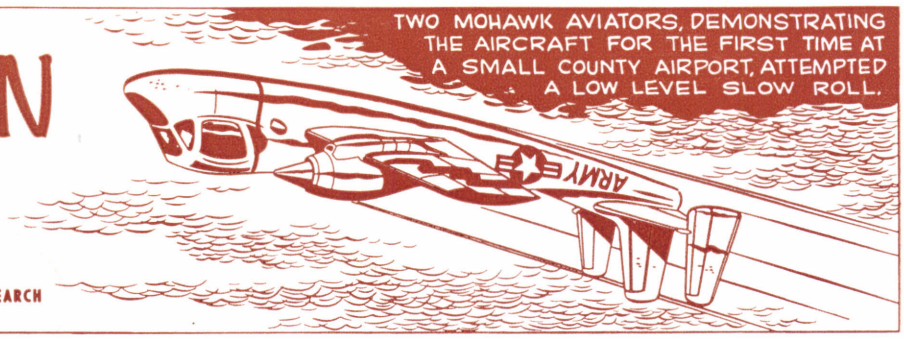
Halaby observed that the laws of aviation, like aviation itself, cannot long remain static and the FAA cannot keep piling new rules on top of the old. He said that air safety rules must be stated in simple, straightforward language. With this aim in mind, the FAA will combine all pertinent regulatory material into a unified system, in one place, one series, under one authority, and in simplified, accessible form.

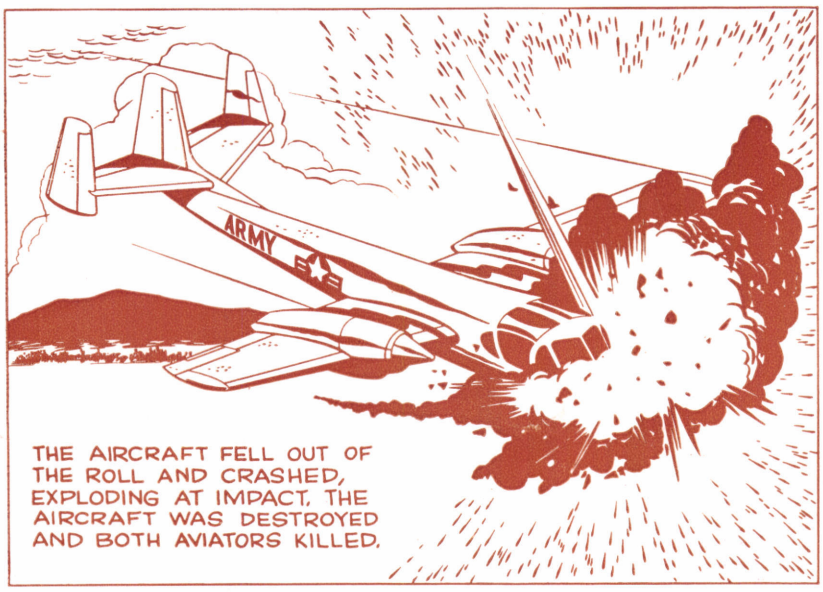
Some six to seven thousand pages of regulatory material will be boiled down into one coherent document that will be designated by some new name, such as Federal Aviation Regulations. The jobs will involve a reduction of about 123 regulations and a mass of unnumbered material into approximately 60 simplified rules.

EJECTION SENSE

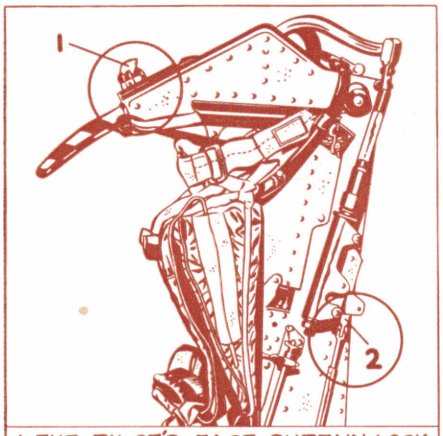
prepared by

THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH



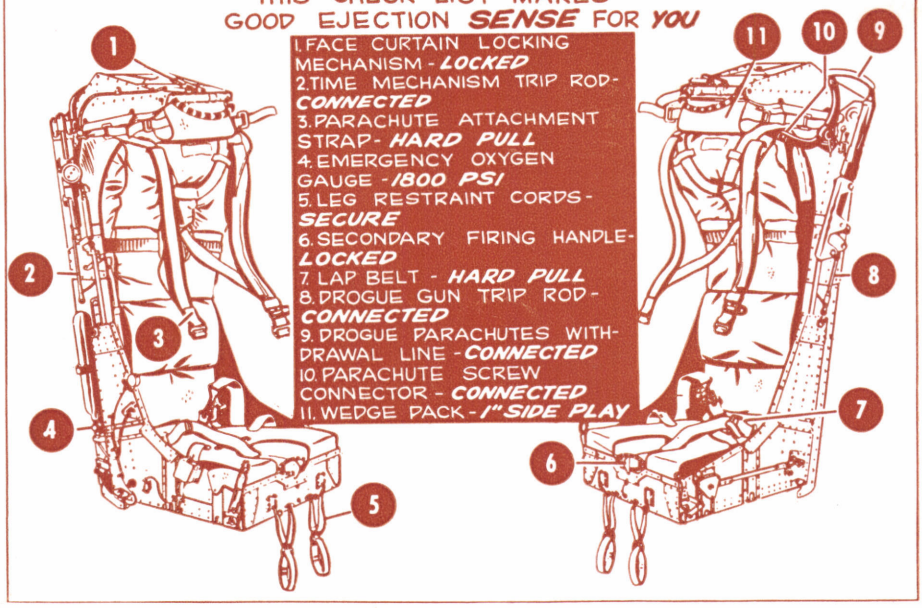


INVESTIGATORS, DIGGING THROUGH THE WRECKAGE, DISCOVERED THAT THE AVIATORS NOT ONLY DISPLAYED POOR JUDGEMENT IN THE LOW LEVEL SLOW ROLL, BUT FAILED TO CHECK TWO ITEMS ON THE MARTIN-BAKER SEATS THAT WOULD PROBABLY HAVE PREVENTED SUCCESSFUL EJECTION!



1. THE PILOT'S FACE CURTAIN LOCKING LEVER WAS FOUND JAMMED IN THE "UP" OR SAFETIED POSITION.

2. EVIDENCE WAS FOUND TO INDICATE THE DROGUE GUN TRIPROD SEAR WAS NOT INSTALLED IN THE OBSERVER'S SEAT DROGUE GUN FIRING BODY PRIOR TO COCKING.

THIS CHECK LIST MAKES GOOD EJECTION *SENSE* FOR *YOU*

1. FACE CURTAIN LOCKING MECHANISM - ***LOCKED***
2. TIME MECHANISM TRIP ROD - ***CONNECTED***
3. PARACHUTE ATTACHMENT STRAP - ***HARD PULL***
4. EMERGENCY OXYGEN GAUGE - ***1800 PSI***
5. LEG RESTRAINT CORDS - ***SECURE***
6. SECONDARY FIRING HANDLE - ***LOCKED***
7. LAP BELT - ***HARD PULL***
8. DROGUE GUN TRIP ROD - ***CONNECTED***
9. DROGUE PARACHUTES WITHDRAWAL LINE - ***CONNECTED***
10. PARACHUTE SCREW CONNECTOR - ***CONNECTED***
11. WEDGE PACK - ***1" SIDE PLAY***