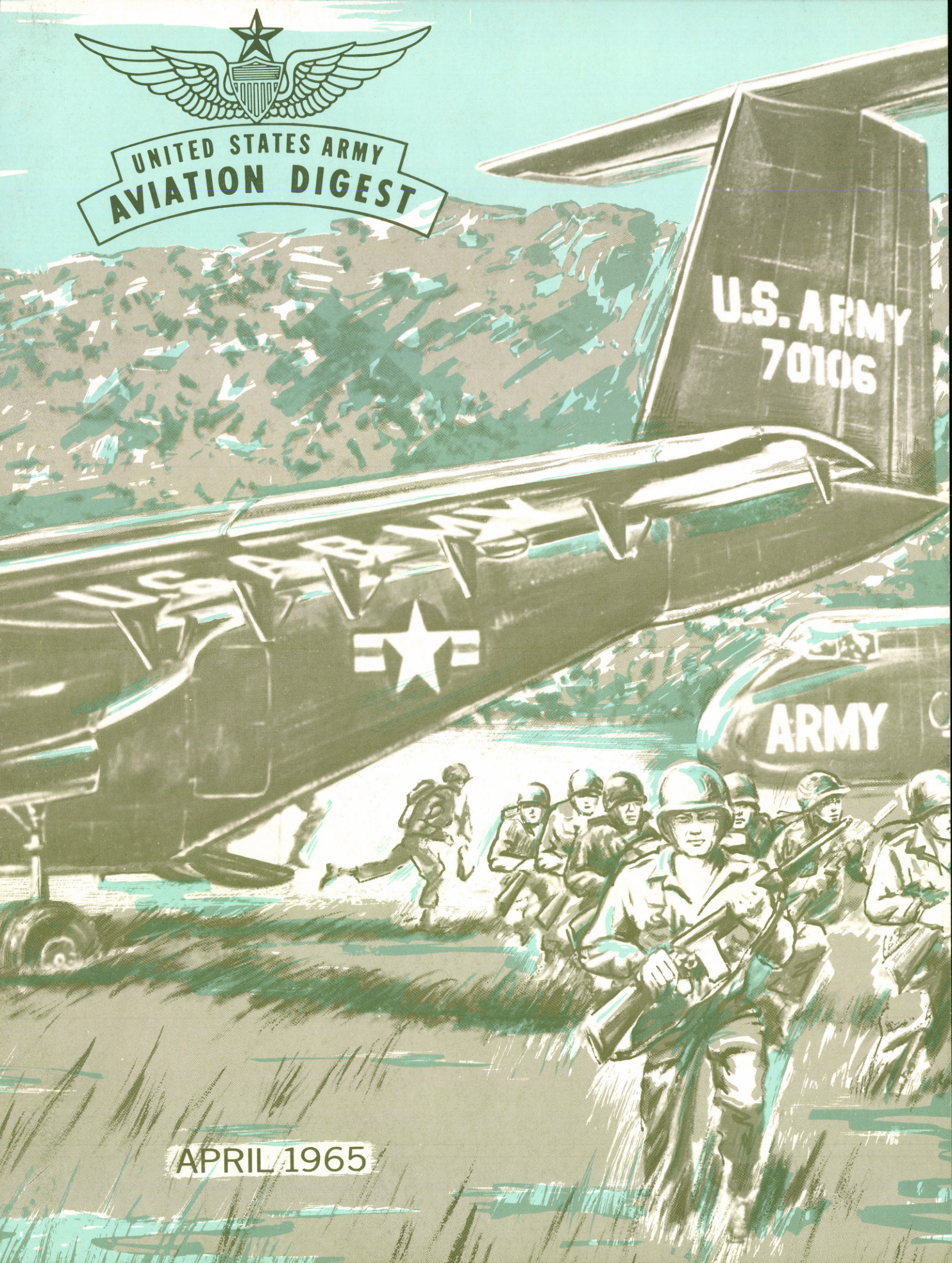
UNITED STATES ARMY AVIATION DIGEST



APRIL 1965

UNITED STATES ARMY AVIATION DIGEST

APRIL 1965 VOLUME II NUMBER 4

DIRECTOR OF ARMY AVIATION, ACSFOR
DEPARTMENT OF THE ARMY
Col George P. Seneff, Jr.

COMMANDANT, U. S. ARMY AVIATION SCHOOL
Brig Gen John J. Tolson, III

ACTING ASST COMDT, USAAVNS
Col Robert E. McGraw

EDITORIAL STAFF
Capt Richard C. Anglin
Fred M. Montgomery
Richard K. Tierney
William H. Smith
Diana G. Williams

GRAPHIC ART SUPPORT
H. G. Linn
H. A. Pickel
D. L. Crowley
A. Lofe

USABAAR EDUCATION AND LITERATURE DIV
Pierce L. Wiggin
William E. Carter
Ted Kontos
Charles Mabius

CONTENTS

Project Flattop, A. E. D'Angelo 1
Formation Flying, Maj Lester R. Kerfoot, Jr. 7
Something Missing? 10
Chinook Deployability, Capt Leonard H. Burroughs 12
Roller Coaster of Death, SFC Glenn E. Hudson 16
Two Flights Aborted, Maj Milton C. Sheridan 18
Mountains To Be Moved, Lt Col Jack W. Ruby (Ret) 20
Productive Safety Meetings 24
A Little Something Extra, William H. Smith 30
Send a Magician, Maj Daniel R. Keenan 33
Say Ah'h'h, Ted Kontos 35
Crash Sense 41
Sighted Ship, Sank Same, Capt James M. Adler Inside Back

Cover—First of three CV-7A prototypes scheduled for Army user tests will be delivered this month. A variety of environmental evaluations will be conducted during the year.

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.

The DIGEST is an official Department of the Army periodical published monthly under the supervision of the Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. Photos are U. S. Army unless otherwise specified. Material may be reprinted provided credit is given to the DIGEST and to the author, unless otherwise indicated.

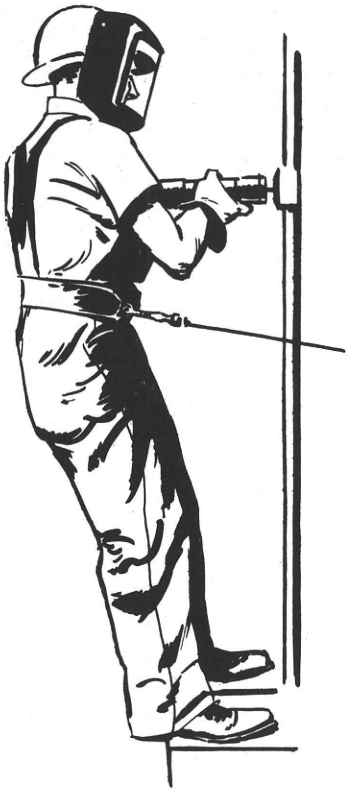
Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U.S. Army Aviation Digest, Fort Rucker, Alabama.*

Use of funds for printing this publication has been approved by Headquarters, Department of the Army, 29 December 1964.

Active Army units receive distribution under the pinpoint distribution system as outlined in AR 310-1, 20 March 62, and DA Circular 310-57, 14 March 63. Complete DA Form 12-4 and send directly to CO, AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md. For any change in distribution requirements, merely initiate a revised DA Form 12-4.

National Guard and Army Reserve units submit requirements through their state adjutants general and U. S. Army Corps commanders respectively.

For those not eligible for official distribution or who desire personal copies of the DIGEST, paid subscriptions, $4.50 domestic and $5.50 overseas, are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.



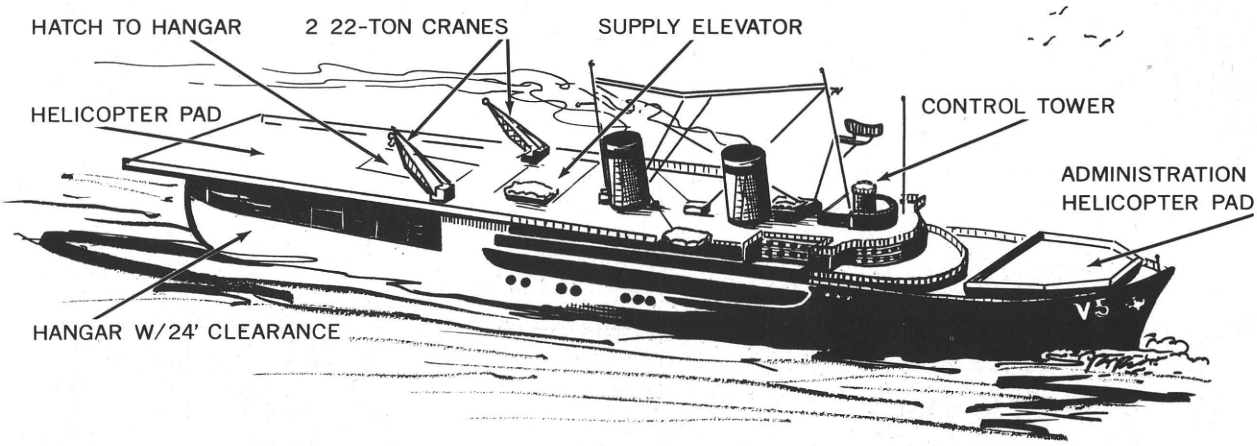
Project Flattop

A. E. D'Angelo

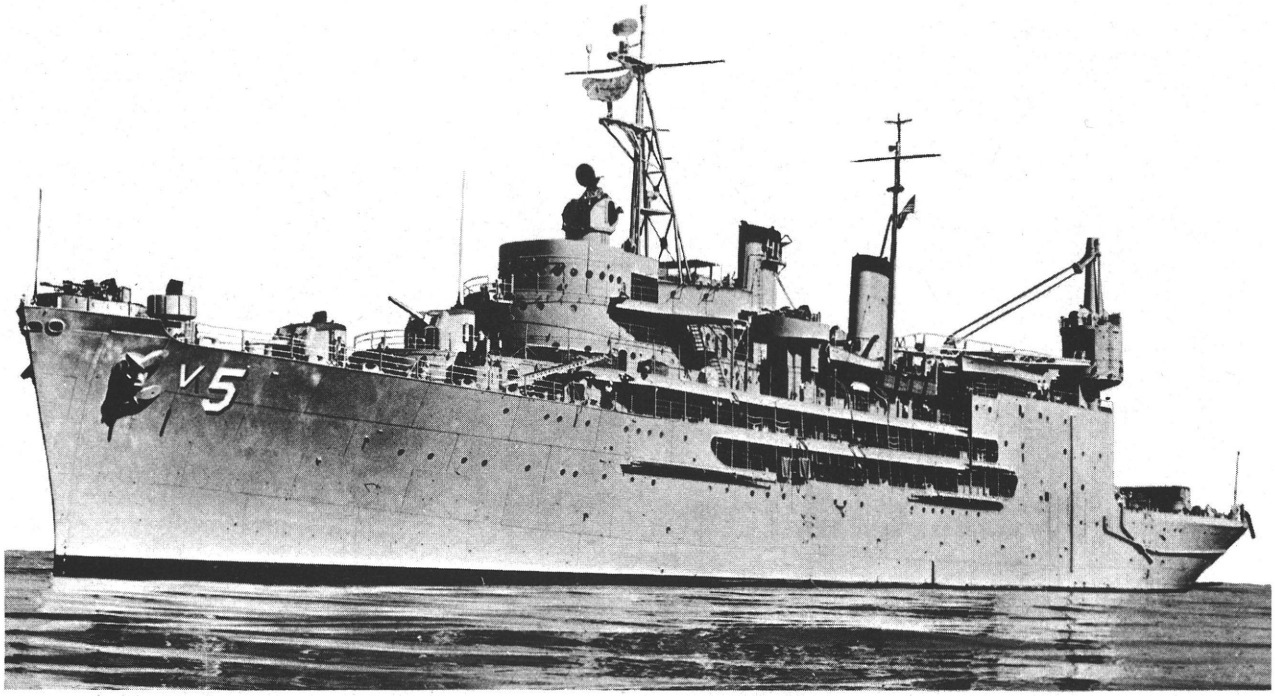
ARMY AVIATION maintenance is going to sea! The *USNS Albemarle* is now undergoing conversion for a new role—to be played in support of Army aircraft. At the Charleston, S. C., Navy Yard the *Albemarle* is being outfitted as a floating maintenance unit capable of providing fixed base repair facilities at critical overseas areas.

This U. S. Navy vessel is expected to help solve the problem of maintaining complex Army aircraft in underdeveloped areas by providing a highly mobile, relatively secure facility capable of a wide range of shop functions.

The "Project FLATTOP" unit will do extensive class C maintenance (depot type) to include inspection, testing, adjusting, repair, overhaul, and salvage of all types of aircraft. It will be able to fabricate parts and tools to overcome the inability of the overseas depot supply system to stock spare parts and tools for the great variety of aircraft used in the Army. It will also be able to provide production



The USNS Albemarle as it will look after conversion. Its maintenance capability will fill a void in cold war or contingency plan type operations.



USNS Albemarle as she looked before the Navy conversion into a floating maintenance facility

type maintenance equipment in the forward areas.

Although it may sound like a revolutionary idea, such units are not new to United States forces. Floating maintenance units were used in the old U. S. Army Air Corps, and the U. S. Navy uses them extensively today. In fact, the vessel selected to house the unit is a former U. S. Navy seaplane tender designed as a floating repair ship to maintain Navy PBM and PBV aircraft.

In October 1962 the Army and Navy started jointly to explore the idea of furnishing such a unit to Vietnam. In January 1964, it was decided that the *USNS Albemarle* (AV-5) would be the easiest to convert and least expensive to maintain of the available ships, and Project FLATTOP was originated.

After nearly a year of staffing Project FLATTOP through the various approval agencies, formal Congressional approval was obtained in September 1964. A field office was established at Charleston, S. C., Navy Yard to coordinate the ship conversion, and an office was established at the U. S. Naval Air Station, Corpus Christi, Texas, as the control center to coordinate activities of all installations supporting Project FLATTOP.

The Army unit to be on board the ship was activated 1 October 1964, and is known as the U. S. Army Aircraft Maintenance Battalion (Depot) (Seaborne). It is a subordinate element of ARADMAC (Army Aeronautical Depot Maintenance Center) at Corpus Christi. The Naval Air Station at Corpus Christi is also home port for the ship.

Not all of the unit will be housed on board however. A number of backup functions are more efficiently and effectively performed ashore and a small part of the outfit will be retained at Corpus Christi for this purpose. Also newly assigned men will receive any training they need ashore before being sent to the ship.

The *Albemarle* is scheduled to come out of the Navy shipyard in early October and will undergo a shakedown cruise with all assigned personnel on board.

In November it will move to Corpus Christi where hand tools, small items, and supplies will be loaded. Then another two weeks' shakedown cruise or CPX will work out all the kinks. On 31 December 1965 the ship is scheduled to leave for the Republic of Vietnam to accomplish its mission.

Mr. D'Angelo is with Project Flattop, Headquarters U. S. Army Materiel Command.

OPERATIONS

This floating maintenance facility will act in direct or general support. After being assigned to an area it will operate there for extended periods and will leave when adequate land-based facilities have been established or the need for the unit has diminished.

Present plans schedule the *Albemarle's* first port of call to be somewhere in Vietnam. Later it will move from port to port in Asia, stopping at each long enough to repair the local aircraft. It will be essentially a maintenance organization, not a source of supplies.

It will move in as close as possible to the units it is supporting, but availability of shipside facilities and consideration for the safety of the ship will determine how close this will be.

The time it takes the ship to sail after getting orders will vary from a few hours to a few days, depending on the degree of readiness before being alerted. If the ship is completely supplied and all personnel available, steaming time alone is involved.

When the unit is required to change type, model and series of aircraft it supports, the Navy method of mission change will be used. A changeout package will be assembled at Corpus Christi and shipped aboard a Navy vessel to a rendezvous point.

The length of time the unit can remain at a particular site is limited only by maintenance requirements of the ship itself. Out-of-service periods are estimated to be 30 days in every 3 years. The ship will have a deployment range of 12,000 miles without refueling.

No defenses will be on board except the small arms normally carried by soldiers. It will be listed as a noncombat ship.

MAINTENANCE OPERATIONS

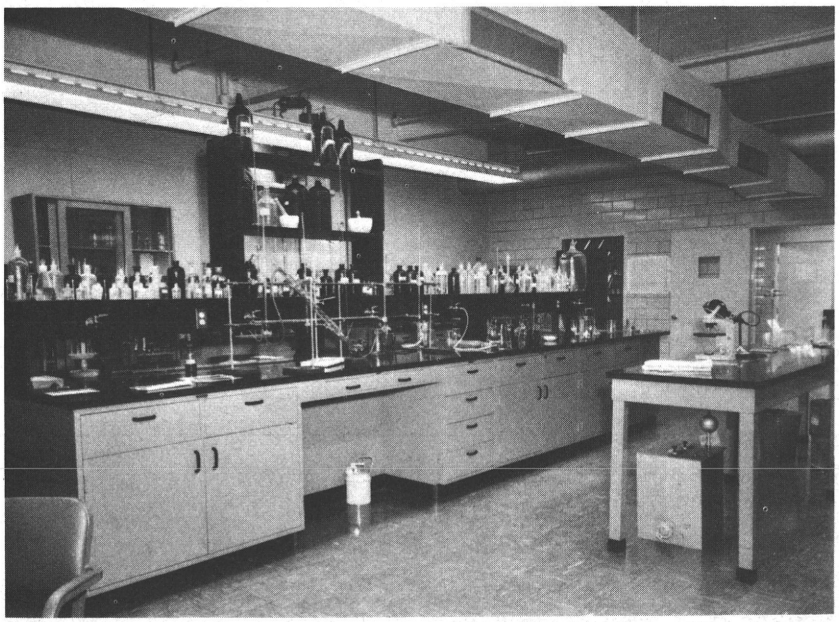
The unit will specialize in class C (depot) type maintenance but it will be capable of class B (some organizational and field) type.

More efficient and a greater variety of equipment will be on board than is normally found in field maintenance housed units. Large metal-working machinery is an example. The unit will be able to clean, heat treat, and cold harden metals. Also on board will be aircraft armament repair shops, avionics shops for minor repair of black boxes, wiring harness and components shops, and a parachute drying and packing shop. The parachute capability is needed for maintenance of Martin-Baker seats.

Limited shop areas will be available for helicopter airframe work. Fixed wing aircraft will not be able to land on the ship, so plans call for making only component repairs on this type aircraft. In certain cases fixed wing airplanes will be crane-lifted aboard from dockside.

The test capability of the unit will be one of its most important functions. The object is to short-stop as many items as possible that need only minor repairs. When it is necessary to send an item back to ARADMAC it will be with a clear determination of the malfunction or cause for rejection.

Chemical laboratory on the Albemarle will aid in equipment improvement, accident investigation, lubricating fluids contamination evaluations, and accomplishment of routine PE that require extensive teardown



SUPPLY OPERATIONS

Little logistics support will be required from units the ship supports. Normal everyday supplies needed to operate the ship and feed the personnel will be obtained from area Navy sources.

On board will be enough repair parts and kits to operate the maintenance shops for 120 days. The kind and amount are to be determined by a materiel requirements list prepared by ARADMAC. For easy handling on board ship, the supplies will be packaged in small bundles for each functional shop and contain enough material to last only a few days. Replacement will be made by ARADMAC.

Bulk items will be replaced item by item based on the rate of

consumption through normal Army and Navy supply sources. The same holds true for replacement of hand tools and consumable items such as grinding wheels and saw blades. A 150-day supply of repair parts for the industrial equipment on board will also be stocked.

The system to be used in the repair of aircraft components is designed to reduce paperwork to a minimum. The supported unit brings in an unserviceable aircraft component, waits while the trouble is diagnosed, has it adjusted on the spot if that's all it needs, or exchanged for a like item if it needs repairing.

The maintenance shop then repairs the item and places it back on the shelf. If it cannot be repaired by the unit it will be returned through regular channels to the United States.

Programmed component work is to be received from the area supply depot, repaired, and returned. Unprogrammed fabrication work will be performed for both supported units and the supply system.

Much of the equipment on board the ship is similar to that used in standard maintenance shops. Because of the ease in procuring replacement parts and because the soldier operator is familiar with them, they will be used whenever possible. However, some of the production equipment needed is not standard. This type equipment is usually manufactured on order only and has never been cataloged.

When completed, the ship will have 41,977 square feet of covered shop space, 12,416 square feet of open work deck, and 10,088 square feet of storage space. Each of its 43 shops will be adjacent to or easily accessible to the shop stores to simplify retail parts handling. Bulk storage areas will be in the lower levels of the ship.

Aft of the ship will be a hangar with 24-foot clearance. Leading into the hangar will be a hatch big enough to handle all types of rotary wing aircraft except the CH-54A Flying Crane. The Flying Crane and most fixed wing aircraft will be lowered into the hangar after being partially dismantled. Two 22-ton cranes will do the actual lowering. They are placed to enable pickup from the aft deck-helicopter pad or from shipside.

Avionics laboratory on board the floating maintenance facility will be elaborate; will require controlled conditioned environment not readily available in ground mobile units

PERSONNEL

There will be 180 men in the battalion. The tour of duty will be for one year. Dependents will not accompany their sponsors. In authorizing the Navy to use the *Albemarle* for Project FLATTOP, the Secretary of Defense approved the use of 150 military sea transport service (MSTS) civil service personnel to run it.

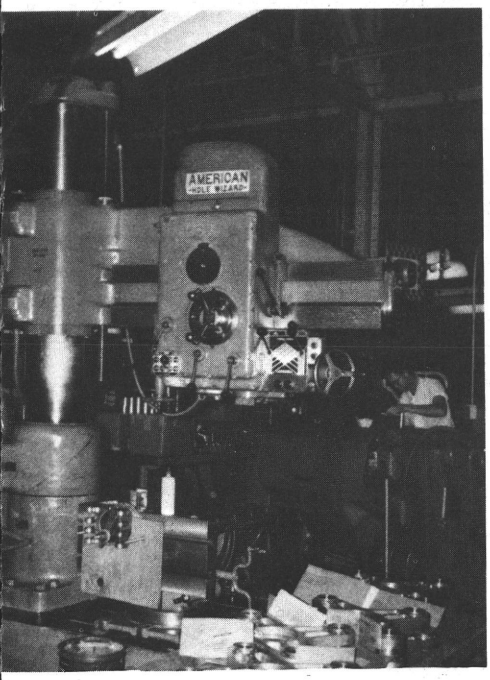
At full strength the unit will be able to provide 32,000 manhours per month for maintenance of Army aircraft and aircraft components, 3,600 manhours per month for maintenance of avionics equipment, and 1,600 manhours per month for maintenance of avionics armament systems.

This is more hours of work per individual than is normal in comparable field units. Efficient shop layout and more sophisticated production equipment contribute to this. Also manpower will be more productive because of the relief from nonproductive tasks and the improvement in living and working conditions afforded by the ship.

All personnel needed for the initial sailing of the ship have been assigned. Most of these are volunteers.

Replacement and transfers to and from the unit will be moved from ARADMAC directly to the ship. At times it may be necessary to make the transfers through the Navy's replacement system.

Plans call for use of the platoon system in replacing the maintenance crew. There will be two groups of maintenance personnel. One will serve on the ship for a year while the other will be stationed at Corpus Christi. After a year the two crews will switch. This practice will eliminate the need for the ship to return to its



The floating maintenance facility will have equipment that will enlarge the range of support available to overseas activities. This will reduce the operational time lost to groundings because of non-availability of parts. Such equipment includes cable tension testers, plating vats, rubber extruders, large mouth metal saws, propeller blade straightener.

home port for remanning.

No one will be kept on board the craft who is not needed for the actual mission being performed at the time. As the mission changes, personnel not needed will be sent back to ARADMAC for cross-training.

TRAINING

Approximately two-thirds of the personnel assigned to the ship will require some degree of specialized training. Much of this training will be in skills not usually performed by military men. Such things as metal heat treating, non-destructive and destructive testing, engine rebuild, and rubber goods manufacturing are usually done by civilian technicians and are not taught by Army schools.

For this reason these three training school systems will be used to qualify the men assigned:

- Military technical school system—Whenever possible military schools will be used whether they are Army, Navy, or Air Force.
- Civilian technical schools—These will be used when the skills needed are not taught in any military school.
- Special contract—When special tests and production equipment need a skilled operator trained on that particular machine, contracts will be let to teach the men assigned.

Individual skill level at the time of assignment is a key factor. Most of the men selected for the initial crew are field maintenance school graduates, experienced in their primary MOS, in at least their second enlistment, and are career soldiers. Average enlisted time of the crew is 8 years.

Formalized survival and seamanship training is required for all personnel assigned the floating element. This will take 8 weeks and be conducted by the Navy. This special training will include seamanship, fire control, CBR aboard ship, shipboard living, and lifesaving and swimming.

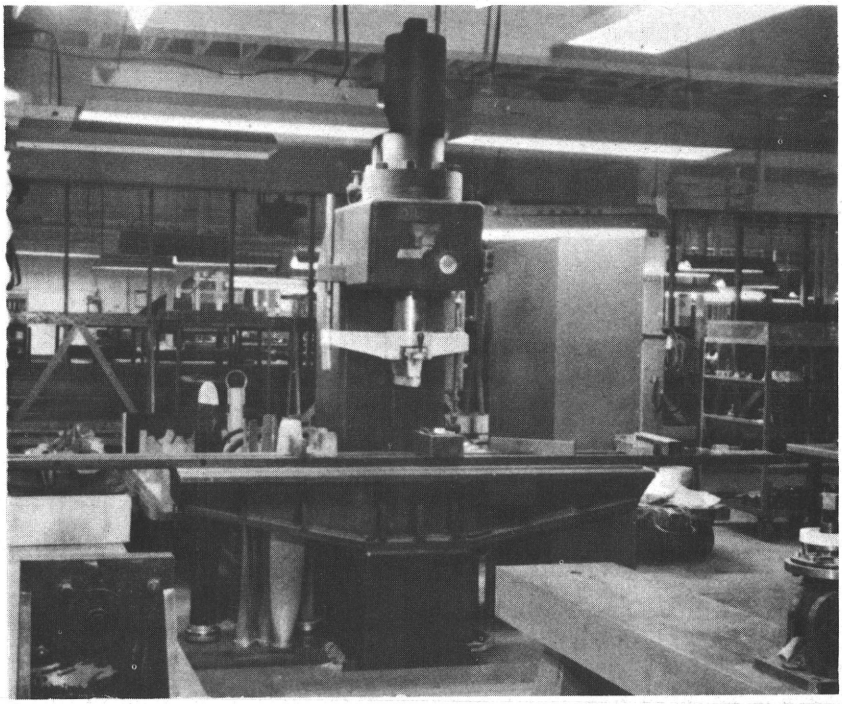
ON-BOARD FACILITIES

Two UH-1D helicopters will be on board the ship for administrative use and will have their own operating and maintenance crews. In addition to administrative uses, the helicopters will be used for other tasks, such as bringing in light supplies and picking up and delivering light aircraft components.

Two or three ground vehicles will also be on board. They will be used to transport supplies and other materials over land.

Both the Army and Navy will operate boats from the vessel. The Army will have two work boats

Production line industrial type maintenance equipment is essential in providing adequate support to operational units and backup elements. Such equipment poses no problem in weight, space, and power on the Albemarle.



and a personnel boat while the Navy will have a similar number of boats for its use.

The two Army work boats will be amphibious resupply cargo lighters (LARC-15) with 15-ton capacity. These will be used mainly to ferry heavy supplies and unflyable aircraft to the ship. The other Army boat will probably be a 26-foot craft used for administrative purposes and to escort the LARC-15s.

The Army will furnish an Army medical officer and dental officer to the project. The medical facility will have four isolation beds and 20 beds in a dispensary. Military Sea Transport Service personnel will use the Army's medical facility.

MSTS will operate the mess hall. Hotel type service will be furnished. A snack bar will also be available for all hands.

Postal, barber, tailor, and cobbler services will be furnished by the Army.

FUTURE PLANS

With the use of this floating maintenance battalion the Army hopes to reduce excessive aircraft nonavailability rates, reduce the size of the supply pipeline to and from the United States, and make its aircraft more efficient and reliable in the field. The Army's response to emergency conditions in remote corners of the earth should be greatly accelerated with improved maintenance support.

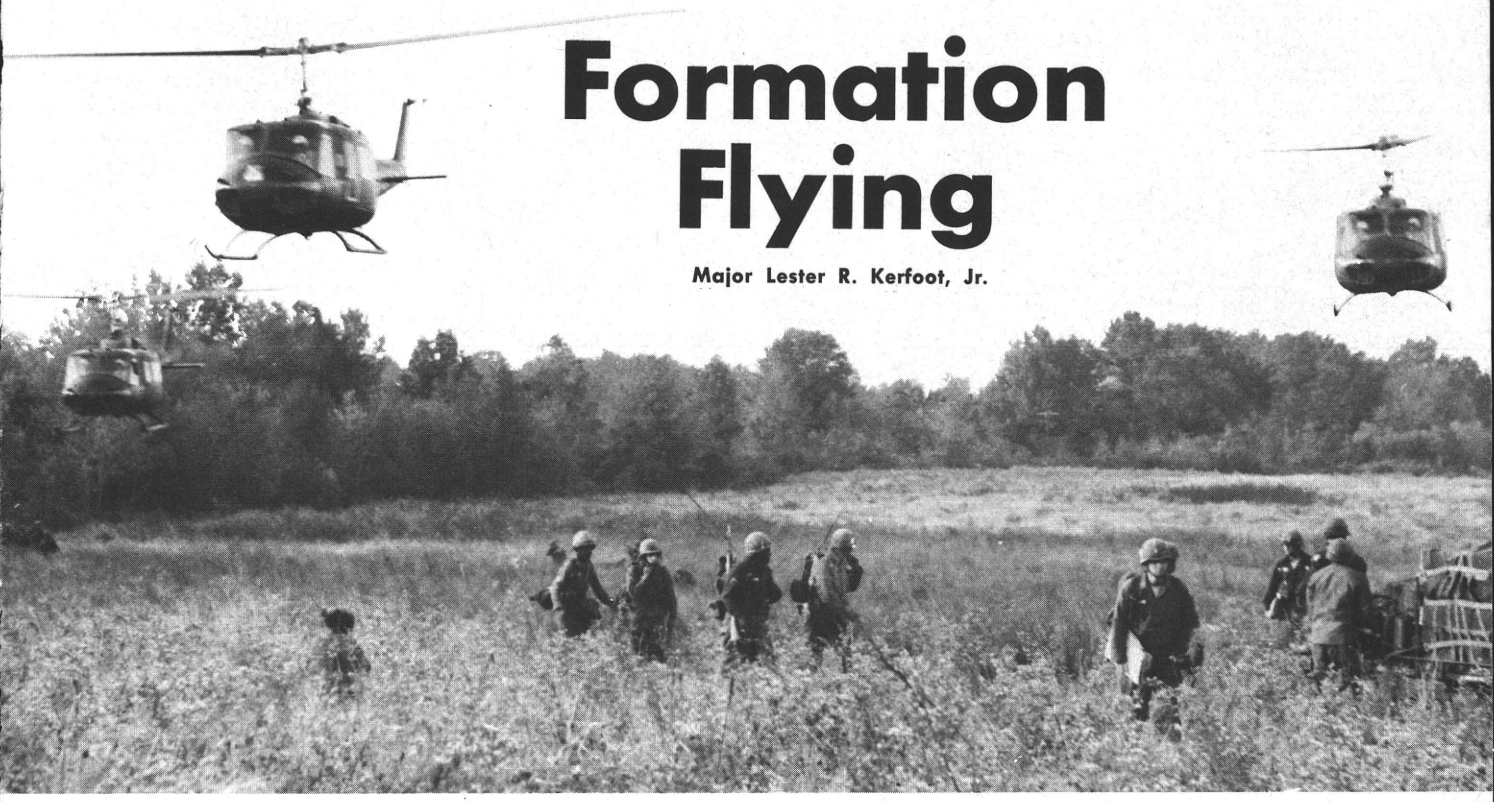
This unit should also reduce the cost of maintaining Army aircraft overseas. Earlier it had been found that 12 percent of the more costly items and 30 percent of the less costly items returned to the United States for overhaul could be repaired overseas with only limited teardown if diagnostic and test equipment were available. With such equipment on board, the floating repair shop can repair these items on the spot. Furthermore, the unit can service about 50 percent of the more costly items and 90 percent of the less costly items needing extensive repair.

Shortstopping these repairable items will result in annual savings of about $500,000 in overall costs and $400,000 in transportation costs.

Additional savings will also include $5.9 million by FY 1967 because of the reduction in the size of the supply pipeline and $968,000 annually thereafter.

If this unit fulfills expectations, more such ships may be commissioned. It is even possible that the ships may develop into a joint facility repairing aircraft for all the services.

Repaired Hueys waiting to be loaded aboard ship for Vietnam. Shortstopping aircraft being returned to the United States from Vietnam for repairs will reduce the number of aircraft in such scenes by more than 50 percent.



Formation Flying

Major Lester R. Kerfoot, Jr.

THE PURPOSE of helicopter formation flight is not merely to participate in a flyby for a new commander or a visiting VIP. Its main function is quite practical and utilitarian. Specifically, the purpose of formation flight is to move the maximum number of aircraft over a given point on the ground in a minimum amount of time, thus enhancing the security of the formation by denying an enemy on the ground sufficient reaction time to deliver accurate fire. Further, formation flight helps the aviation unit commander maintain control of his aircraft and the tactical integrity of the transported unit.

Certain basic principles of helicopter formation flight have been developed. Although these principles are not absolute rules, they are strong guides for training a unit. We will discuss each of these principles; however, it must be emphasized that they are *only* principles. Certain deviations may and should occur when a unit becomes proficient in formation flight.

Only by flying with the same pilots day after day does an individual aviator become a good formation pilot. Only by constant practice does a unit develop the degree of proficiency which will enable it to execute proper formation flight, develop its own procedures in deviating slightly from basic principles, and operate a tight, secure, quick reacting formation.

With this in mind, we will consider the basic principles:

One aircraft flies only on one other aircraft. In formation flight a pilot must be constantly vigilant to detect any changes in altitude, airspeed, or heading that his leader may make. In holding his assigned relative position he has a full-time job just watching his leader. He cannot watch helicopters to his side or rear. Fixed wing aircraft may brush wingtips and only damage navigation light reflectors. However, rotor rpm is extremely difficult to synchronize between helicopters. They "inter-

Pilot maintains station on leader only

mesh" rotor blades with disastrous results.

A 45° angle between aircraft should be maintained. Experience has proved that this is not only the safest relative position in the event of an engine failure or other emergency, but at this angle an aviator is best able to judge his distance from his pair leader. This is also the easiest angle to hold in formation.

There are many ways to determine this angle. In a UH-1 for example, this angle is obtained by lining up the intersection of the aft cross tube of the near skid with the intersection of the forward cross tube of the far skid. In a CH-34, it is accomplished by lining up the rotor head and mast in the center of the pilot's small side windscreen. Whatever system is used is determined before the flight and thoroughly explained to each participating aviator.

Fly as nearly level as possible or only slightly above the leader (1 to 3 feet differential). TM 1-260, which is under revision, specified 5 to 10 feet stacked above, however, extensive experience in both Vietnam and Europe has shown that it is far easier to turn, approach, land, and take off without losing sight of the pair leader with less vertical separation. With only slight elevation each aviator gets a more immediate indication of any maneuver about to be executed. Additionally, a small elevation differential would not force the tail helicopters to fly 20 feet or more above the lead helicopter. This enhances the security inherent in nap-of-the-earth formation flight.

The easiest way to judge level flight is to visually place the pair leader pilot's (copilot's) head on the horizon. If copilots are not used, then a relative cockpit position may be used. It should be noted that at 2 rotor disk separation between tip paths, or between aircraft, turbulence from rotor wash *is not* incurred at level or slightly elevated positions.

Maintain uniform separation. Pity the poor aviator flying the number four aircraft in an echelon formation when uniform separation is not maintained. He is not unlike the end man on a 20-man "crack the whip." Each movement, especially in lateral separation, is grossly exaggerated by the time he must execute his movement to maintain his proper separation.

If flying at the end of, or in an intermediate position in, an echelon (3 or more aircraft in echelon) and the aircraft on which you are flying is erratic in altitude control, do not fly altitude on it but on the helicopter ahead of it. This is an apparent contradiction to the first principle. We again picture "Jack on the end of the whip." As long as this is a true formation, with a single mission, we apply the heretofore unspoken principle of "make it easy on yourself." Formation flying at best is greatly fatiguing.

The erratic individual will eventually settle down and control his altitude, so just let him

All approaches and takeoffs should be made to a

Maj Kerfoot is Assistant Chief, Employment Division, Department of Tactics, USAAVNS, Ft. Rucker.

flop around the blue until he does relax and enjoy the trip. Of course, if *all* helicopters ahead of you are erratic in altitude control, then one of two procedures may be applicable:

Examine your own flight technique and altitude control.

Grin and bear it.

Do not change relative position unless an airspeed-erratic pilot moves toward you in formation. The comments above apply here, too. By moving toward you the airspeed-erratic pilot hazards your aircraft. Therefore, for safety reasons, you may find it necessary to further reduce your own airspeed or even, in extreme circumstances, to break formation.

As in the case of the individual aviator in formation, the do's and don'ts of flying as formation leader are based on solid sense. As formation leader:

Maintain a constant airspeed, altitude and heading. Again, look at the poor individual on the end of the whip. Each unnecessary movement or change the formation leader makes is greatly exaggerated by the time it is passed down the formation.

Do not exceed 10° bank in turns. This is the one principle which may not be followed as a unit develops its proficiency. When proficiency is obtained, this degree of bank may be exceeded and free cruise employed as depicted in paragraph 96b and figure 40 of Change 2, TM 1-260.

Plan turns sufficiently ahead to avoid excessive bank or overshooting routes. Again, this is contingent upon the status of unit training. Planned turns are especially applicable in airmobile operations, particularly when required to adhere closely to specified routes. At 60 knots and at a 10° bank, it requires over ½ mile to execute a 180° turn.

Lastly, let's take a detailed look at the landing and takeoff techniques of good helicopter formation flying. The two secrets for a good formation are in the leader's overall technique. If his every maneuver, even the slightest turn or airspeed change, is at a constant rate, the wingmen exert very little effort in maintaining station. The other secret is in the use of power. If the leader uses the absolutely minimum power required to execute any maneuver, then his wingmen will never have to exceed their available power to follow him in that maneuver. Again, they will be able to maintain station throughout the execution of all maneuvers. Effective and professional formation flying requires that:

All approaches and takeoffs be made to and from the ground with absolute minimum hovering. This becomes especially important when operating under maximum load conditions. This procedure permits each helicopter to operate in as nearly undisturbed air as possible, thus deriving maximum lift and requiring minimum power under the existing circumstances. Further, if on a troop lift, the troops and their equipment are least effected by rotor wash and the resulting wind-blown debris.

In landing, all helicopters in the formation touch down as nearly simultaneously as possible. The helicopters in the rear of the formation use a slightly greater rate of descent in order to achieve a simultaneous touchdown. This is an extension and refinement of the principle above. It permits landing in relatively undisturbed air under critical gross weight-density altitude conditions using minimum power.

When taking off, all helicopters break ground simultaneously. The lead helicopter accelerates slightly faster than in a normal takeoff, while the trailing helicopters execute a normal takeoff. When operating under maximum load conditions, this principle allows all helicopters within the formation to reach translational lift at approximately the same time. It permits the use of minimum power by obtaining maximum lift in relatively undisturbed air.

The foregoing are basic principles. If properly applied they will assist the individual aviator in developing and increasing his skill and proficiency in formation flying. They also will assist the unit commander in enhancing his unit's formation flying capabilities. It cannot be overemphasized that good formation flight is dependent upon constant practice which is well supervised, controlled, and critiqued.

om the ground with absolute minimum hovering

SOMETHING MISSING?

A 24TH INFANTRY Division fuzzy-headed lion named ZeD has joined the battle against a fuzzy-headed monster called irresponsibility. Victory is expected to produce Zero Defects in military equipment maintenance—and 100 percent combat readiness in the division.

ZeD will appear on division posters as part of a new campaign, "Zero Defects" maintenance program. He will point out in various ways that 90 percent combat readiness is not good enough; that every man in the division must learn to be a lion tamer of complacency, indifference and irresponsibility toward his job and his equipment, and overall military effectiveness.

An aviation officer checks OH-13 rotor assembly hub during time set aside for new Zero Defects maintenance program.

The Zero Defects program is an adaptation of the much publicized approach used by civilian enterprise (see "Zero Defects," March 1965 DIGEST). The key to this approach is instilling in the individual the desire to pull perfect maintenance on every job.

An item produced for the Army may contain as many as 250,000 complex and interdependent parts. And items must perform according to specifications. A poor solder joint in one of these parts may result in the loss of thousands of dollars or, even more costly, a combat operation.

Industry must produce equipment quickly and efficiently. Years of manufacturing experience, plus a highly refined quality control system, produce tools of war. When an item is accepted by the Army, the problem of ensuring that it will perform according to specifications must be faced. Equipment as complicated as the Pershing missile or as simple as a squad tent must be maintained in a condition deemed by supply and maintenance people as "combat ready."

A lack of responsibility is usually the culprit in most cases of equipment damage and malfunction. Here's where ZeD steps boldly into the fight. He helps ingrain a sense of responsibility into every person servicing equipment to maintain it in perfect condition. A planned program of "by the numbers" maintenance is the object of a vigorous drive by ZeD within the division.

Emphasis on the individual's responsibility to his assigned equipment — whether binoculars, M-60 tanks, or Beavers—will be spirited. The program will include a daily "Zero Defects" hour in the 16 hours a week of scheduled organizational maintenance. Supervision of the ZD hour will begin at the highest levels of command with on-the-spot supervision of work.

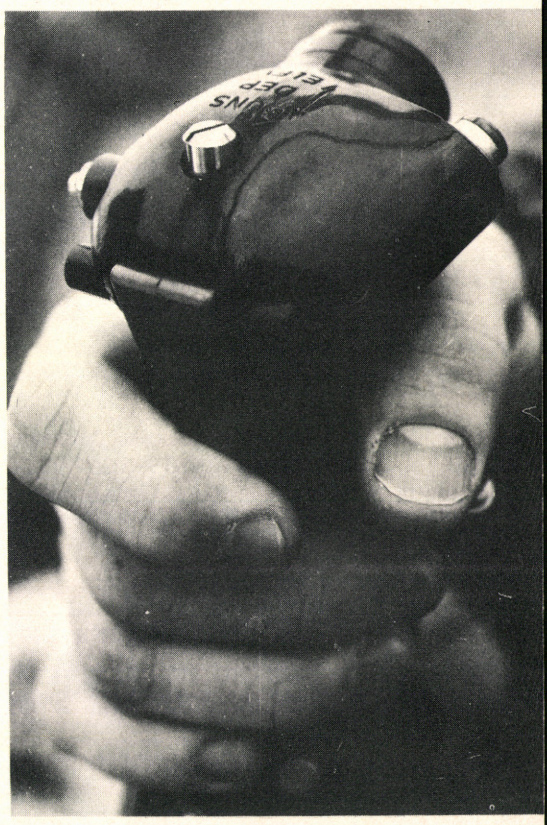
A certain area of an item will be inspected and corrected daily. For example, Monday's ZD hour may center around Jeep fender bolts. During this hour all fender bolts will be checked and tightened if necessary. Tuesday all division radio antennas may get a thorough inspection.

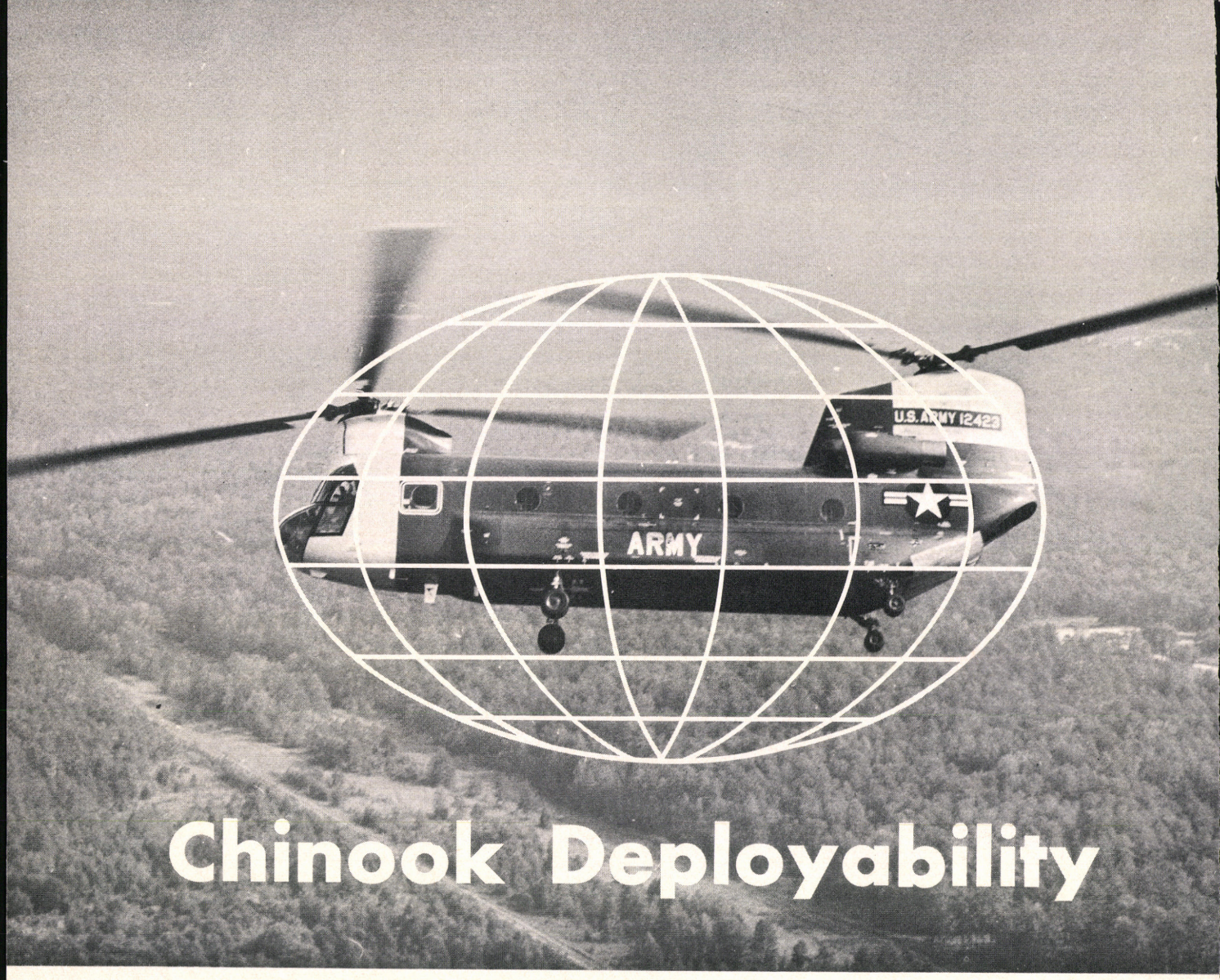
The commander may understand an item's capabilities and needs, but the enlisted men service it. The responsibility to keep equipment combat ready falls to these men. The slightest oversight can have disastrous results. A loose nut in an OH-13 rotor assembly can cause the chopper to crash. A loose radio tube in a PRC-10 can interrupt a platoon leader's report to his CO during an assault.

Army service schools exist to give the soldier a good dose of information on any item he will work on. This, coupled with day to day experience with the equipment, should ensure that the item is always in good working order. However, the intangible ingredient of responsibility — a man's responsibility to that item—is also necessary.

Integrated into the maintenance period, ZeD's program will get definite results on a division-wide basis — provided the individual responsible for the equipment senses the importance of being 100 percent ready. The tools, the time, and the emphasis are given to his mission. It is now up to him — and ZeD.

Machinegun trigger mechanism (OH-13) is checked by pilot during intensified Zero Defects program





Chinook Deployability

Captain Leonard H. Burroughs

SINCE THE first helicopter was obtained a single increasingly significant capability has been lacking and has hampered the strategic movement capabilities of Army Aviation—SELF DEPLOYMENT. To further magnify this problem let us consider the ships and transport aircraft, parts and maintenance tear-down and build-up necessary to move 3 helicopters or even 400 from the continental United States to an overseas area of operations. Then consider such a movement if the aircraft had a suitable and dependable ferry capability. Staggering isn't it?

This article presents the conclusions and recommendations of an extensive study on CHINOOK DEPLOYABILITY, conducted by the 228th Assault Support Heli-

---

Capt Burroughs is with the 228th Aslt Spt Hel Bn., 11th Air Assault Division (T), Ft Benning, Ga.

copter Battalion, 11th Air Assault Division, Fort Benning, Ga., concerning this vital subject.

To fully qualify all conclusions in the minds of the readers, and to erase doubts that major and minor factors had not been considered, the following resumé of considerations in deployability is offered:

Type of war — sophisticated or unsophisticated.

Operational capability upon arrival at destination.

Transport or deployment means available — both military and civil.

Worldwide bulk fuel storage.

Availability of critical transport media in both limited and total war.

Current and forecast inventory of shipping.

Current and forecast inventory of civil and military aircraft capable of transporting the CH-47A.

Assembly and disassembly data and manhour requirements.

Cocooning materials requirement.

Current and scheduled Chinook capabilities.

Deployable routes for ferry.

Route weather.

IFR and anti-icing capability.

Training.

Navigation.

Maintenance support.

Air-sea rescue.

Security.

Alternate refueling possibilities.

Sea Movement. The CH-47A can be deployed via the *Bogue* class carrier if deck loaded. Carrier elevators will not accommodate the Chinook. Either cocooning or daily fresh water washing would be required, along with limited preservation of exposed mechanisms. Forty-four Chinooks could be deck transported aboard a single *Bogue* class carrier.

An entire Chinook battalion (48) plus maintenance float aircraft (6), personnel, equipment, and complete support maintenance can be transported aboard a single *Essex* class aircraft carrier. Carrier elevators will accommodate the Chinook for hangar deck stowage. However, rotor heads must be removed and aft gear kneeling kits installed to reduce height.

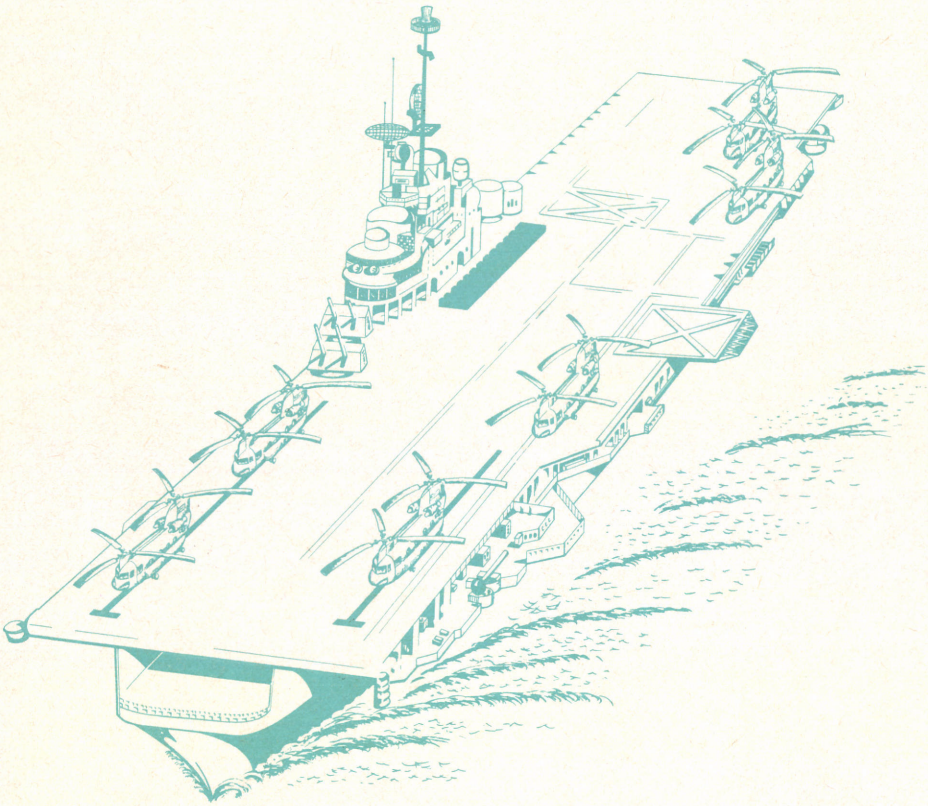
Air Movement. Possible via the C-133A and C-133B Air Force transport aircraft. Two Chinooks can be squeezed into one C-133A, a single Chinook in a Bravo. The major limitation here is the extensive disassembly and reassembly required. This includes removal of heads, transmissions, fuel pods, aft pylon and wheels. Though obviously not a desirable means of deployment, it still represents an answer.

Under total or mass mobilization circumstances it is doubtful that either means would be available to deploy a large number of CH-47s without depriving the Armed Forces of a major strategic capability for X number of days or weeks.

Ultimately the most effective means of deploying the Chinook is *flight delivery*. So, how do we accomplish this mission?

First: In its current configuration (33,000 pounds maximum gross weight, hover out of ground effect, sea level, standard day) the Chinook can be flight delivered to any point on the globe via the northern route to Europe: Goose Bay, Greenland, Keflavik, Iceland, Scotland, Continent. Maximum range with internal tankage: 800 nautical miles with 10 percent reserves. Winds are favorable a major part of the year. Greatest problem: IFR conditions and moder-

Two Chinooks can be squeezed into one C-133A, a single Chinook in the B model. Engines, rotors, transmissions, fuel pods, wheels and pylons have been removed.



Forty-eight Chinooks, personnel, equipment for complete support maintenance can be deployed aboard Essex class carrier

ate to heavy icing a large portion of the year. Conclusion: a deployable route, but not a desirable route because of weather limitations. This is the single route by which the Chinook can be deployed in the current configuration.

Second: The Boeing Company's Vertol Division was scheduled to incorporate engineering changes in the Chinook that would provide a maximum gross weight of 38,550 pounds and a ferry gross weight of 43,700 pounds by December 1965. This increase, coupled with a suitable auxiliary fuel tankage system, will provide a second route: Newfoundland direct to the Azores — direct Continent. Now we have two routes. However, this still severely limits the overall strategic deployment capability of the CH-47. With multiple routes available to the European Continent it may well require weeks to ac-

Deflated 2,000-gallon capacity bladder. When full should give CH-47 a range of 800 nm.

complish a move to the southwestern Pacific islands. Next question: How can we go west?

Preliminary research by *Boeing-Vertol* in conjunction with the 228th Assault Support Helicopter Battalion indicates that air-to-air refueling from C-130 tanker aircraft is a strong and hopeful possibility. Modification of drogue lengths and testing of flight techniques will be proof of the pudding. A capability such as this would allow traverse of the Pacific via Hawaii (2,200 nm). Along this route annual fair weather prevails, little icing at the lower flight levels and, most important, a worldwide, multiple-route deployment capability, both east and west. Responsive. . . !

Perhaps the question has now arisen regarding auxiliary tanks. Several systems are readily adaptable to the CH-47. Among these are the KC-97 auxiliary tank, 1,800 gallon — a good system with minimum plumbing. Two can be fitted into a Chinook to accommodate the modified 43,000-pound ferry weight, and will provide a 1,200 nautical mile nonstop capability with 10 percent reserves. The 500-gallon collapsible drum provides an alternate system. Still another, and indeed a hopeful one, is a 2,000-gallon collapsible rubberized bladder with baffles being developed specifically for the Chinook.

Initial tests conducted by the 228th Assault Support Helicopter Battalion reveal no problems of reportable significance. Fifteen-hundred gallons were carried per load under field operating conditions and in varying turbulence and aircraft attitude conditions. The baffling appears to be adequate and the load shift is absorbed by the isolated floor of the aircraft. The single drawback will be that the bladder size will not permit the maximum fuel load allowable under the proposed ferry gross weight of 43,700 pounds.

A bladder of increased size will hopefully provide ferry tankage to the maximum range, as well as field refueling units, capable of being folded and stored in minimum space. This represents a sincere attempt to develop an item of multiple usage.

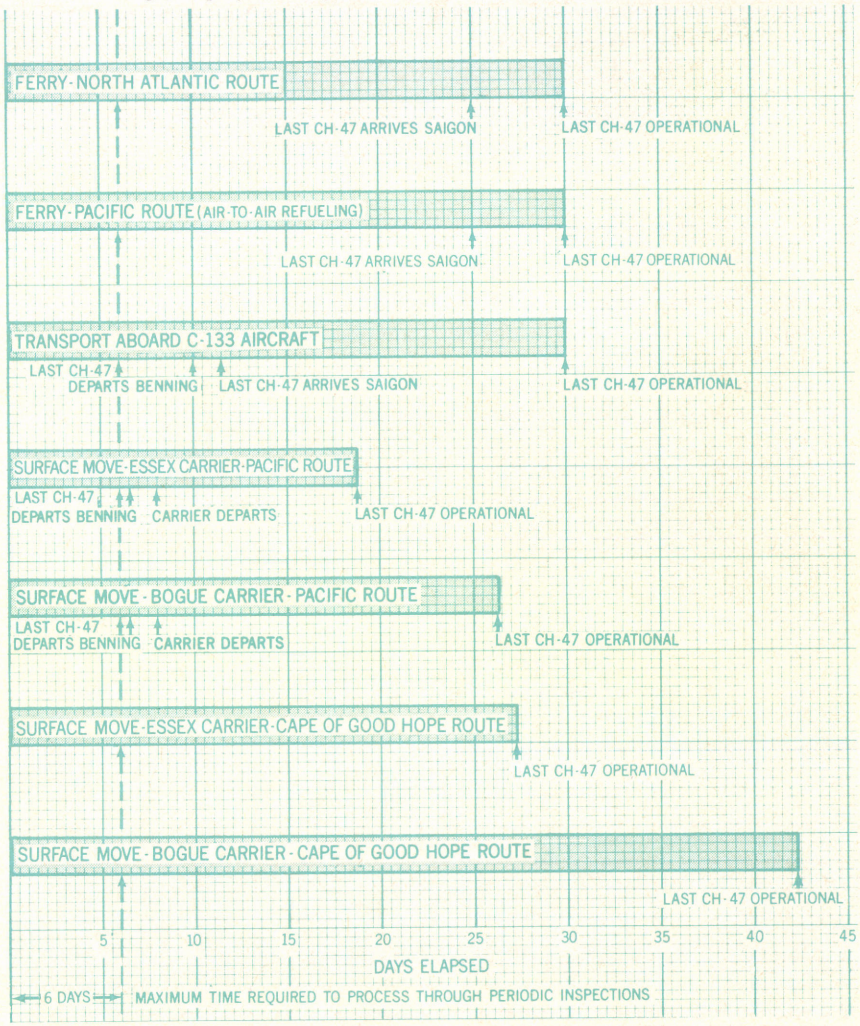
The chart illustrates the deployment optima available and the estimated time required to move a battalion of 48 Chinooks from Fort Benning, Ga., to Saigon, Republic of Vietnam.

To attempt a comprehensive solution of CH-47 mobility would be folly. It's a big machine with big problems. But a step has been taken in the direction, the solutions to which are not only at hand, but are being developed and improved.

If you're interested in these projects (major units) we'll be happy to provide a complete copy of the CH-47 deployment study on request. In return, let's not waste the wealth of information on this vital subject that has accumulated over the years. Send your ideas and facts; we need them and we'll use them:

Headquarters, 228th Aslt Spt Hel Bn
11th Air Assault Division
Fort Benning, Ga.

CH-47A strategic deployment options—Fort Benning, Ga., to Saigon



Roller Coaster of Death

SFC Glenn E. Hudson

MAN, I HAD her to the firewall, nose up and I was going down like a rock. I don't know what happened, but another thousand feet and I would have bought the farm!"

Many aviators have encountered a similar situation. It is unlikely that anyone who has had such an experience will ever forget it.

This situation has been a problem to aviators since man first began to fly. Some pilots know it as a standing wave, lee wave, or mountain wave. To me it's a "roller coaster" ride that can end in disaster.

A mountain wave does not always have a roll cloud or the lenticular alto cumulus; that is strictly the classic picture.

Basically, but not necessarily, the situation is associated with a low pressure trough moving across a relatively flat area towards mountains. Other meteorological parameters are involved, but for general use consider this: When you see a trough, whether dry or wet, approaching a mountain area, use extreme caution — the old roller coaster will probably be there.

Minor mountain waves will even occur in an extremely small area with no apparent trough at all. A good rule to use is this: If at any level below the mountain peaks your winds exceed 25 knots and have an angle of incidence approximately 60° to 90° into the mountain range, look out! The more direct the angle of incidence and the higher the winds below the level of the peaks, the more violent the effects.

Helicopter pilots can encounter the same problems as fixed wing aviators, plus one other. If you are like most rotary wing aviators you don't like strong winds, so you duck down the lee side of the mountains and scoot up and down the valleys. When a mountain wave condition is present, you will hit the most dangerous areas right where you like to fly.

Sgt Hudson is with the U. S. Army Meteorological Team, Ft Huachuca, Ariz.

From the base of the mountains to about 7 miles out, downdrafts exist that can push you into the ground before you know it. From the 7-mile area out to about 10 miles, updrafts are just as violent. Turbulence will decrease as the distance from the mountain area increases. Wave amplitude sometimes changes until it becomes nil or hits another mountain range, and then here we go again.

A classic example of this situation is a rock in a stream. On one of your fishing, hunting or hiking trips you have probably encountered a quiet stream with stepping stones across it. Notice how the water flows gently around and between the stones, with small eddies and swirls occurring on the downstream side. Nice, isn't it?

But notice what happens when somewhere upstream a sluice gate is raised, increasing the flow of the stream. Look at the stepping stones now. No longer are gentle eddies and swirls behind them. Water rushes at the stones, spilling over them in a wave. A depression is formed on the back side of these stones, and a series of up and down motions takes silt from the bottom of the stream and carries it along with the churning water. As we move downstream away from the stepping stones, the waves become ripples; then the ripples become smooth. The water clears and all is serene.

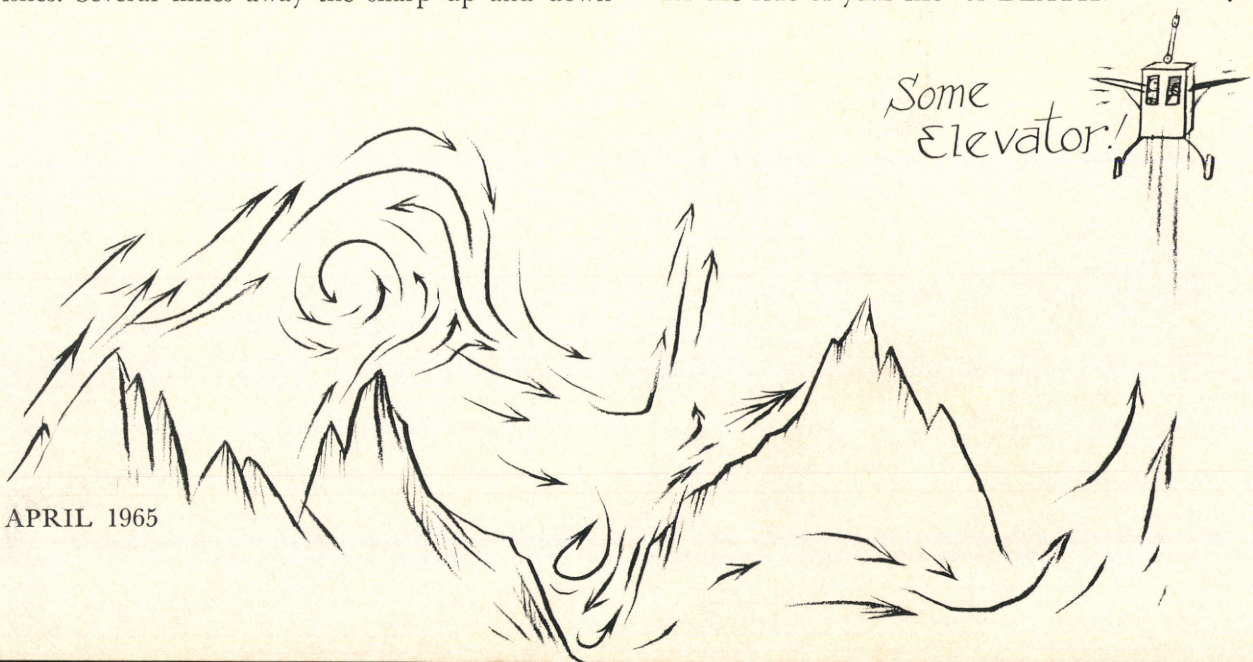
The same state exists in our atmosphere. The mountains are stepping stones and the moving air masses are water. When conditions are right, we have only gentle eddies and swirls. When the conditions are wrong, air spills over the mountains, with up and down drafts sometimes exceeding 5,000 feet per minute. Even as water tears silt from the stream bed, air currents pick up dust from the earth. This dust is deposited downwind, as the silt is deposited downstream. As distance from the mountains increases, the force of the wave diminishes. Several miles away the sharp up and down drafts become gentle, rolling motions that finally cease altogether.

If we place a small chip of wood upstream from our stepping stones and let it flow downstream, we could watch it dart over the stones and into the depression behind. It would pop to the surface from natural buoyancy and once again disappear as succeeding waves force it under. We can do the same thing in our atmosphere with a pilot and plane, but I doubt seriously if either has enough natural buoyancy to bounce back like a chip of wood.

With the mountain wave it doesn't make any difference whether you go with the flow or against it; the final results are the same. Here are some suggested rules for flying in areas where mountain wave conditions are suspected to exist:

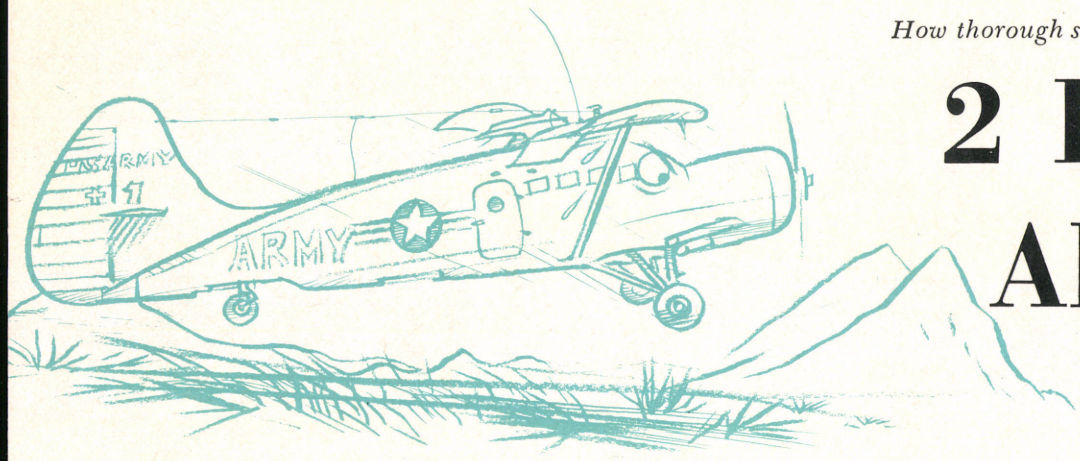
- If possible, fly around the danger area.
- If you must fly over mountains, fly at least 50 percent higher than the height of the mountain range.
- Avoid cloud formations of any type on the lee side of mountains.
- If caught in an updraft, use it to gain altitude before you encounter the downdraft which follows. Remember, you go down a lot faster than you go up.
- Do not place too much confidence in your pressure altimeter; usually an induced low pressure area is on the lee side of the mountains.
- Do not fly high-speed aircraft into the wave condition without first reducing power. Structural damage may result.
- Avoid penetrating a strong mountain wave on instrument flight.

Your weatherman will probably be able to tell you when and where you can find the next roller coaster ride. If you enjoy thrills be sure to catch it for the ride of your life—or DEATH!



How thorough should a pilot's preflight be?

2 Flights Aborted



Major Milton C. Sheridan

THANKSGIVING Day was clear and crisp with a cool –35° F as we drove the 15 miles through the arctic night to Thule AFB, Greenland, from Camp Tuto, the home of USA Polar Research and Development Center.

We had just finished our Thanksgiving dinner in the mess hall, and it had been a dinner to remember. I was thinking to myself that this would be my last flight to Camp Century, the city under the ice. We had three passengers, their baggage, fresh vegetables and fruit, a few other parts, and as always MAIL. On Thanksgiving Day this flight would certainly be a morale booster for those at Camp Century.

Thule looked deserted as we drove through the lighted streets to the hangar. We drove inside the hangar and parked the station wagon near the Otter for unloading. Specialist-4 Pecora, the crewchief, had checked the aircraft and it was ready for the flight. While he weighed and loaded the cargo, Captain Dupree and I both made a preflight of the aircraft. The normal walk around inspection found everything ready. We filled out a 175 and phoned the information to base operations, checked the load, seated the passengers, and we were ready to depart.

The horn from the huge hangar doors sounded as they opened. The tug began to move the aircraft into the arctic night, and the warmth of the hangar was left behind. The Otter was pulled well clear of the hangar, tow bar disconnected, and an immediate start attempted. The engine sound shattered the still arctic night then settled into a steady purr. Normal checks were made and taxi instructions were received to move the aircraft to the yellow line. As throttle was applied the rpm fluctuated 200 to 400 rpm. Thinking it was possibly the cold we continued. At the yellow line we started a normal runup, but the rpm still fluctuated. Running the propeller through did not help.

We taxied back to the hangar and shut down the engine after showing Specialist Pecora the problem. The aircraft was pulled back into the hangar and the engine cowling removed. Repair was started while our passengers moved into the break room to warm up and have a cup of coffee.

Specialist Pecora found our trouble to be the governor wires with burnt insulation shorting out on the exhaust. The wire was taped and secured away from the exhaust pipes.

While Specialist Pecora was working on the aircraft Specialist-4 Candalissa was holding the light and handing tools as needed. He had placed his hand on the spark plug for number nine cylinder and quite by accident found the spark plug loose. He proceeded to tighten it with his fingers. He was quite surprised to have the spark plug in his hand and out of the cylinder with the steel insert still on it. A close inspection found the cylinder cracked from the front spark plug well to the rear spark plug well. The flight was canceled.

The crewchief had made a runup of the engine the day before without having fluctuated rpm and his inspection had failed to uncover the cracked cylinder. The preflight had also failed to detect the bad cylinder. How thorough must a preflight be by the pilot? It certainly demands more attention than the much talked about kick of the tire and

---

Maj Sheridan is Flight Commander, Flt I, HIFC Branch, Instrument Division, Department of R/W Tng, USAAVNS, Ft Rucker.

climbing aboard. Even after thorough checks aircraft can still have maintenance problems.

Many times it is not maintenance, but an occurrence at the right time and right place that could be prevented by a more thorough preflight. One such incident happened to me at Fort Campbell in February 1958.

It was a clear, cold morning with a heavy frost. On arrival at the aircraft the maintenance crew was already removing the frost with a Herman Nelson heater. I went ahead with my preflight and was ready to start as they finished.

The flight was to Leavenworth, Kan., and I was copilot as I had not completed my transition in the U-6A. I started the airplane and taxied it up to the hot spot and shut down. The pilot came out and he also made a preflight while we waited for our passengers. The aircraft was free of frost and no water was left on the surfaces.

As soon as our two passengers arrived we loaded and cranked the engine. We taxied to the yellow line, made our runup and were cleared to the active.

The Beaver moved to the center of the runway and the pilot set the directional gyro and added power. Everything seemed wonderful; the sun was coming up, beautiful weather all the way, and nothing but flying for the day.

However, at 50 feet I had an odd feeling that something was wrong. My look at the flight instruments told me the airspeed indicator was still zero. The vertical speed indicator was also zero. Looking out I knew very well we had the required airspeed as well as being in a climb.

I looked at the pilot and he looked at me. He called for landing instructions. We remained in closed traffic and set up our approach a little faster than normal (thank goodness for a 11,800-foot runway).

We landed without incident and taxied back to operations for parking. After the aircraft was shut down I found the trouble—ice in the static port. A normal inspection of the static port would not reveal the ice unless you were a short man, but looking at it from its level you could certainly see the ice. Undoubtedly the maintenance crew had wiped over the static port, forcing water inside while removing the water from the surface and since it was about 15° F the water froze inside.

After the ice was removed the flight was resumed and completed without incident.

The two experiences above are presented to emphasize the importance of a thorough preflight. During uncomfortable weather some Army Aviators tend to minimize or overlook items of the preflight and go to the kick the tire (skid), climb aboard type inspection.

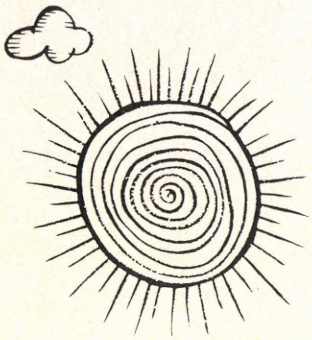
For those Army Aviators just recently rated I say, Don't relax your preflight because there isn't an instructor around to check you. Improve your maintenance knowledge at every opportunity by reading the -10 and -20 concerning the aircraft you fly.

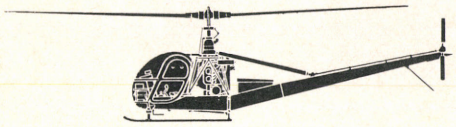
It's also been noted that the old pro can get a little careless. Maybe a few of you oldtimers might reconsider your preflight habits. A bad preflight is like three other items of no value to the pilot—runway behind you, altitude above you, and gas on the truck.

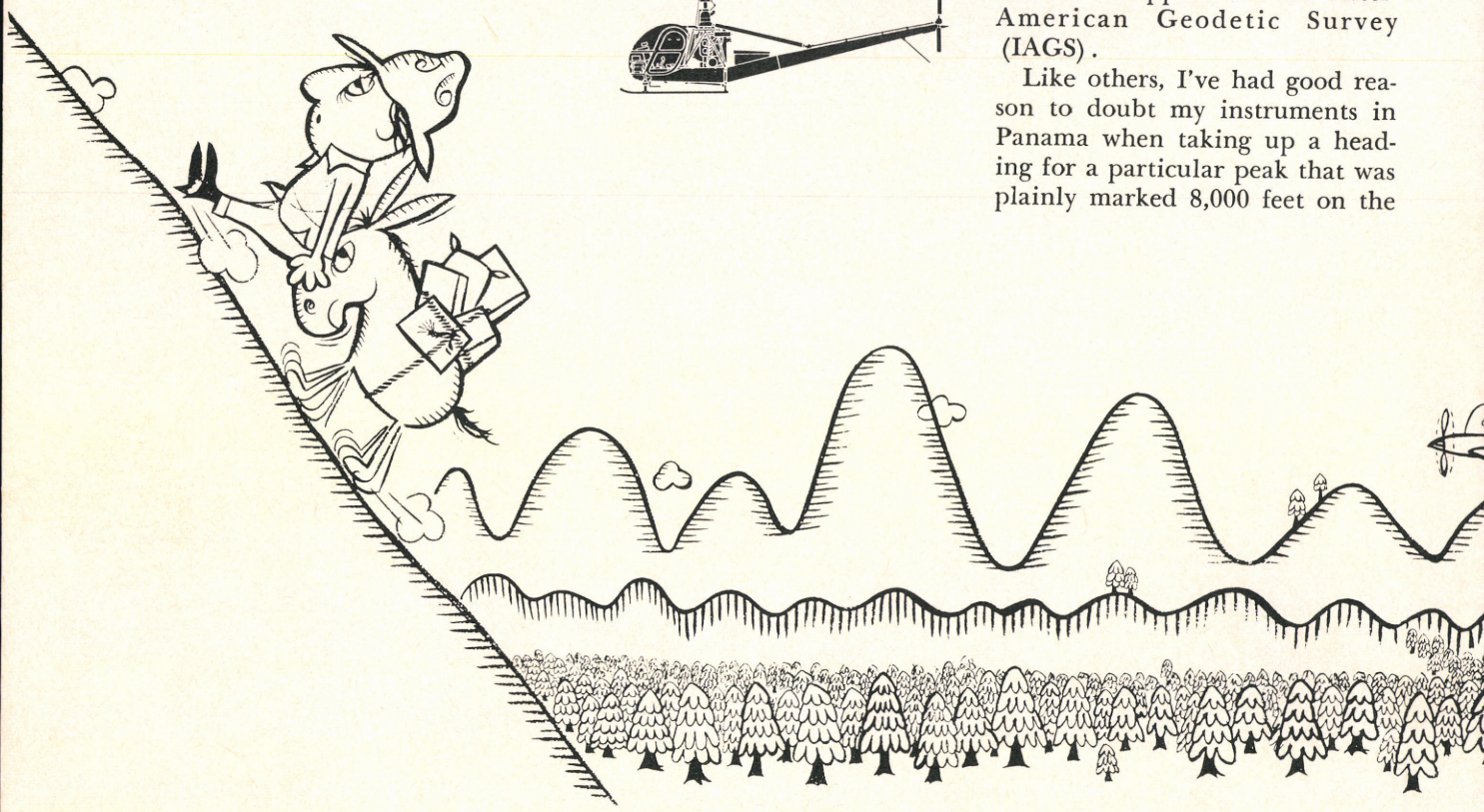
Cracked cylinder in this Beaver is similar to type found in Otter

Mountains To Be Moved

Lieutenant Colonel Jack W. Ruby (Ret)







SURPRISING as it may seem for a planet that now has close-up photographs of its moon, most of the world is only crudely mapped, and many of the most current maps are inaccurate to the point of being dangerous.

In fact, only 4 percent of the earth has been mapped to present-day, first-order standards of one error in 25,000 units. Even in the United States only 50 percent of the land is mapped to the accuracies expected from modern survey methods.

In Latin America, for example, a 125-mile-long mountain range near the Canal Zone doesn't even appear on present charts. The bold fact that it is there has become quickly obvious to pilots: most of it is 5,000 feet or higher. The range was discovered by the 937th Engineer Co (Avn) which flies some 15,000 hours annually over an area of two million square miles in support of the Inter-American Geodetic Survey (IAGS).

Like others, I've had good reason to doubt my instruments in Panama when taking up a heading for a particular peak that was plainly marked 8,000 feet on the

chart and not finding the checkpoint when I got there. The 937th Engineer Co (Avn) later measured it at less than 4,000 feet.

Throughout South America, we found many such peaks—thousands of feet higher or lower than what they were previously thought to be. Some were found to be as far as 25 miles distant from previously indicated map positions.

Yet the need for maps, accurate ones, is universal. Not only the pilot and the military demand them; economic exploitation of the world's natural resources depends upon advance parties of surveyors. Development of roads, railways, cities, irrigation projects, flood control and powerplants are just a few of the countless engineering tasks that begin with a map. The existence or lack of accurate maps affects virtually every person in the world.

Why, then, do we have this map gap?

Land surveying — the tedious jungle-trekking, mountain-climbing chore that has to be accomplished before accurate maps and charts begin to take form—has always been plagued by these classical problems: time and terrain.

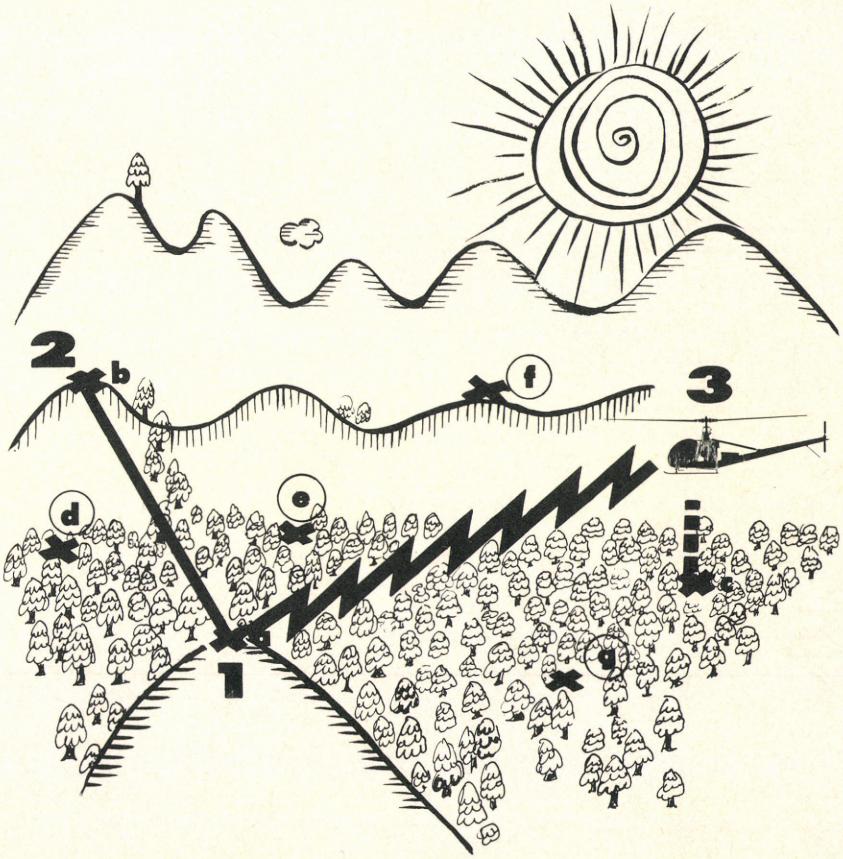
Early attempts to survey the hinterlands — long before Kitty Hawk — involved pack animals, crude instruments, and many months of hardship to measure distances and elevations in areas of only a few square miles. Even the modern surveyor has had to pack-in to get the job done in areas too rugged for ground vehicles—until he learned to use the helicopter.

Helicopters have made it possible to shuttle crews, equipment, and supplies across difficult terrain in minutes instead of days. In the past decade, development of electronic distance-measuring devices that transmit high-speed microwaves between master and remote units has permitted survey teams to obtain first-order accuracy without physically measuring the distance on the ground.

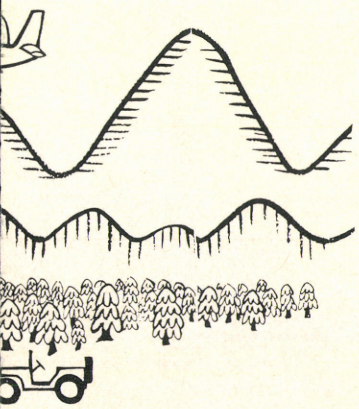
On a typical ABC mapping operation the survey party will determine hundreds of supplemental control points. These locations, often called "picture points," will be used to convert aerial photographs of the terrain into a highly accurate topographic map.

1. Basic control point a was measured by ground parties and marked with bronze monument before mapping operation. Determination of basic point includes considerations of mean sea level, temperature, and many other factors affecting accuracy. From this location, mapping crew sights on helicopter with Hydrodist master and theodolite.

2. Mapping crew at control point b also take angle and distance sightings on hovering helicopter with Hydrodist and theodolite. 3. Helicopter, equipped with remote Hydrodist unit, marks supplementary control point with paint bomb, then hovers above timber while crews at a and b take readings. When positions and elevation measurements are complete, the aircraft will move to other supplemental control points (d, e, f, g) for new determinations.



Col Ruby (Ret) is assistant military requirements manager for Hiller Aircraft Company. He formerly commanded the 937th Engr Co.



Using helicopters, nearly inaccessible control points are easily spotted and used by survey crews in today's mapping operations

But these electronic units are restricted to line-of-sight operation, necessitating elaborate ground preparation for placement of equipment in rugged terrain. In heavy timber or dense jungles, for instance, high towers are needed to raise the electronic units above treetops. Although the towers are portable and are transferred from site to site by helicopter, their erection is costly and time consuming. In Latin America, crews of local Indians are hired to laboriously clear the tower sites as well as other remote landing and triangulation positions. (See "Tell Me A War Story," March 1965 DIGEST.)

Until now the helicopter and its electronic teammates have only *alleviated,* not eliminated, the time/terrain problem. However, an entirely new survey system—every bit as revolutionary as when the surveyor added the helicopter to his gadget bag—has recently been perfected and is now operational in United States Geological Survey (USGS) and Bureau of Land Management projects.

Called AirBorne Control Survey System (ABC), the new technique makes the helicopter an actual survey tool for the first time.

Serving as a roving member of a triangulation team, the specially equipped helicopter hovers motionlessly over a preselected spot just long enough to allow ground crews many miles away to zero-in on the aircraft and take readings.

USGS officials began experimenting in 1959 with an electronic instrument known as the Tellurometer *Hydrodist* which can be used to read distances accurately even though the recording instruments are in motion. Investigations with this equipment mounted in a helicopter showed that ground crews at master stations could measure distances and read angles directly to the airborne platform — instead of constructing costly ground stations at each point to be located.

Subsequent USGS research yielded three additional pieces of equipment to accompany the airborne hydrodist:

—An optical unit called the *hoversight,* developed by USGS engineers to enable the pilot to plumb the aircraft over the supplemental control point to be located.

—A *height indicator* to determine altitude of the helicopter above the ground. A calibrated dial counter, graduated in feet, records the length of a weighted Dacron line as it is lowered to the ground below.

—A high intensity *rotating beacon* to provide a visual target for readings from distant ground stations.

Parallel development by Hiller Aircraft Company (builders of the Army's OH-23 series) of the *L rotor* and its unique stability augmentation system contributed the final ingredient to make the ABC system a reality.

Here's how the new system works:

Before an area can be mapped, ground parties determine a few basic control points, and the entire terrain is photographed from the air. These photographs are not adequate for mapping, however, until many hundreds of supplemental control points are established for vertical and horizontal accuracy requirements. Establishing these supplemental control points is the task of the ABC system.

Survey crews equipped with Hydrodists (for distance measuring) and theodolites (for angle measuring) are transported by helicopter to the basic control stations. Here the crews remain while the ABC helicopter goes out into the field.

The ABC pilot flies to the nearest supplemental control point to be located, guided by his airborne engineer. When precisely over the control point, the pilot uses the hoversight as a bombsight, dropping a paint bomb or weighted color panel on the spot. This not only provides a more definite hovering target but also assists future crews in locating the point again, if necessary.

The helicopter hovers at the most ideal height above the point, consonant with good visibility from the basic control station and the pilot's ability to hold the point in the hoversight without error. Hovering height ranges up to 600 feet above ground, beyond which error increases are unacceptable for mapping. (Hoversight refinements, however, may permit altitude increases.)

When the helicopter is directly above the point to be measured, the pilot signals the basic control station by radio. A number of distance and angle measurements are taken for maximum accuracy. When a second base station is used, the pilot rotates the antenna toward the new station, and the process is repeated.

During hovering the airborne engineer records meteorological data, height above ground, antenna direction, control point data, and time of observation. When all measurements are complete—a matter of a few minutes—the helicopter moves to the next of many points to be measured that day.

Upon completion of the ABC phase of the total mapping process, the new data is fed to computers for conversion into map points. The resulting preliminary map is taken back to the field for a final check, the addition of features, contours, and classification of roads, streams and other landmarks.

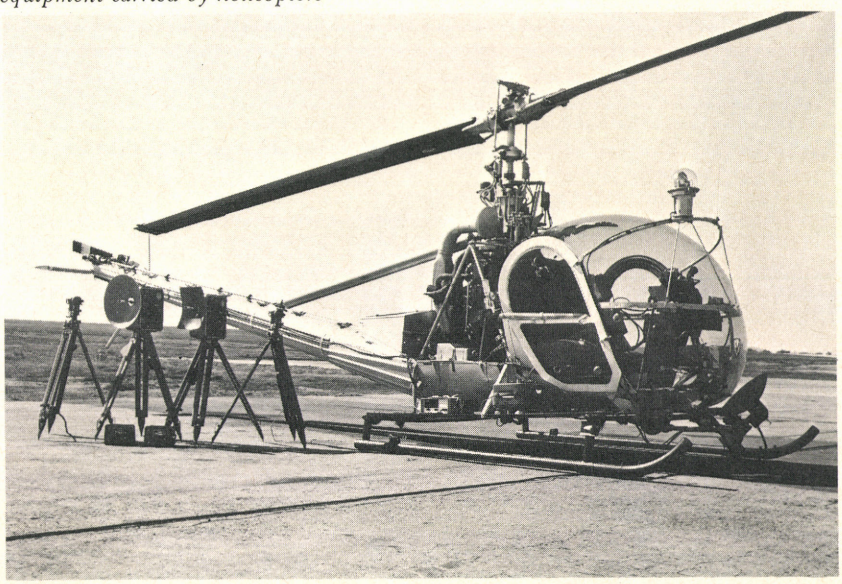
Initial tests of the ABC system have yielded excellent results in accuracy and efficiency. FAA certification of the electronic package in the Hiller ship has been obtained, as well as certification of the stability augmentation system so essential to the operation.

In Alaska, the Bureau of Land Management is surveying at the rate of 50 square miles per day with ABC, against only 6 miles per day using conventional methods. Another team in the southwestern United States completed a conventional 6-week, 200-square-mile survey in only 4 days using the ABC method.

Using the helicopter as an integral tool of survey, in addition to its traditional role as a utility vehicle, the ABC system can be adapted to such industrial and military uses as positioning offshore oil rigs, speeding battlefield survey for target acquisition, calibrating radar and spotting mines in naval operations, and extending survey control to offshore islands and underwater reefs. Demands for mapping newly emerging countries the world over make ABC one of the most promising geodetic developments in history.

And it will speed the "movement" of mountain ranges and peaks to their rightful positions and elevations on aeronautical charts.

The hardships associated with surveying the little known areas of the world are being eased with quick availability of scientific electronic equipment carried by helicopters



Productive Safety Meetings

This article has been adapted from the Flying Safety Officers' Study Kit, April-May 1964.

SAFETY OFFICERS? Me! WhatdoIdo? WhatdoIdo?

Don't moan. Sure you have great responsibilities and extensive duties, but you too can be a good safety officer—one who can effectively achieve an accident prevention record worthy of note.

The main worry of many safety officers is organizing and conducting effective safety meetings. Here you must be a leader and a motivator; you must be able to sell your safety program. Unfortunately, too many Army Aviation flight safety meetings fall far short of this goal of selling the program of accident prevention. However, the safety meeting can be one of the most effective methods of getting messages across.

The following discussion is offered as a guide to help you plan interesting and productive safety meetings. Of course, you must adapt and modify these suggestions to fit your particular requirements.

The safety officer meets three common problems in planning his safety meetings.

First, there is the matter of *time*. His duties are usually extensive, and he finds himself pressed for the time he feels is necessary to plan a really good safety meeting.

Then comes the problem of

sustaining *interest*. Safety meetings must be held regularly, and it becomes quite a task to repeatedly provide a program that is stimulating and educational for the same group of men.

The third problem is actually *conducting* the meeting. An unskilled chairman can bring confusion to the program with lack of control. Yet, overcontrol can easily stifle interest and kill a program.

TIME

Almost every safety officer has the problem of finding enough time to perform all his duties. One way to conserve time is to spread the responsibility for meetings. You should serve as organizer and coordinator of the meetings while someone else actually conducts the programs. When possible, you should decentralize your meetings for more frequent sessions involving smaller groups of men. Small meetings are easier to manage than large ones, and audience participation is more easily secured.

One effective method of decentralization is to place flight safety meetings on a competitive basis by assigning unit responsibility for each session. The safety officer would provide the topic and the individual unit would choose the form of presentation. This program could be used for either post-wide meetings or smaller ones.

Another technique to conserve the time of the safety officer is the use of audio tapes and films. They can be purchased, made, rented, or drawn from film libraries. Many commercial productions are excellent and can be adapted for many different situations. However, a moderately priced tape recorder provides the safety officer with opportunities to record material for later programs, record planned dramatic skits for speakers, or provide commentary for filmstrips or 35 mm transparencies.

With imagination and a little experience, a library of tapes can be built up for effective programing, and for interchange with other units for variety. Films are available from many agencies and provide vivid and dramatic impact to a program.

Of course the use of tapes and films can be overdone and become monotonous if not used imaginatively. But when carefully planned, they can provide variety and drama to safety meetings.

INTEREST

Entertainment is one way to get across a safety message. Just because the subject is a serious one does not mean that it must be boring and dull. Skits, pantomimes, and tableaux can be used effectively to generate interest and educate the audience. Other techniques for creating interest may be more effective, however, for your particular audience.

Careful planning is perhaps the most important tool the safety officer works with. A meeting date and a speaker do not make a successful safety meeting. Interest must be planned into the meeting. A productive meeting has three ingredients: an appropriate topic, audience anticipation, and variety.

The subject selected for the program must appeal to the audience. It must provoke controversy, stir up emotions, or generate curiosity.

The topic also must be significant. The safety meeting must educate the participants; therefore, the subject must be important enough to stimulate self-concern and serious thought.

How can you tell whether a subject is significant? Basically it must answer these questions:

Does it influence the way a man does his job?

Does it pertain to self-preservation?

Does it affect such basic motives as the desire for personal development, security, or approval?

The subject must be timely. If a meeting deals with a problem the men are facing at the moment, it is sure to interest them. Careful planning is necessary to organize meetings on a problem that is coming up. A spur-of-the-moment subject cannot be handled effectively.

A little hoopla never hurts

PUBLICIZING THE MEETING

It may appear to be unnecessary to publicize a meeting which aviators are directed to attend. However, effective publicity can build expectancy and a favorable frame of mind rather than one of resentment.

Notices, posters, bulletin boards, newspapers, and individual letters are all good publicity measures.

Colorful and illustrated notices and posters can be used very effectively. Newspapers (or perhaps television or radio programs) can be used to emphasize meetings of an unusual nature or those having outstanding speakers.

Timing is an important element of publicity. Your announcements should be planned to remind people of the meeting at least twice. They should not be so far in advance as to be ignored, nor yet so late as to preclude additional buildup.

Mailing or distributing individual announcements for the safety meeting when practicable have been found very effective. One safety officer developed an interesting variation of this technique by writing letters to the wife of each officer, asking her to remind her husband of the safety meeting on a scheduled day. This was followed up by a later "reminder" letter containing an announcement of the meeting. A third letter was sent to thank her for her assistance.

VARIETY

Repetition and routine can kill any meeting—even if the subject itself is interesting and well presented. To prevent boredom and lack of interest, something different should occur at each meeting. This variety can be introduced through topic, form, materials, and pacing of the meeting.

Don't let the meeting fall into a fixed pattern or format. Vary the order of presentation so that the audience doesn't know what to expect next. Choose topics that cover the whole variety of safety considerations. Don't concentrate on only one aspect of the subject.

Effective use of materials and careful pacing can add variety to your meeting. Supplementary charts, slides, tape recordings, etc., interspersed with speakers, can add high points that change the pace and keep up enthusiasm. Build your meeting to its climax and then disband while the interest is high.

If you select an appealing topic, publicize it well, and keep your meeting varied in form, you will have made a good start toward planning interesting and educational meetings.

SECURING AUDIENCE PARTICIPATION

Interest soon lags in passive meetings. The way to work up emotions is to get the audience into the program. Make them defend or advocate something; challenge them so they feel they have to respond, and then set up the machinery for doing so. Mutual interest is in direct proportion to the number of people who will speak out at a meeting.

Small meetings can be personalized by direct contact between the chairman and the audience, but in the larger meeting a more formal organization is necessary to gain audience participation.

The quick decision exercise. For small audiences, this is an effective attention-getter. The chairman describes a situation in which quick judgment is called for. When a critical point is reached, instead of revealing what the person actually did, he calls on a member of the audience to relate what he would have done.

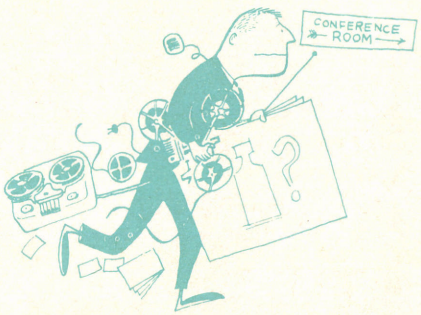
There is no lapse of interest because each man must be on the alert for the moment the leader might call on him. With larger audiences, this method could be modified by using the team technique.

Several techniques exist for securing audience participation in large meetings. Here are some examples:

Prearranged questions. To get the question period started, five or six people are stationed around the room with some questions previously formulated to arouse interest. If no one else begins the question period, they start the ball rolling.

Question cards. Many people have good questions but are reluctant to raise them in a large

Use variety in presentations



Effective safety meeting should stimulate audience reaction

gathering. Cards distributed before the meeting allow a reluctant person to write down his question. It also enables persons to write down questions as they occur to them. After the presentation is over, the cards are collected and answers given. Several variations on this method can be used.

Listening teams. This is a device for securing questions or reactions from the audience. Before the platform presentation the audience is divided into teams, and each team is asked to listen for a different point in the presentation. Questions or reactions are written down by each member and passed to a team chairman. He reports these contributions to the platform.

Observing teams. At demonstrations or film presentations, the audience can be sectioned off into observing teams. Each team pays particular attention to that part assigned to them. The pooling and reporting of observations is handled like the listening team.

Audience reaction teams. Where platform personnel do not mind being interrupted, several members of the audience may be invited to sit on the platform. Their job is to interrupt the speaker at any time they feel a point is confusing or needs clarifying.

Another way to use the reaction team is to have them raise questions for the speaker to answer. In this case he has no prepared speech, other than a few introductory remarks.

Buzz groups. This is particularly useful in large meetings where maximum audience participation is desired. It works this way:

The chairman introduces the problem, explains its background and significance, and makes clear what the audience is to discuss.

The audience, seated in movable chairs, is divided into groups according to row numbers, etc. The rows turn to face each other (10-15 for large audience, 5-6 for smaller) for the buzz session. A time limit is set. When the time elapses, the seats are returned to their original order, and the chairman (chosen by seat number or some other device) reports the opinions for this group.

The chairman of the group summarizes the views expressed and then conducts a general discussion regarding them.

This buzzing technique serves two purposes: It gets everyone into the discussion, and it protects people from personal responsibility for views expressed.

Subgroups. In meetings where the subject is broad or has many aspects, the audience can be divided into subgroups around specific interests. Each group should have a chairman and a recorder. Each subgroup meets separately, discusses the problem assigned to them for a specified period of time, then reassembles for a general meeting.

OTHER TECHNIQUES

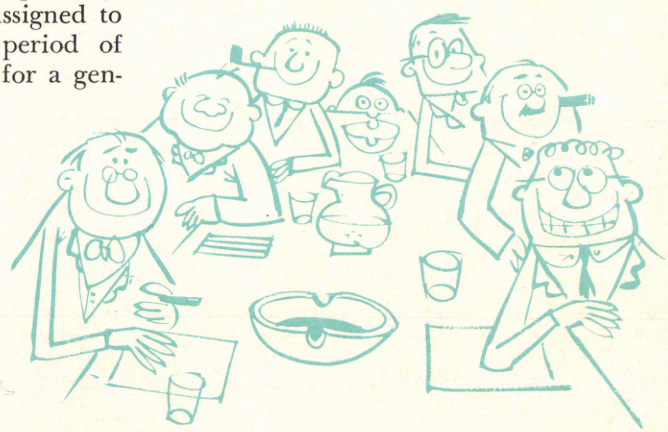
Other than the methods for securing audience participation, there are many other discussion techniques. Directed skillfully, they can result in a stimulating exchange of ideas and a fast moving meeting.

The panel. This is a seemingly informal, provocative discussion by several individuals, followed by group discussion. No set speeches are used. The chairman introduces the topic or problem and directs questions to panel members. Differences of opinion and interchange of views among panel members are encouraged. Members of the audience may ask questions and challenge panel members.

Although it appears to be spontaneous, the panel presentation must be carefully planned. Some considerations are the selection of a provocative topic, comfortable physical conditions, proper seating arrangements of the panel, proper time schedule with time allotted to each part of the discussion with the meeting running for 60 to 90 minutes, preplanning with the panel, and method of presentation.

The forum technique. Three to five members deliver prepared speeches on different aspects of a problem. After the speeches a brief discussion may follow among the group and then some questions from the audience, or a discussion may be held after each speech. Audience participation is

Carefully plan panel presentations



governed by the length of formal speeches. This method is best used for presenting factual matter about which the audience may have no knowledge.

The symposium technique. The symposium is similar to the forum except that more speakers are used and there is less opportunity for discussion. Usually speakers are specialists on different aspects of a problem. The audience may or may not be invited to participate, depending on time available.

As with all presentations proper preplanning and techniques must be used. Intersperse good speakers with poor ones, with the best saved for last. This closes on a high note.

For variety these basic discussion techniques may be combined with each other and with other discussion methods. Some possible combinations are: the debate-forum, the debate-panel, the lecture-panel, the colloquy panel, the dialogue-discussion, film panel.

CONDUCTING A SAFETY MEETING

We have discussed the preliminary planning necessary by the chairman of a meeting and some methods for securing audience participation. But his job is not finished with these details. Now he must confront the actual operation of a meeting.

Use coffee breaks to relax audience, renew attention, or change the pace

The physical setting. The room should be arranged to serve the purposes and audience of the meeting. Seating arrangements should be controlled so the audience will sit where you want them to sit and will not be distracted by open windows or the glare of sunlight. Heat and ventilation should be adjusted to suit the comfort of the audience, not the speaker's platform. Entrances and exits should control traffic to avoid disturbances.

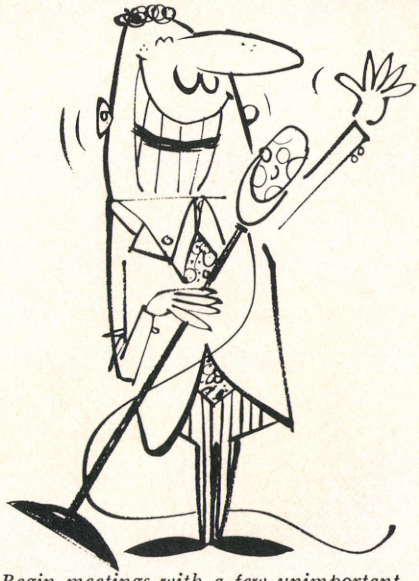
Other decisions. Other than problems associated with the physical location of the meeting, you may have to make decisions regarding such matters as recesses, entertainment, refreshments, materials, discipline, and business.

Business. Matters of business should be taken care of either before or after the program. If they take more than 5 minutes, save them for the end. Dragging business on dulls the interest and begins the program with a handicap.

Recesses. Recesses are used as rest periods during long meetings to relax people and renew their attention to the subject. They are also useful in pacing a meeting or helping to clear the air when controversy threatens to run out of bounds.

The length of the recess will depend on the size of the audience. Five or ten minutes will usually be sufficient for a small group, but for a larger one that amount of time is usually consumed just in exit and entrance. A signal should be used to terminate the recess period and resume the program.

Handling materials. Distribute handout materials either before or after the meeting begins. Passing out materials while the speaker is talking is a sure way to lose control of the meeting.



Begin meetings with a few unimportant remarks to focus audience attention

Entertainment and refreshments. If used, these should be held for last. Once the mood of the audience is changed, they will return to a more serious subject with great reluctance. Serving coffee may be a legitimate exception; however, a recess should be declared while the coffee is being served.

Conducting the meeting. The chairman usually begins a meeting with a few unimportant announcements or remarks to quiet the audience and focus their attention. After securing the attention of the audience, he begins the program.

The guest speaker. Speakers have been mishandled so badly that this subject deserves special attention.

Be prepared to give the speaker you invite the pertinent information he will want to know—such as what subject to use, how long he is to speak, problems you would like discussed, who the audience will be, the number present, and type of presentation. Ask him if he needs assistance for his presentation, such as illustrative equipment or other props.

Secure in advance any material which may be used for publicity. Let your speaker know you are giving him a build-up, and when he

arrives show him clippings of what you have done.

If he is from out of town, arrange his housing and transportation. Have someone meet him and escort him to the meeting place. After the meeting have the speaker escorted to his car, hotel, or train.

Introduce the speaker to the people who will converse with him, and don't let him sit alone until it is time for him to speak.

In introducing the speaker to the audience, the chairman should briefly outline his background, accomplishments and qualifications to discuss the subject, then present the speaker. An introduction is supposed to make the audience eager to hear the speaker. Vary your statements but end the introduction with a phrase that lets the speaker know he is an important and welcome person.

When you have introduced the speaker, clear the platform. Any person or eye-catching object that remains on the platform will distract attention from the speaker.

If questions are to be raised after the talk, find out from the speaker what specific questions he would like to have brought up. Assign certain people to ask these questions—in a normal, natural manner—if they do not arise spontaneously.

Good speakers are entitled to an appreciative audience

Be ready to make a contribution yourself, or to open another issue if the discussion lags. Take care of hostile reactions, speechmakers, or other disturbances from the audience.

As a rule the chairman should take over the question period. This allows him to control the length of the period and helps protect the speaker from the audience. Each question raised should be repeated and then referred to the speaker. This gives the speaker a few moments to frame his reply and also brings the question distinctly into the open.

When the speaker is finished, if applause is called for, start it yourself. Give the speaker a good sendoff by telling him what you like about his talk and how worthwhile it was to have him present. As a parting gesture, shake his hand and lead him off the platform. If you must continue the meeting, turn him over to an escort.

Concluding the meeting. It is as important to end a meeting properly as it is to open it properly. An educational meeting should be closed with a summary of what has happened and a preview of what is to happen. The problems, issues, information, or skills dealt with in the meeting must be pulled together so that each member of the audience has a clear view of what was accomplished. Many chairmen find it helpful to secure an evaluation of the meeting from the audience before the session is adjourned. A simple form can be used for this.

Another way to close a meeting is to have a previously appointed evaluation committee comment on the meeting and point out what individuals can do to further the aims of the meeting. Care must be taken not to draw out these discussions too long. It is better to send the audience away while they are still enthusiastic rather than when they are chafing to get out of an overlong session.

Effective safety meetings demand follow-up. Important features are recorded, summarized, written and given to audience.

Follow-up procedures. The best way to secure a carry-over of the meeting is to have some regular follow-up procedures. Record the important procedures and issue a summary in written form. This will remind the audience of what was said.

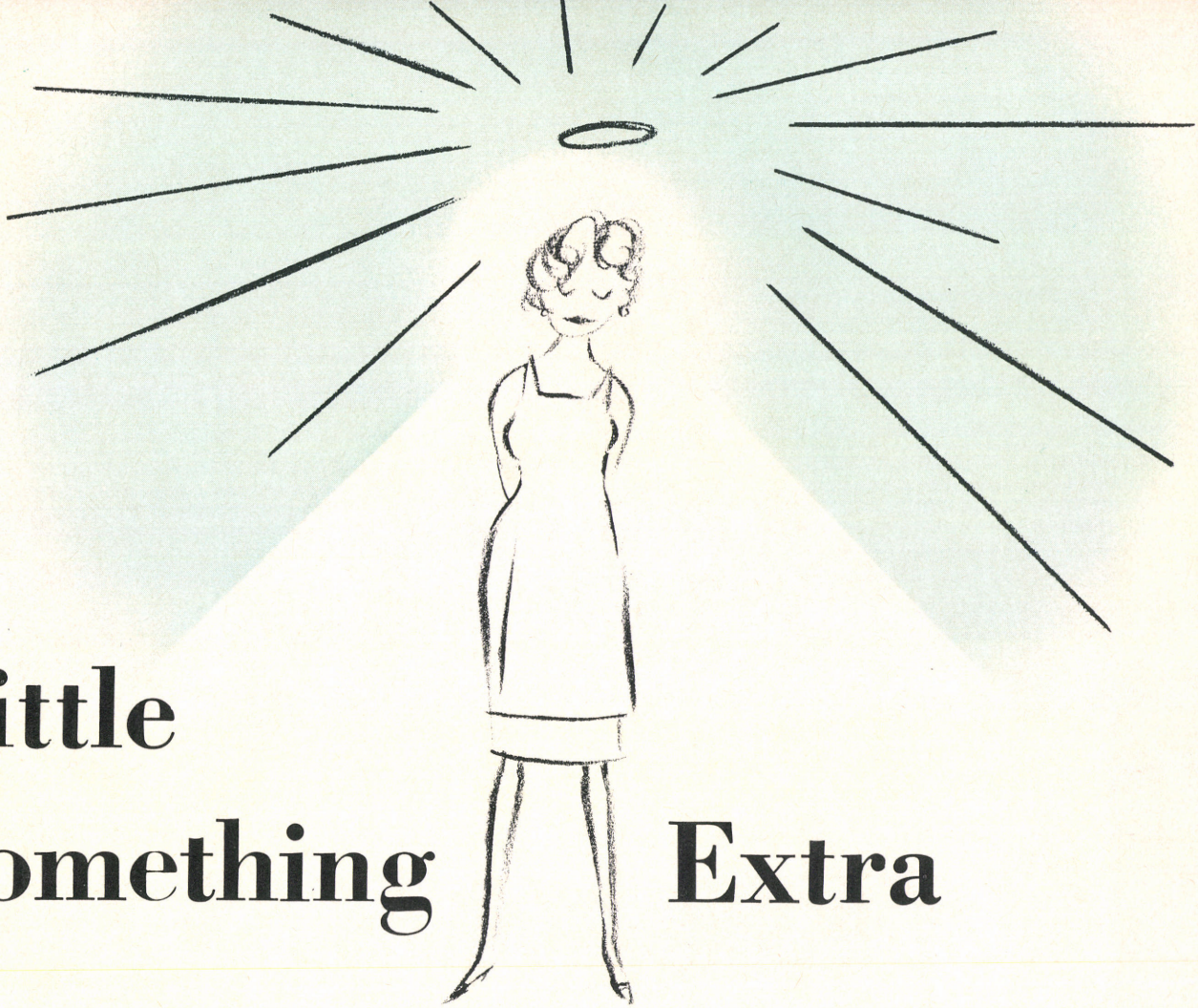
A followup in the post newspaper will increase interest. Mention names and give credit for participation. Most people enjoy publicity.

See that things get done. If plans were made to take certain actions, don't rely on good intentions to get them done.

Keep the commanding officer informed of what happened at the meeting. A summary of the content of a meeting and the action agreed upon will give added support to the accident prevention program.

———

Safety meetings can be an important part of the accident prevention program if they are made interesting and instructive. Careful planning and proper use of techniques for conducting meetings will pay safety dividends to the chairman, the participants, and the audience. So, don't bemoan your fate if you're assigned as safety officer. Put these suggestions to work for you in selling accident prevention.



A Little Something Extra

May Get Him Home Again

William H. Smith

WHEN I WAS young my father ran a grocery store in the Cajun country of southern Louisiana. Many of the customs of that area are different from those in the rest of the United States. One of these is the practice of "lagniappe" (lan-yap').

In Cajun, lagniappe means "a little something extra." Back when my father had his store his customers usually sent one of their children to buy the immediate needs of the day—a nickle's worth of red beans, five cents' worth of rice, and a small ham hock for seasoning. When the youngster had made his purchase, he would hold out his hand for his lagniappe—a few jelly beans or two or three candy peanuts.

In the business of flying it's you, the little lady at home, who furnishes the lagniappe for your aviator husband. If you can make him feel contented and cheerful instead of irritated and disgruntled you may furnish the little something extra that will bring him home safely.

It has been known for a long time that the safe pilot is usually the contented one. It is also a well known fact that the pilot can't put aside his family troubles or wish them away. He can't say, "I'll forget about my home and family while flying."

Nor can drugs help him. Tranquilizers might make him stop worrying about his home life, but unfortunately they also make him forget the hazards of flying.

In your campaign to help your husband, why not start off by being sympathetic? It's positively amazing how a policy of sympathetic listening and support will drain the anger, frustration, and resentment from a man's mind and leave him clearheaded, calm, and soothed.

The time he usually needs your sympathy most is when he has gotten home after work. He's had a hard, tough day. There was a difference of opinion with his superior officer, who is "just not smart enough to understand the real situation." And there was a particularly annoying argument with a brother officer who just wasn't doing his share of the work.

He's frustrated, angry, and down on the world.

At a time like this nothing—drink, food, or soothing music—can take the place of a loving wife who quietly listens as he unburdens and at the appropriate time assures him that he was absolutely right in what he did and said.

Of course he may not have been right, and he probably realizes this. But his wife's support and attention provides a solid rock that he can depend on when all else goes wrong.

Another way to help him to contentment is to run the house to please him. Sure you are the mistress at home but, in spite of what some would have you believe, he is still the master. Chances are, you will find he has very few "druthers" and you can have things pretty much your way if you will only cater to his few likes and dislikes.

Take food, for instance. If he likes seafood and the children don't, have seafood as much as possible when he's home. When he's away, serve the children the things they like.

Most military men like things well organized and run smoothly. This is a trait developed while in the service. Naturally, your husband will expect his home also to be well run. Do you have things under control? Or are there late dinners, no clean socks available, and last-minute ironing?

How about the morning lineup at the bathroom? Most families are faced with this problem, especially if there is only one bathroom. Since Dad has to go to work, there should be no question about his priority. The trouble caused by the rest of the family being a few minutes off schedule won't be near as much as when Dad is late. The family's feeling of security is threatened when "His Nibs" schedule is seriously or frequently upset.

Children who don't understand that there is a difference between week nights and weekend nights also contribute to disorganization. The younger ones want to romp and play until all hours. The 9- and 10-year olds can see no reason why the TV can't blare full blast, no matter what the hour. All of this cuts into Dad's quiet restful evenings.

During Dad's free time don't overload him with household chores. You'll find he will want to do a few things here and there, but help him to feel that it's something he wants to do for himself and not something he must do.

Sure the grass must be cut and the storage room cleaned, but must it be done today? If Dad doesn't feel like doing it just at this moment, let it go until another time.

The idea of work going away if you just let it alone is an old joke but it actually does sometimes. Half the chores done around the house are usually in response to an obsessive idea or restless nervous tension rather than because it needs to be done.

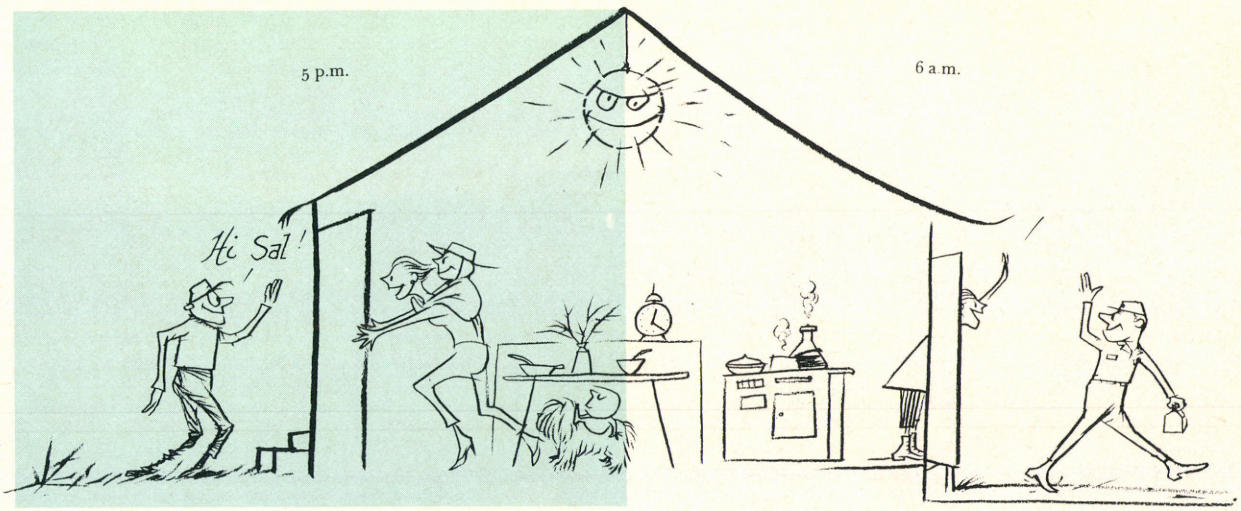
Of course a lot of tasks simply must be done. You probably have your hands full looking after the family and can't be expected to clean yards and wash automobiles, too. So if Dad can't get to that yardwork, why not pay to get it done? Many teenage boys can find no other way of making an extra dollar or two.

If you have teenagers or subteens around the house, put them to work. Working is part of the training of a child. Practice makes perfect, you know. You can't expect your daughter to be able to cook if you never let her practice, and millions of teenage boys don't know how to hammer a nail or weed a garden.

Helping to keep the home in shape is part of the children's rightful heritage in growing up. When they do a chore, it makes them feel needed and increases their feeling of security.

When you first start the pro-

Pampering papa from the time he comes in from the office until he leaves the next morning is conducive to his peace of mind



gram of self-help your children will probably gripe and complain miserably. However, I have never seen a man or a woman who hated his mother and father because he was required to do a little work in his younger days.

One more thing about overloading Dad with chores. Some wives have a bad habit of giving friend husband a lot of little things to do in his off moments at work. He's asked to drop in at the bank, get a book from the library, pick up the cleaning, etc. It's probably true that Dad works only a few doors from the commissary but he should not be asked to pick up the bread and milk during his lunch time. It's much better if he is allowed to eat slowly and have a few minutes of rest before the office work demands his attention again.

Now let's tackle the problem of nagging. Nagging is high on the list of complaints voiced by practically every poll of husbands. It's a good bet that few wives would admit to nagging if they were asked.

The trouble is that not many women can define nagging, or at least have the same definition as their husbands. To most men, nagging is asking more than twice that something be done or stopped. Being tactful or nice about it doesn't keep it from being nagging.

It would seem unnecessary to mention this next item since you have already managed to find and capture a husband, but have you forgotten how to be affectionate or to dress to please your man? You'd be surprised how many married women have.

Unfortunately, as time goes by, many wives think more of what their children or friends like than what their husbands like. If you fall into this category, you are not helping your aviator be happy and content.

And the last bit of advice is a specific one but one so important and apparently so hard for most wives to do that it deserves mentioning. It's the matter of making mornings pleasant for your husband.

In most cases, you and the husband get up before the children, especially if he has an early morning flight. If at all possible, get the breakfast on the table soon enough for the two of you to have a quiet half hour together.

A good filling breakfast is necessary for an active man. He will burn up the energy in a light breakfast in only a few hours. When you're pushing a Caribou through the sky you can't afford to run out of energy.

Food for his stomach is not the only thing a man needs at breakfast. He needs the pick-me-up a pretty, pleasant, and interesting wife can give him. If necessary get up a bit earlier than he does and spend the time "putting on your face." That way, when he goes down to the office he won't be comparing your curlers and washed out face with those painted and prettied secretaries.

These are only a few suggestions but they will be a starter in making your mate a happier and healthier man. Your aviator is sort of a "living insurance" so take care of him with lots of lagniappe.

who needs a safety officer?

.. SEND A MAGICIAN

Major Daniel R. Keenan

THREE OFFICERS nervously pick up their helmets, flight jackets, and orange air cushions, and cautiously ask each other if they are ready to go. Finding no reason to remain, they quickly go through the routine and make their takeoff. They are members of the 572d Engineer Platoon (Topo/Aviation), a part of the 64th Engineer Battalion (B/T) located in Tripoli, Libya. They are flying OH-23G models at maximum gross weight. On board each helicopter is a pilot, 600 pounds of gasoline, two extra gallons of oil, and 30 pounds of survival gear, mostly water. They are to travel 700 miles from Tripoli without benefit of map, roads, or navaids to find a pinpoint in the desert.

Shortly after takeoff, the three ships are winging along the beautiful Mediterranean coast. Sand dunes, 150 feet high, soon come into view and form fingers that slip into the sea. After an hour of flying the coast, the great Biblical city of Leptis Magna comes into view. A few camels and Arabs with their palm-leaf houses live near the great columns that once knew all the glory of Rome. As you fly over the city that would make Pompeii look like a disaster area, you can almost hear the shouts of the gladiators in the huge amphitheater below you.

As you continue down the coast, you pass the works of 20th Century Romans in their attempt to stabilize the sand of the Sahara. In a short while you reach an Air Force NDB radio site that serves Wheelus Air Force Base. There you refuel with gas that had been preplaced there by your maintenance section, have a cup of coffee, turn south and start into the great wasteland of the Sahara. In a very short while you settle into the routine of flying over constant colored, uninhabited, flat terrain. Four hours pass before there is something to look at on the ground.

In our normal work of mapping under this kind

Maj Keenan is commander of the 572d Aviation Platoon, Army Map Service.

of terrain and environment, it is not unusual for a pilot with plenty of rest to doze off at the controls of a Raven. That could be a fatal sleeping sickness. After 4 hours, you and the aircraft are one and the same. You feel every vibration the helicopter makes. Every time you shift your weight, the helicopter reacts. Practically all the air has been let out of your air cushion in an attempt to find a comfortable position.

Finally, an oasis comes into sight. It is about 20 miles long and 5 miles wide. You have dead reckoned 300 miles to the oasis. It is a welcome sight to see one of your camps where you can have a full meal and relax for an hour.

Nightfall is just a couple of hours away, and now the most difficult part of your flight is to take place. You are to fly almost 200 miles and find a camp that will be 100′ x 200′ at most. It would be an impossible task without radio aid. The people on the ground know you are coming and your approximate time of arrival. The idea is to get close enough to talk on your ARC-44 FM radio; then, by using the D & U signals, locate the camp. Unfortunately for us, this was not to be the case. The VRC-8 radio at camp had broken down while we were in flight. Our estimated time en route expired and no contact had been made.

With dark coming on, 700 miles deep in the desert from our home base, dressed for 100° heat, and looking forward to a below freezing night, we were lost in the largest desert in the world.

Rationality at a time like this is hard to come by. We remembered the lessons of WW II about a B-24 crew (The Lady Be Good) that had been lost for 17 years in this locality. Something had to be done fast. Survival in the desert is not an easy task. All kinds of survival books have been written on mountains, jungles, cold weather, and in the snow. There is only one way to survive in the desert—drink fluids.

Our decision was to separate. We parted to the east, west, and south to search for 20 minutes. Whoever found the camp could operate as a homing beacon for the other two. Our search proved fruitless, even though we learned later that the men on the ground had been burning oil, shooting flares and throwing smoke. Our situation started to look desperate. Although surviving the night would be uncomfortable, the problem would be in the days to come. Air Rescue Service would have to conduct the search. The other aviators in our unit were at projects 2,000 miles away.

As our thoughts turned to survival, an alert crewchief at the camp saved the day. He started up a GRC-6 that was left with him and called on the ARC-44. In a short time we found the camp. You may think that didn't take a Marconi to figure out, but to three lost aviators it was the equivalent of the Einstein Theory.

This is not an uncommon occurrence. During our last year of mapping in Libya, we alerted Air Force Air Rescue Service five times. In all cases the aircraft landed with fuel nearly exhausted at a village without communications.

There is only one sound way to attack our problem—*planning*. We can't hope to carry enough fuel for a round trip and to carry sufficient survival gear for extended periods would limit our mission. Lightweight ground and air radios are locked up in the paperwork of logistics. Our maintenance difficulties are monumental. Engines in our OH-23D models were programmed to last 1,000 hours. In 6,000 hours of flying time, we installed 31 engines in 10 helicopters.

Sand can't be kept out of our engines though we have installed Winslow oil filters and Vortex oil bath air cleaners. Oil is changed every 10 hours and two Hiller tech representatives are on hand to maintain 17 ships in five countries.

Planning is the key. To start, we give a survival course. It may not be elaborate, but it must set the ground rules. Everyone who is to survive must be expected to react from training. In searching for a survivor, if he has reacted differently from his training, we must look for things that would influence him. An example would be that of violating the first rule by leaving the aircraft. We would expect that the pilot had knowledge of nomads, wells, or desert travelers nearby. After training, flight planning is most important. Everyone involved must know what the pilot's intentions are. Changes in flight plans are unheard of. Finally, flight following to the best of our ability ensures speedy search methods.

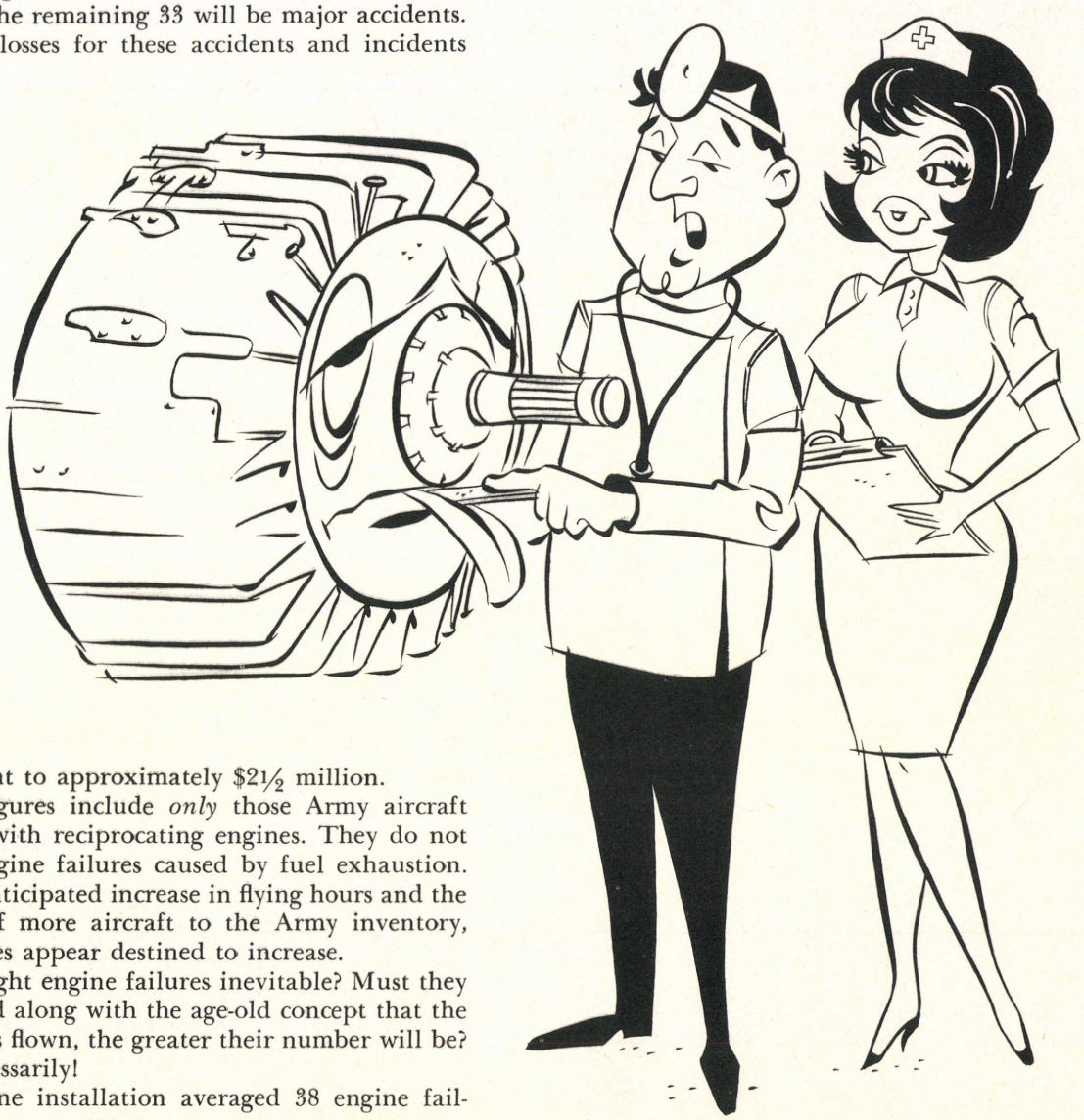
For example, a couple of years ago an oil company helicopter with two men on board made a trip into the desert. They were to meet a refueling truck. Their instructions to the truck driver were that if they did not arrive by dark they had changed their plans. Five miles from the refueling point the aircraft crashed. The new pilot decided to walk to the truck without benefit of hat, shirt, or water. The oil company executive passenger was an old hand in the desert. He stayed with the helicopter and used his best piece of survival equipment, a mirror. Three days later the executive was found in good shape resting under the helicopter. Two kilometers away the pilot was found prostrate in the sand, near death. Desert survival is a full-time business.

SAY AH'H'H!

Ted Kontos

Engine Conditioning . . . a way to prevent inflight engine failure

BEFORE THE HOUR hand of your watch can complete three and one-half revolutions, an Army aircraft engine will fail during flight. If history repeats itself as it has for the past 7 years, there will be 211 engine failures this year. Thanks to pilot skill, 167 of these emergencies will end with successful forced landings. Seven will result in incident damage to the aircraft and four in minor damage. The remaining 33 will be major accidents. Hardware losses for these accidents and incidents will amount to approximately $2½ million.



These figures include *only* those Army aircraft equipped with reciprocating engines. They do not include engine failures caused by fuel exhaustion. With an anticipated increase in flying hours and the addition of more aircraft to the Army inventory, these figures appear destined to increase.

Are inflight engine failures inevitable? Must they be accepted along with the age-old concept that the more hours flown, the greater their number will be?

Not necessarily!

While one installation averaged 38 engine fail-

ures annually, another comparable facility averaged only one. The difference between the two was a program known as *engine conditioning*.

Engine conditioning got its start over 20 years ago in the South Pacific during WW II. At a time when men and machinery were at a premium, newly designed B-29 bombers, equipped with equally new R-3350 engines, were harassed by powerplant problems. Frequent inflight engine fires caused losses of crews and equipment. Engine failures were common. The demand for replacement parts was overwhelming and the small percentage of operational aircraft that could be maintained was disheartening. Submitting unsatisfactory reports was a routine task.

Of all B-29 units, one group appeared immune to the engine problems which plagued the others. While others were accepting poor performance and blaming the engine, this group was doing something about it. Though valve clearances, ignition timing, idle mixture adjustments, and other factors affecting engine operation were more critical on the R-3350 than on most powerplants, they found this engine could be made to perform perfectly. They developed a new approach toward preventive maintenance.

This new type of maintenance became standard for all B-29 groups. Because of the remarkable improvement in performance of the R-3350 engine, similar methods were developed for other engines. Eventually, an engine conditioning program applicable to all aircraft reciprocating engines was adopted by the U. S. Air Force. This program now includes ground operated as well as airborne ignition analyzers and vibration pickup attachments. The advantages of this effective engine conditioning program can be measured in time, equipment, lives, and efficiency.

WHAT IT IS

Engine conditioning is an integrated system of checks and tests based on a thorough understanding of engine operation. Designed to bring engines to peak operating efficiency and to keep them that way, it provides a method of spotting engine malfunctions before serious trouble has a chance to develop. Basically, it is a consolidation of all the best known methods of maintenance. It differs from previous systems in that it enables the maintenance crew to determine the complete condition of an engine and, with the aid of an aircrew, to keep a running check on its condition. It is a far cry from troubleshooting which makes random use of various tests in a disorganized fashion. Conditioning is systematic and does not wait for difficulties to become serious enough to make themselves known. This results in a higher degree of preventive maintenance, a reduction in the need for corrective maintenance, and an overall increase in engine efficiency and safety of operation.

Engine conditioning falls into two categories, scheduled and unscheduled. Scheduled conditioning, accomplished initially at a specified time and at regular intervals thereafter, serves the same purpose for an engine as periodic physical examinations do for an individual. Using a series of standard tests and checks, doctors are able to detect glaucoma, tuberculosis, cancer, diabetes, ulcers, and a host of other diseases. Once detected, a disease can be cured or controlled before it cripples or kills. In the same way, scheduled engine conditioning spots troubles before symptoms appear. Corrective action can be taken immediately and the engine returned to service. A possible engine failure is prevented and the engine will function at its best.

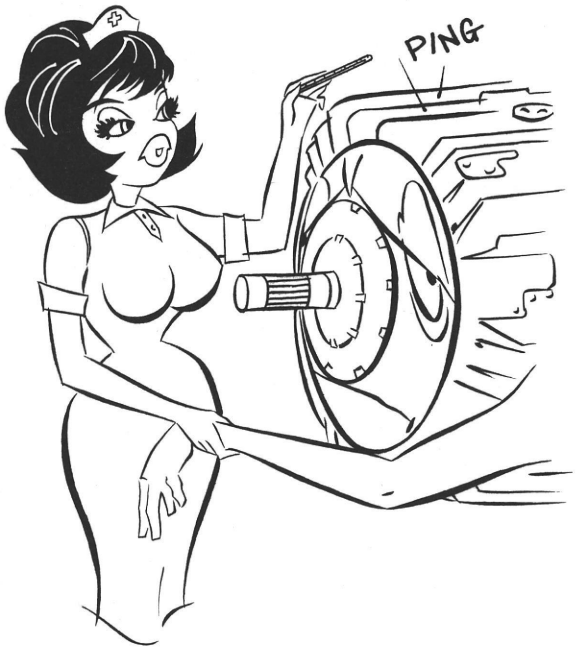
Does this mean that engines subjected to regularly scheduled engine conditioning will not give trouble? Not at all. Just as an individual will suffer a variety of illnesses in spite of periodic physical examinations, an engine will fall subject to numerous ills. Here again, engine conditioning proves its worth. At such times, it is usually better to perform unscheduled engine conditioning rather than rely on standard troubleshooting procedures. Last month, for example, an OH-13 engine lost power during flight and the pilot had to make a forced landing. The cause was fouled spark plugs. This aircraft had a long history of engine roughness and spark plug changes.

In this instance, normal troubleshooting detected only the defective plugs, and maintenance personnel replaced them. The engine would then function normally and the aircraft would be returned to service. Yet, the cause of the spark plug failures, which in this case was oil pumping into cylinders, went undetected. This is like taking a shot of novocaine for a toothache. You can temporarily relieve the pain, but the infection remains and continues to spread.

Treating engine symptoms alone will not guarantee engine reliability. Furthermore, as in the case described, it requires more frequent maintenance and more replacement parts. It also results in lost time and ultimate engine failure.

If unscheduled engine conditioning had been used for this OH-13, the underlying cause, worn piston rings, would have been found. Corrective action would have been taken months earlier and

. . . in spite of periodic examinations, an engine will fall subject to numerous ills



the failure would never have occurred.

Frequently, erratic engine operation may be the result of some obvious defect, such as a chafed ignition lead. In such cases, a complete conditioning would not be needed. In the majority of instances, it is recommended and desirable.

Engine conditioning often serves another important function. It exposes improper maintenance practices for correction. One military installation suddenly found itself plagued with a rash of engine problems. The cause, ignition trouble, was quickly discovered through the engine conditioning program. One discrepancy was common to all of these engines: the magneto breaker points were set too wide.

Since these points had been checked for proper adjustment during the previous *scheduled* engine conditioning, investigation appeared to be in order. Using an R-1340 engine which had excessive magneto drop, the crews adjusted the breaker points. To their surprise, they found they could not only reduce the magneto drop to within permissible limits, but could virtually eliminate it. By adjusting the breaker points on both magnetos, they were able to control the magneto drop. The engine passed an operational check by an inspector.

Yet the original trouble had not been determined and an additional problem was added. Further checks showed that these engines had previous writeups of excessive magneto drop. Corrections were made by flight line personnel who apparently had also discovered that opening up the magneto breaker points would reduce magneto drop. As a result, this had become standard practice. Because of an engine conditioning program, this procedure was quickly discovered and stopped.

A good engine conditioning program serves still another function—it weeds out unserviceable engines in the field. For example, suppose we discover fouled spark plugs in an engine and conditioning crews determine the cause to be a leaking impeller seal. Rather than keep replacing plugs until the impeller seal gets worse, we remove the engine and ship it to the overhaul depot without wasting materiel or time, and without chancing engine failure.

An effective engine conditioning program entails both regularly scheduled and unscheduled engine conditioning. It traces causes, prevents further troubles from developing, and ensures peak performance during engine life. It exposes poor maintenance practices and weeds out unserviceable engines in the field. It saves time, money, equipment, and lives.

CONDITIONING VS OIL ANALYSIS

At first glance, it appears engine conditioning would duplicate spectrographic oil analysis, a highly successful established program. Nothing could be further from the truth.

Basically, oil analysis keeps a running check on an engine by a periodic count and identification of metal particles found in oil samples. Due to normal wear, oil samples taken from the best-cared-for engine will contain a certain amount of metal particles. Warning of impending engine failure is sounded when these particles begin to increase in volume, number, or size. Since they may be sub-

microscopic, maintenance personnel can neither detect nor identify them. Oil analysis can. As a result, impending failures are predicted.

In many instances, failing components can be identified with remarkable accuracy. However, the failures predicted are those caused by wear of such units as bearings, cam rings, gear trains, etc. Oil analysis cannot spot ignition, carburetion, or induction troubles. Nor can it detect cracked cylinders, burnt pistons, feathered valves, distorted valve seats, and a host of other defects. Engine conditioning can.

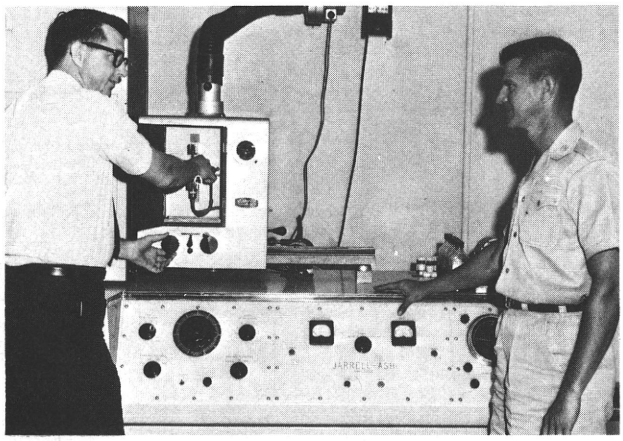
The two programs supplement each other. With the chip detector light now common in Army aircraft, these two programs can eliminate the majority of engine failure accidents.

THE CONDITIONING PROGRAM

Examining the Army's engine conditioning program as outlined in Section I, Chapter 3, TM 55-405-5, we find that *complete* conditioning consists of these 18 steps:

1. Ignition system timing
2. Compression test
3. Valve adjustment
4. Ignition harness check
5. Spark plug installation
6. Check for hydraulic lock
7. Blowby check
8. Engine start
9. Engine warmup
10. Power check
11. Ignition system check
12. Cruising mixture check
13. Idle speed check
14. Idle mixture check

The spectrographic oil analysis program is a valuable partner with engine conditioning in efforts to eliminate engine failure accidents



15. Acceleration and deceleration check
16. Engine backfire test
17. Ignition switch check
18. Spark plug check

This procedure appears to be thorough. It should produce effective results, but it doesn't, as evidenced by the 211 engine failures which happen each year. The reason it is not effective is that no complete engine conditioning program is required *except during overhaul.*

Experience has shown that an effective program can be obtained by performing a *complete* conditioning at some initial period, and following this with a *complete* conditioning at regularly scheduled intervals of 200 flying hours (every 2d PE). The only exception to this concerns engines having hydraulic valve lifters. Valve adjustment for these engines is required only during overhaul. The first requirement for an effective conditioning program is *scheduled* conditioning.

A second requirement calls for a boroscope, a simple instrument which can be inserted into each cylinder after the spark plugs have been removed. By looking through the eyepiece, the operator can visually check the condition of the cylinder walls, piston, valves, valve seats, cylinder head, etc. The boroscope examination should be made *in addition* to other engine conditioning steps. Following is an example of a successful engine conditioning program used by one installation.

1. Engine operational check using cockpit check sheet
2. Cold cylinder check
3. Visual inspection of engine, and draining of oil sumps
4. Ignition system timing
5. Compression test
6. Cylinder examination with boroscope
7. Valve adjustment
8. Ignition harness test
9. Spark plug installation
10. Check for hydraulic lock
11. Blowby check
12. Inspection of engine by inspector
13. Engine cowled
14. Completion of all engine operational checks as outlined in TM 55-405-5, Chapter 3, Section I, *steps 8 through 18.* This includes idle mixture and idle speed adjustments as well as cold cylinder check.
15. Engine operational check performed by inspector
16. Test flight to complete conditioning

Much depends on maintenance personnel who

Maintenance personnel must be trusted to follow procedures "by the book"

make up engine conditioning crews. Experience has shown that these crews must be highly skilled. They must understand engine theory and be proficient in all engine maintenance procedures. *They must be trusted to follow TM procedures.*

At one installation, the average experience level of engine conditioning mechanics was 7 years and the average experience of their supervisors was 10 years. All had excellent qualifications when selected. But all were required to complete a special engine conditioning course. *The importance of screening prospective engine conditioning crew members and providing proper training cannot be overemphasized.*

Look around your unit when mechanics are doing some routine task, such as installing spark plugs. Do they use a tap to clean each bushing, or a brush in case of Heli-Coil inserts? If they fail to remove the accumulation of carbon, excessive torque will be required to seat the plug. This may crack the insulation or close up the points. After cleaning the threads, do they wipe the outer surface of the spark plug bushing with a cloth moistened with solvent? This is necessary to prevent dirt or antiseize compound from fouling the electrodes of the plug as it is started into the bushing.

Do the mechanics thoroughly inspect each plug for correct type? Do they check the barrel insulator as well as the nose insulator to be sure they are clean and free from cracks? Do they check for the specified electrode gap? If the spark plug was slushed for storage, do they wash it with an approved solvent? Do they make certain that copper gaskets are clean? Good contact is necessary for maximum heat transferral.

Do they screw each plug by hand until the plug and gasket are seated on the bushing? Do they properly torque each plug with a calibrated torque wrench? These are some of the steps that *should* be followed during spark plug installation.

Within a recent 30-day period, four O-1 aircraft had to make forced landings. In each case, improper carburetor adjustment caused the engine to fail when the pilot retarded the throttle.

A few months ago, a mechanic failed a U-8 first and second echelon maintenance course. Before he was sent to school, this man served two years at an overseas assignment where he crewed three types of aircraft. One was a U-8.

Training is not limited to maintenance personnel. Flight crews play an important part in proper maintenance. Their operating habits often affect engine performance. Instances have been found where pilots overboost engines and make no record of it. Frequently, they may not realize it. For example, the 0-480 engine installed on U-8 aircraft is limited to a maximum of 48″ manifold pressure at *sea level.* Pilots who pull 48″ Hg during takeoffs from high field elevations create overboost conditions. Cracked cylinders and engine failures are the result.

Pilots sometimes operate engines at high idle speeds to prevent spark plug fouling. This will not happen with engine conditioning, which gets to the basic cause of spark plug fouling, usually an improper idle mixture setting, and eliminates it. When the cause of spark plug fouling has been eliminated and adjustments have been made for proper idle speeds, fast taxiing and excessive braking, with resulting brake failures, can be avoided. Taxi accidents are also reduced.

Flight crews can help ground personnel by learning to recognize and accurately report engine defects. Some defects can be observed only in flight. For example, an ignition harness may break down and cause rough engine operation at altitude. At sea level, the engine may operate smoothly with no apparent defects.

In one instance, where the pilot's writeup simply stated that the engine "ran rough," maintenance crews wasted a great deal of time in finding the trouble — which turned out to be a badly out-of-balance nose wheel. The vibration, which the pilot interpreted as a rough engine, occurred only after takeoff.

Learning to spot defects in flight and knowing how to report them accurately are good ways for flight crews to assist maintenance personnel and promote their own safety.

Is elaborate test equipment required? No. In most

instances, test equipment used for routine troubleshooting is all that is needed. The only exception is the boroscope. Those units which do not have this instrument should obtain it. A conditioning program cannot be fully effective without it.

Will the cost for additional training of flight and maintenance personnel be prohibitive? Let's take flight personnel first. No additional cost or time for training is needed. Emphasis on identifying engine troubles and making descriptive writeups can be done during flight training at schools, during unit training, and at safety meetings.

Training of maintenance personnel is more involved, but poses no major problems. This training can be given within the unit. It can either be a classroom course or OJT. An engine conditioning phase could also be added to the present course taught at maintenance schools. The additional knowledge obtained and skills developed as a result of this training will guarantee better maintenance.

Will an engine conditioning program require more time and additional personnel? Again the answer is no. It takes less of the mechanic's time — not more. True, time is spent in putting the engine into proper shape at the beginning, but much less maintenance is necessary between *scheduled* engine conditionings. And much time is saved over hit-or-miss troubleshooting practices when troubles do develop.

At one installation, an R-1340 engine gave every indication of a defective carburetor, and maintenance personnel decided to replace it. After spending more than 2 hours getting a new one, flushing it, preparing it for installation, and installing it, the engine operated just as erratically. The new carburetor was removed and the original one reinstalled. Feeling certain their problem was in the induction system, the mechanics then removed some of the intake pipes to check for oil from a possible defective impeller seal. None was found and these were reinstalled. Finally, after much time and effort, the trouble was discovered—a bent exhaust valve push rod. Had unscheduled engine conditioning been performed at the start, the trouble would have been found in less than an hour. As it was, they worked a full day.

Will additional funds be required to operate an engine conditioning program? Once more, the answer is no. Because conditioning saves time, the cost is less. Fewer major troubles are allowed to develop. In addition, the number of forced landings that are prevented represent savings in damaged aircraft. Nor should we overlook the number of serviceable parts that are replaced annually because of trial-and-error methods. Time and money are wasted in removing, shipping, and overhauling serviceable equipment. Trying to keep unserviceable engines in operation is highly uneconomical, in both man-hours and replacement parts. A good conditioning program definitely costs less.

The only disadvantage, if it can be called that, is that gas turbine engines are replacing piston types. But reciprocating engines will be with us for years to come. It is no argument to say that improved methods should not be used simply because someday these engines will be obsolete.

During the first month of this year, five major accidents, one of which resulted in total destruction, one incident, 11 forced landings, and 31 precautionary landings were caused by inflight engine problems. Some of the cause factors read: . . . cracked cylinder . . . blown cylinder . . . cylinder head parted from barrel . . . piston ring failure . . . low idle rpm setting . . . exhaust valve failure . . . piston failure . . . materiel failure of compression rings . . . low compression . . . spark plugs fouled with oil . . . broken spark plug electrodes . . . ignition failure . . . broken intake valve . . . cracked piston . . . valve seat failure.

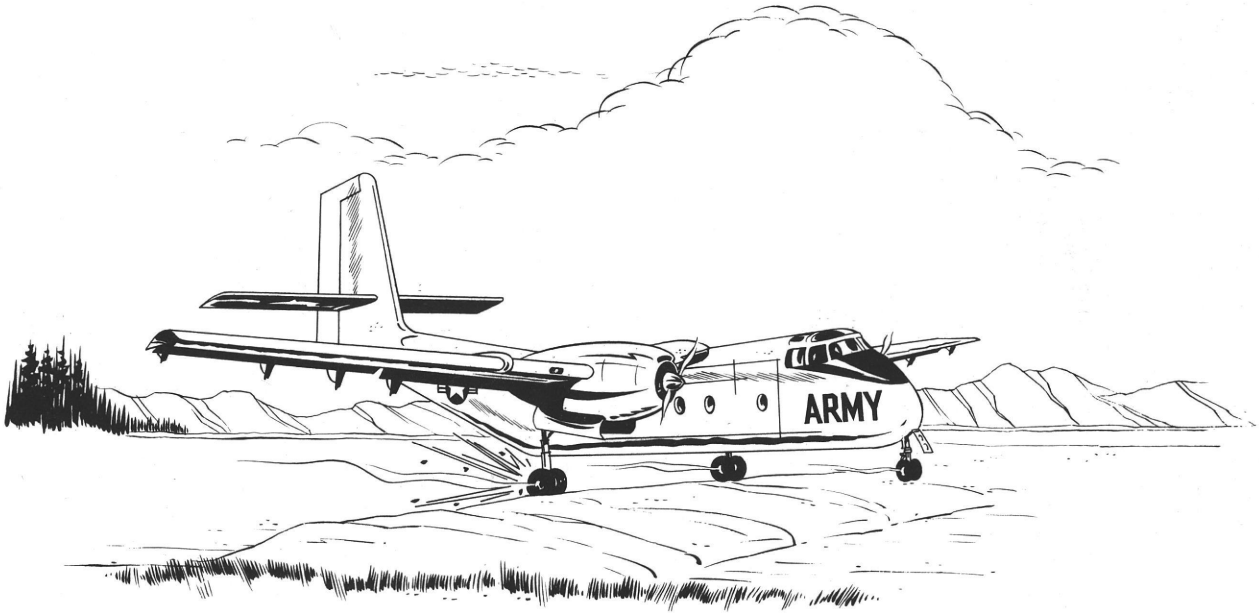
Isn't it time to make our engines say "A'h'h'h!"?

the pilot heard what he described as "... a loud thud"

A CV-2B CREW of three, pilot, copilot, and crewchief, were assigned to deliver miscellaneous cargo from one site to another during a field exercise. It was an ideal day for flying, with scattered to broken clouds between 4,000 and 9,000 feet. Visibility was estimated at 7 miles and the temperature was 70°. The surface wind was calm.

At 1048, the flight departed with a 500-gallon bladder of JP-4 fuel to be delivered to a forward field site. The strip at the field site was 1,600 feet long and 60 feet wide, with a smooth dirt surface. Running east and west it had a considerable upgrade from west to east. Landing was uneventful. The copilot said later that he thought the approach was too shallow, but he did not call it to the pilot's attention.

They off-loaded the bladder, picked up miscellaneous cargo and passengers and flew back to the point of departure where the passengers and cargo were discharged. Empty, except for the three crewmen, the Caribou was then flown back to the field



crash sense

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

strip. When they arrived at the strip, the pilot was cleared to land to the east and the landing gear was lowered on downwind opposite the intended touchdown point. Here, the pilot called for 10° flaps. The copilot, misunderstanding, lowered 19° flaps.

As he was about to turn base, the control unit called and advised the pilot to extend his downwind leg or make a 360° turn to allow another CV-2B to take off toward the west. The pilot elected to extend the downwind leg. The aircraft on the ground took off and broke traffic and the control unit advised the pilot on downwind that he was cleared to land. It was estimated that the downwind leg was extended one and one-half times the normal distance from the end of the strip.

The turn to final was made at approximately 500 feet and, although the approach angle was shallow at that point, 30° flaps were lowered and the aircraft continued a shallow approach. While on short final, the pilot had to adjust his approach angle to clear trees several hundred yards short of the strip. He added power and raised the nose of the aircraft. After they cleared the trees, the aircraft settled because of loss of airspeed and insufficient power. The pilot started his roundout and the right main gear struck an 18-inch dirt mound 78 feet short of the strip. The pilot heard what he described as a "loud thud." The landing roll was completed and the aircraft taxied to the loading area.

After shutting down the engines, the pilot noted that both his and the copilot's shoulder harness inertia reels were locked. The crewchief called his attention to the emergency lights that had come on during landing. An inspection was made and major damage to the right wing, outboard aileron, outboard foreflap, root foreflap, and engine mounts was estimated to be $15,000.

After examining the evidence and questioning witnesses, the investigation board made the following analysis:

"The approach to landing was poorly executed. The approach angle was too shallow and had to be altered on short final to clear trees that were in the flight path; 30° flaps were selected prematurely, which caused the pilot to drag his approach and allow the approach angle to become more shallow; a constant approach angle was not and could not be maintained and still clear the trees that were located several hundred yards from the end of the runway. The poor approach was not the cause of the accident in itself, *but a poor approach frequently leads to a poor landing.* In this case, the combination of errors contributed to the pilot's misjudgment of altitude and airspeed at point of landing.

"The pilot's judgment in altitude could have been affected by the illusion of being higher than he actually was. This illusion is created when landing over a barrier, if the barrier is immediately followed by low terrain and a surface that slopes uphill.

"The pilot and copilot realized early that the approach was shallow but failed to take corrective action to establish a steeper and more desirable approach angle. The copilot thought that a safe landing could be made although the approach angle was too shallow.

"The aircraft was landed short due to the pilot's misjudgment of altitude above the ground at time of roundout.

"The aircraft was not stalled nor near stall at the time of touchdown, but landed with flying speed.

"The right main gear took the entire landing impact when it struck the dirt terrace. The left main gear passed over a depression in the terrace and didn't touch the ground until 18 feet beyond the right gear touchdown point. If both main gear had touched the ground at the same time, it is possible there would have been little or no damage to the aircraft."

The flight surgeon's analysis of this accident is well worth quoting:

"This accident resulted when a pilot set up an improper approach and landed 78 feet short of the end of the runway. He then had the double misfortune to have a mound of dirt on the area of ground where the right main gear touched down.

"If he had not landed short, no accident would have occurred, or, if he had landed short and the overrun had been smooth, there would have been no damage.

"The accident is interesting in that the weather was good, the time was during daylight hours, the strip was of adequate length, the aircraft was empty, the crew was well matched in experience and in recent flying experience, they had adequate amounts of rest and food prior to the accident, the mission was a normal one for the unit, and the strip was familiar to both principals. In short, we are getting down to two individuals.

"The individuals concerned set up an improper approach and there are some extenuating circumstances, i.e., the other aircraft taking off just prior to the landing and necessitating the extension of the downwind leg, the pilot's decision to let down the flaps prematurely, the uphill slope of the strip that gave the illusion that he would land long rather than short.

"But these just mentioned factors do not cause alert aviators to have accidents. By this, I do not mean that good aviators do not have similar incidents, but it is when good aviators are not alert that this type of situation occurs. While it is interesting to explain the accident in terms of secondary cause factors, the cause comes back to the two principal actors in the tragedy.

"Landing short is a cardinal sin in flying according to many aviators. However, I feel that it probably happens more frequently, although without damage to aircraft or occupants, than we are wont to admit.

"Thus I do not feel this accident can be blamed upon the platoon leader, the operations officer, the commanding officer, the Aviation School at Fort Rucker, the flight surgeon who gave the most recent physical, nor the good Lord for not smoothing off that mound of dirt.

"The analysis is pilot error and copilot error in not being aware of the situation. However, I remind all those who hold a throttle that, although landing short is a cardinal sin, it, like all the more enjoyable sins, is many times committed unknown to all our peers and stays locked in our secret hearts."

Outstanding Investigation

the board was not satisfied in finding the obvious cause factors, they dug deeper . . .

It was a cool fall morning with misting rain and fog. The ceiling was 300 feet broken and 500 feet overcast. Visibility was about 1½ miles. The unit, part of a field exercise aggressor force, was scheduled to move to a new command post a few miles away.

Flying in an OH-23G, the pilot took off to the northwest, circled to the right and climbed to 150 feet, following a county highway. Here, in his own words, is what happened:

". . . I first noticed the engine making funny noises, so I checked my rpm and it was at 3,000. I opened the throttle to the full open position, but the rpm would not increase. I then started an approach to the road, trying to get to the ground with power. At about 50 feet, the engine quit. I bottomed pitch, flared, and pulled pitch to stop the descent, but it did not seem to have any effect. We hit tail low, bounced, and slid across the road . . ."

The tail skid hit first and was broken off. Then the tail rotor blades dug in and were sheared. The tail rotor assembly sheared upward, bending the 1-inch drive, and breaking the tail boom. The aircraft bounced back into the air, turned 90° right, came down hard on the right skid, and came to rest on the left shoulder of the road. G forces at impact buckled and twisted the cabin, causing numerous breaks in the bubble. The pilot and his passenger escaped with minor cuts.

When investigators arrived, they found the engine oil tank empty. There was no evidence of spillage in the immediate area and only a small amount of oil on the engine deck. The oil scavenge sump drain was in the open position and the engine had seized.

After collecting all available information, the investigation board met and questioned several witnesses. The first was an engine components section

shop officer. Asked for his opinion of the cause for the accident, he stated that the oil scavenge sump drain valve had been left open and the engine oil drained overboard. He was not sure whether the engine oil would drain if the engine was not turning. He was certain it would drain if the engine was running. He had no knowledge of the time the engine would run after losing the oil. Asked which engine gauges would indicate an oil loss, he replied that an oil temperature gain would be indicated and an increase shown on cylinder head temperature.

The witness was asked to review and comment on the DA Form 2408-13. He noted that the crewchief and not a tech inspector had signed off three red Xs; that the "status today" block indicated the aircraft was flown on a red X; and that the flight had not been approved by the maintenance officer for overflying an intermediate inspection.

The second witness called, a sergeant first class, was a maintenance supervisor. He stated that he had been in his present assignment for 6 weeks and that it had been 3 years since he had any OH-23 experience. He said the engine oil would drain rapidly, probably within 4-8 minutes, with the engine running and the oil scavenge sump drain valve open. He also thought the oil would be lost with the engine shut down if the drain was left open. Asked what indication would show loss of oil, his answer was—a drop in oil pressure and engine seizure after an excessive cylinder head temperature reading. He also said that the oil would have to be nearly gone before the pressure drop was indicated. Based on past experience, he estimated an engine would seize 1-2 minutes after loss of oil. He was not sure of proper oil change procedures due to his time away from small unit operations.

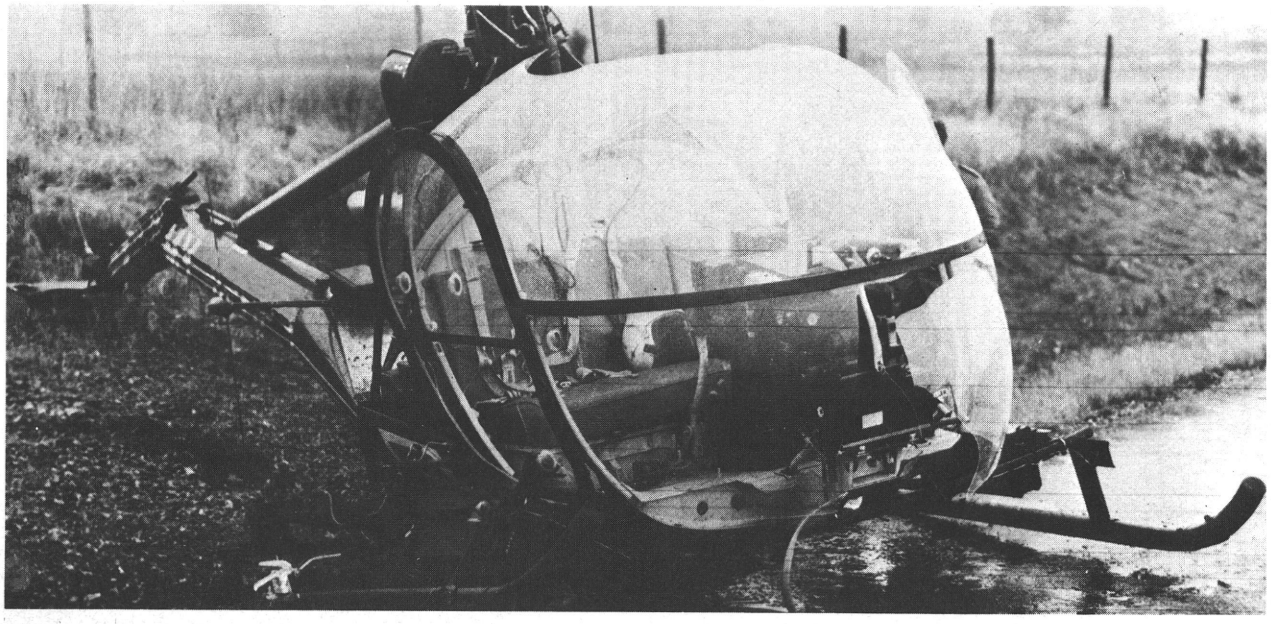
Several other witnesses were questioned and gave substantially the same answers, all indicating a lack of knowledge about the engine and maintenance procedures.

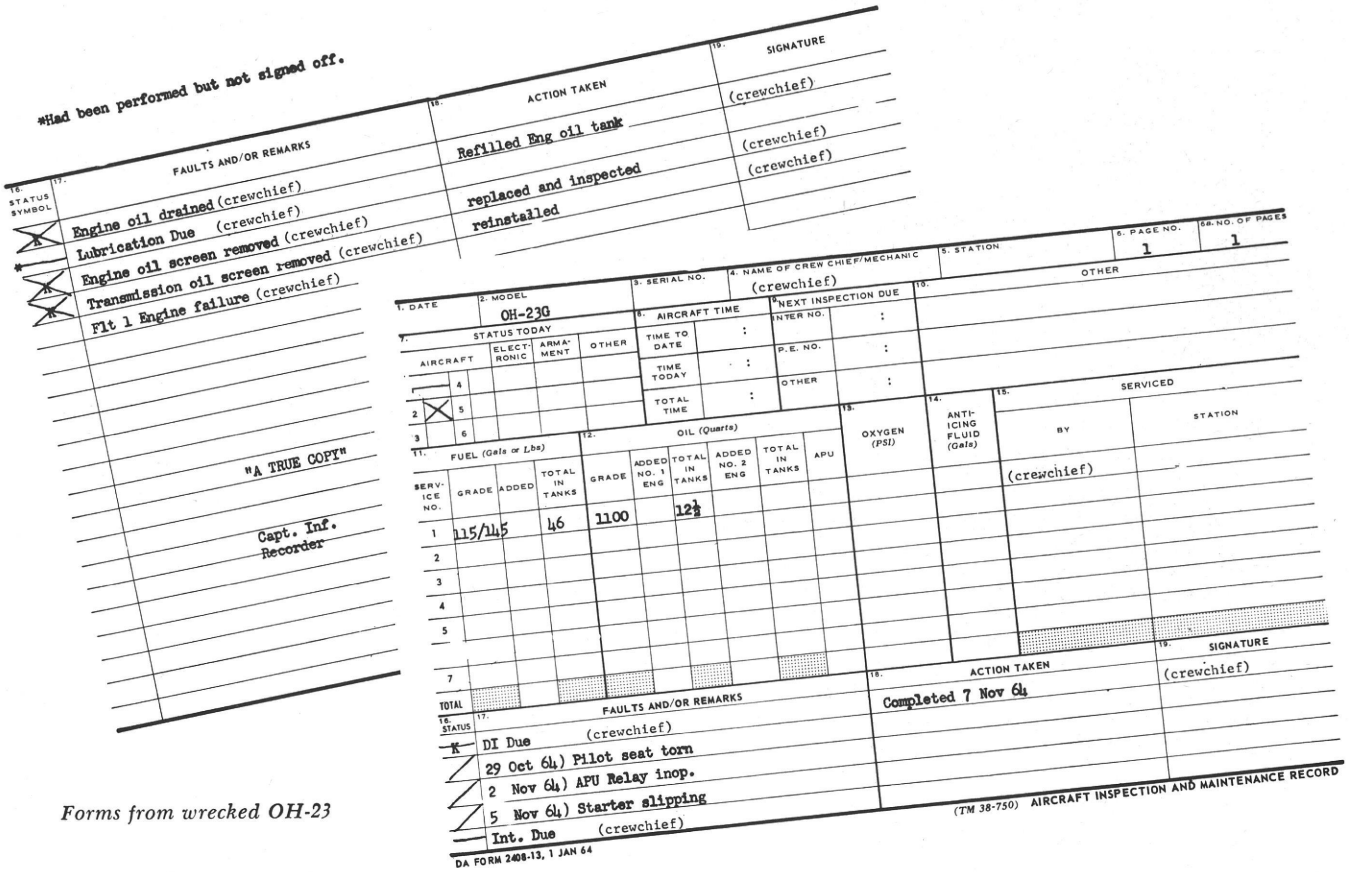
Then the crewchief for the aircraft was questioned. He stated that a tech inspector had always signed off red X conditions on aircraft in the unit and that this was the *first time* a red X had not been signed off by a tech inspector. He said that *he thought he could sign off the red X under the field conditions, although he had not been granted the authority.* Though the crewchief had no formal school training, he had started as an OJT trainee overseas 2 years before and had almost 2 years experience crewing helicopters. He did not use the —20 while working on the aircraft in this instance, because, in his words, *"It was locked up in a tool box."*

He had not seen and did not know of a unit maintenance SOP. He stated that the unit maintenance officer did not check his work.

According to the crewchief, another man made the oil change and he (the crewchief) checked the work and signed it off. The check was made about 1830 hours the night before the accident. Although it was dark and he did not use a light, he was sure he had closed the valve.

Aircraft was damaged beyond economical repair





*Had been performed but not signed off.

16. STATUS SYMBOL	17. FAULTS AND/OR REMARKS	18. ACTION TAKEN	19. SIGNATURE
K	Engine oil drained (crewchief)	Refilled Eng oil tank	(crewchief)
	Lubrication Due (crewchief)		
*	Engine oil screen removed (crewchief)	replaced and inspected	(crewchief)
K	Transmission oil screen removed (crewchief)	reinstalled	(crewchief)
K	Flt 1 Engine failure (crewchief)		

"A TRUE COPY"

Capt. Inf.
Recorder

1. DATE | 2. MODEL: OH-23G | 3. SERIAL NO. | 4. NAME OF CREW CHIEF/MECHANIC: (crewchief) | 5. STATION | 6. PAGE NO.: 1 | 6a. NO. OF PAGES: 1

7. STATUS TODAY

AIRCRAFT	ELECTRONIC	ARMAMENT	OTHER
1			
2			
3			
4			
5			
6			

8. AIRCRAFT TIME: TIME TO DATE :; TIME TODAY :; TOTAL TIME :

9. NEXT INSPECTION DUE: INTER NO. :; P.E. NO. :; OTHER :

10. OTHER

11. FUEL (Gals or Lbs)

SERVICE NO.	GRADE	ADDED	TOTAL IN TANKS
1	115/145		46
2			
3			
4			
5			
7			
TOTAL			

12. OIL (Quarts)

GRADE	ADDED NO. 1 ENG	TOTAL IN TANKS	ADDED NO. 2 ENG	TOTAL IN TANKS	APU
1100		12½			

13. OXYGEN (PSI)

14. ANTI-ICING FLUID (Gals)

15. SERVICED

BY	STATION
(crewchief)	

16. STATUS	17. FAULTS AND/OR REMARKS	18. ACTION TAKEN	19. SIGNATURE
K	DI Due (crewchief)	Completed 7 Nov 64	(crewchief)
	29 Oct 64) Pilot seat torn		
	2 Nov 64) APU Relay inop.		
	5 Nov 64) Starter slipping		
	Int. Due (crewchief)		

DA FORM 2408-13, 1 JAN 64 (TM 38-750) AIRCRAFT INSPECTION AND MAINTENANCE RECORD

Forms from wrecked OH-23

The next witness called was the pilot, who also served as the unit aircraft maintenance officer. He stated that he had been assigned to the unit for about 3 months and was receiving OJT as maintenance officer. His only prior maintenance experience had been as a motor officer overseas. He reported that he did not make a thorough preflight, but that he did check the oil, fuel, and rod end bearings. The engine oil tank dipstick had been normal. He said he had never checked the oil scavenge sump drain valve and didn't know it was there. He had been used to checking two valves on the D model and did not realize the G model had three valves to check, although he had logged 103 hours in the OH-23G.

The pilot reported that his transition training for the OH-23G consisted of a cockpit checkout. He had been given no dual instruction, no flight check, and no ground school. Asked specifically if his checkout included a preflight inspection, he replied that it had not. He knew where the aircraft gauges were from memory, but could not remember any gauge indications except for 3,000 rpm immediately prior to or following the engine failure.

The pilot said unit procedure for oil change was to run up the engine after adding new oil and emphatically stated, "And we do it!" *But he admitted it hadn't been done in this case.*

When shown the DA Form 2408-13, he could not pick out the discrepancies and indicated by his lack of knowledge and answers that he was unfamiliar with maintenance record procedures.

The report of this accident was an outstanding example of a thorough and complete accident investigation. The board was not satisfied in finding the obvious cause factors for the accident. They dug deeper to find why the cause factors existed. Here is their analysis:

"This accident was certainly avoidable. If proper maintenance practices had been followed; if applicable -20 handbook or TB-Avn's had been used; if supervisory principles had been applied; if adequate procurement principles were established at higher levels; if adequate maintenance assistance and train-

ing programs had been effected within the division; all IF.

"This accident investigation has revealed a considerable number of contributing cause factors. Although the board is required to point to a primary cause factor, which pinpoints a mechanic trying to do a reliable job, this factor in itself should not be overriding. It is so easy for supervisors to point the finger at a crewchief, who was working in the dark under tactical conditions and say: 'You caused the accident!'

"There is usually an inadequacy or fear on the part of supervisors and commanders to take the time to reflect about what they could have done to have avoided an accident or to be tall enough to say: 'My part in the program was not adequate.' Our purpose then is to point out to commanders at various levels where they possibly failed in hopes that this report will cause command reflection and, ultimately, command action. We'll start at the top first:

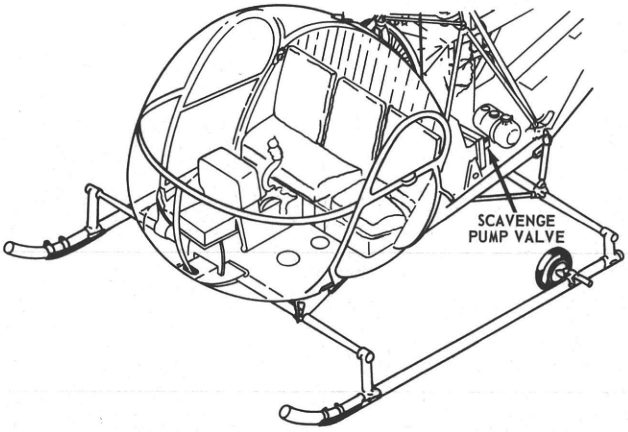
"*Aircraft Procurement:* The Army buys aircraft with procurement funds and, in this case, caused delivery of a new series aircraft with single controls. Sometime after procurement, the unit receiving delivery initiates requisitioning action for dual control kits, or scrounges kits through their own initiative. Maintenance funds must then be made available to procure the dual control kits. In the meantime, the unit has a mission to perform and begins checking out individuals without benefit of proper dual instruction.

"AR 95-4 requires that commanders who receive a new series aircraft provide adequate flight and ground school instruction to aviators. Yet, that same commander is restricted in his training program because of lack of proper hardware, due to what the board considers obsolete procurement practices.

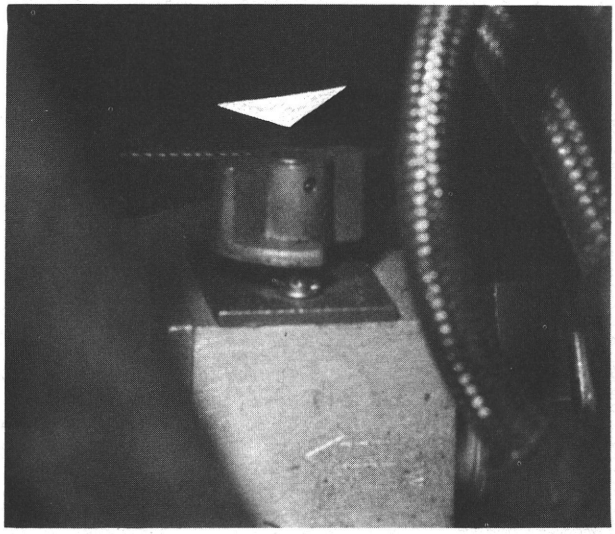
"One cannot say that this particular accident would have been avoided if the pilot had been checked out with proper dual instruction. However the probability that this is a recurring factor in Army aircraft accidents could be eliminated if updated policies pertaining to procurement of aircraft with installed dual controls were effected. There is too much lag time between new aircraft procurement and dual control kit procurement.

"*Pilot Training and Ground Schooling:* Improper pilot training and ground schooling are apparent from the statements made by the witnesses. The pilot stated that he received a cockpit checkout only. He had not received benefit of ground school, not even a preflight orientation; he had not received any practice autorotations; nor had he

Scavenge pump valve closed



Scavenge pump valve open



practiced of his own accord. This implies lack of command supervision. A more vigorous, closely supervised standardization and pilot training program is certainly called for.

"Maintenance Training Assistance: A maintenance training and assistance program could have possibly averted this accident if the division artillery aviation unit had been included in such a program. According to the crewchief, he never received any training other than OJT. It is readily apparent that the crewchief and pilot, two key maintenance personnel in the unit, were not familiar with proper maintenance procedures and their knowledge of maintenance records is considered inadequate. With the amount of 3d and 4th echelon support available, it appears that a program could have been established to give formal training to the mechanics and aviators of all aviation units receiving the new aircraft. Such a program should also provide for periodic assistance visits to include checking OJT type training, records management, adequacy of unit SOPs and maintenance standards.

"Unit Maintenance Practices: A very definite lack of supervision at the unit level was evident by the statements made to the board. A handbook had not been used; the aircraft was inspected at night without benefit of lighting, and signed off. The inspection had not been signed off by an authorized individual. There was no unit maintenance SOP, nor an effective maintenance training program."

Based on this analysis, here are the board's findings and recommendations:

Findings: "1. Oil starvation caused by improper supervision of maintenance and inspection procedures, resulting in engine failure.

"2. Improper pilot technique and poor judgment were used in attempting to land with partial power rather than execute a full autorotation on initial power loss.

"3. Supervisory error, in that division pilot standardization program is lax. This resulted in pilot being checked out in a G model aircraft without benefit of practice autorotations or checkride, even though a dual control ship was available.

"4. Supervisory error at higher levels for not insuring that dual control kits are purchased in sufficient quantities with initial aircraft procurement. This places restrictions on subordinate unit standardization programs as pertains to aviator flight checks in newly delivered aircraft.

"5. Injury to pilot was caused by left leg making contact with transmission oil pressure warning light.

"6. Unconfirmed report of partiality of aviator assignments to the aviation battalion which does not allow for best possible spread of aviator experience throughout all division aviation units."

Recommendations: "1. To reposition scavenge sump drain valve to a more accessible position, i.e., near drain outlet on left side of engine deck.

"2. To change all three oil drain valves to type which are spring loaded to the OFF position.

"3. To change paragraph 1-28c, section 1, chapter 2, TM 55-1520-206-20, to include a five minute engine runup after engine oil tank is filled. Then make a visual inspection of engine and oil lines to check for leaks, and a visual reading of engine oil tank dipstick. Then refill to prescribed level.

"4. Change service notes in lubrication chart, figure 1-9, section 1, chapter 2, TM 55-1520-206-20, to include changes recommended in 3 above.

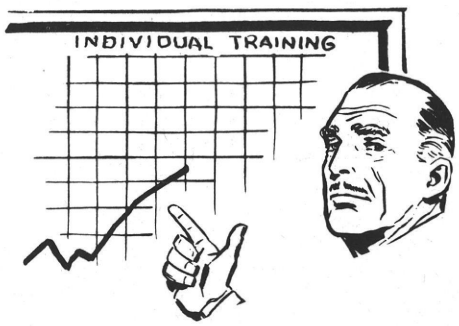
"5. Change daily and preflight inspection lists, to include a visual check of all oil drain valves in OFF position.

"6. Establish a maintenance SOP within unit charged with accident and require all aviator and maintenance personnel to be familiar with SOP; to follow proper maintenance procedures as outlined in current publications; and to require that applicable publication be used when maintenance is being performed.

"7. Establish a Maintenance and Assistance Program to advise and assist subordinate units. Program should include formal maintenance classes for all aircraft maintenance personnel.

"8. Establish a training program within the unit charged with the accident and insure individual pilot proficiency is maintained through proper supervision.

"9. Establish a functional Division/Post Standardization Program to oversee subordinate unit pilot training; to provide instructor pilots for proficiency checkrides, including written tests each six months; and to initiate recommendations to the division aviation officer in the interest of safety and accident prevention.



"10. That command action be initiated by Department of the Army to establish requirements for procurement of dual control kits on receipt of new type, model or series aircraft, and that new aircraft with dual control kits, mounted by the factory, be distributed on a prearranged and equitable basis. This will eliminate the long lag time experienced between aircraft and dual control kit procurement which presently hampers unit standardization programs and is a probable accident cause.

"11. That transmission oil pressure warning light be moved in line with transmission oil temperature warning light."

The flight surgeon member of the investigation board also had some cogent observations and recommendations in the analysis section of his report:

"In the investigation of this accident, the board found several aspects of the training of both the pilot and crewchief which were less than acceptable. Recommendations have been made in the preceding section by men more versed than I in such administrative and technical fields.

"Better training and closer supervision, however, is still not the whole answer in preventing accidents of this type. The final responsibility for preventing errors of omission and judgment in safety procedures involving aircraft lies with those men who maintain and fly the aircraft. Both the crewchief and pilot, in this instance, allowed the exigencies of deadlines to interfere with the performance of the proper precautionary measures which would have detected the open valve. The crewchief did not 'run the engine up' to check for oil leaks; he checked the alignment of the valve in the dark by the sense of touch only. He did not stay by the aircraft during 'runup' prior to takeoff, and he had signed off three red X conditions himself, including the oil changes.

"Because the pilot had not taken it upon himself to be fully acquainted with the aircraft he was flying, he did not perform proper preflight inspection of the aircraft and he must not have checked the oil pressure gauge after 'running the engine up' just prior to takeoff, as it certainly should have indicated a reduced pressure prior to takeoff.

"Built-in mechanical safety devices and repetitive instruction to maintain proficiency and emphasize the importance of double-check safety procedures can definitely help to avoid accidents such as this one, *but the final determinant is the will of the individual to follow such procedures.* In this situation, the simple routine nature of an oil change, the need for some haste, the relative unavailability of a tech inspector, and the distraction of weather conditions all contributed to the failure of both men to follow standard procedures.

"There is no ready solution to this problem of intellectual honesty with oneself, but research into methods of improving would certainly be worth the effort.

"Recommendations:

"1. Improvement in training and checkout procedures for both pilots and crewchiefs.

"2. Built-in mechanical safety devices on all valves and devices of this nature, as well as more proper positioning for easier access.

"3. Replacement of the transmission oil pressure warning light box to the top left side of the console in the interest of avoiding injury, as occurred in this case, and for more ready visual access to the pilot."

"Sighted Ship -- Sank Same"

Captain James M. Adler

I SUPPOSE IT all started when an old soldier named Julius Caesar sent back his battlefield report in three words, "Veni, vidi, vici" and was praised for saying so much in a so few words. Many years later the U. S. Navy offered its contribution to brevity with "Sighted ship, sank same" and a tradition was born in the military services which reads in unwritten law: Tell the whole story but do it in the fewest words possible.

Now this tradition may or may not be good, depending upon the situation. When it applies to aircraft maintenance forms and records, it definitely is not good. For example, the entry "Both omnis and rear tire low" was actually found by maintenance personnel recorded in the FAULTS AND/OR REMARKS column on a DA Form 2408-13. It brings to mind the old classic example where the pilot writes "Engine missing" and the mechanic adds his corrective action — "Checked A/C and found engine."

It all seems rather humorous until you put yourself in the shoes of the mechanic who must figure out what you were talking about. Let us look at a few more examples found every day by maintenance personnel the world over.

—"Aircraft out of trim." Swell! Now all we have to do is figure out on which axis.

—"30° difference between cylinder head temps." O.K. But was #1 too high or #2 too low? What was the reading on each one? Was the aircraft in climb, cruise . . .?

—"Excessive mag drop." Really! When? On preflight runup? Same drop after landing? How much of a drop?

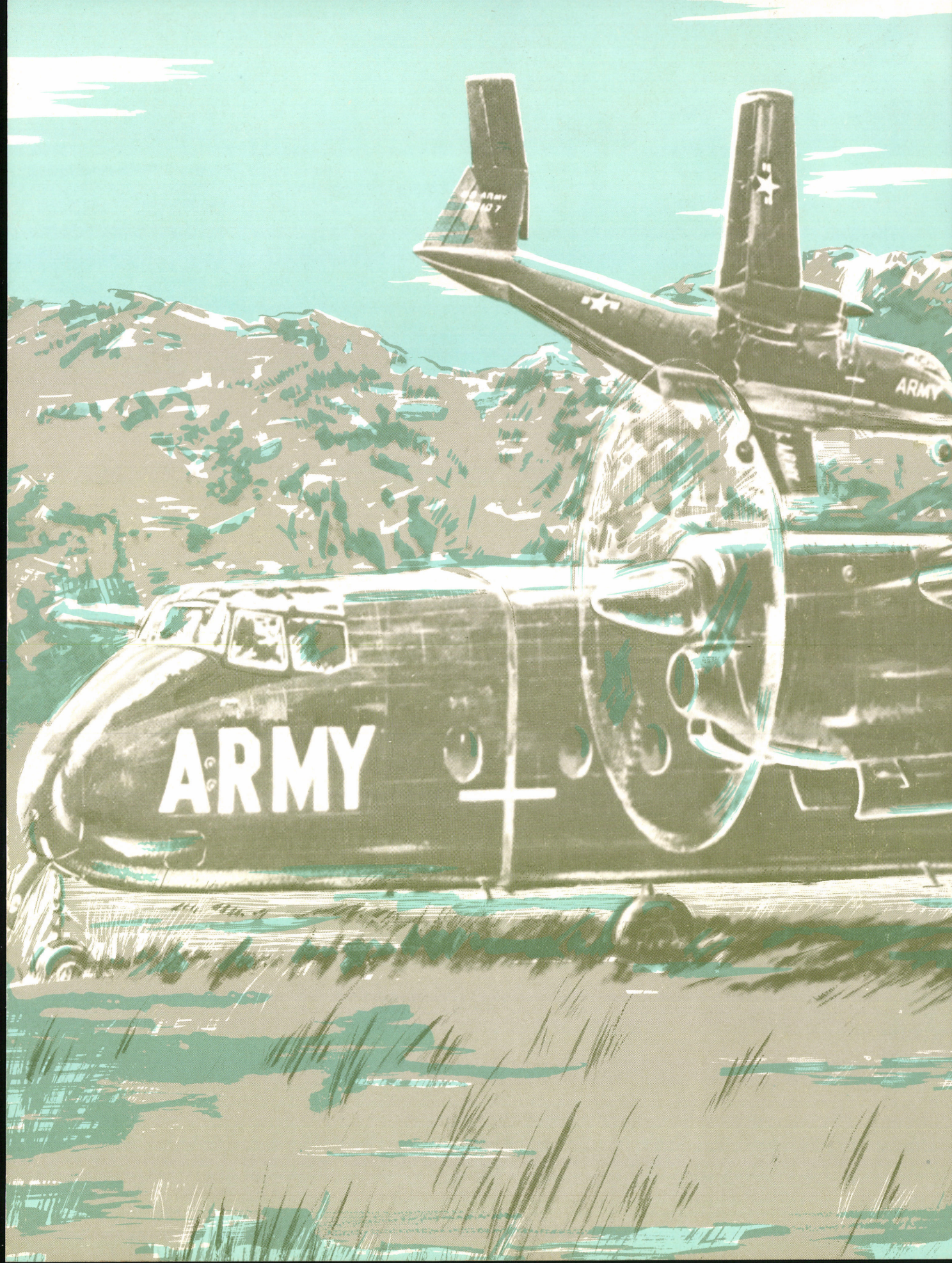
These questions that puzzle the wrench benders usually have to be solved by a follow up telephone call or a time consuming test flight trying to duplicate conditions. What's the solution to this problem? Well, we could put scratch pads in every airplane, but that's unnecessary since we already have a note pad in the log book. That is exactly what Block 17, DA Form 2408-13 is intended for — a place for you, the operator, to leave a note to your maintenance people and tell them what you found wrong with the aircraft.

TM 38-750 directs that the -13, with your notes on it, is to go to the maintenance office for review, necessary action, and then into the file for 6 months. Therefore, since neither the local literary society nor the Pulitzer Prize selection committee will probably ever see it, no one has to feel bashful about his personal writing ability and, therefore, can feel free to tell the whole story.

If you experience a powerplant malfunction you should include in your note on the -13 the cylinder head temperature, fuel pressure, oil pressure and temperature, mixture setting, carburetor temperature, and power settings. Communication or navigation equipment notes should include, when applicable, the specific frequency, whether the equipment was working and then slowly dissipated to an unsatisfactory condition or just plain quit, and any other data that you feel will assist maintenance personnel in making an accurate diagnosis for corrective action.

It's a sure bet that aircraft down time will be reduced and many productive manhours will be saved if all pilots assist their repair personnel by telling the whole story in the space provided. Try it in your own unit and watch the favorable results. Who knows, the practice might even become traditional!

Capt Adler is fixed wing organizational maintenance officer, Davison U. S. Army Airfield, Ft Belvoir, Va.


ARMY
ARMY