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JUNE 1970

UNITED STATES ARMY

AVIATION DIGEST

army aviation's 28th anniversary

UNITED STATES ARMY AVIATION DIGEST

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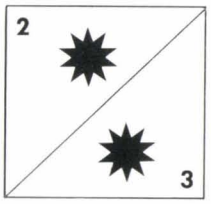

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28TH ANNIVERSARY COVER

Army aviation was born on 6 June 1942 when light aircraft were authorized for the Field Artillery. The cover depicts the evolution of aircraft from the L-4 Cub (upper right) to the OV-1 Mohawk (upper center), and from the H-13 Sioux (center) to the AH-1G HueyCobra (bottom)

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

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Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, U. S. Army Aviation Digest, Fort Rucker, Ala. 36360.

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VIEWS FROM READERS

Sir:

I read with great interest the article "Mapmaker's Wings" in the January 1970 issue of the U. S. ARMY AVIATION DIGEST. CW2 Post gave a fine insight into the Army aviation support rendered the Inter-American Geodetic Survey (IAGS) or as our Latin American friends call it—Servicio Geodesico Interamericano. There are too few articles these days on this most important project, most of which unfortunately appear in technical publications.

I take exception to the lead paragraph of CW2 Post's otherwise fine effort. Army aviators assigned to IAGS, way back in the 50s, developed the jungle-mountain flying techniques long before the United States became involved in the Republic of Vietnam. It was all done with underpowered OH-13Bs, OH-23Cs, UH-19s and later on the OH-23F. For years, the 937th Engineer Company (Aviation) (IAGS), now inactivated, carried on an intensive 2-week, jungle-mountain flying training course for its newly assigned aviators. The aviators were then assigned to an IAGS project in a Latin American country for the balance of their tour. Most of these outstanding pilots went on to serve in aviation units in Vietnam, many in positions of responsibility. I would suspect that the experience these men gained flying in the mountainous jungle areas of Latin America impacted on the development of these techniques in Vietnam.

I am most happy to see that IAGS now has the UH-1D. It has long been sorely needed because of its greater capabilities which will permit operations at altitudes hitherto inaccessible except by foot or by mule.

Let's have more on IAGS in future issues. This outstanding effort gains much for the United States in many, many areas at a relatively low expenditure of funds.

Keep up the good work!

LTC William C. Hale, USA (Ret)
CO 937th Engineer Company
(AVN) (IAGS) from 1962-1965

Sir:

In reference to SSG H. H. Fox's letter, March 1970 AVIATION DIGEST, I would like to clarify something for him on UH-1 helicopters.

If he will check the appropriate dash 10 on each type UH-1, he will find that a UH-1 will carry 4,000 pounds internal and external—not at the same time though—either inside or outside. Reference: TM 55-1520-219-10, paragraph 7-25, for the UH-1B; for the UH-1D refer to TM 55-1520-210-10, dated May 1969, paragraphs 7-29, 7-30 and 7-39.

SFC Wallace E. Draughn Jr.
HQ, Third U. S. Army
Ft. McPherson, Ga. 30330

• Your information is correct. For a more detailed explanation see "Charlie and Danny's Write-In" this month.

Sir:

I read somewhere in one of the aviation-type publications that we are encouraged to make known any ideas or information we might have for prevention of aircraft accidents or anything of a safety nature that may help in aviation. Well, here is my 2 cents' worth and I hope it will be of benefit to someone.

In scanning through the last 2 years of USABAAR's "Weekly Summaries" and "Monthly Maintenance Summaries" I could see the same old thing continuing to knock our birds out of the sky with accidents, precautionary landings, forced landings and incidents. Things like chafed lines, loose lines and nuts, improperly installed parts, cotter pins left out, tools left in flight controls and drive shafting, lack of lubrication and many other things that should have been detected by the technical inspector *if* it had been written up to begin with—and this is a big *if*. As a technical inspector I have seen mechanics have an aircraft half torn apart, with not one red X in the book, doing what they may consider routine maintenance. It may have been routine true enough, but very important from a safety standpoint.

When we remove a filter, oil line, nut, bolt or anything else that makes the aircraft unsafe to fly we have created a red X condition and should be written up as such. The trouble is it's not being done in many cases. We all know it's the little, simple things that cause most of the problems.

Why doesn't a mechanic or crew chief want to write up a red X to begin with? Well, we know the answer to that, too. The word goes out that his aircraft is grounded and everyone from the NCOIC to the battalion commander hits the panic button, even though the aircraft may be repaired and technically inspected in an hour or so. What I'm trying to say is we should get the mechanic to call a spade a spade and get that technical inspector off his duff in an office and on the flight line more often. I'm not saying he is perfect and won't miss anything, but four eyeballs on that item are better than two anytime.

I realize this is not a cure-all for our accidents, precautionary landings, etc., but it's one more tool we have for safety. Why not use it more?

SFC Myron C. Dalton
HQ, Third U. S. Army
Ft. McPherson, Ga. 30330

a PLAN for army aviation

Major Robert S. Fairweather Jr.

Improvements are being made at an increasing rate in Army aviation's management system. However they must be tied together in a total systems package to ensure maximum effectiveness. A revision of current policy and structure is presented here using the concepts of systems management

IN THE EARLY 1960s military operations in the Republic of Vietnam placed great demands on the U. S. Army for a rapid development of mobility concepts. Although little time was allowed for perfecting techniques, Army aviation responded with the highly successful airmobile tactics employed today.

This remarkable success has been accompanied by a rapid but unrefined expansion. Now it is time to determine where Army aviation management concepts can be improved and to develop a long-range plan for the future.

Certain problems concerning Army aviation management now exist. First, there is no true centralization of management at the top level to ensure firm direction of aviation resources and doctrine. Second, Army aviation is subordinate to nonaviation commands at almost all levels and cannot always influence events to assure successful attainment of goals. Third, Army aviation has no formal system to educate and train aviation managers in depth. And last, Army aviation is tactically organized under a concept that differs little from that of ground units.

Steps now are being taken to improve Army aviation management. Aviation training bases are developing a coordination of data processing and computer efforts to ensure better interfacing of training. The U. S. Army Combat Developments Command (USACDC) is in the process of studying the possible reorganization of small tactical aviation units. And, many aviation managers are applying modern techniques such as Program Evaluation and Review Technique (PERT) scheduling. To be sure, improvements are being made at an increasing rate. However, these improvements need to be tied together in a total systems package to ensure maximum effectiveness.

Development of a total system using the concepts of systems management is the approach presented here toward solving Army aviation's management problems. A system, be it good or bad, now exists and a revision of this system

Continued on page 10

MAJ Fairweather is the training officer of the Flight Training Analysis Branch, Evaluation Division, Director of Instruction, U. S. Army Aviation School, Ft. Rucker, Ala. He has served as an assistant S-3 (operations) for the 1st Aviation Brigade and as platoon leader in the 200th Assault Support Helicopter Company in the Republic of Vietnam. He was graduated from the U. S. Military Academy in 1960 and is currently completing requirements for a Master of Science degree from the University of Southern California in aerospace operations management. In August MAJ Fairweather will attend the Command and General Staff College, Ft. Leavenworth, Kan.

the ROAD to success

Army aviation has not just "appeared" on the scene. Those who launched it on its present course in 1942 had experienced and studied the previous 35 years of aviation in the Army. Today's planners are a product of that thinking which has been proven successful in the sternest of tests—combat

AS ARMY AVIATION observes its 28th anniversary this month there is much to be proud of—especially in light of the tactical success it has achieved in the Republic of Vietnam. But the inevitable growing pains have accompanied Army aviation's development and much has been written about its problem areas. The article that appears at left is one of the stronger articles in this respect and is indeed thought-provoking. However, it presents a departure from established thinking and I question whether or not this is the direction in which Army aviation should be going.

Concerning the need for long range planning, continuing efforts *are* being made to improve Army aviation management concepts and planners in the aviation community and U. S. Army Combat Developments Command (USACDC) *are* developing long-range plans. CDC studies involving Army 75 and Army 85 admittedly are crystal ball gazing. These studies, however, combine known doctrine and forecast developments and technology to arrive at a reasonable point of departure. They involve all branches of the Army in an attempt to ensure the interface between missions and roles and that responsibilities are interwoven so that one branch does not outrun the capabilities of another.

MAJ Stiles is a project officer in the Office of Doctrine Development Literature and Plans at the U. S. Army Aviation School, Ft. Rucker, Ala. A 1959 graduate of the U. S. Military Academy, he is both fixed and rotary wing qualified. During his second tour in the Republic of Vietnam he served on the staff of the 1st Aviation Brigade and as the commander of the 335th Assault Helicopter Company. He also is a graduate of the Aviation Safety Course at the University of Southern California and the Aircraft Maintenance Officer Course at Ft. Eustis, Va.

It is quite important to remember that the Army's plan for Army aviation has not just "appeared" on the scene. It has a lineage that goes back beyond Army aviation's official birthdate of 6 June 1942. The men who launched Army aviation on its present course on that date had experienced and carefully studied the preceding 35 years of aviation in the Army. Based on this knowledge they initiated the current concept of Army aviation. Today's planners are a product of that thinking which, as it continues to evolve, has proven sound. You can't argue with success.

Four problems are mentioned in "A Plan For Army Aviation." I would like to address them, beginning with the contention that centralization of management at

Continued on page 14

Nostalgia or . . .

The Army Looked Forward, Too

For years the U.S. Army has been developing the potential of the helicopter and today the fruits of these efforts are clearly reflected in highly successful airmobile tactics employed in the Republic of Vietnam

M. J. (Jake) Fortner

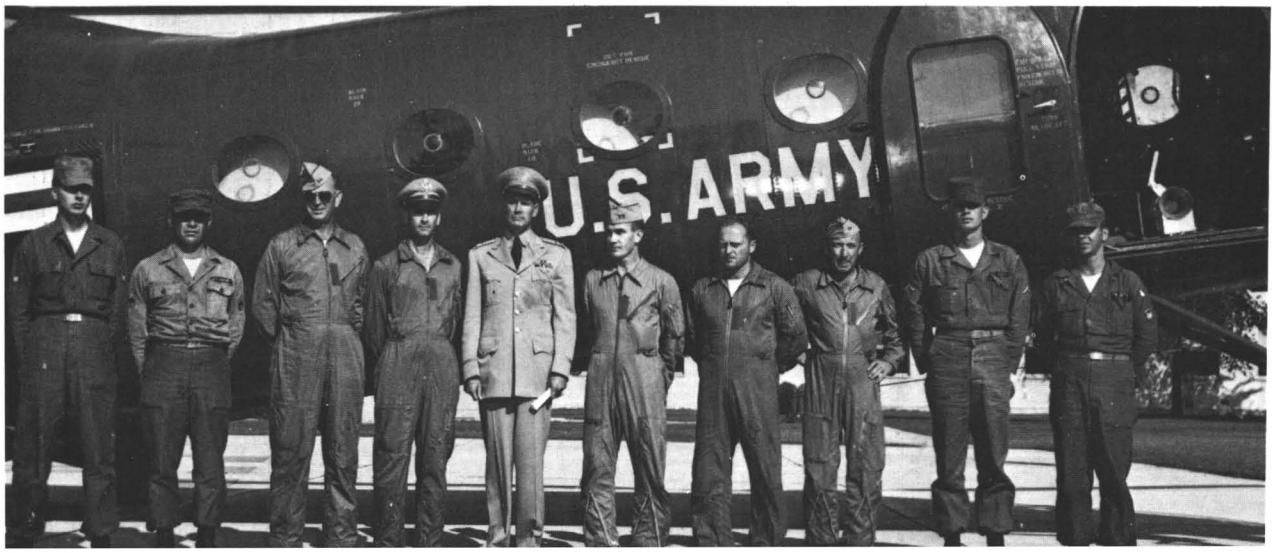
A YEAR OR SO ago the U.S. Air Force received considerable national publicity when it refueled helicopters in flight. Since that time there has been more publicity along this line, and on 27 October 1969 the NEW YORK TIMES carried an article describing a U.S. Navy research and development (R&D) effort which resulted in keeping a helicopter airborne through a "tether tube." In the story project officials indicated, and I quote, ". . . flights of 48 hours would probably be possible if the helicopter were modified to require less frequent lubrication."

To many old-timers in Army aviation these news items brought back a note of nostalgia. And I, for one, began "looking back" to 1956 when the Army "looked forward" into the areas of increasing helicopter distance and endurance, thus inflight refueling.

As the world's principal user of helicopters, the U.S. Army has long envisioned potential uses of helicopters and has provided much of the foresight that has resulted in today's use of helicopters. Much of this evolved from forward looking Army R&D efforts conducted in 1956 by the U.S. Army Aviation Test Board located at Ft. Rucker, Ala.

The test board came into being on 1 August 1955 as United States Continental Army Command Board No. 6. Its first president was Colonel (Retired) Edward McMaken who then was a lieutenant colonel. Over the years its major effort has been devoted to improving the operational capability of helicopters. During 1956 a concerted endeavor was made at the

The crews of the U-1A Otter refueler and the record setting H-21 Shawnee pose for a picture at The Pentagon in Washington. At center is Major General Hamilton H. Howze who was Director of Army Aviation



A U-1A (right) refuels the H-21 making its historic non-stop, coast-to-coast helicopter flight

test board to exploit the potential of helicopters.

H-23 Endurance and Distance

On 31 May and 1 June 1956, the test board conducted a project which resulted in an unofficial world's record for helicopters in endurance and distance. Captain James E. Bowman and Mr. Joseph E. Givens, both pilots assigned to the test board, flew an H-23 helicopter continuously for 30 hours and for a total distance of 1,520 miles. To accomplish this feat, the helicopter was flown from Ft. Rucker on a triangular course with Dothan, Ozark and Ft. Rucker as checkpoints. On every other lap, and while Mr. Givens held the H-23 steady, CPT Bowman climbed out on a small platform built on the skids and refueled with cans of gasoline and oil which were handed to him by ground crew members. This took about 5 minutes.

The primary reason for the test was not to break the world's record nor to perform a stunt but to prove that helicopters had the capability of remaining airborne for long periods of time. This also helped to dispel the rather common concept that ground maintenance or lubrication was required every few hours of flight.

H-34 Speed Records

On 12 July 1956 an H-34 helicopter piloted by Captain Claude E. Hargett with Captain Ellis D. Hill as copilot broke three world speed records during a single flight over a closed circuit course. The Army was able to claim the world's speed record for a 100 kilometer run (123.1 knots), a 500 kilometer run (118 knots) and a 1,000 kilometer run (115 knots). The helicopter was flown nonstop over a 50 kilometer closed course along the eastern shore of Connecticut. The H-34A had been stripped of nonessentials and its fuel capability had been augmented by the addition of a 500-gallon auxiliary fuel tank. The crewmen reported that adequate control was available throughout the flight and they experienced no adverse effects from vibrations or noise. An inspection following the flight indicated that high speed in extended flights was possible with no adverse effect on the helicopter. It was concluded that it was feasible to fly the helicopter over long ranges at high speeds.

H-21 Record Distance Flight

On 11 August 1956, an H-21C helicopter flown by Lieutenant Colonel Harry L. Bush and Major William C. Dysinger established a world record for distance. They flew the helicopter nonstop 1,199-.07 miles in 11 hours over a closed circuit in the vicinity of Philadelphia, Pa. Little effect from noise or vibration was noted by the pilots. The average ground speed during the flight was 87 knots. An inspection following the flight revealed that flying at high takeoff gross weight and for extended duration had no adverse effect on the helicopter.

Inflight Refueling Tests

Again in 1956, the test board tackled the problem of inflight refueling of helicopters. Because of

The late M. J. (Jake) Fortner was involved with Army aviation since its inception. He was a member of the Class Before One which tested the concept of Army aviation in early 1942. As an aeronautical engineer at Ft. Sill, LT Fortner helped establish the Department of Air Training and later to organize and develop the U.S. Army Aviation School. He was primarily responsible for developing maintenance courses for both pilots and mechanics. Most recently he served as an aeronautical engineer and advisor to the president of the U.S. Army Aviation Test Board, Ft. Rucker, Ala.

In 1956 Captains Claude Hargett and Ellis Hill obtained three world records for the Army using an H-34 helicopter, above. Below: Colonel Robert R. Williams congratulates Captain James Bowman and Mr. Joe Givens after a 1,520-mile trip in an H-23. They were aloft for 30 hours

its size, controllability and reasonably low airspeed, an Army U-1A was selected as a tanker aircraft. The first attempts at inflight refueling were made using a YH-13H helicopter equipped with two auxiliary saddle tanks. The air speed of the H-13 was not sufficiently compatible with the minimum air speed of the U-1A tanker and inflight refueling could not be accomplished. However, these attempts did prove the feasibility of flying helicopters in the propwash existing behind refueling aircraft.

An H-21C was then selected for inflight refueling attempts and successful inflight refueling was accomplished at an air speed of 70 knots employing a looped-hose system. Once the feasibility had been proven, the H-21C with internal fuel tanks installed was flown nonstop from San Diego, Calif., via Savannah, Ga., to Washington, D.C., on 23 and 24 August 1956. A distance of 2,349 nautical miles was covered in 31 hours and 40 minutes in this first nonstop coast to coast helicopter flight. Captain James E. Bowman was first pilot of the H-21 which was nicknamed "Amblin Annie"; other members of the crew were Major Hubert D. Gaddis and Mr. Givens. The crew of the U-1A was comprised of Captain Leonard F. Seitz and Captain June H. Stebbins.

During this test, night and turbulent conditions occasionally made air-to-air refueling too hazardous and "Amblin Annie" was refueled from a hover. However, four air-to-air inflight fuel transfers were completed. Following the flight it was concluded that the U-1A was inadequate for use as a tanker aircraft for inflight refueling of cargo helicopters due to its limited payload. An aircraft with more speed and payload would be more desirable.

YH-13 Endurance Flight

Between 1 to 3 September 1956 at the National Aircraft Show at

"Amblin Annie" is refueled while being hovered during the first non-stop, coast-to-coast flight by a helicopter

Oklahoma City, Okla., an Army YH-13H helicopter remained airborne for 57 hours and 50 minutes, consuming 731 gallons of fuel and 19 quarts of oil. To accomplish this feat the test board used seven pilots who took turns flying. They exchanged places when the aircraft came to hover for refueling. Captain Charles A. Walts was the board's project officer for this effort. Other pilots were CWO Alva Anderson, CWO Bert E. Ratliff, CWO Joseph A. Pfluger, CWO Walter S. Catlow, CWO F. E. Pauli and WO George W. Cox. The purpose of this test was to prove that the helicopter could be operated for extended periods without ground maintenance. The aircraft functioned normally throughout the flight and no mechanical or electrical failures were experienced. It was concluded that the YH-13H was capable of maintaining continuous flight for extended periods without encountering excessive maintenance problems.

Awards

In 1956 the Army proved the potential of the helicopter for increased range and endurance and also for inflight refueling. At the same time, it was able to claim four world records—three for speed and one for distance. For these achievements LTC Bush, MAJ Dysinger, CPT Hargett, and CPT Hill were awarded Distinguished Flying Crosses during the 1956 National Aircraft Show. Yet, we should not—indeed, we cannot—"rest on our laurels"; and under the leadership of its current president, Colonel Daniel G. Gust, the U.S. Army Aviation Test Board and many other elements of our Army are planning ahead in terms of improved helicopter performance, capability and utility.

The feats cited above document only a small effort by a small element of the Army over a short period of time in 1956. It would be impossible in a single story to document all of the Army's forward looks during the intervening 13 years into uses of helicopters to improve the capability of its number one asset—the combat infantry soldier: the Army first experimented with armed helicopters; many additional world's records have been attained through the years by Army aviators; the forward thinking of the Army Tactical Mobility Requirements Board (Howze Board); the resulting airmobile concepts; and the establishment of the first combat air cavalry division have expanded the use and number of helicopters—and of aviators—in the Army far beyond the comprehension of most of us who were privileged to be associated with Army aviation in the "Cub days."

With an increase in the number of aviators, the Army is increasing its ability to look forward into more uses for the helicopter. These young, dynamic Army aviators are brimming over with ideas. Army aviation is theirs today—and that is as it should be. Hindsight is good only if it is used to sharpen foresight. Therefore, old-timers can reminisce about the old days; but they must give the young aviator the reins, help guide him into new areas and ideas on use of helicopters and then follow his lead. With this tremendous asset and the continued effort of our Army/industry team, the use of helicopters by the Army is bound only by the limits of human imagination.

Maintenance

Treat Cannon Plugs Right: The use of steel pliers on cannon plugs will result in damage to the cannon plug. However, many tool kits contain authorized aluminum or padded pliers specially designed for cannon plug use which should be used for loosening only. Cannon plugs on avionics equipment and some emergency devices require "break away" wire (normally 0.020 copper wire).

Safetying: To establish a 6-inch limit between bolts, nuts, screws, etc., for lock wire is an invitation for unauthorized modification of aircraft and problems for personnel who are concerned with exceptions to this limit. Systems Engineering Directorate, AVSCOM, does not concur with this limit.

OH-58A Maintenance Tip: Procedures listed will not indicate battery state of charge. If the ammeter needle indicates 5.0 amperes or less *change* from "BATT" position to the "OFF" position the battery is charged. If the needle indicates more than 5.0 amperes *change,* continue running the engine and turn off all electrical circuits not needed.

Troubleshooting The Aircraft D.C. Generator Circuit: A problem which usually creates a great deal of colorful adjectives and unnecessary changing of components is failure of the D.C. generator circuit in aircraft having 28-volt D.C. systems. The mind of the maintenance technician and the drain on the supply system can usually be eased by the following simple check at the mysterious gadget known as the reverse current relay (R.C.R.):

- On a properly functioning generator system all terminals on the R.C.R. will indicate 28 volts when tested.
- If 2 to 4 volts are indicated at the "GEN" terminal of the R.C.R. the problem is in the shunt field circuit. This circuit begins at the "GEN" terminal, passes through the voltage regulator and re-enters the generator on terminal "A."
- An indication of zero volts at the "GEN" terminal shows a lack of residual magnetism in the generator which must be replaced by "flashing the field" before the generator can produce current. The "or the main armature lead" phrase is not technically correct nomenclature and should be deleted. "APP" and "IND" are not used on some aircraft.
- If 28 volts are indicated on terminal "GEN" and zero volts on terminal "SW" the trouble is in the switch circuit.
- If 28 volts are indicated at terminals "GEN" and "SW" all other R.C.R. terminals should also have 28 volts. If this is not the case the fault lies in the reverse current relay.

More On Cannon Plugs: Some unit SOPs require the rocket pod cannon plug to be disconnected upon landing; therefore, the environment of the rocket (in the air or on the ground) should be stated.

OH-58A Maintenance Tip: If you are having a problem with low charged batteries in OH-58A aircraft you can solve the problem by requiring the pilot to check the charge of the battery prior to shutdown of the engine by observing the generator ammeter. Move the battery switch from "BATT" to "OFF" and if the ammeter needle indicates 5.0 amperes or less, the battery is fully charged. If the needle indicates more than 5.0 amperes, continue running the engine and turn off all electrical circuits not needed. Then perform above check again.

High Exhaust Gas Temperature: If high exhaust gas temperature and low performance conditions prevail there can be many causes other than a "dirty engine" and a

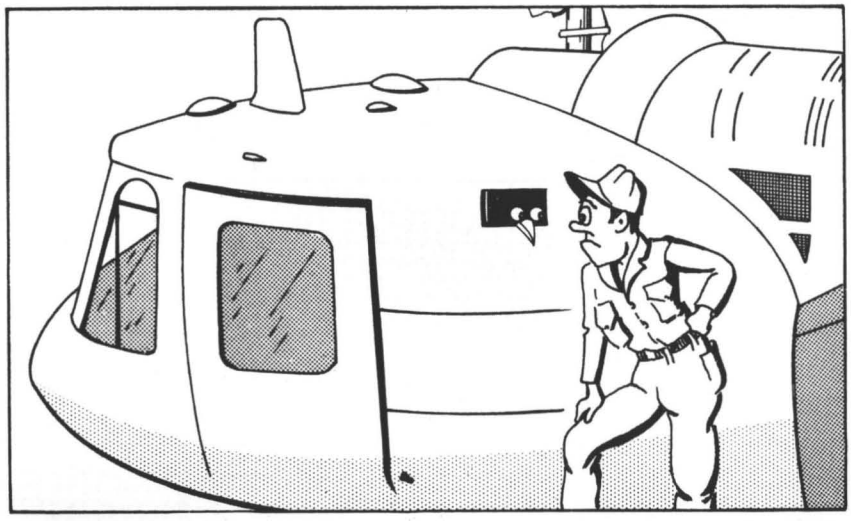
Matters...

restoration of power cannot be guaranteed.

For CH-47 Jockeys: Know the operating limitations and operate the aircraft within them. To operate the aircraft within operating limitations requires a complete knowledge of the aircraft systems. For instance, exceeding air speed limitations for existing conditions with the longitudinal cyclic speed trim actuators retracted places high stresses on the aft vertical shaft and requires a vertical shaft replacement, causing extra maintenance man-hours and aircraft downtime. The cyclic speed trim actuators will not automatically extend as air speed is increased if the speed trim function switch is at "MAN." They will have to be extended by the operator using the manual control switch. Don't forget—and save.

OV-1: Recently it has been noticed that many of the sheet metal screws on the OV-1 aircraft are being replaced with a screw one size smaller. This act has caused an excessive amount of nut plate damage during removal and installation of inspection panels. By use of the proper size screw these inspection panels can be removed and installed many times without causing damage to the nut plate.

. . . when birds are nesting



Won't Fit: When installing the transmission input drive quill on the UH-1 heat the hole—don't freeze the pole.

Safety Check: Be sure to check induction inlets and all other openings for bird nests—it's that time of the year!

Life Insurance: About the most that life insurance will do for a guy is give his family some money —after he's had the course. For a soldier there's one thing far better than insurance. It's PM . . . preventive maintenance. Not only is PM real "living" insurance for you; it's real life insurance for your gear, too. It'll let your gear do its job better and let it last till it reaches a ripe old age. You can't beat that, so try your best PM. It'll pay you . . . NOW.

Did You Know? The overrunning clutch on the OH-6A must be inspected and serviced as per sequence number 5.11 of TM 55-1520-214-20 PMP. The TM states that the overrunning clutch must be inspected every 300 hours or whenever a main transmission, drive shaft or engine is replaced.

a PLAN for army aviation continued from page 2

so that it will meet the desired objectives in an efficient and effective manner is proposed.

A good system certainly must be simple, flexible, reliable, economical and acceptable to those involved with it. Once the objectives are determined, they must be supported by effective plans. These plans should develop from bottom-to-top and cover planning needs from the day-to-day operation to a long-range attainment of goals. The organization should be structured to ensure timely information and decision channels with each subunit contributing to the whole. Control must be available to the manager so that he can ensure attainment of the desired results and be able to take corrective action when necessary. A good communications system ensuring proper flow of information is essential to guarantee that this information will be available at the desired decision point. Planning, organization, control and communications are not separate entities and must be integrated to make the system work.

Determining the objectives for Army aviation is a critical step. A total system would encompass all Army aviation activities and would necessarily be a subsystem within the Army and Department of Defense structures. By collecting aviation oriented objectives of major elements of the Army, a specific set of objectives for an Army aviation system can be evolved. They are:

- Provide tactical airmobility and other direct aviation support for Army ground forces.
- Train aviation managers, aircraft crew members and aviation support technicians for Army aviation.
- Conduct research and development activities in all Army aviation areas of doctrinal and materiel responsibility and procure Army aviation hardware.
- Provide logistics support for all Army aviation activities.
- Ensure coordination of all Army aviation efforts inside and outside of Army aviation.

Responsibility and authority for accomplishment of the objectives must be subdivided along functional lines. This subdivision brings about a need for systematic integration of activities so that the parts equal the whole. Both the U.S. Air Force revised organization and the U.S. Navy Air Systems Command were examined and considered as models for a proposed reorganization of Army aviation.

The Air Force and Navy have placed great emphasis on systems management and have designed these organizations to fit their special needs. Figure 1 portrays, hopefully, an organizational structure for Army aviation which fulfills the desired objectives. It borrows from the Navy and Air Force systems, but has certain modifications which will be explained later.

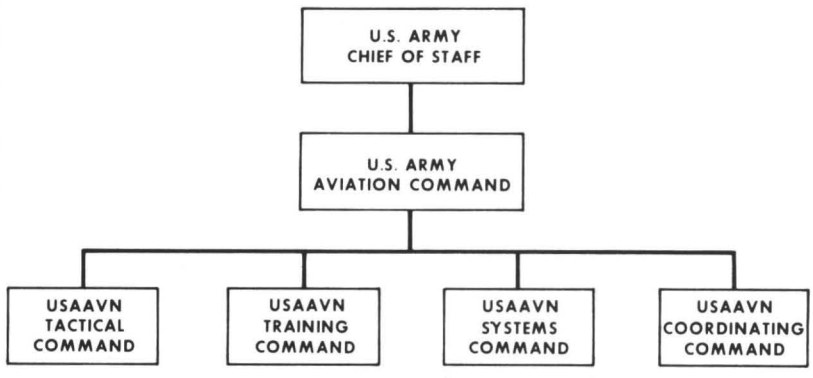
Top management for Army aviation should be centralized as a U.S. Army Aviation Command (USAAVNC) directly under the chief of staff, thus placing it on an equal footing with other functional areas of the Army. Within USAAVNC headquarters would be the usual general and special staffs necessary to support the commander. In addition, management of personnel, to include assignment, selection for schooling and other administration, would be handled at this level.

Subordinate to USAAVNC would be four commands, each responsible for a key functional area. Before developing these subordinate commands, it must be pointed out that USAAVNC would be responsible for *all* Army aviation activities. In addition, adoption of this organizational scheme would force major revisions of other structures under the chief of staff. Reorganization would perhaps benefit other branches of the Army, as indicated by Colonel John B. McKinney's article in ARMY magazine on the Signal Corps (March 1968).

Figure 2 depicts a breakdown of USAAVN Tactical Command (USAAVNTC).

USAAVNTC would accomplish the first objective, i.e., provide tactical airmobility and other direct aviation support for Army ground forces. Determination of tactical doctrine, recommendation for deployment of forces and development of tactical aviation systems would be done by directorates. Geographic and flexible tactical

Figure 1: U. S. Army Aviation Command



Tactical airmobility and other direct aviation support for the ground forces would be accomplished by the U. S. Army Aviation Tactical Command

headquarters would command tactical organizations tailored to fit particular needs. These tactical headquarters would be under operational control of the senior Army commander in the theater, but would retain operational control of all subordinate units. Colocated with the tactical headquarters would be maintenance headquarters which would command all subordinate maintenance organizations. Keeping maintenance under a separate command structure would allow the establishment of sophisticated fixed maintenance bases distributed throughout the tactical area. Keeping a proper balance of tactical and maintenance units would be the job of the Tactical Deployment Directorate. Integration of USAAVN Tactical Command within the total system will be shown later.

The proposed Training Command, figure 3, would be designed to meet the second objective, i.e., train aviation managers, aircraft crew members and aviation support technicians for Army aviation. All formal training activities would be under this command, thus avoiding

Figure 2: U. S. Army Aviation Tactical Command

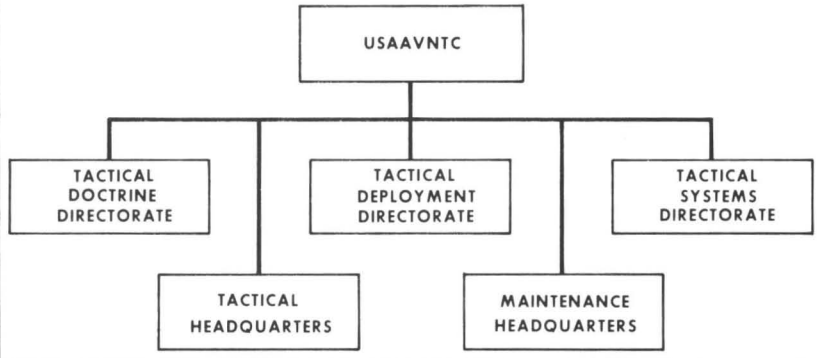
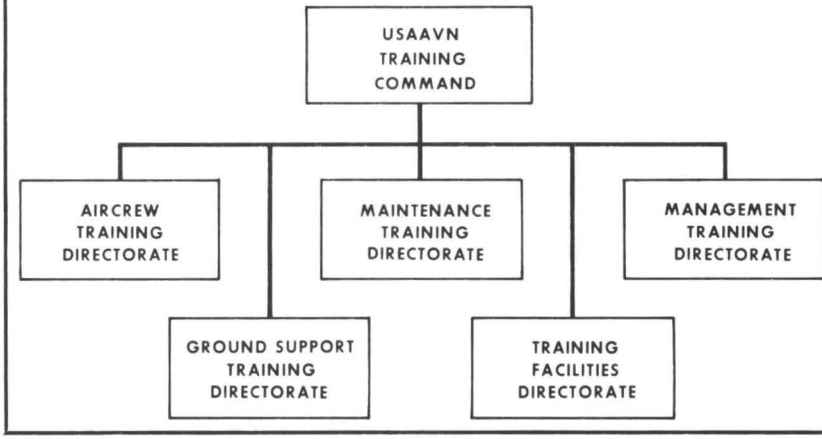


Figure 3: U. S. Army Aviation Training Command



divisions of responsibility existing under the present system (example: aircraft maintenance officers are now trained by the Transportation Corps). The Aircrew Training Directorate would train pilots, observers, crew chiefs and other crew members. The Maintenance Training Directorate would train enlisted and officer personnel in aircraft maintenance procedures. The Ground Support Training Directorate would train air traffic control personnel, crash/rescue crew members, pathfinders and other ground support personnel. The Training Facilities Directorate would provide all the necessary facilities for training and would assume the normal housekeeping functions. Most important, and the major change, would be the Management Training Directorate. This directorate would establish formal programs to train NCOs and officers in all aspects of aviation management. Specific courses would be an NCO academy, an aviation officers' basic course, an aviation officers' career course and functional staff and command courses. Not shown, but also under the Training Command would be an Aviation Safety Institute.

Figure 4 portrays a suggested USAAVN Systems Command. The purpose of this command would be to attain the third and fourth objectives stated earlier. They are: conduct research and development activities in all Army aviation areas of doctrinal and materiel responsibility and procure Army aviation hardware; and, provide logistics support for all Army aviation activities.

The Systems Command would be subdivided into directorates and headquarters responsible for determining what materiel is needed, how to obtain it, procuring it, testing and evaluating it and getting it to the user. The Research and Development Directorate would initiate the process by determining present and future requirements. The Contracts and Budget Directorate would then translate these requirements into civilian/military programs. Approved and purchased end items would then be distributed by logistics headquarters located throughout the world in support of Army aviation activities. Items common to the entire Army would be handled entirely by the logistics headquarters and would be obtained from Army stock piles. Tactical doctrine would not actually be developed within this command but would come from the Tactical Command as an input. The prime reason for this is to ensure that developed hardware meets tactical requirements.

The last major subdivision of the U.S. Army Aviation Command is the USAAVN Coordinating Command. Its prime purpose is to ensure integration of the subsystems within the total system and to ensure that this total system properly interfaces with other agencies or branches of the Army and Department of Defense. The Coordinating Command, in addition, would be the information center on aviation activities, would establish and maintain external and internal communications, and would centralize all Army aviation computer

Figure 4: U. S. Army Aviation Systems Command

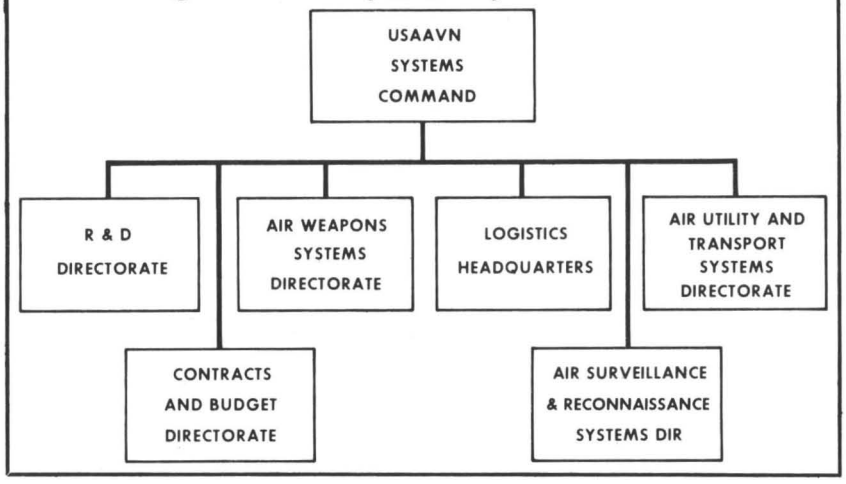
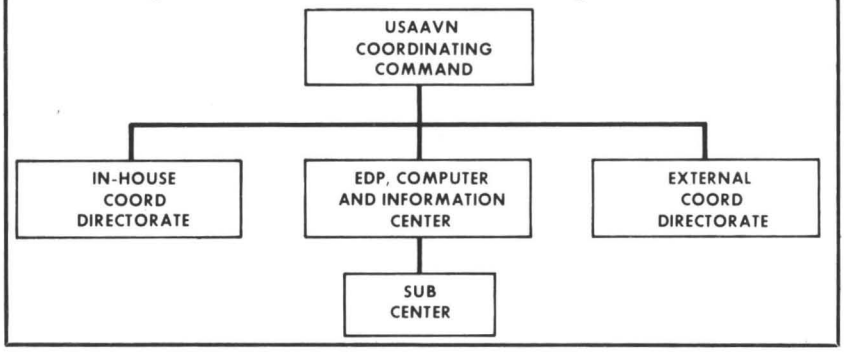


Figure 5: U. S. Army Aviation Coordinating Command

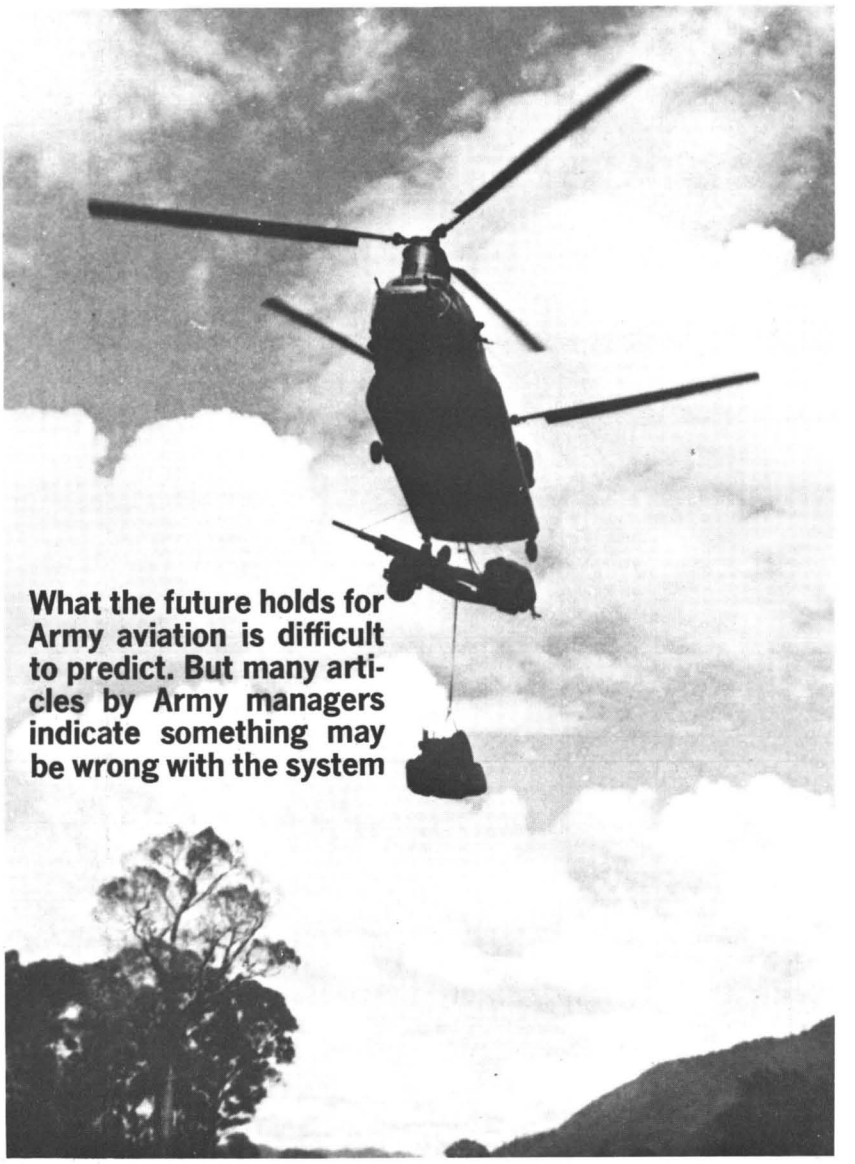


and data processing activities. Figure 5 shows major subdivisions of the Coordinating Command.

The EDP, Computer and Information Center and its subcenters would provide the hardware and personnel necessary for providing information. Subcenters (and further subdivisions) would be located throughout the world in direct support of all Army aviation activities. These subcenters would be equipped for both internal and external communications. The in-house directorate would control the flow of all internal information, while the external coordinating directorate would control the flow of all external information. Thus, Tactical Command could tell Systems Command what equipment is needed, Training Command could ask Tactical Command what type of training is needed, or Tactical Command could determine what aviation support the Army or Marine Corps might need from the Army Aviation Command 10 years in the future. Any government or civilian agency would be able to get up-to-date information concerning Army aviation from the EDP, Computer and Information Center. In addition, centralized computer data processing facilities would allow time-sharing and eliminate costly computer empty time.

Integration of subsystems could be handled in other ways, but the Coordinating Command concept would give more flexibility in tailoring the flow of information to meet the changing needs of a military organization. It provides some of the advantages found in managing of programs, frees managers in the other commands from many communications problems and ensures that the right information gets to the right person. Also, it would ensure that Army aviation speaks with one voice.

Systems management concepts also can help Army aviation.



Whether the proposed total system approach or other system variations are applied, improvement is likely to be the result. Problems arising from present management weaknesses have been pinpointed and are amenable to a systems-type solution. Further, the Air Force and Navy have proven that systems management has been of great benefit to military organizations.

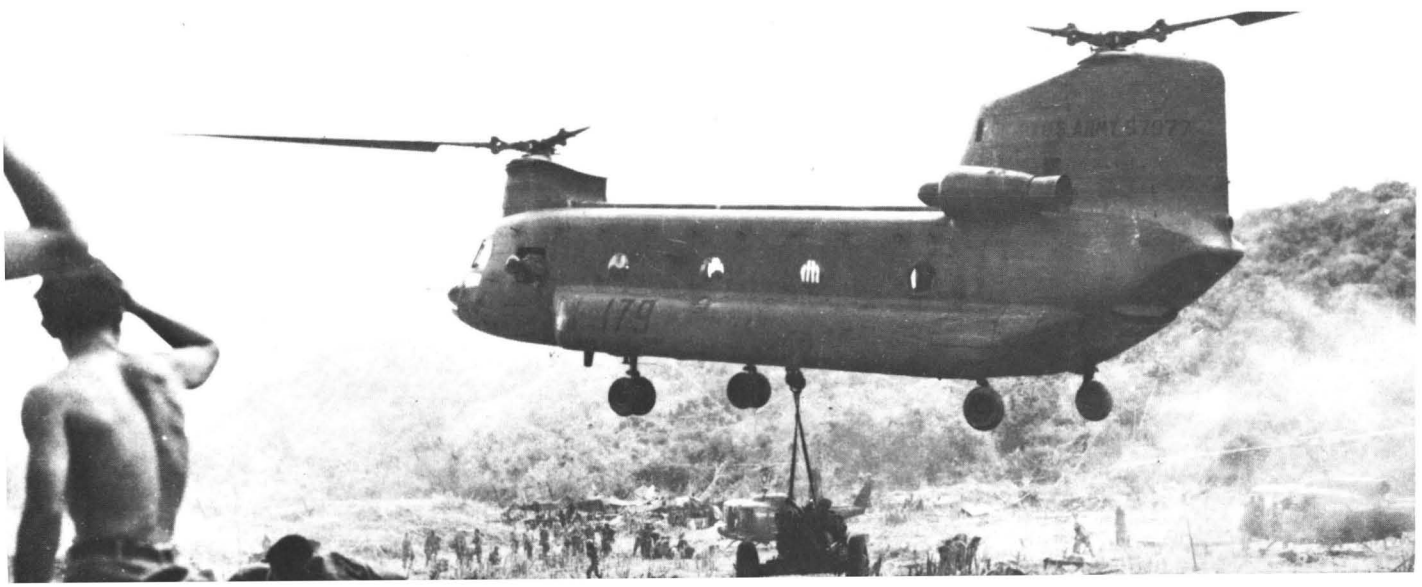
What the future holds for Army aviation is difficult to predict. Awareness that something may be wrong with the system is just now starting to show through statements and articles by Army managers. Official studies are examining the organizational structure for possible revision. Unfortunately, too many officers in Army aviation have not been exposed to new management concepts and blame the problems they meet on individuals. It would be a shame if Army aviation became systems oriented only after the faults of the present organization were brought to light by a major tactical or aircraft development failure.

the ROAD to success continued from page 3

the top is needed to provide direction to Army aviation. Within the organization of the Department of the Army I would say that firm direction already is being given to aviation resources and doctrine. True, all the aviation expertise within the Office of the Assistant Chief of Staff for Force Development (ASCFOR) or Deputy Chief of Staff for Personnel (DCSPER), to name but two high level managers, is not centralized. The Army Aviation Directorate in ACSFOR provides a central point for monitoring aviation actions which cut across the activities of all the Army staff agencies. But is centralization what we need and want? I think not. In my mind's eye centralization would create a cumbersome aviation monster. It would tend to operate in a vacuum. Increased work would be needed to reach out of this vacuum to ensure we interfaced with the rest of the Army. Centralization also would be the first step in making aviation a separate branch.

Is it solely Army aviators who should be defining the specific ob-

Above, an Army UH-1B helicopter airlifts troops of the 1st Cavalry Division (Airmobile) into an area in the Republic of Vietnam where a suspected Viet Cong outpost is located. Below, a CH-47 helicopter lifts a howitzer into an artillery fire base in the Central Highlands. This type of support reflects Army aviation's goal which is to contribute to the mobility and combat effectiveness of the Army whenever and wherever the ground commander conducts operations



a lot of dissatisfaction among aviators would disappear if the branches identified with the aviators

jectives for Army aviation? Again I say no! We serve the basic arms and services. They should define requirements and objectives based on their missions, and we should respond to their needs. One must think in terms of the total Army. *All* goals must be considered. Basic doctrine of the Army emphasizes mobility, flexibility and staying power. The Army's organic aviation must contribute to this basic doctrine. We must augment the Army's capability to conduct effective combat operations. Integrated with our ground forces, Army aviation does offer a modern and responsive means to improve mobility, flexibility, firepower and combat efficiency.

Proposals in "A Plan For Army Aviation" would establish a centralized U.S. Army Aviation Command directly under the chief of staff. This would equate the U. S. Army Aviation Command with U. S. Army Europe, U. S. Army Combat Developments Command, U. S. Continental Army Command and the rest of the Army's major commands. The rationale is to place aviation on an equal footing with other functional areas of the Army. Does it belong at that level? The establishment of a U. S. Army Aviation Command would put all aviators under its jurisdiction—thus in effect establishing an aviation branch. Then we go one step further and elevate it above the Army's branches. I believe we in Army aviation must remember our "raison d'etre." We support. We augment. We complement. We do not exist to be an *Army Aviation Air Force*. Currently, the many branches do not enjoy such an elevated status. The majority of the Army's officers and warrant officers are under control of the Chief of Personnel Operations for assignment control and career management through their branches.

I would speculate that ever since the birth of Army aviation there has been a segment clamoring for branch status to control aviator assignments and schools. An article in the February 1960 AVIATION DIGEST titled "Do We Need An Aviation Branch?" addressed this problem from two points of view—"Centralization Is The Answer" versus "Not Branch, But Balance." My purpose is not to discuss the relative merits of an aviation branch. However, I believe a lot of dissatisfaction among aviators would disappear *if the branches identified with the aviators*. We wear branch insignia and identify with a branch. However, do the branches identify with us? Not nearly enough! I feel a start in this direction would deal with the organization and proponency of Army aerial fighting units. Branches currently authorized commissioned officer/aviators must establish fundamental proponency over those aviation units whose mission/role can be associated with the mission of that particular branch. The branches must realize their stake in the future of the Army aviation program. Branch personnel managers must ensure that the aviator's professional development progresses with that of his peers and within normal parameters. I feel Armor leads the field in this regard.

The second problem stated is that Army aviation is subordinate to nonaviation commands at almost all levels and cannot always influence events to assure successful attainment of goals. What goals? Are our goals different from the goals of the Department of the Army? Are our goals different from those of the people we support? Our *goal* must be—and is—to contribute to the mobility and combat effectiveness of the Army. We will provide airmobile forces whenever and wherever the ground commander feels his ability to conduct ground operations will be improved. Together we must think *air maneuver*.

Success on the battlefield will come from close integration of Army aviation with ground units, regardless of the combat mission. It is said that Army aviation provides outstanding support because it springs from within the Army. If Army aviation was established as the U. S. Army Aviation Command, I foresee a degradation of our support to the ground forces. Normally nonaviation commanders have an aviation staff officer who certainly is equipped to advise and influence his commander toward the successful attainment of their mutual goal. Broadly speaking, that goal should be the efficient utilization of aviation assets—personnel and equipment—to successfully accomplish the mission of the ground unit. I ask, is the support role of the signal officer, ordnance officer or the armor commander in an Infantry division any different from the role of the aviation commander?

In reference to the third point concerning education and the training of aviation managers and

NCOs, my contention is the Army has a fine school system. Leaders and managers are trained through a continuous program from branch basic course through War College level. The ability to manage and lead effectively comes through experience in the field. It comes from command, from having had a variety of staff jobs and from a desire to be an effective leader and manager.

Considering NCO courses, I do not believe a specific aviation NCO academy should be established. The Army currently has a multitude of NCO courses. Think of the cost ramifications involved due to travel alone unless the aviation NCO academies were established worldwide. Then we would have duplication of effort. What we in aviation should clamor for is more allocations to NCO academies. The aviation technician, as well as other technicians, should have additional classes on leadership and management and less on map reading, adjusting of artillery and related tactical subjects. Our aviation MOS-producing schools should emphasize basic leadership to supplement that covered in basic and advanced individual training. The crew chief of today must be the platoon sergeant of tomorrow.

My comment about aviation officer basic and advanced courses is that it smacks of the aviation branch idea. What are we *first*—Army officers or aviation officers? I feel the success enjoyed by airmobile forces in Vietnam has and will cause all service schools to expand their instruction on airmobile operations. This action should benefit all. The successful commander in the future will be the one who thinks *air maneuver*. The aviator, to contribute to that success, must be schooled in the various ground disciplines. This is the responsibility of the branches.

The last point mentioned in "A Plan For Army Aviation" puzzles me. I do not believe that being tactically organized similar to ground units is detrimental. In aviation we have a chain of command similar to the traditional system we all know, i.e., commanding officer, executive officer, platoon leader, etc. We have aviation groups down to aviation sections. Being organized similar to—and integrated with—the supported ground forces is the essence and strength of Army aviation.

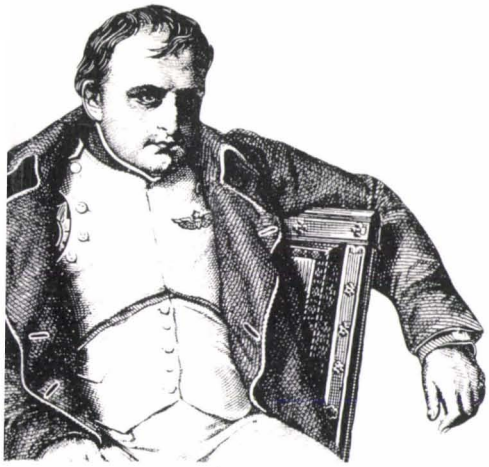
I also must comment on the maintenance organization concept proposed in "A Plan For Army Aviation." The idea of a separate maintenance command which would allow for the establishment of sophisticated fixed maintenance bases is completely contrary to current thinking. The Army criteria is that aircraft must be able to live in the field. The current trend is to integrate direct support maintenance platoons and companies into the aviation unit. Sophisticated bases have no place in the tactical area.

Discussed thus far are four of the problems that face Army aviation today. Surely someone else could define others. The solution to these problems as stated is the development of a total system utilizing the concept of systems management. I have already discussed the problems and commented on several of the specific objectives of an Army aviation system. Again for the sake of discussion, let us probe into the "systems package."

A system is literally an "organized or complex whole; an assemblage or combination of things or parts forming a complex or unitary whole." My contention is that the Army has systems packages and is utilizing systems management. The awareness of the techniques of advanced management are becoming more pronounced within the Army community each day. The key to advanced management is systems analysis and the concept of project managers. If we look at an organization chart of the Department of the Army I think it fair to equate the Office Chief of Research and Development, the Army Materiel Command, the Continental Army Command or the like to systems. As mentioned in "A Plan For Army Aviation," a system does exist. My contention is that *this* system is what must be improved and refined. The complete withdrawal of all aviation interest into a U. S. Army Aviation Command would lead to a bureaucratic monster whose parochial interest in Army aviation would distort its overall interest and objectives.

In conclusion, I feel the last paragraph of "A Plan For Army Aviation" is unfair when commenting about a major tactical or aircraft development failure. This is not the fault of the system. As any systems/project manager can tell you, the possibility of development failure in advanced technological materiel—compound rotor, VTOL, STOL—is extremely high due to the many engineering unknowns. It is not necessarily a fault of the system.

The future of Army aviation is not difficult to predict. Army aviation has truly matured during hostilities in Vietnam. Army aviation has earned a place beside the ground soldier, as well as above him. Army aviation is the most challenging, exciting element within the Army today. Our challenge within the aviation community is to ensure that Army aviation's growth is integrated into the needs and growth of the entire Army.



Your Commanding Officer

READS . . .

POTPOURRI

NATIONAL GUARD and Army Reserve Officers may enroll in three courses to be offered at the Army Transportation School at Ft. Eustis, Va. Officers may register for an entire course or for any 2-week phase.

Company grade officers may register for either the Transportation Officer Mobilization Basic or Advanced Course, which offers instruction in motor, rail, water and air transportation. The 6-week Basic and 8-week Advanced Course will be offered in the following phases:

TOMBC	
Phase II	12 Jul -24 Jul
Phase III	26 Jul - 7 Aug
Phase IV	9 Aug-21 Aug
TOMAC	
Phase IV	13 Sep -25 Sep
Phase VI	27 Sep - 9 Oct
Phase II	11 Oct -23 Oct
Phase IA	25 Oct - 6 Nov

Field grade officers may register for the Transportation Field Grade Officer Refresher Course.

The class is designed to update the senior officer's knowledge of transportation doctrine and developments. Classes are scheduled for 23 Aug, 30 Sep, 31 Jan and 12 Feb.

Throughout its life, the O-470 tends toward a gradually increasing appetite for oil.

Those of us who Bird Dog'd in the Republic of Vietnam can remember the other kind of mission. Missions like night radio relay where, with lean mixture and some sweat, 4 hours and better from block to block was the order of the day. A few of us will remember the sick shock of seeing oil pressure drop to zero 15 minutes out from home on a dark night. Somehow it's always at night.

Those of us who made that long dark 15 minutes safely, did so (more likely than not) because we had learned a particular fact about the bird we were flying.

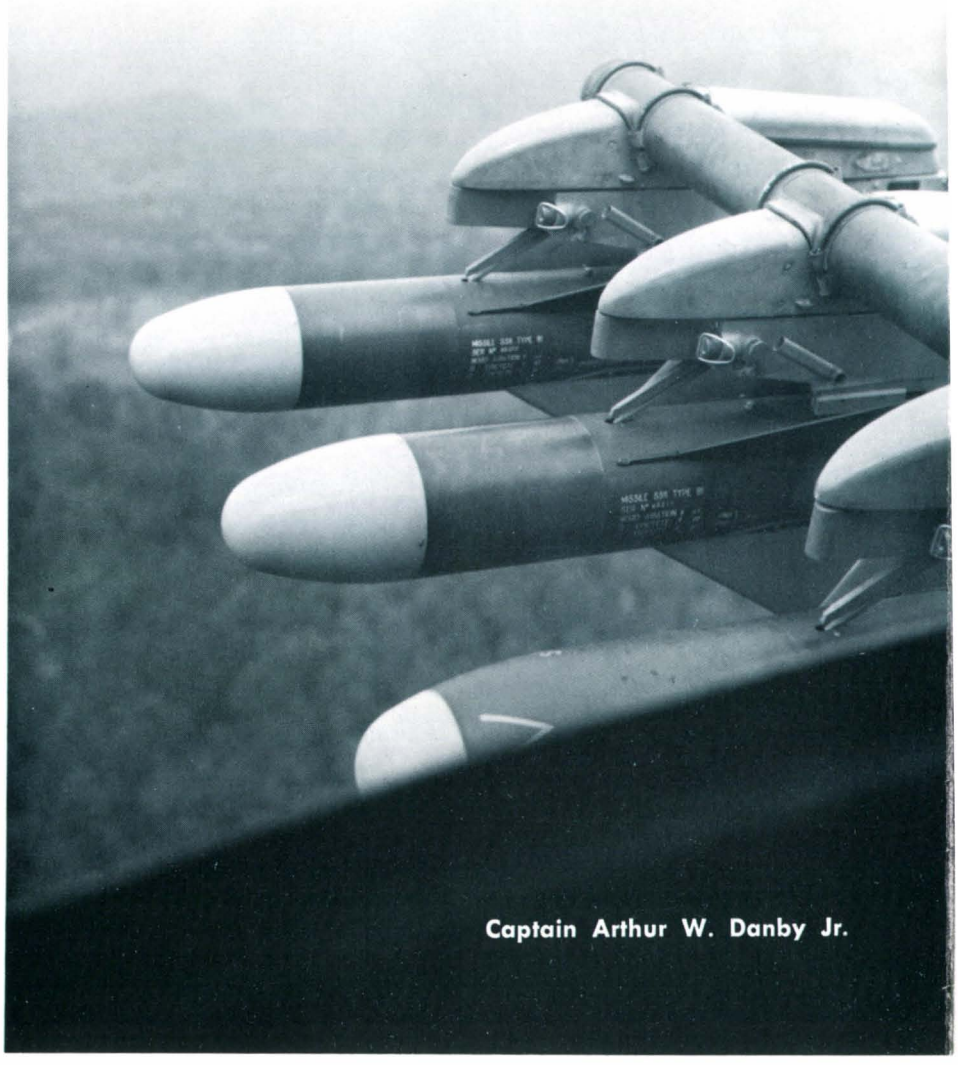
Because of the location from which oil is taken from the sump for the engine, loss of oil pressure due to lack of oil will be experienced first in a nose low attitude, then in level flight and finally in a nose high attitude.

Those of us who have been through this little drill can remember the relief we felt when, throttling back to a nose high, slow cruise we saw the pressure come back. It's a point to remember and one to pass on to your students.

Oh yes, by the way, for you careless preflight types, it works when you have left the oil filler cap off, too.

Even in the modern, mobile Army of today it is still a rarity to find a general officer qualified as an Army aviator. Lieutenant General Melvin Zais (left), Commanding General of the XXIV Corps in the Republic of Vietnam, is a "flying" Army general and on 4 March 1970 was greeted with a short ceremony recognizing his completion of 1,000 hours of flying time, all but 35 hours of which was flown in Vietnam. The oversize aviator's badge worn by LTG Zais is admired by CWO Kenneth C. Ellard who flies the CG's chopper when the general isn't at the controls.

M22



Captain Arthur W. Danby Jr.

The M-22 is one of the least understood aviation armament subsystems in the Army inventory. But it packs quite a punch and boasts a high potential for first round hits

ALL RIGHT UH-1 gun pilots! You think that you know a lot about the UH-1B armament subsystems? What is the maximum effective range of a 2.75-inch folding fin aerial rocket? You say 2,500 meters? That's right!

How about this one? What is the maximum rate of fire of the M-6 system? You're right again—2,200 shots per minute.

You're pretty sharp. Let's try one more. What is the arming distance, from launch, of the AGM-22B missile? I don't hear very many answers, friends, so let's make the question easier. What is the maximum effective range of the M-22 system when fired from a hover? It looks like you aren't as sharp as we thought.

Don't feel too bad. The M-22 system is one of the least understood armament subsystems in use today. Very few units have the system. Even those that are authorized M-22 systems frequently do not use or even mount the system. Of those units that do fire the missile, few pilots have a good working knowledge of the system.

There are not many M-22 qualified gunners in the Army. Only 24 aviators per year are trained at the U. S. Army Aviation School, Ft. Rucker, Ala. Other units do train some additional gunners; however, the total number of gunners is extremely limited.

Every 2 months four aviators enter the M-22 Gunnery Qualification Course at Ft. Rucker. The course is conducted by the Attack/Scout Instructor Pilot Branch, Aviation Armament Division, Department of Tactics. The program of instruction is 2 weeks and 3 days in length and consists of three basic phases: academic, simulator and gunnery.

In the academics phase the student gunner receives detailed training on the components of the M-22 subsystem to include the control and guidance equipment, sighting systems and the external components. He receives instruction in the methods of maintaining these components and in the use of the M-22 test set to perform circuit checks on the entire system. He receives training in the principles of operation of the AGM-22B missile and its components; the firing sequence; common malfunctions; handling; and, of course, loading. Included in the academics phase are tactical subjects which are of interest to an overseas bound missile gunner.

During a practical exercise the gunner directs the flight of the wire-guided missile through the use of a control stick in the aircraft. The use of the control stick in controlling the pitch and yaw of a missile is similar to the use of a cyclic in directing the flight of a helicopter. Pushing the stick forward causes the missile to dive. An aft movement initiates a climb. A left movement steers the missile left and a right movement steers it right.

The simulator phase of training permits the student to gain the hand and eye coordination so necessary to enable a gunner to control a missile. To do this he uses the DX-44 and DX-43 simulators designed for this purpose. With these simulators he can practice missile firing without missiles, aircraft or regard for weather conditions and under the scrutiny of a highly qualified M-22 gunnery instructor. In simple terms a missile simulator is a machine which projects a movable dot of light controlled by a gunner's control stick. Using the control stick the student moves the dot of light in a manner prescribed by his instructor. During the first 25 periods of simulator training the student is required to trace various geometric diagrams with the missile. His instructor varies the sensitivity of missile control, wind conditions and time of flight. This not only prevents student boredom but also prepares the gunner for any condition which may be encountered during actual live firing.

After a student masters the basics he is introduced to new variables encountered in actual firing such as improper launch angle and loss of the guidance control unit gravity compensation system. This training prepares the student to transition from geometric diagrams to actual tank targets projected on a CinemaScope movie screen. This is also the first time the student encounters moving targets. With actual targets the student learns the four basic steps in target destruction: missile capture, stabilization above the target, lowering on the target and stabilization on the target.

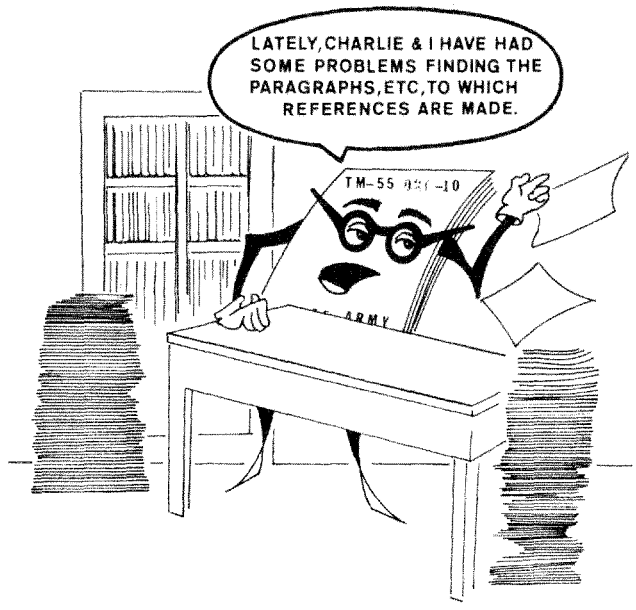
The last exercises of simulator training are conducted on the DX-43 simulator which does not project a light spot on a target. The simulated missile appears between the student and the target on a beam splitter in the same manner that a reticle is projected on a rocket sight. This dot of light is movable as in the DX-44 simulator. The DX-43 is used by the student to continue improving his control touch. The targets used with the DX-43 are actual objects such as buildings, cars and mailboxes. Anyone who has driven down Red Cloud Road at Ft. Rucker during a simulator training period may have unwittingly served as a moving target.

With the 45 simulator exercises completed a student is ready for the third phase of training—range firing. Each student fires nine missiles. The first eight rounds are scored for record with five direct hits the minimum passing grade. The ninth missile is used for night familiarization under Firefly illumination. The targets are armed personnel carriers and the students are graded on their ability to actually hit the target. Unlike horseshoes and artillery "close" doesn't count. Engagement ranges vary from 1,000 meters to 3,500 meters with the longer ranges requiring the student to use the XM-58 sight. How well does the average student fire? Based on the firing records of all gunners trained at Ft. Rucker the average hit ratio is 70 percent. There has been a constant effort to improve training and as a result of this effort the student average since the beginning of FY 69 is 79 percent.

What is the future of the M-22 subsystem? The Army has made extensive tests with the TOW missile and similar systems, one of which will eventually replace the M-22 system. These new systems will be equipped with semiautomatic guidance equipment providing a gunner with limited training the ability to obtain a high percentage of first round hits. The system that replaces the M-22 will be an outstanding weapon even if it only duplicates the characteristics of the M-22 system. The AGM-22B missile fired from the M-22 system has a high potential for first round hits, penetrating 23 inches of armor plate or 6 to 8 feet of reinforced concrete at a range up to 3,500 meters.

Oh yes, the answers to those questions. The missile arms 300 meters from the launch point and when firing from a hover the maximum effective range is limited to 2,900 meters.

Charlie and Danny's



DEAR DANNY: There appears to be some difference in the UH-1D/H operator's (dash 10) and maintenance (dash 20) manuals regarding rpm warning limits. The dash 10 (para 3-30, step 19) says check the "warning light off at 300 rotor plus or minus 10 rpm." The maintenance manual indicates that the correct setting of the warning light is 300 rotor rpm ±5 rpm. Which one is right? My second question is, What is the correct fluid level for pillow block reservoir?

LT C.E.B.

Danny's answer: The dash 10 has been changed to agree with the dash 20; 300 rotor rpm plus or minus 5 rpm. You'll get the change in about 3 months. The maintenance manual (dash 20) gives the answer to your second question. Correct pillow block fluid level is ½ full. If the blade grip seals are leaking and the fluid is low have maintenance personnel check it out.

★ ★ ★

Dear Danny: As a result of an accident in which a parachutist became entangled on the tail ski of a U-1A a review of TM 55-1510-205-10 (U-1A) was conducted. The review indicated there was insufficient airdrop "jump" information available to aircrew members in the manual. What is the chance of getting air speed and flap settings used for jumping published in the operator's manual?

MAJ S.W.R.

Danny's answer: Chances are real good for inserting this information in the dash 10. In fact, it will appear in the new U-1A manual (due out this summer), as follows:

When parachutists are to jump from the aircraft:

a. Adjust air speed to 65 knots.
b. Lower wing flaps to takeoff position.

★ ★ ★

Dear Danny: The March 1970 issue of the AVIATION DIGEST's "Views From Readers" contained a letter stating that the UH-1 "will not carry inside or outside 2,000 pounds of anything" and inferred that 1,000 pounds is all the individual would try to lift with a Huey. If he will check with the appropriate dash 10 he will find that the UH-1H will carry 4,000 pounds. Please tell it like it is.

SSG W.B.L.

Danny's answer: The UH-1B, C, D, H and M series was designed to carry more than 1,000 pounds. On high density altitude days, loads must be reduced because of power limits; however, in ALL cases in temperatures up to 95° F OAT (outside air temperature) at sea level these aircraft will carry loads exceeding 1,000 pounds. For example:

		UH-1H
Basic weight	5,249	lbs.
Pilot weight	200	lbs.
Oil weight	24	lbs.
Fuel weight	500	lbs.
	5,973	total weight
	9,350	maximum gross weight for out of ground effect hover (95°F at sea level) chart 14-14, page 14-65 TM 55-1520-210-10
	5,973	total weight
	3,377	lbs. useful load

In this example fuel load has been reduced to allow more useful load. A Weight and Balance Clearance Form F (DD Form 365F) should be completed prior to flight in order to ensure that center of gravity limits will not be exceeded. By removing the armored seats and reducing the fuel load further, useful load can be increased to 4,000 pounds at temperatures below 95°F.

Write-In

Dear Danny: I am writing in the hope of receiving some clarification between dash 10 procedures and those taught by the flight training school in O-1 qualification. The operator's manual (TM 55-1510-202-10) says that flaps should be set at 30 degrees for minimum run takeoff, yet the O-1 contact manual used at Ft. Stewart states that 20 degrees should be used. Which one is correct? Paragraph 3-60 (AFTER TAKEOFF) of the operator's manual also conflicts with standard school procedures (as published in the O-1 contact manual). The school maintains that the throttle should be reduced *before* flaps are raised. The operator's manual conforms with go-around procedures by raising flaps first. Which is correct? The students whom we are trying to imbue with a professional attitude toward flying often become confused with the obvious contradictions between the two sources.

CPT E.M.F.

Danny's answer: The purpose of the operator's manual is to supply you with the latest information and performance data derived from flight test programs and operational experience. Apparently there hasn't been any flight testing done on the old Bird Dog since 1957. In those days all the Bird Dogs had mechanical flaps and the 30 degree position worked best. Although there are still O-1s with mechanical flaps (according to AVSCOM), today most O-1s are equipped with electrical flaps. Although official tests have not been conducted, it is the consensus of the instructors at the aviation school after many years of experience that 20 degrees of flaps (when available) will give better MINIMUM RUN TAKEOFF performance. A note will be included in the next change to TM 55-1510-202-10 indicating that operational experience has shown that 20 degree flaps produce a little better performance in executing MINIMUM RUN TAKEOFF. This should help explain the difference between the two manuals. Your second question sent me running to the Standardization Branch of the Department of Advanced Fixed Wing Training, USAAVNS, Ft. Rucker, Ala. The latest issue of their O-1 IP Guide reads as follows concerning after takeoff procedures:

> **"Maintain takeoff attitude and full throttle until there is no possibility of settling back and contacting the runway, then smoothly adjust the pitch to climb attitude (70 mph with flaps, 80 mph without flaps). Complete after takeoff check, adjusting rpm to 2,300."**

This technique and procedure does not appear to conflict with the procedures in the operator's manual. I hate to answer your question with another question, but do you have the latest O-1 contact manual?

★ ★ ★

Dear Danny: I have a problem for you. I checked my UH-1D manual (TM 55-1520-210-10), chapter 14, and found my best endurance at sea level at a weight of 9,000 pounds was 115 knots air speed with a fuel flow of 612 lbs/hr. I tried this speed but found it too rough so I slowed down to 90 knots. I tried to find my fuel flow at this speed but couldn't. What gives?

CWO G.L.

Danny's answer: I knew this question would appear someday. I'm not going to say I don't know; I'm just going to take the Fifth Amendment for the time being and say I'll have some performance data chart information for you in the next issue. Any of you other aviators have any performance questions like this one? Let's see how sharp some of you are regarding the performance data charts.

★ ★ ★

Lately, Charlie and I have had some problems finding the paragraphs, etc., to which references are made. We would appreciate it a whole lot if you would include the date of the manual and change number when sending in your questions.

Don't Give Up The Ship

For several seconds there seemed to be no alternative but to crash and burn. However with the copilot on the controls and with the aircraft commander using both hands to control the cyclic, the aircraft was righted and certain disaster was barely averted

CW2 Benito A. Trevino

IF YOU ARE RATED in rotary wing aircraft then surely you can remember how, during your pre-solo stage of training, you often witnessed some rather unusual attitudes. In most cases these attitudes were pilot induced and could be recovered. But when Charlie decides to put a round in the hydraulic system of your UH-1 it may not be quite as easily recovered, especially when the irreversible valve is affected and your cyclic stick comes back at you with 150 to 200 pounds of pressure. I managed to survive such a moment of stark terror and can only attribute it to an alert crew and the good Lord.

It was about 1130 hours on 24 February 1969 in the vicinity of Chu Lai, Republic of Vietnam. We were on the last leg of the morning's routine resupply mission when a familiar, but frantic, voice broke the silence on our company's UHF radio: *"Any Minuteman aircraft!"*

It was really more of a yell than anything. Then there was silence once again as 10 other ships stood by for a few seconds in hope of hearing more details on the apparent emergency at hand.

With the help of the operations section, a radio search confirmed that one of the company's UH-1Hs was missing. After the supported unit of the missing crew informed us of the missing Huey's approximate last known location, we began our search and spotted a high column of smoke about 5 miles away. As we drew closer I could see two AH-1G HueyCobra gunships orbiting over the smoke. About 2 miles away at 2,600 feet we started to receive .50 caliber machine gun fire. At this time we were flying the same flight path as the downed Huey had reportedly flown.

I instructed my crew chief and gunner to put down suppressive fire while I took evasive maneuvers. As I started to lose altitude I saw a light observation helicopter making a low recon of the fire. Recognizing the recon element's unit designation, I switched to their radio frequency and with the help of the light observation helicopter made a low level recon of the area. It was confirmed by the still intact tail section of the crashed Huey that it was the one we were looking for. It was also evident that all four crew members were still strapped to their seats and there was no hope for them.

Further inspection of the area failed to reveal any sign of life around the wreckage. We landed, along with another UH-1H from my unit, and unloaded our few infantrymen. We had been on the ground no more than 3 minutes when the infantrymen reported a lot of enemy movement in the immediate area. Since the troops were obviously outnumbered and there was no hope of finding survivors, we left the area under the cover of the two HueyCobra gunships.

A battalion commander, who had been aboard one of the search and rescue ships, volunteered to send some of his troops into the area, even though it was out of his jurisdiction. Thus, in less than an hour I was leading a three-ship formation with infantry back into the area to recover the bodies. Jet fighters and helicopter gunships were laying down suppressive fire on the two .50 caliber machine gun positions which had, as later determined, shot down the Huey and fired upon us. They did a fine job and we didn't receive any fire on this trip.

We dropped off the troops and proceeded to a nearby tactical airstrip to wait for the call to extract the troops. While on the airstrip we noticed a big hole in the roof of a nearby Marine hootch. We were told it was the result of a mortar attack the day before. Consequently, I decided it would be wiser to orbit the general area while we

waited for the extraction call.

At approximately 100 feet and in a gradual left turn I instructed my flight to reform into a diamond formation. While the flight was reforming I heard the old familiar sound of an enemy bullet hit my ship. As was discovered later the round had entered 12 inches behind my left seat, had gone diagonally across the empty cargo compartment, through the rear wall forward of the transmission and into the right cyclic hydraulic servo.

Since the irreversible valve had been severed or affected the cyclic control stick started vibrating first lightly, then with increasing violence. Simultaneously it started back and to the left slowly, then faster.

The cyclic was vibrating so much that it shook my whole body and it would have been impossible for me to say anything on the radio and be understood. The backward pressure on the cyclic was between 150 and 200 pounds. As soon as I recognized the problem I released the collective and fought the cyclic with both hands. At this point I glanced at my pilot and he came on the cyclic just in time to keep us from doing a complete loop. Later reports from the flight behind me

confirmed that at one point we were exactly perpendicular to the ground in a nose high attitude. To make matters worse we came to a complete stall and started falling toward the ground on our left side since the pressure on the cyclic was to the left. As we fell toward the ground with no forward air speed, the pilot and I managed to get the cyclic to the right. This time we recovered just prior to exceeding a 90-degree left bank and making contact with the ground.

Finally we managed a 30-degree attitude while we were being tossed around like a couple of puppets on the cyclic stick. At this point, both door guns instinctively went hot on the source of fire below. From the position of the bullet hole we later determined that we must have leveled off directly over the source of fire.

I had my pilot ensure that the hydraulic circuit breaker was in and the hydraulic control switch turned off. This did not help at all. While we had been falling on our left side, one of the numerous thoughts that went through my mind was that we must be falling right on top of my left wing ship; however, he miraculously managed to slip away. The pilot later told me that he was prepared to help fight the fire and pull us out of the wreckage. He claimed that the question was not *if* we were going to crash but *where* we were going to crash. As for the rest of the ships, they must have done a remarkable job of breaking formation.

I had time to think of a hundred and one things in that short period of 8 to 10 seconds. I could see my ship burning such as I had just seen my unfortunate friend's ship. I was able to think of my wife, my kids and my mother. I thought of how useless my crew chief and gunner must feel as they have no control of the action up front. But above all, I had the feeling that as long as we were airborne we still had a fighting chance.

Realizing that the only thing wrong with the ship was loss of hydraulic assist, I knew it could be flown to home base which would not only be a safer place but also had adequate firefighting equipment and trained personnel to get us out of a fire. Enroute I requested the Huey pilot who was escorting us to call the tower at Chu Lai and get things layed on for an emergency landing. Meanwhile, we experimented with the ship. We decided that the only feasible way to land it would be with me using both hands on the cyclic and my pilot handling the collective. I briefed the gunner and crew chief and told them to dump all ammo and other explosives on final approach—and to make sure that it landed inside the perimeter fence. I figured we had already had enough of our own type of ammo fired at us.

Nearer to home base, we got on the tower's frequency and were cleared to land with crash and rescue personnel standing by. I instructed my pilot to pull his seat armor plate back while I fought the cyclic alone. This was not easy. Then I pulled mine back while he took the cyclic. This, of course, was done to facilitate exiting and provide access to our compartment if we had to be pulled out.

The tower requested that after landing we move the ship off the active runway to make room for high performance aircraft. I informed the tower that if we could get her down in one piece there was no way that I would get airborne again due to the unusual circumstances.

"Roger, Minuteman 20, in that case we request that you land on the crosswind runway. We'll shift the fire truck."

We had a right crosswind as we set up for a shallow approach to a running landing. I had both hands on the cyclic while I directed my pilot's movements on the collective. We touched down level and after skidding about 10 feet I instructed my pilot to roll the throttle down to flight idle—and relaxed for the first time in what seemed a lifetime.

I shook my pilot's hand while a man with a fire ax in his hand opened my door and asked if everything was okay. Sweat was pouring from my face as I managed a thumbs up signal. I had exerted all available energy on that cyclic stick.

The 1½-inch diameter hydraulic servo in which the bullet was lodged had kept my door gunner from getting hit in the middle of his back where he did not wear protective armor. So the whole terrible ordeal had been worthwhile after all.

The pilot who had been escorting us went about his business while the maintenance ship with a few remaining pieces of wreckage on board landed close to my ship. I glanced at the remains of the Huey we had been searching for and my mind raced back to my friend and his crew. They had not had a chance as we had.

Our ship had been repaired enough to make a one-time flight to the company area for the seemingly never ending patch job. I called the unit that we had been supporting earlier and apologized for the delay. I told them that my ship would be down for maintenance reasons.

When I think back over this incident I find it easy to cherish a saying I once read that goes something like this: . . . *for those who have fought for it, life has a flavor the protected shall never know.*

Nothing But Indians

THE GENERAL policy of naming Army aircraft after Indians tribes, chiefs or terms has been made official by authority of AR 70-28, dated 4 April 1969. The names are authorized for use in public releases and other documents as a ready reference. The Indian names have been very popular among Army personnel.

The commanding general of the U. S. Army Materiel Command, St. Louis, Mo., has the responsibility of initiating action to select a popular name for aircraft. For this purpose he has a list of possible names obtained from the Bureau of Indian Affairs (for brevity the names usually consist of only one word).

When a new aircraft reaches the production stage or immediately before it goes into production, the commanding general selects five possible names. He bases his selection on the way they sound, their history and their relationship to the mission of the aircraft. They must appeal to the imagination without sacrificing dignity and suggest an aggressive spirit and confidence in the capabilities of the aircraft. They also must suggest mobility, firepower and endurance. The names are sent to the Trade-Mark Division of the U.S. Patent Office to determine if there is any legal objection to their use.

After approval by the Patent Office the five names are sent to the Chief of Research and Development, Department of the Army, with a short justification for each. From these five the Chief of Research and Development selects one.

The approved name then goes to the Aeronautical Systems Division, Directorate of Engineering Standards, Wright-Patterson AFB, Ohio. This Department of Defense unit has the responsibility of officially registering the names of all aircraft used by the military. It also prints a list of the names in a publication called "Model Designation of Military Aircraft, Rockets and Guided Missiles."

Some Army aircraft, such as the Bird Dog and Otter, do not have Indian names. Most were named before the present policy went into effect. AR 70-28 specifies that these will not be changed.

The only helicopter recently introduced into the Army without an Indian name is the AH-1G Huey-Cobra. This aircraft was named by its maker before it was purchased by the Army. When the Army started buying the helicopter the name was firmly entrenched in the minds of the public. Also, Huey-Cobra is descriptive of the fighting ability of the AH-1G.

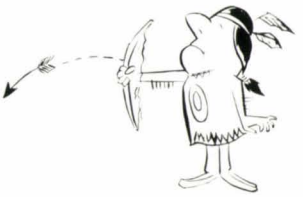
FIXED WING

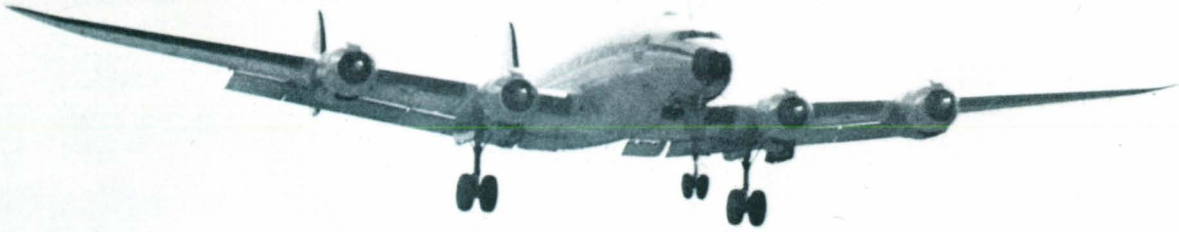
O-1	Bird Dog	U-6	Beaver
OV-1	Mohawk	U-8	Seminole
T-41	Mescalero	U-9	Aero Commander
T-42	Cochise	U-21	Ute
U-1A	Otter		

ROTARY WING

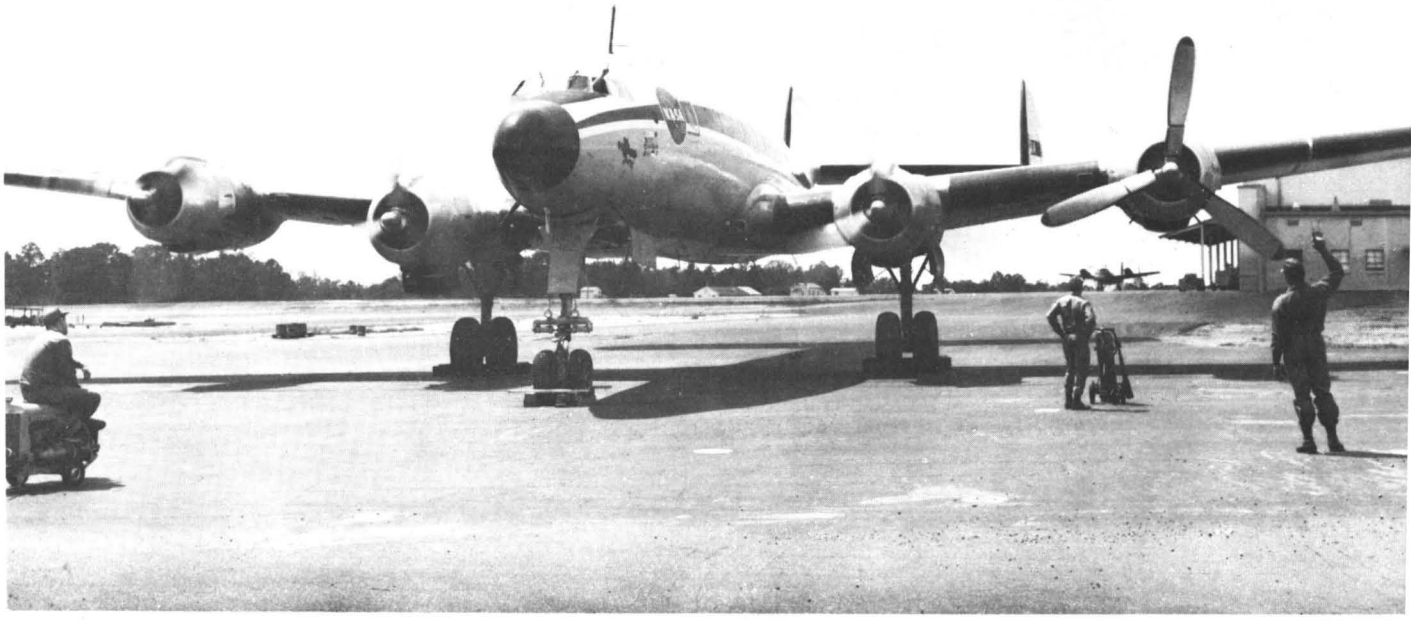
AH-1G	HueyCobra	OH-13	Sioux
CH-21	Shawnee	OH-23	Raven
CH-34	Choctaw	OH-58	Kiowa
CH-37	Mojave	TH-55	Osage
CH-47	Chinook	UH-1	Iroquois*
CH-54	Tarhe	UH-19	Chickasaw
OH-6	Cayuse		

*The UH-1 is often referred to by its unofficial nickname Huey.





Private First Class John R. Moore



General Douglas MacArthur's flying command post, the Bataan, is landed at the Army Aviation Center, Ft. Rucker, Ala., where it is on display at the Army Aviation Museum. The pre-Korean War vintage aircraft was donated to the museum by the General Services Administration. Above, the 4-engine C-121 Constellation is being run up at Guthrie Field which is near the museum. Since, the engines have been filled with a paraffin-base oil to prevent corrosion from nonuse

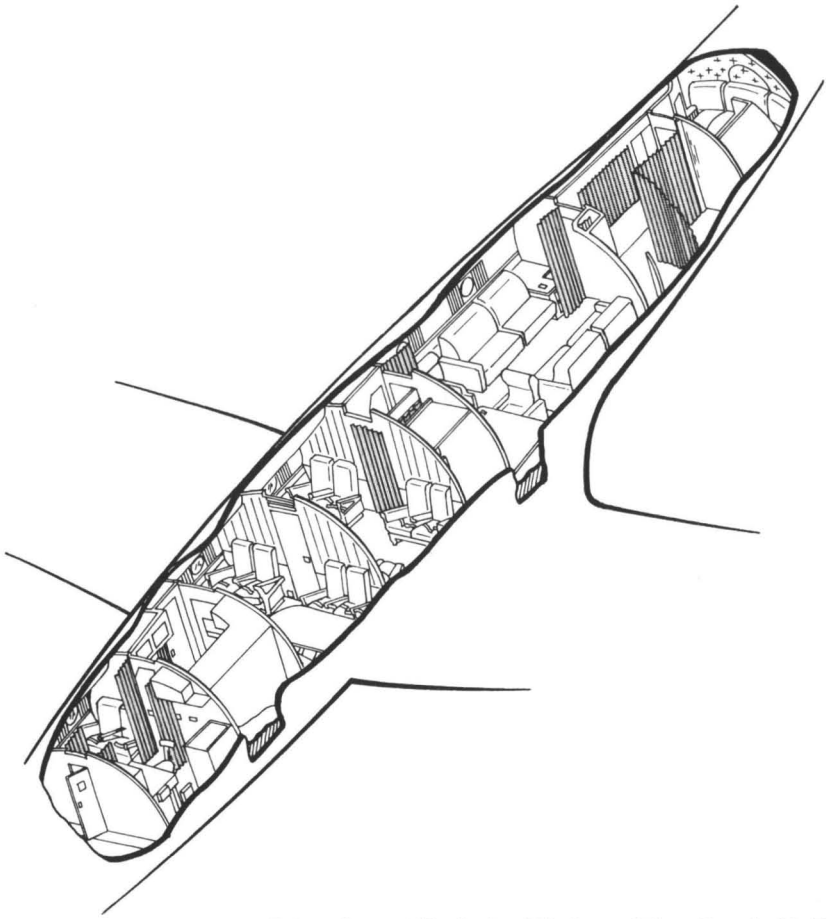
ON 10 MARCH 1970 the "Bataan," General Douglas MacArthur's airborne command post, made its last flight, its last landing, its last taxi. The C-121 Constellation which has born witness to numerous historical events went on display on that day in March at the U. S. Army Aviation Museum, Ft. Rucker, Ala.

The Bataan became GEN MacArthur's personal plane shortly after its construction by Lockheed Aircraft Corporation in 1948, but not before it had gained prominence for participating in the Berlin Airlift. With its interior stripped, the Bataan was capable of transporting a sizable payload of supplies.

Now its interior stripped again, GEN MacArthur's plane awaits restoration by Mr. William A. Howell, civilian curator, and other museum personnel.

In 1966 the Bataan, named by GEN MacArthur, was used by the National Aeronautics and Space Administration (NASA) as a space capsule simulator. Making numerous flights, the aircraft was monitored by NASA ground radar tracking stations simulating procedures which would be used to track space capsules on re-entry paths to the earth's surface. The C-121 carried about $3 million worth of relay equipment and instrumentation similar to that in a spacecraft.

Because of its contributions to the space program, Francis Glynn,



Left: the interior arrangement of the Bataan when it was used by General MacArthur as a command and control ship

chief of aircraft operations at the Goddard Space Flight Center, Greenbelt, Md., has credited the Bataan with assisting in the success of landing man on the moon.

But prior to helping put men on the moon the Bataan had another vital, distinguished mission: that of ferrying GEN MacArthur throughout the various trouble spots of his Far Eastern command. Constructed along with nine other C-121 Constellations intended for VIP use, the Bataan was given to GEN MacArthur in 1950 as a replacement for the C-54 he had been using since the end of World War II. The C-54 also was named the Bataan, as was a B-17 the general used during the war.

GEN MacArthur began extensive use of the C-121 shortly after North Korean troops invaded the Republic of Korea on 28 June 1950. From his headquarters in

Below: General MacArthur bids farewell from Haneda Air Force Base, Tokyo, before departing for the United States in the C-121 Bataan in April 1951

Military honors are given General MacArthur in San Francisco upon his arrival from Japan. The General's party is enroute to Washington in his C-121

Tokyo MacArthur was able to reach any airfield in Korea in a short time flying in the Constellation.

On 16 April 1951 GEN MacArthur made his final journey from the Far East to the United States in the Bataan. He was given a hero's welcome in San Francisco and then flew to Washington, D. C., where he received national recognition for his distinguished career.

The Bataan was declared obsolete and put into storage at Davis-Monthan AFB, Ariz., in the late 1950s. It remained there until 1966 when NASA obtained it and based it at Friendship International Airport near Baltimore.

The Bataan originally could sleep 10 passengers and was equipped with restrooms, swivel chairs, desks, telephones and a galley. However, it was stripped prior to its procurement by NASA. Mr. Howell is attempting to locate the discarded decor so that the interior may be restored to its original MacArthur theme.

"If we can locate 50 percent of the interior furnishings we can build the rest," stated Jim Craig, assistant curator at the museum.

The Bataan has been preserved by Page Aircraft Maintenance, Incorporated, by filling the plane's engines and internal mechanisms with a paraffin-base oil that will prevent corrosion and rust that results from nonuse.

Upon arrival over Ft. Rucker there was some speculation as to whether the plane could be landed on the 2,200-foot strip at Guthrie Field near the museum—the C-121 normally requires about 3,000 feet of runway. But after several practice approaches it was successfully landed and taxied to its resting place outside the museum.

Major General Delk M. Oden, Ft. Rucker's commanding general, approved obtaining the $2.5 million aircraft after the General Services Administration offered to donate it to the museum.

The Bataan is expected to be opened to the public either this month or next.

General of the Army Douglas MacArthur, commander-in-chief, Far East command, standing by the nose wheel of the C-121's predecessor, a C-54 also named the Bataan

Aeromedic

Provided by the Society

To the air crewman. No matter how many carrots you eat you'll never be able to see as well at night as an owl can. He is better adapted and more used to night flying than any of us ever will be and thinks nothing about night navigation.

How does an owl's eye differ from yours? Except for one striking difference, the owl's eye is pretty much like yours. His has a pupil-lens arrangement to focus on objects and let light through to form an image back on the retina. A mass of little nerves transmit the image for action and information to whatever portions of the inner brain system ought to know about it. The difference between his eyes and yours is that the owl has one type of nerve on the retina while you have two varieties:

- the cones, which do most of your day seeing, are relatively insensitive to low intensity light and register both color and depth
- the rods which, if permitted, do most of your night seeing and are very sensitive to light of low intensity but tell little about color and depth.

Each of your nerves has a special seeing job to do. The owl who goes about his mouse-catching with only one type of seeing nerve (the rods) can't help being a nocturnal animal. He lives in a colorless, near-sighted world but his eyes register light when the average man can't tell a mouse from third base.

Long habit and specially adapted vision make night flying second nature to our feathered friend. Turn an owl loose in the deepest gloom and he doesn't care a hoot. Not so for the human being. People connect the night with the mysterious and unreal. Anybody's first impulse in a darkened room is to strike a match or snap a switch. We're not used to the dark and don't much want to be. The civilized character is a child of light.

This feeling about the night keeps most people from finding out that they're not as helpless in the dark as they believe. While the human retina is not all rods like the owl's, it has enough of these nerves to pick up a fair amount of night information. But, they're seldom given a chance. Like a baseball pitcher's throwing arm, the rods need time to build up their snap instead of being thrown into action stone cold as they too often are.

A fellow steps out into the pitch black night from a brightly lighted room where he has been using his cones, the day nerves, and finds he can't see a thing. If he were to wait in the darkness long enough for his rods to warm up from the effects of intense light he'd find the night wasn't so black after all.

Any good photographer knows that absolute darkness is hard to come by. It's about as rare as the perfect vacuum. If darkness is not complete then there must be some light which can be picked up. Night vision researchers have had to move deep into the remote wilds before they could get away from any trace of man-made lights. There they found it was a rare night indeed when there wasn't some illumination from the moon or stars. Also, they discovered that the properly adapted human eye is more sensitive to light of very low intensity than they had suspected. This knowledge has helped to develop a new approach to night-vision training for both submarine lookouts and aviators. But to use this knowledge effectively man must put aside his terror of the dark and learn to systematically and scientifically adapt to darkness.

The big trick with rods is to keep them warmed up but not overwhelmed. Anybody who has been operating at night without the aid of artificial light can be temporarily blinded by a sudden bright light. The rods, which have been doing the seeing, function only in low-intensity illumination. Even an instant of high intensity exposure is blinding.

The night flyer's aim is to have his rods ready for action while he's in the air and to keep them that way until the tiedown is complete. Provided a pilot takes a few precautions the usual sort of preflight sequence to the ordinary night mission is enough to start getting his rods adjusted. The maximum dark-adaptation time of 30 to 40 minutes applies to people exposed to intense artificial light beforehand. If you avoid strong lights during the usual flight preliminaries you can be warming up the night nerves without strain or pain. The 5 or 10 minutes it takes to go from operations to your aircraft, plus making the usual checks and warmup under dimout conditions and finally becoming airborne gives the rods a

An Army aviator will never be in the same league with the wise old owl when it comes to night flying. But by applying techniques of seeing in the dark and using his instruments he can survive quite well in the night sky

of U. S. Army Flight Surgeons

good start. Your main concern is to avoid ruining this gradual adaptation to darkness once it has begun. Red instrument panel lighting should be kept at a minimum and the use of white flashlights in the cabin or cockpit is strongly discouraged. An instant of intense white light overwhelms the rods immediately, forcing the whole dark-adaptation process to begin again.

Ground people must help too. The joker who appears with a flashlight beamed right on the bridge of your nose and asks, "Is everything okay, sir?" should be clapped in irons.

Following a takeoff on an ordinary night mission—assuming there is proper panel lighting and no mishandling of matches and other glare-making devices—the business of rod warmup continues. After the 30 minutes or so it takes to reach your target area your night nerves will be prepared. In the moonlight seeing will be done with both rods and cones (the moon is not usually intense enough to overwhelm the night nerves).

Obscuring rods mechanically also should be avoided. Windscreens or other composition-glass surfaces impaired by scratches, oil film or just plain dirt and dust can be as dangerous as peering through sunglasses at night. "Light scatter" from dirty glass produces effects like a Coney Island fun house mirror, though no pilot straining to see his objective through such distortion has been known to knock himself out laughing. The objective is to let that low intensity light through to the rods with as little interference as possible.

The night pilot will never be in the same league with the owl as a night flyer. But knowing and using the technique of seeing in the dark and by taking advantage of various instruments designed to help him, an aviator can make his way around pretty well in the night sky. No human after-dark flyer has sharp enough vision to get by without instruments. Owls, yes; people, no.

Instruments are designed to make up for human limitations. Chances are that even the owl, for all those extra rods on his retinas, would give a whole hatful of tail feathers to borrow a Mark IX gyro-horizon on a really thick night.

Thus, the expert night flyer is a proficient instrument man who has checked himself out in all manner of tough flying weather. Sharp night eyes plus thorough instrument training make the unbeatable combination needed to survive in the night sky.

To the flight surgeon: The flight surgeon can be instrumental in assuring a complete understanding of the capabilities and limitations imposed upon air crew members by night operations. The following points should periodically be explained and/or demonstrated:

- Do not attempt night duties until reasonably dark adapted.
- Maintain dark adaptation by avoiding as much as possible, all light except red light. The rods are essentially insensitive to red light, thus exposure to red light will not decrease the degree to which the rods are adapted. Meanwhile, the cones will see the red lighted instrument panel.
- Once dark adapted, closing or covering one eye will prevent loss of dark adaptation even if the other eye is exposed to white light. Avoid looking directly at illuminating flares or muzzle and ballistics flashes.
- Learn to look for night targets out of the corners of the eyes. Practice an "off-center" vision technique.
- Scan the sky systematically. Move eyes frequently over a small area at a time; don't stare. Due to the central blind spot at night, looking directly at an object will cause it to disappear.
- During operational missions where night vision is critical use oxygen on all flights above 5,000 feet.

While some controversy exists regarding the use of low intensity white versus red light, the Army feels that due to the nature of its night missions the concept and benefits of red light warrant its use. Many Army night missions require contact flight conditions. Other services tend to depend exclusively on radar-controlled instrument flight and infrared techniques.

Finally, the flight surgeon should be alert to the problems of night (blue) myopian and red light hyperopia that can be induced by night conditions in some individuals. These conditions have been previously discussed in the AVIATION DIGEST, October 1969.

I AM ARMY AVIATION

Major Larry E. Joyce

My olive green chest has donned a host of great names: Kelly, Rosbeck, Dempsey, Holloway and a multitude of others that have etched my worn and weary smile on history's mirror.

From a humble beginning, I have climbed to the summit. I have seen my family mature in the hottest of cold wars and I have mixed my blood and sweat and tears with the brackish paddies of Nam Can and the crystal blue of Dong Ha. Thus, I have paid the price of involvement, earned my badge of courage and have come of age. On my durable wings I have leisurely soared through the thin humid skies over Ia Drang and my rotor wash has uncovered "Charlie" in the mangroves of Ca Mau.

From Soc Trang, Blackhorse and Lane I have flown and have sent my tracers slicing through the Asian dusk and dawn . . . stabbing at the elusive shadows that menace freedom. My rockets have given relief to my brothers-in-arms and brought smoke, flame and death to our enemies. With keen vision and through my ingenuity I have found my enemy . . . the tyrant, the oppressor, who would deny his fellow man's rights. I have guided the awesome terror of my cousins' shells to fix the fleeting, faceless guerrilla.

On my back the Queen of Battle showed the fury of her long rifle. Together, through the swamp and the jungle, we have pursued, engaged and won.

The battle for democracy will go on until free men everywhere have won this age-old conflict with the forces of oppression, the shadows of darkness, the face of hate! Whether at home or on foreign shores, I will be there . . . keeping my faith in God and country. I AM ARMY AVIATION.

Practice Makes Perfect (well almost)

Despite having practiced engine-out procedures at every opportunity, CPT Seemee's confidence deteriorated quite rapidly. He was disturbed by the feathered propeller on the GCA final and as he struggled to stay lined up he felt his legs trembling

CW3 Sherrel D. Kelly

CAPTAIN D. F. Seemee had never had a real inflight emergency before. The one he was having now happened quite suddenly, as they often do. No advance warning, just a sudden muffled banging noise, vibrations and the swinging back and forth of the nose of the aircraft as he applied varying amounts of rudder pressure.

CPT Seemee wasted no time shutting down the right engine of his RU-8D. By the time he had feathered the propeller and trimmed off some of the control pressures, the copilot had made the necessary radio calls to a radar control site. In a few moments they were being given radar vectors in the direction of an airfield with an instrument approach about 25 miles away.

The ceiling and visibility were always low during the monsoon season in this part of the Republic of Vietnam. But Seemee wasn't worried. He'd had plenty of recent practice making instrument approaches and had made this particular approach several times. In fact, he had the entire procedure memorized. And, the aircraft was equipped with Doppler naviation equipment which could be monitored during the approach to help keep him oriented.

CPT Seemee entered solid instrument conditions after he had covered about half the distance to the NDB (nondirectional beacon), but this did not present a problem. With altitude to spare he began a slow descent. This enabled him to keep his speed up without having to carry excessive power on the good engine. As the aircraft crossed the beacon at about 1,500 feet above procedure turn altitude and turned outbound, the copilot updated the Doppler and took care of the checklist and other required copilot duties. The approach was flawless. Visual contact was made

with the runway over the missed approach point and the aircraft was perfectly aligned with the runway.

Inspection of the aircraft by maintenance personnel showed that CPT Seemee had been correct in his decision to shut down the engine immediately when the malfunction occurred. He had avoided extensive damage to the engine and greatly reduced the possibility of fire from the oil and fuel leaks that accompanied the failure.

CPT Seemee was highly praised by everyone for his skillful handling of the incident. He didn't let modesty stop him from sharing his vast knowledge and experience with his fellow aviators. He talked for hours to anyone who would listen about engine-out operations in multiengine aircraft. He started practicing engine-out procedures at every opportunity and was proud of the speed with which he could identify and feather.

A couple of weeks later CPT Seemee was preparing to fly a similar mission with about the same weather conditions. The tops were reported to be 6,000 feet. His aircraft had a history of one engine running rough, especially with climb power and the engine was an oil burner, which could account for fouled spark plugs. Also, the aircraft was written up as having one inoperative generator.

Our hero and two other crewmen completed their preflight and were inside the aircraft in time to avoid getting wet from the light rain that had started to fall. Visibility was deteriorating fast as they completed their runup and rolled into position for takeoff. The climbout was uneventful and they were just about to break out on top when one engine started running rough. Quick as a flash CPT Seemee determined it was the left engine and reached for the mixture. The copilot interrupted the shutdown by stating that he thought they should wait. After a brief discussion CPT Seemee agreed. He asked approach control for a GCA (ground controlled approach) and explained that he had a rough running engine.

They had climbed to VFR conditions-on-top by this time and the left engine was still running rough at cruise power. CPT Seemee informed the controller that he intended to shut down the troublesome engine prior to entering instrument conditions. He reasoned that this would be better than having it quit later. Having made this decision CPT Seemee stuck to it. Just prior to descending into the clouds he shut down the engine and feathered the propeller. The copilot still wasn't convinced of the wisdom of this action, but he was overruled.

Upon review, the U. S. Army Board for Aviation Accident Research concurred with the professionalism points brought out in this article, but stressed that good operation policy demands that an engine be feathered only when necessary, which it wasn't in this story. Never feather an engine that is operating until it is absolutely necessary. For more on this see USABAAR's "Weekly Summary" 3-10, October 1969

They were in solid weather before either discovered that they did not have an operational generator. The copilot quickly shut off all nonessential electrical equipment. The pilot was busy trying to get the aircraft under control. He briefly considered trying to restart the number 1 engine, but decided against it. If he used up his battery and the engine didn't start, he could be in even more trouble.

CPT Seemee began feeling pretty uneasy. The aircraft didn't handle nearly as well as it had the other time. The left propeller was fully feathered but continued to turn—whipping over and over at various speeds, something like 20 rpm. This windmilling was distracting and seemed to make the aircraft hard to control.

CPT Seemee's confidence deteriorated rapidly as he wrestled the aircraft around the GCA pattern to final approach. The copilot had pointed out a couple of times that the ball of the turn and slip indicator was out to the left, but Seemee just couldn't get it to stay in the center. He had begun his final descent and could hear the controller saying, "Turn left—stop turn. Right of course, on glide path. Turn left—stop turn. Two miles from touchdown. Going further right of course now, turn left."

CPT Seemee was terrified. He was rolling out of those left turns into a right turn and couldn't do anything about it. His legs, strained from pushing one rudder pedal against the other, began to tremble.

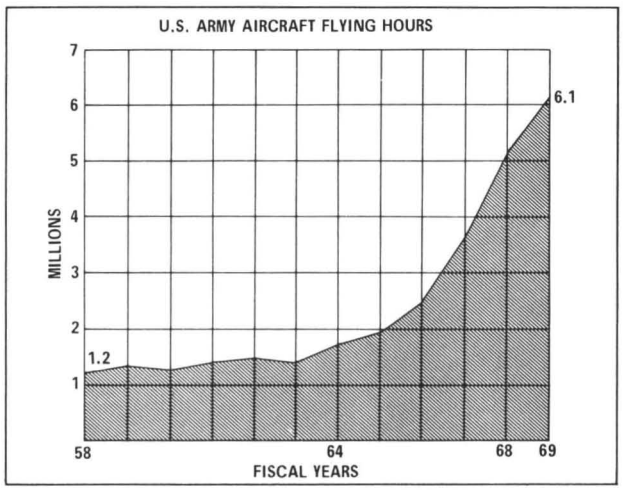
The controller's words were calm but firm, "You are too far right of course to make a safe approach. Pull up."

CPT Seemee knew he couldn't pull up. In desperation he forced his aircraft into a left bank and held it. When they came out of the thick overcast and entered the fine mist below, he could barely see the runway ahead. They were headed for about the halfway point of the runway at no less than a 60-degree angle.

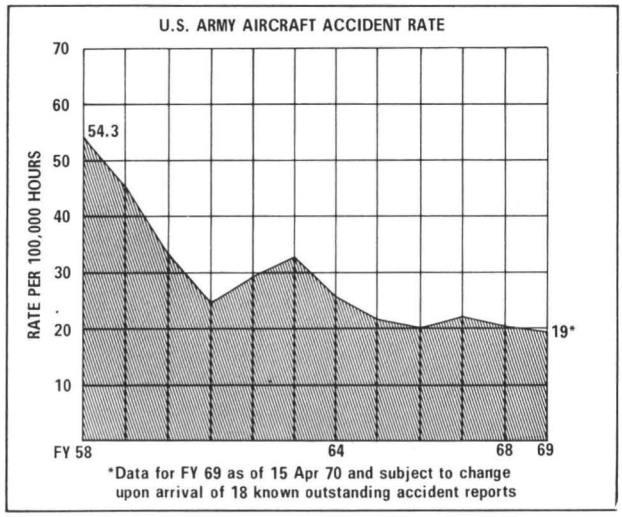
The copilot told the story of how the aircraft was maneuvered to the runway, how the gear was barely extended before touchdown, how they braked to a stop without running off the end and how the engine was found to just have a couple of fouled plugs.

CPT Seemee doesn't like to talk about it; in fact, he hasn't talked very much since. But you can bet he's been doing a lot of thinking—about flying and common sense.

ELEVEN STEPS TO EFFECTIVE



Flying hour program increased 5½ times during 11 years



Accident rate shows no significant downward progress during past 4 years

DURING A RECENT 3-year period, fiscal years 1966 through 1968, 2,272 *noncombat* Army aircraft accidents resulted in 949 fatalities, 2,079 injuries and a hardware dollar loss of approximately $256 million. Estimated dollar losses alone can be equated to *the cost of 1,000 UH-1 helicopters, or the cost of equipping, training and deploying 17 airmobile companies or 500 infantry rifle companies.*

Estimated dollar costs for noncombat FY 1969 Army aircraft accidents are approximately $150 million. Increased accident costs are the result of several factors. One is the annual flying hour program which represents our exposure to accidents. This has increased 5½ times from 1958 to that projected for the FY 1969 program, from 1.2 million flying hours during FY 1958 to 6.1 million flying hours during FY 1969. Another factor is the increased cost of aircraft as we have moved into more complex and higher performance equipment. Still another is an ever-increasing variety of missions.

Despite these factors our accident rate has been reduced, as shown in the worldwide Army aircraft accident rate chart. However, no significant downward progress has been made during the past 4 years. This leveling off indicates that our accident prevention measures are no longer adequate and that our collective efforts, no matter how great, are not enough.

Aircraft accidents in the future are going to be much more difficult to prevent because the easier and more obvious prevention measures have already been implemented to a large degree. The less complex and readily definable accident cause factors have been attacked with a large measure of success. If we are to achieve further substantial reduction in accident losses, we must intensify our efforts and find new and more positive methods and techniques for prevention. We must do this while we continue to

Adapted from a presentation made by the author to the Army Aviation Commanders Conference, 14-15 October 1969

Colonel Eugene B. Conrad
Director, USABAAR

AIRCRAFT ACCIDENT PREVENTION

apply those measures which have already proven successful.

Crew error, a consistent leading cause factor in more than 50 percent of our accidents, offers the most fertile field for new and intensified prevention efforts. A UH-1D landed at a heliport to transport 10 replacements to a unit. The pilot made a hover check and discovered that he was overloaded. He dropped one passenger. Then, still in the gray area of overload, he took off downwind, barely becoming airborne, while managing to miss an obstruction and a building. A short time later, the aircraft returned and carried the one remaining passenger to his destination. The question is, Why not split the load in the first place? The answer is judgment and command corrective action. This aviator is an accident waiting to happen.

About 2 years ago Major General Robert R. Williams, then the 1st Aviation Brigade commander and now the Deputy Assistant Chief of Staff for Force Development, DA, was vitally concerned with the high accident rate, especially in the face of an impending decline in replacement aircraft. He issued a command letter directing that renewed emphasis be placed on aircraft accident prevention and specifically identified 11 items to be incorporated into unit accident prevention programs. I had the privilege of being a member of that command at the time and it was evident that significant reductions were realized during the following months.

Although these 11 items were initially prepared for implementation in the combat environment, their application is by no means limited to any particular locale or operational circumstances. The energetic integration of these points in all prevention programs will pay tremendous dividends in the preservation of combat resources.

Step 1: Performance of preflight checks (hover checks). There is considerable evidence these reliable indicators are still ignored. Also, it appears that in many cases, when performed, they are either ignored or done only with the intent of satisfying a requirement so it could be said that the checks were performed. How else can we explain a pilot bringing his helicopter to a 2-foot hover and watching the rpm bleed down to 6300? As he started to put it down, the aircraft commander said, "I've got it," and began to take off. The last time anyone bothered to look at the rpm, it was down to 5400 and the helicopter was crashing. When this occurs, strong command action is required to get the attention of offenders.

Step 2: Avoidance of downwind operations. This point is well known, but must be repeated again and again. The history of the catastrophic results of ill-advised downwind operations is as old as aviation, yet we continue to attempt to defy the laws of physics.

A CH-47B was on a resupply mission with a load of miscellaneous cargo, 20 passengers and a crew of five. A radio call was made to the LZ ground element enroute, but no further contact was made. Arriving at the LZ, the pilot established his approach on a northwest heading, while the aircraft commander monitored the rpm and radios. Smoke was not requested from the ground element and none was provided. On short final, the aircraft commander found that he had used all his available beep in attempting to maintain 225 rpm, but still had a slight drop. He told the pilot not to pull any more pitch. The pilot crosschecked his instruments and saw he was pulling 860 pounds of torque, passing through 40 knots, about 50 yards from the helipad. He reported the rotor rpm to be 200 at that time. The aircraft continued to settle and was falling below the level of the helipad. The aircraft commander

took control, banked sharply to the left (30° to 40°) and lowered thrust. After a 180-degree turn, the aft rotor struck a small tree, the helicopter impacted on the aft left gear and ramp, rolled to the right, came to rest inverted and burned. Seven fatalities, three severe burn injuries and 12 minor injuries resulted. The crew failed to determine wind direction and the approach was made almost directly downwind in a southeast wind of 7 to 12 knots.

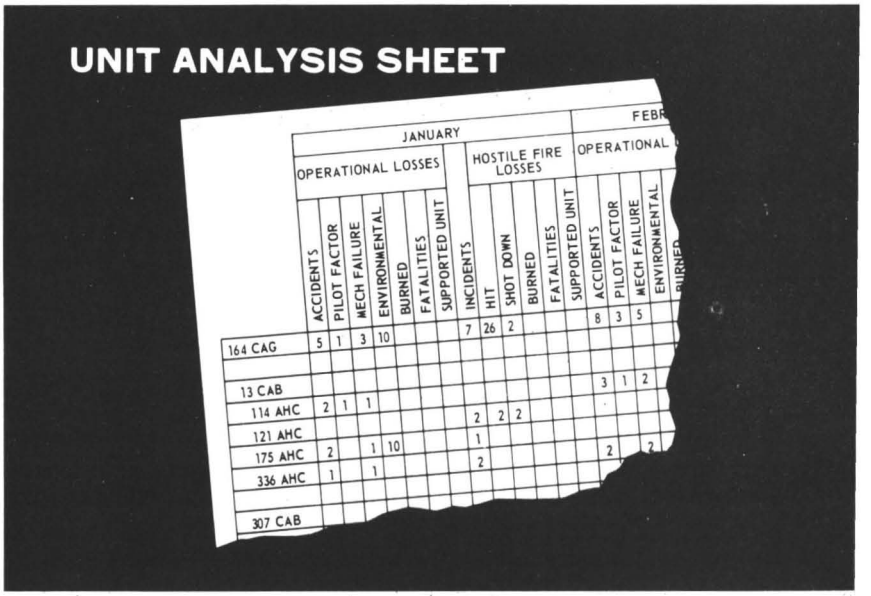
A UH-1D was the lead helicopter in a formation of three airlifting a patrol to an LZ in a wooded area. The pilot chose to make his approach on a heading of 035 degrees. The wind was from 270 degrees and he overflew his touchdown point, then tried to salvage the mission by attempting to land in an unsuitable area. He terminated to a hover above trees, had a tail rotor strike, lost rpm and crashed. One passenger had a broken leg and the helicopter was a total loss.

Downwind takeoffs and landings and steep low level downwind turns continue to cause many of our accidents.

Step 3: Individual aviator standardization. This not only requires standardization of flight techniques, but must include standardization in preflight inspections and adherence to good habits and sound procedures.

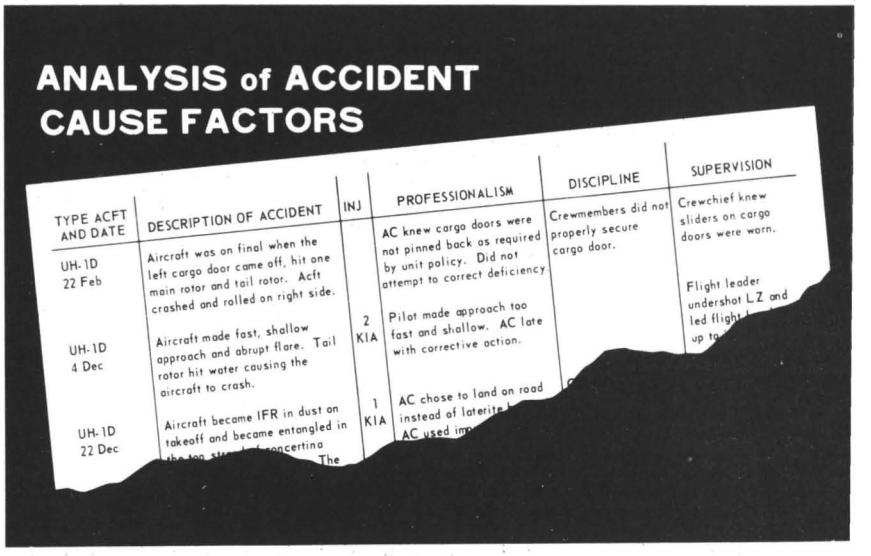
A UH-1D landed at a fire support base to trans-

Major UH-1H accident caused by failure to clear fuel pumps and filters after pumping water



UNIT ANALYSIS SHEET

	JANUARY												FEBR			
	OPERATIONAL LOSSES						HOSTILE FIRE LOSSES						OPERATIONAL			
	ACCIDENTS	PILOT FACTOR	MECH FAILURE	ENVIRONMENTAL	BURNED	FATALITIES	SUPPORTED UNIT	INCIDENTS	HIT	SHOT DOWN	BURNED	FATALITIES	SUPPORTED UNIT	ACCIDENTS	PILOT FACTOR	MECH FAILURE	ENVIRONMENTAL
164 CAG	5	1	3	10				7	26	2				8	3	5	
13 CAB																	
114 AHC	2	1	1											3	1	2	
121 AHC								2	2	2							
175 AHC	2		1	10				1									
336 AHC	1		1					2						2		2	
307 CAB																	



ANALYSIS of ACCIDENT CAUSE FACTORS

TYPE ACFT AND DATE	DESCRIPTION OF ACCIDENT	INJ	PROFESSIONALISM	DISCIPLINE	SUPERVISION
UH-1D 22 Feb	Aircraft was on final when the left cargo door came off, hit one main rotor and tail rotor. Acft crashed and rolled on right side.		AC knew cargo doors were not pinned back as required by unit policy. Did not attempt to correct deficiency.	Crewmembers did not properly secure cargo door.	Crewchief knew sliders on cargo doors were worn.
UH-1D 4 Dec	Aircraft made fast, shallow approach and abrupt flare. Tail rotor hit water causing the aircraft to crash.	2 KIA	Pilot made approach too fast and shallow. AC late with corrective action.		Flight leader undershot LZ and led flight up to
UH-1D 22 Dec	Aircraft became IFR in dust on takeoff and became entangled in the top strand of concertina. The	1 KIA	AC chose to land on road instead of laterite b AC used im		

port seven passengers. There were only seat belts for five, but the aircraft commander loaded all seven passengers. He performed a hover check, saw the rpm bleed off, settled to the ground, lifted to a hover again and attempted to take off over obstacles and down a dusty road. The helicopter started to settle, went IFR in dust and crashed. Fortunately, the crew and passengers escaped with minor injuries. This aviator demonstrated an obvious and acute need for standardization of his flying habits and procedures. Frequent observations of individual aviator performance are needed to ensure compliance with directives.

Step 4: Standardization of operational procedures. This should include, but by no means be limited to, defining responsibilities of individual crew members; procedures for refueling and rearming; spacing between aircraft; performing operational checks against existing environmental conditions; control of formations; and dismounting crew members to guide aircraft in tight situations.

A UH-1H had a major accident because refueling personnel failed to clean their pumps and filters after pumping water. The helicopter refueled, took off and the engine stopped during climbout. It was autorotated into a valley and crashed. The crew escaped injury, but the helicopter was a total loss. During the investigation, it was found that the refueling personnel were not aware of the proper procedure for cleaning the pumps and filters.

Step 5: Unit analysis of aviation accident prevention program. This is probably the most essential aspect of a prevention program. Unfortunately, it is usually the one that receives the least attention. At the company level, it is relatively easy to implement and it is the heart of the program. Effective analysis requires frequent evaluation of pilots, operational procedures, maintenance procedures and habits and techniques. When this type of analysis is performed, a positive prevention program can be established.

UH-1H crashed and burned during attempt to approach hilltop camp with clouds below landing pad

The unit analysis sheet shown in an accompanying illustration is a device that will assist in analyzing accidents. If you will use such a system to methodically lay out and analyze all the ingredients involved in each mishap, it will enable you to more easily isolate the root or basic causes which must be corrected or eliminated.

Another illustration shows a simple but useful format for the analysis of accident cause factors. I recommend its use by commanders and safety personnel at all levels, from section and platoon to brigade and Army. It can be adopted as a daily, weekly and monthly log from which personnel concerned can have constant up-to-date information about accidents and the major factors involved. It provides quick and ready information to assess and take immediate corrective action.

Step 6: Adherence to established directives. Many directives, messages and bulletins which state requirements and establish procedures and restrictions have been issued. Existing directives are sound and designed to provide a basis for meaningful accident prevention programs. Yet the majority of our accidents contain elements of flagrant disregard for oral and written instructions.

Three UH-1H helicopters, with crews of four and six passengers aboard, had refueled and were taking off from a pickup zone. The flight leader encountered a crosswind from the right after clearing a tree barrier and lost 200 rpm, but continued his takeoff successfully. The aircraft commander of the second UH-1H saw his rpm drop to 6000 at approximately 30 feet. He put his collective down, but could not regain enough rpm to continue, so he landed. Despite these warnings, the aircraft commander of the third helicopter elected to take off with a full load. The helicopter cleared the barrier and immediately lost rpm. It traveled 1,000 meters, never regaining rpm or gaining altitude and the main rotor struck a tree, breaking a blade. The tail boom struck trees and separated and the fuselage crashed inverted, killing the aircraft commander and two passengers. The pilot, crew chief and three passengers sustained major injuries and only the gunner and one passenger escaped uninjured. During the investigation, it was brought out that hover checks were not made regularly.

There is an apparent reluctance on the part of commanders to take punitive action when warranted.

Understandably, younger commanders may have misplaced compassion for their aviators and are reluctant or hesitant to punish or correct an individual for committing an unsafe act. We should not be misled. It is not charity, nor is it compassion for inexperience, when we allow a flagrant unsafe act which may lead to more such acts and the inevitable accident to go uncorrected. Most accidents really result from supervisory error committed at some time in the background of the individual ultimately involved in a mishap.

A good accident prevention program is a function of command attitude, which, if properly emphasized, can permeate throughout the command and down to each aircraft crew member. We must police ourselves and insist on good habits. If an aviator develops a reputation for unsafe flying, his commander should investigate. If command supervision and guidance do not solve an existing unsafe condition or correct an aviator's poor flying habits, disciplinary action should be taken.

We must make more use of the flying evaluation board. The recently published revision of AR 600-107 adds more strength to the portion of the regulation pertaining to mandatory flying evaluation board action. There are indications that current procedures may be too flexible and that some obvious offenders are not being challenged. By winking at poor habits, poor techniques or poor discipline, we allow lax or unskilled pilots to put themselves and innocent personnel in jeopardy.

A search of USABAAR data revealed that 135 Army aviators were involved in two or more pilot error accidents during the period January 1967 through June 1969. The number of flying evaluation boards on record during that same time frame bears out my statement that many more aviators may be suspect of unsafe flying habits than we can tolerate. In fact, only five of the 135 met a flying evaluation board. This is not to say that all of these 135 aviators should have been boarded. I am only pointing out that if appropriate counseling, admonishment and other command actions are not effective, then mandatory board action is probably dictated.

Step 7: Adherence to normal mission parameters and avoidance of marginal operations. Ready acceptance of unnecessary risks by unit commanders and individual aviators is an alarming manifestation of the *combat syndrome* stemming from operations in a combat area. It is difficult to accept the concept that many of our accidents occur because of a physical or emotional environment. But we have only to review the number of accidents occurring from single-ship administrative type missions, operating from one safe base to another, to recognize that the overall circumstances differ very little from those encountered any place in the world.

A UH-1H was carrying a load of supplies to a hilltop camp. As it turned final, the pilot found himself confronted with clouds hanging below the level of the landing pad. He went down far enough to clear the bases of the clouds and continued his approach. About 600 meters out from the pad, his air speed was down to approximately 45 knots and he started applying power and went into a slow deceleration. At about 200 meters out, he added more power, but the helicopter was not climbing and he was losing rpm. The helicopter settled into the hillside and a rotor blade hit the ground in front and started it rolling to the right. It settled on its right side inverted in a garbage pit that had burning garbage in it. The crew and passengers got out and the engine continued to run until a large fire caught and consumed the helicopter.

The reliance on *combat environment* to justify the urgency in delivering a load of soft drinks or a casual passenger on an unnecessary trip is nothing more than an excuse for lack of command attention and the abuse of resources. Accident records show that operations of individual aircraft in marginal weather over inaccessible terrain for no apparent valid reason is pronounced.

Step 8: Air traffic control. We must continue to review and improve our control of aircraft at airfields and during operations. Gross violations of communication procedures and long-winded conversations between air crewmen and towers are still evident; tower personnel continue to direct helicopters to hover taxi over other aircraft; and aviator discourtesies are evident.

The situation is more acute at operational bases. A UH-1 was approaching a refueling area at a tactical field before daylight. After three aborted approaches, the fourth approach terminated on top of another helicopter, resulting in three fatalities, three injuries, one destroyed helicopter and one with major damage. Airfield control was not in operation and the area was obscured.

Step 9: Assignment of individual safety responsibilities within functional areas of each aviation organization. There is an adage in the Army that safety is everybody's business. Some commanders will tell

you that all their aviators are safety officers. But the lone individual designated as the safety officer usually operates in a vacuum, compiling statistics and pleading for safe practices. On a given staff, each staff member must be responsible for safety in his area of responsibility. At the small unit level, each member of the chain of command must be assigned specific areas of safety for supervision.

Step 10: Loading of aircraft according to flight conditions. We must demand that aircraft commanders know the capability of their machines for various conditions and adjust their loads accordingly. It serves little purpose to *take one more,* only to lose the machine and the load.

A CH-47 aircraft commander landed, refueled and shut down to take on an internal load of 6,000 pounds. The officer in charge of the cargo then told him he had 50 passengers to go with the load. The aircraft commander objected, but agreed to try at the insistence of the officer.

He picked the helicopter up to a hover, found he could not maintain rpm and put it down to offload 2 dozen passengers. He picked up to a hover again, lost rpm and landed to offload 15 more passengers. He made another hover check, then started his takeoff. After clearing telephone wires, the helicopter dropped, hit guy wires and rolled over into a ditch. It came to rest partially inverted and five passengers were killed.

Unit policy limited the allowable CH-47A load to 8,000 pounds. Investigation revealed the weight of the load exceeded this limit by 1,965 pounds and exceeded the design alternate gross weight of 33,000 pounds by 874 pounds.

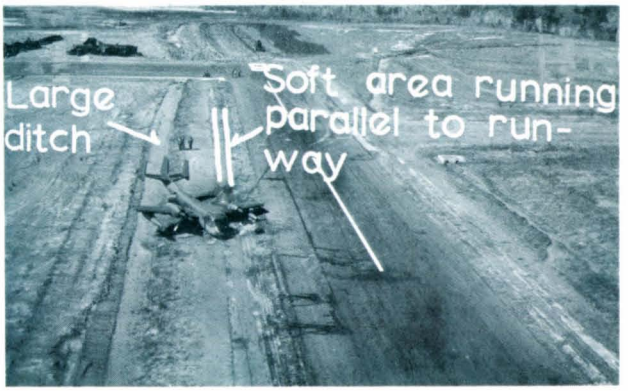
Operations of gunships and lift ships can become critical with the loading of unneeded water, rations and ammunition. Prescribed loads and insistence of proper loading is the answer.

Step 11: Elimination of hazards on and around airfields.

Three OV-1s had directional control problems landing on a 50-foot wide runway at one airfield and slid into soft areas caused by a filled-in ditch which was not adequately compacted, resulting in major damage to all three airplanes. These three accidents happened within a 3-month period. All three could have been prevented by a wider runway and adequate shoulders. The estimated cost to widen the runway and prepare the shoulders was $90,000. Damages to the three OV-1s totaled $127,922.

A look around ramps and revetments too often

One of three OV-1s trapped by soft area beside runway. Damages to the three airplanes totaled $127,922. Estimated cost to widen runway and prepare shoulders was $90,000



reveals various types of debris, including paper boxes, small arms ammunition and soft drink cans. Uncontrolled vehicular and pedestrian traffic crossing runways are constant hazards. Some of our worst accidents are caused, in part, by personnel working on runways during operations. Positive control must be established and enforced.

I'm sure most of you are aware of the problem of engine replacements and the ever-present potential for foreign object damage (FOD). We are prone to blame such damage on ingestion of materials during normal operations, but the facts show that much of this damage is caused by such items as cigarette lighters, monkey harness rings, billfolds, screwdrivers, etc., left at air intakes during maintenance or inspections. We must constantly renew our efforts to prevent this type of damage.

The loss of aircraft from apparently preventable accidents detracts from the otherwise outstanding performance of Army aviation. It reflects unfavorably on aviator professionalism, supervision, discipline and our ability to manage resources.

Accidents can be prevented. A recent check revealed that at least 26 company size aviation units have gone for a year or more without an accident. These units represent a cross section of world environments. There were 10 in CONUS, 6 in USAREUR, 3 in Eighth Army and 7 in Vietnam. One company in Vietnam had gone 25 months without an accident. Another was accident-free for 22 months, another for 21 months and a fourth for 19 months.

Reversing the unfavorable trend in aircraft accidents is a real and everyday challenge. The solution rests with the chain of command. We must use all the techniques of command with an unrelenting demand for professional performance and effective supervision to the lowest level.

TIPS FOR AVIATION SAFETY OFFICERS

YOU HAVE JUST left the company commander's office. His introductory briefing was thorough and to the point. He is a busy man in this organization, with many aircraft, hundreds of personnel and a very important mission. Although you fully expected some sort of additional duty, he really floored you with the safety officer job.

Where do you begin? What does the commander expect of you in this assignment? How do you establish a safety program or check the current program for effectiveness? The commander knows you are not a graduate of the Army Aviation Safety Course. He has really put you in a tight spot. Has he? Not really, when you sit down and think about the job and how it might be accomplished. The following tips should aid anyone who feels he is in a similar tight spot.

ANALYSIS: First, determine the commander's personal philosophy about aviation safety. Staying within the guidelines of this philosophy, one of your

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Education and Prevention Department
USABAAR

first tasks will be to evaluate the unit and analyze its problems, including recommendations for solving what problems you may find. To perform this analysis, you will need to gather information and use some accident prevention tools.

Your first step should be to perform an aviation accident prevention survey. A survey is the same as an informal inspection of the unit's operation and facilities, as well as an examination of its policies. Your tool here is the Guide to Aviation Resources Management for Aircraft Mishap Prevention, prepared by and available from USABAAR. You should be able to answer many of the questions in this booklet in a positive manner. However, you will be unable to answer some of the questions. List the unanswered questions as potential problem areas, then gather the unit inspection records in all fields—maintenance inspection records, Command Maintenance Management Inspection (CMMI) records and Inspector General (IG) records. Each contains indicators of past problem areas.

By listing these areas and adding them to the results of your survey, you come up with still more problem areas that must be resolved. History records will reveal some of the past problems of the unit, particularly accident experience.

Then look at the unit mission accomplishment record. Has the unit consistently accomplished its mission without difficulty, or has it at times been unable to perform the full mission due to lack of aircraft or damaged aircraft?

Evaluate unit discipline. Discipline includes the flying habits of the aviators. Are they professional at all times? Are the enlisted men well motivated? Does the unit have problems with morale? All of these have an adverse effect on safety attitudes. When you have completed your analysis of unit problems, your next task is to determine how best to attack the problems.

EDUCATION: One of the first problem areas you will likely encounter is in the unit education program. The people involved in this program must be knowledgeable in several areas if the program is to be effective. Your first step is to build a positive attitude toward aviation mishap prevention throughout the unit. You can do this through monthly aviators' meetings and through personal contact with other aviators, the commanding officer, instructor pilots and enlisted personnel. You must instill in these individuals a pride in workmanship. This can be achieved by various incentive awards—letters of appreciation, simple praise and an occasional pat on the back for work well done.

You must continue to communicate. With whom? You must be free to talk to the maintenance officer, the operations officer, the commander and enlisted men throughout the unit. You must move outside the unit and talk with the safety officers of adjacent units, higher headquarters and subordinate units. The communications chain in accident prevention must never be permitted to break.

One of the most difficult areas in which you must communicate and educate is hazard identification. Many people walk by known hazards every day without seeing them. As the old saying goes, "You can't see the forest for the trees."

Hazards may be in the form of foreign objects in revetment areas, on airfields, in shop areas, or petroleum, oil, lubricants (POL) areas. The simple use of handtools can be extremely hazardous if proper techniques are not followed. This becomes an education problem for the aviation safety officer.

You must be prepared to give specific classes on hazard identification and elimination or control. All hazards must be eliminated or controlled if the mishap prevention program is to be effective. If a hazard cannot be eliminated, it must be controlled.

Perhaps one of your most difficult students will be the unit commander, who may not be receptive to positive controls. He may not have the right attitude toward a mishap prevention program, simply because he believes it is interfering with his ability to accomplish the mission. If you are a good salesman, you can correct this situation by pointing out that an effective prevention program improves mission performance because it conserves resources, making them available for mission accomplishment. You may also have problems between operational and maintenance personnel. Quite often they are at odds in their attempts to satisfy the commander.

BUILDING A PROGRAM: Having analyzed the current aviation mishap prevention program of the unit and embarked upon a major education program, you must now build an effective prevention program, with certain goals in mind. The program must be oriented toward mission accomplishment, not mission interference.

You must know the deficiencies of the unit. You may be concerned with such things as the 11-point

program, listed in 1st Aviation Brigade Regulation No. 385-10. The major topics of these 11 points are:

1. Individual aviator standardization.
2. Standardization of operational procedures.
3. Loading of aircraft according to flight conditions.
4. Elimination of hazards on and around airfields.
5. Improved air traffic control.
6. Performance of preflight (hover) checks.
7. Assignment of individual safety responsibilities within functional areas of each aviation organization.
8. Unit analysis of aviation accident prevention program.
9. Avoidance of downwind operations.
10. Adherence to established directives.
11. Adherence to "normal" mission parameters and avoidance of marginal operations.

By following these 11 points, most known deficiencies existing in the standard unit can be corrected. Last, but not least, you must develop professionalism among all personnel. Professional attitudes in aviators, maintenance personnel, truck drivers and all others are essential. Each man must do his job safely and effectively. If this is carried throughout the chain of command, you can ensure a hazard-free operation.

DOCUMENTATION: Merely paying lip service to a prevention program will not implement the program, nor will it guarantee that all members of the command are aware of its existence. You must put on paper what the program will be. It may be put into the unit's standard operating procedure (SOP). It may be put out in the form of a regulation, a directive, a policy letter or a training document.

Whatever form the program takes, you must be certain that it is in writing and that it is well displayed for all members to see. Once published, the communications process must carry it throughout the organization and the information must be disseminated to all personnel.

SUPERVISION: The program now requires command interest. The unit commander, through the philosophy that he gave you, must ensure that his program is implemented and that it is properly supervised. A commander who is aware of mishap prevention methods and is safety conscious soon finds his entire unit with the same state of mind. The commander who thinks little of safety will find his unit feels the same way.

If the commander uses his staff properly, all staff members will be continually coordinating mishap prevention matters throughout the organization. He must use his chain of command down to the lowest individual. He should consult with the noncommissioned officers who are working throughout his organization. There is no aviation mishap prevention school at the present time for noncommissioned officers. Therefore, the commander must further educate these people. Once he has developed, disseminated and implemented the program and made use of his chain of command, the program should be effective.

REEVALUATION AND CORRECTION: A commander or safety officer must continually check the results of the program, not only for compliance but also for effectiveness. If it is not effective, errors exist. These errors must be identified. The program must be reevaluated and corrective action taken. Positive recommendations are the requirements.

Let's look at a near miss. Two aircraft coming close together indicate an error in air traffic control. Something is amiss. You must evaluate this situation, look closely and perhaps reroute the traffic pattern.

Precautionary landings are sound indicators of errors. They also constitute the most fertile area for investigation because they do not leave a pile of wreckage. They leave an undamaged aircraft. Yet, something went wrong.

Forced landings are excellent investigative tools. When we move to the next higher categories—the incident, the minor accident, the major accident and the catastrophe—we are now dealing with major classifications of errors. Here, the investigative techniques may become far more complex and the causes for some accidents may never be found.

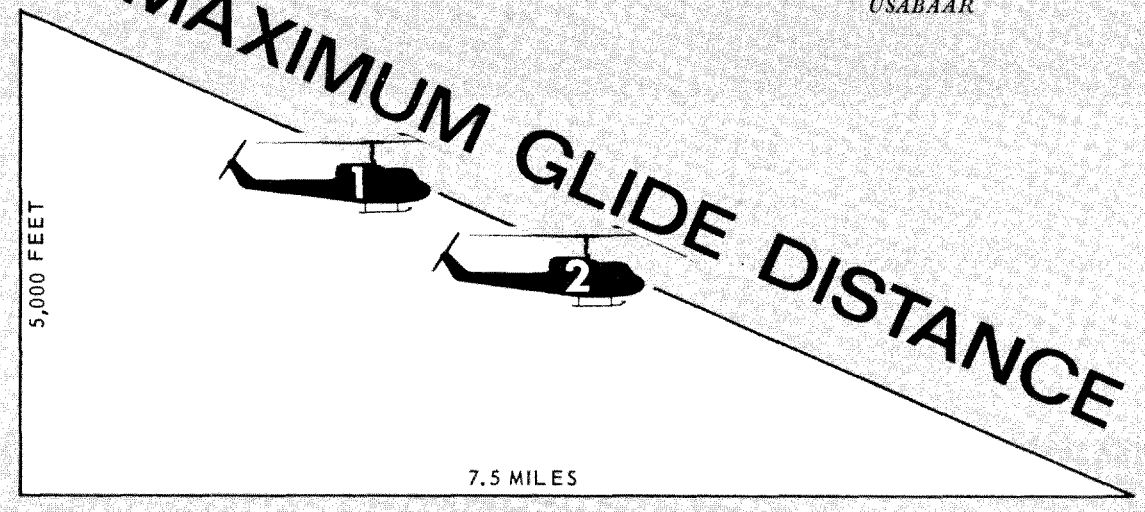
FUTURE REQUIREMENTS: With this in mind, and in an attempt to lower the present accident rate, we should see changes to AR 95-5, AR 385-40 and the DA Form 2397 series during CY 1970. These changes will require all incidents, forced landings, precautionary landings and ground mishaps, as well as minor and major accidents, be investigated and reported on the DA Form 2397 series.

The first thought you have may be: "I have too much paperwork now to be bothered with investigating every mishap that occurs." The DA Form 2397 series has been revised to require only certain forms to be completed according to the system that failed. They will replace the need for most of the supplemental crash facts messages now submitted.

The new DA Form 2397 series will identify aviation problem areas to all echelons of command. They will serve as guidelines for engineering changes to aircraft hardware and help establish new design criteria. In turn, this should reduce the number of accidents occurring at the present time. With fewer accidents, we will reduce the number of lives and aircraft lost, *and the accompanying paperwork.*

Louis H. McKenzie
Aircraft Accident Review and Analysis Department
USABAAR

MAXIMUM GLIDE DISTANCE



TWO AIRCRAFT with the same aerodynamic configuration, one weighing 6,400 pounds and the other 8,500 pounds, have engine failures. Which will glide further, the light or the heavy? Provided both are flown at the specific coefficient of lift to produce the optimum lift/drag ratio, they will glide the same distance. Weight has nothing to do with maximum glide distance for a specific aircraft.

The dash 10s give air speed and rotor rpm to maintain in helicopters and the air speed for airplanes, both with average gross weights. If you operate at the gross weight listed on the chart, you should maintain the rpm and air speed listed. This will give you maximum glide distance. But how often do you operate at the weights listed in the dash 10s? For the UH-1B, it is 6,400 pounds; for the UH-1D, 7,100 pounds. It's not very often we fly with these precise weights. So what good is the chart? It gives you what you need to know to interpolate and come up with the air speed you need to maintain in a glide for whatever weight you have. If your aircraft is heavier than the average weight listed in the dash 10, then you must glide faster. How much faster? Before we give you the formula, look at the altitude/distance chart.

Helicopter No. 1 is gliding at 90 mph and a 1,000 fpm rate of descent. It weighs 5,000 pounds. Helicopter No. 2 is gliding at 120 mph and a 1,333 fpm rate of descent. It weighs 8,300 pounds. At the end of 2 minutes, helicopter No. 1 will have traveled 3 miles and be at 3,000 feet. After 5 minutes, it will touch down and will have traveled 7.5 miles. Helicopter No. 2 will have traveled 4 miles and be at 2,334 feet at the end of 2 minutes and will touch down 7.5 miles from the start of its glide at the end of 3.75 minutes. Both traveled the same distance. Helicopter No. 2, heavier by 3,300 pounds, or 66 percent greater than No. 1, increased its air speed 30 mph, 33 percent greater than No. 1. Both traveled the same glide path.

The formula for determining air speed for maximum glide when weight is changed is:

$$\frac{V2}{V1} = \sqrt{\frac{W2}{W1}} \qquad \text{(Constant CL)}$$

V1—best glide speed corresponding to original gross weight, W1.

V2—best glide speed corresponding to new gross weight, W2.

For the examples given, the formula would work this way:

$$\frac{V2}{90} = \sqrt{\frac{8300}{5000}}$$

$$V2 = 90 \quad \sqrt{\frac{8300}{5000}}$$

$$V2 = 90 \quad 1.66$$

$$V2 = 90 \text{ X } 1.29 = 117 \text{ or } 120$$

Rule of thumb: When weight increases 10 percent, increase air speed 5 percent to attain maximum glide distance. The UH-1B requires 73 knots, 310 rpm, with a weight of 6,400 pounds for maximum glide distance. When the aircraft is flown at 8,400 pounds, a weight increase of 31 percent, the air speed should be increased 15 percent to 84 knots to attain maximum glide distance.

Point to remember: Maximum glide is the best your aircraft can do. If you try to improve or stretch it, you will end up short.

References: "Aerodynamics for Aviation Personnel," by H. H. Hurt Jr., and dash 10s for UH-1B and UH-1D helicopters.

Although fictitious, this article illustrates the importance of positive command influence in unit aviation safety programs

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Education and Prevention Department, USABAAR

AFTER THE CHIEF of the safety survey team concluded his final comments on an aviation company, the unit commander quickly rose, checked some notes in his hands and addressed the team. "Sir, I've been listening to the critque, and I know that we're not too sharp in the safety area. I take exception to some of the comments, but then I'm no safety expert. I'd like to point out," he continued, "that my unit has been involved in training exercises most of the year. Safe we may not be, but combat ready we are!"

Whether it was his intention or not, this declaration substantiated the survey team's findings that the unit aviation safety program lacked the correct command influence. The impact on the audience was readily apparent. Let's backtrack and examine how this commander's attitude toward safety affected his unit's accident prevention program and what the survey team uncovered.

It was obvious to the survey team from the moment they entered the unit's hangar that they had been labeled the opposition. Apprehension of unit personnel prevented a free exchange of communication between the team and the personnel. Conversely, the purpose of the survey, which was to provide assistance and guidance, was impaired. What creates this atmosphere? In the final analysis, the responsibility rests with the commander. He establishes the tenor of any situation through his actions and reactions.

It was apparent to the team that the commander was not particularly concerned with the safety survey. Although the date for the survey had been coordinated in advance, the commander was conveniently absent that morning. His absence prevented the team chief from evaluating the attitude and influence of the commander on the unit's safety program. But the findings of the team and subsequent remarks of the commander corroborated the team's suspicions.

It didn't take the team members long to discover the unit's reluctance for being surveyed. In effect, there was no semblance of a unit safety program, nor indications of effectual command resource management. The deficiencies noted by the team read like a Chinese laundry list. There were many excuses offered for the poor safety posture. The survey team concluded that the primary reason for the sad state of affairs was due to an absence of basic management documents essential to any safety program. The missing documents included a maintenance standing operating procedures (SOP), a unit safety SOP and a standardization program.

The survey team also uncovered a condition which was more detrimental than the physical deficiencies —failure to develop the proper attitude of the unit aviators toward aviation safety. Most of the aviators assigned to the unit were recent flight school graduates. In all likelihood, this was their first assignment to a unit as rated aviators.

In the early stages of their development, aviators solicit the advice and guidance of "old heads." Usually, the commander is the most influential member of the group of experienced aviators. New aviators follow the examples established by commanders. Their opinions and attitudes are greatly affected by those of the commanders. Even their flight performance and judgment are influenced by their commanders' actions.

Accordingly, the failure of this commander to support and promote a vigorous aviation safety program and incorporate it into the unit's mission was reflected by the attitude of his aviators. Many of the basic safety rules and considerations were being disregarded by the aviators, both in the air and on the ground. It was the commander's responsibility to correct this condition, but he did not recognize the obvious hazards. Thus, the stage was set for a major aircraft accident as a result of supervisory error.

This commander, however, should not shoulder the entire responsibility for any accident or mishap caused by his lack of guidance or supervision. His immediate staff supervisor or superior must also share this responsibility. Had sound command resource management been practiced throughout the chain of command, this situation would have never developed.

Unfortunately, it does not stop here. If an aviator from this unit is reassigned, he will confront his new commander with problems created by his former commander. This aviator will not leave behind the habits and attitudes formed under the influence of his previous commander. It will be necessary for the new commander to redevelop this aviator's thinking about aviation safety. If he doesn't, his unit's accident prevention program may well be the victim of another commander's mistakes.

Aviation managers must always be aware that the development of any aviation safety program involves both physical and mental aspects. The same must hold true for an aviator's development. Commanders must ensure that their unit's standardization program reinforces mechanical training with a philosophy which enhances the Army's aviation safety efforts. Without a proper balance of the two, individual aviator development is handicapped.

neglected factor in aviation mishap prevention . . .

Ted Kontos

BASED ON MISHAPS reported for a recent 5-week period, Army aviators were involved in 102 accidents, 133 incidents, 76 forced landings and 319 precautionary landings. *These figures do not include combat losses.* This is an average of 81 accidents, 105 incidents, 60 forced landings and 256 precautionary landings per month, at a cost of 39 fatalities, 42 injuries and $12¼ million, including 21 destroyed aircraft.

Put another way, an occupant is accidentally killed every 18 hours and 28 minutes; another is injured every 17 hours and 20 minutes; and the hardware cost exceeds $18,000 every hour. An aircraft is destroyed every 32 hours; an accident occurs every 8 hours; an incident occurs every 6 hours; some forced landing emergency arises every 12 hours; and a precautionary landing takes place every 2 hours and 45 minutes.

Is our prevention program at fault? Not at all. On the contrary, the Army aviation safety record has steadily improved each year for more than 12 years, despite a flying hour program which has increased 5½ times during the past 11 years and a corresponding increase in the number of aviators and aircraft. This improvement was also accomplished during a period of tremendous increases of mission requirements and the introduction of more complex aircraft and equipment. However, no significant downward trend in mishaps has been evident during the past 4 years. Yet, further strides in prevention can and must be made. Where can we direct our attention to reap additional benefits? One area involves the human element.

The human element is directly or indirectly responsible for almost every aviation mishap. At first glance, this statement appears exaggerated. It's easy to see the part played by the human element in mishaps which result from failure to use torque wrenches, preflight, safety hardware, follow maintenance procedures as outlined in TMs; or from flying into known adverse weather or violating regulations. It's more difficult to picture the human element as a cause factor in mishaps which occur when a tire blows out, a bird is ingested in an engine or some component fails because of an inherent materiel defect. Yet, the human element may very well have played a responsible role in these mishaps.

Did quality control ensure that the failed tire met the manufacturer's specifications when it was manufactured? Was the tire allowed to remain in use until dangerously worn? Did it strike a rock because the runway was not properly maintained?

Did the bird strike occur while the pilot was flying low level near water or over other areas known to be inhabited by birds when his mission did not require it?

Did the component fail because of design error? Was some mistake made during the metallurgical process? Was the item properly heat treated if this was a requirement?

Close examination of mishap cause factors clearly shows responsibility of the human element. To ensure correct equipment maintenance, the Army has devised a set of checks and balances designed to eliminate human errors. These include establishment of procedures for logging discrepancies; using proper symbols to denote the condition of aircraft; performing maintenance; clearing discrepancies; and having certain maintenance work inspected by TIs. These actions are further bolstered by daily inspections and preflights.

Months ago, we found ourselves plagued with mishaps caused by loose or overtorqued fittings, loose quick disconnects and chafed lines. We still are. Why hasn't this elaborate system of checks and balances cured these problems?

Since it's easy to spot the faults of others, let's take a look at the publishing field. When you pick up a newspaper and glance through it, do you see a title that interests you, only to discover the article has nothing to do with the title? Somehow, the title was misplaced. How many misspelled words do you find? Some evoke a chuckle. One recent item read, ". . . Following church services, a covered dish sinner was held in the parrish hall . . ." Other errors create frustration. You read to the bottom of a column and discover that the unfinished article, concerning some vital issue, does not continue anywhere else in the paper.

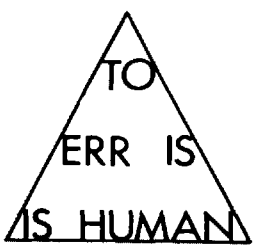
A tear-out sheet was included in one issue of a publication. The point where the page was to be removed was clearly marked by a dotted line, with instructions to "cut along dotted line." If anyone followed the instructions, he must have wondered what he was supposed to do with the quarter-inch strip of blank paper. The page had been marked along its outer border.

Although errors in printing can result in reactions ranging from laughter to frustration, real harm is seldom done. This isn't true for aviation. What if these mistakes were aircraft maintenance errors? Yet, the publishing field generally has a system of checks

as elaborate as that for Army aviation. A writer prepares a draft, the editor edits it and the typist prepares the final draft. This is proofread, the composing machine operator sets the copy and this copy is proofread. Layout or makeup men prepare the layout as the material will appear in print, and this layout is checked and approved before it's printed. Despite such meticulous preparation, errors get by.

The writer doesn't want his material printed with mistakes in it. Neither does the editor, the typist, the composing machine operator nor the proofreader. Yet, even when these individuals conscientiously examine the material, errors get by. Why?

Read the statement in the triangle . . .



Did you catch the extra "is" in the triangle on your first try? If you did, consider yourself an astute observer. The principle purpose of this sentance is to ilustrate the illussion that occurrs when the eye does not remain stationery while scanning a familiar quotation. Did you also spot all six errors in the preceding sentence? Did you note the wrong words, as well as the mispelled words? Did you also note the misspelling of the word *misspelled* in the previous sentence? Get the idea? The eye looks but the mind doesn't always recognize what it sees. Have you ever dropped a coin and looked for several minutes before you found it in a perfectly obvious spot? Is there really any difference between these examples and a mechanic overlooking a chafed line, cracked "B" nut, loose quick disconnect or tool left in an engine inlet; or a pilot overlooking the same items during preflight?

It's well known that psychological and physiological factors contribute to these types of actions, but all are characteristic of the human element. In Army aviation, we attempt to reduce mishaps and eliminate errors and oversights by the most effective means we know. These include adopting regulations, establishing specific procedures, issuing checklists, EIR programs, etc. But how do we ensure the regulations will be obeyed, procedures followed, checklists used and EIRs submitted? And what about the psychological and physiological factors affecting the person trying to work by-the-book? Must he complete a job in a hurry? Is he tired? Has he skipped meals or lost sleep? Does he have serious personal problems? Is he taking medication? Is he overconfident or worried? Obviously, his performance is going to vary from one given time and situation to another, even though his tasks remain identical.

Why don't we obey regulations, follow procedures, use checklists, etc.? Maybe an old story puzzle can help us find the answer. The story states that two cars are approaching an intersection at right angles. Both are equidistant from the intersection and moving at exactly 70 mph. Neither car has its headlights on, nor any other lights that can be seen by the approaching drivers. Yet both cars stay on the road and no accident occurs. How is this possible? Reading this story for the first time, most people will hesitate and think, suspecting a trick answer. The solution is simple and logical. Both cars are being driven in broad daylight. Though the facts were truthfully told, most of us tend to *assume,* because the headlights were not on, the incident was taking place at night. This kind of assumption can get us into hot water.

An OV-1 pilot on a cross-country flight landed for refueling. He had thoroughly prepared for his flight, including a by-the-book preflight, and he maintained a constant check of his systems during flight. He knew the airplane was mechanically sound. After refueling, he checked the tires and the general condition of the airplane and made his engine operational checks. During takeoff, both engines lost power and the OV-1 crashed. *The fuel was contaminated with water.*

In another instance, a pilot took off after a hasty preflight and ran out of fuel a short time later. *A defective fuel gauge indicated full, but there was very little fuel in the tank.*

A U-8 pilot peered into the fuel tanks during his preflight and saw they were full. During flight, both engines lost power and cylinder head temperatures soared, necessitating a forced landing and replacement of both engines. *The airplane had been serviced with JP-4.*

In each of these instances, someone *assumed* something was right when, in reality, it was not.

Comical signs which have been in vogue for years tell us a basic truth about ourselves

THIMK

PLAN AHEAD

Even as we strive to instill perfection in others, we goof!

Murphies and other maintenance errors occur because of human willingness to assume. Because a part fits, a mechanic assumes it is installed correctly. If publications were used and procedures followed, none of these errors would have been made. If the OV-1 fuel sumps had been drained as part of the preflight, the water would have been found. If the fuel tank had been visually checked, the hasty preflight pilot wouldn't have run out of fuel. If attention had been given to inspecting the fuel in the U-8 tanks, the pilot would not have taken off with JP-4 in them. If TM procedures were followed, Murphies would not occur.

Why do we make such assumptions? Maybe it's because of our knowledge, training and experience, because of established habits and familiarity with our equipment. *Knowledge—training—experience—habits—familiarity?* These are qualities we strive for. How can they be detrimental to safety? No one can argue their merits. They are not merely desirable—they are essential. But the human element finds a way to distort these qualities into producing overconfidence. We become so familiar with our duties and equipment that we develop undesirable habits. These negate essential work habits. We fail to perform required inspections or do so without benefit of checklists. We perform maintenance without the use of TMs. When this happens, we may get away with it for awhile. Then an MWO makes a change or a procedure is revised and we find ourselves directly or indirectly involved in a mishap.

Just about everyone owns a camera today. Depending on the type of camera, there are several things we must do before taking a picture. If it's a complex camera, we must remove the lens cover, pull out the dark slide, make certain the camera is loaded and the film advanced, set the desired shutter speed, cock the shutter, focus, frame the subject in the viewfinder, hold the camera steady and trip the shutter. Now we have our picture. Right? Wrong! We forgot to determine our exposure and set the aperture. How many times have you ruined a picture by failing to follow one simple step? The same applies to aviation. One misstep can ruin an otherwise perfect flight.

That can't happen to me, you say. That's about the most human statement ever uttered. Granted, you don't expect to be involved in an accident and you don't climb aboard an aircraft fearing you will be. If this were true, you'd get out of the flying business. But you're wrong if you think it can't happen to you. This was the attitude of a seasoned hunter and gun collector. He took meticulous care of all his firearms and practiced elaborate safety precautions. All his guns had trigger guards installed and were kept unloaded and locked in wall cabinets. All, that is, but one. This 12-gauge shotgun was kept loaded in a special section of a storage closet with the door locked. During a discussion with a friend about features of various guns, the collector unlocked the storage closet, unloaded the shotgun and doublechecked it before handing it to his friend. After examining some of the features they had discussed, it was returned to the owner who proceeded to reload it before returning it to the closet.

"How does that gun handle when you need to get off a quick shot?" the visitor asked.

Instinctively, the collector swung around and replied "Excellent!" He positioned the gun to his shoulder and promptly blasted a hole in his den wall. No one was hurt, but you can bet neither of these gentlemen will be saying, *That can't happen to me!*

What's the answer? Unfortunately, there is no simple solution. The human element is much too complicated for that. It is much easier to develop a fix for some aircraft mechanical problem than to find a cure for an undesirable human characteristic. But we can begin a cure by taking a different approach. Suppose you had skimped and saved for years so you could someday own a new Rolls-Royce. During those years, you never ate out. You forfeited your vacations and held part-time jobs for additional money. Finally, you saved enough to buy your Rolls. You can be certain that no oil changes or other

routine maintenance and inspections are going to be skipped. You can also bet only the best gasoline will find its way into the tank. You can be sure a dry handkerchief will not be used to wipe the windshield or dust the finish. If anyone else is to drive it, you are going to be very particular who that person is and what his driving qualifications are. Maintenance will only be done by a factory representative who knows every inch of your car; who has the latest factory specs; who uses the proper tools and procedures for every job; and whose work is warranted. *We don't provide this kind of treatment for million dollar aircraft.*

To begin our cure for human problems requires a change in our attitude. We must endeavor to treat all equipment for what it is—expensive, complex and vital to our nation's security. We must use it for what it was designed, making certain that only qualified personnel will operate and maintain it, *in accordance with stipulated procedures.*

We must develop pride in our work and instill it in others, encouraging the formation of habits which will make every pilot and mechanic treat each mission or job, no matter how insignificant it may seem, as if it were the most important in the world. It is! Formation of positive attitudes and habits must be made as much a function of the classroom and on-the-job training as that of teaching a man to fly or maintain an aircraft.

We can also devise improved screening methods for selecting and training aviation personnel. And we can be more selective in assigning personnel to key positions, ensuring that supervisory personnel have a positive attitude toward mishap prevention and a sincere concern for quality performance. We can provide training for supervisory personnel in identifying and understanding the significance of such human symptoms as fatigue, changes in attitude, etc., in those under them. Flight surgeons and other specialists can provide the best advice on how to cope with human problems.

We can refuse to accept *any* accident as unavoidable and refuse to wait for mishap trends to develop before admitting problems exist. We always have trends, even when we have no mishaps. How many chafed lines have your mechanics found and corrected during the past month? How many pinched O rings and loose nuts? What discrepancies were noted during PE inspections? All of these represent potential problem areas and give fair warning—*before mishaps occur.*

We can study our present use of human resources and determine if they can be used more effectively. For example, who is your aviation safety officer? Is he trained and experienced? Or is he the newest aviator in your unit? Who is your test pilot? Recently, an OV-1 test pilot was involved in an accident during a test flight in deteriorating weather. This pilot was the least qualified in his unit for the job. He had less than 200 hours in the OV-1. Flight times of other pilots in the unit varied from 800 hours to more than 2,000. Why was this man selected for the flight, particularly in deteriorating weather conditions?

We can provide formal training in aviation safety to an increasing number of younger men and reap more benefits from their longer service. We can devise new ways to create incentives. What unit or individual spotted a potentially hazardous problem in a particular aircraft or procedure before an accident could occur? What unit submitted the most EIRs in relation to the number of aircraft in the unit during a given period?

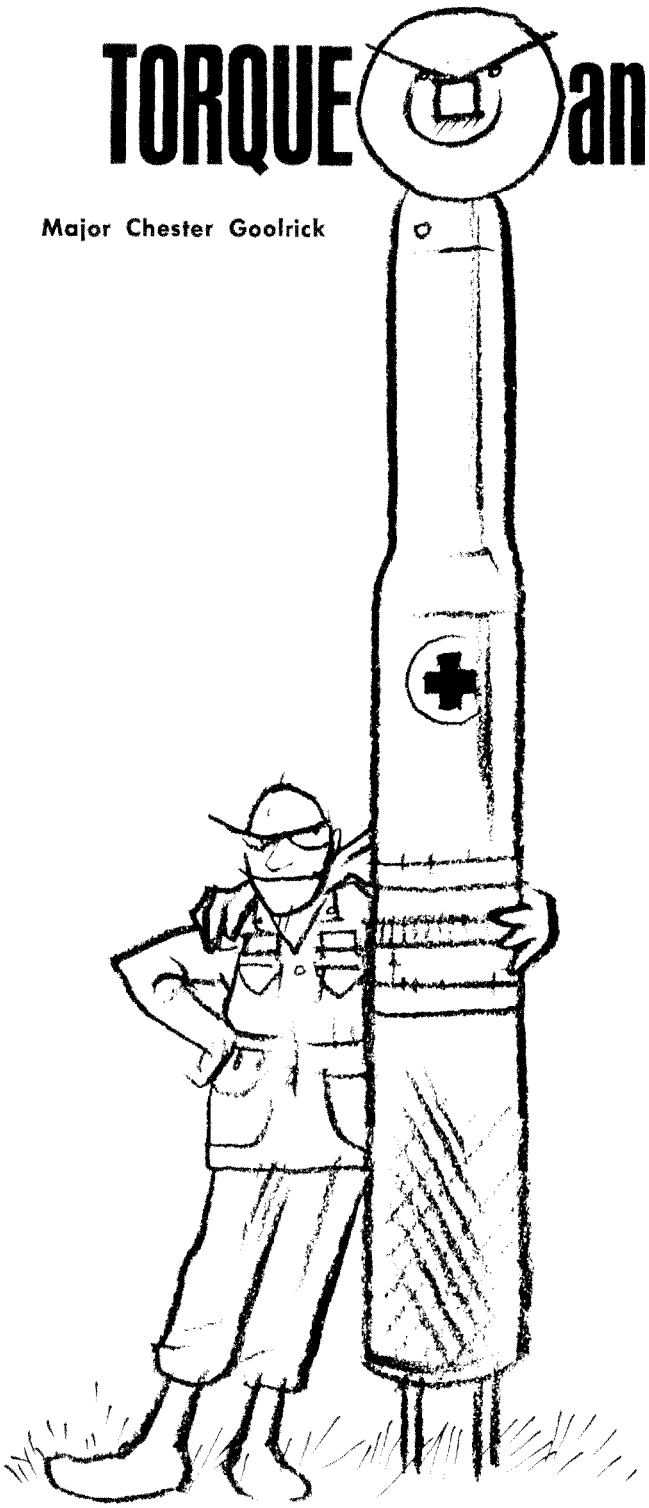
We can even build a safety factor by *assuming,* the habit that often gets us into trouble. We can assume that, although we think we've done a particular job correctly, we may not have. In this way, we will tend to doublecheck our work.

At first glance, the human response would be to say these things can't be done—that, no matter what, the human element cannot be relied on—that we must always depend on mechanical checks and rechecks, regulations, procedures, design, etc.—that any effort to improve safety by dealing with human characteristics is going to be wasted. After you've thought it through, we hope you will accept this as a personal challenge, because the human thing to happen will be for someone to come up with a program that will produce results, if for no other reason than to prove it can be done. That's another and productive side of the human element.

Think about it. As you go about your tasks, whether you're assigning crews for a mission, preflighting, replacing a frayed hydraulic line or any of the other hundreds of tasks necessary for Army aviation—remember the human element. Make it work for and not against mishap prevention.

TORQUE and TUBE SENSE

Major Chester Goolrick



THE FIRST PIECE of solid information a budding surgeon has hammered into him at medical school is that when you begin poking around in somebody's insides the key words are (1) precision and (2) certain knowledge of what you are doing. When old Doc Crosscut does a pick and shovel job on a patient he knows exactly what results he wants and how to go about getting them. Out at the race track, Doc may dilute his bank roll using by guess and by God methods to pick his nags which would make professional gamblers wince with pain. At the operating table, Doc is a precisionist as finicky as a jeweler splitting up a 140 carat diamond for Elizabeth Taylor.

Thanks to these admirable qualities Doc's patients are likely to end up as contented occupants of the Old Folks' Home. You can be certain you won't find any of them turning blue and keeling over because he has hooked up two parts which don't need to be hooked up, has inadvertently punched a hole in an artery or left a surgical clamp firmly throttling a gizzard. Things of this sort are severely frowned upon in medical circles. Anyway, Doc has his own self-esteem as well as his reputation to think about. If he knew there was even one person in the bone yard because of some blooper he'd pulled in the operating room, Doc would soon develop a case of galloping heeby-jeebies which would eventually land him in the loony bin.

At first glance, you wouldn't think Doc Crosscut would have much in common with an Army aviation maintenance man. Stand a surgeon in his sterilized operating gown and shiny steel scalpel beside a grease-stained mech holding a torque wrench and you'd be hard put to find a resemblance.

There's considerably more here than meets the eye, little friends. The fact is that a surgeon and a top-flight maintenance man are blood brothers under the skin, identical twins in several highly important respects—*especially* important to the people they work with.

1. Both are highly trained, crackerjack professionals.
2. Both have an extra helping of honest pride

and self-respect.

3. And both are in the business of saving other people's lives.

You can't find a much closer blood-brother relationship than that.

OUT PATIENT CLINIC

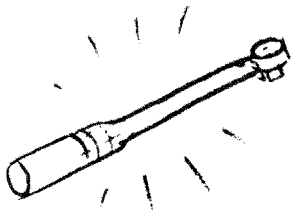
A surgeon's job is to operate on patients to cure what ails them, or advise treatment which will make an operation unnecessary. A maintenance man's job is to restore health to a sick aircraft or to see to it in advance it doesn't get felled by a stroke in mid-flight or at some other inconvenient moment. The surgeon has one big advantage over the maintenance man, at that. His patients can at least tell him where they hurt. A mechanic has to rely on his own keen ears, experience and a thoroughness that checks out all the danger points with the kind of efficiency bank presidents expect and demand of the chaps who keep an eye on the vaults at night.

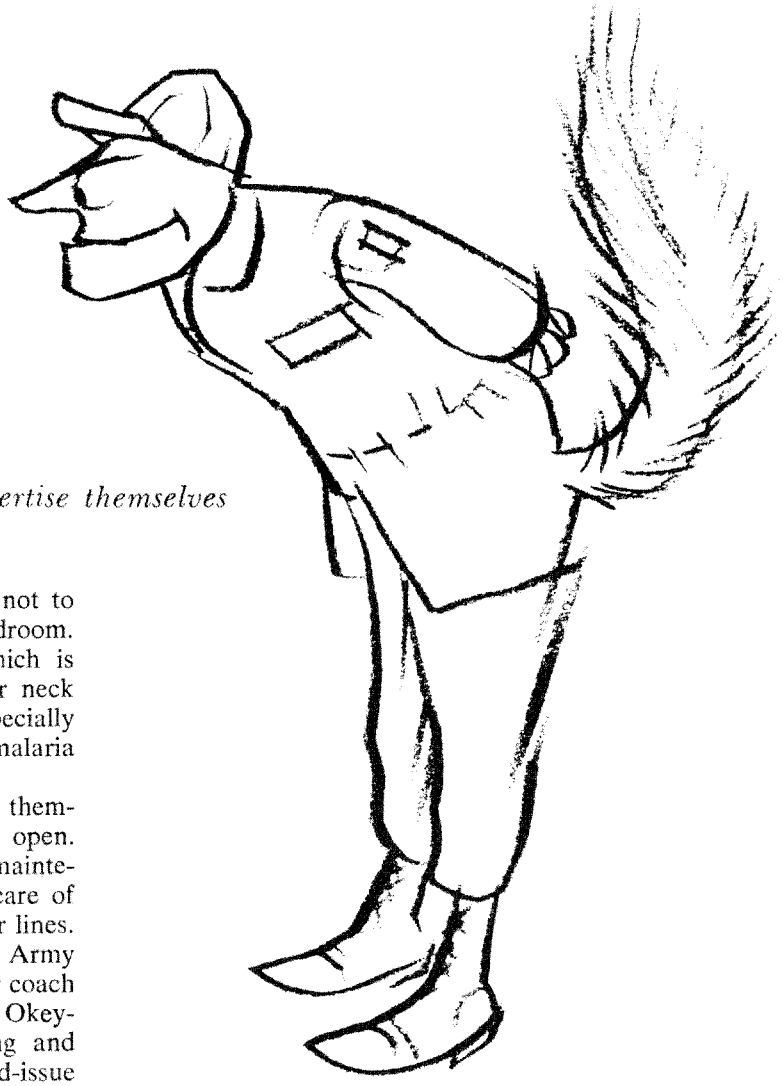
It is a large, demanding task.

There's no doubt about it—this kind of professional competence is definitely one of the Good Things of Life. Like most Good Things, however, there's a catch attached. For one, it figures that a man who keeps his nose applied firmly to the grindstone is going to get twice as tired as the one who waddles sloppily through his tasks with all the energy of a hippopotamus asleep in a mudhole. And when somebody is bone-weary it is a lot easier to overlook or forget a vital detail.

Particularly when that detail is easy to overlook, anyway, or you have never grasped its full impor-

The fact is that a surgeon and a top-flight maintenance man are blood brothers under the skin . . .





Small but important details don't advertise themselves

tance. You'd have to be tired as all get out not to spot a wildcat or a king cobra in your bedroom. You just might not notice the mosquito which is practicing approaches so it can land on your neck and give you a nice fat case of malaria—especially if you didn't know the difference between malaria and the common cold.

Small but important details don't advertise themselves like an ambulance with its siren wide open. Let's consider two vital areas of aviation maintenance—proper torquing of nuts and proper care of an aircraft's system of tubes. Hoses, that is. Or lines.

As we all know, everybody who has been in Army aviation, be he a pilot, supervisor, mechanic or coach of the Little League football team at Fort Okey-Pokey, Minn., has been told about torquing and tubing. You get it on all sides, like a standard-issue political brainwashing in a communist prison.

Just the same—whoever you are and wherever you are, can you stand up in court and honestly swear that you always give torquing the attention it deserves and that you *never* fail to see that an engine's fluid lines are attached properly and in the correct places?

You can? Well, bully for you and you can move to the head of the class. The Pentagon will be delighted. But one thing's for dead sure. Some people aren't in your class, as the figures bear out. There are some people ol' Doc Crosscut wouldn't allow to touch a patient with a 12-foot pole, much less a scalpel. Some maintenance men aren't as responsible as they could be, either.

Consider. During one 5-month period, the Army was burdened with 10 accidents, 19 incidents and 100 precautionary landings which were laid at the door of faulty maintenance. Five of the accidents—exactly half—were caused by improperly torqued hardware and 42 of the others were caused by the same thing. Chafed oil and hydraulic lines set up another 19. And, remember, when you start talking about five of this, 42 of that and 19 of another, you are talking about *people* who got in deep trouble because somebody goofed. They are not so many ten pins, waiting to be knocked over.

Want more evidence? No problem. There are enough figures lying around loose to keep a battery of statisticians happy for the next 10 years or so. During one period improper torquing caused 21 percent of all accidents, 12 percent of the incidents, 13 percent of the forced landings and 30 percent of the precautionary landings. Not only that, over another span of 8 months in a single year, 68 UH-1D flights ended prematurely because of hydraulic leaks, mostly brought on by chafed lines.

Any statistician will tell you that when you are confronted with such an impressive array of known facts you can make a sound guess that there are a lot

more figures waiting to be added to the list.

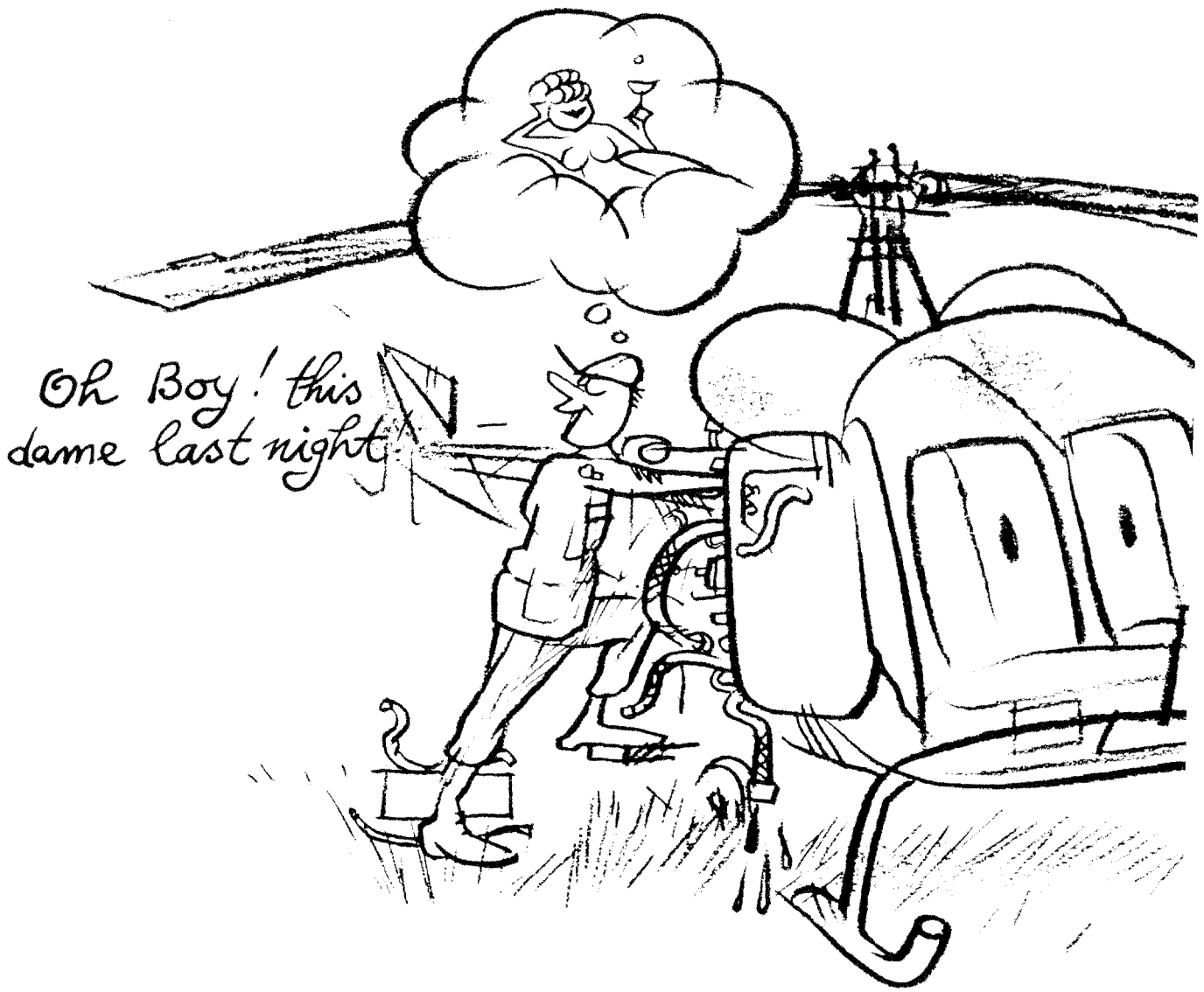
It's something to think about, what? Enough, you might think, to justify considerable more attention to torque and tubes than seems to be going on in some circles.

ONCE OVER LIGHTLY

As a starter, what's all the fuss over torquing about, anyway? You screw on a nut good and tight so it won't work loose. Anybody who has ever changed a tire knows that, including your Aunt Emma, who couldn't tell the difference between a torque wrench and a pair of Chinese chopsticks.

Try this line of thinking sometime on the experts who handle stock cars during pit stops. These lads may not all be graduates of M.I.T., but they can give you a lecture on elementary physics that would do credit to any professor of metallurgy. The men in the pits know things about what can happen to materials under extreme conditions a Sunday driver never has to learn. Above all, they learned a long time ago that no driver ever won first place trying to run on three wheels and that drivers whose wheels or other essential parts fly off in mid-race generally start looking around for another pit crew—provided they survive the resulting crash, that is.

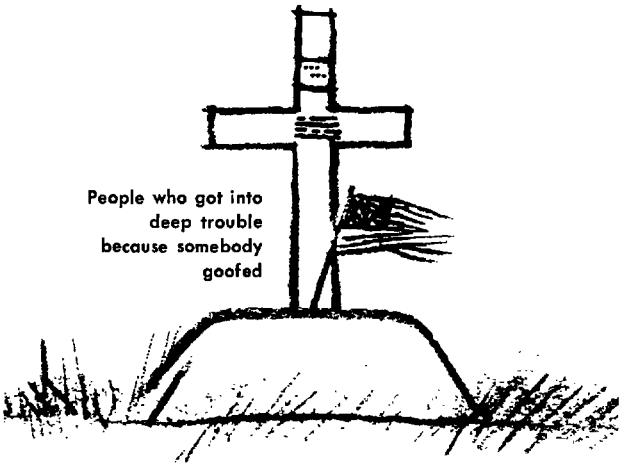
It doesn't take much savvy or experience to realize that if you torque a nut with your fingers it will probably work loose in a gentle breeze, or that if



you use brute force to torque a nut of the wrong size you've a situation as potentially painful as a size 12 foot in a size nine shoe. Something has to give.

The need for exact torquing is a little harder to grasp. The fact that *over*torquing can be every bit as explosive as *under*torquing, more so, in fact, is one of those mysteries of life which can make most of us non-geniuses want to lie down and pull the covers up over our heads.

Be of good cheer. There's no point in addling your brain trying to understand things which could overload the mental voltage of people with an I.Q. of Einstein. That's what the handbook is for in the first place. It tells you how to service and operate



the precision instrument a modern aircraft is without violating physical and aerodynamical limits worked out by batteries of experts through long hours of lab work, study, observation and experience. As far as overtorquing is concerned, when you "snug-down" a nut with no thought of the stipulated torque value you're stretching the bolt like a piece of bubble gum. Not as much, maybe. Not even visible to the naked eye. But the damage is permanent, and sooner or later—tomorrow, next week or next month—some unfortunate airman is going to find himself in deep trouble.

What is likely to happen to him? Any number of things, all of them unpleasant. Cracks in places like bearing races and trunnion supports. Stripped filter studs. Hose connection failures. Little things like that. Little things which grow into big things in a whale of a hurry, once the chain reaction gets underway.

A LITTLE KNOWLEDGE

One trouble seems to be that, with the best intention in the world, people who appreciate the value of proper torquing are making mistakes because they don't fully understand torquing procedures. They think they do but they don't, which can be a dangerous thing, as every man who thinks he understands women sooner or later finds out.

Take the words "check torque" and "retorque." It's a plain fact that there has been considerable confusion as to what they even mean, and when instructions are so much Greek to the man who is being instructed he already has his back to the goal line.

Once again, there's no reason to get upset. Most experts agree they mean exactly the same thing. Maybe not *exactly,* but they *amount* to the same thing. When you "retorque" you are doing exactly that—torquing over again. When you "check torque" you are taking a look to see if a particular nut still has the proper poundage after operating the number

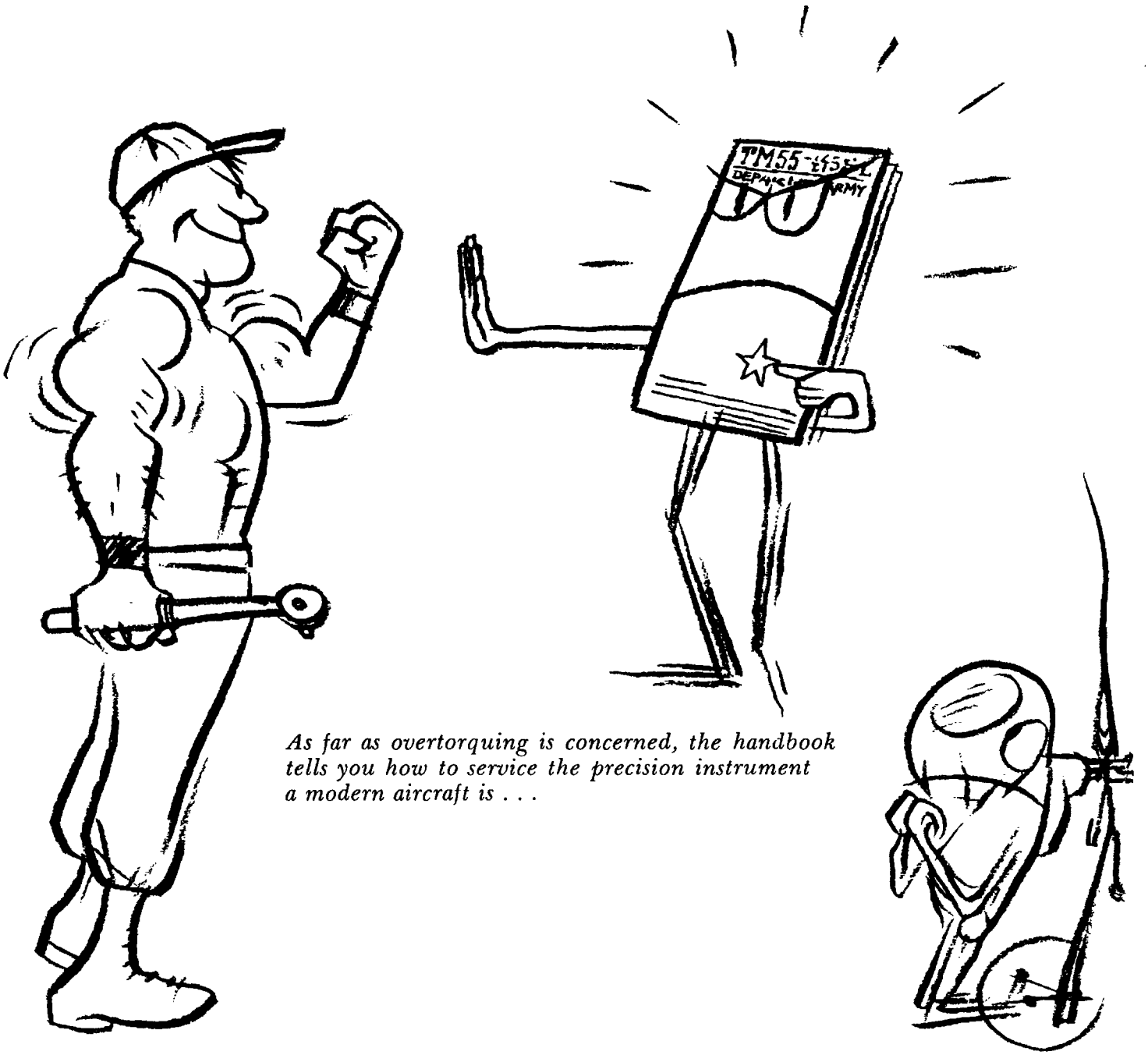
of hours the experts have specified.

So far, so good. The catch is that the experts tell us there is no way on earth to check the torque value of a tightened nut; in fact, you run the danger of adding poundage by overtorquing. The only way to get at the truth is to back the nut off to below the minimum prescribed value and then run it up to the prescribed value. It is then ready to go until the next PE.

Not so complicated after all, right? Once you get the swing of it, it's easy, as the belly-dancer observed.

ROAD TO HELL

When you understand something and appreciate its importance, the battle is half over. But only half. The world is cluttered up with broken-down projects which were started by people who started out with



As far as overtorquing is concerned, the handbook tells you how to service the precision instrument a modern aircraft is . . .

the best will in the world but who didn't know how to get the job done, or botched it up somewhere along the way.

We've come a long way since the barnstorming days when any crossroads garageman could service an aircraft with not much more than a monkey wrench, a pair of pliers and a screwdriver. As we've noted, today's flying machines are something else again, as precisely constructed as a $1,500 Swiss watch. If they are to work properly they have to be treated with the same respect.

It is a process which requires a delicate, skilled approach. When a man is under pressure, there is always a temptation to hurry the job, but as some wise old boy noted a long time ago, too much haste results in a lot of spilled milk. After which it's too late to do much weeping. Proper torquing has to be done smoothly and steadily until the specified torque is reached. If you go about the job with all the grace and agility of a man flailing away at a rattlesnake you're sure to wind up with an improperly torqued fastener.

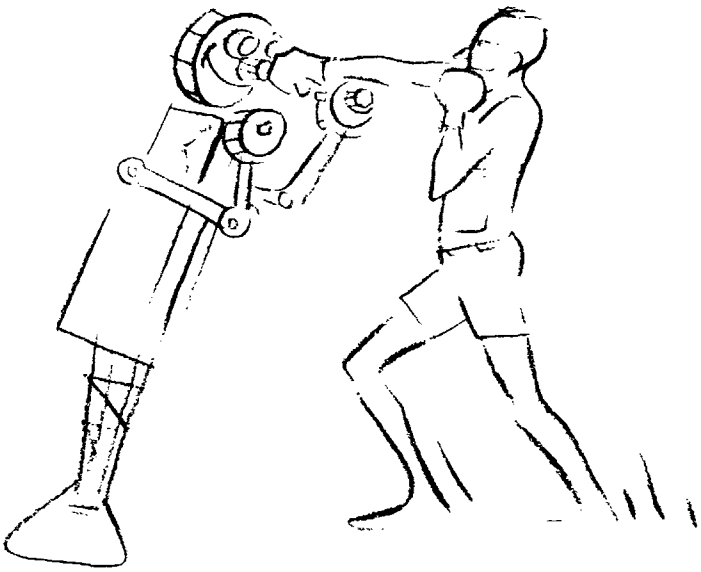
While we are at it, don't forget the torque wrench itself. It's also a precision instrument, as much as Doc Crosscut's scalpel. You could use an old-fashioned monkey wrench to drive nails or crack walnuts without impairing its usefulness to any great extent. A torque wrench is as different from a monkey wrench as a Huey is from a Model T Ford. Treat it rough, bang it around, drop it on the floor and you wind up with a sick torque wrench on your hands. It can be relied on to give values with about the same accuracy a 3-year-old can tell you the time.

Every mechanic should treat a torque wrench as one of the prize items in the Army inventory of special tools, and give it lots of TLC (tender loving care). It should be calibrated on a regular basis and color coded. As for calibration, the rule of thumb is simple indeed. When in doubt, calibrate.

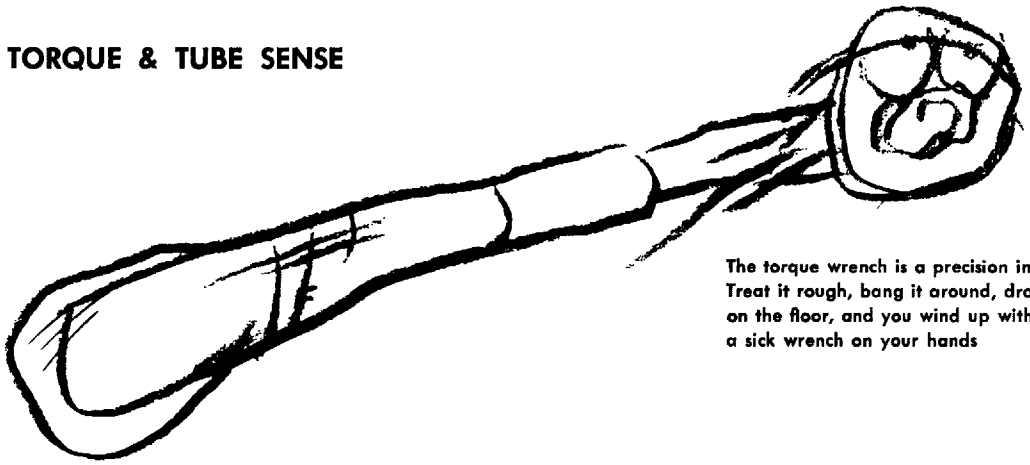
Finally, torquing is too big an item, too essential to reliable performance of modern aircraft, to be left in the hands of any one person without supervision. A shortage of qualified TIs might make it not always possible but where it *is* possible it's sound procedure to have one present whenever critical torque is being applied to a component. A case of two heads being better than one. As we've seen, there's no real way a man who wasn't on the spot in the first place can check the torque accurately once the job has been completed.

So, nothing about torquing is so complicated your Aunt Emma couldn't grasp the idea once it has been driven home. Like a lot of other aspects of Army

The only way to "check torque" is to back the nut off . . .



. . . then tick it on just right



The torque wrench is a precision instrument. Treat it rough, bang it around, drop it on the floor, and you wind up with a sick wrench on your hands

aviation, it is really only a matter of understanding, care, responsibility and by-the-book procedures. Follow that doctrine and bad-torquing disease will be relegated to the past along with some of the other old ailments like scurvy and the bubonic plague which used to be the concern of the M.D.'s whose job it was to keep people's bodies and souls in close association.

CAN OF WORMS

A novice peering into the innards of an aircraft for the first time might be forgiven for thinking he was looking at a mess of fish bait somebody had dug up in the back yard. A modern aircraft engine looks less like a power plant than it does an insane octopus trying to commit suicide by strangling itself to death.

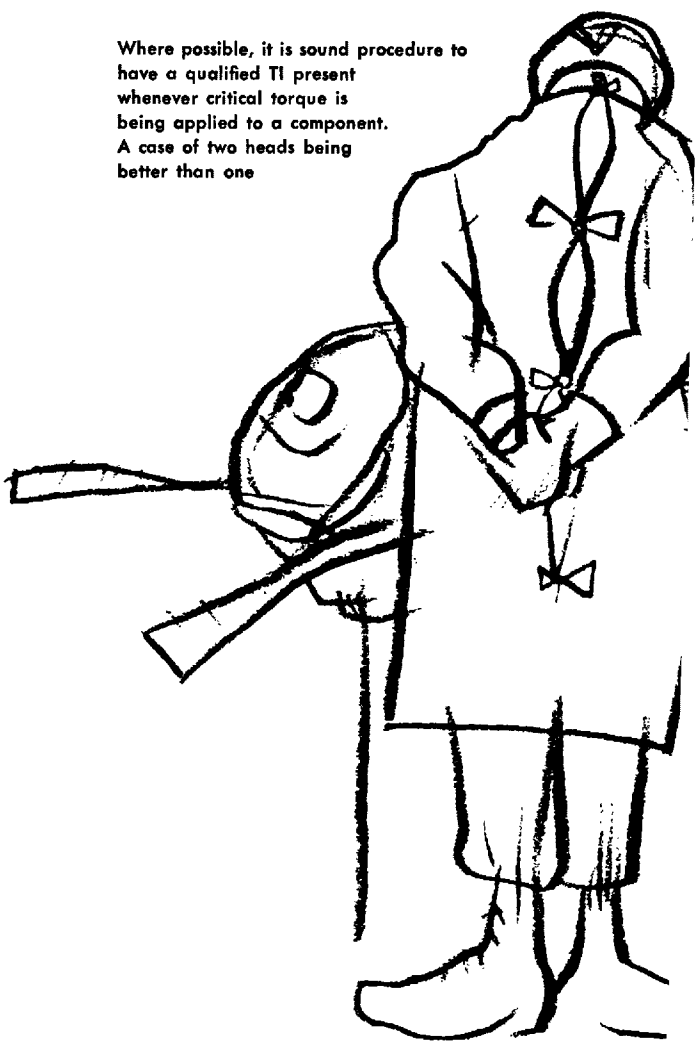
It will, too, given half a chance.

Only it won't be suicide so much as murder.

Back in the good old monkey wrench, pliers and screwdriver days when most people would have told you that "torque" was some sort of new-fangled dance, what tubes an engine had—and there were precious few—were made of rubber. Rubber was fine except that it tended to crack and spring leaks in extremes of temperature, as any man with a garden hose knows. It had a limited life expectancy, and some fluids had the same effect on it a couple of shots of Carolina moonshine can on a drunk's liver.

About 15 years ago the laboratory whiz kids came up with something better. Teflon, which is short for tetrofluorothelene resin, in case you run up against it the next time you are in a spelling bee. Your wife knows it as that groovy stuff they coat frying pans with to keep eggs from sticking. As far as Teflon tubing goes, which has replaced rubber on virtually all Army aircraft, it is high up in the ranks of those brand new miracle products you keep hearing about on TV between shots of the football game and which are guaranteed to make life a lot easier for the housewife.

The guarantee holds. Where rubber generally yielded up the ghost at temperatures below -65 or above 260 F, Teflon sturdily keeps functioning from -100 to 450. It can handle virtually any kind of fluid the aircraft makers can dream up and it can be used over and over again, like a toothbrush. What puts the icing on the cake is that, given proper handling, it has the life expectancy about that of Methusaleh.

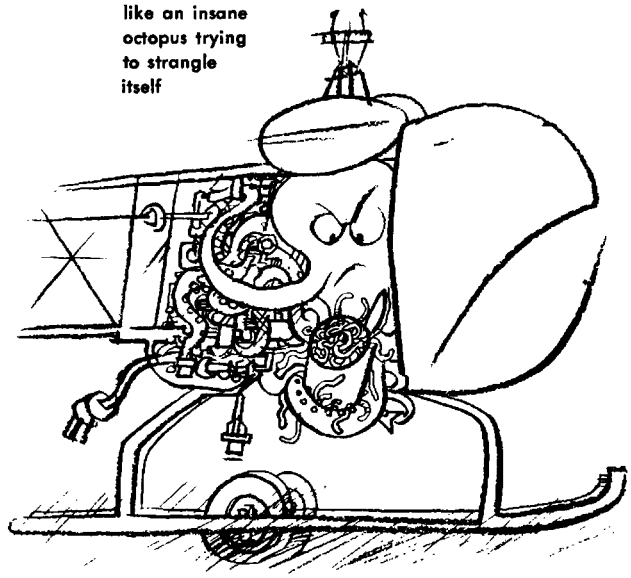


Where possible, it is sound procedure to have a qualified TI present whenever critical torque is being applied to a component. A case of two heads being better than one

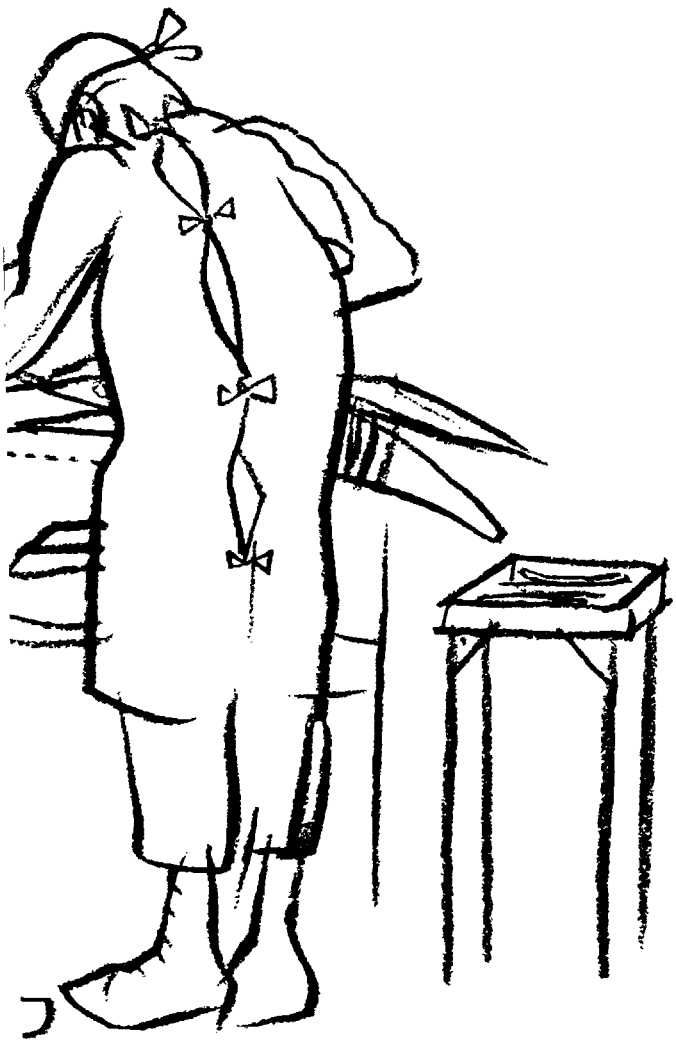
Given proper handling? Remember those statistics we cited back there a bit? How chafed oil and hydraulic lines caused a total of 19 accidents or near misses during one brief period? And those 68 UH-1 flights forced down because of chafing? That's not the whole story, either. The gloomy truth is that hydraulic and oil hose failures are on the rise and while they haven't reached the proportions of an epidemic of Hong Kong flu, there is plenty of cause for alarm.

For instance, one UH-1D pilot more recently set his aircraft down after his transmission oil pressure began to drop. The cause was a chafed pressure hose which was rubbing against the tube assembly at the top bulkhead fitting. That was bad enough by itself, but get this. A check of transmission oil pressure hoses on an *even dozen* other aircraft belonging to the *same* outfit showed various degrees of chafing. Twelve potential accidents or mishaps lurking in the bushes and biding their time.

Not all are detected before they get a chance to leap out of ambush, as the unhappy UH-1D pilot



The inside of a modern aircraft looks like an insane octopus trying to strangle itself



and all the others like him have found out. Nine such failures, each completely preventable, took place over a 2-week period and in another stretch of 2 months there were a half dozen. All of it adds up to a lot of unnecessarily failed missions, expense, time, and wear and tear on the good dispositions of everybody involved. Sometimes, in fact, the result can be even worse if you happen to be forced down in a rice paddy surrounded by a passel of unfriendly little men wearing black pajamas.

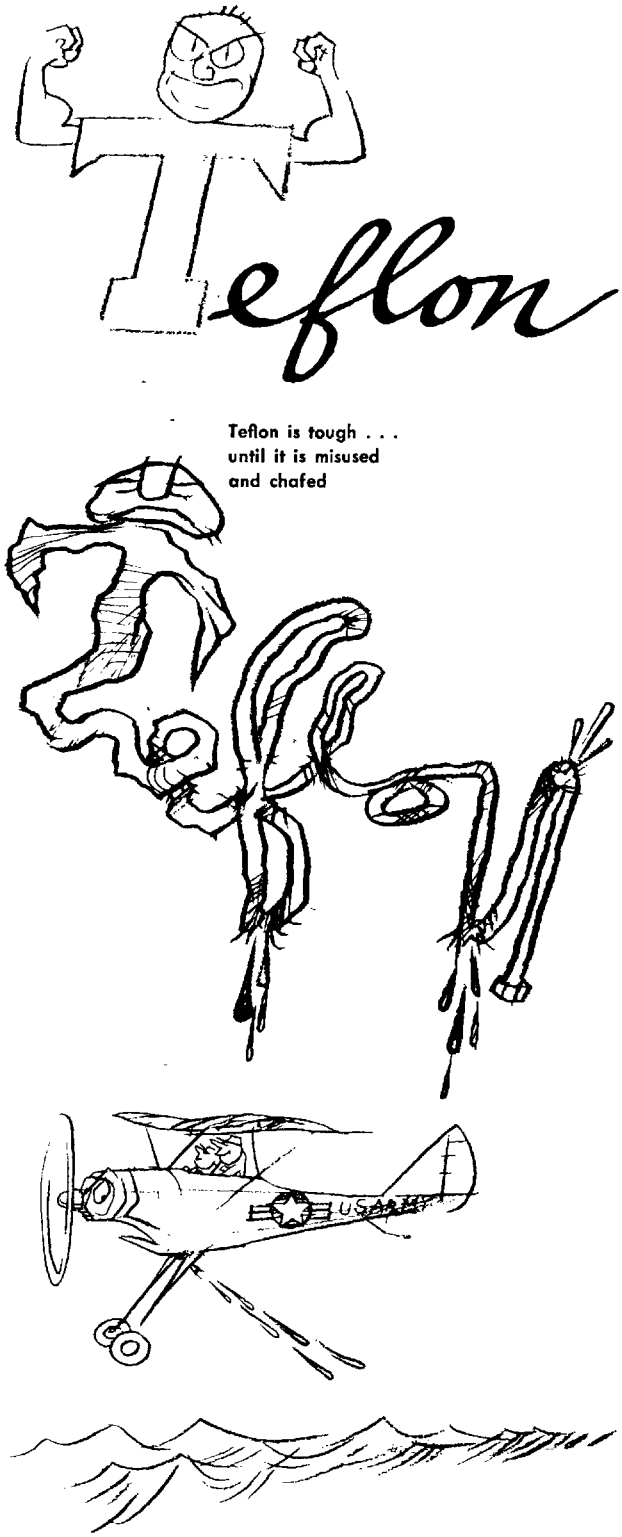
So Teflon, like everything else man has ever put a hand to, isn't fail-safe. Tough as it is, it can be abused. Abuse it sufficiently and it will fail.

It doesn't like to be twisted. If you have looked at a Teflon hose with a critical eye, you will have noticed that it consists of an inner tube (the Teflon) with a braided wire exterior which varies in strength according to the pressure it is designed to carry. Now then. If you took a notion to, you could probably bend and twist a new Teflon tube itself until it resembled a plate of spaghetti in an Italian restaurant. The wire braid is another matter. Excessive bending or twisting of a hose, forcing it where it doesn't want to go (it will try to return to its original shape) will reduce the service life of the braid and, presto!, you are setting up another failure in mid-flight.

Stepping on hoses which have been carelessly left lying around on maintenance stands, or dropping heavy weights on them will do the same thing.

So will improper storage.

When hoses are tucked away pending use they should be given the same tender care Mother gives Junior when she sees to it he is safely sacked in for



the night. Dust caps should be placed over end fittings. They should be stored loosely and coiled to prevent kinking, and pre-formed hoses shipped with tie wires to hold their shape should be left tied until they are ready for installation. The whole idea is that a hose should be just as serviceable when it is installed as it was the day it was turned out at the factory, or removed from an aircraft in reusable condition. Most of us have to buy new hoses to water the lawn each spring because we didn't do the job properly when we put them down in the cellar in the fall.

That's all right.

A new lawn hose doesn't cost much.

A UH-1D—and its crew—does.

The same high regard for the sensitive feelings of the braiding should be applied to all aspects of handling and installation of hoses. Take the pre-formed hoses we mentioned. Some come that way but all Teflon hoses carrying hot fluid eventually tend to take the permanent shape of their installed position. Trying to straighten one is a little like trying to oblige a man by bending his lower arm so he can scratch his left elbow with his left index finger. He isn't going to thank you for the favor.

As for the chafing which keeps cropping up, you can wear a hole in anything if you keep rubbing it long enough, including the Pyramids or Hoover Dam. Teflon is no exception. When a line is put in improperly and no chafe guards are installed at potential trouble spots, you can expect trouble as surely as you would pneumonia if you went wandering around wearing nothing but Bermuda shorts in a snowstorm.

Chafing is one problem. The fact is that Teflon, tough as it is, can be misused in other ways. You could make a hose out of platinum and braid it with diamonds and it would still cause trouble if foreign matter got in through an uncapped end when it was not in use or disconnected. If hose clamps do not provide proper retention and support, or the hose has been bent or forced at sharp angles, you have a series of situations which eventually is going to cause some unhappy aircrew to find itself somewhere it didn't intend to be.

Improper installation and care of hoses is one thing. Frequent inspection is another, the kind of thorough going over Doc Crosscut gives his patients when they come in for their annual checkup. Inspection can reveal chafe areas which have developed

since installation or discoloration of the normal silver color of the hose due to extremes of heat beyond the hose's capacity, or even leaks caused by improper torquing of connections. Corrective action, like correct installation, nips the trouble before it has grown big enough to make its move.

ON BENDED KNEE

When the banks and paymasters implore you not to bend, fold, spindle or otherwise mutilate their nice new checks they are in dead earnest. Strong men in their computer centers have been known to break down and cry at the sight of checks which have been so mishandled they are sure to give the IBM machines a possibly fatal case of the heaves.

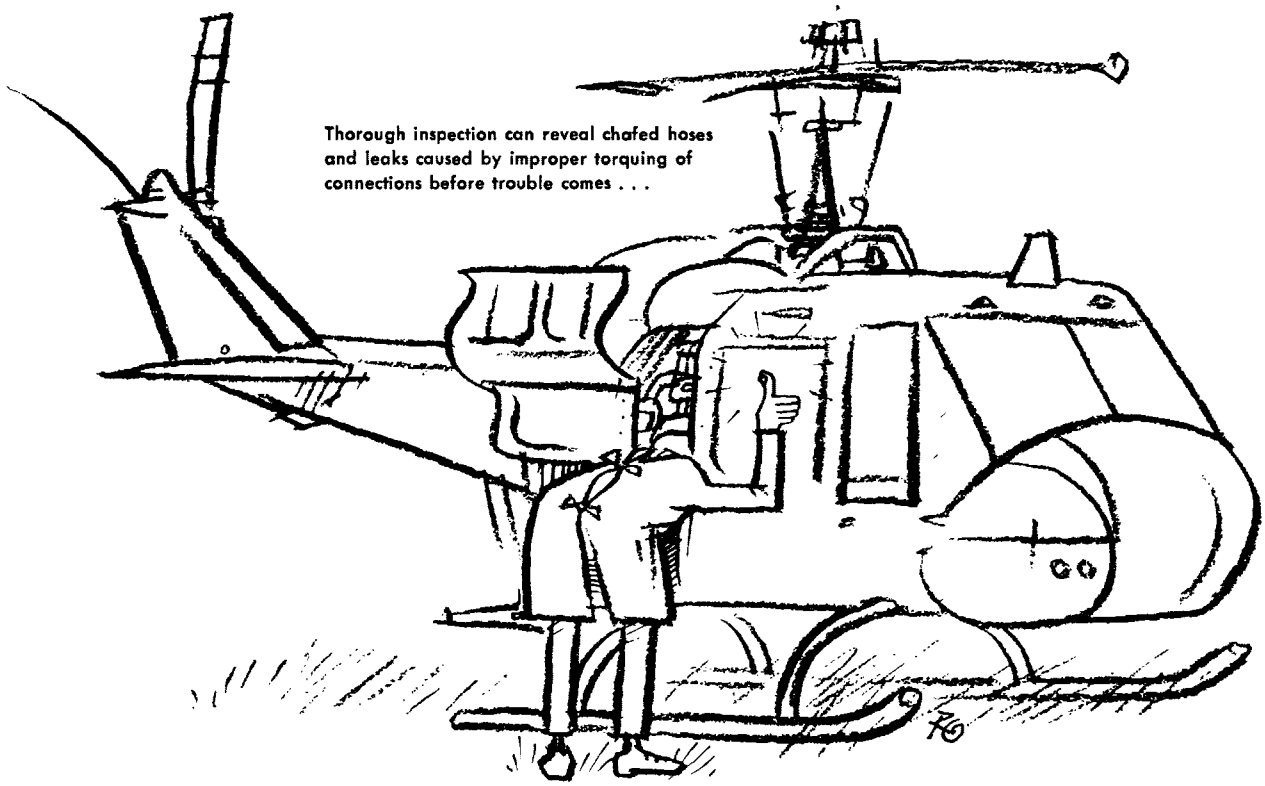
If your faithful aircraft had a voice in the matter you can be certain it would ask that you give torquing and tubing the same care you do your checks. As matters stand, aircraft have to suffer in silence so the first thing anybody hears about what is bothering them is when a hose springs a leak or something comes apart because a mechanic or supervisor hasn't fully understood how critical this area of maintenance is. By then it is too late.

There's an old story about the king who lost a battle because he found himself on foot after his horse had cast a shoe. Somebody back in the maintenance shop had used the wrong-size nail or had failed to hammer it home properly. History doesn't record what the king did about the situation when he got home—provided he got home at all, which seems doubtful.

But we don't have any trouble making an educated guess, do we?

Proper torquing, and installation and care of hoses in Army aircraft aren't too far removed from the horse shoeing business. The knight in the saddle or the pilot at the controls of an aircraft are utterly dependent on the service they get. Maybe the king involved could have spotted the trouble if he had made a thorough pre-battle check, maybe not. Thorough preflights by the aircrew also can turn up last-minute danger areas, but not all. Constant vigilance, standard procedures, pride and a full grasp of the problems by everybody concerned make up the only permanent answer.

In any case, an aircrew hiding in the paddies from the men in the black pajamas after a torque or tube-induced landing can be forgiven for entertaining the same harsh feelings about their maintenance men the king did about that knucklehead back at the castle who installed his horse's shoe the wrong way.



Thorough inspection can reveal chafed hoses and leaks caused by improper torquing of connections before trouble comes . . .

USAASO Sez

The U. S. Army Aeronautical Service Office discusses

The need to report equipment shortcomings
Quizzers for air traffic controllers
An added code for transponder-equipped aircraft

Equipment Improvement Recommendations: In the November 1968 issue of the U. S. ARMY AVIATION DIGEST "USAASO Sez" carried a short item on the equipment improvement recommendation (EIR). In that article we stressed the fact that the EIR is the official means for reporting equipment deficiencies. We also asked that when EIRs were submitted we be furnished a copy. We have yet to receive the first one. Our conclusion should be that all is well; however, we continue to get much "lip service" on equipment shortcomings. Again, we are asking that you use the Army system to correct these deficiencies. TM 38-750 is your guide. Let's stop the gripes and take action to correct a bad situation.

Air Traffic Controllers: Those long, dull, workless hours in the tower cab seem never to end—can't wait to get off duty. No traffic, bills to pay, car to fix, take the wife to the store, car insurance due and CQ tomorrow night—all these things going through your mind while you're waiting for the time to pass. The chief had a 10-question quiz for me to do tonight on the swing shift. Sure were silly questions—all about emergency procedures, jet airliner characteristics, arresting barriers, etc. We don't have that kind of stuff here at Podunk. Who is he kidding? The Sarge sure has some funny ideas about running this facility.

Yes, he does, but how many private aircraft, airliners and jet fighters go over Podunk in an hour? Only the ALPHA center knows. But it could happen that a Boeing 707, or even an F-104, might have to make an emergency landing at your airfield; a private pilot could run out of gas; there could be a fire on the aircraft. A thousand things can happen—when they do a few minutes may seem like hours to you. A tower controller is supposed to be mentally awake and alert. What would you say if the refueling boys or alert section called on the phone and asked about the Cessna 172 upside down on the end of the runway? What would you tell an F-104 pilot who sees your runway lights and wants to make an emergency landing due to a flameout and he just left ALPHA 4 minutes ago? It can happen.

It is easy to become complacent at an airfield that has very little traffic at night, but a "pro" keeps current, always alert to any activity, on, over or around the airport. Many controllers have saved houses from burning to the ground because they were alert. You are paid to look out the window. Do so—all the time.

Attention: Change 2 to TM 11-2557-29 is just off the press with an effective date of 1 April 1970. Read and heed. Change 1 to the -29 added a code for transponder-equipped aircraft that have two-way radio failure—Code 7600. Be sure you know the difference and application of 7600 and 7700. Field reports indicate some controllers are a little confused. Read your changes. Facility chiefs, preparing a quiz on changes is a good way to keep your controllers "current."

WELL DONE

THE ACTIONS of many aviators nominated for Broken Wing Aviation Safety Awards do not meet the required criteria of chapter 7, AR 385-10, dated 17 February 1970. A large majority of these aviators, however, demonstrate a high degree of professionalism during emergencies, piloting their aircraft, crews and passengers to safety. Professionalism of this type has made Army aviation what it is today. The United States Army Board for Aviation Accident Research points with pride to these aviators for jobs WELL DONE:

CAPTAIN ROBERT J. SCHISSELL II, UH-1H pilot, had a low-side governor failure shortly after takeoff. By immediately applying proper emergency procedures, he regained control. During his approach to a maintenance area, the engine failed and Captain Schissell autorotated, landing with no damage.

CAPTAIN ORVILLE L. SHREVE, U-1A AC, was in cruise flight at 4,500 feet and 90 knots when his engine failed over a triple-canopy jungle. Emergency restart procedures were unsuccessful, so Captain Shreve established a maximum distance glide and successfully landed on a short, rough field strip without damage.

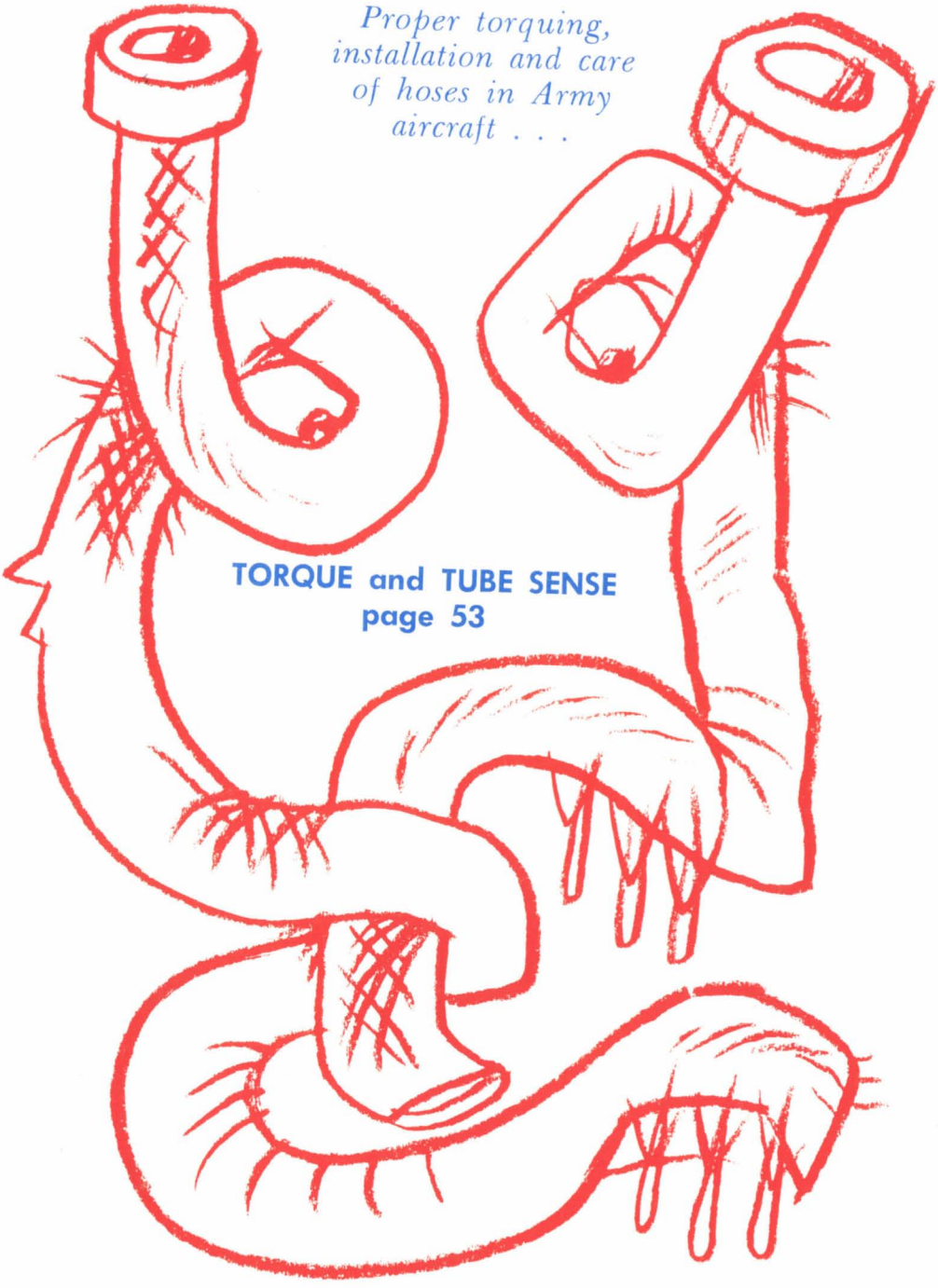
CAPTAIN CHARLES M. SILVIOUS, UH-1A IP, was on a night training flight when his engine failed at 650 feet. He autorotated to a small, cultivated field and landed with no damage.

CAPTAIN GERALD L. BUCHTA, U-1A pilot, had an engine failure in cruise flight. He quickly located a small unattended airstrip surrounded by high trees and landed without damage.

WO1 ROBERT D. SCHMIT, UH-1C AC, had engine failure in level flight at 1,500 feet and the nose of his helicopter swung left. Although impeded by darkness and haze, WO1 Schmit autorotated to a clear rice paddy and landed with no damage.

WO1 LARRY E. CUNNINGHAM, UH-1D AC, was on approach to a rice paddy pickup zone for a troop extraction mission. He terminated at a hover and, as he was maneuvering the helicopter closer to the troops, he lost antitorque control. WO1 Cunningham skillfully maneuvered away from the troops and landed without damage.

WO1 BYRON M. WILKINSON, AH-1G pilot, had a tail rotor failure during climbout after a combat assault. He increased air speed to streamline the helicopter and correct for yaw, then flew to the nearest airfield and made a successful running landing without antitorque control.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TORQUE and TUBE SENSE
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