UNITED STATES ARMY AVIATION DIGEST

LOH Test Program - Page 2

AUGUST 1964

UNITED STATES ARMY AVIATION DIGEST

DIRECTOR OF ARMY AVIATION, ACSFOR
DEPARTMENT OF THE ARMY
Brig Gen John J. Tolson, III

COMMANDANT, U. S. ARMY AVIATION SCHOOL
Maj Gen Clifton F. von Kann

ASST COMDT, U. S. ARMY AVIATION SCHOOL
Col Robert F. Cassidy

EDITORIAL STAFF

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

GRAPHIC ART SUPPORT

H. G. Linn
H. A. Pickel
D. L. Crowley
A. Lofé

USABAAR EDUCATION AND LITERATURE DIV

Pierce L. Wiggin
William E. Carter
Ted Kontos
Charles Mabius

AUGUST 1964 VOLUME 10 NUMBER 8

CONTENTS

Letters 1

LOH Development and Test Program,
Maj Boyce B. Buckner 2

OH-4A 6

OH-5A 8

OH-6A 10

SATIRE, Capt Paul J. Buchanan 12

Crash Sense, Maj Chester Goolrick 15

Survival Kits, Maj George W. Aldridge, Jr. 31

Research Aircraft 34

Effective Unit Capability,
Capt Ulysses S. Large, Jr. 35

Keep in Touch With the Weather Back Cover

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

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

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

Use of funds for printing this publication has been approved by Headquarters, Department of the Army, 27 November 1961.

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

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

LETTERS

Sir:

Having just finished reading the April 1964 issue, I was amazed that the monthly winner, "The Beaver" by Capt David M. Monroe, should contain so many evident errors. I am taking this opportunity to bring these errors to your attention only in the interest of maintaining your consistently high standards and to prevent any possible misconceptions by some of our newer aviators.

On page 25, the first paragraph in the 3d column is incorrect and in conflict with the current issue of TM 55-1510-203-10, dated August 1963. I make reference to chapter 10, section VI, paragraph 6-18 which states: "Every 30 minutes, exercise the propeller lever through approximately 00 rpm either side of cruising rpm, then return to cruising. This action will circulate warm oil through the propeller actuating cylinder and prevent sluggish operation of the propeller governor." This can also be confirmed by reading the -20, chapter 2, section IV, paragraph 4-324.

Also on page 25, the second paragraph, which makes reference to the power check is incorrect; as can be determined by reading chapter 3, section II, paragraph 2-20, subparagraph 12, Engine Power Check, which states: "Set manifold pressure to field barometric pressure. Check 2100 ± 100 rpm."

On page 26 the paragraph on turbulence, stating "The -10 tells a very pretty story about how to fly this Beaver kite through thunderstorms." I think Capt Monroe failed to comprehend the contents of chapter 10, section IV, paragraph 4-2, including the WARNING which states "Thunderstorm flying should not be deliberately undertaken in this aircraft."

Although this was an interesting article, it is the opinion of the aviators assigned to this unit that there were too many errors to warrant the monthly award, even the leadin on Andy Aviator wouldn't have happened if Andy was familiar with the contents of chapter 9, section II, paragraph 2-19 and 2-20 a, b and c.

CWO GEORGE R. COLLINGE
513th INTC Grp
APO 757, New York, N. Y.

• *They must select Intelligence Unit aviators for their sharp eyesight. The article was written using a now outdated handbook for reference. We, of course, should have re-reviewed the article before printing. If you will reread the paragraph cited concerning the U-6 and thunderstorms, however, we are sure you'll agree that the author's advice, "Just don't do it," shows an awareness of the hazards involved.*

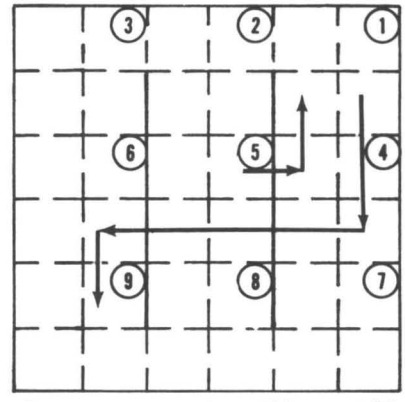
We appreciate letters such as yours — keep us on our toes. —Editor

Sir:

With reference to the article "Maps" contained on page 29 of the June 1964 issue, written by Captain Sands, there appear to be several errors in the second paragraph on page 31 and on figure 8.

I believe the paragraph should read: "For example, if you desire to use section 1 (fig. 8), you open the map to the center (fig. 7), move to section 4, then to section 1. If you were using section 1, and desired to go to section 9, you would simply turn back to section 4, then through the center (section 5) to section 6, and finally down to section 9."

Figure 8 should show:



In no way construe this as criticism of Captain Sands' article. The method he describes would be excellent for use in close quarters.

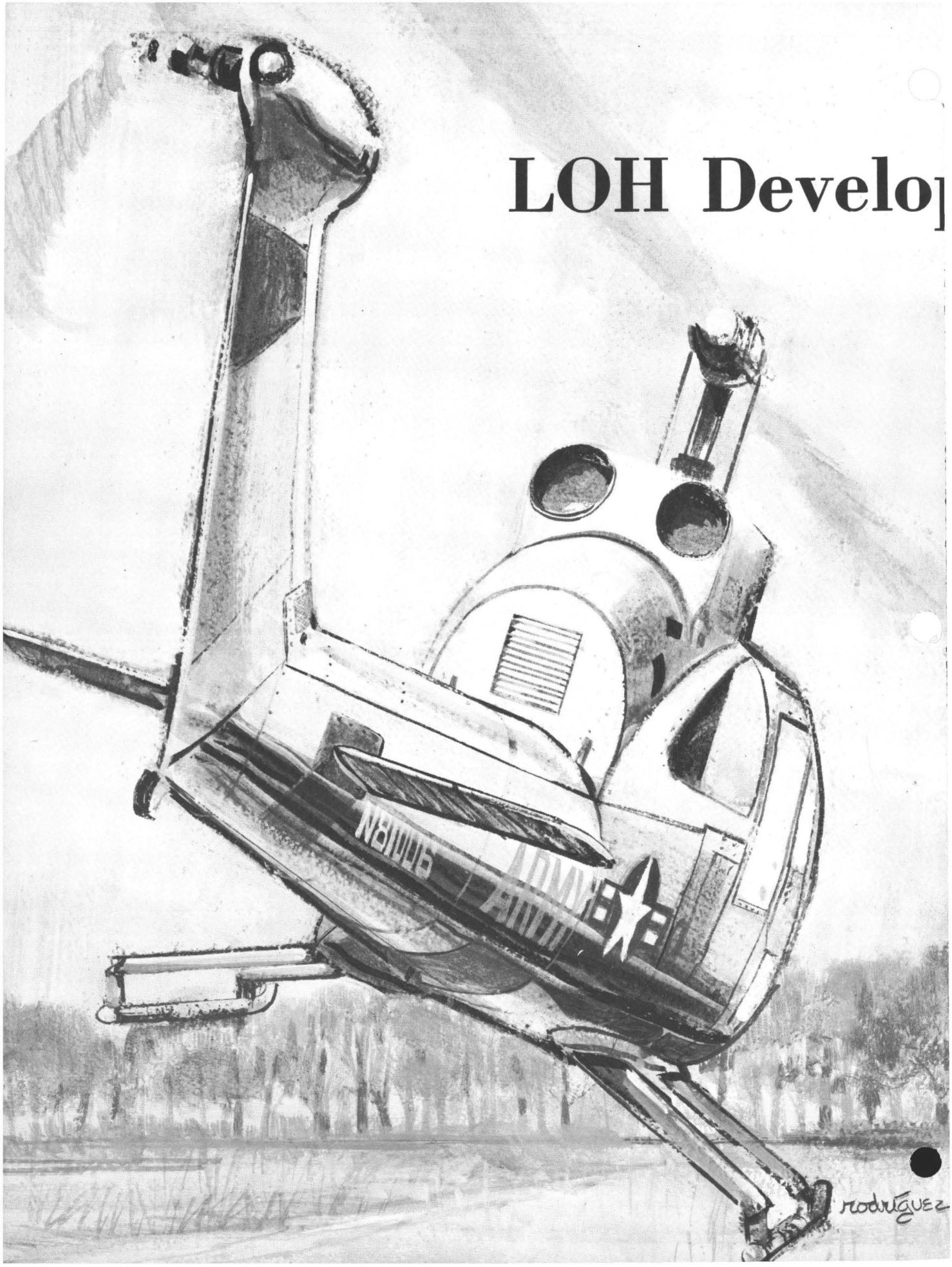
Captain Louis B. Rodenberg, Jr.
U. S. Army Engineer District,
New York
APO 23, New York, N. Y.

• *You're right. We tried the system far enough to get enthused and rush it into print. Thanks for pointing out the author's slip in an otherwise excellent tip. —Editor*

Deadline Extended For Special Issue Contest

NO, YOU ARE NOT TOO LATE. If you haven't already submitted your article on helicopter instrument flying for the special issue this fall, get to it right away. (See page 1, May 1964 DIGEST, for Maj Gen Clifton F. Von Kann's announcement of a special $100 cash award.) Deadline for submission of articles has been extended from 1 August 1964 to 1 September 1964. So, sit down and write an article on what you think about any phase of helicopter instrument flying. You just might win a cash award for your efforts, but what is more important, you will be contributing to the development of a body of doctrine for helicopter instrument work.

LOH Develo



Major Boyce B. Buckner

nent and Test Program

Competition between Bell, Hiller, and Hughes for selection to manufacture the Army's turbine powered light observation helicopter has aroused interest throughout the services and the aviation industry.

In presenting this historical background information about the development of the LOH, plus each manufacturer's concept of his design, we believe we will bring our readers up-to-date on this important project.

THE OFFICE OF Chief, Research and Development, Department of the Army, in October 1959 conducted a study of Army Aviation capability. This study noted a need for an aircraft development program to better meet future aviation requirements. The Chief of Staff then established the Army Aircraft Requirements Review Board, more commonly known as the Rogers Board, which was responsible for preparing a 10-year Army Aviation program covering the 1960-1970 time frame. The program included research and development, procurement, personnel, and organization.

In the research and development field, particular attention was given to light observation, manned surveillance, and tactical transport. The light observation mission consists of visual observation and target acquisition, reconnaissance, and command control. Presently, the O-1 Bird Dog, OH-13 Sioux, and the OH-23 Raven are used for this mission. The Rogers Board findings pointed to a single machine as a replacement for these three aircraft. This aircraft, because of the required capabilities, was to be a helicopter.

After a careful study of what the industry said could be produced, the military characteristics were determined. These characteristics included:

- Power to be provided by a turbine engine in the 250-horsepower category.
- The overall dimensions and weight of the helicopter to be equal or less than that of the OH-13 helicopter.
- Main rotor blades with provisions for manual folding and unfolding without need for blade tracking.
- Cabin provisions for a pilot, observer, and a cargo area containing stowable seats for two passengers.
- At design gross weight and standard sea level conditions, a useful load, less 200-pound pilot, oil, and 3.0 hours fuel, of 400 pounds, a cruise speed of 110 knots, and 3 hours endurance at 85 percent of cruise power.
- Hover out of ground effect at design gross weight at an altitude of 6,000 feet on a 95°F day.
- Design emphasis on forward area self-sufficiency, supportability, reliability, maintainability, and ease of servicing. If certain characteristics were not attainable without compromising other specifications, the priority to be followed was:

1. mission capability,
2. reliability,
3. ease of maintenance,
4. performance.

Maj Buckner is Test Manager, LOH Project, U. S. Army Aviation Test Board, Ft Rucker, Ala.

Model specifications were prepared from the military characteristics and presented to interested contractors in October 1960. This action initiated the design competition for the Army Light Observation Helicopter. The U. S. Navy indicated a strong interest in this program and was selected to help develop the design. In February 1961, twelve contractors submitted design proposals to the U. S. Navy. These proposals were given to the Army Operational Evaluation Group at Fort Rucker, Ala., and the Navy Technical Evaluation Group of the Navy Bureau of Weapons in Washington, D. C., for detailed analysis.

On 3 May 1961, the results of the analysis were submitted to the Army LOH Design Selection Board. After careful deliberation, the Design Selection Board forwarded recommendations to the Chief of Staff on 17 May 1961 that the Army develop the Bell D-250 (OH-4A), the Hiller 1100 (OH-5A), and the Hughes 369 (OH-6A), and procure a test quantity for further competitive evaluation and final selection of one design for production. The powerplant chosen for all three helicopters was the T63, 250 hp, gas-turbine engine built by the Allison Division of General Motors Corporation.

The Chief of Staff approved the selection board recommendations on 19 May 1961. Original funds provided for the development of only two prototypes, so funds were reprogrammed to include the Hughes design. Also, to reduce the developmental costs and to stimulate competition, the Army proposed a revised program of development. This program was based on:

- A request from the three selected manufacturers for a fixed-price bid to produce a test quantity of aircraft.
- The bids to be for designs similar to those proposed.
- Guarantee of performance and delivery date with provisions for a penalty clause.
- Airworthiness based on type certification by the Federal Aviation Agency.
- The manufacturers to be given latitude in determining the detailed designs.
- Military monitorship during the development to be limited to contract administration only.
- Each contractor to be provided with the test directive and a full understanding of the competitive evaluation leading to the final selection of one helicopter design.

Since both developmental and production items were to be type certified by the Federal Aviation Agency, a departure from normal development procedures, the Army was authorized to issue contracts directly to the manufacturers. Army representatives held a pre-bidders conference with the three manufacturers on 6 July 1961 and negotiated the contracts in November 1961. Each manufacturer was to deliver to the Army five prototype helicopters type-certified by the Federal Aviation Agency under Part 6 of the Civil Aeronautics Regulations. The Army retained the option of accepting delivery before certification, provided a Type Inspection Authorization which included an acceptable flight envelope had been issued.

The original schedule called for each manufacturer to begin delivery of his five helicopters to the Army in November 1963. The first delivery would be followed by one helicopter each month until all five were delivered. The three manufacturers faced a delay in receiving their FAA Type Inspection Authorization. The first helicopter, an OH-5A (Hiller), arrived at Fort Rucker for acceptance on 13 January 1964, followed by the arrival of the first OH-4A (Bell) on 25 January 1964, and the OH-6A (Hughes) on 9 February 1964.

Military and civilian mechanics and maintenance supervisors who attended schools conducted by the helicopter and engine manufacturers provided maintenance for the helicopters during the evaluation period. Additionally, service engineers representing Allison, Bell, Hiller, and Hughes were on call around the clock for technical assistance. Stringent ground rules were imposed upon manufacturer personnel by the Army to assure equal treatment for the test machines.

The first helicopter of each type was used for initial pilot training and 1,000-hour accelerated logistical tests at Fort Rucker, Ala. Manufacturers' instructor personnel provided the flight and ground school training of project instructor pilots. The project instructor pilots conducted transition training as required during the flight evaluation. The logistical evaluation consisted of flying the helicopters through typical mission profiles to generate and record data for determining logistical support requirements and recommending design changes in the production helicopter. This test provides basic data for determining reliability and maintainability.

The second helicopter of each type was used for engineering and aerodynamic tests by U. S. Army Test Activity at Edwards AFB, Calif. These tests will confirm contractor compliance with the military characteristics in the area of performance, stability, and control.

The third helicopter participated in tactical and operational suitability tests at Fort Rucker, Ala. The mission suitability of each LOH was evaluated by prescribed service test methods. These tests are characterized by qualitative observations and judgment of selected military personnel having a background of field experience with this type of helicopter. The test was conducted using soldiers representative of those operating and maintaining the equipment in the field. Emphasis was placed on operation of each LOH under simulated tactical conditions and with actual troop exercises wherever possible. Each helicopter was evaluated with respect to the requirements of the approved military characteristics (excluding performance, stability, and control) to include mission profiles developed by the U. S. Army Combat Developments Command Aviation Agency.

Top: Hiller OH-5A *Middle: Hughes OH-6A* *Bottom: Bell OH-4A*

The fourth helicopter of each type was provided with armament installations. Initially, these LOH went to Hunter-Liggett, Calif., for operational test of the armament installation. Each of these helicopters was provided with two armament kits. The XM-7 kit consists of a dual M-60 machinegun installation. The XM-8 kit consists of a single 40 mm grenade launcher installation. Upon completion of these tests, the helicopters went to Edwards AFB, Calif., for engineering and aerodynamic tests of the armament configuration.

The fifth and last helicopter of each type participated in avionics testing at Fort Rucker, Ala., and Eglin AFB, Fla. Air transportability tests were conducted at Fort Rucker by personnel of the U. S. Airborne, Electronics and Special Warfare Board.

The official starting date of the LOH evaluation was 1 January 1964. The evaluation was completed on 30 June 1964.

The LOH program has featured many unique innovations in development, procurement, and testing. Widespread interest has been expressed in military and civil aviation circles both here and abroad. The test program is progressing satisfactorily, although the actual starting date was delayed because of late delivery of equipment. Indications are that the Army-Industry team has advanced light helicopters to a degree that will materially benefit the mission of Army Aviation.

The Army will select one LOH design and award a production contract during the last quarter of calendar year 1964. Delivery of the first production LOH is scheduled for early 1966.

OH-4A

Prepared by Bell Helicopter Company,
A Division of Bell Aerospace Corporation

This article represents the manufacturer's concept of his product and in no way reflects on the status of evaluation or on a final decision on choice of helicopters. After a comprehensive program of evaluation directed by the U. S. Army Materiel Command Project Manager and conducted by the U. S. Army Test and Evaluation Command, a decision on the winning LOH is expected this year, with first deliveries programmed for 1966. Editor

SINCE 1861, WHEN Professor Thaddeus Lowe ascended in a balloon over Washington to observe Confederate troop movements after the Battle of Bull Run, the Army has recognized the advantage of aerial observation in combat. The scope of this vital intelligence function has broadened in direct relation to the increasing mobility of combat forces.

In the early 1940s organic Army light Aviation belonged to the Artillery, with fire adjustment as the primary mission. Ground commanders, however, saw increasing requirements for additional observation, reconnaissance, and liaison functions. So great was the requirement that since the first observation aircraft, the Piper L-4, some 19,000 airplanes (19 types and 68 models) and 3,300 helicopters (24 types and 42 models) of the observation/reconnaissance class have been procured.

Today, increased mobility and dispersal of forces demands even greater organic observation capability. The myriad of types, however, is to be replaced with a single aircraft designed for the mission.

One of the most successful of the observation vehicles has been the OH-13. Since first introduced in 1946, over 1,650 of the OH-13 series have been produced or are now on contract for the Army. During the formative years of Army Aviation, Bell has been closely associated with operational units in peace and war, gaining insight into the basic mission of the observation helicopter. The advantages as well as the deficiencies of the OH-13 were observed and Bell's engineering team went to work.

OH-4A Design Goals

The OH-4A is the culmination of 18 years' field experience, combined with continuous research and development aimed at improving the basic mission suitability of the light helicopter. This invaluable background was applied to the stated program objective . . . a simple, inexpensive, highly reliable helicopter capable of protracted operations in the forward battle area. Owing to this approach the OH-4A design draws upon the heritage of the first generation OH-13 series and the second generation UH-1 series helicopters.

Primary design philosophy has been to produce a balanced blend of all mission characteristics and requirements. Among weight, reliability, maintainability, and performance, no one has been overemphasized at the expense of the others. More specifically the OH-4A fulfills these

Continued on page 39

Famed OH-13, Army veteran since 1946, evacuated over 18,000 casualties in Korea. Lessons learned from Sioux have contributed to development of the OH-4A.

OH-5A
ARMY 624206

Prepared by Hiller Aircraft Company

This article represents the manufacturer's concept of his product and in no way reflects on the status of evaluation or on a final decision on choice of helicopters. After a comprehensive program of evaluation directed by the U. S. Army Materiel Command Project Manager and conducted by the U. S. Army Test and Evaluation Command, a decision on the winning LOH is expected this year, with first deliveries programmed for 1966. Editor

A NEW AGE of Army Aviation has been ushered in with the arrival of the first turbine-powered LOH at the Army Aviation Test Board, Fort Rucker, Ala.

Hiller Aircraft Company's OH-5A, one of three contenders in the LOH competition, landed 13 January at Fort Rucker after a 2,300 mile, cross-country dash from California. It was the first to start a six-month evaluation program that will determine which of the new LOH will replace the OH-23 Raven, OH-13 Sioux, and O-1 Bird Dog.

When the trials end, the Army will have logged a total of 6,000 flight hours on the Hiller OH-5A, Bell OH-4A and Hughes OH-6A. Each company has delivered five aircraft for evaluation, and each type will be flown about 2,000 hours.

A decision on the winning LOH is due late this year, with first deliveries projected in 1966.

It is believed that the new LOH will have a 500 percent cost-effectiveness edge over present observation helicopters. This is based on similar acquisition cost, 50 percent greater speed, 50 percent less maintenance requirements, lower operating cost, greater availability, and other advantages associated with the turbine powerplant and airframe advances.

Although rigorous trials of a new aircraft before procurement is not a new concept in Army procedures, the LOH program represents the first time that more than one aircraft has been simultaneously ordered, developed, and evaluated competitively.

The six-month evaluation program is by far the most extensive aircraft testing effort prior to procurement of any branch of the military. Further assurance of a topnotch machine is sought by requiring Federal Aviation Agency certification before final acceptance of the new helicopters. Ordinarily, aircraft developed specifically for the military bypass FAA civil aircraft trials.

Mission gross weight of the OH-5A is under 2,500 pounds. It's a four-place helicopter, or two-place with 400 pounds of cargo. During manufacturer's testing, the OH-5A was flown to 22,400 feet and has exceeded 150 mph groundspeed. (Army specifications for the new LOH require that they hover out of ground effect at 6,000 feet on a 95° F day.)

All three LOH have the same powerplant, a 250 shp free turbine, turboshaft Allison T63 developed specifically for the LOH program. Weighing only 136 pounds, its takeoff power rating is 240 feet/pounds torque at 6,000 rpm. It is barely a yard long.

Under combat conditions, this tiny turbine has several advantages over piston engines. Start-up procedure is accomplished in less than 30 seconds, and virtually no warmup period is required — enabling the aircraft to get off the ground in a hurry. It is much quieter than a piston engine of comparable rating.

At cruise speed, the OH-5A consumes about 20 gallons of JP-4 an hour, about 2 gallons more fuel than the OH-23G. But, within the hour, the OH-5A has gone *half again* as far as the Raven. Fuel capacity is 69 gallons, so the endurance period is beyond 3 hours.

Continued on page 43

OH-6A

Prepared by Hughes Tool Company, Aircraft Division

This article represents the manufacturer's concept of his product and in no way reflects on the status of evaluation or on a final decision on choice of helicopters. After a comprehensive program of evaluation directed by the U. S. Army Materiel Command Project Manager and conducted by the U. S. Army Test and Evaluation Command, a decision on the winning LOH is expected this year, with first deliveries programmed for 1966. Editor

WHEN THE engineers at Hughes Tool Company's aircraft division joined the program to develop an aircraft for the Army's Light Observation Helicopter (LOH) competition, they were well aware of the fact that only a major breakthrough in helicopter design would satisfy the requirements set forth by the military.

The Army's LOH requirements were specific and uncompromising: "Attention is specifically drawn to the paramount desires of the U. S. Army for a small, lightweight, inexpensive, reliable, and easily maintainable vehicle" with high performance characteristics.

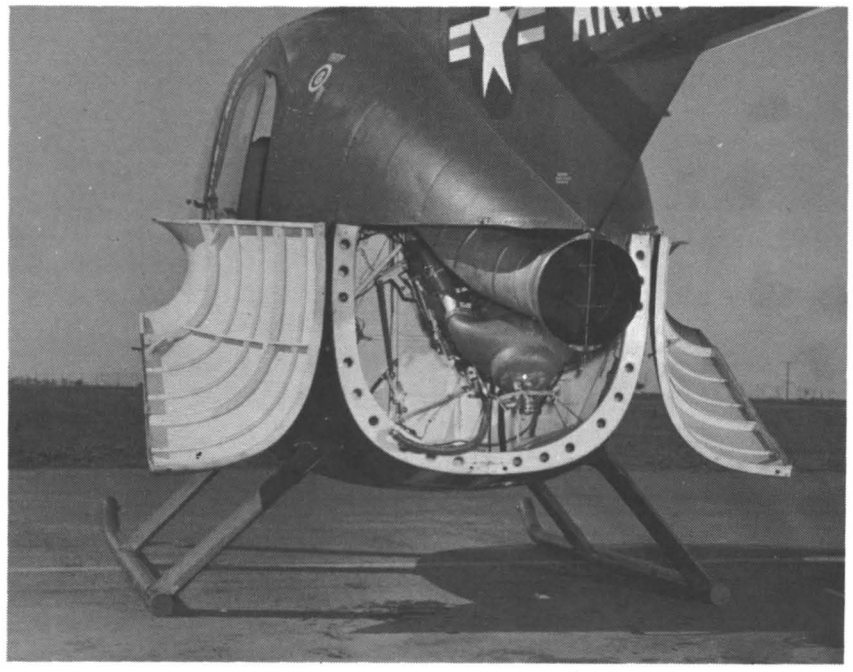
In other words, the Army was asking for a helicopter that would overcome all the shortcomings inherent in rotary-winged craft of conventional design.

The Hughes engineers entered the competition with a confidence born of experience in their ability to deliver the desired product. This experience was gained during the development of the first low-priced, compact, easy-to-maintain helicopter ever to be mass produced for the commercial market—the Hughes 269A two-place helicopter.

Today, the design breakthrough necessary to meet the Army requirements has become a reality in the sleek form of five Hughes OH-6A helicopter prototypes currently undergoing evaluation test flights at Fort Rucker, Ala., with the Bell OH-4A and the Hiller OH-5A.

Test information evaluated to date indicates that the OH-6A equals or surpasses all of the rigid design and high performance specifications guaranteed in its original proposal to the Army.

The breakthrough achieved by Hughes was in simplicity of overall design and component parts.



Engine can be removed and installed by one man. Low mounted engine provides best c.g. and assures greatest safety in event of accident.

It produced a helicopter with unparalleled performance characteristics, reliability factors and low maintenance requirements in a small configuration that provides an extremely high cargo carrying capacity and the utmost in pilot safety features.

Throughout the development of the OH-6A, special emphasis was placed on substantially reducing basic weight and size while providing for maximum structural integrity. Externally, the aircraft was given an aerodynamically clean design that provides for high performance and extreme maneuverability.

Veteran helicopter pilots are quick to voice their admiration for the OH-6A and its outstanding performance and safety features. A Hughes test pilot, with more than 4,000 hours logged in rotary-winged craft, had this to say about the Hughes machine, following his evaluation flights in it:

"I have been particularly impressed with the OH-6A's ability to maneuver at high speeds with handling characteristics similar to those of a fighter. The ability to maneuver at high speeds is limited in conventional helicopters due to lack of control response and because of blade stall consideration.

"The sensitive cyclic control stick gives instant response in roll and pitch, which is necessary for quick maneuvering and nap-of-the-earth flying. This aircraft feels good when rolling into and holding a steep bank, which may be done close to the ground with a feeling of confidence.

"The helicopter is surprisingly good in autorotation. The clean design of the rotor blades reduces rotor decay following a throttle chop, and the low inertia rotor gains rpm rapidly with a slight flare. The very low drag gives an excellent glide ratio.

Continued on page 46

SA

The U. S. Army Combat Developments Command Aviation Agency, located at Fort Rucker, Alabama, has installed a centralized files location for aviation material. Called SATIRE, this new system was developed by the System Development Corporation at Falls Church, Virginia, for its own use and they modified it under contract for the Aviation Agency. The system provides the only central clearing house for the retention and use of significant thoughts and data pertaining to Army Aviation.

Captain Paul J. Buchanan

Capt Buchanan is Operations Officer, U. S. Army Combat Developments Command Aviation Agency, Ft Rucker, Ala.

WHAT DOES THIS word SATIRE mean? To say that it is an acronym for "Semi-Automated Technical Information Retrieval" tells us nothing until we realize the importance of having readily available for present and future use the vast complex of documents and studies generated through the course of time. This is the purpose of SATIRE: to retrieve and store in one place all the documents that are of value to the Army Aviation program.

What does SATIRE mean to the individual aviator? It is a centralized archives system to which an aviator can turn for information directly or indirectly related to almost any project or type of mission he may become concerned with. Conversely, it is a program to which he can contribute significant thoughts, techniques, and principles that will today — or someday — increase the combat effectiveness of the Army through aviation support.

Those who doubt SATIRE's value to the Army can learn a lesson from history. In 1940, the

U. S. Army Air Corps was on the threshold of a new type of warfare. Airpower ideas were being developed and tested, concepts were being developed, and doctrine was emerging. There was one weakness in this productive period, however. It was discussed by Dr. Robert F. Futrell in "Some Patterns of Air Force Thought," published in the AIR UNIVERSITY REVIEW, Jan-Feb 1964. Dr. Futrell relates that testimony of qualified Air Force officers "indicate that Air Force thinking about its fundamental beliefs *has not been systematically recorded.*"

Many of the Air Force ideas and practices became lost in the 1940s. In the 1950s, that service began to feel the impact of this situation. Major General John De Forrest Barker, Deputy Commander of the Air University, stated in 1953: "We definitely need a body of air principles, backed by historical evidence, of air employment." Perhaps General Barker was thinking of the following exerpt from an Air University staff study, dated 1948:

> The Air Force has never maintained a complete and current compilation of those concepts, principles, policies, tactics, techniques, practices, and procedures which are essential to efficiency in organizing, training, equipping, and employing its tactical and service units.

In 1957, the Air Force Chief of Staff, General Thomas D. White, pointed out that an Air Force officer in 1955 could only conclude that "the Air Force as a service does not have a set of ideas against which it is operating, at least not a complete set of ideas."

This situation was also a matter of concern to General Curtis E. LeMay who, in 1961, pointed out that "understanding our doctrines and concepts is basic and important to our very existence."

SATIRE is the Aviation Agency's answer to providing a solution for the problems experienced by one of the Army's sister services. The Aviation Agency's SATIRE system will assist the Army in the improvement of concepts, doctrine, and techniques for employment of its aviation capability. How does it

RE

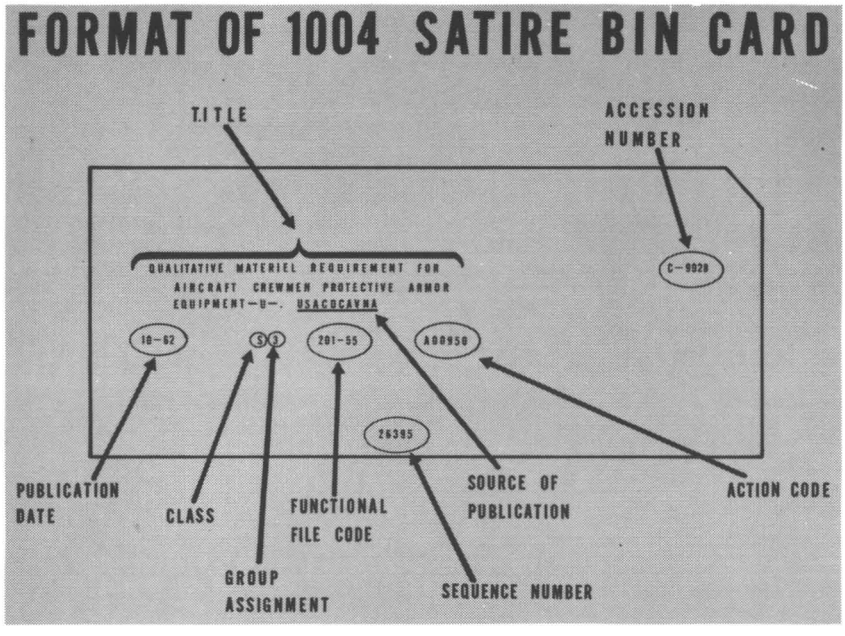
work? Basically, SATIRE is an electrical accounting machine (EAM) application, combining the procedures of library science with machine processing.

Incoming documents are designated by security classification and accession number, which is the key to retrieval. The original title of each document is punched on a printing card punch machine, with key words specially marked, and the punched cards become a part of what is known as the "master numeric" deck. The cards are then processed through a computer which recognizes the key words, makes a new card for each, and arranges the entire new deck in alphabetical order.

From this deck of cards, which is periodically updated, alphabetical indexes are printed. The agency also processes and maintains source, source code, and subject decks of cards for separate indexes, which are used as alternate means of research. Other aids for retrieval and information are bin cards, weekly accession listings, and charge out listings.

With this centralized files location having been created for aviation material, the Army finds itself in an extremely enviable position. Personnel can now quickly, easily, and conveniently locate information concerning an almost unlimited number of subjects related to Army Aviation. Every effort is being made to assemble in this one location every document which is, or will be in future years, of importance to Army Aviation doctrine.

Through SATIRE an efficient system has been devised to collect, catalog, store, and retrieve important information. These files are now available for your use through the U. S. Army Combat Developments Command Aviation Agency. However, if Army Aviation is to be well documented, each of us has the responsibility to contribute new ideas, reports summarizing lessons learned or knowledge gained, or simply comment on existing doctrine, policy, or procedures. In one word, PARTICIPATE!



Whoa There!

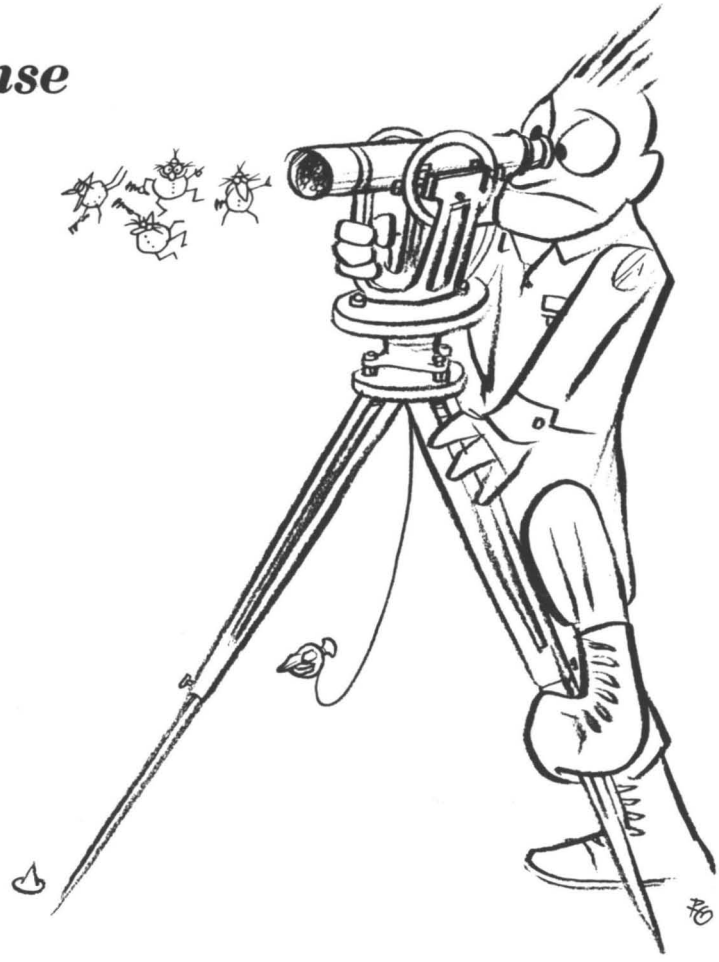
Demand for the DIGEST keeps going up! However, budgetary limitations have placed a ceiling on the number of DIGESTs printed each month. So it may be that all units are not going to get all the copies they have requested on DA Form 12 submitted to AG Publications Center in Baltimore.

It is impossible for AG to make arbitrary distribution cuts and ensure that operating aviation units get the number of magazines they really require.

We need your help. Take a good long look at your unit's requirements for the DIGEST and request only the number you can get by with. Let's pass each copy around within the unit so we can give as many copies to each unit as possible.

Take a hard look at your requirements, then request — on DA Form 12 — only what you need.

crash sense

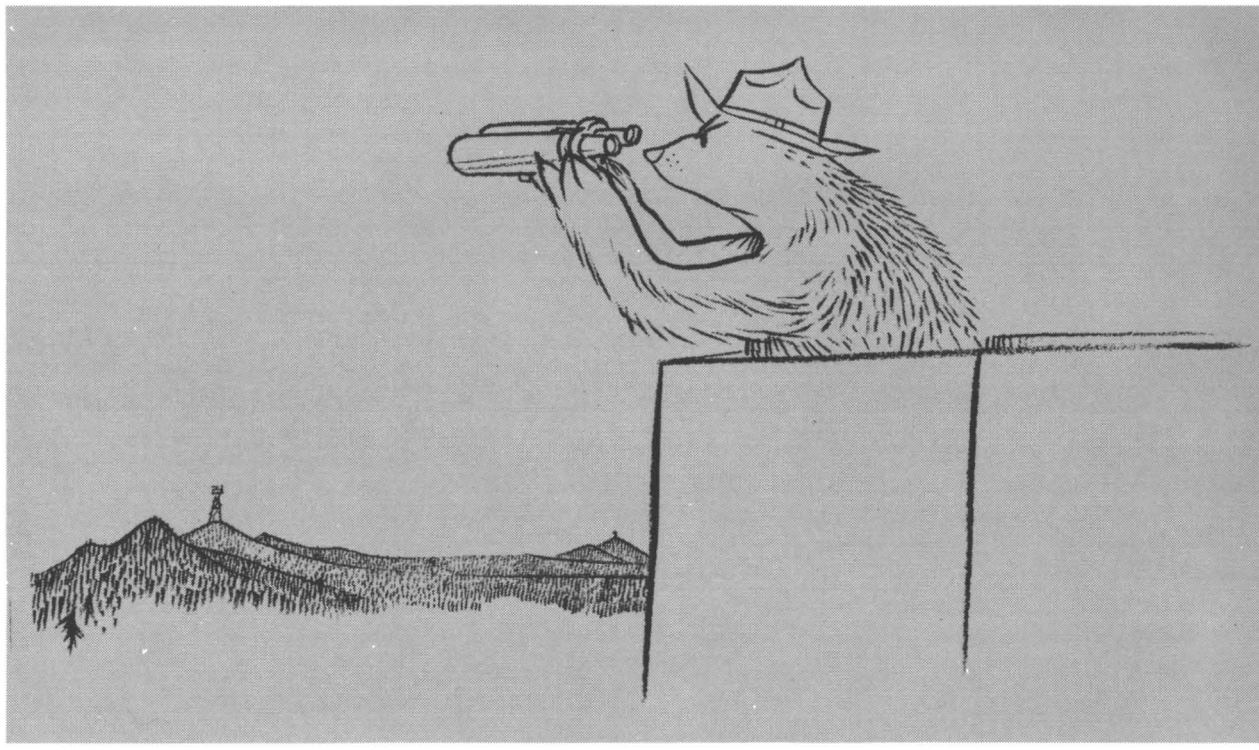


SURVEY SENSE

Major Chester Goolrick

CONTRARY TO a belief entertained by every red-blooded American boy under the age of 12, members of Hook and Ladder Company No. 5 get no real charge from being pulled out on a snowy night to respond to a four-alarm blaze down by the docks. Given a choice, a veteran smoke-eater prefers sitting around the station house, drinking coffee and playing pinochle to perching atop a four-story ladder in a 30-knot breeze, or being turned into a living icicle as a result of handling hoses in weather which would have given Admiral Peary food for thought.

Despite what the youngsters think, about the only blaze a fireman really enjoys is the one in his fireplace or at the department's annual picnic. He leads a frustrating life. Experience has



taught him that nearly every time the engine rolls, it is on its way to a fire which never should have started in the first place. If everybody shared his views there would be a marked drop in the number of midnight slides down the brass pole.

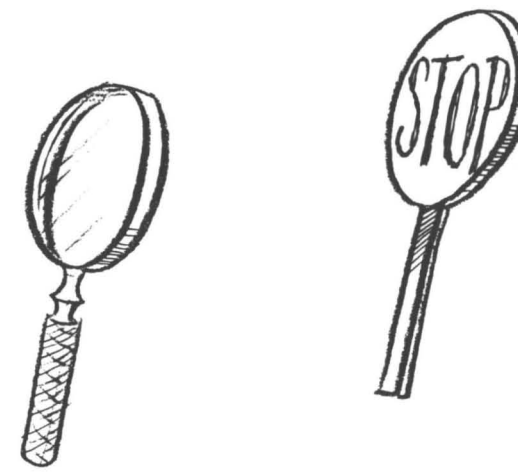
This is why all firemen are enthusiastic boosters of Fire Prevention Week, an annual occasion when every householder in the block is likely to be visited by a friendly soul in a blue uniform. He will ask to look over the premises for oily rags, open cans of paint, defective wiring, and anything else which could cause the place to flare up like a napalm bomb some evening when everybody has sacked in for the night.

Such application of prudent foresight is technically known as a positive approach to eliminate causative factors behind fires, or trouble of any kind. Business firms, anxious to cut down on overhead and sell more soap, call it the self-study. What's in a name? In Army Aviation circles we refer to it as the Survey — and you can take it from the old hands that when it is properly planned and carried out, it could also be called the Aviator's Best Friend. Whatever name you stick on it, only the bird-brain incapable of peering past the end of his own nose will argue that it is not the handiest method known for making Army flying life as serene as a day in May.

Basically, the survey is nothing more than simple common sense expressed in the form of this rule:

LOOK FOR EVERYTHING WHICH *CAN* CAUSE TROUBLE
GET RID OF IT BEFORE IT *DOES* CAUSE TROUBLE
AND SEE THAT IT *STAYS* GOT RID OF

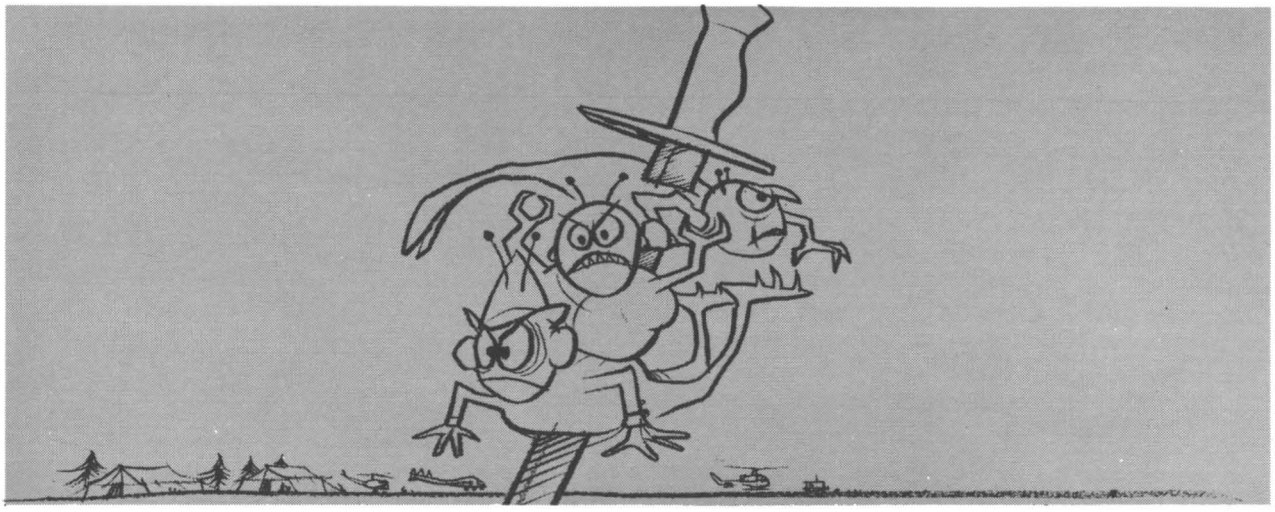
It applies to every field of human activity in which there is a risk to be taken or a chance of loss, and in which a little time and thought expended beforehand to avert trouble saves a

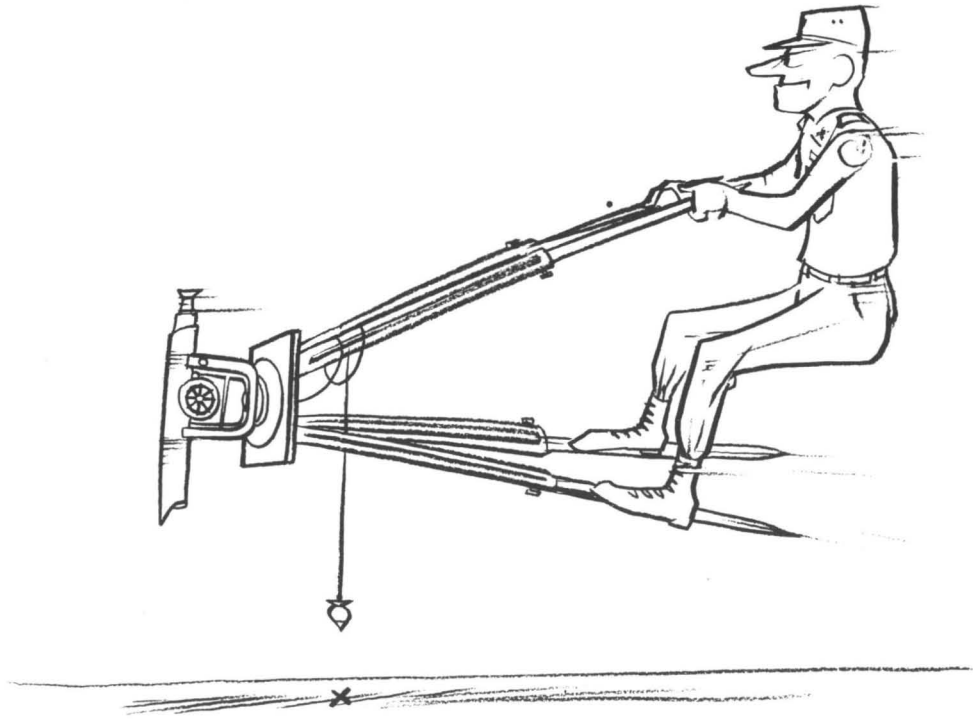


great deal more time and effort than tidying up the mess after it has happened. Doctors know how to cure most diseases these days, but preventive medicine has made life longer and happier by doing away with the causes of a long list of ailments which used to carry off our ancestors in job lots.

Elmer Snodgrass, the nation's first farmer, as a youngster found out he could sleep easier if he hired a good watchdog and put a stout lock on the henhouse door. And every veteran aviator can point to a baker's dozen aircraft accidents he knows would never have taken place if a conscientious survey had uncovered the lurking factors which touched off a chain of events.

On reflection all of us will thus agree that the survey should be as much a part of Army Aviation as the hominy grits in the Rucker PX cafeteria. The big hurdle is in the reflection part. Most of us, being normal human beings, have the normal human feeling that the less we think about trouble, the less likely we are to run into it. Fine and dandy, if all you are hunting for is an excuse to take a nap rather than cut the lawn.



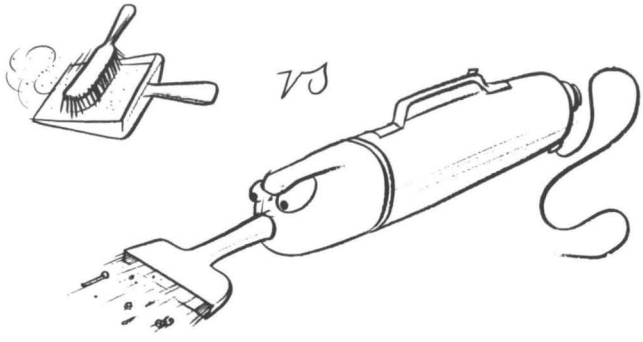


As an Army Aviator with a head full of Grade A brains, you are well aware that a mature approach and a thorough consideration of the possibilities provides the only effective means of keeping the Gremlin population in check. All the same, it is a sad fact that in the past the survey sometimes has fallen short of its goal or has been overlooked as an accident-prevention tool because aviation units have failed to appreciate

what the survey is,
how to apply it, and
what it can produce.

STEM TO STERN

Naturally, unless you have been down in the Yukon for the past several years, living off seal blubber and caribou steak and out of touch with the DIGEST, you have at least heard about the survey as a procedure designed to whittle away at the accident rate. All of us have *heard* of Newton's Third Law of Motion, but that doesn't mean we spend much time trying to understand it, or pondering the effect it has on our daily lives. The truth is, when we think about the survey at all we may associate it in a hazy way with some sort of inspection.



Hold hard, men! Surveys and inspections are distant cousins, to be sure, but to say they are identical is like comparing a well-rounded program of medical care to a glance in the mirror at your own tongue on the morning after the New Year's Eve Ball. An inspection turns up sand in the sugar and dust on the foot lockers, which are keeping an outfit from being in tiptop shape at the moment. The fine-tooth comb, fore and aft, perpetual motion survey is a continuing process. It is designed to spot potential stumbling blocks as they exist now and as they come up in the future, and to take care of them before somebody trips over them.

In other words, a survey starts before an inspection and keeps on going after it is over. Look at it this way. When a pilot checks the aircraft before taking off, he is making an inspection to determine whether mice have been nibbling at the rotor blades or if there is any other factor which renders it unfit for flight. But as we all know, the preflight is only a part of the whole business of preparing for a flying mission.

A mature aviator, even if he doesn't always realize it himself, makes a thorough survey of the whole situation before he flies. He takes stock of his physical and mental state. If he

inspection

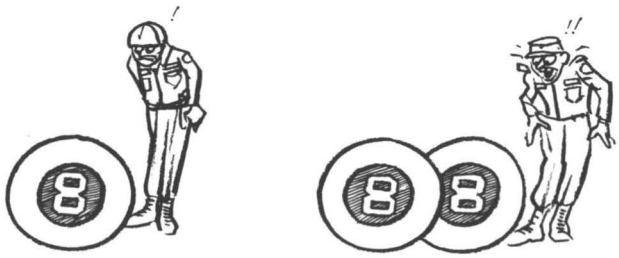
survey

feels as if he had breakfasted off railroad rivets or is jumpier than a man in the waiting room of the maternity ward, he stays on the ground until the flight surgeon has had a chance to determine what *might* be wrong. Nobody in his right mind goes up for an extended flight without being filled in on the weather situation. Where the situation calls for it, survival equipment gets a thorough check. In other words, when an aviator makes his preflight check he is hunting for what *is* wrong. His personal survey is designed to take care of what *could* go wrong if the causes were not taken care of at the start.

A failure to appreciate what the survey can do for anybody, from an Army Aviator to a man planning to go over Niagara in a barrel, is responsible a good deal of the time for those people who always seem to have an arm in a sling, a cast on one foot, or a pair of black eyes. We used to say charitably that these unfortunate souls were accident-prone, as if to indicate they had been born under a dark star or that black cats made a special point of crossing their paths. A more hard-nosed way of putting it is that they are simply not accident-conscious.

A chap who never bothers to make an evaluation of the possibilities in a situation will set out with the same carefree attitude Little Red Riding Hood had when she started through the woods to visit Grandma. Miss Hood was lucky not to have been gobbled alive. Our friend walks under a ladder instead of going around, gets hit on the head by a paint bucket, and wakes up wondering why trouble seems to light on him like crows in a corn field.

Emergency wards in hospitals are kept on the go around the clock dealing with freak accidents because the average citizen's way of life doesn't accustom him to take stock of the possibilities in most situations. Normally, there is no need for



him to plot his trip home from the office with the same care he would a safari into the heart of the Congo, so he trips over the new traffic marker at the corner of Main and Elm or slips in a batch of fresh-load concrete.

But as we all know, flying Army aircraft is a shade more exacting and risky than commuting. From the moment the engine turns over until the aircraft is parked for the night, any aviator on even a routine flight is faced with more nightmare possibilities than the average citizen is likely to run into in a long lifetime of commuting. We'll grant there is no known method of removing every obstacle. Unlike Old Doc Winterbottom's Golden Elixir, the survey is no cure-all. But the mature aviator has learned from experience that if flying life can never be as soft as a melted marshmallow, a survey puts the odds against accidents where they belong, and on the long side at that.

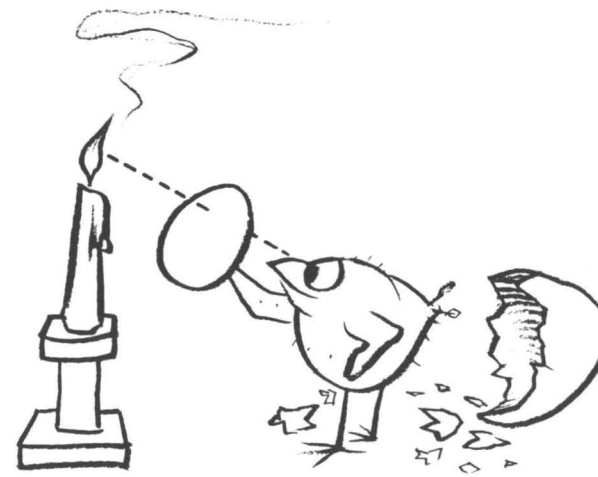
He also knows that what goes for Army *Aviators,* goes double for Army Aviation *units.*

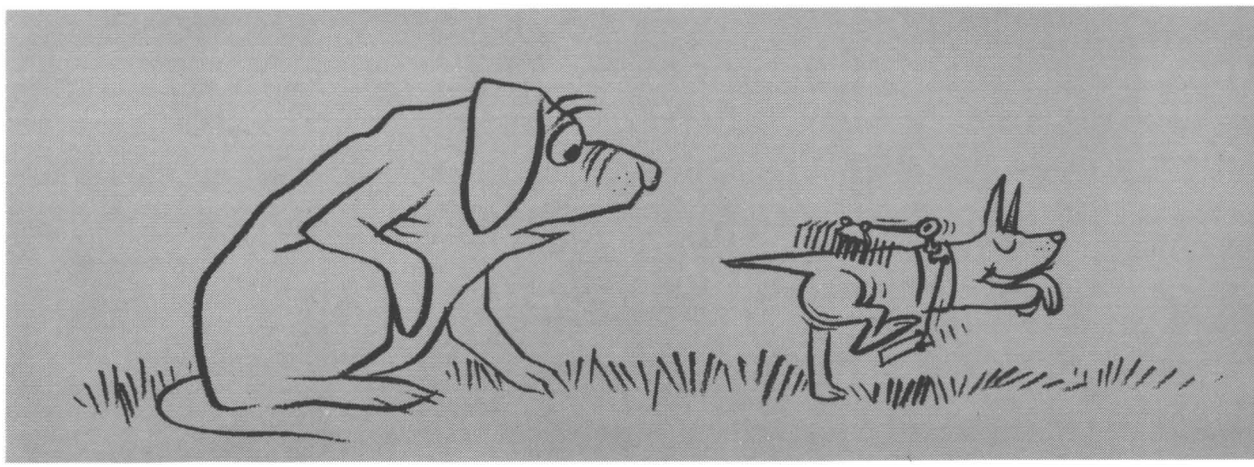
GROUP THERAPY

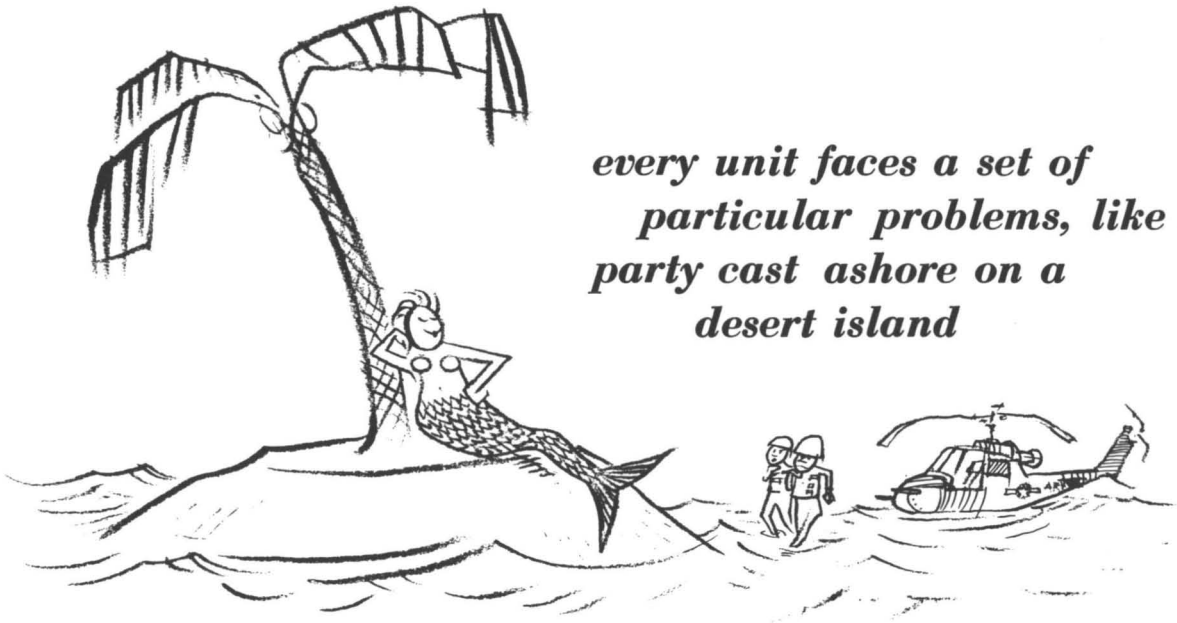
Nobody ever accumulates so much experience that a survey can't help him. Experience cannot make an aviator immune to chamois in the fuel intake or faulty weather information. Even if the Army had an aviation unit in which every pilot had logged at least 5,000 hours and the CO had been on hand when the internal combustion engine was given its first test, a continuing survey program would be needed to keep things up to snuff. When it comes to aviation safety, an old dog is always ready to learn new tricks.

Fresh-hatched units, however, profit from a survey at the start as a means of setting up good operating habits. Every outfit has the benefit of all the background and experience the Army can give it, but every unit finds it faces a set of particular problems it must learn to handle, like a party of people cast ashore on a desert island. There's the added fact that new units often are not only new themselves but are manned by people short on experience. One unit constituted not long ago drew 40 percent of its enlisted personnel directly from basic training. A thorough survey at the start put it on the right track, and periodic surveys since have helped keep it there.

New or old, the unit undertaking its first survey gets best results if it draws on outsiders for the initial job, preferably a board which has been through the mill before. A man who is not a member of the family can spot a sore spot





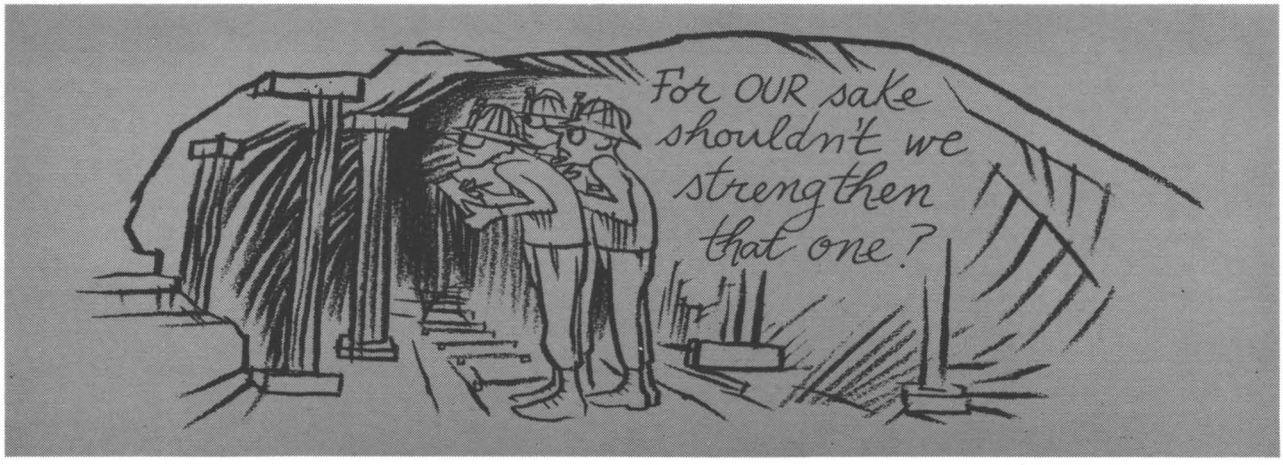


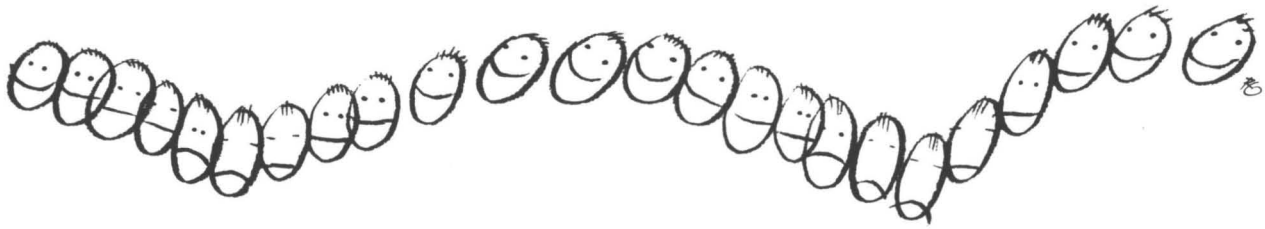
every unit faces a set of particular problems, like a party cast ashore on a desert island

which may have been around so long everybody in the unit has taken it for granted and has learned to live with it, the way a chap can get used to fallen arches or a wart on his girl's nose.

The outside survey team, working with the thoroughness of a clutch of new brooms, isn't likely to miss anything of importance. You'd think any unit would be as anxious to have one as a Washington hostess is to snare top-ranking VIPs for her annual garden party. Here's where another misconception about the survey gets in the way. No self-respecting hostess likes to have a neighbor sniffing at her pots and pans, peering under the beds, and poking into closets — especially if the neighbor is the gabby type who can be expected to turn in a full report at the next meeting of the Thursday Monopoly and Canasta Club. When an aviation unit acquires the notion a survey is some kind of inspection and that the fellows running it are aching to draw up a long list of faults to be handed along to higher authorities, the survey, to put it mildly, will fall somewhat short of success — if it ever comes off at all. Even if a survey team is called in, it will find it is being viewed with the same suspicion it would be if it showed up at the bank wearing masks and carrying sawed-off shotguns.

The real truth is that a survey is basically an internal affair, no matter who runs it, and is designed to open a unit's eyes to its own needs and the procedures it must operate under for maximum results. Surveyors recommend higher headquarters be apprised of a condition only when they feel a unit is bucking conditions it cannot overcome by itself. Otherwise, they let





the *unit* know what needs adjusting. Beyond that they are about as talkative as a man who has just discovered where Blackbeard buried the loot.

PERPETUAL MOTION

The initial survey, whether for an old or a new unit and whether run by the unit or someone asked in for the purpose, is the first giant step in the program. Handled the right way, it reveals and removes a cartload or so of factors which have been lying around waiting for the right moment to cause an accident. It is a boon to one and all. The CO's gray hair growth rate slows considerably. The flight surgeon loses the dark circles which have been accumulating under his eyes. The aviators' wives are pleasantly surprised by their husbands' cheery mood when they come home after a day in the air.

With all this in its favor, it would be nice to be able to say that once the survey is over, and the team has packed its bags and gone home after a hearty handshake all around, the unit could settle down and live happily ever after, like couples in the fairy tales. The sad truth is that nothing in the Army remains static and that beating off trouble is like swatting mosquitoes in a Louisiana swamp — there is no lack of replacements. This is why the survey, worthwhile as it is, will never achieve its goal if it is not repeated at regular intervals under a conscientious program of surveillance. Here again is the resemblance to an annual Fire Prevention Week. Smoky Stover, the fireman, knows oily rags breed like rabbits and that the only way to get rid of them is to keep going back.

To be really effective, then, the survey becomes the survey *program,* a kind of do-it-yourself, 24-hour alert, as far as the aviation unit is concerned. The intervals at which it is held naturally vary under changing conditions. If an outfit is moved from mountain work in the tropics to a base

the path through the jungle never stays cut

where 12-inch snowfalls on the Fourth of July are considered normal, it naturally will want to take a long, hard look at the new set of problems it has inherited. New types of aircraft call for a searching survey to determine their personalities and how they fit into the scenery and the mission. The arrival of a batch of new hands, pilots or enlisted men, may demand a survey as a sure-fire method of keeping the machinery properly oiled.

Even when a unit is lucky enough to stay put for a fairly long time, a repeated survey cannot be beat for warding off migraine headaches caused by mishaps in the air or on the ground. Fresh problems constantly come up to bother even the most well-ordered household — squirrels move into the attic, the puppy chews holes in the rug, and the TV blows a fuse in the middle of "Gunsmoke." Each demands corrective action, in the form of squirrel-proofing, a muzzle for the dog, and an extra supply of fuses. A resurvey performs the same service for the aviation unit by

revealing gaps in preceding surveys,
pointing to progress, or lack of it, and
uncovering new trouble spots.

Above all, a good survey program makes every man-Jack in the outfit survey-conscious — the same as saying they are the exact opposites of our accident-prone friends who log so much hospital time with bruises and broken bones. After a time, a survey becomes almost an unconscious reflex ground deep into every member of the unit. An airman who has seen how effectively the survey works knows causes of accidents can wear more innocent-appearing disguises than Sherlock Holmes. He also knows they have to be ferreted out the way you go after the bottom olive in the bottle. He develops a sixth sense for trouble, like a Grand Banks fisherman who can tell a nor'easter is coming by the hairs on the back of his neck.

This souped-up alertness on everybody's part, a by-product of the survey, results in a sharp drop in the kind of accidents which in pre-survey days would have been put in the you-wouldn't-have-thought-it-could-happen-but-it-did category. Unit members are made aware of factors they never before consciously tied in with accident prevention.

Take the unhappy example of a unit not yet survey - indoctrinated which was operating a while back in a part of Germany where the natives do not think a snow worth commenting on unless it is deep enough to swallow a normal-sized giraffe. After every fresh snowfall, taxiways had to be bulldozed through the drifts so the aircraft could get to the strip. The lanes were 26 feet wide, wide enough for a 16-foot Beaver flanked on each side by a squad of Cub Scouts. Wide enough, you'd say. Yet an aviator tore off the end of his left elevator when he tried to veer around a slick spot in the middle of the lane.

Maybe this minor mishap was one of the once-in-a-million kind nobody could be expected to foresee. Chances are, a survey background would have indicated to the CO that the time had come to close up shop until a thaw came. Or somebody would have recognized the ice as a booby trap. The point is, the accident indicates what can happen without a survey as a guide to positive measures, leading everybody to follow that sound baseball doctrine known as touching all the bases.

PLANNED PARENTHOOD

To achieve full value, a unit's survey must be as thorough as a bride cleaning house for her mother-in-law's first visit. It covers any and all problem areas involving all functions of the unit affecting operations. This covers just about any activity members of the outfit engage in from the time they get up in the morning until they call it a day and go home to the wife and kiddies.

Naturally, any program so comprehensive must be undertaken with a generous helping of care, planning, and foresight. Any survey handled along the same lines as a children's Easter Egg hunt, with all concerned charging off aimlessly and falling over each other's feet, will wind up as a small-scale version of the Donnybrook Fair or a subway station during rush hour. A hit-or-

a unit's survey must be as thorough as a bride cleaning house for mother-in-law's first visit

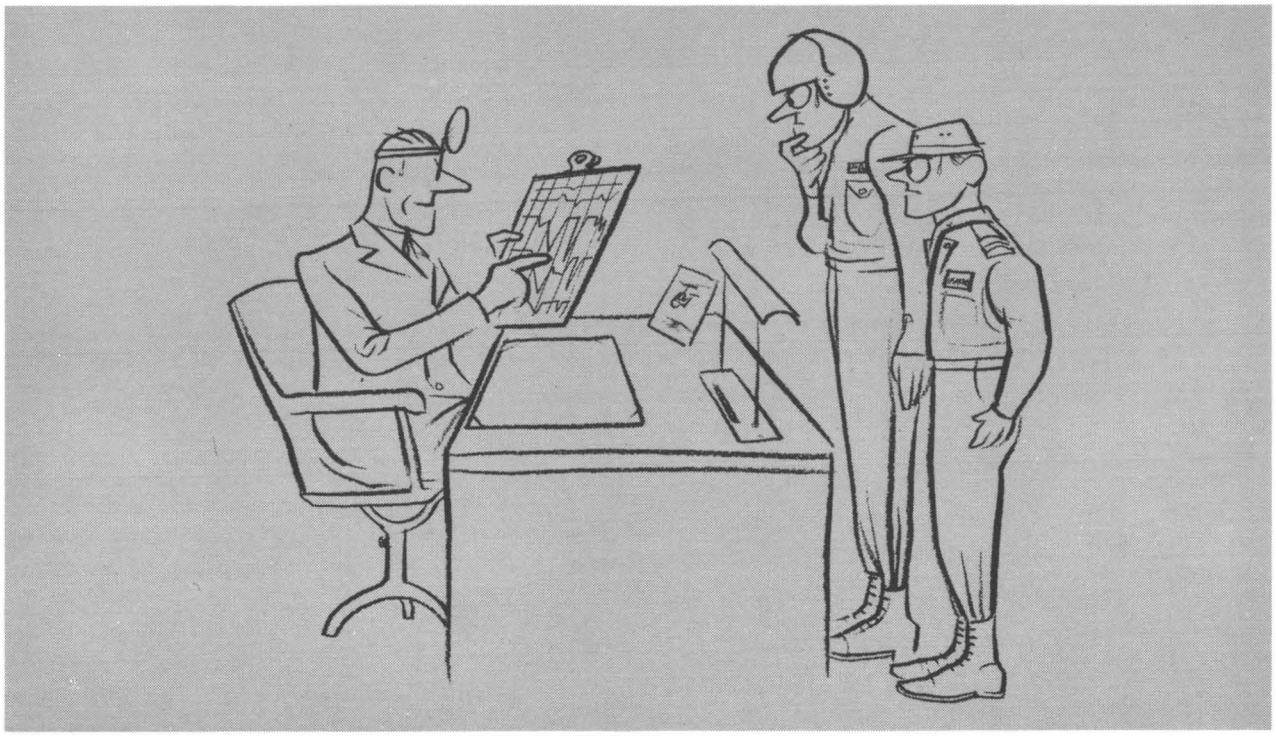
miss survey without doubt will score a few hits, but what is missed will be just as deadly as ever, if not deadlier. A survey which has more gaps than a picket fence can actually do harm by lulling all hands into a false sense of security.

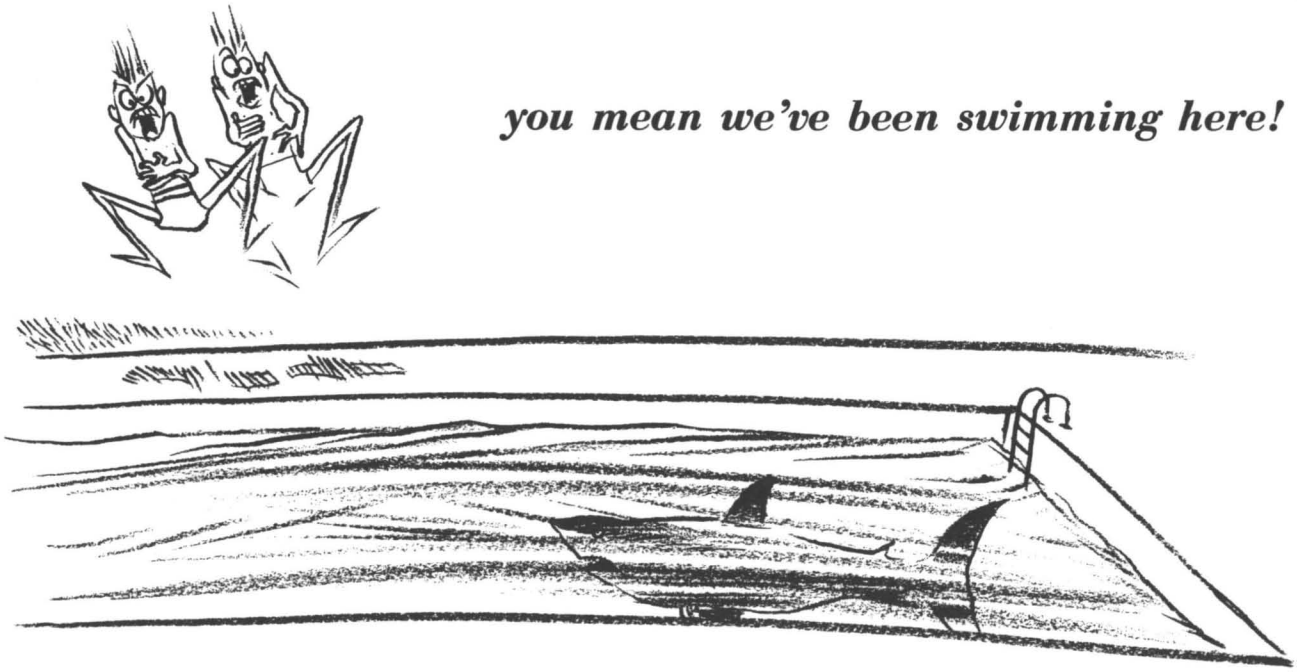
A really bang-up survey requires more cumulative study than an individual Ph.D. in nuclear physics. First, the CO and his assistants take a long, hard look at the outfit's past record, analyzing the incidence and specific causes of such black marks as accidents, forced landings, and near things which could have been messy but were not because the chaps involved had their pockets stuffed with rabbits' feet, horse shoes, and good luck charms. Sometimes definite trends appear, showing areas in which remedial action is indicated — in the training program, in facilities, or in the way the unit is attempting to grapple with its own set of problems. What always emerges is a set of guides based on a thorough study on which to conduct the full survey.

Once it has made a thoughtful self-appraisal of its past, a unit sets up its survey with reasonable confidence that nothing of critical importance will be overlooked. No one survey will ever be exactly like another — aviators in Korea face different problems from those in Germany, and there is not much point in investigating the instrument approach situation if instrument approach facilities are about as rare as quintuplets — but in general the well-rounded survey will require a week to ten days and will cover at least eleven major points:

the airfield,
operations office,
weather information,
control tower,
rescue procedures *in effect,*
aircraft operation,
aviator training,
medical safety and equipment,
maintenance,
instrument approaches,
accident prevention.

None takes precedence over the other. As we all know, dirty fuel (maintenance) can cause a crackup as surely as a thunderstorm in the wrong place (weather), and the comfort and sometimes the life of a crashed aviator often depends on how fast he is picked up (rescue procedures) or what he knows about survival techniques (training). Even if a survey accomplished nothing else, it would serve as a handy reminder for everybody from CO to mechanic that successful Army flying is a large and complicated proposition, that a unit's accident statistics rest on the smoothness with which it operates as a team, and that no matter how skilled an aviator may be, he is in trouble if somebody somewhere overlooks a small but essential part of his job.





All this is already well known by ball carriers in the pro leagues who learned in their first games they could make it to the line of scrimmage only when everybody up front executed his assignment without a flaw. When a guard or end misses a key block, the All American with the ball ends up on his back, wondering who turned out the stadium lights.

In other words, the survey hammers home with all the force of a driving tackle what the veteran aviator has also found out: the kind of performance the Army wants and needs at all times can come only from unremitting high standards set up and executed faultlessly in the smallest detail by all hands in all departments.

LOUDER THAN WORDS

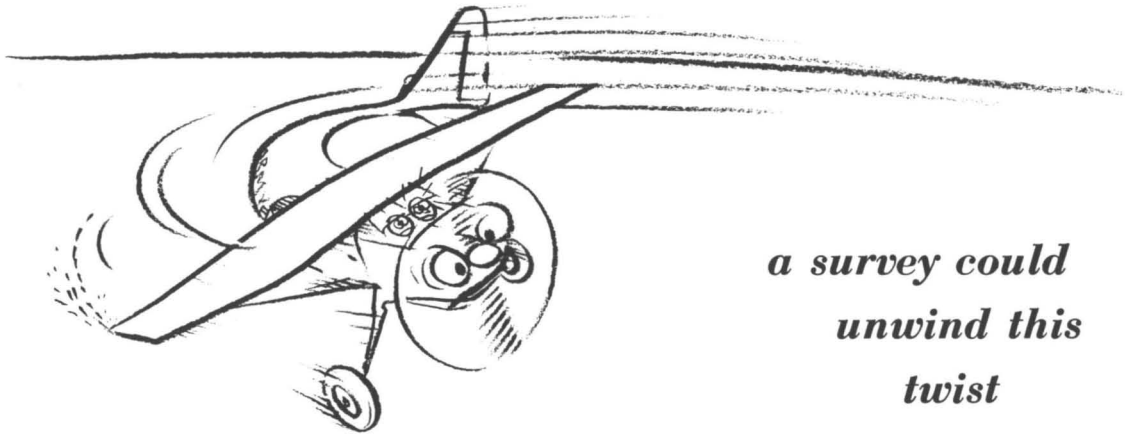
So a thorough survey helps a unit achieve and maintain standards guaranteed to put a bloom in every cheek and draw hearty praise from the Pentagon. The *degree* of help it furnishes depends on the action taken. When a sensible man is warned by his doctor that he is suffering from seven different ailments and is headed for the boneyard at a gallop unless he mends his ways, he cuts out the all-night poker sessions at the lodge — if he has a burning ambition to be around to see Halley's Comet when it reappears in 1985. Otherwise, he goes down in the doc's book as another lost cause.

Any survey's success over the long pull depends on

conclusions,
educated action, and
continuation.

One thing a survey does is to present a unit with its own case history, tied together in one neat package. A good part of the time, when the pieces are assembled and the evidence examined the way the D.A. prepares a racketeer's trial, everybody in the unit from the CO down can see that what had been thought of as a series of isolated incidents were in truth about as far apart as Siamese twins. Defects or gaps in training stand out like a whale in a swimming pool. An accident on July 1 and another in January will be shown to have started with the same causative factor, not recognized until the survey hauled it out into the spotlight. A need for emphasis on certain procedures the unit has slipped into taking for granted will be so obvious everybody will wonder why he hadn't seen them all by himself a long time before.

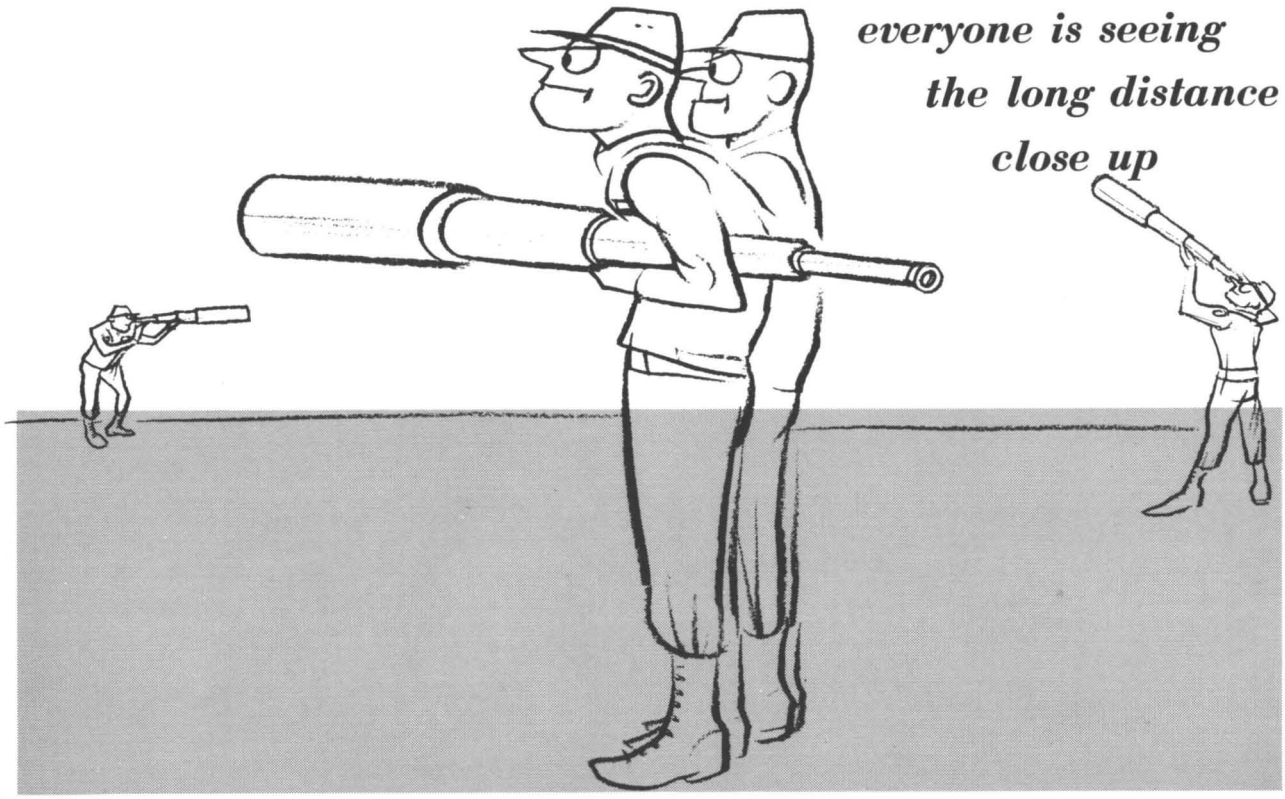
Armed with the conclusions the survey leads to, the unit sets out with screwdriver and wrench to tighten up every phase of its operations which might have come loose enough to cause assorted rattles and pings in the machinery. If the case history points to a couple of crashes laid to engine failure and a stallout or so before takeoff, the CO



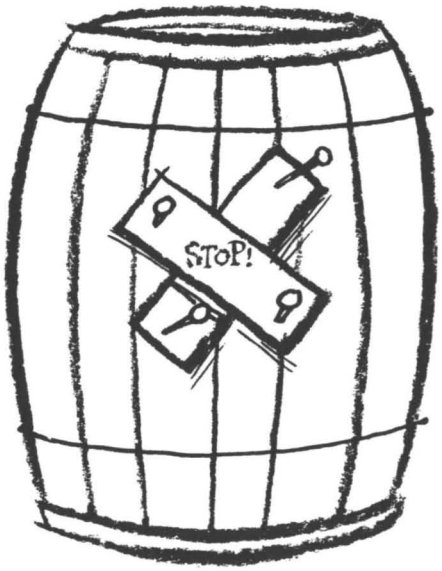
a survey could unwind this twist

looks to see if all is well in the fuel-handling department. Too many close shaves in pinnacle operations might indicate a new approach to training. Or perhaps the aviators could stand a few well-chosen words on the subject of density altitude and weight and balance. So it goes, and all for the best.

Not long ago, a unit's survey showed that its record of groundloops was a trifle fatter than it should be. Studying this factor in the light of the overall record, the survey board recommended a training program covering *all* phases of flying likely to be encountered, including that which comes after touchdown on landing. In another, when flying Bird Dogs for the first time after months in heavier aircraft, a rash of minor accidents was pinpointed by a survey as evidence of a crying need for a familiarization program including standard procedures, checkout, and transition. In each case, and every survey has its parallels, the conclusions pointed like a weathervane in a high wind to curative steps which have



everyone is seeing the long distance close up



cut the accident rate in the categories involved to the point where they could barely be spotted by a sharp-eyed Eagle Scout.

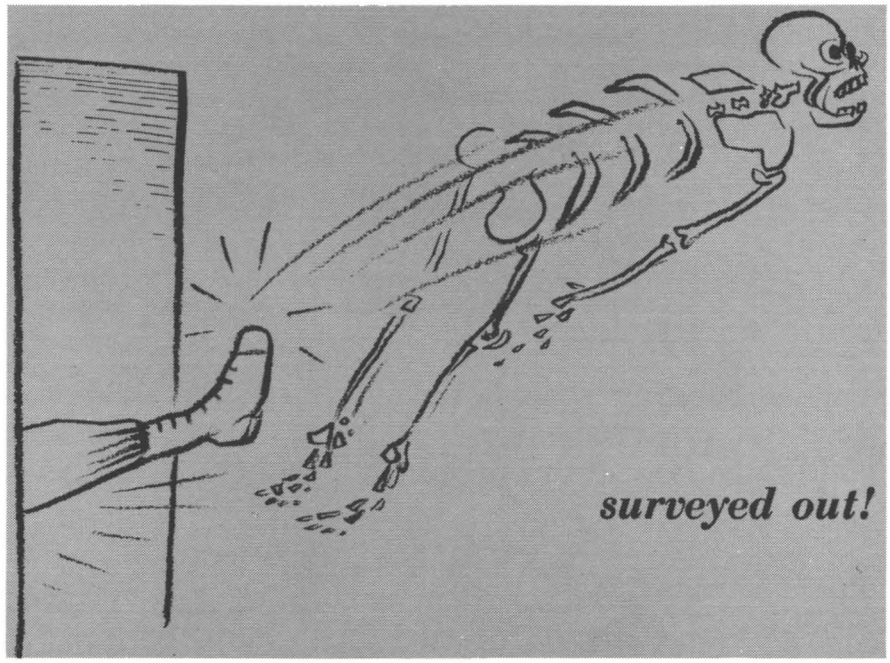
AND RECHECK!

Continuation of the remedy prescribed is what cures the patient. When a man takes one pill and throws the rest away because they stick in his throat or taste like a poor grade of glue, he won't get much benefit from the treatment. So with the survey. *It discloses factors and gives a basis for sound procedures to eliminate them.* But its full effectiveness depends on the degree to which the survey becomes a way of life to all flying men, something no more to be overlooked than payday, wedding anniversaries, or the income tax. Only by making the survey a regular and continuous procedure based on a planned program can a unit be sure it has all the built-in life insurance it can get.

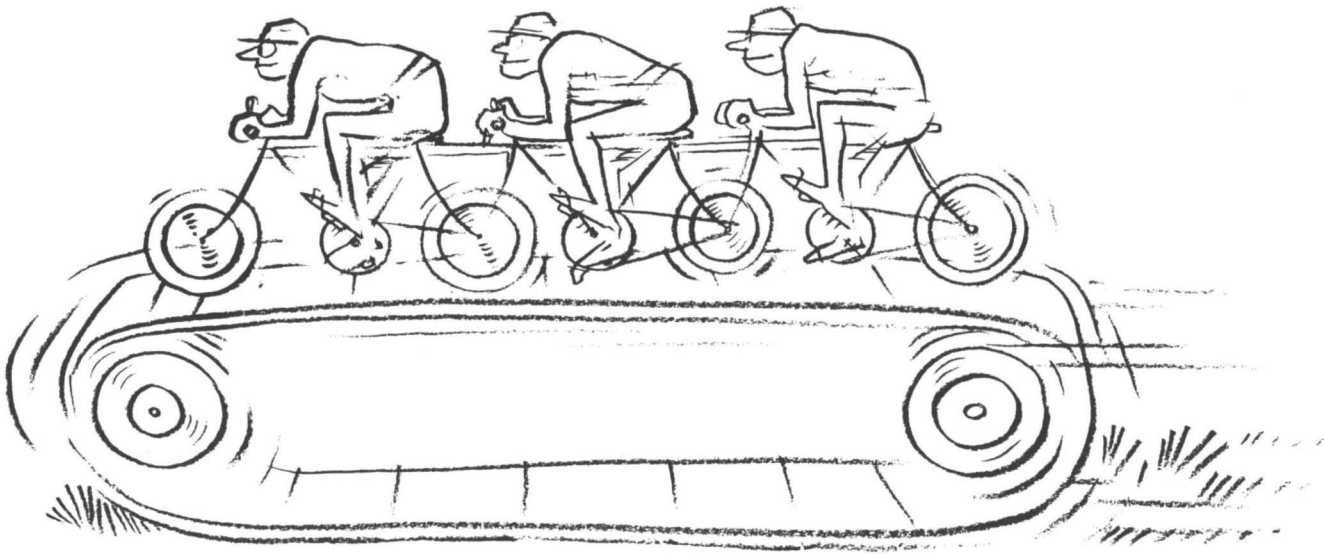
The role the survey plays goes beyond merely showing a unit what progress it is making, or failing to make, in its never-ending effort to achieve an accident rate so low it could be summed up in a 15-word telegram. The survey is more than a means of helping the unit cope with new problems as it moves from one to another of the various tough locales where the Army operates. These are valuable aspects, to be sure, but like most worthwhile things in life the survey offers a bonus, a hidden dividend most people get without realizing it.

The fact is, a survey makes a unit *conscious* of factors behind accidents. Once a man has driven into him a full appreciation of what a survey is, how it works, and the benefits it brings if everybody pitches in to keep up standards, he turns into the *survey's* best friend. He is ready to defend it loudly in arguments with anybody who may persist in the notion it is (a) an inspection to be got over as soon as possible, (b) too much trouble, or (c) not worth it, anyway.

Our survey defender is a man on the alert. Like a forest ranger who spots a cigarette butt



a survey keeps everything in top trim!



in a stand of pines, the member of an aviation unit who finds a nail on a runway not only picks it up, but finds out how it got there, plugs up the hole in the nail keg, and takes steps to prevent a recurrence.

This kind of conscientious lad is pulling his full weight in the survey and, what is more, he knows everybody else is doing the same.

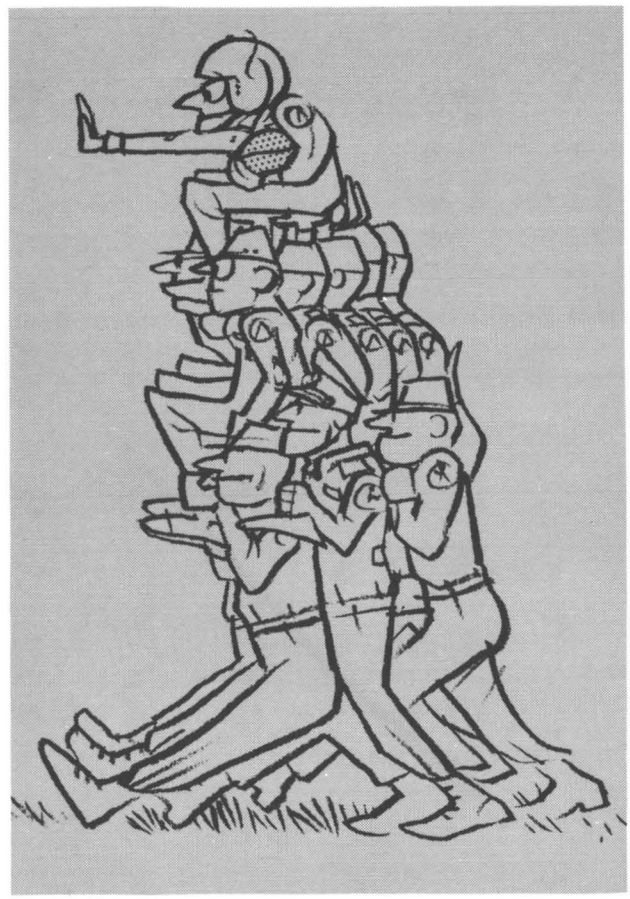
ODDS ON FAVORITE

As long as aircraft remain subject to the law of gravity and are serviced and flown by human beings able to make an occasional mistake, any unit will have an accident from time to time. Nobody is likely to use this as an excuse to accept crashes as an unhappy fact of life and to shrug them off the way people in some parts of the world do avalanches and earthquakes. Almost any accident can be prevented if somebody takes a hand at the right point. The survey is designed to put the accident prevention program on the widest and soundest basis possible, to ensure that it

is handled properly, and

never lets down.

Everybody is affected. Anyone can see that if a unit has an abnormally high accident rate, a survey is the first logical step in an all-out program to find out where the trouble is and take the necessary measures to remedy matters. But unlike those glamorous games played on green baize-covered tables in casinos, a survey is one



game in which everybody profits through removal of all possible gambles in Army flying. Even a unit which hasn't had any more serious blot on its record than a bent prop or so and a few paint scratches finds out a thing or two about itself from a survey — something which could cause an accident tomorrow or the next day.

Taking chances can be great fun if you happen to own several oil wells and enjoy a fling at blackjack or roulette at Monte Carlo. The only thing you can lose is money. An Army Aviator at the controls of an aircraft has a lot more at stake than a pile of chips. He prefers to go aloft knowing that even though he may have to cope with something unforeseen, he has already had the benefit of a sound, thorough, and conscientious survey which has made his job as much of a sure thing as it will ever be.

The aviator is carrying the ball. Thanks to the survey, he can be certain he will never be thrown for a loss because somebody has missed an assignment.

Survival Kits

Aviation personal clothing and equipment contents of all kits described here are available upon request. Address inquiries to Editor, U. S. Army Aviation Digest, Fort Rucker, Ala., or to the USACDC Aviation Agency, Fort Rucker, Ala.

Major George W. Aldridge, Jr.

THE USACDC Aviation Agency is currently evaluating all items of aviation crewmembers' personal clothing and equipment. This project is intended to determine what presently-authorized items are satisfactory and what items are unsatisfactory and need improvement or replacement, and what new items are required.

It is believed that a series of articles will help you, the aviation crewmember and user, know what you're now authorized or will be authorized in the near future. Correspondence and queries received by this Agency and the U. S. ARMY AVIATION DIGEST indicate that the word just isn't getting around.

Let's start in the most important area, and probably the most controversial, of personal equipment — survival kits.

The aviation crewmember has, or will soon have, available to him three types of survival kits — standard kits, personal kits, and OV-1 Mohawk kits.

Standard survival kits were under development for 7 years before a satisfactory configuration and list of contents could be decided upon. During this development phase, no two sur-

Maj Aldridge is Chief, Associated Equipment Branch, Materiel Division, U. S. Army Combat Developments Command Aviation Agency, Ft Rucker, Ala.

Figure 1. Hot climate kit

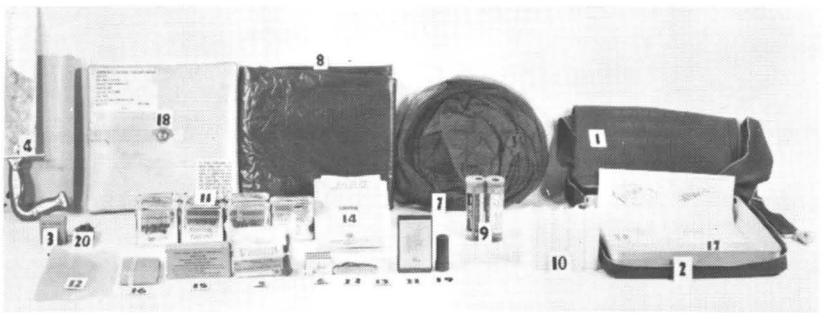


Figure 2. Cold climate kit

Figure 3. Overwater kit

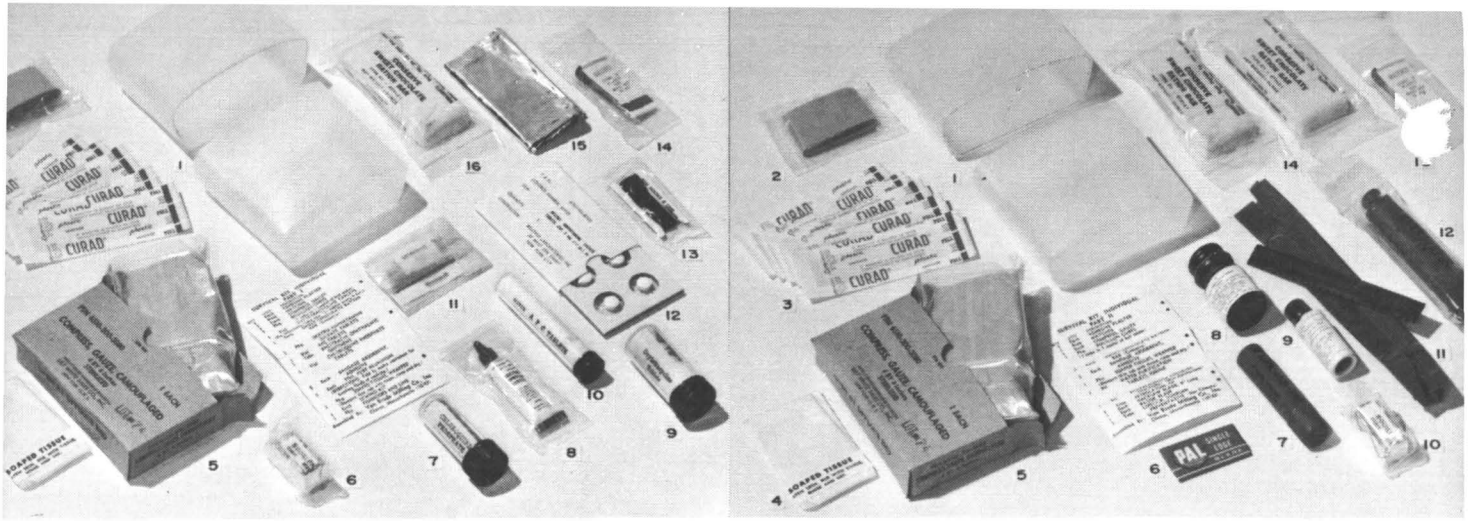


Figure 4. PSK-2 container 1 contents . . . *Container 2 contents*

vival experts could agree on the basic contents of a survival kit. Finally, in March 1961, USCONARC published the military characteristics for Army Aviation survival kits based on the following philosophy:

- Survival depends to a large extent on training and the will to live.
- Emergencies requiring aircraft abandonment occur much less frequently than those in which personnel remain with the aircraft.
- Survival kits should be designed for convenient stowability in the aircraft rather than to fit in a seat.
- The kits should be attachable to the parachute harness for jumping.
- Separate kits should be developed for cold climate, hot climate, and overwater operations.
- The kit should supplement the crewman's clothing and equipment. Therefore, the crewman must be dressed, equipped, trained, and armed for the environment he will encounter after a forced landing or after parachuting from the aircraft.

Kits designed to meet these CONARC requirements were tested by the U. S. Army Aviation Test Board and Arctic Test Board and type classified Standard A in November 1962. Stock numbers, nomenclature, and approximate costs of these kits are:

Survival Kit, Hot Climate, FSN 8465-973-1861—$125 (fig. 1)

Survival Kit, Cold Climate, FSN 8465-973-1862—$190 (fig. 2)

Survival Kit, Overwater, FSN 8465-973-1863 — $185 (fig. 3)

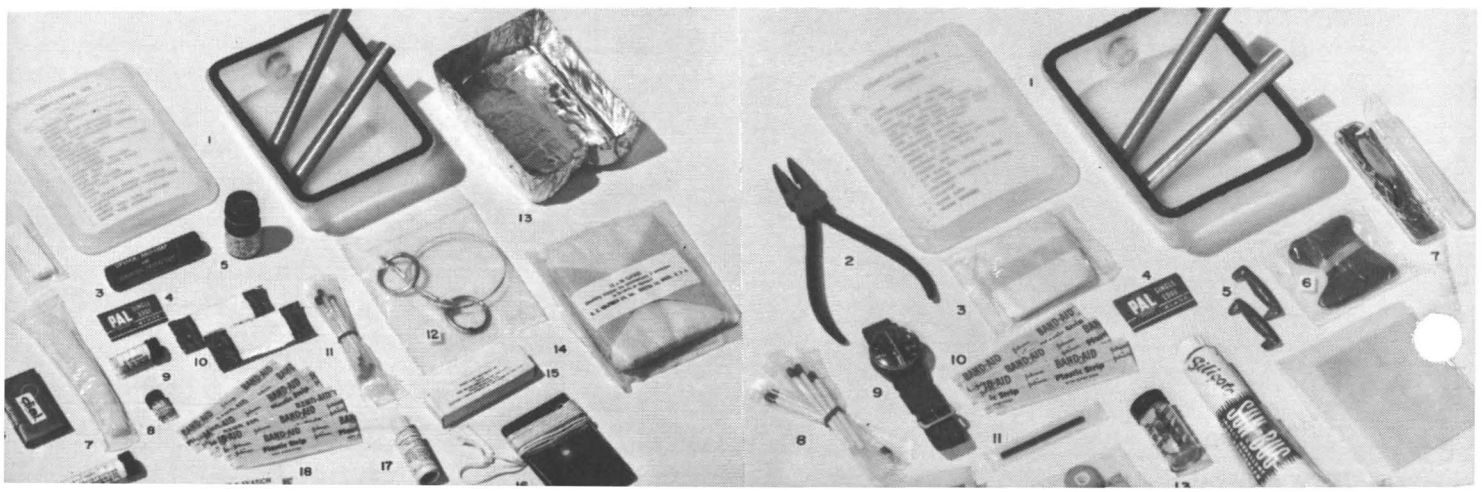
The basis of issue of these kits, as contained in TA 50-901, 24 September 1963, is "one per Army Aviator, crewman Army aircraft, WAB TOC, CONARC or appropriate ZI command."

Much has previously been written about the availability of these kits — some of which wasn't quite accurate. Here's the latest on availability: The Defense Clothing and Textile Supply Center in Philadelphia, Pa., states that the estimated date of supply for the three kits is now 1 October 1964. This is their target date barring unforeseen contingencies. The kits which have previously been issued in very limited quantities in some areas were preproduction test items.

Requisitioning procedures for these kits remain as previously mentioned in LETTERS section of the November 1963 issue of this magazine.

During the testing of the standard kits by the Aviation Test Board, a Navy-developed personal type kit (PSK-2) was also evaluated and recommended for Army use. The Survival Kit, Individual (PSK-2), FSN 6545-611-0978 (fig. 4) was type classified Standard A for Army use in January 1963. Basis of issue

Figure 5. SEEK-1 container 1 contents . . . *Container 2 contents*



is one per Army Aviation crewmember.

The Navy has replaced the PSK-2 with an improved individual kit. In the interest of standardization and continual improvement of our equipment, the Army plans to adopt this kit and has recommended that it be type classified Standard A and that the PSK-2 type classification be changed to Standard B. This new kit will be the Survival, Escape and Evasion Kit, Individual (SEEK-1), FSN 4240-731-9909 (fig. 5).

These kits should be available for issue several months after type classification action is complete. The PSK-2 and SEEK-1 kits fit neatly in the bottom leg pockets of the flying suit. Provisions will be made in the design of future aviation crewmembers clothing to accept these items.

Survival kits have been developed which are compatible with the ejection seat system of the OV-1 Mohawk (fig. 6 A, B, C). These kits are essentially a smaller version of the standard kits. They fit in the seat pan and remain attached to the crewmember after seat separation. The hot climate and overwater versions of this kit have been recommended for type classification. The Arctic Test Board has just completed testing the cold climate kit and final reports of test are being prepared.

Supply channels have been set up by Supply Letter 57-63, dated 2 July 1963, from the Aviation and Surface Materiel Command, St. Louis, Mo. This letter gives Federal stock numbers and requisitioning instructions for the survival kits (p. 18, Aug '63 DIGEST).

Address funded requisitions to: Headquarters, U. S. Army Support Center, 2800 South 20th Street, Philadelphia, Pa., 19101. These requisitions should be submitted to this office, ATTN: SSMCP-AFEF, Routing Identifier AP5. Units interested in the PSK-2 kit should forward requisitions to the Defense Medical Supply Center (DMSC), Brooklyn, N. Y.

Finally, a word on the Army field manual on survival, FM21-76. This manual was published in 1957 and has had two changes since then. A complete revision is scheduled for next year.

We can talk all we want to about survival equipment and manuals, but we must never forget that the real essentials to survival are training and fitness, both mental and physical. An author of a recent book on survival said in his preface: *Survival booklets, if destined to be given to untrained personnel, had better be printed with vegetable dyes on palatable paper.*

Figure 6C. OV-1 overwater kit

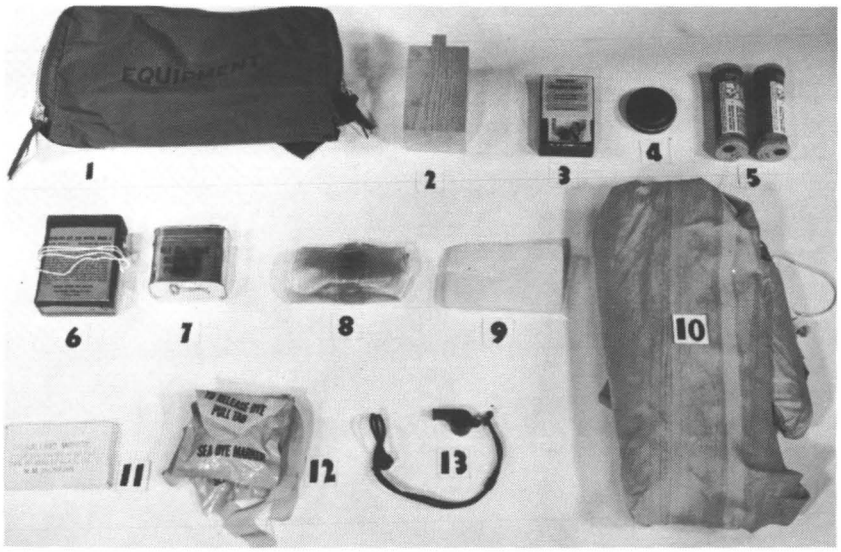
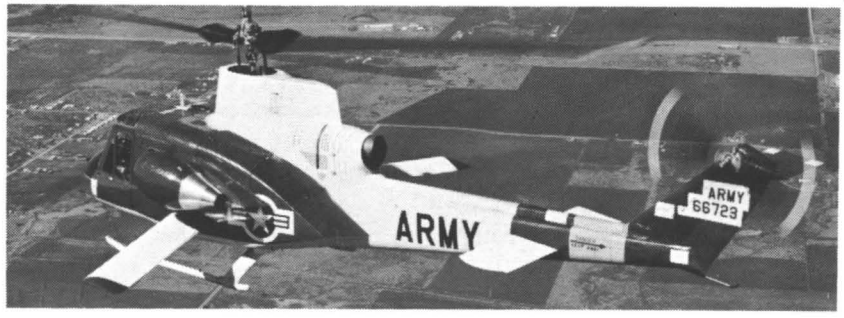


Figure 6B. OV-1 cold climate kit

Figure 6A. OV-1 hot climate kit



Army Research Compound Helicopter Flies 222 MPH

A U. S. ARMY flight research compound helicopter has been flown at 222 miles per hour, exceeding the Russian-held rotorplane world speed record.

The world's official rotorplane speed record is 221 mph, set in 1961 by the Russian Kamov compound helicopter. The Army mark will not be claimed as a world record since is was not made under conditions required for official recognition.

The high-speed machine, designed and tested by Bell Helicopter Company, is being used in a high-performance helicopter research program conducted by Bell for the U.S. Army Transportation Research Command.

The high-performance ship is a modified YUH-1B, basically similar to the operational UH-1B flying in the Republic of Vietnam. The streamlined Y-model has wings and two auxiliary Continental J69-T-9 jet engines in addition to its Lycoming T-53.

—Bell news release and photo.

XH-51A Gets Wings For High-Speed Flight Program

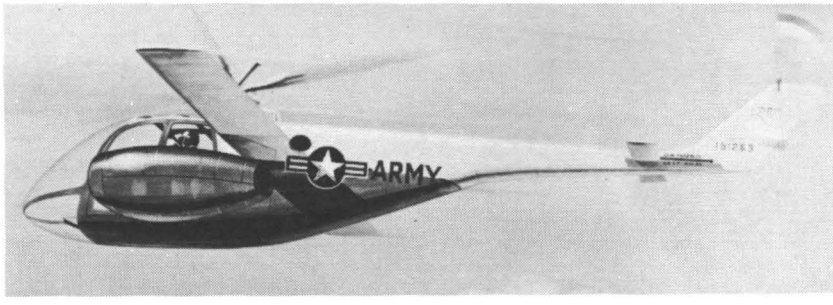
ABILITY OF A winged version of the XH-51A Aerogyro to perform at speeds in excess of 200 mph will be evaluated by Lockheed-California Company under a new research study for the U. S. Army.

Specially modified with a stubby, fixed wing and a Pratt & Whitney J60-P-2 turbojet auxiliary engine mounted in a pod on the left side of the forward fuselage, the winged Aerogyro will aid the Army in obtaining advanced data urgently required for designing future high speed rotary wing aircraft.

The research program will extend into late 1964. It is keyed to further laboratory and flight analysis of Lockheed's revolutionary rigid-rotor concept.

Two XH-51As, built under a joint Army-Navy research contract, have completed military flight evaluations. They attained 160-mph speeds in level flight.

—Lockheed-California news release



Need help in getting your helicopter company to achieve a higher rate of availability, safety, and service mission support? It can be done by implementing a unit program that gets results. Here's how.

Effective Unit Capability

Captain Ulysses S. Large, Jr.

AIRCRAFT FLYING hour program? Oh, that's something that has to do with some office somewhere in CONUS — maybe AVSCOM in St. Louis or the Pentagon!

We have all seen letters from higher headquarters stating that certain aircraft can fly only a given number of hours per quarter, and during a particular fiscal year, but that's the maintenance officer's area, so why bother? Everyone knows that a *good* maintenance officer keeps them flying regardless of all that technical jargon of programs, higher echelon maintenance support, and so forth. But need we stop here? How about programming at unit level?

This is a story of how an idea can be pursued and eventually lead to the exploitation of a heli-

In addition to several other unit accomplishments, an effective aircraft availability program permitted one helicopter company to complete over 50 airmobile missions involving 5 or more helicopters in a 6-month period

copter company's capability. For contrast, here are the stories of two helicopter companies in an overseas area.

Helicopter Company X has approximately twenty CH-34 type aircraft assigned. Missions are scheduled through the battalion scheduling officer, who keeps a nice status board which reflects flyable aircraft. "Our mission," he says to himself, as he approves each mission request, "is to support the division with Army Aviation, and if it's flyable — well, fly it." Each day practically all flyable CH-34 aircraft are used for service missions.

Periodically the maintenance officer places a frantic call to the scheduling officer or company operations officer. "Hello Joe! Listen we're getting into trouble. I have seven aircraft in P. E. plus four more coming up for their sixth and twelfth long periodic inspections. This morning we lost three through unscheduled maintenance." The panic button is glowing bright red and some missions are cancelled. The company operations officer halts all transition, proficiency, and instrument training until the now "no good" maintenance officer gets on the ball.

"Our mission . . . is to support the division . . . and if it's flyable — well, fly it."

"Captain No-Good" pushes his section and they make hasty repairs to get the unscheduled maintenance aircraft back into the air. Down the back of his sensitive neck, he feels the hot breath of his commanding officer, operations officer, scheduling officer, supported personnel who had their missions cancelled, and the pilots who had to stop training.

Hasty repairs finally got three aircraft to a somewhat flyable state, but now his career is doomed. The company's direct support already has five aircraft to repair. Then suddenly four more lengthy periodic inspection aircraft are thrust upon them. In addition, they must support five other units which have just brought in more aircraft. Add EDP problems and the situation becomes hopelessly beyond their capability.

A period of a month or 6 weeks elapses before the process starts all over again. Morale suffers from such a constant cycling, and requests for transfers are a dime a dozen. The reenlistment rate drops. Only a lot of luck and/or crystal ball gazing can prevent another or possibly worse situation from developing. The availability rate jumps up and down like a mexican jumping bean on a hot stove.

Helicopter Company Y is essentially the same as Helicopter Company X. It has experienced these very unpleasant situations for a number of years but now has a new challenge under the ROAD concept. One day, the company commander casually asks the operations officer to estimate the flight training hours required for the first 6 months of the fiscal year. No problem, the operations officer says to himself as he starts writing a two-line DF in answer to the question.

Wait a minute! It's not that simple. How many total hours can the unit fly and still receive adequate company and higher echelon support? How can one determine these hours and the number required for training? What if flying operations and maintenance were meshed together to afford an orderly utilization and maintenance turnover of aircraft? Step by step, through discussions and study, a plan was devised.

First a detailed estimate of the flight training hours was researched. A program was prepared covering each training area, subsequently mimeo-

---

Capt Large is assigned to Company A, 8th Aviation Battalion, 8th Infantry Division, APO 185, U. S. Forces.

graphed for distribution and approved by higher headquarters. All these training programs or guides — transition instructor pilot training and standardization, accomplishment of annual flight minimums, mountain training, basic and advanced instrument training — were carefully prepared and evaluated against concrete requirements of regulations and manuals.

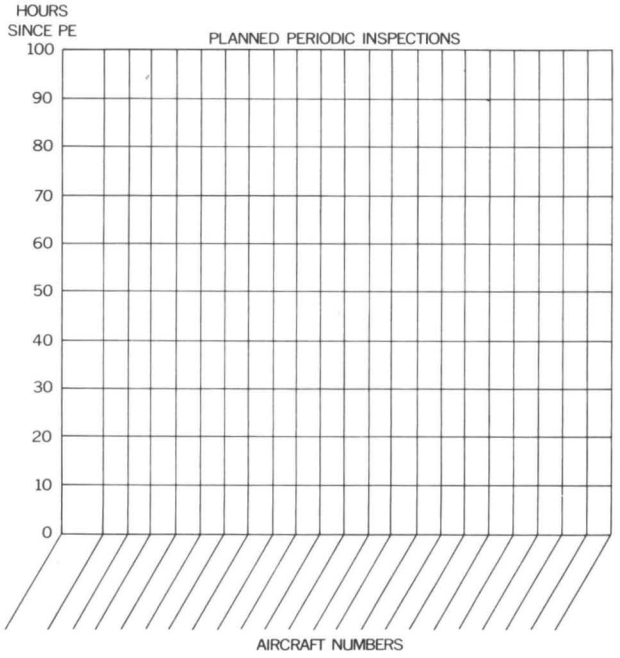
The operations officer obtained an estimate of the projected number of incoming aviators and their aircraft qualifications from the battalion S-1. From this figure, he could estimate the number of aviators that would be assigned during the forecast period. The annual flight minimums and transition programs gave a total number of training hours required to accomplish the goals in these areas. The instrument training program was geared to a goal of two students graduating every 10 weeks. This class length was selected because of the varying service mission requirements. Careful adherence to the program and the flight training hours allocated would allow a steady advancement of each class through the basic and advanced phases. Finally, a six-page detailed request for flight training hours was submitted to higher headquarters and approved.

Maintenance support from all echelons figured prominently in unit's capability

The second phase was conducted simultaneously by the maintenance officer. Referencing publications, such as SB 1-1 and the flight hour program from Army level, he rapidly confirmed the total flight hours the unit was authorized. Because one limiting factor was the direct support capability, many conferences were held with this unit. Factors considered were the experience level of assigned mechanics, projected mechanic gains and losses, supply problems, and the average input of aircraft from other supported units.

All too often the higher echelon unit's problems are not recognized. Under the present system, direct and general maintenance units are not under control of the ROAD Aviation Battalion. As such, they are not integrated under the same command that has the flying-maintenance problem.

After determining that higher echelon maintenance units could accomplish the recommended workload, the maintenance officer began to prepare bar charts and graphs to aid in programming aircraft through the maze of inspections with their varying lengths and requirements. The most useful was a simple chart shown below. Each day the aircraft numbers were repositioned at the bottom of the chart according to their flight time since the last periodic inspection. Long-time inspection aircraft had a green line, while short-time periodic aircraft were portrayed in black. A black line aircraft could bypass the



long-time green periodics, but the goal was to achieve equitable spacing between all maintenance loads. This system is not new and can be found in many publications (appendix V, TM 1-320, for example). However, how many units practice such maintenance guidance?

The third phase was the crucial testing stage. Service missions were scheduled through the operations officer as far in advance as possible. Mission sheets were typed in three copies: one copy to the platoon leader assigned the mission, one copy on file in the operations section, and one copy to the maintenance officer with an estimated flying time entered upon it. A certain percentage of flight time was set aside for emergency type missions.

On a standby basis flight crews were rotated each day for these missions. This action improved morale by equalizing the responsibilities; it also decreased reaction time of these flights. Because the transition and instrument programs offered a known flying hour input, aircraft were rotated between these areas and service missions. This kept all aircraft moving evenly and according to plan into periodic inspection. Annual minimums and proficiency flights were scheduled periodically between service mission loads. The monthly total flying hours were broken down into weekly goals.

Command emphasis led to consolidation of many mission requests so CH-34 aircraft capability could be properly utilized. Some missions were eliminated or transferred to other type aircraft in the battalion because of small personnel loads, economy, etc. By careful scheduling and programming, the division received uninterrupted and safer aviation support than ever before. Each program moved steadily along according to plan.

Results? Helicopter Company Y established an enviable record of aircraft availability, safety, and service mission support. On every higher headquarters inspection it was commended for its outstanding training and standardization programs.

During a 6-month period it flew approximately 2,400 hours, conducted over 50 airmobile missions involving 5 or more aircraft, transitioned 6 newly assigned aviators, trained and standardized 1 new instructor pilot, and graduated 6 aviators from its instrument school. This gave a total of 13 rotary and 4 fixed wing instrument certificates out of 30 assigned aviators. All semi-annual minimums were completed according to plan before the middle of the fifth month.

Careful unit program implementation does give effective capability and renders results.

By Gemini!

A UNIQUE ROLE was played last May by Army Aviation in the race to the moon.

A UH-1B from Company A, 501st Aviation Battalion, 1st Armored Division, Fort Hood, Texas, was used by a NASA engineering team to test the "para-sail" technique in the search for a landing system that can be used to lower a two-man Gemini spacecraft on its re-entry to earth.

Equipped with a built-in TV camera, "Little Genny" — a 400-lb. model of the moon spacecraft — was attached to the Huey and flown to 10,000 feet altitude and released. Engineers from the Manned Spacecraft Center (MSC), Houston, Texas, watched a TV monitor from inside a panel truck. As the one-third scale model of the Gemini spacecraft fell, an engineer turned the craft to the right or left by remote control.

"We could guide the model down by just looking up and seeing it. However, that's what these tests were about — to see if it could be accurately controlled without direct visual contact," explained one of the NASA engineers.

Once "Genny" was released, the helicopter crew circled the craft and kept it in sight. If it landed out of sight of the recovery team, the pilot relayed its grid coordinates so they could easily locate it. "Little Genny" was dropped more than 100 times during the test at Fort Hood.

OH-4A

Continued from page 7

objectives:

Maximum Mission Value—
A high degree of reliability, utility, performance, and safety for a minimum manufacturing and operating cost.

Simplification—
Minimum dynamic component parts, reduced systems adjustments, reduced degrees of effort and levels of skill required for both mechanics and pilots.

Advanced Technology—
Improved aerodynamic efficiency, new structural techniques, use of new materials and processes and advanced manufacturing methods.

Review of specific design details is highlighted by comparison with the current OH-13.

Configuration

The OH-4A has a four-place cabin which is specifically designed for the variety of tasks assigned to the LOH. A primary consideration was the best all around visibility for all occupants while retaining adequate structural integrity. The cabin has two crew doors forward plus two sliding cargo doors. Flights can be made with the aft cargo doors open or removed. Doors have been arranged to permit easy and rapid loading of passengers and/or cargo.

The rear cabin features a folding seat which can be converted, or folded flat much like one in a station wagon, to provide a knee-high deck and a 30-cubic-foot cargo capacity. As flight can be conducted with the cargo doors open, cargo items longer than the width of the cabin can be carried "through-loaded," i.e., extending beyond the width of the ship. The rear cabin can be separated from the forward cabin by a plexiglas panel to isolate the crew from wind and noise, should the mission require the rear doors be open or removed.

By removing the copilot controls and folding the back of the seat forward, there is adequate room for a prone casualty bed extending through the front and rear cabin. A four-way intercom system is provided for all occupants.

OH-4A has good all-round visibility for its four occupants. Four doors provide easy access to crew or cargo compartment.

Design and fabrication techniques for the OH-4A depart radically from conventional helicopter techniques. This departure is the use of contoured honeycomb for primary structure. The forward fuselage uses relatively large aluminum honeycomb components. Basic element is the lower shell of 1-inch thick aluminum honeycomb sandwich. This component, which weighs only about 40 pounds, is a simple structure assembled in one step in a contoured tool. In this case, a few pieces plus one manufacturing step replace the normal hand assembled combination of skins, stringers, angles, brackets, intercostals, and rivets of conventional structure.

The upper shell, seats, aft bulkhead, and other minor portions are also of honeycomb design.

The roof and lower shell are joined together by a heavy continuous ring bulkhead between the fore and aft cabin. To this basic honeycomb cabin shell are affixed all the controls, fittings, wiring, etc. Transmission and engine are attached to the roof through threaded inserts. A rectangular section beam in the center of the fuselage bulkhead extends vertically to the roof and serves the dual function of routing for controls to the rotor and transmitting loads from the engine and transmission to the airframe.

Aft Fuselage

The aft fuselage is a semi-monocoque structure with a honeycomb deck and single curvature wrapped-skin lower section. The honeycomb upper portion provides structural stiffness and serves as a maintenance walkway. Lower skins are formed with integral beads for added stiffness. The tail boom is a simple monocoque structure with ring formers added for

stiffness at concentrated load points.

Safety-Rigid Structure

The LOH can fly and fight along nap-of-the-earth profiles in a hostile environment. Bell felt, therefore, that it must provide the pilot and crew with all the inherent safety possible. Added structural strength required was achieved by accepting an estimated 150-pound weight penalty. As a result, the cabin design far exceeds Federal Aviation Agency crash safety requirements. OH-4A is designed to take 15 g's vertically and longitudinally and 8 g's laterally, compared with FAA requirements of 4, 4 and 2 respectively. Even beyond these figures, the structure is so designed that the yielding honeycomb material will continue to absorb considerable energy under the high loading of a crash condition. This degree of ruggedness will enable the OH-4A to stand up under the rough handling normally associated with field service. In this respect the OH-4A should far outlast its predecessor, the OH-13.

All seats are of honeycomb material and are integral parts of the basic fuselage structure for added safety. Shoulder harnesses are provided for all occupants.

Dynamic System

A complete OH-4A dynamic system is mounted external to the primary fuselage. This design provides for an in-line drive system completely accessible for maintenance. The T63 turbine engine is located above and behind the main cabin. This results in minimum noise level within the cabin and minimum exhaust hazard to personnel or inflammable materials on the ground. To afford maximum protection against foreign object damage, all inlet air passes through a cleanable plastic foam filter.

From the turbine output, the tail rotor drive shaft extends rearward to the 90° tail rotor gear box and forward to the main transmission. This layout eliminates the gear box often required when the tail rotor shaft is angled up the tail fin as in the UH-1.

The main transmission has been designed for and qualified at 300 hp and is considerably simplified over earlier Bell transmissions. A single planetary gear reduction unit employs three pinion gears mounted on self-aligning spherical roller bearings in the planetary spider. This replaces six or eight rigidly mounted pinions as used on the OH-13 and the UH-1. Result is automatic load equalizing and compensation for deflection which means that lower manufacturing tolerances can be permitted. Summarizing, this simplified in-line drive train requires only 10 gears compared with 25 gears in the OH-13 and 33 gears on the UH-1.

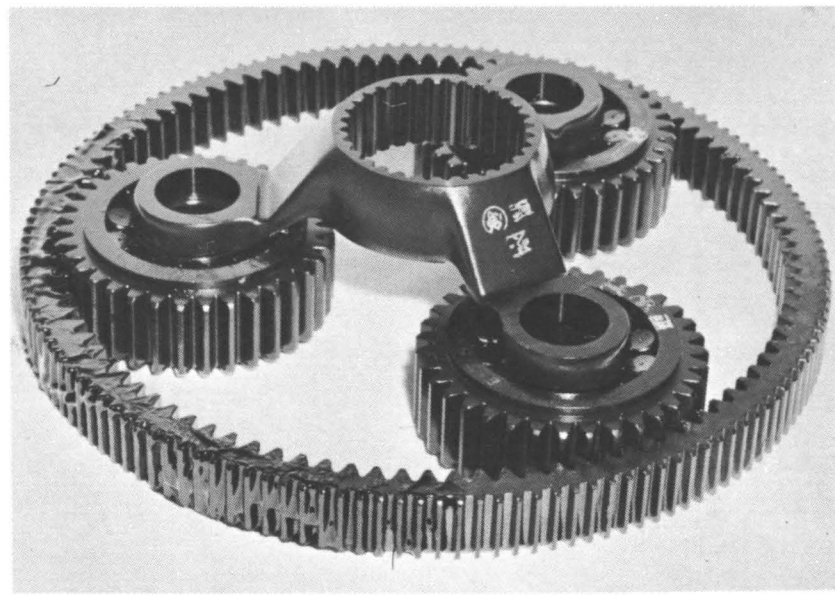
Simplification is further exemplified by the transmission in the use of only one accessory drive gear. This pinion drives a stacked package consisting of tachometer generator, hydraulic pump, and transmission oil pump. The control system hydraulic pump is mounted in a unique package which encompasses hydraulic reservoir, filter, and pump.

Improved Aerodynamic Efficiency

A unique characteristic of the OH-4A is the use of a non-symmetrical main rotor airfoil. This blade section features a relatively thin (11 percent thickness) airfoil compared with the OH-13, resulting in profile drag reduction of 17 percent. The leading edge is drooped, providing a 14 percent increase in maximum lift compared to the OH-13 blade. Combining this reduced drag with increased lift, the new blade section represents a substantial advancement in helicopter aerodynamic efficiency.

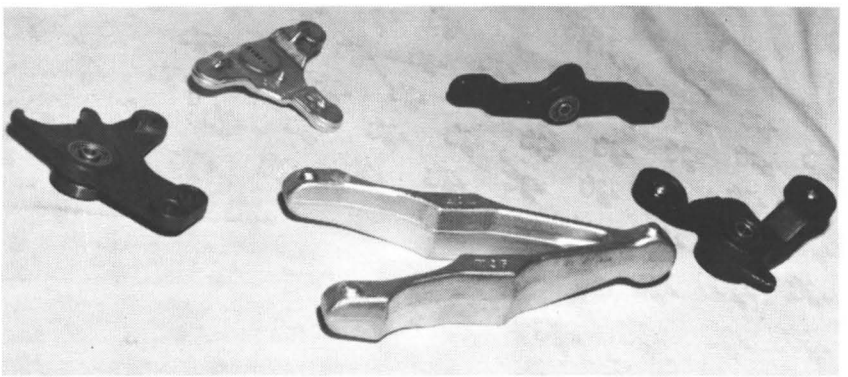
Fabrication of the main rotor blade has also been considerably

Transmission planetary gear reduction unit showing self-aligning and self-centering pinions supported by simple forged spider



simplified as compared with the OH-13 blade. Where the latter consists of 13 pieces, the OH-4A blade consists of only 6. The blade assembly consists of extruded leading and trailing edges plus upper and lower skins separated by flat milled honeycomb core. Again, in comparison with the OH-13, the OH-4A blade chord is 2 inches wider. Although the wider blade section does not offer an advantage in hover capability, it does provide 2½ g capability compared to 1½ to 2 g's for conventional design. This was felt to be essential to the maneuverability and safety required for true nap-of-the-earth flying.

For basic stability the OH-4A retains the Bell stabilizer bar rather than resorting to more complex electronic stabilization means. The bar is an improved version of the UH-1's "soft" or variable rate stabilizer bar. This system affords stability completely adequate for hands-off cruise flight while affording excellent maneuverability when the pilot applies control. Stabilizer bar dampers are a fixed orifice design eliminating the maintenance requirement for damper adjustment as in the UH-1 and OH-13.



Murphy-proof items — parts specifically designed to prevent their being installed backward

Maintenance Factors

Simplified maintenance is inherent in every part of the OH-4A design. The chart below indicates the substantial improvements made over the OH-13.

Another important feature designed to simplify maintenance is the use of numerous Murphy-proof items. Many castings and forgings have bumps or tabs added to prevent improper installation. Other parts are designed symmetrically for the same reason. Still others have markings such as "top" and "aft" embossed on their surfaces. Adjacent hydraulic fittings have been made intentionally in different sizes to preclude inadvertent reversal of lines.

Alignment Eliminated

Another significant feature incorporated to simplify field replacement of components is the elimination of all component alignment requirements. From the tail rotor gear box through the engine, transmission, pylon, rotating controls, and rotor, all parts are installed in fixed locations. This feature alone eliminates many special tools.

Another maintenance feature contributing to simplicity in the field is the very simple rigging procedure. The majority of the control system's components are of fixed length. To check rigging, a small nylon pin is inserted into the base of the pilot's cyclic to center controls. Rigging is then accomplished by dimensional checking of five adjustable control tubes in the system.

In several other areas, nonessential items have been eliminated to further simplify maintenance. For example, tail rotor pitch lengths are of fixed length; Thomas couplings are used on the tail rotor drive shaft in lieu of universal joints; and sealed or dry bearings are used throughout the ship to eliminate grease fittings.

	OH-13	OH-4A
PERIODIC	25 hr	300 hr
TIME BETWEEN OVERHAULS	1,200 hr (13 yrs)	1,200 hr (initial) 2,400 hr (design objective)
SERVICING		
Grease Gun Points	73 (25 hr)	0
Hand Grease Points (330 hr)	7	2
No. Oils	5	1
Oil Levels	Dipstick	Sight Gauge
SPECIAL TOOLS (Through 4th Echelon)	41	2

Servicing

One oil, type MIL-L 7808, is used throughout the OH-4A. This includes main rotor hub, swashplate, main transmission, turbine, tail rotor gear box, and the primary control system. This latter application is believed to be a first and eliminates requirement for hydraulic fluid, thereby simplifying logistics support. Other than hand packing of the input drive shaft couplings every 300 hours, no grease is required by the OH-4A.

A Pilot's Aircraft

To the pilot, the OH-4A has been designed to be not only safer but also considerably easier to fly than previous observation helicopters. The T63 turbine engine incorporates automatic rpm governing, the pilot being provided with a beeper switch for rpm selection within normal operating range.

Collective, cyclic, and rotor controls are all hydraulically boosted. Control forces are light even with boost-off. For safety, the pilot's and copilot's seats are a part of the basic airframe. Therefore, both cyclic and rotor pedals are adjustable for pilot comfort. The variable ratio stabilizer bar affords good hands-off stability combined with excellent control response. Because of the need for a high degree of maneuverability in nap-of-the-earth flying, as determined by Bell flight tests, the OH-4A has approximately twice the control response per inch of stick displacement in both pitch and roll as has the OH-13.

The instrument panel is arranged in a standard Army T pattern of directional gyro, altimeter, attitude gyro, and airspeed. In addition, a rate of climb indicator plus needle and ball afford an adequate panel for limited IFR flight. Primary engine instruments, torque and turbine outlet temperature, are located directly in front of the pilot.

Like the UH-1, the OH-4A incorporates a lighted word warning panel to alert the pilot of abnormal conditions. This system is mounted in a row above the instrument panel and warns the pilot of: excessive cabin heat, low ammunition, DC generator failure, inverter failure, high transmission oil temperature, low transmission oil pressure, partially blocked fuel filter, partially blocked oil filter, low fuel state, failure of either fuel pump, engine failure and low rotor rpm. Engine failure indicator is a flashing red light in the warning panel plus an oscillating tone in the pilot's earphones.

OH-4A Program Status

The first flight of the OH-4A was in December 1962. Throughout calendar year 1963, three test aircraft were put through the paces to prove performance and general characteristics and to resolve problem areas. Concurrently, the five delivery articles were manufactured. By late 1963 configuration was finalized, and on 14 January 1964 the OH-4A received a TIA (type inspection authorization) from the Federal Aviation Agency. All five OH-4As have been delivered to the Army, within the originally contracted delivery schedule. ☆

Cockpit interior showing standard Army instrumentation T-pattern

OH-5A

Continued from page 9

Around this engine the three manufacturers have each built a new helicopter within the Army specifications for an inexpensive, lightweight, simple, and easy-to-maintain machine.

This is Hiller's approach:

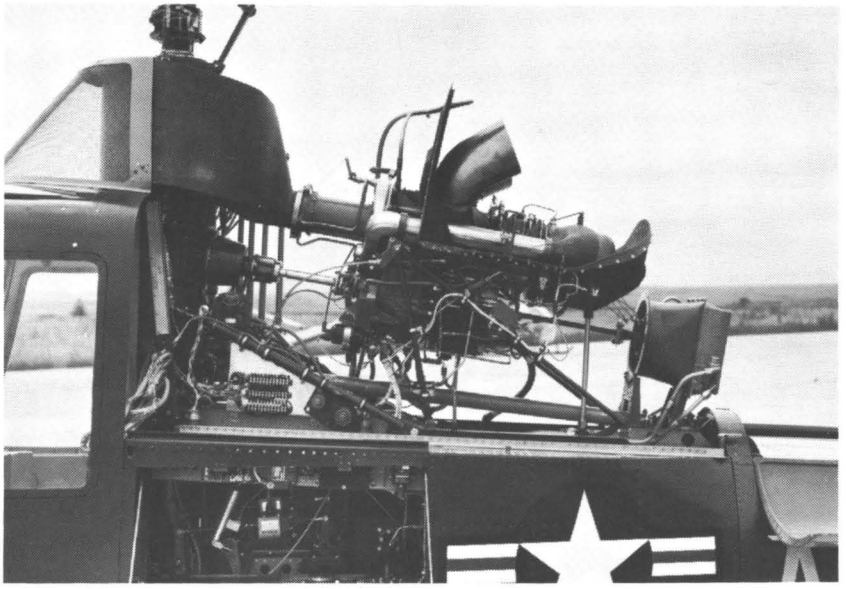
Because of the nap-of-the-earth flying technique inherent in latest Army tactical helicopter missions, Hiller engineers and designers reason that the LOH should possess handling characteristics heretofore unknown in military light rotorcraft to optimize maneuverability and safety. They teamed up with the Hamilton-Standard Division of United Aircraft Corporation to incorporate into the OH-5A a version of the electro-mechanical stability augmentation system now standard on late Hiller commercial models.

Providing continuous damping in the pitch and roll modes as well as attitude control, the OH-5A's stability augmentation system (SAS), combined with hydraulically powered controls, results in what Hiller describes as flight handling characteristics that surpass most fixed-wing aircraft. It can be flown or hovered indefinitely with hands off the controls.

Highly simplified and lightweight, the SAS consists of three basic elements: a sensor to detect aircraft motions and provide an electronic signal proportional to such motions, a power supply and signal modifying unit, and an electronic actuator to move the controls. Failure of the system in flight does not constitute an emergency, for it has limited authority and the pilot can easily override the system. In fact, the SAS can be switched off by the pilot.

Cross-country ferry flight of first OH-5A delivered to Army exposed the aircraft to a variety of climates and topography. Here, the OH-5A skims across tops of sand dunes in Arizona desert. Range is 3 hours at cruise speed.

Ease of access to entire engine is a prime consideration in OH-5A maintenance design, permitting simplified preflight inspection and routine maintenance. Lower compartment houses SAS servos, oil tanks and battlefield identification system. Top of tail boom hinges back to expose tail rotor drive shaft.



Ease and safety in nap-of-the-earth maneuvers is just one SAS advantage cited by Hiller. Others include more hours daily availability of the aircraft, because SAS permits flying at night and under marginal weather conditions; stability as a weapons platform; indifference to turbulence; and the hands-off capability that reduces pilot fatigue and facilitates such tasks as reading flight charts. Although the OH-5A pilot is relieved of the need to constantly attend cyclic controls, and thereby can devote a greater portion of the flight to the actual mission, the SAS is not an autopilot.

Much cleaner than rotor heads on present LOH, the OH-5A rotor hub is composed of just two large, interchangeable units and one smaller unit. Blade chord is a constant 10.2 inches, and the blades have stainless steel leading edges. Rotor diameter is 35 feet, resulting in disc loading of approximately 2.5 pounds/square feet and a rotor area of 960 square feet.

Rotor capability of the OH-5A permits a sink rate in autorotation that is about 400 fpm less than that of the OH-23 — about 1,400 fpm at the optimum forward speed. Hiller pilots have exhibited the aircraft's unique power-off handling by using the energy stored in the rotor system, forward speed, and the OH-5A's clean lines to climb out from the deck to 350 feet without the aid of the engine.

During a recent demonstration at Fort Rucker, the pilot came across the deck at under 10 feet at an indicated 105 knots, a typical OH-5A cruise speed. *He chopped the power and zoomed.* When he reached 250 feet, the pilot performed a complete 360° turn — still without engine power — and made a perfect zero forward speed landing.

SAS compartment doors on either side of OH-5A serve as maintenance platforms when open for access to engine top and transmission. Most engine maintenance is performed from ground level, while rotor hub inspection is accomplished from engine deck. Upper controls are reached by standing on the maintenance platform.

In a nap-of-the-earth situation, particularly in wooded areas, the pilot can react to an engine failure by climbing high above treetops to observe and maneuver into a desirable landing area.

The rotor system and airframe is designed to operate with an emergency overload of 500 pounds, or a 15 percent increase in gross weight.

Overgross considerations have also been built into the OH-5A's landing gear. It's constructed with energy-absorbing torsion tubes to soften hard landings and endure the thousands of rough terrain setdowns that the LOH's mission will necessitate during its lifespan. Gear struts are airfoils, and the fuselage attachment points are faired cleanly.

Crew and passengers in the OH-5A have full 360° visibility, with rear vision provided through plexiglass windows that straddle the engine cowling. The tail rotor is visible through these windows for safety in close-quarter landings.

To facilitate visibility and communication between cabin occupants, the cabin has no bulkhead to separate crew from passengers. Rear seats fold down into a well, leaving a flat, clear surface for cargo stacking. Front seats are buckets. Rear doors slide open and can remain open in flight.

Even seasoned helicopter pilots climbing into the OH-5A for the first time will have a few lessons to learn, not the least of which are the effects of the aircraft's clean lines. Twenty-five different fuselage shapes were wind-tunnel tested by Hiller before choosing the OH-5A configuration, after which aerodynamicists concentrated on local drag reduction. The underside of the fuselage is aerodynamically clean and uninterrupted. The airfoil-shaped landing gear

struts align with the airstream, and sliding cabin doors close flush. Even rivets in the forward portion of the fuselage are flush.

A pilot accustomed to earlier observation helicopters will learn during his first running approach in the OH-5A that the bird has a tendency to keep flying. Such unhelicopter-like characteristics of the OH-5A as smoothness and rapid power response are quickly apparent to the newly initiated pilot. But, he will want to watch the airspeed indicator.

In line with the Army's requirement for an LOH that is easy to maintain, the OH-5A has a single cowling unit that slides aft on tracks to expose the entire engine, accessories, drives and controls. Through-compartments on either side of the aircraft, located directly below the engine compartment, house the SAS servos, oil tanks, and battlefield identification equipment. Compartment doors are maintenance platforms when open. Most of the engine is easily serviced from ground level; the transmission, upper controls, and top of engine from the intermediate level (compartment door platforms); and the rotor head from the engine deck.

Ten sight guages that indicate lubrication and hydraulic fluid levels simplify OH-5A preflight and maintenance checks. Four are on the main rotor head, one each on intermediate and main tail rotor gear boxes, one for each of the hydraulic systems, one for engine oil, and one for transmission oil.

Much higher performance can be achieved within the present envelope of the OH-5A. It has been designed to accept twinned 250 hp engines or a single 500 hp engine, increasing maximum permissible speed to about 160 mph without costly, major modifications. Several other compound versions under study at Hiller would push the aircraft into the 200 mph-plus Vne category.

Historically, performance requirements of military aircraft have been increased to keep pace with changing mission requirements. The UH-1, for instance, was conceived as a 600 hp machine, but the D model now in Army service has 1,100 hp.

With this in mind, Hiller design philosophy is to build an aircraft that will meet today's mission requirements, and yet be able to grow with the dynamics of tactics.

When the Army decided in 1959 to replace its existing rotorcraft and fixed-wing aircraft with primary missions of observation with a single helicopter, Hiller was one of 40 companies that participated in an Army-sponsored definition of requirements for an LOH that optimized current technology.

In 1961, the Army named Hiller, Bell, and Hughes as winners of an industry-wide design competition.

During the six-month evaluation program presently underway, the five aircraft from each company will be subjected to the following tests.

Ship One— Logistical evaluation to determine reliability and ruggedness of aircraft, i.e., ratio of down-for-maintenance to flight hours, etc. Fort Rucker 1,000 hours.

Ship Two— Examination of engineering and aerodynamic characteristics, checking of manufacturer's guarantees. Edwards AFB, 80 hours.

Ship Three— Tactical and operational suitability trials, including simulated combat situation flights. Fort Rucker, 300 hours.

Ship Four— Engineering tests of armament installations at Edwards, 36 hours. Then transfer to Rucker for more extensive operational tests of armament systems under combat situations, 50 hours.

Ship Five— Testing of avionics equipment, and determination of radar reflectivity. Fort Rucker, 100 hours. ☆

Lightweight fiberglass engine cowling, which slides aft for routine engine inspection and maintenance, can be completely removed for major overhauls

OH-6A

Continued from page 11

The helicopter may be zoomed to a high vantage point in the event of engine failure, and the small size of the helicopter allows landing in an area restricted by obstructions.

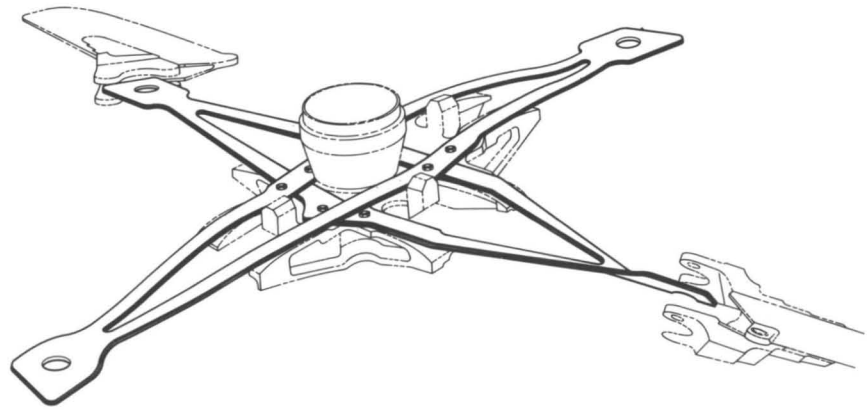
"Nose-high autorotational landings do not induce nose-down pitching that is usually experienced with skid gear. This shock absorbing landing gear will prevent tail boom and main rotor blade intersection, which has been a frequent cause of accidents in helicopters equipped with skid gear. The short distance from the pilot to the tail rotor allows safer steep flares close to the ground when zero speed touchdowns are desired. Power recoveries are easily made without compromising safety by automatic selection of maximum N_2 when making the recovery."

Powered by the 250-horsepower Allison T63 jet engine, the OH-6A has a guaranteed continuous cruising speed of 144 mph (125 knots) and a Vne (Velocity never to be exceeded) of 147 mph (128 knots). However, during test flights the Hughes design maintained true airspeeds of more than 160 mph and on its delivery flight to Fort Rucker, it attained groundspeeds in excess of 180 mph.

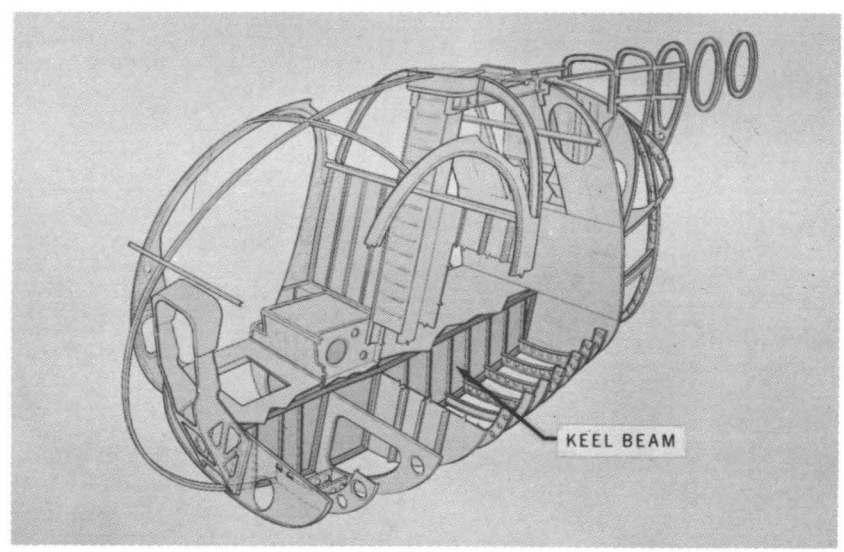
The OH-6A is only 23 feet in length; the four-bladed rotor has a diameter of 26 feet; and it stands slightly over 8 feet high at the top of the rotor fairing. The design gross weight is 2,100 pounds, and the empty weight is 1,084 pounds.

At design gross weight on a 95° day, the Hughes LOH design is capable of hovering at 6,000 feet out of ground effect. At sea level the OH-6A has a rate of climb of more than 2,000 fpm at design gross weight. The Hughes design is capable of carrying a pilot and 400 pounds of payload 320 nautical miles at cruising speeds.

The OH-6A is possibly the most rugged light helicopter ever developed. Structural integrity of the aircraft is enhanced by a central pyramid structure formed by the two main bulkheads in combination with the main longitudinal beams and longerons. Rotor loads, landing loads, as well as the major mass inertia reactions are transmitted directly through this pyramid, or A-frame structure, and the cockpit and crew compartment



New blade retention system replaces need for antifriction bearings normally used on rotor head system. Comprised of 15 stainless steel straps, this system eliminates the need of lubrication, assures high reliability with minimum maintenance.



Semi-monocoque, energy absorbing construction results in minimum weight, providing superior safety characteristics. Deep keel beam places structure between pilot and ground. Intercostals, stringers, stiffeners and ribs use C flange, reverse lips and rolled flanges for maximum strength

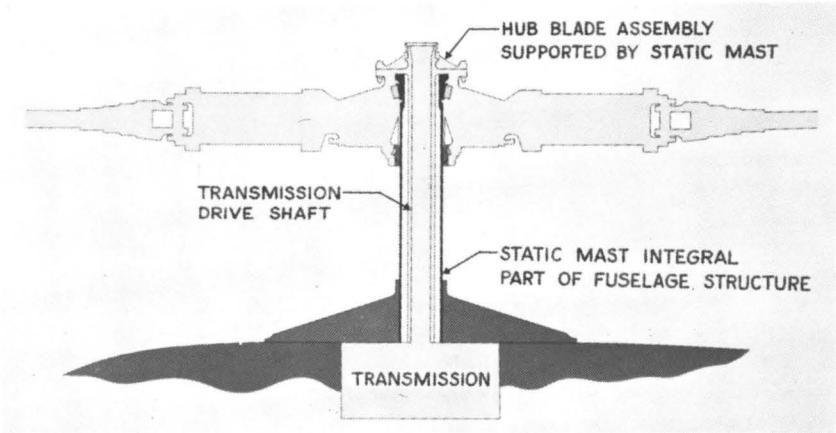
will retain their basic shape in a crash landing of relatively high impact. This is a radical departure from traditional helicopter designs where the cabin is forward of the central structure.

The OH-6A's cockpit and crew compartment are further protected in a high-impact landing by the engine's location behind the occupants rather than above them. Additional crew protection is obtained by seats that are an integral part of the structure and by the double-walled keel assembly that yields progressively under impact energy.

The four-bladed, fully articulated main rotor system of the OH-6A has an exceptionally low drag factor, and therefore provides the aircraft with highly desirable autorotational characteristics. The autorotational glide ratio is 6 to 1, and the rate of descent is relatively slow (measured at 1,470 fpm at full gross weight). So the pilot facing an emergency situation is able to choose from a number of landing areas. Under combat conditions this is a highly important factor in favor of the safety of personnel and equipment.

Another reason for equipping the OH-6A with a fully articulated four-bladed main rotor system is its weight-saving features and excellent high speed flight characteristics. This rotor system greatly reduces the amount of vibration transmitted to the cabin, another important safety factor when consideration is given to pilot fatigue and component life.

The strap retention system used on the main rotor assembly is an outstanding example of design simplicity that results in low maintenance and high reliability. The lubricated, antifriction bearings normally used on rotor head systems have been replaced by laminated, stainless steel straps on the Hughes OH-6A. Each pair of blades, diametrically opposed, is connected by 15 laminated straps. Therefore, centrifugal force is countered by the straps and not the hub. Full flight loads may be carried by any 9 of the 15 straps, thus making the retention system infinitely reliable. Tests have demonstrated an indefinite life capability for these straps.



As rotor hub is supported by static mast rather than transmission drive shaft, dynamic loads of rotor system are not transferred to the transmission. This not only assures maximum safety, but minimum maintenance of transmission and drive shaft components.

Individually mounted oleo shock absorbers on the landing gear permit landings under emergency conditions on steep slopes with the nose high and no danger of pitching that might force the main rotor into the tail boom. Landings and takeoffs from slopes up to 20° are feasible with the OH-6A.

Although the external configuration of the OH-6A has been kept as small as the design requirements would permit, the internal cargo volume exceeds any helicopter in its horsepower class. The 40 cubic foot cargo compartment is centered beneath

Although designed to carry four persons, the OH-6A under overload conditions can safely transport five combat troops and pilot with a full load of fuel.

the main rotor mast, making nearly indiscriminate loading possible.

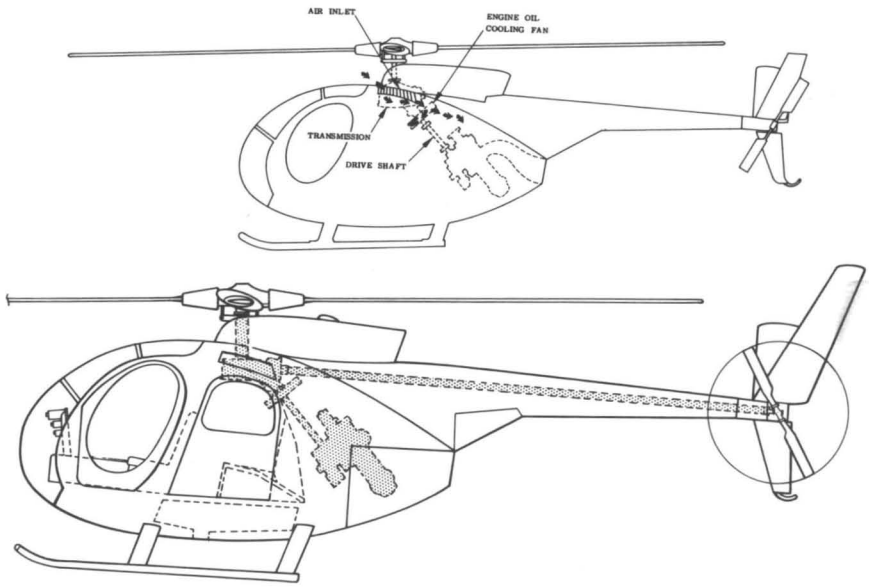
The small size, light weight and high performance characteristics of the OH-6A make it ideally suited to the performance of missions set forth by the Army's original LOH specifications, which read as follows:

"The primary missions for which this helicopter will be employed are visual observation and target acquisition, reconnaissance, and command control. To the extent compatible with the primary missions, the helicopter shall be readily adaptable to utility tasks at the combat company level without use of special kits or special attachments, except for installation of light armament. . . ."

All of these missions require a helicopter that is swift, highly maneuverable, and able to take advantage of every possible source of cover with nap-of-the-earth flying. With its small rotor diameter and size, the OH-6A has no trouble flying through forests and down narrow valleys to avoid detection by the enemy until the last possible moment. Helicopters with larger dimensions would often be forced to fly in the open under the same conditions, thus greatly increasing the danger to crew and reducing the chances of successfully performing the mission.

Although the OH-6A is designed to carry four persons, under overload conditions it will safely transport five combat troops and the pilot in addition to a full load of fuel. This will provide frontline combat companies with the mobility necessary to successfully wage fast-moving brushfire type of warfare.

Due to its light weight, the Hughes OH-6A achieves the desired degree of stability with conventional mechanical control systems comprised of simple push-pull tubes and bell cranks that assure the greatest reliability with the lowest possible maintenance factors. There is no need for servos or hydraulic booster systems, which only increase the chances for failure.



Top: Self-contained oil system. The transmission is cooled by inlet air to engine oil cooling fan. No external apparatus needed to cool or lubricate transmission (oil never leaves gear box).

Below: Drive shaft between engine and transmission requires no greasing.

In designing the Hughes LOH, careful attention was given to the safety and comfort of personnel. The cockpit configuration provides the pilot with 360° visability in the azimuth plane, 350° visibility in the right-left vertical plane, and 230° visibility in the fore-aft vertical plane. The instrument panel offers minimum restriction to visibility and is similar in arrangement to the panel developed by the Army for its UH-1 trainer.

Another major advancement in helicopter design has been achieved with the OH-6A's main gear box and oil cooling system. The cooling air is drawn downward through air intakes at the top of the fuselage and through a shroud enclosing the gear box. The air is then discharged through the fan and into the engine oil cooling system. This dual purpose system results in a great savings in weight and complexity. The fan mounted on the drive shaft eliminates the need for any additional mechanical or V-belt drive systems, and has completely done away with the bulky oil heat exchangers used by conventional helicopters.

Overall maintenance of the OH-6A will be less than 1 hour for every 5 hours of flight. This includes time for overhauls. Greasing is never required on the OH-6A, and the Army can throw its grease guns away when maintaining this ship. All field maintenance operations on the Hughes LOH design can be performed by a single mechanic with standard hand tools. This includes changing the engine, which is conveniently located for quick servicing from the ground by one man. ☆

Continued from back page

Obtaining IFR clearance to circumnavigate severe weather can often be accommodated more readily in the en route areas away from terminals because there is usually less congestion and therefore greater freedom of action. In terminal areas the problem is more acute because of traffic density, ATC coordination requirements, complex departure and arrival routes, adjacent airports, etc. As a consequence, controllers are less likely to be able to accommodate all requests for weather detours in a terminal area or be in a position to volunteer such routes to the pilot. Nevertheless, pilots should not hesitate to advise controllers of any observed severe weather and should specifically advise controllers if they desire circumnavigation of observed weather.

WEATHER PHENOMENON AS OBSERVED ON RADAR

It must be recognized that those weather echoes observed on radar (airborne or ground) are a direct result of significant precipitation. RADAR DOES NOT DISPLAY TURBULENCE. It is acknowledged that turbulence is generally associated with heavy areas of precipitation; however, all radar utilized for air traffic control purposes is not capable of equally displaying precipitation information. Under certain conditions in the past, the echoes received from precipitation have rendered ATC radar unusable. To avoid such disruption to radar service, modifications designed to considerably reduce precipitation clutter have been added to ATC radar systems. This feature, known as circular polarization, eliminates all but the heaviest areas of precipitation. Consequently, all areas of precipitation will not appear on the controller's radar scope.

In accordance with current procedures, controllers will provide information concerning severe weather echoes observed on their radar when deemed advisable and will, upon pilot request, provide vectors for avoidance whenever circumstances will permit. However, for the reasons outlined above, it is emphasized that pilots should not completely rely on air traffic controllers to provide this service at all times, particularly in terminal areas or in holding patterns. Pilots should also recognize that the controller's data is often far from complete due to the design of the radar and its location relative to the weather observed.

In addition to primary surveillance radar, all Air Route Traffic Control Centers and some terminal facilities are also equipped with secondary radar systems. These secondary systems receive only those signals emitted by airborne radar beacon transponders and do not display weather echoes. Since all aircraft operating in positive control areas are required to be equipped with operating radar beacon transponders, controllers handling such traffic normally utilize only the secondary radar system. This permits filtering out nonpertinent traffic operating below the positive control areas. Although controllers using only secondary radar will not observe any weather on their scopes, they can, if alerted, often turn on the normal radar to observe weather, provided this will not result in weather clutter rendering the scope unusable for traffic control. One exception is the Great Falls ARTC Center which, at this time, does have this capability.

RECOMMENDED ACTIONS

PILOTS

AVOIDANCE OF KNOWN SEVERE WEATHER — Recent research has proven beyond any doubt that all thunderstorms are potentially dangerous and should be avoided if possible or penetrated only when the pilot has no other choice.

FORWARD REPORTS to ATC of any severe weather encountered, giving nature, location, route, altitude and intensity. Pilots are also reminded to review Federal Air Regulation 91.125 pertaining to pilot reports.

INITIATE REQUESTS to avoid severe weather activity as soon as possible being specific concerning route and altitude desired. Pilots are reminded to review the Flight Information Manual pertaining to "Detouring Thunderstorms" and "SIGMET Procedure."

ADJUST SPEED as necessary to maintain adequate control of aircraft in turbulent air and advise ATC as soon as possible.

Do not rely completely on air traffic controllers to provide information or to initiate radar vectors to aircraft for avoidance of severe weather, particularly when arriving and departing terminals or in holding patterns.

PLAN AHEAD to anticipate the need for avoiding areas of known severe weather. If necessary, delay takeoff or landing, as applicable.

CONTROLLERS

SUGGEST UTILIZATION of alternate routes, whenever possible, to avoid known areas of severe weather along normal or requested routes.

EXPEDITE ACTION on requests for route/altitude deviation to avoid known areas of severe weather. Such requests are time critical.

RELAY PILOT REPORTS of severe weather or other flights as appropriate and, if necessary, initiate requests for additional reports to aid in anticipating requests for detours.

PLAN AHEAD when known areas of severe weather conditions exist and provide pilots with maximum information, rendering assistance in avoiding such areas when requested.

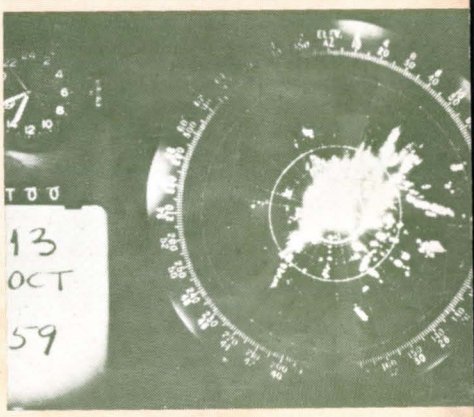
—FAA ADVISORY CIRCULAR 90-12

Every aviator knows he should avoid severe turbulence when flying. A new FAA advisory pinpoints the limitations and responsibilities of ATC controllers to help pilots

Keep in Touch With the Weather!

This sequence shows what happened when weather forecast was ignored. Top photo of

radar scope (and clock) shows T-bumpers in area. Bottom photo taken 1 hour later shows



T-bumpers still present. Middle photo shows what's left of Beaver that tried to go through.

THE NEED FOR exercising prudent judgment with regard to flight through areas of known or forecasted severe weather is well recognized by experienced airmen. Flight through severe weather activity should be avoided if possible.

Present procedures provide for controllers assisting pilots, particularly when operating on IFR flight plans, in avoiding areas of known severe weather. It is important, however, that all parties concerned with aircraft flight operations be fully aware that there are, at times, limitations to an air traffic controller's capabilities to provide such assistance. There are several reasons for this. First, it should be recognized that the controller's primary responsibility is the provision of safe separation between aircraft. No additional services can be provided which will derogate performance of a controller's primary responsibility. Secondly, limitations of ATC radar equipment, communications congestion, other air traffic, etc., may also reduce the controller's capability to provide any additional services.

To a large degree the assistance that might be rendered by ATC will depend upon the weather information available to controllers or the request by pilots desiring to avoid severe weather areas. Due to the extremely transitory nature of severe weather situations, information available to controllers might be of only limited value unless frequently updated by pilot reports or radar weather information.

Inflight reports from pilots in direct communication with controllers, giving specific information as to area affected, altitudes, intensity and nature of severe weather, can be of considerable value. Such reports when received by controllers should be relayed to other aircraft as appropriate.

Should a pilot desire to avoid a severe weather situation along his route, he should request such deviation from route/altitude as far in advance as possible, including information as to the extent of deviation desired. Controllers should bear in mind that limitations of airborne radar, limited flight visibility, and the speed of modern aircraft may result in pilots having only a limited amount of time in which to avoid a detected weather condition they might wish to avoid.

Continued on inside back page