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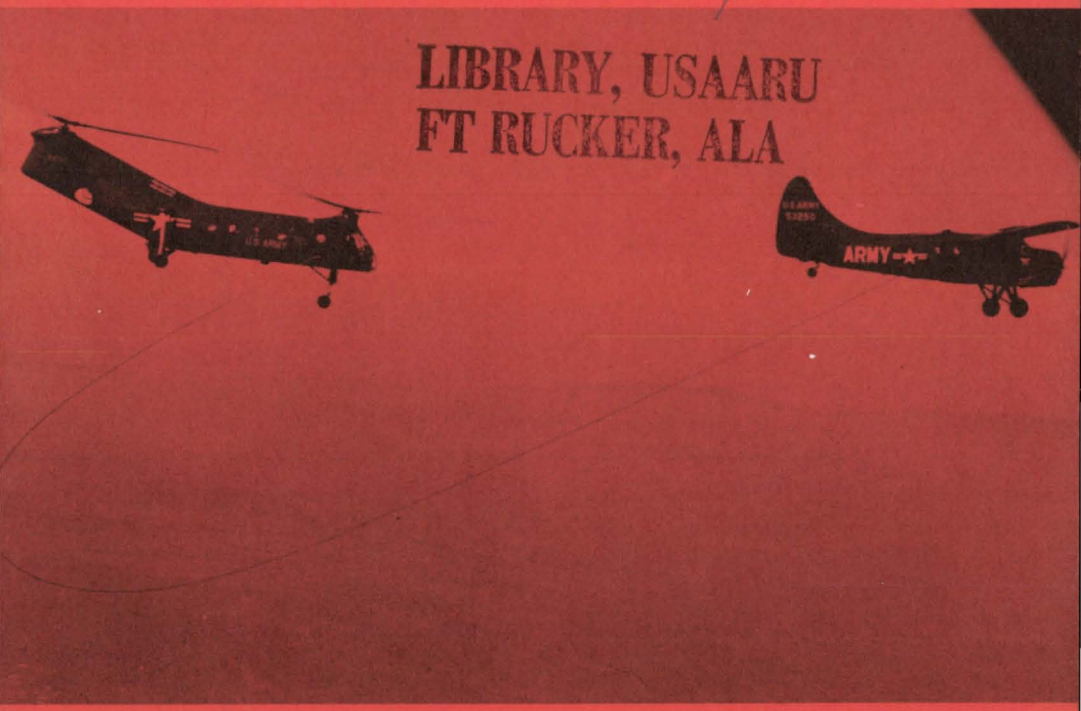

ARMY AVIATION SCHOOL
FORT RUCKER, ALABAMA

OCTOBER 1956 VOLUME 2 NUMBER 10

ARMY AVIATION SCHOOL

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ARMY AVIATION
DIGEST

VOLUME 2 | OCTOBER, 1956 | NUMBER 10

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COVER: H-21 being refueled in the air by a U-1A Otter tanker airplane. This was a practice run as a prelude to the record-breaking, coast-to-coast flight in an H-21. See page 10.

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PLEASE READ IT AND PASS IT ALONG

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The printing of this publication has been approved by the Director of the Bureau of the Budget, 15 March 1956.

The ARMY AVIATION DIGEST is an official publication of the Department of the Army published monthly under the supervision of the Commandant, Army Aviation School. The mission of the ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

Manuscripts, photographs, and other illustrations pertaining to the above subjects of interest to personnel concerned with Army aviation are invited. Direct communication is authorized to: Editor-in-Chief, ARMY AVIATION DIGEST, Army Aviation School, Fort Rucker, Alabama.

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THE COMMANDANT'S COLUMN

Brigadier General Carl I. Hutton, *USA*
Commanding General, The Army Aviation Center

The views expressed in this article are the author's and are not necessarily those of the Department of the Army.—The Editor

Economics of the Military Helicopter

SOON OR LATE, the subject of ton-mile costs is brought up in discussions about Army helicopters. These costs are high and they can be made to look exorbitant when they are compared with the wrong figures—such as motor van, railroad, ocean shipping, and air freight costs.

We seldom make computations of ton-mile costs for tactical movements of supplies and personnel. Tactically, the problem is to do the job, and helicopters in many cases can do the job more efficiently than it is being done at present. An example from Korea will illustrate the point. An infantry battalion occupied a front line position. Over 400 Korean Service Corpsmen were used to "chogie" supplies to the battalion by A-frame. Upon one occasion two H-13 helicopters were substituted for the 400 laborers. These two reconnaissance helicopters were able, by their speed and lifting power, to surpass the job done by the KSC's.

If helicopters are considered as simply additional equipment which is added to the Army, their costs tend to place them in the category of luxury items. These days of shrinking budgets inevitably bring danger to all luxury programs. With this approach, it is very likely that the Army will be able to afford a few machines for special purposes such as the evacuation of casualties but that might well be the limit.

A true measure of the helicopter's value to the Army would be how much in equipment and man-power can it replace. Because it

flies at average speeds of many times the average speeds of surface transportation, one helicopter can do the work of several trucks. The savings from this characteristic begin to accumulate all of the way back through the system. If the air transported vehicles of an airborne division could be reduced 20% to 40%, major savings would reach to Troop Carrier Command. These are savings which should be taken into account when figuring military helicopter costs.

In order to make these savings possible, military helicopters must be put to work on a daily basis within the units to which they are assigned, or they cannot replace vehicles which are available to the commander twenty-four hours each day. The secret of the reduction of ton-mile costs in air freight was the combination of larger airplanes, faster speeds, and pooled operations. The helicopter solution appears to be just the opposite. Smaller helicopters assigned directly to the user can realize the advantages of the miraculous flexibility of the helicopter, and become economical through their capability of replacing ground transportation.

This method of calculation of course cannot be applied to commercial helicopter operations. There the helicopter will probably find its field in doing work which it alone can do well. The military problem is entirely different and high commercial ton-mile costs should not be allowed to confuse the issue.

OPERATION GRANITE MOUNTAIN

1st Lt James C. Greenquist, *Inf*

MAJOR JEROME B. FELDT finished dinner in the air-conditioned cafeteria at Bisbee-Douglas International Airport and was sauntering out into the hot Arizona twilight. The time was about 1800 hours, 30 June 1956. Little did the Commanding Officer of the 14th Army Aviation Company realize that in a few short hours he and his outfit would be engaged in an extremely hazardous mission that would catch and hold the attention of a watching nation.

Normally stationed at Fort Riley, Kansas, the 14th, along with the 93rd Transportation Company, was providing support for an important mission in establishing and evaluating procedures in air control and tactical navigation. A part of his duties included an operational position: Deputy Commander for Operations at the Sub-Post of Fort Huachuca which had been set up at Bisbee-Douglas.

A few moments later Major Feldt was on the telephone talking to his Commanding Officer, Major Griffith E. Cook. Two commercial aircraft were long overdue and Major Cook wanted to know if Major Feldt's unit had been asked to assist in search and rescue.

"First I've heard about it," Major Feldt explained. "I'll tell you what, Griff. I'll get in touch with the CAA and the air line people and see what I can find out."

"Keep in touch," Major Cook requested.

The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

Pictured are the men and officers of the 93rd Helicopter Co. who participated in the Grand Canyon recovery operations. In the picture are, left to right, kneeling, 1st Lt Paul S. Walker, CWO George D. Brinto, Jr., CWO Donald R. Wright, CWO Donald Mallow, Jr., WO Thomas B. Deason, WO Robert Whatley, Jr., CWO Wilbur M. Isenberg, CWO Lowell D. Johnson, CWO Billy L. Parsons, CWO David R. Saylor; standing, 1st Lt Henry B. Grudberg, SP3 Ronald R. Granger, SP3 Muriel G. Tunnell, Pfc James R. Palizzolo, Pfc Robert G. Rogers, SP3 Bob A. Lee, Pvt Bernard C. Nugent, SP2 William J. Gottlieb, SP3 Ronald O. Wolhart, 1st Lt Jack B. McDougall, Capt Walter E. Spriggs, and Capt Morgan H. Mathews.

After promising to keep his CO informed, Major Feldt contacted the Civil Aeronautics Administration and air line officials without getting any news. He called Flight Service and soon learned that there had been a crash in the Winslow, Arizona, area. A Captain Ryland of the Air Force had been designated as "Mission Commander" for the search. Talking to Captain Ryland, Major Feldt learned that one aircraft had been spotted deep in the Grand Canyon.

Captain Ryland wanted to know what type of equipment the Army had at Bisbee-Douglas and, when told this consisted of nine U-1As of the 14th and four H-21s of the 93rd, asked that help be given in search and rescue.

After obtaining permission from the Chief of Staff, Fort Huachuca, Arizona, Major Feldt alerted his company and the acting commanding officer of the 93rd Transportation Company, Captain Walter E. Spriggs.

Major Feldt and Captain Spriggs flew over to Winslow and reported to Captain Ryland. The Air Force officer gave them a short briefing and maps of the area marked with the crash site of one of the aircraft. He also told them that two Air Force helicopter pilots had surveyed the area and determined that helicopter operations below the rim of the canyon was impractical due to turbulence in the canyon. While this briefing was going on, the second aircraft was reported found in a nearly inaccessible spot within the canyon.

Sheriff Richardson of Coconino County, Arizona, telephoned Major Feldt and told him it was impossible to reach the sites of the crashes except by helicopter. Major Feldt promised to pick up the

---

1st Lt James C. Greenquist *is the Public Information Officer for Bisbee-Douglas Sub-Post (Prov), Douglas, Arizona.*

Members of the 14th Army Aviation Co. (fixed-wing) who participated in the Grand Canyon recovery operations. From left to right, standing, they are: Lt Roy Hudson, Lt Kenneth Niederbrach, 1st Lt Donald Melton, Capt Kenneth McGaughey, Lt Warren Strong, Lt John Ahern, Major Jerome Feldt; kneeling, SFC Earle Hogan, Pfc James Pierce.

sheriff as soon as possible.

As Winslow was beyond the fuel range of the Otters and the Workhorse, Major Feldt recommended that a base of operations be set up closer to the scene of the crash. After making a reconnaissance of the area it was decided to base at Grand Canyon Airport, just 22 miles from the worst disaster in aviation history.

Soon after setting up operations, TWA and United Air Line officials arrived and found Major Feldt standing by to assist in every way possible. Arrangements had been made for mess and quarters and a plan of organization laid out. Captain Spriggs was appointed executive officer of the operation. 1st Lt Paul Walker, 93rd Transportation Company, and 1st Lt John Ahern, 14th Aviation Company, were named operations officers. Captain Spriggs was additionally charged with the responsibility of advising on the capabilities and use of the H-21s. Lieutenants Walker and Ahern also acted as aircraft dispatchers and maintained other operational records.

At daylight, 2 July, Operation Granite Mountain began functioning. A quick flight over the crash area confirmed the Air Force pilots' reports of the location of the wreckage. No signs of life were visible. Captain Spriggs and CWO Howard Proctor flew the helicopter and Major Feldt flew cover in the U-1A. Aboard the helicopter were two para-medics and Warrant Officer Robert Whatley, a 93rd pilot who volunteered to work with them. The Workhorse also carried county officials and about 1,000 pounds of equipment and supplies. Six photographers and a radio station representative were aboard the Otter observing the first flight.

Captain Spriggs and his co-pilot made the descent into the can-

yon after lightening their load by discharging three passengers at the canyon rim. After a thorough reconnaissance of both crash sites they landed on a small pinnacle about 60 yards from the main wreckage of the TWA airliner. The passengers were discharged and the H-21 returned to the southeast rim where the three men previously left off were picked up and returned to the crash site. After landing these passengers, Captain Spriggs attempted to land near the UAL wreckage.

The UAL site was extremely dangerous because of its location on a finger ridge extending from Chuar Butte. Up and down drafts and violent eddy currents plagued the only approach into the site. The air was extremely turbulent, caused by the rugged terrain and high temperature. The fact that the finger ridge rose about 1,400 feet from the canyon floor meant that structural failure or poor judgment would result in almost certain fatality. Two attempts to land on the precarious ridge failed because of wind and heat-created turbulence.

Meanwhile Civil Aeronautics Board and air line officials were ferried into the canyon and the work of removing the victims from the TWA site continued. These were air-lifted to the rim and transferred to the Otters for the flight into Flagstaff, Arizona. Late in the afternoon, the H-21 attempted another unsuccessful landing at the UAL site, after which flying had to be suspended because of high winds and severe turbulence. A call was now put in for Swiss mountain climbers.

On 3 July four helicopter flights were made into the canyon to establish a base camp on a sand bar below the UAL crash site. Ten recovery and investigation personnel and 2,000 pounds of equipment were delivered to the sand bar at the confluence of the Colorado and Little Colorado rivers. TWA site personnel were resupplied, and the canvas bags containing the dead were ferried out. Flying again had to be suspended early because of turbulence in the canyon. The chances of landing on the finger ridge where the UAL flight came to final rest lessened.

A sudden high pressure area moved across the rugged country on the sixth day, bringing cooler air with light winds. Acting quickly to capitalize on this break in the weather, Captain Spriggs and Mr. Proctor dropped down to the base camp on the river and picked up a mountain climber and 200 pounds of gear. Circling to gain altitude, they flew directly to the hitherto inaccessible UAL crash site, making a successful landing within 50 feet of the crash in a space not much

larger than the helicopter itself. Following this successful landing, a second helicopter brought another climber up, and Captain Spriggs briefed the second pilot by radio on the proper approach. Within the following two hours, Mr. Whatley and six other mountain climbers were delivered to the UAL crash site with gear and provisions. Mr. Whatley, a native of Georgia, had little mountain climbing experience other than that gained in the escape and survival school in Korea, but quickly adjusted himself to the climbing techniques of the Swiss experts.

On 9 July, after four flights on the southeast rim in a final search for remains or wreckage, plus a flight along the Colorado river on the same mission, the unit returned to Bisbee-Douglas Sub-Post. During the nine day operation the helicopters flew a total of 131:55 hours, while the Otters logged 142:05 hours, with a total of 139 separate flights. Eighty-four passengers, 68 crash bags, and 12,400 pounds of cargo were hauled.

All over the land the Army was lauded. The powerful and respected Air Line Pilots Association were high in their praise for "the magnificent job performed by the Army. The assistance of this unit aided beyond our ability to estimate the investigation efforts and the recovery of the bodies.

"It was very clear that the investigation could not have been successful without the assistance of the helicopters and their support equipment to bring in the investigators and rescue workers. We wish to express our admiration for the initiative and operational 'know-how' exhibited by Army Aviation at Grand Canyon. We think that the service rendered in this case shows the possibility of Army Aviation being of great service to the U.S. in case of civil or national disasters."

Along with the personal thanks of the Air Line Pilots who participated in the operation, gaining first-hand knowledge of Army Aviation in action, the *New York Times* paid special tribute by stating editorially: "One unassailable certainty stands out and that is the superb courage of the Army helicopter crews who made possible the recovery of the bodies from this horrible disaster. From the first day, when these crews fought turbulent air to reconnoiter and land, to the mass funeral services at Flagstaff at which five members who risked death daily stood as part of the honor guard, these men distinguished themselves by selfless devotion beyond the ordinary call of duty."

COAST TO COAST IN AN H-21

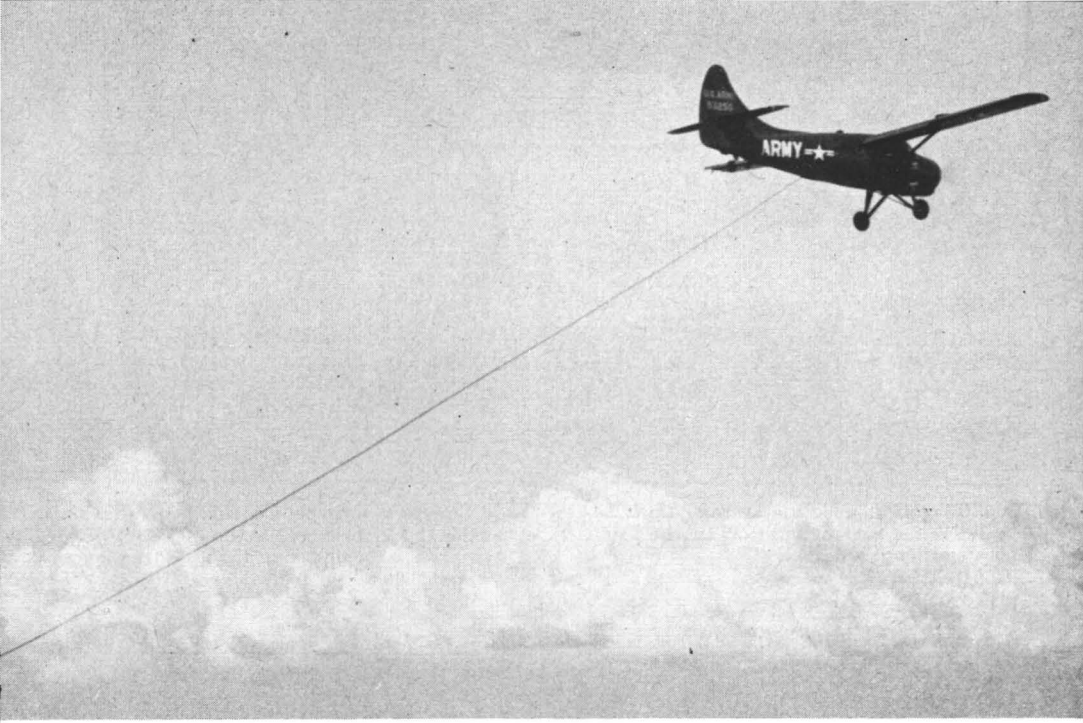
William E. Vance

AN ARMY H-21, flailing away at an early morning ground fog, shook the earth loose, and lumbered away from Miramar Naval Air Station near San Diego, California, heading eastward toward the mountains. Inside the craft, two Army aviators, Maj Hugh Gaddis, Capt James Bowman and a Department of the Army civilian test pilot, Mr. Joseph Givens, exchanged a few words on the intercom, then settled down to the tedious job that stretched nearly three thousand miles and thirty hours ahead. A grueling grind across mountain, desert and plain that would test both men and machine.

Almost on the hour of their estimate, the H-21, known affectionately to the crew as "Amblin' Annie," settled to the ground before the Pentagon and another world record had fallen to Army aviation.

Across treacherous mountain passes, turbulent desert air,

The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor



The H-21 being refueled by the U-1A Otter, tanker. Fuel transfer time is 17 minutes.

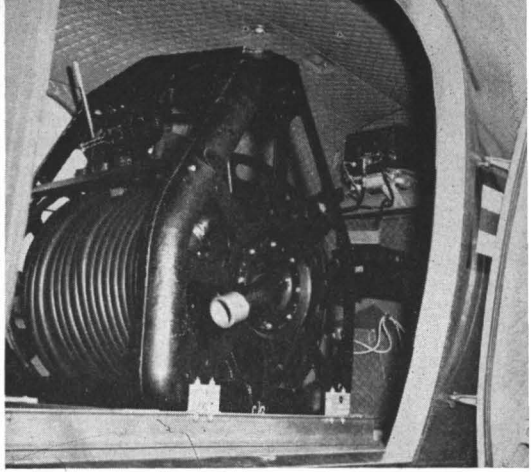
"Amblin' Annie" shook and thundered. Over oil fields and cities and ranches and the wide Mississippi to final victory. But the story started three months ago, when Capt Bowman and Mr. Givens, the latter an ex-Navy fighter pilot, and both assigned to Board 6, established the first of a number of world records for the Army with a 30-plus hour sustained flight in an H-23 around a closed circuit course. In this pre-coast-to-coast phase, it was established that rotary-wing aircraft could be operated efficiently without resorting to frequent maintenance or periodic checkups. Crew fatigue, while a definite factor, also did not appear to limit long flights. Refueling from a hover was tried at this time and found to be practical.

Following this endurance run, Army aviation startled the world by casually announcing through the Department of Defense that a world distance record had been set. Lt Col Harry L. Bush and Maj William C. Dysinger, also of Board 6, had taken the old distance record from France, just a short time after Captains E. D. Hill and C. E. Hargett broke three world speed records in the H-34.

All these tests resulting in new records were in preparation for the cross-country flight of "Amblin' Annie." After the series of test runs, studies were made on in-flight refueling. Inflight Refueling Corporation of Baltimore, developed a powered reel, pump and 207

***William E. Vance** is the editor of the* ARMY AVIATION DIGEST.

The 300 gallon gasoline storage tank being delivered for installation in the U-1A Otter, tanker airplane.



The hose and reel assembly installation in the U-1A. The reel holds 207 feet of hose which is reeled out through the camera port.

feet of hose which was installed in an Army U-1A and barely a week before the scheduled coast-to-coast run, the first in-flight fueling was attempted. The 207-foot hose with nozzle attached was lowered from the Otter, flying ahead of and slightly above the Workhorse. The hose streamed out on a miniature parachute and was retrieved with a grappling hook by one of the helicopter pilots. When the ready signal was given, the crew chief, SFC Joseph Loncar, started the pump. It worked satisfactorily.

Thus was started the first coast-to-coast non-stop helicopter flight. News generated by this feat went around the world by newspaper, wire, radio and television. This was gratifying but the primary purpose of the mission was to establish important facts about rotary-wing aircraft and not a publicity stunt.

What are some of the developments brought out by this unprecedented flight? In-flight refueling for helicopters was found to be practical. Using even as incompatible set-up as the U-1A, which definitely is not in the tanker category, in-flight refueling of helicopters was found to be feasible. This method might be crude a year from now but it worked fine for "Amblin' Annie's" crew and what can be done for one can also suffice for many. An entire battalion could be moved across countries or oceans, using this technique, landing with integrity intact, ready to fight or render assistance in some catastrophic occurrence.

True, in two cases plane-to-plane refueling couldn't be accomplished because of turbulent air, but with a specially designed fixed-wing tanker, this difficulty could be overcome. Fuel couldn't be transferred in El Paso, Texas, because of convective turbulence. Temperature was at 95-100 degree mark on the afternoon of the

first day when they reached the area near El Paso where the hook-up was abandoned because of this turbulence. It could have been attempted, but the crew of "Amblin' Annie" did not want to take that calculated risk.

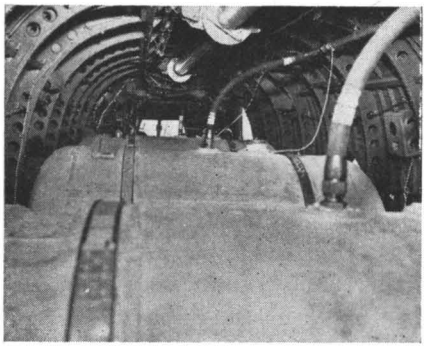
Fortunately good weather prevailed throughout the flight. Except for severe turbulence in eastern California, which continued through Arizona, no weather was encountered. In mid-Texas, it was necessary to weave through a few thunderstorms and the air crews saw lightning strike an oil tank on the ground. Aside from this incident, the weather was better than predicted. The forecasts had all been adverse for the entire flight. Cross winds held most of the way, with the only strong winds encountered on the Columbus, New Mexico, to El Paso, Texas, leg.

Maintenance troubles were practically non-existent. Shortly after clearing the mountains just east of San Diego, Joe Givens smelled something that closely resembled spilled iodine. Feeling around the panel with their bare hands, the pilot and co-pilot felt a warm spot and pulled a circuit breaker. All that was left after this electrical fire were navigation lights but the L-23 flying cover provided guidance for them. Excessive vibration caused a door to cave in and the crew chief stand to fall down. Other than the irritating quality of the flapping noise caused by the crew chief stand, no damage was done. The vibration, excessive immediately after refueling, was attributed to the weight and balance. Internal tanks had been installed to hold extra fuel and immediately after filling them it was necessary to operate at maximum rpm. As the fuel was consumed and the rpm backed off, first to 2,650, then to 2,600 and

The H-21 refueling at a hover over El Paso, Texas, municipal airport. Severe turbulence made it hazardous to refuel in the air.

Refueling the H-21 at midnight while hovering over the Shreveport, La., municipal airport. A night hook-up was not planned for this flight.

finally down to 2,500, the vibration smoothed out. These constituted the maintenance difficulties. " 'Amblin' Annie' was running better at the finish than at the start," Joe Givens declared.



The three, 300 gallon cabin tanks installed in the H-21.

A cruise speed of 75 to 80 knots at indicated 2,500 rpm and 35 to 37 inches of mercury was the usual order of operation. A speed of 70 knots was established as most compatible for aerial refueling. Tests were made at speeds ranging from 55 through 80 knots before 70 was found to be best.

Fuel consumption averaged 75 gallons per hour. Immediately after refueling the figure would be higher, around 95 gallons an hour. Then, as the weight decreased, consumption decreased so that four hours after refueling 60 gallons per hour were used.

Everyone had high praise for Mr. Givens' ability in establishing contact with the tanker. It required a high degree of skill to approach the Otter and hold in position while the hose was dropped and picked up.

As everyone knows, a helicopter is hard on the pilot. Just how hard no one has determined exactly, but the coast-to-coast flight established that long flights such as this are not beyond human endurance. True, the crews were tired in spite of being able to take turns in the litter behind the bulkhead. The pilots and crew of the tanker and chase planes did not fare so well. They couldn't find time to sleep and the necessity of landing to refuel and take on fuel for "Amblin' Annie" frequently caused them to drop far behind, making it difficult to keep up with the helicopter.

In-flight lunches prepared by Navy personnel at Miramar Naval Air Station was the only food available. While the helicopter crew had enough for several snacks, the chase planes had only one box lunch for the thirty-hour flight.

At the end of the flight, audiometer tests were given by a naval flight surgeon at Bethesda, but no adverse effects noted. Further medical examinations, though scheduled, were not made.

Mr. Givens again summed it up: "We all felt fine."

ARMY WINGS FOR THE INTER-AMERICAN GEODETIC SURVEY

Captain John Bergner, CE

THE PAN AMERICAN AIRWAYS DC-7 241-N was over the midway point of Brazil's Amazon River basin enroute from New York to Rio de Janerio. The pilot called his company for weather and made a position report. Upon completion of this routine exchange, he was startled to hear in his earphones, "241-N, this is Army 2799, over."

The caller was 1st Lt Dalton Smith in an L-20, enroute from Recife, Brazil, to the Canal Zone via Trinidad, B. W. I. He too wanted the weather and wondered if 241-N would relay a position report for him. Pan American, always agreeable, said sure, and added, "Didn't expect to find an Army plane out here."

Most people are surprised, but Army aviation can be found in almost every country of Latin America. Army flight personnel operating these gaudy aircraft with red and white tropic markings are members of the 937th Engineer Company (Aviation) (IAGS), whose "Seven League Boot" mission is to afford aviation support to the Inter-American Geodetic Survey (IAGS). The 56 officer-pilots, and 101 men of the 937th are daily proving the workability and utility of Army aviation in support of topographic field operations

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by maintaining and flying 44 aircraft in dispersed groups from Mexico City to Rio de Janerio, Brazil.

Inter-American Geodetic Survey

The Inter-American Geodetic Survey is just 10 years old. It got its start when the Defense and State Departments, realizing the need for a coordinated, accurate, and progressive survey and mapping program in Latin America, activated the group. World War II operations in Latin America had revealed a dire need for maps and proved that any future military operations in this area would be extremely difficult without them. However, accurate maps, charts, and allied geophysical data are a must under any circumstances. Through diplomatic agreements, IAGS was formed with participating Latin American governments being assured the United States would provide technical assistance, coordination between participating governments, and extend the loan of required equipment. The United States Army Corps of Engineers was given IAGS as a mission and it was designated a major subordinate command of the United States Army Caribbean. Headquarters were set up at Fort Clayton, Canal Zone. The present director of IAGS, Colonel Robert R. Robertson, states the role of support aviation lucidly, "*No airplanes—no maps!*—we couldn't operate without Army aviation support."

Special DA TO&E Aviation Unit

Forty-four aircraft of six different types are assigned under the special Department of the Army TO&E. These aircraft are dispatched to participating countries of the survey as required, whether it be for 90 days TDY or a 2 year permanent change of station. Presently the aircraft are assigned in 17 of the 21 Latin American Republics in groups of from one to four aircraft. In use at this time are six U-1A "Otters," six L-20 "Beavers," ten L-19s, two L-23s, thirteen H-13 helicopters and seven H-19 utility helicopters.

To those who are not familiar with the vast undeveloped areas of South and Central America, the variety of terrain ranges from steaming jungles to the snow-capped Andes, and has to be seen in its magnitude to be appreciated. Usual reaction to a first flight in

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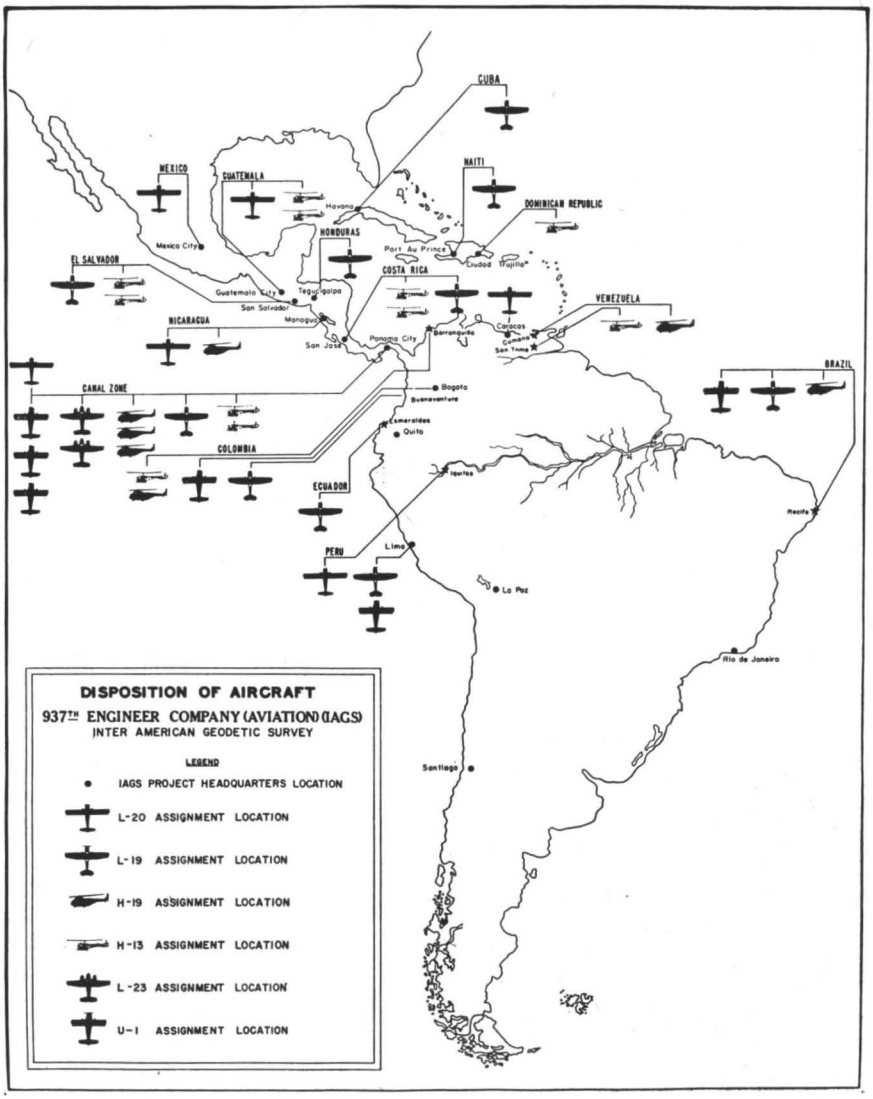
Capt John Bergner *is the Aviation Officer in charge of the Guatemala project, 937th Engineer Co. (Aviation) c/o U. S. Embassy, Guatemala City, Guatemala.*



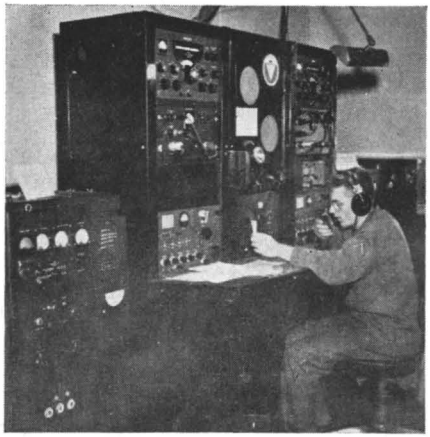
the area is a shuddery, spine-tingling feeling of apprehension, complete with the thought, "I'd hate to make a forced landing down there!"

It is natural for flying personnel to be apprehensive when operating over this terrain in single engine equipment for extended periods. However, methods developed in the 937th during the last

four years have lessened this apprehension to a degree where in routine operations, it is not considered an operational detriment. As an example of one of the methods: new aviators are sent as soon as possible to the ten day Jungle Survival Course operated by the Caribbean Air Command at Albrook Air Force Base. There, techniques of survival and utilization of survival equipment are stressed until each student feels that life afoot in the jungle is not certain death.

Upon completion of processing and survival school, newly joined and especially pilots who hold recent ratings, are sent to selected field projects having an experienced aviation officer-in-charge (AOIC) who will train the neophyte in the peculiarities of the tropical pressure altitude conditions, Latin American ATC procedures, company operating policies, and the allied arts of "bush" flying. The training continues until the student is proficient. This generally takes 60 to 90 days, after which time the pilot is ready for a permanent assignment, possibly alone.

Communications



The communications center at Ft. Kobbe consists of two medium frequency stations, one has a 600 mile range and the other has a 1,500 mile range; plus one VHF receiver transmitter used for air ground communications. This facilitates radio communications with all the South American locations.

All 937th aircraft, with the exception of helicopters, are equipped with ARC-5 or Collins 18-S medium frequency radio transceivers which afford up to a 600-mile range of communications from aircraft. This is quite an improvement over the "peanut powered" ARC-12 VHF which limits an effective Mayday call to almost within sight of the field. Additionally, enroute weather or other operational information may be gathered from Panama ATC, IAGS Radio, Pan American Airways Radio, or the numerous IAGS project stations in participating countries. This improved communications is a definite safety factor.

Float Equipped Aircraft

Where terrain is especially forbidding, and landing areas non-existent, floats are fitted to the aircraft. Presently, an L-19 in Columbia, and L-20 on the headwaters of the Amazon in Peru are on floats, flying over terrain where rivers, ponds, and streams are abundant, and afford the only operational landing areas.

High Terrain

Oxygen is available to pilots in the form of TO&E bottles and masks, which can be carried when tackling high terrain. One such flight occurred in March of this year when an L-19 aircraft, escorted by an ADF equipped L-20, flew 1,230 miles from Santa Cruz, Bolivia to Lima, Peru, across the Andes at an enroute altitude of 18,000 feet. Oxygen allows the pilot to select safe altitudes over mountains, which in case of the Peruvian Andes, features passes 14,000 to 15,000 feet, with 20,000 feet the general enroute altitude. These extreme heights are common in Columbia, Ecuador, Peru, Bolivia, and Chile.

Navigational Facilities

Navigational facilities are especially sparse in Latin America, with ADF being the only reliable aid. Non-directional homers of medium-high and low frequency are the standby, and commercial broadcast facilities can be used if your Spanish is good. So far Jeppesen does not cover the Caribbean or South America for the

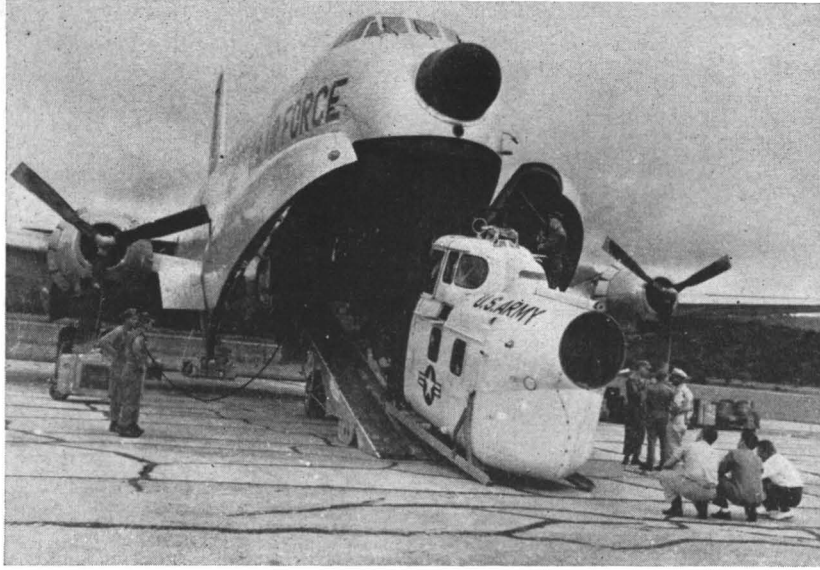
Engine change in the field near Pito, Republic of Panama. The crane was flown in by U-1A Otter.

Army. The USAF Facility Chart for these areas, however, does have sufficient coverage to permit instrument flying. All 937th multipassenger aircraft are equipped with the ARN-6 ADF which has proved reliable and excellent in service.

Operations

Working detachments are as large as the priority of the mission and proportionate to the extent of participation by the host government. Presently, detachments range in size from a lone L-19, pilot and mechanic in Honduras, to an H-19, L-19, U-1A, H-13, and crew of ten in Columbia. The senior aviation officer present in the country is designated AOIC for the project, and is responsible for all 937th flight operations within that area.

The workhorse of the unit aircraft is the helicopter. They are used to place personnel and equipment on terrain that would be either impossible or very slow to reach otherwise. Reconnaissance, resupply, low-level aerial photography, and flying cover for the choppers are missions of the L-19s and L-20s. Long range radios in the latter aircraft, and their speed are invaluable in this type of closely coordinated operation. Generally, all food, equipment, fuel, and personnel are flown in and out of remote areas being surveyed by the L-19s and L-20s. Heavy hauling is relegated to the U-1A aircraft which are stationed in Mexico City; the Canal Zone; Bogata,



Loading an H-19 aboard a C-124, to be flown to Recife, Brazil. There were no intermediate refueling facilities between Cuba and Recife to ferry the helicopter.

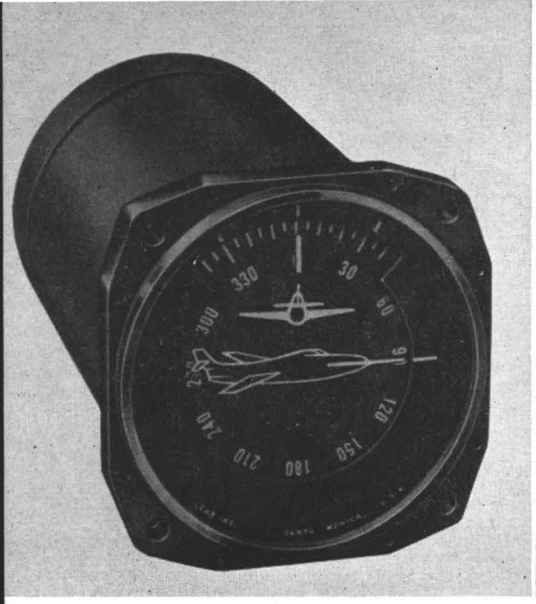
Columbia; Lima, Peru; and Recife, Brazil. The faster L-23 command aircraft are used for VIP, staff trips, and special mission aerial photography.

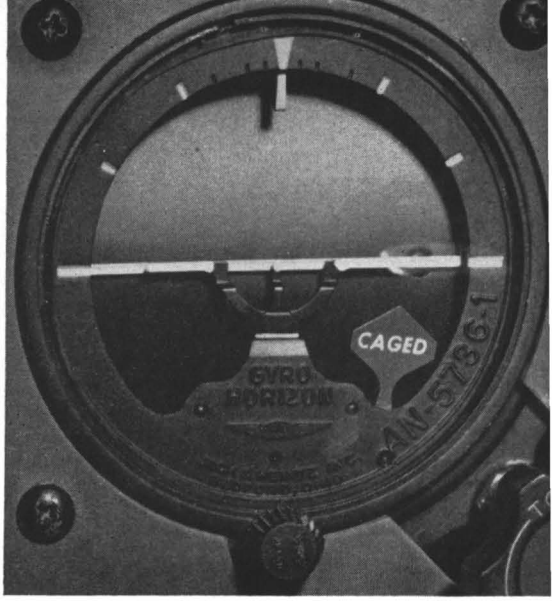
Island Hopping

It is interesting to note that almost all aircraft, with the exception of H-13 helicopters, were flight delivered to the Canal Zone from the ZI and on to subsequent assignments. Two routes were used in the ferry flying, with aircraft coming down through Mexico, or island hopping from Miami to Cuba to the Yucatan peninsula. The Cuban route is faster, and features better weather with lower enroute altitudes.

Conclusion

Major Don R. George, the present commanding officer of the 937th Engineer Company (Aviation) (IAGS), just about sums up the unit attitude when he states that, in his view, his job is the "most challenging and interesting ever undertaken." The work of the Inter-American Geodetic Survey will undoubtedly continue for several years, and afford many Army aviators the challenging experience of flying in Latin America.





FLIGHT REPRESENTATION— PICTURE OR SYMBOL?

CWO-2 Clifford V. Turvey

THE ARMY AVIATION SCHOOL and Board 6 (CONARC) test of a natural flight indicator under simulated instrument conditions in the H-19 helicopter has again brought the old question of pictorial versus symbolic indication to the forefront.

This indicator is an excellent representative of the pictorial group. It is a three-in-one gyro instrument for flying which combines in a single presentation the same information ordinarily presented by the directional gyro and gyro horizon indicator. The attitude is indicated by pointers representing the aircraft in silhouette; one, a side view, indicates nose up or down (pitch), the other, viewed as looking forward from behind the aircraft, indicates bank (or roll) by the attitude of the wings. In addition, the vertical needle or roll pointer and heading card work in unison so that when turning, bank and heading are read together. A directional gyro card surrounds the outer border of the instrument and is calibrated in five degree

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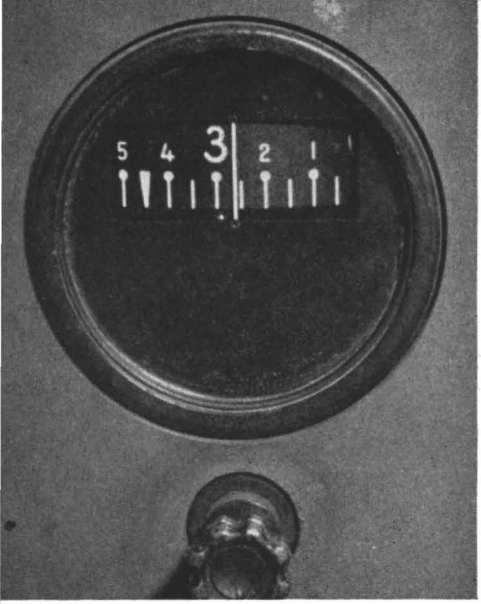
The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor



increments. This card rotates as the aircraft changes direction.

All test pilots reported favorably on the instrument but most important was their consensus that the novice pilot can adapt to instrumentation faster this way than with separate indicators.

Pictorial Vs Symbolic

Thus, in a recently tested piece of equipment, we find another argument for pictorial indication. This has not always been so. Proponents of symbolic presentation assert that symbols are less complicated to build and, consequently, less expensive both in dollars and pounds. They further claim that a pilot can fly more accurately by matching pointers than by any other method. The pictorial backers feel that although these statements are true, there are more advantages to be gained by replacing symbols with more natural presentation. A look at the problem will permit factual judgment rather than depending upon personal opinion or past history.

First, just what is a symbolic instrument? Certainly not a picture as the name indicates. Symbolic instruments give data by means of bars, pointers, circles, or other geometric shapes moving with respect to an index to represent position, displacement, or rates of change. With very few exceptions, all instruments in present-day aircraft are symbolic.

Pictorial instruments are those which present information by a natural or synthetic reproduction of the visual cues experienced when flying contact. An instrument panel equipped with pictorial presentation would require a minimum of symbolic indication, mostly for rate information—rate of turn, rate of climb, and so on.

The history of our present instrument panel follows the usual pattern. Early aircraft had very few instruments, usually a tachometer, oil pressure gauge, and sometimes but not always, a com-

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Instrument History

pass. The fuel gauge was there and in some cases an altimeter. These early instruments were taken "as is" from the automotive industry. In that period these basic instruments were sufficient to handle the problem of supplying required information to the pilot. As aircraft and engines progressed, the need for more and more information dictated the development of the airspeed, rate-of-turn, direction, rate-of-climb, and other instruments. All of these instruments followed the same basic pattern of a pointer rotating with respect to a fixed dial with one exception—the artificial horizon. Here was the first approach to pictorial presentation.

Reality was the engineer's goal. In the early stages they tried to reproduce a picture of the ground and sky. Some of the very first models even included a background painted blue for the sky and black for the ground. This quickly diverted into a stabilized bar representing the horizon. Further development of the horizon from that point has been progressive in the actuating mechanism but stagnant in the type of indication. Instruments grew smaller, then larger, then smaller. They changed from a bar to a ball, back to the bar, and now tending again toward enlargement. In every stage the gyros were improved. Legibility and lighting were improved, but the same basic presentation always remained. In one instance the sensing was even reversed but was soon changed back.

As aircraft became more complicated, the instrument panel likewise followed suit. Informative instrument devices were added as necessary but nothing ever came off. Instrument flying was no longer the domain of the scheduled airlines and today most aircraft fly in all but extreme weather conditions. This entails a tremendous amount of training and continual refresher activity and represents a lot of effort on the part of the aviator. Some flight personnel will deny that instrument flying is difficult, and perhaps for the ones who make the claim, it isn't. For the average pilot, though, it is an effort requiring constant training to maintain proficiency. Every single MATS landing is a GCA landing. This holds true for many Air Force organizations.

Instrument Training

Not the least reason for this heavy training is symbolic presentation. Visualization is more difficult because what we are accustomed to seeing is not reflected in a mere symbol. Too, symbols

must be memorized and must be related to some basic visual cue to which we are accustomed. This means more training—just to learn what the symbols mean. It follows then, that training time could be reduced if all symbols were replaced with a reproduction of the visual references.

Moreover, the difficulty of instrument flying is due to our physical makeup. Man is not equipped to operate efficiently without full use of all his senses. The strongest of these is vision. In maintaining balance, it is the visual sense which supplements and refines the inadequacies of the proprioceptive and equilibrium senses. For example, when making a standard turn in an aircraft under VISUAL conditions, there is no apparent feeling of instability nor does this feeling exist when the turn is stopped and the plane rolled out to level flight; yet when under INSTRUMENT conditions, this same maneuver sometimes produces vertigo. The physiologists tell us that this is due to the inertia within our vestibular apparatus which upsets our balance and produces this vertigo. It can be established from this that the information which we receive from the artificial horizon and directional gyro is not strong enough to overcome this feeling of unbalance. It can be stated with certainty that if this horizon were designed to reproduce the visual cues which are apparent under visual conditions, vertigo probably could be eliminated.

It would appear from past history that proper training would take care of this problem even with symbolic representation. It is also true that the cost of initial instrument training plus refresher training increases the total cost of pilot training. Since the pilot training begins with flight by visual reference, it would seem sensible to reproduce these same references rather than condition the pilot's reflexes to a completely different set of cues. The present method is like teaching a person to play music by ear and then having him read notes during a concert.

Interesting Experiments

An interesting experiment was carried out shortly after World War II, by the officer in charge of link training at a Western Training Command sub-installation. The link trainer operators were asked to actually fly an airplane by instruments. It was found that these operators became quite expert in handling the plane. Upon removing the hood, however, the link operators were quite disoriented and

incapable of making a landing, even though they had previously made precise touchdowns on instruments.

The test was informal and perhaps proved nothing. Some contended that it proves almost conclusively that symbolic presentation is adequate to fly an airplane. With enough training this is true, providing everything goes according to plan without change or without an emergency and if enough reliable equipment is in the aircraft. This equipment should produce the necessary presentation throughout the entire flight, from take-off to a completed landing.

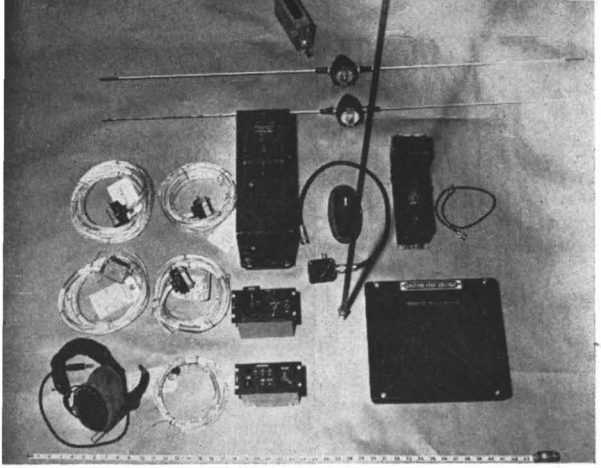
Another completely disassociated experiment had students who were qualified in basic flight placed under the hood and supplied with pictorial presentation of attitude and direction. In this instance it was learned that these students were capable of maintaining attitude, direction, and altitude with very little effort within the first 10 minutes of flight. When the hood was removed, the students were quite capable of landing the airplane.

This proves conclusively that if the presentation is similar to visual reference, the ability to fly straight and level on instruments requires very little additional training beyond the basic visual flight training. There is nothing to be unlearned because the student is essentially flying in the same way that he flies under visual conditions. Since little or no transition is necessary, the training in instrument flying is reduced to learning navigation and traffic procedure.

It might be pointed out that most accidents during instrument conditions are due to pilot confusion caused by his being overloaded with too many things to do at a critical time. Most pilots who have flown "on the gauges" will admit that at one time or another they experienced panic when several operations had to be carried out almost simultaneously. If the data presented is more comparable to visual flight, it is plain that there will be only as much confusion as encountered during visual conditions, other than that psychologically induced. If there is less confusion, there will be fewer accidents.

Conclusion

Until we arrive at that happy moment when radar is developed to the point where we can see through fog and rain, we must design instruments which will present required information in a much more natural way than symbolic presentation.



A long needed item appears:

THE ARC-44

Major John H. Gray, *Signal Corps*

ARMY AVIATORS WHO found combat communications lacking due to the necessity for several different transmitter-receivers to communicate with various ground units will be delighted with a single black box called AN/ARC-44. This single unit, the first radio built expressly for Army aircraft, answers the need for communicating with towers, fire direction centers, tanks, infantry units, or for communicating with a walkie-talkie operator on the ground. Intercommunication channel is provided in addition to the 280 channels for radio communication in the unit.

Radio set AN/ARC-44, currently undergoing troop tests by the 3d Division, is a small, lightweight, airborne FM radio receiver-transmitter set, operating in a frequency range of 24.0 to 51.9 megacycles. Its primary function is to provide two-way communication links between different aircraft or between aircraft and ground stations. An auxiliary function enables the operator to use the equipment to home on any signal within its frequency range. The radio set can be installed in any type of Army aircraft.

The manufacturer claims a 50-mile line-of-sight limitation on the set. However, troop tests proved that two-way communication with a ground station can be carried on up to 90 miles, at which point contact with the ground station was lost. The ground station continued to receive the aircraft up to 300 miles. Due to the spectrum at the lower end of the VHF band, a true line-of-sight condition does not prevail.

By use of the retransmit function, the effective operating range can be greatly increased. By using this feature, two stations in range

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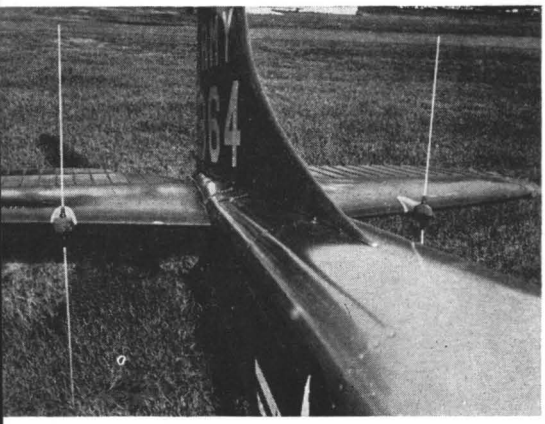
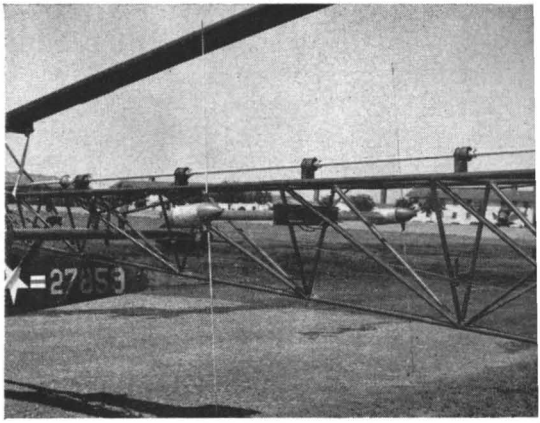
The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor





The ARC-44, AN/ARA-31 Homing Adapter impedance matching networks and antenna elements installations for the L-19A (above left) and the H-13 (above right).

of the aircraft, but each beyond the operating range of the other, are able to intercommunicate. The signal of either of these stations is received by the airborne unit, which (when the retransmit switch is on) automatically channels the signal into a second transmitter for retransmission. There must be two sets in the aircraft acting as a relay station in such an operation.

By use of the controls on the distribution panel the operator may utilize any one of five receivers or any of three transmitters for listening and talking. He may also select the aircraft interphone channel. Thus, in addition to providing an FM communication facility, the equipment can be used as a master control for selecting other receivers and transmitters in the aircraft.

The set uses 29 tubes: 11 in the receiver, 11 in the transmitter, and 7 common to both the receiver and transmitter circuits. The unit tuning drive mechanism, which is remotely controlled from the control panel, automatically tunes the receiver stages and transmitter stages to the frequency selected at the control panel. In addition, this mechanism provides crystal control by connecting the stages of the double-conversion superhetrodyne circuits employed. It also automatically tunes the tunable intermediate frequency circuits in the second conversion stage.

Major John H. Gray *is the Chief of the Communications, Navigation and Equipment section, Test Division, Board Nr. 6,* CONARC, *Ft. Rucker, Ala.*

The communications antenna is a tapered whip about eight feet long. It is made of fiberglas reinforced plastic with a center conductor of copper. The homing antenna consists of two identical homing antennae, one for each side of the aircraft.

Used as a Navigational Device

For use as a navigational device it is only necessary to put the homing switch to an "on" position and tune to the desired frequency. The coded "D" and "U" signals, or a steady 400-cps on-course tone, should be present in the pilot and observers' headphones. There are three types of signals and each signal has a specific meaning for the pilot. These are: a steady 400-cps on-course tone; "U", a turn to the right will bring a heading toward the on-course signal; "D", a turn to the left will bring a heading toward the on-course signal. It is possible that when a steady 400-cps tone is heard, the aircraft is heading directly away from the station. By flying to the right or left of the on-course heading, the error will be "automatically" corrected by following the directions for reception of "D" and "U" signals. A pilot can home on any signal, even a walkie-talkie transmission. All that is necessary is for the operator of the station on which the home is to be made to depress the microphone button periodically.

The set is designed for very rapid trouble-shooting, utilizing a set tester and procedures perfected by the manufacturer. The entire installation is unitized in such a way that the defective unit can be removed and replaced and the faulty unit passed on to the next higher echelon for repair.

BOOKS

For The Army Aviator

AIRCRAFT ENGINES OF THE WORLD 1956—*Wilkinson, Paul H. (Paul H. Wilkinson, Publisher, 225 Varick St., New York 14, N. Y., 1956. $15.00)*

(However, there is a 20% discount to military personnel provided the book is ordered direct from the publisher.)

Reviewed by Lt Col Charles P. Damon
Director of the Department of Academics, The Army Aviation School

Here is the answer to anyone needing varied and detailed information on aircraft powerplants, or just interested in keeping abreast of this rapidly moving and highly important field of aviation. This book has an annual edition and points out all the significant developments of the preceding year.

All information is reduced to a standard form and listed on the page opposite a photograph of the engine—with the exception of U.S.S.R., for which there are no photographs of the subject engine. This type of format is easily read and lends itself to the average pilot seeking general information or a designer looking up detailed power plant information.

The book in general is divided into two sections: 1. Jet Engines, Gas Turbines, and Specialized Powerplants; and 2. Reciprocating Engines. In addition the book contains a small section on accessories and equipment. A short introduction to each section gives the general information, by country, as to the engines in production and those under development.

Additional information is available from the numerous tabulations included in the book. The section of jet engines and gas turbines has tabulations on: 1. Turbojets (without afterburner); and 2. Turbojets (with afterburner); 3. Turbojets. Of particular interest to the Army aviator is the fact that in the reciprocating

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Book reviews appearing in this department do not necessarily reflect the opinions of the Department of the Army or of The Army Aviation School.—The Editor

engine section is a tabulation of helicopter engines. Other tabulations cover U.S. Air Force Aircraft and their Engines, U.S. Navy Aircraft and their Engines, Airlines and their Engines, Cargo Aircraft and their Engines (U.S., Britain, France, and U.S.S.R.), Pilotless Aircraft and their Powerplants, and Aviation Gasoline and Oil.

A typical listing of the detailed information of a reciprocating engine is as follows: Model, type, construction, supercharger, fuel system, ignition, lubrication, starter, bore, stroke displacement, compression ratio, width (across valve covers), width (across carburetor), height, weight, weight/horsepower, fuel consumption (H.P./Hour), oil consumption, gasoline grade, oil viscosity, output/displacement (H.P./Cu. In.), output/piston area (H.P./Sq. In.), piston speed (max), B.m.e.p. (max), rating (cruising), and lastly all the models are listed, with a description of how they differ from the basic one described above.

A similar description of jet engines and gas turbines is made, but the details are changed to cover the important data on those powerplants.

The book is an encyclopedia of information for the individual who needs a world of detailed information on aircraft powerplants or is interested in keeping up with this rapidly moving field.

THE ARMY AIR FORCES IN WORLD WAR II, VOLUME VI, MEN AND PLANES—

(Prepared under the Editorship of Wesley Frank Craven, Princeton University, and James Lea Cate, University of Chicago, by the USAF Historical Division of Research Studies Institute.)

(The University of Chicago Press, 5750 Ellis Ave., Chicago 37, Ill., 1955. $8.50)

Men and Planes, Volume VI of the Army Air Forces in World War II, deals with the activities of the Army air arm in the Zone of the Interior. It was within the Zone of the Interior that activity during the war was directed toward implementing the basic formula laid down by General Arnold when he described an air force as "a balanced compound of three essential elements—airplanes, combat and maintenance crews, and air bases." *Men and Planes* provides a comprehensive record of the development of an effective air organization, the forging and distribution of weapons, and the recruitment and training of airmen.

This volume covers in detail the origins of the Army Air

Forces; air defense of the United States; development of base facilities; production planning and organization; expansion of aircraft production and the production record; logistical organization; allocation and distribution of aircraft; basis of procurement of airmen; foundations of the war training program; basic military training; individual flight training; combat crew and unit training; and training of ground technicians and service personnel.

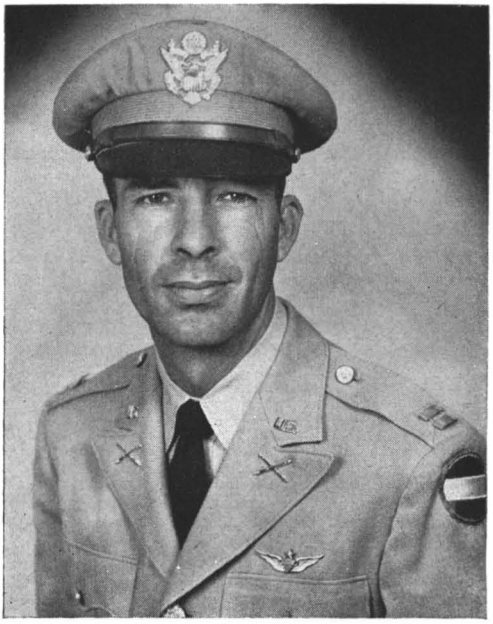
The first five volumes of *The Army Air Forces in World War II* have completed the story of the combat activities of the Army Air Forces in the several theaters, a story that began with Pearl Harbor and came to a close within a few days after the atomic bombing of Hiroshima and Nagasaki. *Men and Planes,* the sixth volume of the series, makes possible a thorough understanding of the groundwork which underwrote these combat operations. A judicious appraisal of the efficiency and effectiveness of a vital aspect of the Army Air Force action in World War II, *Men and Planes* adds to the already established value of *The Army Air Forces In World War II* as an authoritative record of the scope and significance of air power in a global war. A seventh volume, *Services Around The World,* will complete the series.

ROTORCRAFT—*Liptrot, Capt R. N. and Woods, J. D. (Butterworths Scientific Publications, 88 Kingway, London, W. C. 2, 1955. $5.00)*

This book is an introduction to the theory and practice of rotary-wing aircraft, explaining the fundamentals of rotorcraft engineering in a simple and practical manner. No attempt has been made to introduce advanced theory or practice, as no useful purpose would be served by perplexing the reader with long mathematical expressions, of no practical use to him at this stage.

The subject matter is presented in a readable and useful manner so that the book can be a practical help to the engineer in his daily work, both as a work of reference and a guide.

"In a development as comparatively new as rotary-wing aircraft, a thoughtful compilation of the available data is widely helpful at the time it is current and becomes a valuable contribution to the history of the art in the future. *Rotorcraft* is such a volume."—From the Foreword by Igor Sikorsky



The Gray Hair Department

Simulated?
H-13E

DURING THE PROCESS of an annual proficiency check ride in an H-13E, the check pilot switched off the magneto switch while the pilot being checked was maneuvering at a hover. Unexpectedly, the pilot bottomed the collective pitch. The helicopter slammed into the ground, fortunately in a level attitude, but the forward and

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Captain James H. Lefler *is a Project Officer in the test Division of CONARC, Board 6, Ft. Rucker, Ala. He has accumulated over 8,000 hours of first pilot time in his 18 years of flying experience and is qualified in all types of Army fixed- and rotary-wing aircraft. His flying career began in 1938 as a civilian pilot instructing and flying for hire until 1942 when he joined the RCAF. After completing transition training in Spitfires he was sent to the RCAF Central Instructors School. However, late in 1942 he returned to the United States and became a liaison pilot, graduating in class No. 9 of the Department of Air Training, The Artillery School, Ft. Sill, Okla. He remained at Ft. Sill as a flight instructor until being assigned to Headquarters, U. S. Constabulary in Germany in 1946.*

He has played a prominent role in many firsts in Army Aviation. He helped establish the instrument flying training program at Ft. Sill, and instructed in that program until being transferred to the Army Aviation Detachment at Ft. Belvoir. In 1952 he was ordered to Korea and assigned to

(Continued on page 34)

rear cross tubes were bent out of limits and the forward left strut was cracked at the upper weld connection.

Lesson: Simulated forced landings very probably produce more accidents than forced landings do. This instructor pilot was embarrassed to find out the very hardest way that the pilot's reaction to surprise was improper.

Slippery When Wet
L-19A

The main runway was being repaired and the pilot of an L-19 lined up on a marked-off temporary sod runway to make his landing. A steady wind was blowing at 7 knots per hour and the strip was very wet and slippery from a hard two-hour-long rain, which had stopped about 30 minutes before his arrival. He made a smooth three point touch-down using 30 degree flaps and began applying brakes alternately on the roll-out. Approximately 370 feet from his point of touch-down there was an asphalt taxiway that intersected the sod runway. As the pilot approached it he applied brakes, the wheels locked and slid onto the asphalt. Still locked, the wheels skidded for several more feet over the hard surface. Then the aircraft pitched forward, the propeller dug into

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(LEFLER *continued from page 33)*
the 8th Army Flight Detachment as the Standardization Instructor for 8th Army; also, between assignments in the 8th Army Flight Detachment, he flew for the 7th Inf. Div. for a short period in 1953. During this Korean tour he helped work up the TO/E for the first provisional Aviation Company and later established the AFFE Twin Engine Transition School in Japan. Additionally, he "ferried" the first L-23 in the Far East Theater, aboard an aircraft carrier.

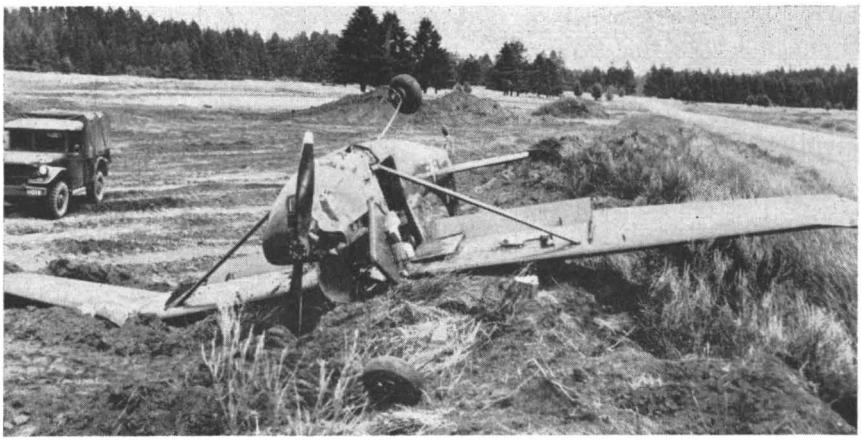
He returned to the Flight Detachment at Ft. Belvoir in 1954 and flew General Maxwell D. Taylor, and other high-ranking Army and Government officials as well, for approximately 2 years until being assigned to Board 6, where he is primarily concerned with the testing of newly developed electronic navigation equipment.—The Editor

the asphalt and the nose struck hard with enough force to lift the wheels from the ground before the aircraft settled on its nose in an unorthodox three point position.

Lesson: 70% of L-19 accidents occur during landing, and almost invariably, they involve improper use of brakes at some phase of the accident. Remember, L-19 brakes are easily strong enough to bring on unexpected and sudden disaster.

Slow and Drifting
L-19A

An artillery battalion pilot and his observer were working with their battalion in the field, using a road strip for their landing area. At this point, the description of the accident can best be presented in the pilot's own words.



"About 1100 hours, my observer and I prepared to leave our position, so I checked the wind. Dust rising from vehicles that were traveling the road indicated a slight breeze from the west-southwest. I went through the normal procedures of preflighting and engine run-up, then taxied out onto the road and lined up and dropped 30 degrees of flaps in preparation for a maximum performance takeoff. I held the brakes and pushed the throttle full open. When the rpm reached 2,200, I released the brakes and started my takeoff run. The aircraft became airborne within about 160 to 170 feet. When approximately two or three feet off the ground, the L-19 drifted to the

left and over a ditch paralleling the side of the road. I was dragging the landing gear through tall brush and it seemed to slow me down somewhat. I started a shallow bank to the right and realigned the aircraft over the road.

"I started applying back pressure to the control stick to gain altitude but the aircraft settled, bouncing the wheels on the road. It veered abruptly to the left and I lost directional control. Seeing that we were going to hit a large pile of dirt on our left, I completely closed the throttle and held back-stick, attempting to "mush" the airplane down as easily as possible to prevent excessive damage. The left gear hit the dirt pile and snapped off. The aircraft bounced into the air, flipped upside down and came to rest on its back. I cut all switches, released my safety belt and shoulder harness and helped my observer out of the aircraft."

Lesson: Army flying is not easy. Operations away from carefully prepared bases must go on. All pilots, and even more particularly young ones, can protect themselves from accidents which are connected with this type of flying only by careful attention to the procedures which have been found best from experience, and which are taught in the school. Do not try to force the performance of the airplane.

Materiel Failure
H-13G

An H-13G pilot was flying with a passenger on an administrative mission. At one of their stops, the pilot, through the course of checking the helicopter while he waited, noted that the tail rotor gear box felt warmer to his touch than usual. However, he gave no further thought to this discovery.

On the return flight he demonstrated a power recovery autorotation for his passenger. Very shortly after this demonstration, the pilot heard a loud grinding noise from the tail section. This was followed immediately by a loud snapping noise and directional control was lost. The nose of the helicopter first pitched up approximately 10 degrees and then dropped in a steep angle. The helicopter began turning to the right at an increasing rate. It turned 360 degrees

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The Gray Hair Department *is prepared by the* ARMY AVIATION DIGEST *staff with information obtained from the files of the Army Aviation Safety Board. The views expressed in this department are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor*

while the pilot tried to maintain straight and level flight in order to reach a suitable forced landing area. The aircraft had no tendency to streamline and the pilot decided that directional control could not be regained. He entered autorotation. By this time the aircraft had turned an additional 90 to 110 degrees to the right but the rate of turn decreased during autorotation. The attitude was nose low and full aft cyclic would not bring the nose up. According to the pilot:

"The autorotation itself was normal with a very slight turning tendency to the right and rotor rpm was in the green. As we neared the ground I decided to attempt a flare in order to raise the nose to a level attitude prior to landing. At an altitude of approximately 20 feet I pulled back sharply on the cyclic. The result was not a true flare. The rpm did not build up and the rate of descent did not appear to decrease, but the nose did raise enough to put the helicopter into a comparatively level attitude.

"Airspeed dropped off during this maneuver and the right turn began to build up in velocity again. I was also drifting slowly to the left. I pulled pitch at approximately three feet at which time the forward air speed was almost zero, the helicopter leveled laterally and slightly nosed down.

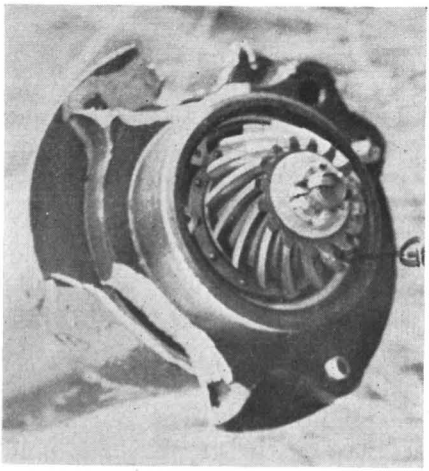
"With the cyclic stick in the full right rear position, collective pitch approximately three quarters up and throttle in over-ride, the helicopter touched down almost gently, laterally level, in a slight nose down attitude, turning to the right and still drifting slowly to the left. The forward half of both skids struck the ground first and the rear of the left skid dug into the soft mud and sheared. The helicopter turned 15 degrees more to the right, rolled over on its left side and the blades disintegrated as they hit the ground. The helicopter crashed at the point of initial touch-down."

A report from the Transportation Aircraft Field Maintenance Shop stated the " . . . personnel of this shop disassembled components of the helicopter and found that bolt, tail rotor hub, part number 47-641-052-1, had sheared. Further investigation revealed that this bolt had previously been cracked.

"Based on the above and the position in which various components of the helicopter were found on the ground, in relation to the helicopter after the accident, the following conclusions are made as to the sequence of events preceding the accident:

a. Bolt, tail rotor hub, part number 47-641-052-1 sheared.

b. One blade, tail rotor was thrown from the assembly.



c. The remaining tail rotor blade caused an unbalanced condition which resulted in the tail rotor gear box being torn from the tail boom extension.

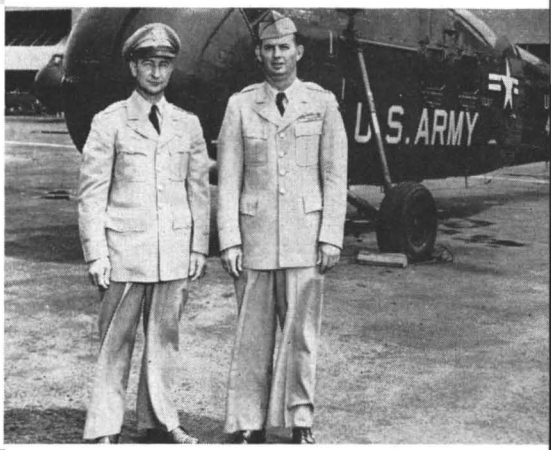
d. Loss of the tail rotor blades and the tail rotor gear box caused an extreme forward center of gravity and, of course, loss of directional control."

Lesson: This aviator is to be congratulated upon a fine job of flying. The loss of the tail rotor gear box is an emergency of deadly seriousness. Keeping cool, and flying the helicopter to the best of his ability prevented an accident of much greater damage.

CONARC BOARD 6

RECORD BREAKERS

Above, Board 6 test pilots Capt James Bowman (right) and Mr. Joseph Givens in the H-23 in which they established the first endurance record for light helicopters, 31 May-1 June 56. Refueling and changing pilots at a hover, they flew 30 hours before landing. *Right*, Capt Ellis D. Hill (left) and Capt Claude V. Hargett who established three new world speed records in an H-34, 12 July 1956—100 kilometers, 141.9 mph; 500 kilometers, 136.0 mph; and 1,000 kilometers, 132.5 mph. Previous record was held by a French SE-120, but Russia had recently set a new 500 kilometer record of 116.3 mph, 20 miles per hour slower than the Board 6 test pilots.



Left, Lt Col Harry L. Bush, and Maj William C. Dysinger, of CONARC Board 6, congratulate each other after their record-breaking distance flight in an H-21, 11 August 1956, over a closed circuit course. They flew 1,199.07 miles in 11 hours and 58 minutes. The former record was held by the French at 778.3 miles.

Right, Maj Hubert D. Gaddis, Mr. Joseph Givens, and Capt James Bowman standing by their H-21 before making their record-breaking nonstop coast-to-coast flight from San Diego, Calif. to Savannah, Ga. and Washington, D. C. Employing inflight refueling they covered this distance in 31 hours and 40 minutes.

Straight and Level

TO: Editor-in-Chief

We are grateful to the "Big Red One" aviation people for giving us an idea that has paid off in many dividends. Several issues ago we noticed an article in the ARMY AVIATION DIGEST concerning unit level publicity. The above mentioned group had participated in a television project worthy of note. We got to thinking about it and as a result contacted the Division PIO. Fortunately the timing coincided with the 4th Armored Division organization day. We contacted a local television station and worked out an arrangement whereby we would fly to the municipal airport close to their station and pick up one of their cameramen, take him to the strip, transfer him to a helicopter and fly him to the parade field where he could take aerial shots of the parade. Then we returned him to his studios so that he could get the film processed in time to show that evening. In the process the company received some much needed publicity. But more important, Army Aviation received a boost. Since then, we have followed up on the idea and have a vigorous program going to further take advantage of the cooperative efforts of the division PIO and the local television stations.

The local newspapers have shown a real willingness to use all of the material that we send them, also the TV stations use any of the photographs that are sent to them. As a result of this the company has sired some real TV personalities such as Lt Robert D. Brown, Lt T. J. Clark, and Capt John Wesphal. Men, check with your respective PIOs, you might be missing some good opportunities to get a few plugs for your outfit and for Army Aviation. Projects for the future include a half hour TV show on film devoted exclusively to the division aviation company. It will run on all three of the local television stations.

Armed Forces Day Army Aviation received a big play when the company put on a demonstration of the capabilities of the division's aircraft. Pilots of the company donated the money to one of our people who owns a 16 mm movie camera so that we could take pictures of the demonstration. The film was then delivered to a local TV station and shown twice to the surrounding communities. We also delivered the film by helicopter and once again Lt Brown stole the show. The angle that they used was to interrupt a feature program and take live shots of the delivery. Considerable favorable comments were noted from civilian spectators.

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Fort Hood, Texas

Letters of constructive criticism are welcomed by the ARMY AVIATION DIGEST. *To appear in this column they must be signed.—The Editor*

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NG: State AG (10)

USAR: None

For explanation of abbreviations used see SR 320-50-1.

Keep Current

with the Army Aviation Digest

Army aviation was unknown when Otto Lilienthal made his first glider flight back in 1891. He didn't live in the air age but you do, and the ARMY AVIATION DIGEST can keep you abreast of the latest developments in Army Aviation. If your favorite topic hasn't been discussed in this magazine recently, why not sit down right now and write an article to us? The pages of the DIGEST are open to all Army aviation personnel and direct communication with the editor is authorized.

Articles are needed on such diversified subjects of interest as flying safety, aircraft accident prevention, maintenance, training, operations of all sorts, aviation medicine, research and development of new equipment and techniques, and other related fields.

This is your magazine. You don't have to be a Hemingway or a Steinbeck to break into print in the ARMY AVIATION DIGEST. Send us your material and let your fellow pilots and crewmen benefit from your background and experiences in this rapidly expanding field of Army aviation.