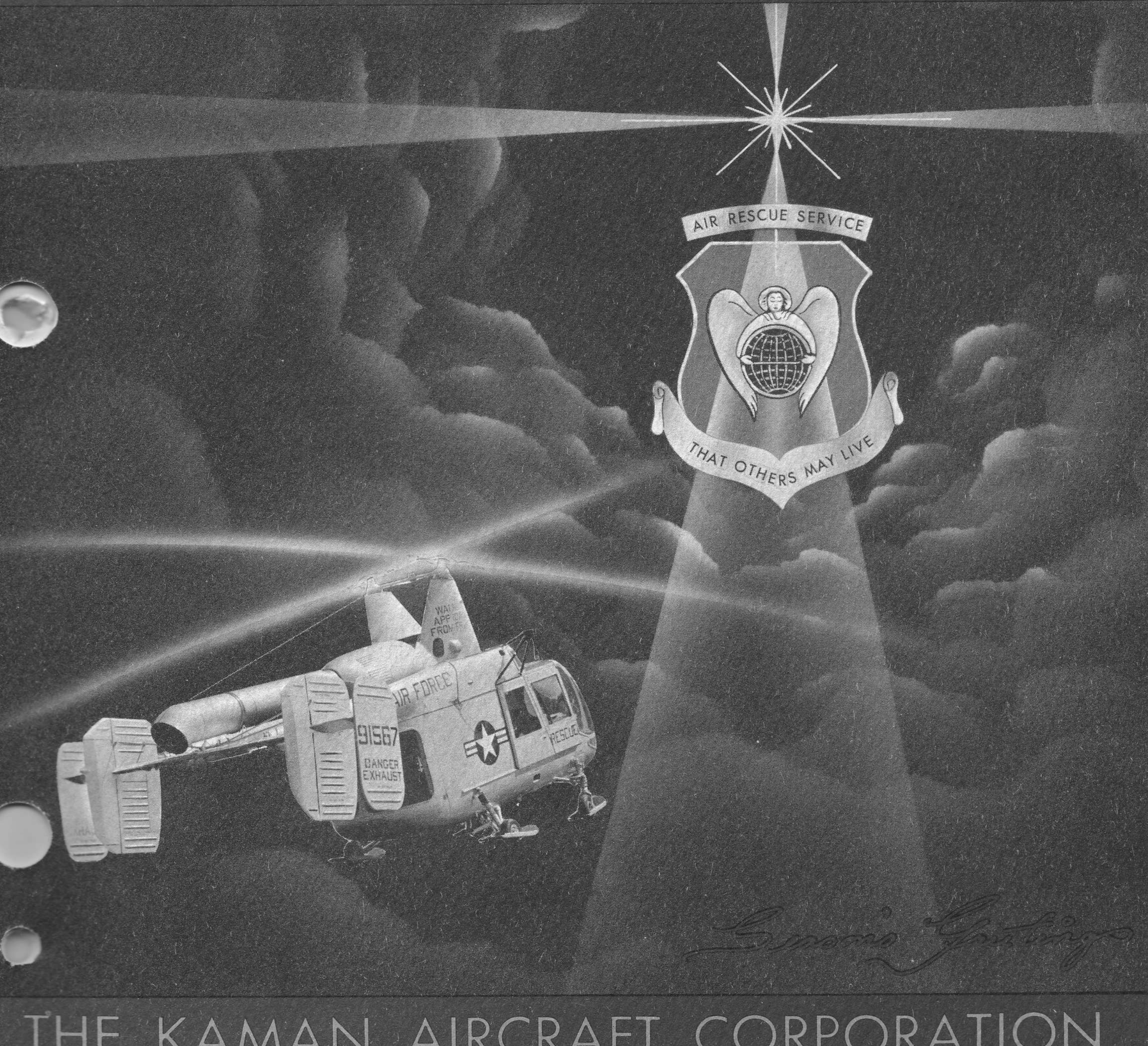
KAMAN
Rotor Tips

VOL. II No. 6 DECEMBER 1961



THE KAMAN AIRCRAFT CORPORATION

PIONEERS IN TURBINE POWERED HELICOPTERS

KAMAN Rotor Tips

DECEMBER, 1961

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IN THIS ISSUE

THE COVER

"That Others May Live"—the dedication to humanitarian service found in the words on the ARS insignia may also be applied to all helicopter crews who fly their missions of mercy.

— PLEASE SHARE THIS COPY —

DSAS

DIRECTIONAL STABILITY AUGMENTATION SYSTEM

by P. Greco
Analyst, Electronics
Field Service Department

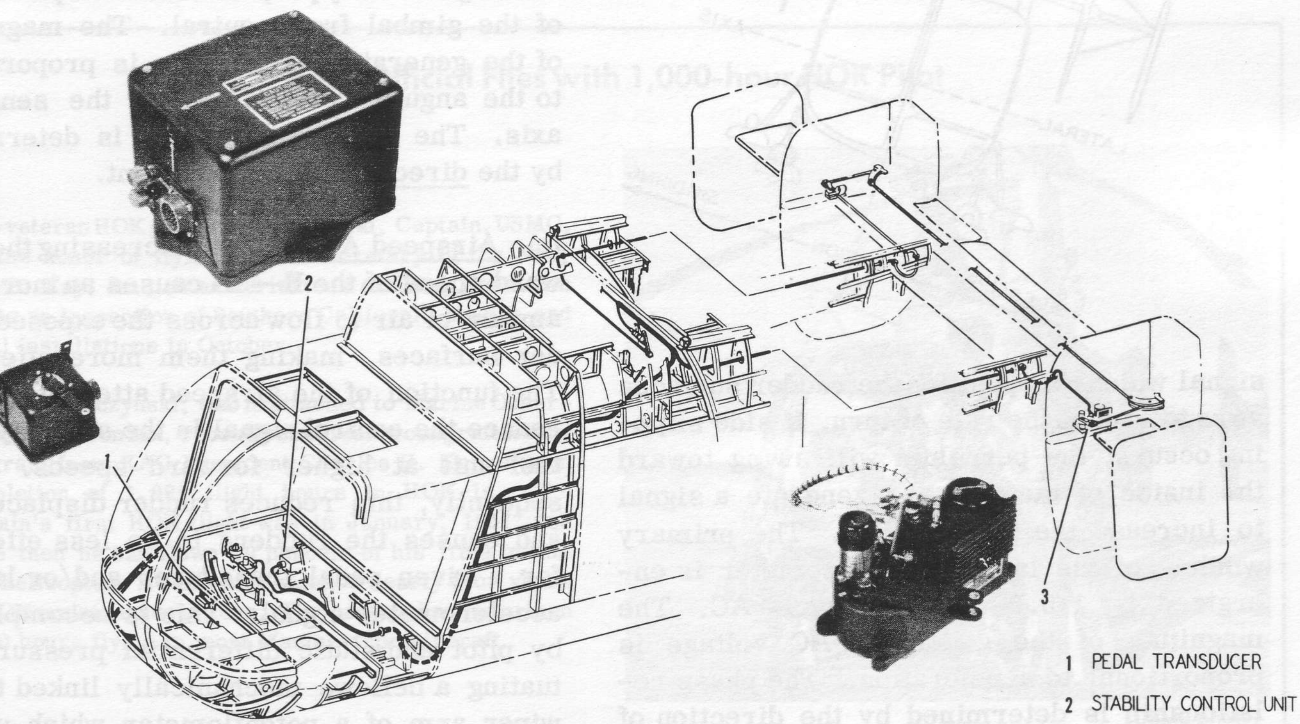
A general description of the function and operation of the Directional Stability Augmentation System was presented in the November 1960 issue (No. 8) of Kaman Rotor Tips. The following information is provided to supplement and broaden the technical scope of the previous article and explains in some detail the various circuit functions and the way they react to aerodynamic disturbances. Procedures used in DSAS testing "on the line" with only the K704606-1 Test Set are also presented.

The pedal transducer, stability control unit and rudder actuator, together with the necessary accessories to interconnect and activate these units, make up the directional stability augmentation system in the H-43B.

DESCRIPTION AND FUNCTION

1. The Pedal Transducer: The pedal transducer assembly contains an electrical device called an induction potentiometer, the rotor of which is secured to an arm assembly linked mechanically to the pilot's and copilot's foot pedals. The primary winding of the induction potentiometer is energized by 26-volt, 400-cycle, AC. As the foot pedals are displaced, moving the rotor of the potentiometer, a signal (AC voltage) is generated. The signal magnitude is directly proportional to the amount of pedal displacement, while the phase relation is determined by the direction. This signal is applied to the stability control unit and is summed with other signals to control the amount of rudder displacement when making a turn.

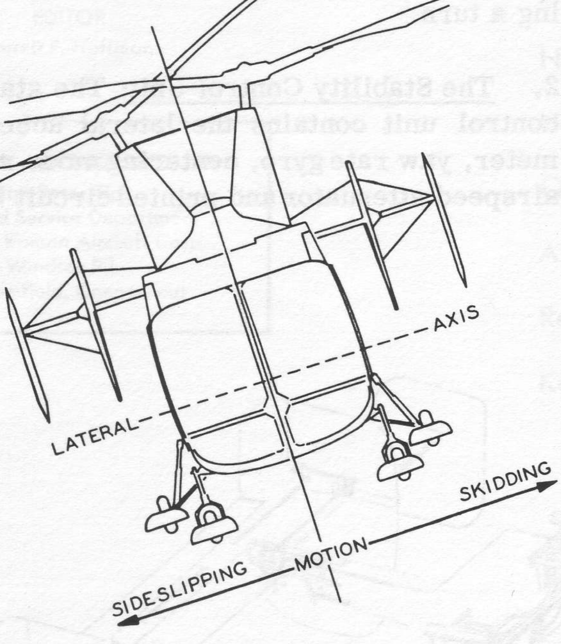
2. The Stability Control Unit: The stability control unit contains the lateral accelerometer, yaw rate gyro, centering mode relay, airspeed attenuator and printed circuit board



1 PEDAL TRANSDUCER
2 STABILITY CONTROL UNIT
3 RUDDER ACTUATOR

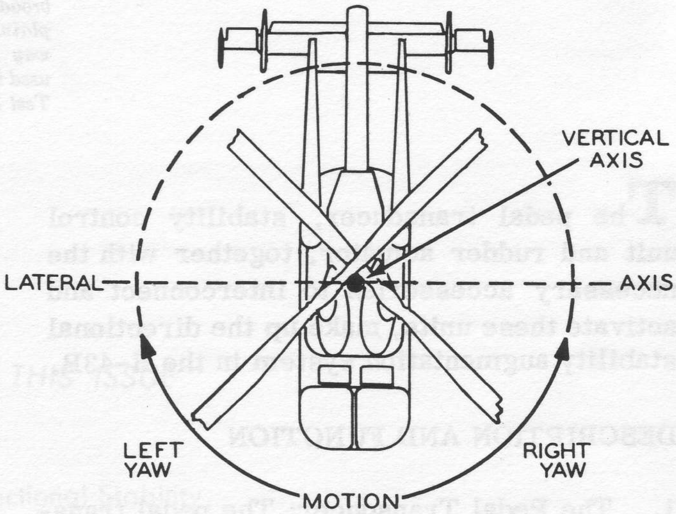
carrying the components and circuitry required for system operation.

(a) Lateral Accelerometer: The accelerometer senses skidding or side slipping of the aircraft and converts this lateral acceleration into electrical energy. It is mounted along a single sensitive (lateral) axis of the helicopter and functions somewhat like a pendulum with its axis of rotation aligned with the fore-and aft axis of the aircraft. If the aircraft is flying straight and level, the pendulum will hang straight down; this is the minimum signal or null point of the accelerometer. If the aircraft banks into a coordinated turn, the weight of the pendulum and the centrifugal force of the turn will maintain the pendulum aligned with the helicopter's vertical axis and no signal will be generated. However, if the turn is not coordinated and skidding occurs, centrifugal force will move the pendulum towards the outside of the turn and generate a



signal which will position the rudder surfaces so as to reduce the rate of turn. If side slipping occurs, the pendulum will swing toward the inside of the turn and generate a signal to increase the turning rate. The primary winding of the lateral accelerometer is energized by 115.0-volt, 400-cycle AC. The magnitude of the generated AC voltage is proportional to acceleration. The phase relationship is determined by the direction of acceleration.

(b) Yaw Rate Gyro: The rate gyro senses the aircraft's turning rate and converts this rate of turn (yaw) into electrical energy. This unit is mounted with its input axis aligned with the vertical axis of the helicopter. When the aircraft turns (yaws) about its vertical axis, the gyro rotates about its input axis. This results in a torque proportional to the



angular momentum of the spinning mass and the angular velocity about the sensitive axis, displacing the gimbal about its output axis. The gimbal is connected by means of a torsion bar to the rotor of a rotary differential transformer. This transformer generates a voltage directly proportional to displacement of the gimbal from neutral. The magnitude of the generated AC voltage is proportional to the angular velocity about the sensitive axis. The phase relationship is determined by the direction of displacement.

(c) Airspeed Attenuator: Increasing the forward speed of the H-43B causes an increased amount of air to flow across the exposed rudder surfaces, making them more effective. The function of the airspeed attenuator is to reduce the control signal in the stability control unit at higher forward speeds. Consequently, this reduces rudder displacement and causes the rudders to be less effective for a given pedal transducer and/or lateral accelerometer signal. This is accomplished by pitot and static differential pressure actuating a bellows mechanically linked to the wiper arm of a potentiometer which varies the output of the summing amplifier.

3. The Rudder Actuator Assembly:

(a) Servo Motor: The servo motor is used to convert the resultant electrical control signal to the mechanical energy required to drive the gear train assembly. The servo motor reference winding is energized by 115-volt, 400-cycle AC. The control winding is energized by the control signal from the servo amplifier in the stability control unit. A pinion gear attached to the output shaft of the servo motor drives the gear train and the rudder is positioned accordingly.

(b) Gear Train and Slip Clutch: A gear train is housed in the rudder actuator assembly between the upper and lower housing assemblies. The gear train having the required gear reduction is driven through a gear attached to the servo motor. A slip clutch is incorporated to protect the gears against shock loads and provide reversibility in the event of gear failure or gear jamming.

(c) Rudder Position Transducer: As the rudder is displaced from neutral, a rotary motion type induction potentiometer is acttuated and converts rudder displacement to an electrical signal. The rudder position transducer contains an induction potentiometer, the primary (or stator) being energized by 26-volt, 400-cycle AC. A gear attached to the rotor of the potentiometer is driven by the gear train in the lower housing. Movement of the rotor generates a signal in direct proportion to rudder displacement while the phase relationship is determined by direction and is 180 degrees out of phase with the control signal.

(d) Rate Generator: The rate generator is, in effect, a minature AC generator converting the rate of rudder displacement to an electrical signal. The primary winding is energized by 26-volt, 400-cycle AC. As the rotor of the rate generator is turned, a signal is generated whose magnitude is in direct proportion to the rate of the rudder displacement. The phase relationship is 180 degrees out of phase with the signal generated from the rudder position transducer, thus preventing rudder oscillation.

THEORY OF OPERATION

1. Modes of Operation: The directional stabilizer will operate in one of two modes of operation, "Normal" and "Centering." When the system is operating in the Normal mode, it aids the directional stability and control of the H-43B. When the system is operating in the Centering mode, the rudder is locked in its neutral position. Here is a functional description of the operation of the directional stability system: (continued on page 19)

High Official Flies with 1,000-hour HOK Pilot

To veteran HOK pilot S.J. Kuczynski, Captain, USMC, fell the honor of flying Under Secretary of the Navy Paul B. Fay, Jr., on an aerial tour of Camp Pendleton during an inspection of Southern California Marine and Naval installations in October.

Captain Kuczynski, who is attached to Marine Observation Squadron Six, recently received a congratulatory telegram from KAC President Charles H. Kaman upon completion of 1,000 flight hours in HOK-1s. The Captain's first HOK flight was in January, 1957, and since then he has flown 70 percent of his time in this type helicopter. He has also worked nearly four years as HOK maintenance officer. The captain has more than 5,000 hours flying in most Marine-type aircraft.

(USMC photo)

NEW WORLD'S RECORDS SET BY H-43B

Four world's records were shattered by an H-43B HUSKIE recently, bringing to five the total number broken by Air Force pilots in this type helicopter within the last six months.

Three new time-to-climb records in a single 15-minute flight at the Kaman Aircraft plant in Bloomfield, Conn., were set Oct. 24 by Lt. Col. Francis M. Carney, Commander of the 3638th Flying Training Squadron (Helicopter), Air Training Command, at Stead AFB, Nev. A few days earlier, Colonel Carney set a new world altitude record for helicopters when he reached 32,279 feet.

Time-to-climb records claimed are:

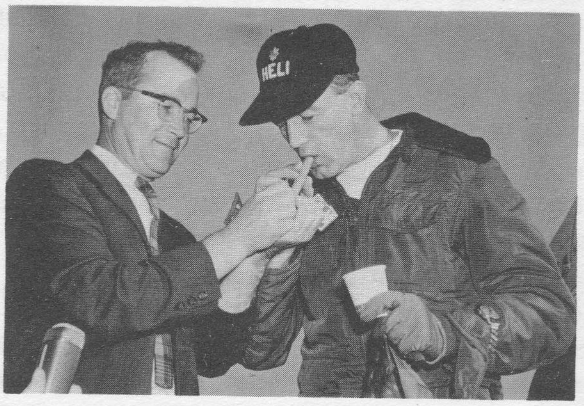
To 3,000 meters (9,842 feet) 2 minutes 44.5 seconds. Previously held by the Army Bell HU-1 with a time of 3 minutes 29.1 seconds set on July 19, 1960.

To 6,000 meters (19,684 feet) in 6 minutes 42.3 seconds. Previously held by the Army Bell HU-1 with a time of 8 minutes 7.1 seconds set on July 19, 1960.

To 9,000 meters (29,526 feet) in 14 minutes 11.5 seconds. Previously held by the French Alouette with a time of 17 minutes 43.9 seconds set on June 13, 1958.

The time required to reach the altitudes established rates-of-climb for the H-43B at 4,200 feet per minute initially and 600 feet per minute at 30,000 feet. The initial rate-of-climb is faster than the highest performance World War II fighter aircraft and no other helicopter has ever attained this rate before.

The new world altitude class record with the H-43B was set by Colonel Carney on Oct. 18. He took off on the altitude record-breaking flight at 8:04 a.m. and completed his flight at 9:05. The new mark was set in Class E-1d for helicopters in the 3,858 to 6,614 pound weight range. The previous record of 29,846 feet was also set by the H-43B in a flight Dec. 9, 1959, by Air Force Capt. Walter J. Hodgson and Maj. William J. Davis.



COFFEE AND A CIGAR—Along with congratulations, Lt. Col. Francis F. Carney receives a cup of coffee from KAC President Charles H. Kaman. A minute later Chief Test Pilot Al Newton stepped up with a cigar for the man who had flown the H-43B to four new records. Afterward an engraved desk barometer was presented to Colonel Carney on behalf of Kaman Aircraft employees as a token of their appreciation for his achievements.

In May of this year, Capt. Walter C. McMeen of TAC's Luke AFB, Ariz., established a world altitude record of 26,369 feet for helicopters carrying a 1,000 kilogram (2,204 lb.) payload.

Lt. Col. Francis M. Carney is Commander of the 3638th Flying Training Squadron (Helicopter) at Stead Air Force Base, Nevada. He has more than 4,000 flying hours, including 1,550 hours in rotary wing aircraft on his record. As Commander of the Stead Squadron, he commands the only school for helicopter pilot training in the Air Force. The school is under the Air Training Command flying training program.

The thirty-nine-year-old native of Philadelphia, Pennsylvania, entered the Army Air Corps aviation cadet program February 13, 1942. He earned his wings and was commissioned at Blackland Field, Waco, Texas, the next year.

He served in Europe during 1945-1946, in Korea 1950-1952 and Japan-Eniwetok-Okinawa-Burma during 1956-1959.

In May, 1954, he learned to fly helicopters at Shaw Air Force Base, South Carolina.

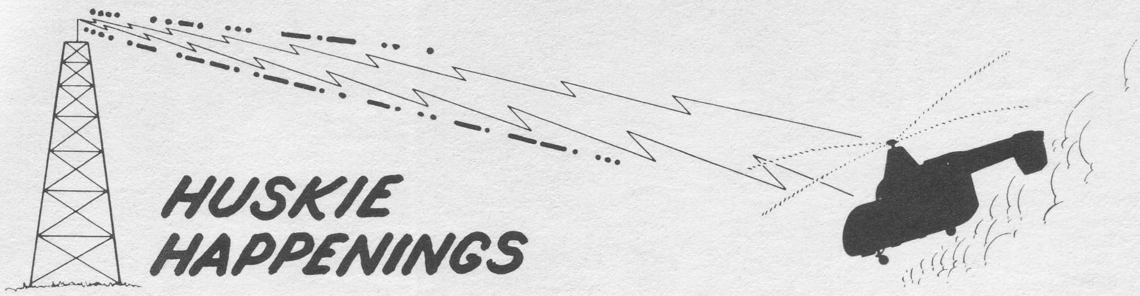
As a helicopter pilot, Col. Carney has rescued one hundred and fourteen persons. He performed the largest night rescue ever attempted, picking up a total of sixty-six during a night storm in South Carolina, March, 1955. Two helicopters participated, saving ninety-three persons in all that night.

He commanded the 24th Helicopter Squadron during the time it earned the Air Force Outstanding Unit Award, the only helicopter squadron so honored.

Primary reason for the award was the squadron's support of atomic testing performed during Operation "Hardtack" at Eniwetok and Bikini Atolls in 1958.

Col. Carney has been awarded the following decorations during his Air Force career: Air Force Commendation Medal, European Theater Ribbon, Victory Medal, World War II; Occupation of Germany, Occupation of Japan, Korean Service Medal with three battle stars, National Defense Medal, Longevity Ribbon with three oak leaf clusters and the Good Conduct Medal.

He is married to the former Eleanor M. Childs of Doylestown, Pennsylvania. They have four children: Rick, 17; Ronnie, 15; Randle, 12 and Robin, the only girl, 8 years old.



HUSKIE HAPPENINGS

H-43B crew from Dow AFB, Me., makes 100-mile round trip beneath clouds and through driving rain storm to evacuate coastguardsman and two civilians stranded on tiny island four miles off the Maine coast. Aboard the helicopter were Capt. H. H. Davis, pilot; Capt. Glenn Marks, co-pilot; and Ralph Lee, KAC test pilot. Lee, who happened to be at Dow Field on a routine visit called the navigation "superb."

.... HUSKIE crew from Malmstrom AFB, Mont., flies 70 miles from base to evacuate dentist injured in fall while on hunting trip in mountainous territory. 1st Lt. Joseph Penault was pilot and Captain LeFeure, co-pilot, of the helicopter which made the pickup at 4600 feet.... Lt. David Allison, Lt. LeRoy Aafedt and S/Sgt. Jerome Casey, flying in H-43B from Duluth MAP, Minn., locate three boys missing in wilderness for 34 hours and direct ground search parties to them.

.... HUSKIE crew at Luke AFB, Ariz., scrambles with fire suppression kit and extinguishes burning F84 which crashed near highway two miles from base. Pilot, who bailed out, picked up and returned to Luke. Manning the H-43B were Capt. R.R. Cowles, pilot; Capt. Zack Stockett, co-pilot; S/Sgt. R.H. Cain and A1/C R.J. Stone, firemen.... Three boys stranded by flash flood rescued by H-43B manned by Capt. W. McMeen, pilot; Capt. R. Cowles, co-pilot, T/Sgt. H. Alford and S/Sgt. D. Tagett, medic. Impossible to land at site, Sergeant Alford lowered to insure that the sling is properly placed on the boys, aged 10, 12, and 14.

.... Missing boat, object of widespread search, located safely at anchor in small inlet by H-43B from Brookley AFB, Ala. During the search H-43B crew on first mission were Capt. Milton Gordon, pilot; Lt. John Moore, co-pilot; S/Sgt. William Fulford, rescue technician; T/Sgt. Eugene Hughs, fireman and A2/C Kenneth Morin, crew chief. Second mission was flown by Capt. John Allison, pilot; Lt. Moore, co-pilot; Sergeant Fulford and A1/C Norman Tenney.

.... H-43B crew from Kincheloe AFB, Mich., locates hunter lost in wild brush country near Lake Superior. Hunter, object of five-day land, water and air search, located by helicopter two hours after takeoff. The pilot, Capt. "Chet" Ratcliffe hovers HUSKIE with front wheels against rocks and with the rotor blades scant feet from tall trees while the rescuee was hoisted to safety. Others aboard the helicopter were Capt. James V. Berryhill, co-pilot; and A2/C Lewis G. O'Doherty, hoist operator.

Quick Service

The Time: 1504

The Place: Minot AFB, N. D.

What Happened: Lt. W. J. Wolf, pilot; Capt. J. F. Santos, Jr., instructor pilot; S/Sgt. McCarty and A3/C Kelly, firemen; scramble in H-43B with fire suppression kit after pilot in F-106 declares an emergency. HUSKIE proceeds to approach end of runway and then hears F-106 pilot radio he is bailing out. As FSK is dropped off, smoke column is spotted five miles north of runway.

The Time: 1508

"B" rushes to scene of crash and notifies tower of exact location, then speeds to spot where parachuting pilot is going to touch down, lands and waits for him.

The Time: 1515

Pickup of pilot and personal equipment made.

The Time: 1524

H-43B lands at base and F-106 pilot is escorted to waiting ambulance.

Colonel Carney's achievement in breaking three rate-of climb records has turned some H-43B pilots into "real Tiger-types" according to a recent report.

Seems at one base the chopper pilots are challenging the "jet jocks" to a contest to see who can get to 10,000 feet the fastest from a standing start.

So far there have been no takers!

LT. J. SOSNKOWSKI, RCN; left, and Mr. C. R. McMillan, KAC test pilot; prior to flight in the HU2K-1 from Kaman Aircraft plant in Bloomfield, Conn.

CDR. P. L. SULLIVAN, USN, is the officer in charge of the flight Test Division Phase of the Navy Preliminary Evaluation presently being conducted on the HU2K-1. Earlier this year, Commander Sullivan set a helicopter world's speed record as pilot of an HSS-2.

MR. W. J. HOERMAN, KAC test pilot; left, and Lt. W. P. Franklin, USN; after local pattern flight for evaluating the Kaman design Automatic Stabilization Equipment and the Dead Reckoning Navigation Plotter.

CDR. J. L. BLADES, USN; right, in charge of Weapon Systems Test for the Kaman NPE, reviews flight notes with Mr. J. V. LeForte after two days' test flights over Long Island Sound. The tests were conducted from the Naval Air Station at Quonset Point, R. I.

Members of the Naval Air Test Center at Patuxent River, Maryland, are currently at Kaman Aircraft Corporation putting the HU2K-1 through its paces in conducting a Navy Preliminary Evaluation. Flight Test Division and the Weapon Systems Test Division are accomplishing their respective phases of the evaluation, to be followed shortly by the Service Test Division phase. As a part of the program, the helicopter is being flown under many diverse weather conditions both day and night. The teams are gaining further familiarity with the ultramodern features of this high-performance helicopter. Naval Air Test Center personnel who are participating in this NPE include:

Capt. B. K. Lloyd, USN
Capt. F. G. Edwards, USN
Cdr. P. L. Sullivan, USN
Cdr. J. L. Blades, USN
Lt. Cdr. D. J. Roulstone, USN
Capt. D. A. Spurlock, USMC
Lt. B. W. Witherspoon, USN
Lt. J. Sosnkowski, RCN
Lt. W. P. Franklin, USN

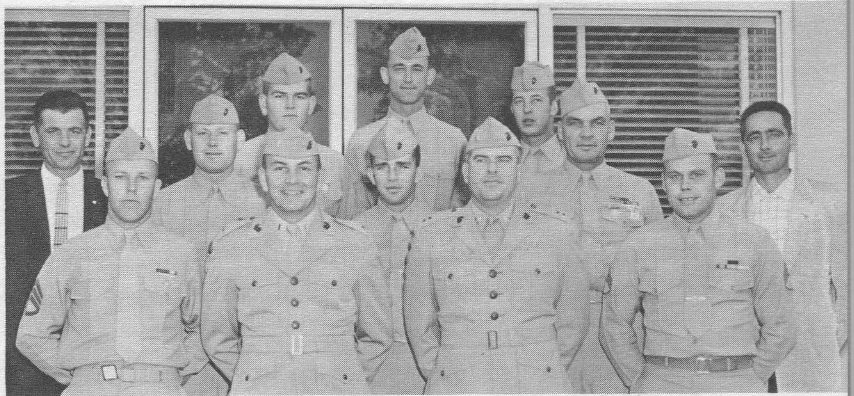
Capt. L. K. Keck, USMC
Mr. R. L. Wernecke
Mr. R. C. Dumond
Mr. J. V. LeForte
Mr. F. W. Ferns
Mr. W. O. Sprinkle
D. E. Felix, ADRC
K. L. Adams, AD-1
P. S. Plank, ADR-3

CDR. W. D. WADE, USN; center, evaluating post flight data on the flying qualities of the SEASPRITE with Lt. B. W. Witherspoon, USN test pilot; and Mr. R. C. Dumond, engineer.

CAPT. D. A. SPURLOCK, USMC; center, reviews in-flight notes on the flying qualities of the SEASPRITE with, left to right, Mr. R. L. Wernecke, engineer; Mr. R. C. Dumond, engineer; and Lt. J. Sosnkowski, RCN.

SCROLL OF HONOR—Congratulations are extended to members of H-43B crew from Kincheloe AFB, Mich., who received Kaman Scrolls of Honor recently for hazardous mission during which injured six-year-old boy was flown to hospital for an emergency operation. Left to right are, Bill Welden, KAC Service Representative, A2/C James B. Hegwood, medic; 2nd Lt. Richard Harwood, co-pilot; Capt. Paul J. Darghty, pilot; and Col. Thomas W. Hornsby, Commander of the 507th Fighter Wing. Capt. Edward J. McMurry, flight surgeon who tended the boy during the flight, was not present when the awards were made. (USAF photo)

HU2K-1 NAMT(M) NAVIGATION PANEL INSTRUCTOR'S COURSE—USN personnel and their instructors are, left to right, Dade R. Hoyle, AT1/C, NAMTD 1070, NAS Lakehurst, N. J.; R. W. Spear, KAC; Eugene W. Michalski, ATC, NAMTD 1071, NAAS Ream Field, Calif.; Lively Darr, ATC, NAMTD 1070; F. G. Bober, KAC; Warren E. Rietz, AT2/C, NAMTD 1071.



SPECIAL HOK-1 MAINTENANCE CLASS—USMC personnel from VMO-6, Camp Pendleton, Calif., and their instructors, are, front row, left to right, S/Sgt. David C. Tunmire, 1st Lt. Curtis R. Bohlscheid, Capt. Richard E. Skinner and S/Sgt. Albert L. Shaw. Second row, Jack King, KAC; S/Sgt. Thomas R. Ward, Pfc. Samuel C. Wilson, Gy/Sgt. Lawrence L. Cormichael and Ray Vokes, KAC. Rear row, Pfc. Russell A. Creamer, Cpl. Cecil W. Massey and Cpl. Charles T. Baird.

HOKs Save Three

Two snake-bite victims and a teenage mountain climber were rescued recently by HOK crews attached to VMO-2. Both rescues were performed under adverse conditions.

Capt. Robert B. Mason and Sgt. Ralph O. Jacks were called upon for assistance after two marines engaged in a night exercise on Okinawa were bitten by poisonous Habu snakes and were in need of speedy evacuation to receive anti-venom serum. The marines on the ground cleared the remote, densely-wooded area of the taller trees so that Sergeant Jacks could hoist the two injured men into the helicopter.

The other rescue took place in Japan and was performed by two members of Sub-Unit One, VMO-2. Capt. C. Smith was pilot and W. O. "Wally" Bracken, co-pilot, on the mission which began with a request for assistance from a town in a mountainous section 100 miles away. A teenage mountain climber had fallen 40 feet and was seriously injured.

The two marines flew through fog most of the way to the pickup site. When they arrived the boy, his mother and a doctor were placed aboard the HOK and flown to the hospital. The doctor said the quick trip undoubtedly saved the boy's life. K

HUKs On The Job

Seconds after Station Operations at NAS Jacksonville, Fla., was notified that a sailboat had capsized, tossing two doctors into the St. Johns River, an HUK-1 was airborne. The pilot was Lt. I. Hastings and AD3/C Getta was crewman.

Five minutes after the alert sounded, the doctors were safely aboard the helicopter and it was headed back to the station. The rescuees were in the water a total of 10 minutes.

A few days earlier and several thousand miles away, another HUK-1 crew was instrumental in the rescue of four young men who had become lost while on a hike in Hawaii.

Lt. Richard A. Carlson and Albert Moore, AB2/C, attached to NAS Barber's Point Maintenance Dept., took off on the search after being alerted by the Rescue Center at Pearl Harbor. The boys had been missing 22 hours.

After several hours of searching, Moore spotted the young men on Skyline Ridge. The rescue team was immediately notified and directed to the spot. K

Q's AND A's

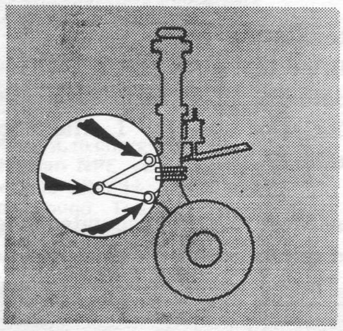
If you have a question regarding Kaman Aircraft maintenance, send it along to Rotor Tips. The Service Department's analysts will be glad to answer it.

Q. (Applies HOK-1, HUK-1, H-43A) WHAT CAN BE DONE TO PREVENT CORROSION AT THE FLAP ROD CLEVIS BOLT P/N AN173-7?

A. This is a close tolerance bolt which is exposed to the elements. It should be thoroughly coated with zinc chromate paste (non-hardening type) during installation. — C. J. N.

Q. (Applies H-43A, H-43B) WHY SHOULD THE CARGO HOOK AUTO-SLING RELEASE BE IN THE "OFF" POSITION AT THE TIME OF HOOK UP?

A. When the auto-sling release switch is "ON," the cargo hook release solenoid is energized and will not allow the latch to lock. — A. D. C.



Q. (Applies HOK-1, HUK-1, H-43A, H-43B) HOW MUCH TORQUE SHOULD BE APPLIED TO THE TORQUE ARM BOLTS ON THE AUXILIARY STRUTS, P/N 9166 AND 9872?

A. The Cleveland Pneumatic Tool Co. has established a torque range of 10 to 30 pound inches for the three torque arm bolts, (see sketch). This information will be included in the next revision to the strut overhaul manual. — R. S. W.

Q. (Applies H-43B) WHEN THE HELICOPTER'S ROTORS ARE NOT TURNING, WHY DOES THE STOP ON THE PILOT'S COLLECTIVE STICK MEET ITS "UP" BOLT BEFORE THE STOPS ON THE COPILOT'S SIDE OF THE AIRCRAFT CONTACT ONE ANOTHER?

A. The pilot's collective stop arm is directly connected to both collective sticks through the inner torque tube. The copilot's collective stop is connected to the outer torque tube. The inner torque tube can move a certain amount independent of outer torque tube movement due to an oversize hole arrangement designed in the torque tube assembly. The pilot's collective stop will lead the copilot stop as a result of the oversize hole arrangement and therefore contact its "up" stop bolt first. The condition is entirely normal and will occur when the rigging instructions outlined in the maintenance handbook are followed. — W. J. W.

Q. (Applies H-43A, H-43B) IS IT PERMISSIBLE TO HYDROSTATICALLY PRESSURE TEST THE FIBER GLASS PRESSURE TANK?

A. No! Pressurizing the tank to 5000 psi for a test may weaken it sufficiently so that a following test would result in tank failure if it is subjected to only 3000 pounds psi. — A. D. C.

Q. (Applies HOK-1, HUK-1, H-43A) WHAT CAN BE ONE CAUSE OF ERRATIC DIRECTIONAL CONTROL RESPONSE?

A. Sticking or binding of the reverser sensing rod can cause erratic directional control response. An accumulation of dirt and moisture has been known to cause the sensing rod to bind and cause reverser malfunction. The fix is to disassemble the sensing rod, clean all parts, apply Molycote to sliding surfaces, and reassemble. On HOK-1 helicopters the part number for the reverser sensing rod is K356023-1. HUK-1 and H-43A helicopters use a K756001-1 reverser sensing rod. — W. J. W.

Q. (Applies HOK-1, HUK-1, H-43A) WHEN BOLTS ARE REMOVED SO THAT THE AZIMUTH THRUST ROD BEARING MAY BE CHECKED FOR AXIAL PLAY, WHAT SPECIAL PRECAUTION SHOULD BE TAKEN TO PREVENT IMPROPER POSITIONING WHEN THE BOLTS ARE LATER REPLACED?

A. The bolts referred to are located at the forward end of the left hand collective crank on the firewall and the right hand longitudinal damper arm. When the bolts are removed care should be taken to keep the washers (AN960) from each bolt in the proper order. When the bolts are replaced this order must be adhered to since the washer combination determines the proper positioning of the bolts. If the wrong combination of washers is used, bolt-to-bolt interference may result. This interference, if present, will be noticed with application of full right rudder pedal, aft cyclic and about 6-1/2 degrees of up collective. Rearrangement of the washers will eliminate the problem. — W.J.W.

Q. (Applies HOK-1, HUK-1, H-43A, H-43B) WHY, WHEN REINSTALLING TEFLON HOSE ASSEMBLIES, SHOULD EXTRA CARE BE TAKEN TO REPLACE THE HOSE IN THE SAME LOCATION AND HELICOPTER?

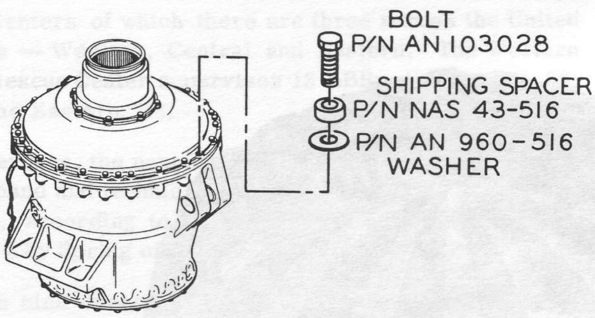
A. After being subjected to temperature and pressure, Teflon tends to retain a permanent "set." Bending or twisting the hose against this "set" will cause the hose to kink and eventually fail. — P. M. C.

Q. (Applies H-43B) WITH THE NEW "TOED-IN" AZIMUTH, IS IT NECESSARY TO PRE-POSITION THE AZIMUTH BAR WHEN GAP FILLING HUB-TO-BLADE RODS AND AZIMUTH BAR-TO-HUB RODS?

A. Yes, the azimuth bar must be placed in the true fore and aft position. Future handbook revisions will reflect this. — W.J.W.

Q. (Applies HOK-1, HUK-1, H-43A, H-43B) IS IT NECESSARY TO COMPLETELY DISENGAGE THE ADJUSTING LOCK BEFORE TURNING THE COLLECTIVE LIMITER HOUSING?

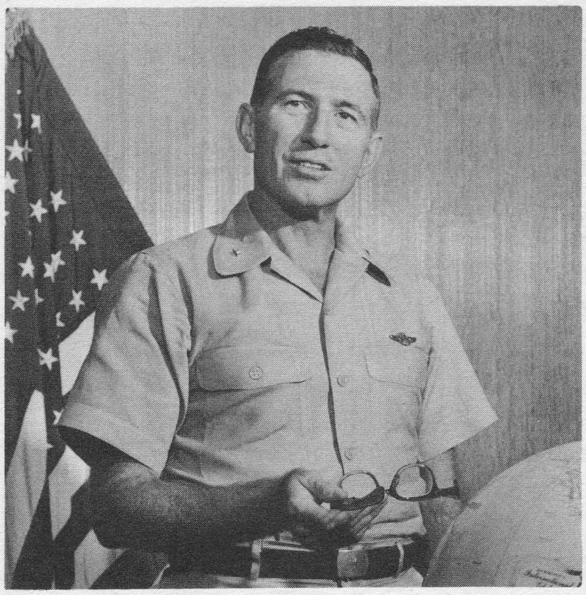
A. Yes, it is necessary. Damage to the adjusting screw may result if an attempt is made to turn the limiter housing without first making certain that the lock is disengaged. The two cotterpins securing the lock to the housing must be removed and the lock moved forward (towards the front of the helicopter) until the entire lock is visible. Only in this position is complete disengagement assured. — W.J.W.



Q. AFTER THE SHAFT AND PYLON ASSEMBLIES HAVE BEEN REMOVED, WHAT PRECAUTION SHOULD BE OBSERVED WHEN SECURING THE LEFT AND RIGHT TOP COVERS TO THE TRANSMISSION FOR SHIPPING AND/OR STORAGE PURPOSES?

A. Care should be taken to place washer AN960-516 under shipping spacer NAS 43-516, NOT under the bolt head. This prevents damage to the transmission cover when bolt AN 103028 is torqued down. A number of transmissions have been received for overhaul with damage in the bolt hole area due to the positions of the washer and shipping spacer being reversed. This damage occurred when the bolt was tightened, for the spacer also turned and imbedded itself in the top case. A correction to Fig. 6, page 2-10 of T.O. 1HA2-2-2-94 which shows the stack-up will be included in the next revision. — R.A.B.

KAMAN SERVICE ENGINEERING SECTION—*G. D. Eveland, Supervisor, Service Engineering; E. J. Polaski, G. S. Garte, Asst. Supervisors.*
ANALYSTS—*R. A. Berg, A. D. Cutter, P. M. Cummings, P. A. Greco, C. W. Jenkins, G. M. Legault, J. McMahon, C. J. Nolin, A. Savard, W. J. Wagemaker, N. E. Warner, A. A. Werkheiser, M. Whitmore, Jr., R. S. Wynott, W. H. Zarling.*



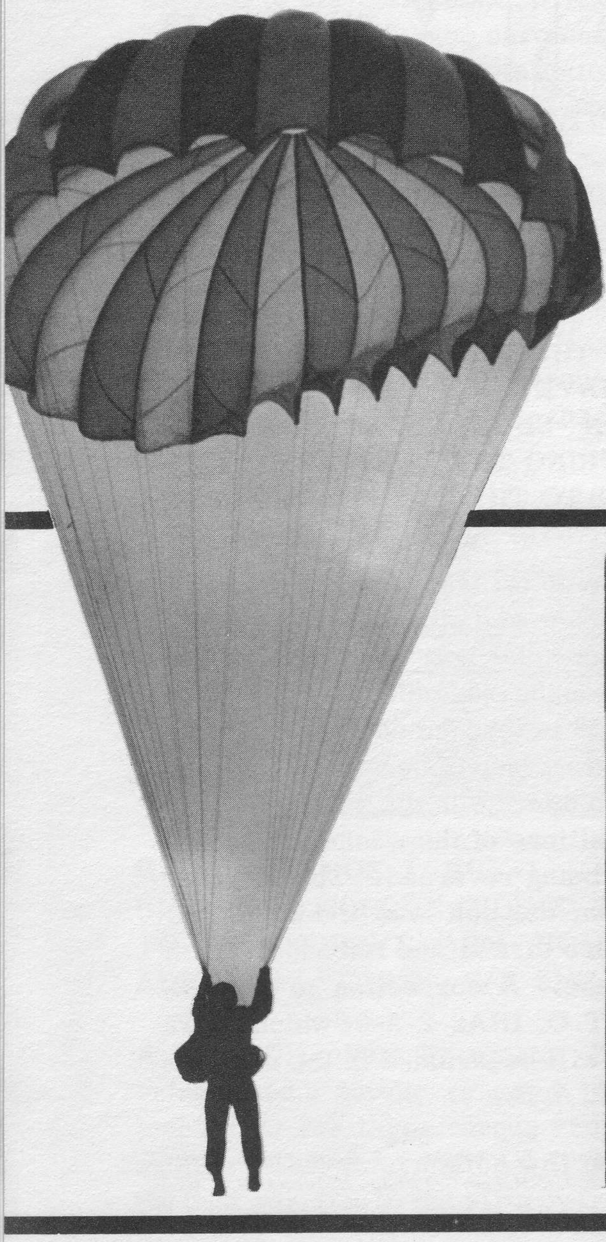
Brig. Gen. Joseph A. Cunningham

A NEW LOOK TO RESCUE

By John L. Vandegrift, Jr.
Deputy Director of Information
Headquarters, Air Rescue Service
Orlando AFB, Fla.

There is a new look to the Air Rescue Service, and the most exciting aspect of this new look is Kaman's H-43B "Huskie." The introduction of this new aircraft to the Rescue inventory came about when, on 1 October 1961, the ARS assumed responsibility for 70 Local Base Rescue units strategically located on Air Force bases throughout the world. Of the 148 helicopters picked up by Rescue on this date, 69 were H-43Bs. It is anticipated that the other helicopters in the inventory will be replaced by "Huskies" at the rate of three or four a month until, ultimately, all LBRs will be Kaman equipped.

The Huskie is bound to have a great impact on the Air Rescue Service and the prosecution of its mission. Indeed, the impact has already been felt. Conversely, the assumption of the LBR responsibility by Air Rescue Service is bound to have a significant impact on Kaman. No longer will it be necessary for representatives of Kaman to deal with a wide variety of using commands. Now they deal directly with one command whose primary mission is rescue — with one group of professionals whose primary business is Rescue.



The impact of the H-43B on Rescue operations was dramatic and immediate. In the first month since assuming LBR responsibilities, there have been a number of "saves" chalked up by the H-43B. Certainly the most spectacular and indisputable rescue occurred at Seymour Johnson AFB, and it involved the Fire Suppression Kit in such a manner as to make a true believer out of the most skeptical. An F-105 Thunderchief piloted by Capt. Charles D. Hollingsworth declared an emergency. The H-43 was scrambled with Lt. Norman R. Albee as pilot, Capt. Jack Armstrong as co-pilot. It went to the end of the runway and orbited while awaiting the F-105.

As the fighter touched down, the fuselage broke in two just aft of the pilot's compartment and both portions burst into flame. The chopper crew immediately landed, dropping off the Fire Suppression Kit and rescuemen. In a matter of moments, a path was cut through the fire to the cockpit in the classic fire rescue technique. Slashing the pilot's shoulder straps, they removed him from the aircraft. As the flames roared around them the pilot shouted to the rescuemen, "Charlie, you'll never get me out of here alive!" A few seconds later, however, the pilot was safely outside the aircraft and receiving first aid from the chopper's medic. Total elapsed time from impact to pilot removal was two minutes.

To paraphrase the old slogan, "Ask the man who flies one," Rescue chopper pilots at the LBRs and at the headquarters have been queried concerning their feelings toward the H-43B. On one thing they are unanimous. The Huskie has ample power year-round to deliver its full rescue crew and equipment to a higher elevation than any other helicopter now in the Rescue system. From Death Valley (-280 feet) to the peak of Mt. McKinley (20,320 feet) the 43 can land a rescue crew anywhere in these 50 United States.

The turbine engine configuration makes it quieter to operate and it is not so annoying to the local population. One of the Rescue pilots (who must be a farmer at heart) says, "Chickens panic at the sight or sound of a helicopter. They probably believe it to be the largest — and last — chicken hawk they ever will see. The H-43B doesn't shake 'em up like some I've flown. As a matter of fact, the chicken ranchers ought to get together and sponsor the Huskie."

On a more serious note, the Stan Board pilots at Headquarters ARS say, "The H-43B helicopter is the first helicopter to have the full capability of a compact rescue system. With properly trained rescue personnel, the Huskie can: (a) Locate the crash (b) Control the crash fire (c) Enter the crash (d) Rescue the crew members (e) Administer airborne first aid and (f) Evacuate personnel to hospitals. They are no longer a secondary rescue vehicle, and with the Fire Suppression Kit there's nothing to touch them in their field."

Among the less favorable comments, mention was made of the limitations imposed by certain deficiencies (lack of VHF radio) of communication between aircraft and ground, and the relatively short fuel supply which limits flight to about three hours. This supply is perfectly adequate, however, to meet the demands of Local Base Rescue for which the H-43B was originally procured. All that is necessary is the requirement for auxiliary fuel tanks to be indicated and they could easily be installed in the helicopters. Other minor discrepancies mentioned are the lack of windshield wipers and the need for better ventilation equipment. Compared to the aircraft's excellent power reserve and superb maneuverability, these pale into relative insignificance.

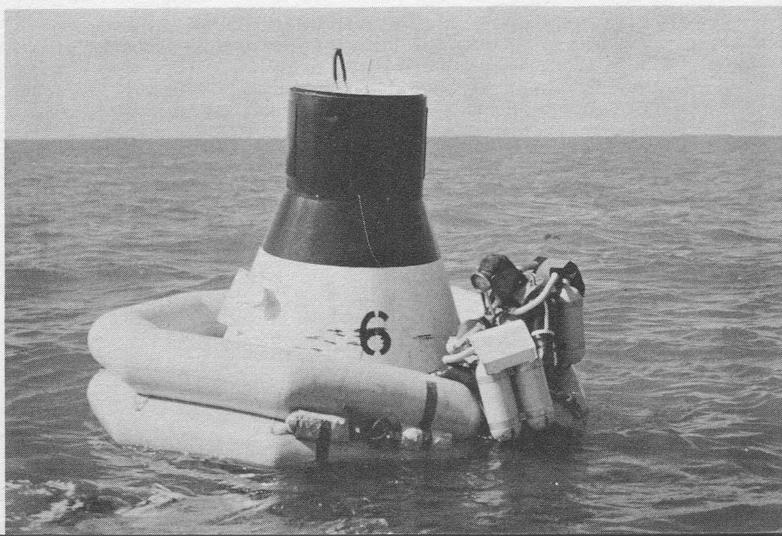
Commanded by Brig. Gen. Joseph A. Cunningham, with his headquarters at Orlando Air Force Base, Fla., the Air Rescue Service was instrumental in proving the worth of the helicopter as a rescue vehicle. In Korea, the ARS saved thousands of lives — many from behind enemy lines — and the chopper earned the nickname "battle taxi."

Presently, only LBRs within the United States have the Huskie. The ZI LBRs are under the control of Air Rescue Centers of which there are three across the United States — Western, Central and Eastern. The Western Air Rescue Center supervises 13 LBRs; the Central, 20; and the Eastern, 18.

Overseas, the nearest Air Rescue Squadron exercises command and technical supervision over these units and these, according to current plans, will be flying the Huskie by Spring of 1963.

The nine overseas Rescue Squadrons are located in Japan, Okinawa, Guam, Hawaii, Bermuda, Labrador, the Azores, Scotland, and Libya. There are two overseas centers, Pacific Air Rescue Center at Hickam AFB, Hawaii; and Atlantic Air Rescue Center at Ramstein AFB, Germany. In addition, operating locations are established in support of special projects all the way from New Zealand to Alaska to Africa — anywhere in the world Rescue support is required. This, then, is the Air Rescue Service — guardian of the air lanes of the world.

Everywhere, men who fly know that should trouble strike, highly-trained rescuemen are standing ready to assist any time, anywhere, under any circumstances. Basically a combat organization, the primary mission of the Air Rescue Service is to save USAF personnel in time of war. Every year since it was organized, in 1946, thousands of hours have been flown, not only to save citizens of the United States, but those of practically every country this side of the Iron Curtain.



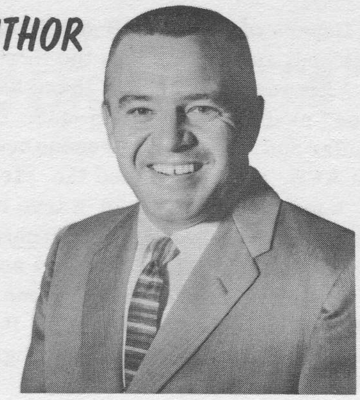
Recently, Rescue's mission has been expanded to include the recovery of aerospace hardware and equipment. Rescuemen are, and have been, working with the famed MERCURY and DISCOVERER Projects developing the new techniques necessary to recover astronauts and space capsules.

It is impossible to estimate accurately the number of lives Rescue has saved in its relatively short history. It can be definitely established that to date over 8,000 persons have been found and rescued from certain death by Air Rescue Service personnel. This is a most conservative statistic. In addition, Air Rescue has directly aided a confirmed total of over 50,000 people and saved over 83 aircraft from destruction.

In the more than 15 years that ARS has been in business, Rescuemen have flown almost 42,000 missions of mercy and logged over 309,930 flying hours for the sole purpose of seeking and saving downed flyers, accident victims and the survivors of a variety of natural disasters. Not included in these hours and missions are thousands of others flown over the years on escort and orbit-type missions. Somewhere in the world every day of the year, Rescue is called on to fly this precautionary type mission just to be on the scene should serious trouble develop.

REPRESENTATIVE OF THE BIG CHANGEOVER—HUSKIE number two arrives for duty with the 42nd Helicopter Detachment at Dow AFB, Maine, while the first HUSKIE, which arrived in early October, stands in the foreground. The 42nd received both its H-43Bs from Plattsburgh AFB, N. Y. Within two weeks of activation on Oct. 1, the detachment was called upon six times. H-43B crews rescued an injured hunter from the Maine woods, assisted in searches for lost civilian aircraft, airlifted an injured man and rescued three men from a lighthouse five miles off the coast of Maine. (USAF photo)

THE AUTHOR



John L. Vandegrift, Jr., is a graduate of Dartmouth College and served in the Marine Corps as a fighter pilot during World War II. He retired from the Corps in October 1946 as a result of wounds suffered aboard the aircraft carrier USS Franklin.

Referring to himself as being "among the least decorated Marine Corps fighter pilots of the war," Mr. Vandegrift says he was almost certainly the first to land a Corsair (F4U) upside down on a jeep carrier. His appreciation for the ARS mission undoubtedly stems from the fact he was picked up twice from the Pacific following "unpleasant" combat incidents.

Mr. Vandegrift has been with the Information Office of Air Rescue Service for approximately eight years. Prior to duty with ARS he edited magazines for the Navy Department and specialized in aeronautics.

None of the above statistics include the countless thousands of persons aboard aircraft that ARS has intercepted and escorted to safety or supplied radio and navigational aid, enabling them to reach their destinations without difficulty. Every year the American taxpayer is saved untold millions of dollars by precautionary flights of this nature. The highly-trained personnel whose lives are saved are priceless.

For heroic work in the face of natural disasters, Rescue personnel have made headlines repeatedly during the years. The majority of these disasters involved people of other countries, and the exploits of Rescuemen have developed bonds of friendship that will never be broken. As an instrument of international diplomacy and good will, its value is incalculable. K

"It is my duty, as a member of the Air Rescue Service, to save life and to aid the injured.

"I will be prepared at all times to perform my assigned duties quickly and efficiently, placing these duties before personal desires and comforts.

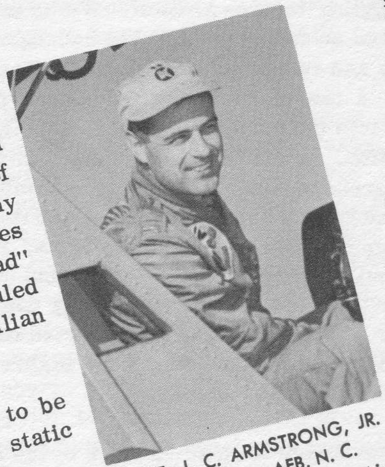
"These things I do that others may live."—Code of the Airescueman

REPORT *from the ready room*

Sept 24-1961

AIR SHOW RESCUE—WILMINGTON, N. C.

As a means of aiding other helicopter rescue units in their programs, Capt. John C. Armstrong, Jr., USAF, agreed to a Rotor Tips' request for a personal account of the mission describing the conditions encountered and the action taken. Similar accounts written by Air Force, Navy and Marine helicopter pilots will appear from time to time with this purpose in mind.



CAPT. J. C. ARMSTRONG, JR.
Seymour Johnson AFB, N. C.

Our entire crew from the Seymour Johnson AFB, N. C., Rescue Section was looking forward to Sunday's trip down to Wilmington, N. C. — and with good reason it seemed; the air show and static display at the civilian airport there promised to be one of the biggest. A crowd of well over 100,000 was expected and many interesting aircraft were to be shown by the Army, Navy, Marines and Air Force, not to mention civilian agencies. An old "Spad" was to be there and numerous exciting fly-bys were scheduled which were to include the famed "Thunderbirds" and civilian stunt teams.

Our part in the show had been clearly defined. We were to be located between an Army HU1-A and a Marine H-37 as a static display aircraft.

The trip down was uneventful and it wasn't long before we had our Huskie in place on the ramp, complete with fire suppression kit and large information placards.

The fly-bys and aerial demonstrations soon got underway. We all watched with special interest as the gaily decorated Air Force C-123 taxied by our position. This aircraft, belonging to the "Thunderbird" Unit, was to take several members of the famous Army Parachute Team to altitude where they would provide the crowd with a unique sky-diving demonstration. They were to attempt, for the first time, the difficult feat of jumping all linked together, i.e., legs and arms hooked together. This demonstration was to be highlighted by the use of multi-colored flares which were to send streams of smoke from their boots as they free-fell from considerable altitude. The C-123 stopped briefly in front of the reviewing stand, as this proud Army team marched single file toward the aircraft to the brisk beat of a Marine Band. As they seated themselves in the aircraft, several newsmen and photographers jumped aboard to record this dramatic event. Within seconds, the loading ramp was up and the aircraft had taxied to the runway. As the aircraft broke ground on takeoff the nose rose sharply — a maximum performance takeoff, it appeared. The aircraft kept climbing in this nose-high altitude to perhaps 300 hundred feet. Suddenly the aircraft banked severely, then righted itself only to bank sharply in the opposite direction and fall! Our crew, anticipating the crash, dashed to the Huskie. I heard the impact just as I reached the cockpit and glanced over my shoulder to see flames erupt around the aircraft. Sirens wailed as fire trucks roared down the taxiways toward the stricken aircraft which lay a few feet from the runway. As I frantically tried to connect the battery, I called to several Marines nearby to help push our aircraft free of the area. Our firemen were grabbing their fire-protective clothing and leaping into the rolling Huskie. Our Flight Surgeon leaped off the nearby wing of an F-105 and jumped aboard. My crew chief was ripping the placard off the nose bubble and clearing people from the sides of the aircraft. Within seconds (it seemed like hours) we were airborne. Split seconds later we were quick-stopping in front of the flaming aircraft. Not one of the 15 people aboard had escaped, it appeared.

Fire trucks were busy throwing foam and water on the aircraft as rescue personnel attempted to pull the stricken crew and passengers free. Immediately, I attempted to back the H-43B clear of vehicles and people to set my crew down, but the fire menacingly erupted toward the cockpit section. Quickly we returned to a position over the cockpit and reduced this flame. A stream of high-pressure water suddenly shot up in front of us. I moved up and back slightly while a fireman beneath us brought his fire hose under control. This position seemed better, we observed, since the downwash blanketed the entire aircraft. We could see the crew members in the nose section pinned beneath cockpit debris and the badly injured pilot struggling to free himself. Water and foam were being poured on the fire which was endangering the cockpit section and rescue personnel were attempting to free the crew. I moved my hover position to provide more downwash into the burning cavity on the right side of the cargo section. As our downwash blasted into this section, I saw numerous bodies crossed over each other and bright colored smoke spurting from the heels of these men. The heat had ignited the flares on their boots. Firemen were in there pulling them free of debris and heavy aircraft cargo. I noticed the downblast rotating much of this debris within this large cavity and adjusted our position to reduce this. Again, hovering a bit higher and further back seemed to be the answer.

The disadvantage to close-in work by the cargo section was that the downwash had no place to go and merely rotated within the cavity. The disadvantage of working close to the nose section was that the enormous wing, which had remained intact in the crash, had rotated nearly 90 degrees to form an unbroken wall. As the downwash hit this wall, it simply bounced up and away from the fire in the cargo section. In order to get the downwash "over the fence" it was necessary to gradually adjust the hover position to the final high and back location. The wind was about 10 knots and on the nose of the C-123 as it skidded to a stop. Unknown to us at the time was the fact that our blast was entering a rupture just behind the cockpit, funneling through the aircraft and coming out in the rear cargo section. This internal "venturi effect" was clearing smoke from burning electrical wires, etc., inside the aircraft and allowed rescuers a clear passage into the pilot's compartment as they entered from the cargo section.

It soon appeared that the fire was under control and at this point we landed and let off our two firemen, Sgt. Donald H. Holloman and Airman Gene C. Mayo and our flight surgeon, Capt. Charles Pummill. We immediately became airborne and continued in our effort to reduce fire and smoke and to ventilate the aircraft. In a few seconds, however, I observed our helicopter mechanic, Sergeant Boyce W. Allen, standing by a badly injured survivor and motioning to me that our litters were needed. I again landed and immediately two survivors were brought to the helicopter and loaded. A third survivor was also loaded but was violent, and Sergeant Allen and Lt. Charles "Chick" Morrill, copilot; led him to an awaiting ambulance. A civilian doctor jumped aboard which also proved to be fortunate, for as soon as we lifted off, the doctor had to perform a tracheotomy on one of the survivors. This was done with Sergeant Allen's survival knife. The tower advised us to land on a foot-

ball field several blocks south of the hospital, due to the fact that hospital authorities had advised that there was no room for a helicopter to land. We landed at this field, alongside an Army H-21 full of survivors. No ambulances had yet arrived so we decided to have a look at the hospital grounds and perhaps make a landing attempt if it looked feasible. We lifted off and observed a Marine HUS depart out of a thick metropolitan area. We headed for his departure point and made a vertical approach and landed into a tennis court beside a large brick hospital building.

As soon as our patients were clear of the Huskie, we returned to the crash. All the survivors had been evacuated and the fire was now under control. Unknown to us, a drama had taken place while we were involved in our air-evacuation flight. A survivor had been trapped under the wing root section and all efforts to free him had failed. There was immediate danger of the hot magnesium igniting the spilled fuel which lay around much of the aircraft. The man was extremely critical and any improper movement of the wing gave him extreme pain. Our fire suppression kit was immediately brought into position. It was the only foam available on the airfield at this time. Military personnel on the scene determined to lift the enormous wing off the trapped man by the combined strength of the many people surrounding the aircraft. This was successfully accomplished and the man was rushed to the hospital.

This unexpected mission clearly established the Huskie as a quick-response rescue aircraft. In reviewing the films covering the crash, it was determined that the H-43B was airborne in 1 minute, 32 seconds after the C-123 hit the ground. Had the Huskie not been there, it is reasonable to assume that the burns suffered by many would have been more severe, perhaps to the point of being fatal. Army Capt. James Perry, Commanding Officer of the famed Army Parachute Team, said in a recent letter, "If it hadn't been for the H-43B, the highly volatile wreck would have exploded and finished the job for both rescuers and injured."

Most gratifying, perhaps, was the marvelous teamwork involved. Here, without planning, was an Army helicopter evacuating injured along with a Marine helicopter, while an Air Force helicopter beat the flames back. It was the same inside the burning aircraft. A 200-pound fireman, unable to crawl up into the pilot's compartment because of his size, quickly grabbed tiny Sergeant Holloman and pushed him up and through the opening so the rescue could be accomplished. There are countless other examples of quick thinking and selfless courage which characterized and perhaps brightened this otherwise dark tragedy.

THE TEAM THAT DID THE JOB—Left to right, front row, Capt. Charles Pummill, flight surgeon; 1st Lt. Charles A. Morrill, co-pilot; S/Sgt. Donald H. Holloman, rescueman; A1/C Gene C. Mayo, rescueman. Rear, S/Sgt. Boyce W. Allen, crew chief; and Capt. John C. Armstrong, pilot. (USAF photo)

Capt. John C. Armstrong, Jr., pilot; was born in 1928 and is from Holderness, N. H. He is assigned to Detachment 49, Eastern Air Rescue Center at Seymour Johnson AFB, N. C. He has eight years of service and 2300 hours flying time with 1750 of them logged in helicopters.

1st Lt. Charles A. Morrill, co-pilot; was born in 1934 and is from Miami, Fla. He entered service in 1954 and is a qualified pilot, navigator and radar observer. He is assigned to Detachment 49, Eastern Air Rescue Center at Seymour Johnson AFB.

Capt. Charles Pummill, flight surgeon, was born in 1935 and is from Dallas, Texas. He entered the Air Force in July 1958 and, shortly after, entered the School of Aviation Medicine in Texas. He is assigned to the 4th TAC Hospital at Seymour Johnson AFB.

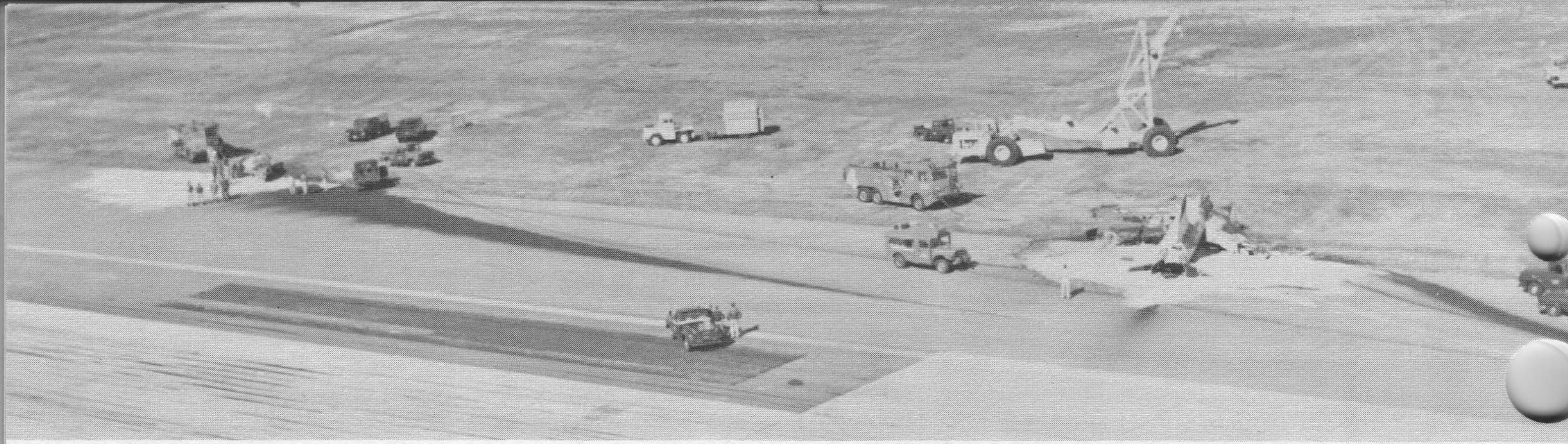
S/Sgt. Boyce W. Allen, crew chief; is from Spartenburg, S.C., and had one tour in the Army prior to joining the Air Force. He has been a helicopter mechanic throughout the entire period and was recently graduated from the H-43B Mechanic School at Sheppard AFB, Texas. He is assigned to Detachment 49.

S/Sgt. Donald H. Holloman, rescueman; was born in 1931 and is from Greene County, N.C. He has 10 years in the Air Force, all of which were with Crash Rescue. He attended H-43B Firefighting School at Stead AFB, Nev., and is assigned to the Base Fire Department at Seymour Johnson AFB.

A1/C Gene C. Mayo, rescueman; was born in 1934 and is from Washington, N.C. Airman Mayo entered into the service in 1952 and attended Crash Rescue Firefighting School during a tour with the Navy. He is assigned to the Base Fire Department at Seymour Johnson AFB.

Seymour Johnson AFB, N. C.

When the crash phone rang, Lt. Ray Albee, the Alert Huskie pilot, ran toward the aircraft. Captain Armstrong, the two H-43B firemen and the medic were close on his heels. It was a good quick scramble and the Huskie was airborne with the Fire Suppression Kit in slightly over a minute. The tower advised the helicopter crew that an F-105 was over the field with fluctuating oil pressure. The Huskie orbited near the approach end, awaiting the appearance of the F-105. Within seconds, the F-105 was in sight on a high final.



F-105 CRASH SCENE--This photograph was taken from an H-43B shortly after the fighter pilot had been rescued from the burning aircraft. Black marks are burned fuel areas. (USAF photo)

The H-43B swung quickly around to intercept the aircraft a few hundred yards prior to his touchdown. The F-105 hit the runway with tremendous impact and exploded in a large ball of flame. Burning sections of the aircraft skidded, rolled and tumbled down the runway. The Huskie sped toward the first large flaming section but quick observation revealed it to be the tail section. The cockpit section had broken off in the impact!

Lieutenant Albee immediately sped to the second large piece of wreckage and saw that it was the nose section. The flames and smoke were intense and it was impossible to determine if the cockpit was underneath or on top. The rotor blast quickly cleared the smoke and reduced the flames as the Huskie dropped off the FSK and let off the two firemen and the medic.

The crew of the H-43B could see the cockpit now. The Huskie immediately lifted and suppressed the fire. Just as the FSK nozzleman hit the cockpit area with his foam, a firetruck rolled in and blasted at the flaming nose section with CO_2. Sergeant DeBerry, the FSK nozzleman, quickly reached the cockpit. He was immediately joined by the Assistant Fire Chief. Both rescuers pulled the stricken pilot through the jagged plexiglass hole of the shattered canopy. Fire trucks flooded the nose section with foam and the Huskie medic quickly administered aid to the stricken pilot. The ambulance rolled up within seconds and the pilot was rushed to the hospital.

It wasn't long before the report came in — "The pilot had suffered minor burns only and there was no immediate evidence of other injuries." Later reports revealed that the pilot was, amazingly, "doing very well and expected to be out of the hospital in a few days."

When the pilot was able to receive visitors, he was asked his opinion of the effect of the Huskie. He replied, "As I lay there on my side in the flaming nose section, I had serious doubt in regard to my chances of getting out alive. The heat was tremendous and I couldn't see or breath due to the smoke. I couldn't free myself so I pulled my helmet visor down and covered my face with my hands. Suddenly there was a blast of air from the hovering chopper and I felt, for the first time, that I had a chance. The heat was reduced several hundred degrees and I could breath much better in the clear air. Within seconds, the firemen were pulling me out."

Doctor Pummill, the flight surgeon treating the pilot, said, "The downwash of the helicopter was definitely a big factor in saving this man's life." K

Use of Emergency Fuel Controls in the H-43B

When switching to emergency, the twist grip is always retarded to flight idle before the toggle switch (fuel control) is actuated. There are some types of malfunction (probably the greatest percentage) that can be corrected by simply flying on the twist grip with the "beeper" in full high and the fuel control switch in auto. In this condition, maximum acceleration and deceleration rates remain controlled, making turbine stall impossible. Remember — the penalty of uncontrolled rates, as might be experienced when on emergency, can be engine structural damage (due to turbine stall or exceeding EGT) or deceleration flame-out.

Failures, such as governor instability (power and rpm surging in a divergent manner) or rpm increases (runaway governor) will most always be stopped by retarding throttle until N_2 is just below governed speed.

Therefore, if necessary to switch to emergency, use the following procedure:

1. Retard twist grip toward flight idle and if problem is corrected (rpm drops or surge stops) continue with steps 2 and 3.
2. Actuate beeper to maximum beep
3. Continue flight, coordinating rpm and power with collective and twist grip
4. If problem is not corrected, continue to retard throttle to flight idle, actuate toggle switch to emergency and advance throttle carefully. Continue flight as in the case of (3) above, being careful not to get turbine stall or acceleration-deceleration flame-out.

Al Newton
Chief Test Pilot

continued from page 5

(a) Centering Mode: The signal paths for the centering mode are shown in the block diagram, figure 1. The helicopter's electrical supply system provides 115-volt, 400-cycle, 3Ø (3-phase) AC power through fuses located in the overhead fuse panel. Twenty-eight-volt, DC power is provided through the directional stabilizer circuit breaker in the console circuit breaker panel. The AC power is fed into the power transformer in the stability control unit, pedal transducer and rudder actuator assemblies. Incorporated in the stability control unit is a silicon diode full-wave rectifier which converts the 400-cycle AC power to the required 28-volt DC power for the associated low-level transistorized amplifiers. This does not include the servo power amplifier, which utilizes the helicopter's generated 28-volt DC power.

With the direct stability servo switch in the center position, no 28-volt DC power is applied to the directional stabilizer relay located in the tub underneath and forward of the pilot's seat. With this relay de-energized, no 28-volt DC power is applied to energize the centering mode relay, the position indicator, the neutralizing solenoid valve and the direct servo caution light.

With the centering mode relay de-energized, the output signals from the attenuated signal amplifier and gyro amplifier are bypassed to signal ground. Consequently, no resultant control signal from these sensing devices exists to actuate the servo motor.

The rudder position transducer and the rate generator are still functioning normally, however, and their respective signals are summed and fed back to the servo motor through the servo amplifier. The relative phase of this signal is such that it will cause the servo motor to return the rudder to its

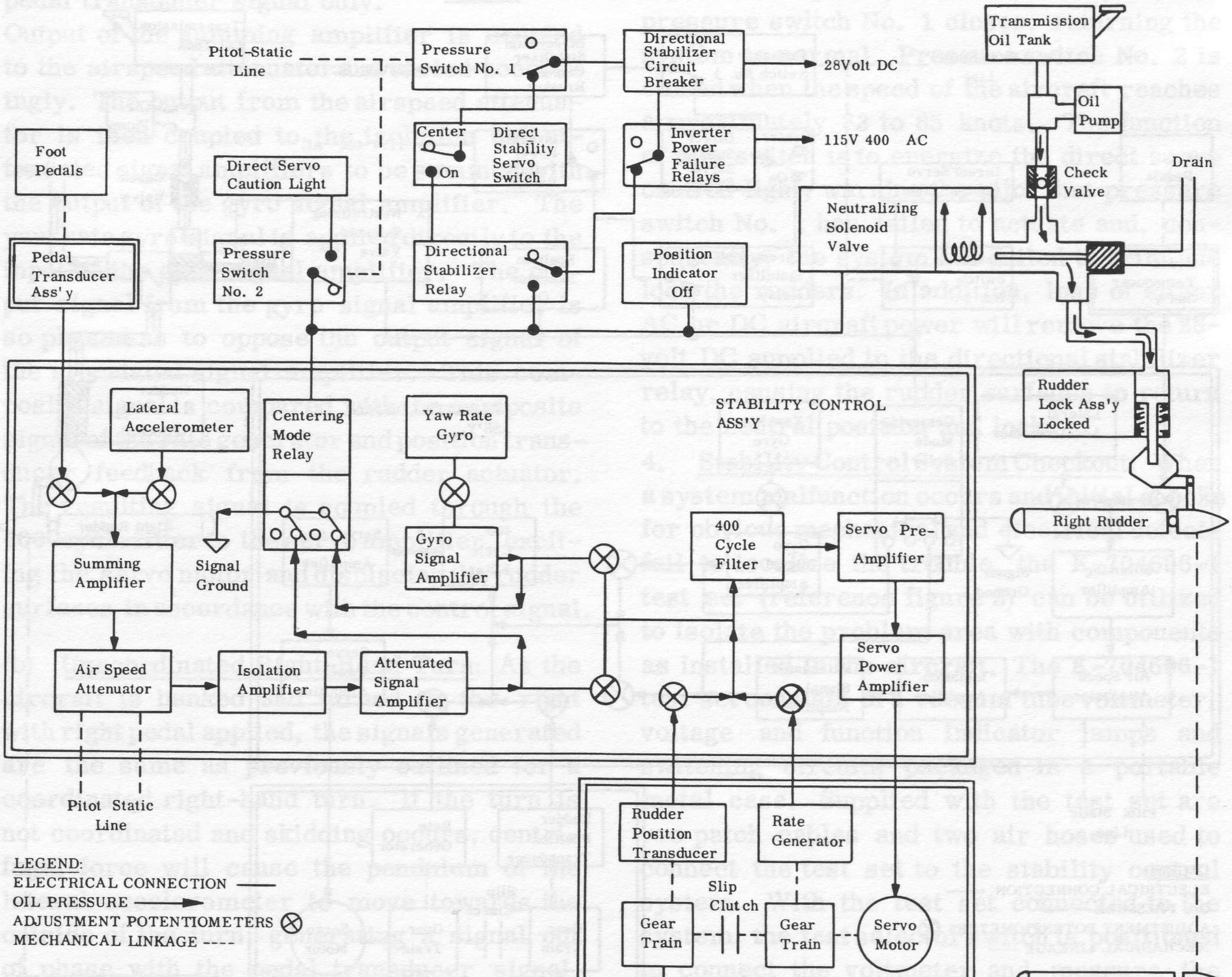


FIGURE 1. CENTERING MODE

neutral position. Simultaneously, the rudder lock assembly located in the right-hand tail fin is hydraulically actuated. The rudder lock system operates at an oil pressure of 250 - 275 psi, locking the rudders in the neutral position when the neutralizing solenoid valve is de-energized. In the centering mode of operation, therefore, the directional stabilizer functions as a locking device, maintaining the rudders in a neutral position. When in this mode, a position flag-type indicator located in the upper right-hand corner of the pilot's instrument panel will indicate the system is OFF.

(b) Normal Mode: The signal paths for the Normal mode are shown in the block diagram, figure 2. Placing the direct stability servo switch to the "ON" position energizes the directional stabilizer relay which, in turn, energizes the centering mode relay, position indicator and the neutralizing solenoid valve. When the neutralizing solenoid valve is energized, it closes the rudder lock port and opens the drain port, thus moving the rudder lock to its unlocked position. This allows unrestricted movement of the rudders throughout their full range. The position indicator will indicate ON and the centering mode relay contacts are opened permitting the output signals from the attenuated signal amplifier and gyro amplifier to be summed. This composite signal is compared with the composite feedback signal of the rudder position transducer and the rate generator. The resulting signal is coupled through a filter, which will accept the 400-cycle signal and reject or attenuate harmonics or spurious signals generated within the system. The accepted signal, amplified by the servo amplifier, excites the servo motor which, in turn, displaces the rudder surfaces in accordance with the control signal.

2. Examples of System Operation During Flight:

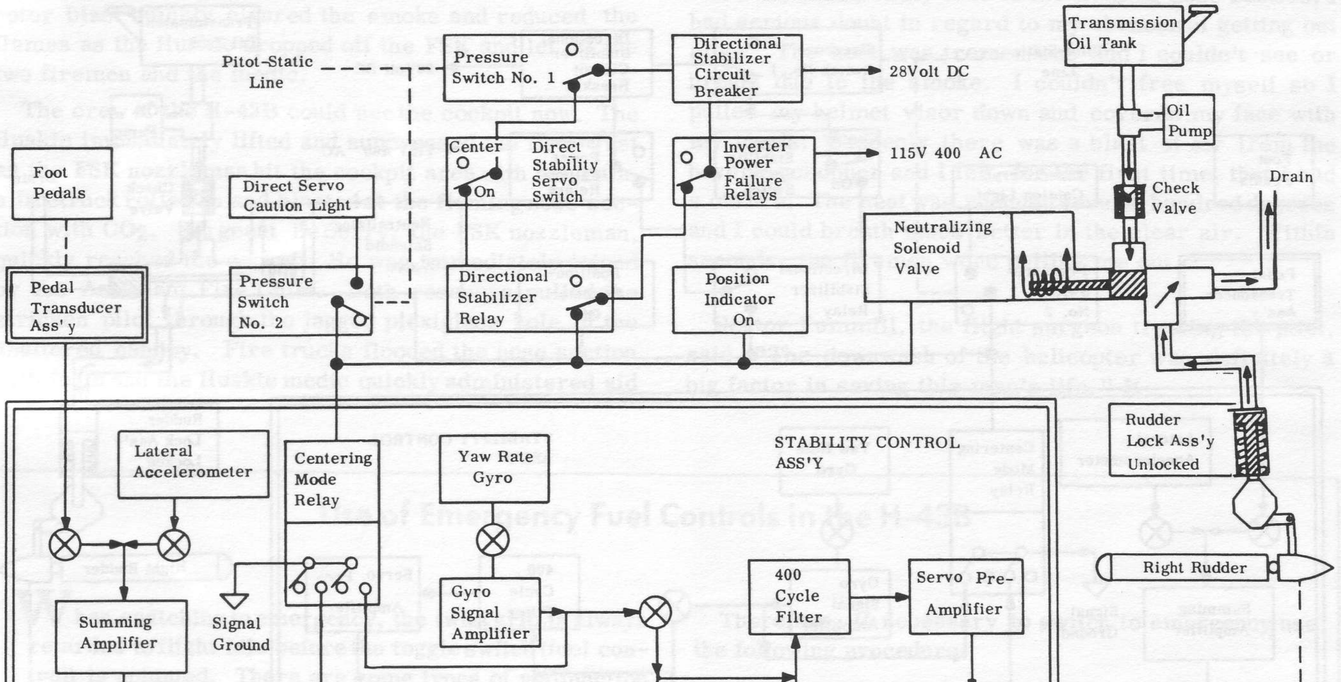


FIGURE 2. NORMAL MODE

(a) Coordinated Right-Hand Turn: Referring to figure 2, the signal paths for a coordinated right-hand turn are illustrated as follows: with the aircraft in straight and level flight and the foot pedals maintained in the neutral position, the pedal transducer, lateral accelerometer and yaw rate gyro will maintain a minimum or null signal condition. The control signal for the servo amplifier at this time is the composite signal of the rudder position transducer and rate generator. The relative phase of this signal will cause the servo motor to maintain the rudder in its neutral position. As the aircraft is banked and turned to the right with the pilot applying right pedal, the pedal transducer and yaw rate gyro will generate a signal. As no side slipping or skidding will occur in a coordinated turn, the lateral accelerometer will maintain its minimum or null signal condition. Consequently, the signal applied to the input of the summing amplifier will consist of the pedal transducer signal only.

Output of the summing amplifier is coupled to the airspeed attenuator and varied accordingly. The output from the airspeed attenuator is then coupled to the isolation and attenuated signal amplifiers to be summed with the output of the gyro signal amplifier. The yaw rate gyro signal is applied directly to the input of the gyro signal amplifier. The output signal from the gyro signal amplifier is so phased as to oppose the output signal of the attenuated signal amplifier. This composite signal is compared with the composite signal of the rate generator and position transducer feedback from the rudder actuator. The resulting signal is coupled through the 400-cycle filter to the servo amplifier, exciting the servo motor and displacing the rudder surfaces in accordance with the control signal.

(b) Uncoordinated Right-Hand Turn: As the aircraft is banked and turned to the right with right pedal applied, the signals generated are the same as previously outlined for a coordinated right-hand turn. If the turn is not coordinated and skidding occurs, centrifugal force will cause the pendulum of the lateral accelerometer to move towards the outside of the turn, generating a signal out of phase with the pedal transducer signal. The resultant signal, coupled to the summing amplifier, summed with the output of the gyro signal amplifier and compared with the feedback signals of the rudder actuator, will position the rudder surfaces to reduce the rate of turn. If side slipping occurs, the pendulum of the lateral accelerometer will move toward the inside of the turn generating a signal in phase with the pedal transducer signal. The resultant signal, coupled to the summing amplifier and compared with the feedback signals of the rudder actuator, will position the rudder surfaces to increase the rate of turn.

3. Protection Circuits: Pressure switches No. 1 and No. 2 are connected to the pitot-static line and are sensitive to the pressure of the air entering the pitot tube. Pressure switch No. 1 is opened when the speed of the aircraft reaches approximately 78 to 80 knots, de-energizing the directional stabilizer relay and causing the rudder surfaces to return to the neutral position and lock. Upon decreasing the airspeed (not less than 75 knots), pressure switch No. 1 closes, returning the system to normal. Pressure switch No. 2 is closed when the speed of the aircraft reaches approximately 83 to 85 knots. The function of this switch is to energize the direct servo caution light, warning the pilot that pressure switch No. 1 has failed to actuate and, consequently, the system has failed to trim and lock the rudders. In addition, loss of either AC or DC aircraft power will remove the 28-volt DC supplied to the directional stabilizer relay, causing the rudder surfaces to return to the neutral position and lock.

4. Stability Control System Checkout: When a system malfunction occurs and initial checks for obvious mechanical and electrical defects fail to localize the trouble, the K-704606-1 test set (reference figure 3) can be utilized to isolate the problem area with components as installed in the aircraft. The K-704606-1 test set consists of a vacuum tube voltmeter, voltage and function indicator lamps and switching circuits packaged in a portable metal case. Supplied with the test set are two patch cables and two air hoses used to connect the test set to the stability control system. With the test set connected to the system, the test selector switch is positioned to connect the voltmeter and measure the operating voltages at specific test points in the system.

(a) Test Set Connections And Starting Procedure: With helicopter's AC and DC power OFF, remove pilot's seat and cockpit floor panel, disconnect wiring from stability control unit, connect test set to control unit and aircraft wiring harness with supplied test cables, as shown in figure 3. Place test selector switch to "OFF," remote disabling switch to "ON," VTVM power to "ON" and meter slector switch to "INTERNAL." Perform the following system checkout:

(1) Place H-43B's battery switch to "ON," secondary bus emergency-normal switch to "EMERG" and inverter switch to "INV 1" position. The test set AC and DC power indicator lamps should light. If lamps fail to light, check aircraft's power supplies and/or indicator lamps.

(2) Place test selector switch to "Ø AB," then to "Ø BC." Meter should indicate 115.0 ± 5.0 volts for both positions. If erratic, low, or no voltage is indicated, check directional stabilizer fuses in overhead panel and/or aircraft's AC power supply.

5. Energizing The Stability Control System: Place aircraft's direct stability servo switch to "ON." The stability control system position indicator on the pilot's instrument panel should indicate "ON" and the centering mode relay indicator lamp in the test set should light. If the position indicator and lamp fail to operate, check the following: directional stabilizer circuit breaker, #1 pressure switch, direct stability servo switch, directional stabilizer relay, inverter power failure relays, test set remote disabling switch and indicator lamp for proper operation.

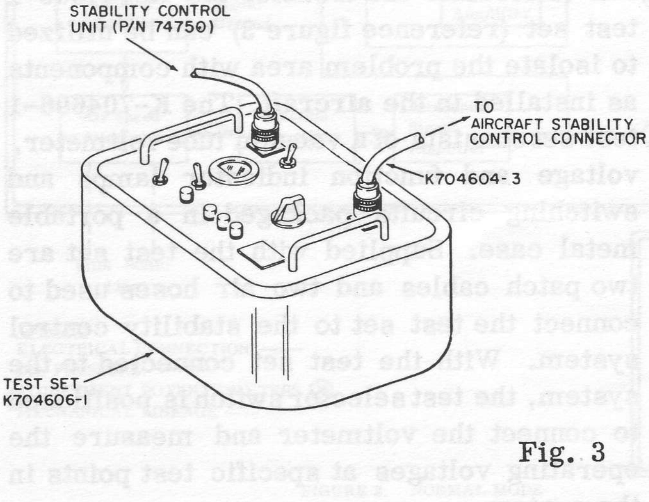


Fig. 3

6. Pedal Transducer Assembly Checkout: Place test selector switch to "PEDAL TRANSDUCER OUTPUT," depress right then left foot pedals to full pedal displacement. Meter should indicate approximately 3.0 volts minimum for both conditions. If low or no voltage is indicated, check the mechanical linkage to the pedal transducer, the wiring harness and the connection. If found to be all right, replace the pedal transducer assembly and repeat above checkout.

7. Stability Control Unit Checkout:

(a) Place test selector switch to "REF. VOLTAGE." Meter should indicate approximately 4.0 volts. If low or no voltage is indicated, install new control unit and repeat check.

(b) Disconnect the pitot-static tubing from the control unit (DO NOT remove wiring connections.) Remove all attaching bolts only, and carefully lift the control unit from its mounting pad with electrical patch cables connected. Maintain foot pedals in a neutral position. Place test selector switch to "Gyro Output." Position control unit simulating the normal mounting position in the aircraft and slowly rotate unit at uniform rate about the vertical axis for 90 degrees left, then right. Meter should indicate approximately 2.0 volts minimum for both directions while the unit is being rotated. If no voltage is indicated, install new control unit and repeat check.

(c) Place test selector switch to "GYRO AMP OUTPUT." Repeat rotation as in above check. Meter should indicate approximately 4.0 volts minimum for both directions. If no voltage is indicated, install new control unit and repeat check.

(d) Place test selector switch to "ACCEL OUTPUT." Maintain foot pedals in a neutral position. Position control unit simulating the normal mounting position in the aircraft and slowly tilt unit about the longitudinal axis a minimum of 5 degrees. Meter should indicate approximately 2.0 volts minimum for both directions. If erratic, low, or no voltage is indicated, install new control unit and repeat check.

(e) Place test selector switch to "AIRSPEED TRANSDUCER OUTPUT." Repeat step (d), above. Meter should indicate approximately 3.0 volts for both directions. If erratic, low, or no voltage is indicated, install new control unit and repeat check.

(f) Remount control unit in the aircraft; do not connect pitot-static lines at this time. Place test selector switch to "ATTEN. SIG. AMP. OUTPUT." Apply full right or left pedal. Meter should indicate approximately 7.0 volts. If erratic, low, or no voltage is indicated, install new control unit and repeat check.

(g) Place test selector switch to "RUDDER MOTOR CONT. WINDING." Maintain foot pedals in a neutral position. Meter should indicate approximately 25.0 to 50.0 volts. Apply full right or left pedal. Meter should indicate approximately 150.0 volts. If erratic, low, or no voltage is indicated, install new control unit and repeat check.

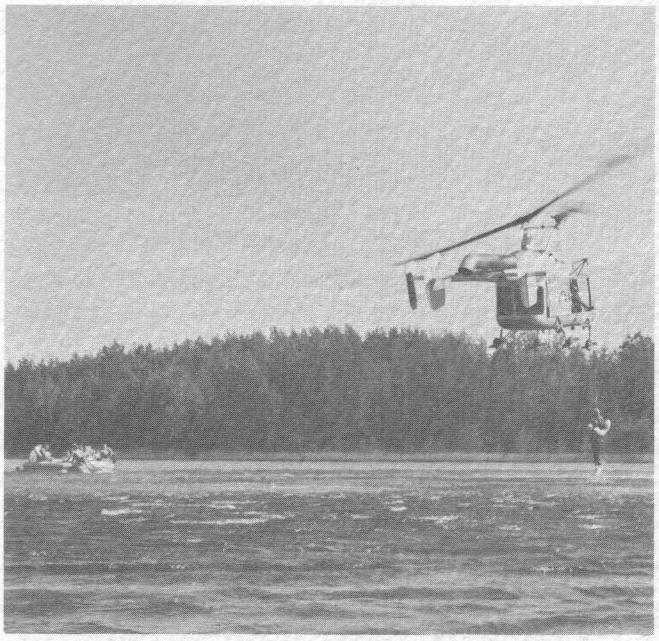
NOTE: A shorted servo motor control winding in the rudder actuator can also cause low or no voltage indication for the above test. Turn all aircraft power OFF. Disconnect and perform continuity check of servo motor windings for proper value.

8. Rudder Actuator Assembly Checkout:

(a) Place test selector switch to "Rudder Rate Gen Output." Apply full right or left pedal. Meter should indicate approximately 2.5 volts during rudder displacement. If erratic, low, or no voltage is indicated, install new actuator and repeat check.

(b) Place test selector switch to "RUDDER TRANSDUCER OUTPUT." Apply full right or left pedal. Meter should indicate approximately 2.5 volts at full rudder displacement. If erratic, low, or no voltage is indicated, install new actuator and repeat check. ĸ

For additional DSAS technical information refer to T.O. 5F1-5-3-2.



SURVIVAL TRAINING—Fixed-wing pilots at both K. I. Sawyer AFB, Mich., and Griffiss AFB, N. Y., recently underwent training in water survival techniques during which turbine-powered H-43B's were utilized. The H-43B in left photo is from K. I. Sawyer and manned by Capt. Earl William Jr., pilot; Capt. Max L. Trainer, co-pilot; and S/Sgt. Charles Seveens. Crew of the HUSKIE shown in other photograph taken near Griffiss AFB is 1st Lt. Gordon L. Hall, pilot; 1st Lt. L. H. Brandt, co-pilot; and S/Sgt. J. C. Ross. Other H-43B personnel participating in the 4-day exercise were Capt. J. H. Jones, 1st Lt. B. D. Merna, 1st Lt. T. F. Brennan and T/Sgt. W. Creech. (USAF photos)

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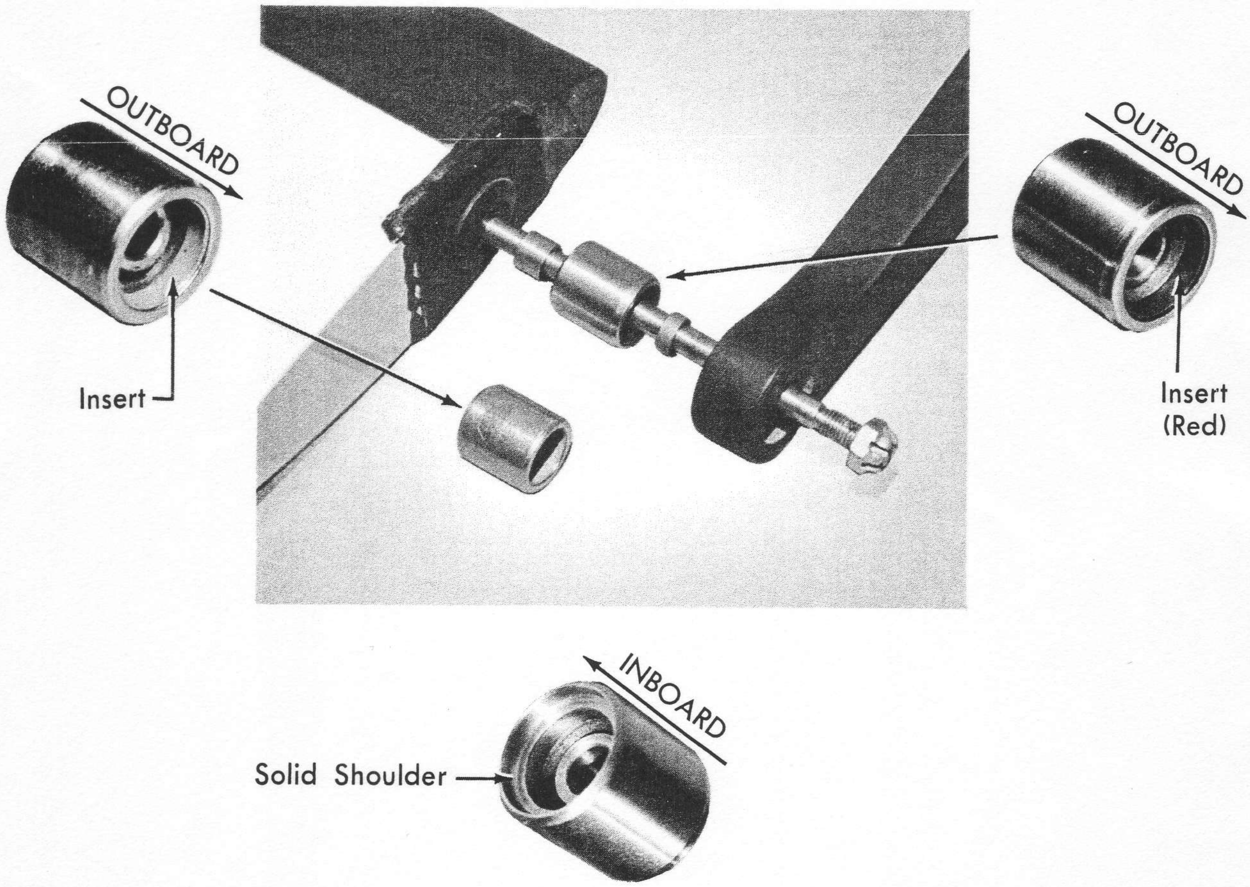
TIMELY TIPS

ALL MAINTENANCE CREWS — HOK/HUK , H-43A & H-43B AIRCRAFT

MAKE CERTAIN

OUTBOARD FLAP BEARINGS (P/N K101030-11) ARE INSTALLED CORRECTLY



1. Each bearing has an insert in one end. This *insert* should face *outboard*. Inserts on new-type bearings have been colored red for easy identification.
2. Each bearing has an internal shoulder or "ridge" to take centrifugal loading. This *shoulder* should face *inboard.*

Reverse direction may result in the outer shell slipping off the bearing with consequent improper support of the outboard end of flap. An erratic track condition would follow.

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Field Service Dept.
December, 1961