# KAMAN
# Rotor Tips

ISSUE NO. 3 JUNE 1960


THE KAMAN AIRCRAFT CORPORATION

PIONEERS IN TURBINE POWERED HELICOPTERS

KAMAN

# Rotor Tips

JUNE, 1960



**ADDRESS ALL INQUIRIES TO:**
Kaman Rotor Tips
Field Service Department
The Kaman Aircraft Corp.
Old Windsor Rd.
Bloomfield, Connecticut

## THE COVER

*Preview of things to come is this composite picture of the HU2K-1 and the U. S. S. HAZELWOOD. The helicopter is scheduled for future delivery to the U. S. Navy.*

*IN THIS ISSUE*

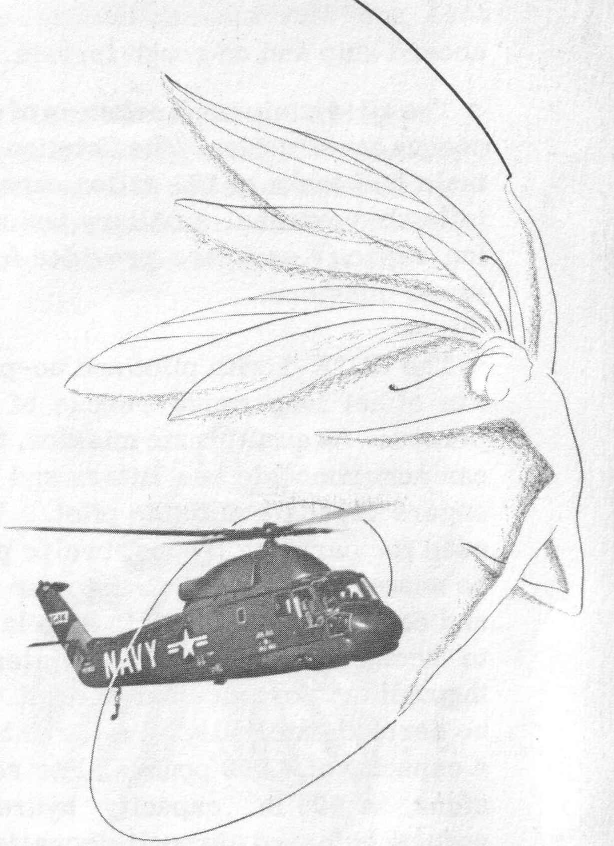




**—— PLEASE SHARE THIS COPY ——**

# THE Seasprite

by
OWEN F. POLLEYS, Project Engineer, HU2K-1 Helicopter;
ROBERT D. COUGHLIN, Military Operations Research Analyst.




High speed, long range search and rescue, together with utility and liaison duty with the fleet is the primary mission of the HU2K-1 SEASPRITE currently being produced by The Kaman Aircraft Corporation for the U. S. Navy. Scheduled for initial fleet delivery in the early spring of 1961, this all-new turbine powered helicopter is presently undergoing the final stages of the contractor's testing program. Navy Board of Inspection, Survey Trials and the Fleet Indoctrination Program are slated for the late fall of this year.

Because the Navy's high speed and long range requirement is best achieved by a single rotor helicopter, this design was incorporated in the SEASPRITE. However, Kaman Aircraft is continuing production of the synchropter or intermeshing rotor design to meet the U.S. Air Force's need for a local base rescue helicopter with high lift and maneuverability capable of operation in confined areas. Deliveries of turbine powered H-43B HUSKIE helicopters with the synchropter design (also in use on the HOK, HUK, and H-43A) are now being made to the Air Force.

The HU2K-1 is a single main rotor/tail rotor helicopter powered by a General Electric T58-6 free turbine engine delivering 1,050 shp military rated power and 875 shp normal rated power. A four-bladed main rotor system utilizes servo flaps on the outboard trailing edge of each blade. This represents the initial application of these servo flaps to a single rotor helicopter design, and insures rotor stability and ease of handling. Similar servo flaps are already in use on the HOKs, HUKs, H-43As and H-43Bs. A three-bladed tail rotor is fitted on a streamlined pylon at the aft end of the fuselage.

Fully retractable main landing gear, while contributing to the aircraft's high speed characteristics, was designed primarily to avoid interference with either the hoist cable or the survivor during rescue operations. The gear retracts smoothly into wells in the lower fuselage with no wheel protrusion. Complete retraction or extension is accomplished in two seconds. The landing gear actuation handle is located adjacent to the pilot's collective stick, permitting him to drop gear and collective in one motion in an autorotative landing.

The tail landing gear consists of a single, conventional air/oil strut member and a solid tire wheel. The tail wheel, while non-retractable, is full swiveling and is provided with a fore and aft lock for landing and take-off aboard ship and on rough terrain.

The all-aluminum fuselage is of semi-monocoque construction. The flotation hull houses main fuel tanks of 276 gallon capacity. Two inflatable external auxiliary tanks of 58 gallon capacity each are provided for extended range missions.

The HU2K-1 with pilot and co-pilot aboard can effect long range rescue of up to four persons. As an alternate mission, the HU2K-1 can accommodate two litters and four passengers in addition to the pilot. When being used for carrying troops, twelve persons can be seated in the cabin to the rear of the pilot and co-pilot. The cabin is also large enough to accept a variety of bulky items loaded through the port side cargo door. Cargo can be carried externally on a cargo hook having a capacity of 4,000 pounds. For rescue missions, a 600 lb. capacity hydraulic hoist swings outboard through doors in the starboard fairing near the pilot's position permitting him a direct view of rescue operations. The rescue door is large enough to admit a survivor tied to a one-man life raft. The hoist can be completely retracted or extended by either the pilot or crewman.

Automatic Stabilization Equipment (ASE) and government-furnished dead reckoning navigation equipment are installed in the HU2K-1 to assure maximum flexibility for search and rescue work, utility operation, and alternate Anti-Submarine Warfare (ASW) missions during all-weather flying conditions. Coupling of the ASE and various instruments provides complete hands-off flight.

Designed initially for shipboard operation, the over-all envelope size of the HU2K-1 permits elevating through the smallest cruiser hatchway without the necessity of tail boom folding. With the ability to fold all rotor blades back in the horizontal plane, the HU2K-1 requires a minimum of hangar-deck space. The light weight of the aircraft permits movement of the helicopter aboard ship by crewmen without the need for special tow bars or equipment.

In addition to search and rescue, other utility tasks for the SEASPRITE include around-the-clock plane guard duty for carrier aircraft operations, gun fire observation, reconnaissance, courier services, personnel transfer, evacuation of wounded, radiological reconnaissance, chemical spraying, emergency supply and re-supply, wire laying and tactical air controller operations. To perform these tasks with maximum efficiency, the SEASPRITE is capable of operating from many types of Naval and merchant ships.

**ANGLE VIEW CLEARLY** shows servo flaps on SEASPRITE'S main rotor blades.

Important all-mission safety factors for over-water operation are the emergency flotation provisions incorporated in the HU2K-1 to permit safe exit of all occupants in the event of an emergency landing at sea. The watertight hull provides necessary flotation while inflatable sponsons provide lateral stability up to a 30° turnover angle. The sponsons are inflated by solid propellant firing through a liquid ammonia cooling agent to fill the bags in 2 1/2 seconds.

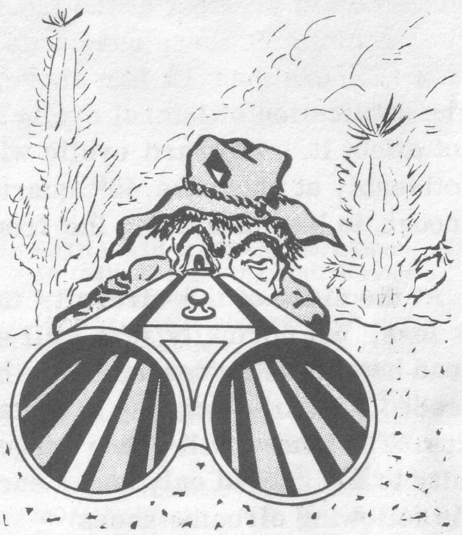
The engine and power transmission system components in the SEASPRITE are supported on top of the helicopter so that structural loads of all major components are carried directly to the fuselage frame structure. Power from the T58-6 turbine engine is transmitted forward through the drive shaft to the main rotor gear box. Power take-offs from

*(continued on page 12)*

# MAINTENANCE MAILBAG

Dear Cliff,

Sorry I missed you the other day but I was out in the boondocks working on one of our choppers which made a forced landing in a cactus patch. The engine began running rougher than a cob and the pilot decided he'd better set her down in a hurry. I'm so scratched up I look like I'd been trapped in a tall tree with three brown bears and a big beaked owl. We were there overnight and it was some place. A coyote ran away with one of my shoes, one guy claims a rattlesnake stepped on his foot and finally the sentry got all shook up around midnight and fired three shots into a mesquite bush because he heard something moving around. It turned out to be a prospector's mule and cost us forty bucks the next morning to keep the sentry from getting shot himself. Boy, that old prospector was mad, and he was waving a double-barrelled shotgun around nine feet long with a bore on it as big as your fist.



We found out when we started checking the 'copter, an HOK-1, there was nothing wrong with the engine---it was just plain suffering from a bad case of air starvation. After pulling the carburetor air duct we found an accumulation of about 350 hours of sludge and dirt. In the filter there was enough real estate to start a small carrot farm. Because we are operating in desert country, the pilot was using the duct filter when he took off,but he had no way of knowing it was so gummed up no air could get through. As you probably know, when this happens the filter is then automatically by-passed and unfiltered air goes direct to the carburetor. The carburetor was designed to mix gas and air but it isn't too good at spitting out globs of dirt at the same time. Result---engine running rough and cactus here we come!

I understand from talking around that other crews have found the same thing in 'copters operating in areas like this with plenty of sand around to be picked up during turn-up.

Another thing to check carefully is the oil radiator cooling system. Get that plugged up and the pilot finds himself getting galloping ulcers from the temperature readings he's getting. I know just how it feels too; almost had to ditch once myself and I don't mind telling you, I was just plain scared.

When you're pulling checks and run into anything like this carburetor air duct deal, let me know and I'll pass the word along. Well, I gotta hit the sack now, these mid-watches are murder.

Jack

# More From Les . . .

*Each month in this column, C. L. Morris, Assistant Vice President–Field Service Manager reports on a subject in which particular interest has been shown*

Every now and then a question is raised regarding the height of helicopter rotor blade tips above the ground. Obviously, if this clearance is too low, there can be danger to ground personnel.

In Kaman synchropters, blade-to-ground clearance is greatest at the front or rear of the machine. In these quadrants, the clearance is more than 12 feet above the ground. The application of lateral cyclic control does not affect it. Forward cyclic will reduce it noticeably at about the 45° quarters, but not enough to be a hazard in the front quadrant.

At the sides of the aircraft, the clearance is less, but normally it is still safely above head height, as evidenced by the height that is needed for a tracking flag to contact the blade tips. The blades will reach dangerous proximity to the ground only under one or more of the following circumstances: -

(a) rough terrain, causing the aircraft to tilt sideways (or with high ground rising under the blade tips);

(b) application of lateral cyclic control;

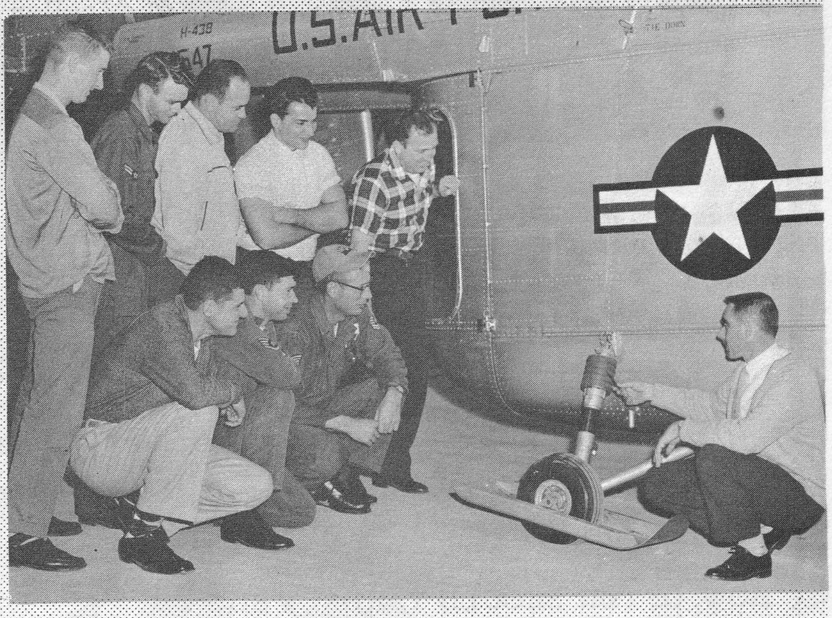
(c) excessive flapping of the blades at low rpm with a droop stop in the disengaged position.

It is well, therefore, to approach or leave the aircraft from the front only. The reason for not using the rear area is to avoid establishing a habit that would be extremely dangerous in a helicopter with a tail rotor.

In over 80,000 hours of Kaman synchropter operation, there has been only one incident involving blade contact with a person entering or leaving the helicopter. This occurred when the approach was made from the side, down a steep hill - category (a) above. Fortunately, a hard-hat took the slight impact and the result was only temporary discomfort. K

**PICTURED IS A DEMONSTRATION** of an H-43A showing blade tracking procedure with use of the tracking flag. Note adequate clearance to the side of helicopter when parked on level, hard surface. The mechanic shown is a six footer.

# TRAINING



**FOURTH H-43B CLASS**—Mr. Raymond Vokes, Senior Instructor in the KAC Service School, points out the features on the H-43B landing gear. Watching are **(front row, left to right) ...** A 1/C Wayne D. Miller, Mobile Air Material Area, Brookley AFB, Ala.; S/Sgt. Colbert Ezell, 337 Cons. Acft. Maint. Sqdn., Portland International Airport, Ore.; T/Sgt. Howard F. Alford, 4510 Field Maint. Sqdn., Luke AFB, Ariz. **(Rear row) ...** A 1/C Hugh L. Hobbs, Jr., Loring AFB, Me.; A 1/C Z. A. Smith, 337 Cons. Acft. Maint. Sqdn.; Mr. John B. Willard, OCAMA, Tinker AFB, Okla.; A 1/C Paul E. Kochis, 380 Bomb Wing, Plattsburg AFB, N. Y.; Mr. Cenious T. Waldron, OAMA, Hill AFB, Utah.

**FIFTH H-43B CLASS**—Mr. Jack Smith, an instructor in the KAC Service School, explains the operation of a reverser assembly used with synchropter-type helicopters. Watching are **(Foreground, left to right) ...** S/Sgt. Terrell C. Turner, 4520 Operations Sqdn., Nellis AFB, Nev.; T/Sgt. Virgil D. McCord, Hq. Sqdn., WRAMA, Robbins AFB, Ga.; **(Second row) ...** M/Sgt. Constantino Pacilio, Hq. Sqdn. MOAMA, Brookley AFB, Ala.; S/Sgt. Theodore M. Youngblood, Hq. Sqdn. WRAMA, Robbins AFB; M/Sgt. Norman C. Benson, 52D, CAMRON, Suffolk County AFB, N. Y.; M/Sgt. Roman D. Campos, 4510 Field Maint. Sqdn., Luke AFB, Ariz.; **(Rear row) ...** Frank Bober, KAC; T/Sgt. Everett L. Rorabaw, 4520 Operations Sqdn., Nellis AFB.

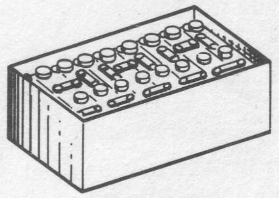
## NEW KAC INSTRUCTOR

Latest instructor to join the Kaman Aircraft Service Training School is Jack E. Smith who has more than eight years experience with rotary wing aircraft. A member of the U. S. Air Force from 1951 to 1955, Smith held the grade of staff sergeant and was a helicopter instructor at Gary AFB, Tex. He joined Kaman Aircraft in March, having previously been employed by another helicopter manufacturer for three years as a service representative-instructor. While in this capacity he established a helicopter school for the West German Air Force.

Five years ago Smith was employed by Reaction Motors, a firm which manufactured rocket motors. While with this company he aided in a development program for helicopter blade tip rocket motors. At the present time Smith is instructing U. S. Marine Corps personnel in HOK maintenance work. K

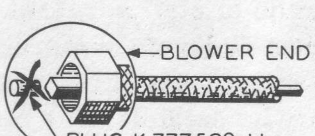
# Q's AND A's

*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.*



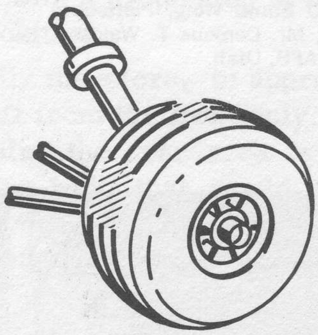
**Q.** HOW OFTEN SHOULD YARDNEY SILVER CELL BATTERIES BE CYCLED, DISCHARGED AND RECHARGED? (Applies to H-43A.)

**A.** This action should be taken every three months. (Refer to T.O. 1H-43A-6, 30 Oct., 59.) The battery should be charged to specified end voltage; all cells checked for proper electrolyte level; and the battery discharged and recharged. Every month the battery should be checked for specified total voltage and individual cell voltage and all cells for proper electrolyte level (Refer to T.O. 8D2-2-1 1 July, 59.) It is recommended that once a week the battery, container, cover and connections should be checked for security. The leads, connectors and vicinity of the battery should be examined for corrosion and the cell tops and terminals for cleanliness and corrosion. The vent hole in the cap should also be checked for obstructions.—A. S.



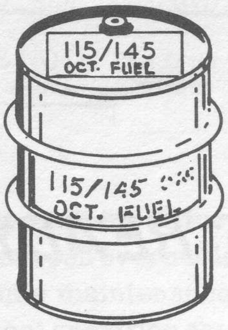

**Q.** SHOULD A PHENOLIC PLUG K777520-11, BE USED AT THE FORWARD END OF THE K777517-3 OIL COOLER BLOWER FLEXIBLE DRIVE SHAFT? (Applies to H-43B.)

**A.** A phenolic plug should not be used in the blower end of the -3 shaft. The -3 shaft has a collar swaged on the transmission end to prevent aft movement. Use of the phenolic plug will cause the flex drive shaft to bow, it will rub against its flexible housing and may lead to failure of both housing and shaft. The -5 shaft, which will eventually replace the -3, has the collar moved 0.125 inches further from the transmission end. This allows the shaft to move aft thus ensuring its maintaining proper engagement with the transmission end. The phenolic plug is used with the -5 only, and is inserted in the blower end.—L.L.



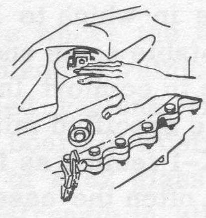
**Q.** CAN A MALFUNCTIONING COMPENSATOR IN THE WHEEL BRAKE SYSTEM CAUSE THE BRAKE PUCKS TO DRAG WITH RESULTANT TIRE AND PUCK WEAR? (Applies to H-43A, H-43B.)

**A.** No. In the wheel brake system the compensators allow for thermal expansion of the hydraulic fluid when the helicopter is parked with parking brake handle on. When the parking brake handle is off, the system is vented to atmosphere through the master cylinders. Dragging brake pucks are more likely due to a mis-rig condition at the master cylinders. Early or low-time replacement of brake pucks without evidence of a dragging brake is generally due to high taxi time with excessive use of the brakes. Tire wear on helicopters is accentuated by run-on landings, especially when parking brakes are on. There is no way possible that a malfunctioning compensator could cause a dragging brake or low-time tire wear. —R. A. B.



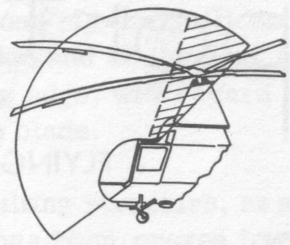

**Q.** IS IT ACCEPTABLE TO USE 115/145 OCTANE FUEL BOTH AFLOAT & ASHORE AND, IF SO, WILL ITS CONTINUED USE BE DETRIMENTAL? (Applies to HOK-HUK.)

**A.** Refer to BuAer (BuWeps) instruction 1034.1 dated Nov. 24, 1959. It states that 115/145 octane fuel is approved for these aircraft both ashore and afloat. It is felt, however, that its continued use will decrease spark plug life from excess leading and possibly increase the chance of valve problems. The recommended fuels in preferential order are 91/96, 100/130 and 115/145 ashore. Afloat 115/145 is recommended.—T. C.



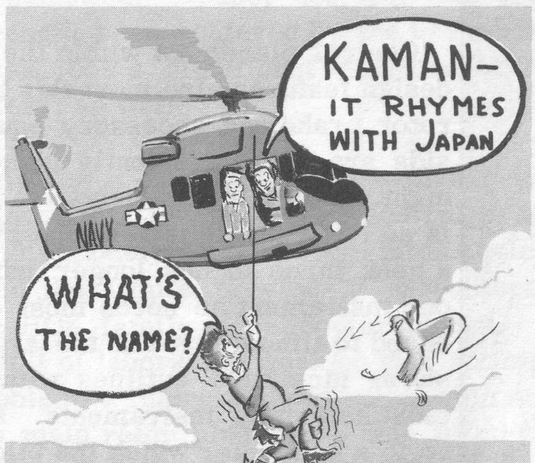
**Q.** WHAT SIMPLE CHECK CAN BE MADE IF IT IS SUSPECTED THE TEETER PIN BEARING IN THE ROTOR HUB IS WORN OR THAT THE LINER FROM THE SMALL END OF THE TEETER PIN HAS BEEN OMITTED? (Applies to HOK, HUK, H-43A, H-43B.)

**A.** Bill Wells, Kaman's Senior Field Service Representative has worked out the following procedure in conjunction with Stead AFB personnel; which we recommend: With the blade positioned laterally and the rotor brake on, pull the droop stop out and have a mechanic place the blade against either the lead or lag stop and apply light pressure. Place the index finger on top of the rotor shaft, resting the side of the finger against the hub. By "jockeying" the blade against the stop, excessive motion or play can be noted on the hub in relation to the shaft. Excessive motion warrants further investigation.—N. W.



**Q.** IT HAS BEEN SUGGESTED THAT A PORTION OF THE UPPER CABIN WINDOWS BE COVERED WITH SHEET METAL AS A MEANS OF PREVENTING POSSIBLE BREAKAGE. WOULD THERE BE ANY DISADVANTAGES TO THIS? (Applies to H-43B.)

**A.** Yes, there would be a definite disadvantage. It would tend to cut down the pilot's visibility in general and would also make it difficult for him to check whether the droop stops are in during shutdown of the rotors in the event no crew chief is available. Protective shield P/N K704026-1 is designed for the express purpose of protecting the upper cabin windows. Whenever maintenance or inspection of the rotor system is contemplated it is recommended that this shield be used as much as possible.—E. P.



# Report FROM THE READY ROOM

## FLYING THE SEASPRITE

**JACK C. GOODWIN**
Project Test Pilot
HU2K-1

Speedy, sprightly and nice to fly --- that's the SEASPRITE! This helicopter, with its high speed and long range capabilities, is also the most comfortable and "pilot kindly" rotary wing aircraft I have ever flown. Destined for fleet support, plane guard, search and rescue duty with naval units, it is certainly what its name suggests. Design and flight qualities reported on in this article are my personal observations based on approximately 250 hours in various flight test situations with the aircraft over a period of nearly a year.

One area of design which will be of great interest to flight personnel is the obvious effort that has been made to engineer an aircraft which will be efficient for people to use, as well as affording space in which to locate electronic, avionic and mechanical components. Adjustable seats and seat cushions were specially designed to afford the ultimate in comfort in consideration of the long endurance flights demanded by the specified mission. Pilots won't walk away from a patrol flight in the HU2K-1 feeling as if they had been straddling a section of split rail fence as is often the case with standard bucket type seats which never seem to quite adjust to suit the pilot's personal "configuration" during a long flight and thus add greatly to fatigue.

Control placement within the cockpit, and the height and style of control design features also meet this test of pilot needs. The landing gear handle, rotor brake and accessory equipment switches for radio and navigational aids are all conveniently placed and styled for recognition both day and night. Pilot's instrumentation is completely duplicated for the co-pilot and is so laid out in this helicopter that there is no need for the co-pilot to grow a neck three inches longer than normal in order to crane it around to the one instrument he needs most consistently. The effect of parallax is reduced to almost zero and the large, full sized 5-inch remote attitude indicator shows nice hard outlines without the characteristic "fuzziness" found in most helicopter instruments. All of these aircraft "personality traits" add up to a helicopter which the pilot really appreciates.

*(continued on page 14)*

# USE OF GLASS FIBERS IN KAMAN HELICOPTER ROTOR BLADES

by W. N. STONE
Chief Engineer

EDITOR'S NOTE: *This is the first of a series of articles planned to cover a variety of engineering activities within Kaman's research and development program.*

In constantly striving to increase the length of blade life between overhauls and to increase strength, reduce maintenance cost and problems, and yet not sacrifice any of the required aerodynamic properties of rotor blades using the servo-flap control systems, The Kaman Aircraft Corporation has been researching the use of glass fibers. Many of the properties required have been found only in wood in the past; however, it now seems that most of the qualities needed can be obtained from the proper employment of fiberglass.

Continuous laboratory fatigue test development of the critical loaded areas of the Kaman rotor blade has resulted in a series of progressive strength improvements, each of which has utilized load oriented glass-fiber construction.

At the place where the blade is bolted to the hub, the blade is reinforced in the most highly stressed regions with a 3/8" thick, prefabricated board of fiberglass. This plate is fabricated of #162 glass cloth (approximately equal strength in all directions) impregnated with a plastic resin and separately cured under heat and pressure in a flat platen press. Depending upon the helicopter model in question, for HOK and HUK the topmost surface, and for H-43A and H-43B, both top and bottom surfaces, have been found to require additional reinforcement which has been supplied by the incorporation of a .15" thick plate of "Scotchply." This particular plate is again separately cured under heat and pressure; however, the glass fibers are oriented, or aligned, predominantly in the spanwise direction, since this is the direction of the maximum vibratory stresses at this particular location in the blade section. Specifically the glass fibers of this outer reinforcing plate are laminated so that the fibers are aligned, prior to cure, in such a manner that the glass fibers in each ply are oriented so that in one ply they will lie 5° toward the leading edge and in the next ply, 5° toward the trailing edge, with regard to the spanwise axis of the blade.

The resulting structure, as assembled with its grip, has been proven to exhibit bending endurance limit well in excess of the maximum bending moment measured under the severest flight conditions. Some specimens have been tested for bending strength at loads (or stresses) greater than the endurance limit in order to define an S-N (stress plotted against number of cycles to failure) curve. During this phase of the testing, cracks were observed to form in certain regions of these glass-fiber reinforcing plates; however, either the crack did not propagate or lengthen as stress cycles continued to be applied, or propagated at such a slow rate as to permit detection long before complete failure occurred. Early experiments performed with similar reinforcing plates made of aluminum or steel, not only failed to perform at as high an endurance limit, but when a fatigue crack was initiated, the crack progressed so rapidly as to have completely failed the metal plate prior to detection. Hence, not only has greater strength been achieved by the use of fiberglass, but a significant measure of "fail-safety" as well.

As the H-43B helicopter evolved, it was evident that the increased control provided in this model required blade pitch angles beyond the limits previously encountered by the HOK family of helicopter blades. As a result of laboratory work on this anticipated problem, a fiberglass structural skin around the main rotor blade spar was found to increase the torsional fatigue life or twisting fatigue by a factor of at least 10. This fiberglass skin is composed of #181 fiberglass cloth laid up directly on the blade spar in the manufacture of the blade. Six layers of glass cloth are wrapped around the spar, each layer being individually coated with a Kaman-evolved resin formulation. The spar so treated is placed in a vacuum bag so that the resin may cure at room temperature under adequate pressure. Rather exhaustive torsional fatigue tests of this construction have once again conclusively proven that glass fibers suitably proportioned, can provide significant increase in structural strength.

Throughout the years of this development work, the absence of chemical corrosion problems and fretting corrosion, so far as the structural fiberglass elements are concerned, has been outstanding.

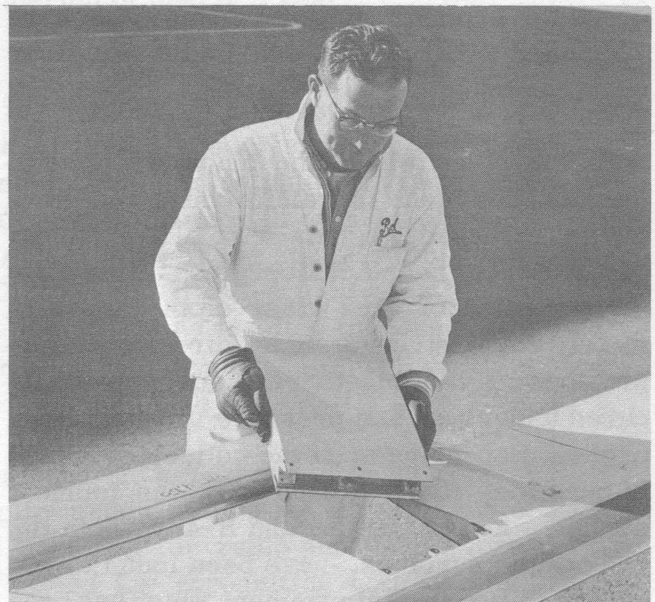
In view of the advantages mentioned previously, plus a specific weight similar to magnesium (but with a 30 - 40% greater strength), it is obvious that we must look to oriented glass fibers as a new engineering material with a very high potential. Already Kaman is developing an all fiber-glass rotor blade wherein all the aforementioned developmental testing may be fully utilized. K

The Seasprite (continued from page 4)

the main gear box drive the accessories and the tail rotor. The engine air intake is remote from the cabin area minimizing engine noise in the cockpit. The inlet ducts lead to a plenum chamber which provides substantial pressure recovery at high speeds and which acts as a settling chamber for foreign objects which could damage the engine. Engine exhaust is high and directed aft and well away from the cabin and cockpit entrances. The power and drive system, characterized by its easily exposed arrangement, provides exceptional accessibility for inspection, servicing, or replacement of components. Growth capacity has been provided in all segments of the power and drive train to accommodate the T-58 engine at higher horsepower ratings.

The HU2K-1 has 44 foot diameter main rotor blades with offset flapping hinges, and an aerodynamic servo flap control system. Coning and droop stops allow routine turn-up and shut-down of the HU2K-1 in winds up to 60 knots. The four main rotor blades are individually interchangeable and can be folded back in the horizontal plane within one minute of engine shut-down without the crewman having to support the weight of the rotor blade or turn any blade "broadside" to the wind. An in-flight blade tracking system assures proper blade track at all times and eliminates the need for manual tracking procedures after initial factory adjustment.

The main rotor blade load carrying member is an extruded aluminum D-section spar to which individual fiberglass airfoil segments or "pockets" are attached to form the trailing edge. These pockets facilitate maintenance as they are individually replaceable in the field. The eight-foot-diameter, three-bladed tail rotor has an aluminum C-section spar with an aluminum honeycomb core trailing edge section. The tail rotor blades are individually interchangeable and can be folded to facilitate storage.

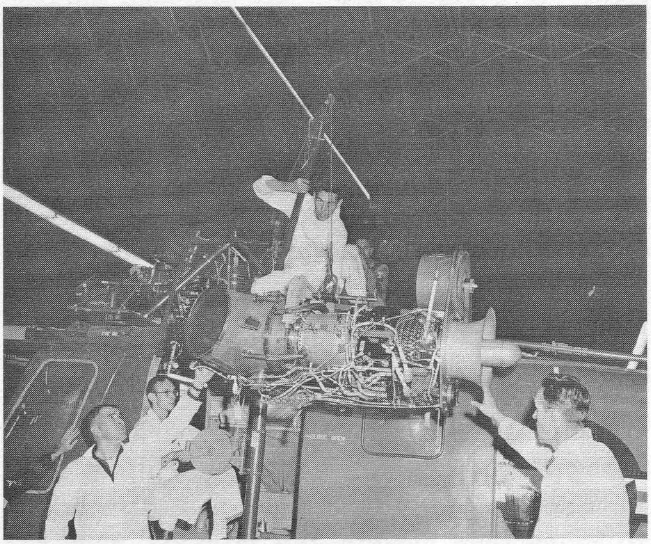


**BOON TO HU2K-1** maintenance crews is the ease with which individual trailing edge pockets of the rotor blade can be removed and replaced.

The HU2K-1 contains the usual radio navigation aids: low frequency ADF, UHF-ADF, and TACAN, all with conventional cockpit display. In addition, a coordinated dead reckoning navigation system (ADRN) is provided, consisting of an analog dead reckoning computer that accepts inputs of magnetic heading and, alternatively, ground or airspeed, and continuously computes the aircraft's position.

Ground speed direction data is furnished to the crew and to the computer from an APN-130 Doppler ground-speed system which adds to navigational accuracy and relieves crew members of navigational chores. Pilot visibility is excellent and extends from approximately 30° abaft the beam throughout all forward quadrants.

Kaman has developed its own Automatic Stabilization Equipment (ASE) for pitch, roll, heading and altitude control of the SEASPRITE. The role of the ASE is to relieve the pilot of the necessity of making continuous small control corrections, while leaving the pilot's flight controls fully operative and always in complete command of the helicopter. In effect, the pilot, by positioning his manual controls, defines an attitude or speed and altitude until the pilot's controls are moved, defining a new reference for the ASE. In this way, the necessity for pilot concentration is



**KAC MECHANICS DEMONSTRATE** HU2K-1 engine change using the helicopter's adjustable field service hoist.

reduced, and greater precision of flight is possible, particularly in hovering, since minor disturbances of the aircraft are sensed and compensated for by the ASE before they develop to the degree necessary for sensing and correction by the pilot.

The HU2K-1 has been designed so that parts most subject to inspection, adjustment or replacement require only the removal of fairings or panels to be completely exposed. Every effort has been made to avoid "burying" such components in the structure, most particularly behind other components. Related equipment is grouped in compact assemblies without effecting the ability to remove or replace basic components individually.

The complete power and drive system, excluding the fuel tanks, is located above the fuselage. Removal of cowling sections leaves the engine, rotor shaft, main gear box, cooling system, accessories and other power and drive system components exposed and individually removable. To further facilitate servicing, portions of the engine and transmission cowlings are hinged to fold down and form convenient work platforms. Electrical and electronic system components are located in readily accessible nose and fuselage compartments. Tail rotor access is provided by means of retractable steps and a standing area on the horizontal stabilizer. Access panels are located adjacent to the upper and lower tail gear boxes, which are provided with visual oil quantity indicators for the self contained lubrication system.

Special support equipment required to maintain the HU2K-1 has been kept to a minimum. Pick up points are provided to accommodate standard jacks and towing and hoisting equipment. An outstanding feature is a self-contained field service hoist provided as a maintenance tool to expedite handling of the gas turbine engine, rotor blades and rotor drive system components during field service operations. This hoist can be readily collapsed into a compact unit for transportation within the helicopter.

The foregoing features, coupled with the fact that all major components of the helicopter are designed for complete interchangeability and 1000 hour minimum retirement life should make the SEASPRITE a highly serviceable aircraft.

In addition to the ability of the HU2K-1 to perform its specified high speed, long range search, rescue and utility missions for the Navy, the capabilities of this helicopter for ASW operations are particularly noteworthy. The HU2K-1 has the payload capacity to carry attack weapons in addition to the latest detection gear with a significantly useful search endurance. These attributes, combined with its capability to operate from many types of ships other than aircraft carriers, offers the fleet a new potential in anti-submarine warfare. K

**Report From The Ready Room**

*(continued from page 10)*

This helicopter, the first single main rotor configuration with the KAMAN servo flap control system, is as nearly free of vibration as any I have ever flown. The servo flap is a miniature airfoil attached to the trailing edge of each rotor blade. The pilot controls only this small airfoil from the cockpit, and the effect of flying this segment of the rotor blade is transmitted to the entire blade to apply changes in flight attitude. This basic aerodynamic feature stabilizes the entire rotor blade system and literally eliminates "aerodynamic feedback" so that the pilot feels no stick shake and none of the allied cockpit vibration problems associated with helicopters. The aircraft can be trimmed up to fly hands off without use of hydraulic boost or Automatic Stabilization Equipment (ASE), therefore if a failure in the boost were encountered manual flight is a very acceptable mode of control. These qualities also reduce pilot fatigue and make the HU2K-1 a sweet ship to fly. Pilot feel is extremely good as might be expected with the elimination of stick shake, high stick loads and cockpit vibration. Pilot visibility from the cockpit is excellent, and the design over-all is further enhanced with the slight fuselage nose which protrudes just far enough forward to give a visual point of reference ahead which establishes a natural horizon.

An additional plus from the pilot's viewpoint is the in-flight cruise attitude of the SEASPRITE. In level flight from forty knots through one hundred knots the aircraft is perfectly level fore and aft, and this changes only three degrees in the nose down direction during maximum cruising speed. A nice mechanical feature is built into the control system which aids pilot control in this regard. The coupling of collective control and cyclic control by a cam arrangement designed into the azimuth assembly automatically adds a proportion of forward cyclic control whenever a new value is added to the collective control (power) in excess of 27% collective stick travel.

The turbine engine, T-58-6, which powers the SEASPRITE, makes it possible to select a rotor rpm which will remain constant throughout a range of load requirements. Balanced fuel controls automatically compensate for changes in load demand and after selecting a rotor rpm appropriate for the mission performance required, the pilot can then fly the aircraft without constant fuel and rotor rpm adjustments. This feature of not having to constantly monitor rotor rpm, allows the pilot to direct his attentions to the mission at hand. The power plant, combined with good basic aerodynamic design and an exceptionally clean profile yields a high cruising speed during straight and level flight at sea level, and, as with any free turbine, the aircraft uses less fuel proportionately as power is increased.

Autorotation with the HU2K-1 is best executed at about 60 knots and although the rate of descent is a little faster than most helicopters, the high rotor inertia makes for easy handling characteristics in a flare-out. This high rotor inertia, achieved because of the extra heavy blades (weight 168 lbs), and a high rotor rpm of 286 rpm, gives a margin of time and control to allow the pilot to execute a better landing from an autorotation descent.

All-in-all, the HU2K-1 SEASPRITE, is a pilot's aircraft. It has incorporated in it many changes which helicopter pilots have been seeking for a long time, and it promises to more than satisfy the mission requirements specified by the Navy. I am sure pilots will find it a very welcome addition to the fleet. K

Approximately 75 Navy and civilian personnel recently conducted a two-week Maintenance and Engineering Inspection of the HU2K-1 at Kaman Aircraft. These representatives, all from operating activities and bureaus within the Naval Establishment, included personnel from the office of the Chief of Naval Operations; Bureau of Naval Weapons; HU-1, ComNavAirPac; HU-2, ComNavAirLant; Naval Air Station, Jacksonville; Naval Air Training Command; Aviation Supply Office, NavAvSafetyCen; and the Naval Aviation Engineering Service Unit.

During the first week of the MEI, which began May 16, personnel from the Kaman Service and Engineering Departments conducted familiarization classes on the various systems in the SEASPRITE and performed demonstrations of the helicopter's handling and performance capabilities.

The HU2K-1 is scheduled to begin the Fleet Indoctrination Program (FIP) this fall.

# CURRENT CHANGES

## AIRCRAFT SERVICE CHANGES (USN)

*Applies — HOK-1 HUK-1*

HOK/HUK ASC No. 104 3 June 1960
Fuel System replacement of Fuel Boost Pump

## FIELD INFORMATION DIGESTS (KAMAN)

*Applies — H-43A H-43B*

No. B-9, 22 April 1960
Modification of Rotor Blade Folding Hooks. (H-43A, H-43B)

No. B-11, 29 April 1960
Clarification of H-43B Starter Relay Circuit. (H-43B)

No. B-23, 20 May 1960
Rigging of the N1 Fuel Control and N2 Governor Rod and Actuator. (H-43B)

*Applies — HOK-1 HUK-1*

A-49, 29 April 1960
Removal of Bolt from Clutch Manual Control Bracket.

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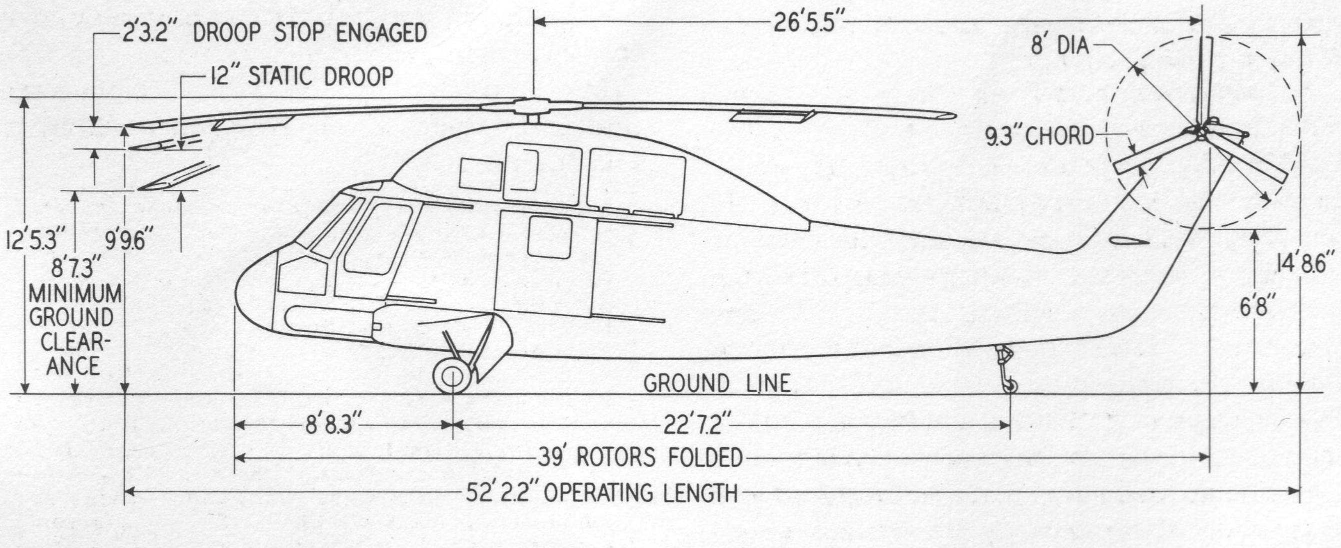


GENERAL DIMENSIONS • HU2K-1

# Kaman Service Representatives

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*R. W. Spear, Asst. Supervisor, Training.*

# FOUND

## IN CARBURETOR AIR DUCTS

**This accumulation of sludge, dirt and vegetation. Presence caused engine to run rough and could have caused engine failure due to foreign objects entering induction system.**

***ATTN:* ALL MAINTENANCE CREWS — HOK/HUK & H-43A AIRCRAFT**

**Check filter screens for more culprits of this description.**

***REWARD* — $afety In Flight Through Elimination of Potential Hazard.**

OPERATING UNITS PLEASE POST

Kaman Aircraft Corp.
Field Service Dept.
June, 1960