KAMAN

Rotor Tips

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THE KAMAN AIRCRAFT CORPORATION

PIONEERS IN TURBINE POWERED HELICOPTERS

KAMAN Rotor Tips

FEBRUARY, 1961

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IN THIS ISSUE

NEXT MONTH: **LUBRICATION**

THE COVER

Precious time-saver is the Airborne Fire Suppression Kit used to aid in evacuating crew from burning aircraft.

PLEASE SHARE THIS COPY

airborne fire suppression kit

by G. W. SCHAEFFER
Supervisor, Health and Safety

It looks like a blown-up version of a space-age gimmick that might be found on the counter in a local toy store.

However, this unit, the airborne fire suppression kit, is a far cry from being a toy; it is a proven piece of fire suppression equipment designed for aerial delivery by the Kaman H-43A and H-43B helicopters to the scene of an aircraft crash. Deposited on the ground within striking distance of the crash scene, this 1000-pound "flying fire engine" contains the extinguishing medium and equipment to effectively suppress a flammable liquid fire in a path fashioned to facilitate the removal of entrapped flight personnel from the aircraft.

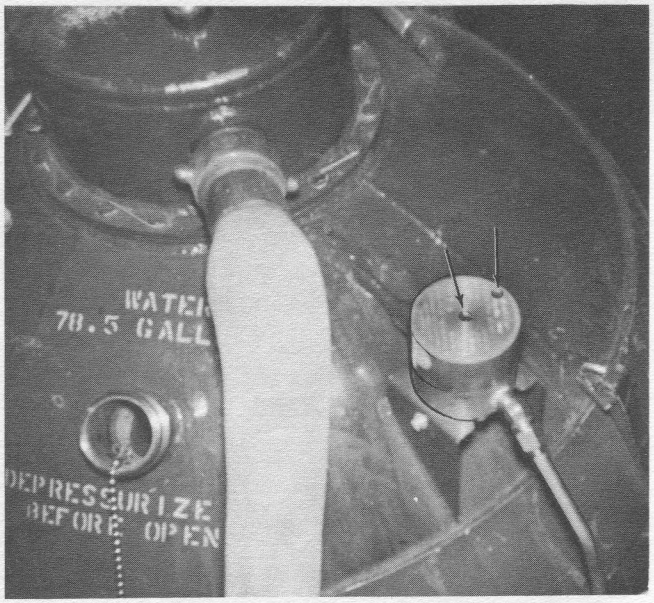
The success of a rescue-from-fire mission can best be realized by continued training of the fire fighters and pilot personnel assigned to this activity. Proficiency in the mission through know-how is certainly desirable, but know-how back at the crash station in maintaining the equipment you depend so heavily on is of the utmost importance. The proper operation of your in-service kit is a must if

a successful mission is to be realized. A loose expansion ring, a burst hose, improperly installed O-ring seals or a malfunctioning regulator most certainly spell the failure of a mission.

After the first fire suppression kit arrived at Kaman for testing, we put it through its paces and then compiled a list of complaints on numerous small items that only through handling and use were disclosed. As I look back, the major "growl" dealt primarily with rubber O-rings used quite extensively that might fail and cause loss of air pressure. In the kit's present configuration the number of these rings has been kept to a minimum and I believe that no difficulty with them is encountered.

While maintenance is the theme, let's look at the kit a little closer. We have an all-dacron jacketed hose line 150 feet in length. This hose is folded down in a basket with one end attached to the discharge outlet on the upper portion of the foam liquid tank, the other is attached to the foam discharge nozzle. I recommend that new hose be on hand for replacement when needed and that old hose be used during training missions. When the kit is readied for stand-by, try to keep new hose in the basket. The older hose should be washed and dried properly after use to prolong its life. Under certain training conditions use regular double jacket line from your station supply——it's easier to wash in 50-foot lengths and you conserve the kit hose.

Air in the hose line makes folding a pretty difficult task, and you end up with line you can't get into the basket. We find the answer to this is to stretch the line out full length and flush it out with water. Two men should pick the hose up midway and, each man holding the line high, walk in opposite directions to the ends of the hose. By this method of draining the line we have no air entering the hose. The female end is then attached to the kit; the male end should be folded and a hose clamp or similar device applied to prevent air from entering that end of the line. I find this works well.



CRITICAL ADJUSTMENT of these hex set screws must be done in base shops to avoid possible malfunction at the scene of an incident.

The pressure-reducing regulator mounted on the kit above and behind the hose basket is a very important unit. Atop the regulator are two hex type set screws; these are setting adjustments and should not be touched. The slightest movement of either screw can render the unit useless. Repairs to this unit should be done according to handbook specs and are best accomplished in the base shops.

A low pressure relief valve is located on top of the foam liquid tank. It is protected from the elements by a plastic cap. To prevent weakening of the rupture disc inside the valve, we have wiped the inside of this unit with a light oil and replaced the cap in an effort to reduce corrosion which can attack the aluminum disc. Always keep the plastic cap in place.

An item of major importance is the charging of the fiberglas pressure sphere. The original plan was to pressurize the spheres with dry nitrogen to be certain that moisture would not be introduced into the regulator. Any moisture present could freeze in the regulator and cause it to malfunction. Realizing that compressed dry air is available on all bases it was decided to utilize this. When the spheres are recharged you should be certain that the dehydrating air filters on the compressor have been changed according to

placarded instructions. It is highly desirable that each crash station have a capable compressor assigned to it for recharging spheres. I have seen units furnished by the alert crews for recharging that have not had the filters replaced in a long time and others had no filters. Watch this closely and insist on new filters. A weight check reveals the moisture content of filters. Don't pump damp air into your pressure sphere or you may be in trouble.

On "the moisture kick," it must be pointed out that overfilling the water tank can cause water to slosh back into the regulator during transportation of the kit on the trailer over rough terrain. The 78.5 gallons of water is realized by filling only to the bottom of the filler neck. If you overfill, drain the water via the petcock on the bottom of the tank. Use a flashlight to check the water level.

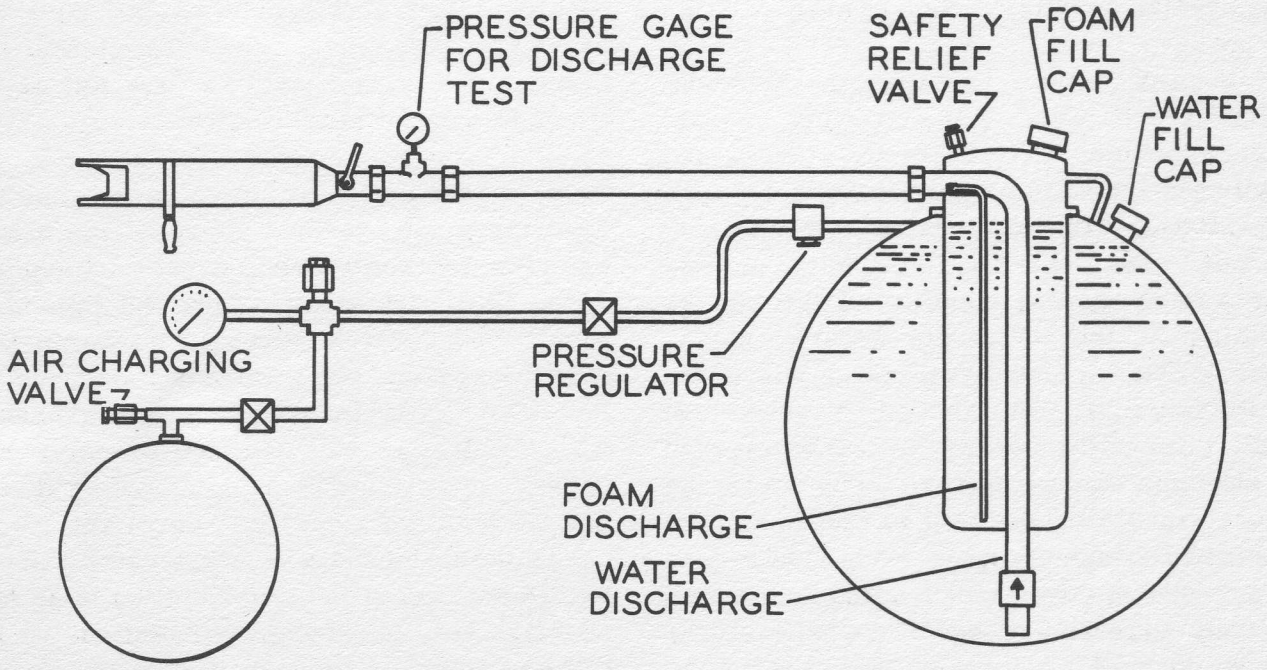
The unit should be flushed out completely periodically to remove any coagulated foam that could obstruct the proportioning tube. This is accomplished by filling both tanks with water and using the pressurized dry air sphere to expell the water under pressure. This must be done under pressure as the foam tank can not be drained and this is the only method by which the proportioning tube can be satisfactorily purged. No hose line is required in this operation.

Occasionally we find that the rubber grip on the phase control handle of the nozzle becomes loose and, when the operator is wearing heavy gloves, control of the nozzle is difficult. Here a little rubber cement solves the problem.

When the kit is on standby and exposed to the sun or heat from some other source, or if there is a leak in the main shut-off valve, the resultant air pressure build-up in the water-foam tank pushes foam up the proportion tube and into the nylon hose, thereby encouraging hose deterioration. This condition could also result in excessively rich foam mixture during initial operation followed by premature exhaustion of the foam fluid. A fix to prevent this condition has been submitted as an Engineering Change Proposal and is awaiting Air Force approval.

Under this proposed change, the present foam tank filler cap would be replaced with a new cap containing a built-in relief valve. This valve, which would normally be open permitting equilization of pressures, would close upon application of discharge pressure to the inside of the foam tank. The proposed design change would assure protection of the valve by keeping it entirely within the tank.

As an item of safety it is important that



PERSONNEL FROM MARINE AIR GROUP-36, Camp Pendleton, Calif., who recently completed a training course at The Kaman Aircraft Corporation are, left to right, Cpls. E-4 J. Monahan and J. Szobocson, Pfc. R. M. Hockenbury, 1st Lt. R. B. Lassiter, Sgt. E-5 J. H. Garbrick, 1st Lts. W. D. Merris and R. E. Usher, Capt. R. G. Miller, and L/Cpl. G. F. Austin. KAC Instructor was Raymond A. Vokes.

Airborne Fire Suppression Kit

you exercise extreme care when working in the vicinity of the compressed air sphere. Although shatterproof, the tank can explode when charged, if penetrated by a sharp object. The sphere should never be rigidly restrained since its size varies slightly with temperature and pressure changes.

The second major part of your equipment is the USAF Type MB-1 trailer chassis equipped with a platform for the storage and handling of the airborne fire suppression unit. Tie-down straps are provided for securing the unit to the trailer. These must be used only during ground handling of the kit; be certain that the kit is not secured during standby. This trailer has a heating unit which is combined with an insulating blanket to prevent the unit from freezing when exposed to sub-zero temperatures. The insulating blanket should be secured to the unit by the provided D-rings and clips when it is necessary to operate the burner. Be certain that the snap flaps are properly located when the kit is covered. The unit may be airlifted during freezing weather with the blanket in place.

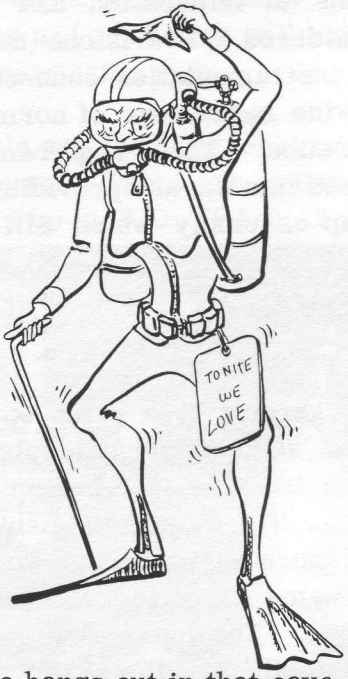
The operation of the heater itself is well described by an instruction plate on the trailer's side. Follow these instructions and no problems should arise as to the burner's operation. It should be mentioned that the burner's fuel tank should be kept full at all times to prevent condensation.

The airborne fire suppression unit has already been used several times during actual emergencies and certainly proven its place in the USAF inventory. Take the time necessary to be certain that your airborne fire suppression kits get proper maintenance so that, should your team be called, you respond with a unit that will function properly and without delay. Delay or malfunction of the operation of your unit can certainly not be corrected at the scene of an emergency. Your know-how back at the crash station is as important as the airborne fire suppression kit itself——and it can save a life. K

Maintenance Mailbag

Dear Scotty,

Hope you had a good leave. Mine was fine except I missed the train and ended up riding in a truck loaded with chickens. I smelled like a walking fertilizer ad by the time I got back.



Speaking of fertilizer, you'll be happy to know that "Lover" LaRue is getting the horselaugh from everybody in the air group. He was scuba diving the other day when he met this girl in an underwater cave. Naturally, the Lover ended up with a date after a lot of writing back and forth on her slate. He spent about five hours getting ready and yakking it up all over the barracks about this great power he had over women. We got pretty curious, so we followed that flashy red sports car of his into town and watched him meet this "gorgeous creature" outside the State Theatre. Man, I tell you! She was eighty if she was a day. Her wrinkles' wrinkles had wrinkles and the only teeth she had not only didn't meet, they'd never even been introduced—they were that far apart. She was gumming a big mouthful of licorice, or something, which sure didn't help any. The policeman who helped us corner Latour in an alley afterward told us she's known in town as "Grandma Grizzle, Queen of the Scuba Diving Set." He said she hangs out in that cave all the time just waiting to grab somebody. One guy fought her off with a shark knife.

I was talking to Stan Balcezak, one of the reps from Kaman, and he tells me the boys at Perrin Air Force Base find disposable cleaning cloths of non-woven fabric work wonders when cleaning the bubbles on the choppers. The Federal Stock Number is 7920-543-7615. Of course, a chamois skin should be used whenever possible but, as you know, these have a way of walking off, even though the animals are dead. Be sure and tell your boys to follow the instructions in the tech manual and always make sure they use a damp cloth or chamois to prevent building up an electrostatic charge which attracts dust to the bubble.

The other day I was reading about S/Sgt. Raynard Satour, OJT supervisor for the helicopter section at Laredo Air Force Base. He put five members of the section through the 3-level helicopter maintenance OJT course in three months. Their average score on the AFJKT 43130 was 146.8. High score was 157 out of a possible 172. This is doggoned good, especially when you take into consideration that most of the training material available was on other types of 'copters and Laredo uses the H-43A. The sarge has a good philosophy on this training bit—"I just try to do the best job I know and help the men all I can." It's pretty evident his people appreciated this.

Let's hear from you,

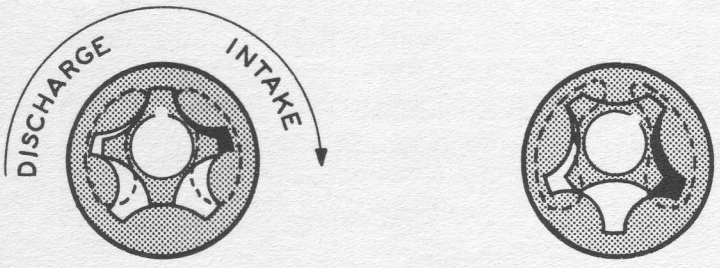
Roy

THE H-43B TRANSMISSION OIL PUMP

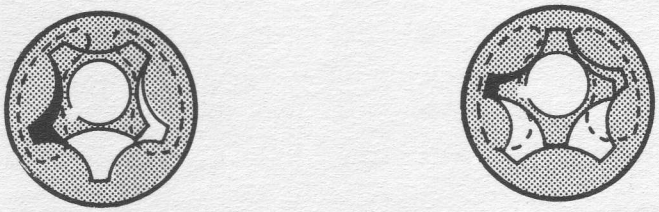
by LARRY LYNES
Service Analyst

The simple process of pushing a fluid through a pipe apparently is a commonplace affair and one which requires little expenditure of our daily time. However, when the fluid is oil, the "life's blood" of a mechanism such as a helicopter transmission, the problems of lubrication and cooling must be considered. Provisions must also be made for instrumentation connections in order to provide indications of normal and abnormal operation. These requirements must be designed into the unit providing the "push." The pump assembly which efficiently performs this function in the H-43B is of the multiple gerotor type

A gerotor-type pump operates according to the same basic principles as a gear-type pump but has a different arrangement of gears. The moving elements are the toothed "gerotors"—inner and outer. Both turn in the same direction and either one may be driven. The inner element always has one less tooth than the outer and the "missing tooth" provides a chamber to remove the fluid from the inlet or suction port to the discharge port. *(See illustration)*



INTAKE CYCLE



DISCHARGE CYCLE

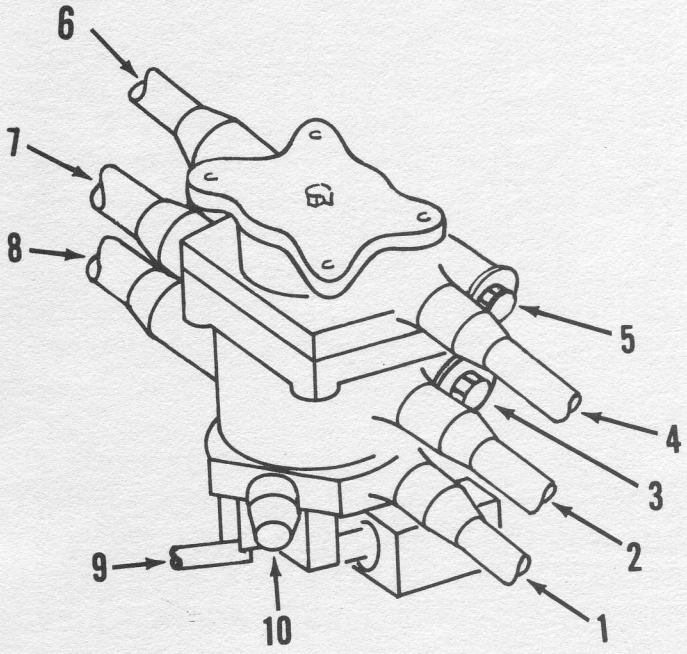
The gerotor needs only a single shaft and both elements are substantially concentric to it. These are mated to provide continuous fluid-tight engagement without the crescent structure found in other internal gear pumps. Gerotor elements can be stacked along a single AN pad to perform multiple pump functions: lube, scavenge, boost and so on.

Some of the outstanding features of this particular kind of pump are that it is a positive displacement type and the oil flow is around rather than directly through the teeth as in a gear pump. This axial flow has less tendency to aerate the oil and therefore gives improved lubrication.

The pump actually consists of four separate pumps mounted in one body and keyed to a single driving shaft. These pumps perform two basic jobs. They provide both "pull" or suction, and "push" or pressure. Since there are only two jobs to do and there are four pumping elements, it follows that more than one does each job, as will be brought out later in this summary. The pump is mounted on the bottom of the transmission and slightly to the left. The pump drive shaft is driven, through a ring and pinion adapter, by the left-hand synchro shaft inside the gearbox. The lower end of this shaft has a female spline which is mated to the male end of the pump shaft. This shaft runs all the way through the pump and in turn provides a female spline for the N2 rotor tachometer generator drive. The pump consists of a magnesium body with aluminum inserts for the gerotors to run in. These inserts separate the various pumping elements and act as ports, directing the flow of oil.

The pump case or body has six flow ports which are shown in the accompanying diagram. Port 1 is the suction intake from the oil

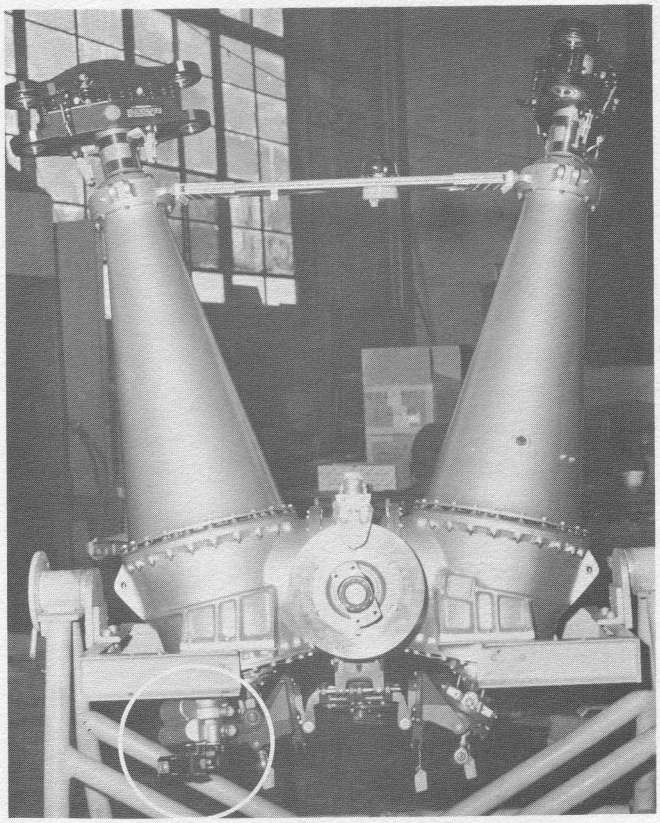
supply tank; ports 2 and 4 are scavenge intakes from the transmission; port 6 is oil out to the cooler and 7 is high pressure, 275 psi, to the collective limiter and rudder lock system; port 8 is low pressure, 65 psi, to the transmission. Also shown are, 9, the pressure switch tap off, 5, the small, or upper, scavenge filter; 3, the large filter, and 10, the oil temperature bulb.



Here is the way the oil flows through the pump; Oil is pulled from the supply tank and enters port number 1. The oil then divides and flows through both the high and low pressure gerotors. The low pressure oil going to the transmission flows through a filter and out port 8; the high pressure oil flows through a separate filter and out through port 7 to the collective limiter and rudder lock system. Oil being scavenged from the left-hand end case of the transmission flows in port 2 and oil being scavenged from the right-hand end case flows in port 4. This oil flow is then combined on the pressure side of the gerotors and flows out port 6 to the oil cooler and back to the tank. The two filters mentioned are of different air mesh and are also different lengths so that they cannot be interchanged. The upper filter is the short fine mesh, allowing a flow of 1.62 gallons per minute. The coarse filter is longer and allows a flow of 5.9 gallons per minute. Instructions for removing the filters for cleaning will be found in this month's Q's and A's section.

There are also provided two pressure relief valves in the body of the pump. The lube or low pressure valve relieves at 55-65 psi. The hydraulic or high pressure valve relieves at 250-275 psi. The relief pressure values given here are for a normal pump rpm of 4200. Flow rates and pressures will vary as a function of transmission rpm.

No special tools are required for the maintenance of this pump. There are spares kits (for overhaul) set up in T.O. 7R4-2-12-3. K

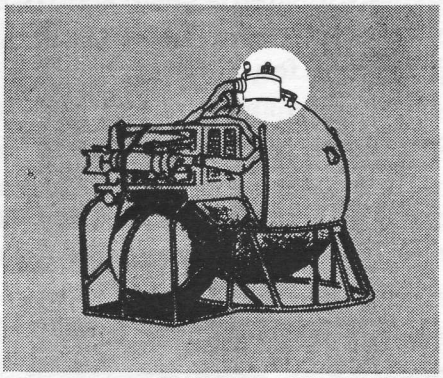


SHOWN INSTALLED, the H-43B transmission oil pump has self-contained filters.

This is the first in a series of articles written by Service Department Analysts on Kaman helicopter components and accessories. Questions from readers, or suggested subjects for future articles in Rotor Tips, will be welcomed.

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.

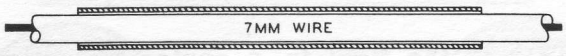


Q. WHY IS IT IMPOSSIBLE TO FILL THE FOAM TANK WITH THE PRESCRIBED FIVE GALLONS OF FOAM ON SOME FIRE FIGHTING KITS? (Applies H-43A, H-43B)

A. The foam tank has collapsed. This is caused by a plugging of the air balance line between the water tank and foam tank with dried foam, resulting in a pressure differential between tanks.

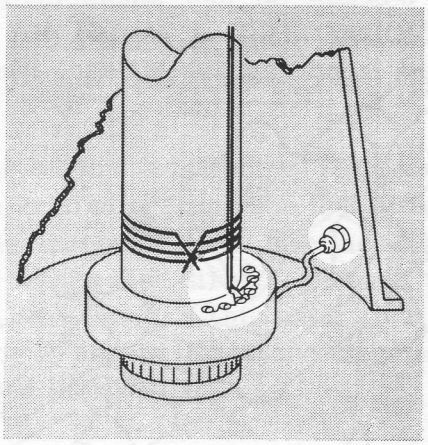
The air balance line should be purged after each usage to preclude the possibility of dried foam liquid plugging this line.

Next revision to T.O. 36A11-8-6-1 should include this requirement. — A. D. C.



Q. WHEN REPLACING IGNITION HARNESS WIRE ON THE R1340 ENGINE, CAN 5 MM IGNITION CABLE BE USED IN PLACE OF THE 7 MM IGNITION CABLE INTENDED? (Applies HOK-1, HUK-1, H-43A)

A. Yes, it can be used. The 5 mm ignition cable has the same dielectric property as the 7 mm ignition cable due to improved cable construction. Therefore, it can be used as an alternate. However, the 7 mm ignition cable should be used whenever possible because the size of the conduit was designed for 7 mm ignition cable usage. If a smaller size ignition cable is used it may move within the conduit and chafing could abrade insulation causing a short circuit. — E. S. M.

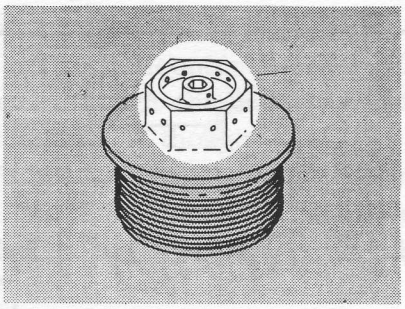


Q. IF ONE OF THE RINGS IN A ROTOR TRACKING SLIP RING ASSEMBLY SHOULD BECOME OPEN OR SHORTED, IS IT NECESSARY TO REPAIR OR REPLACE THE SLIP RING TO GET THE IN-FLIGHT TRACKING SYSTEM BACK INTO OPERATION? (Applies H-43B)

A. No, there is a spare ring which may be used in the event one of the rings providing power to the tracking actuator should fail. When changing to the spare ring refer to T.O. 1H-43B-2, page 11-13 to ascertain the wires and rings which are affected. Changing to the spare ring is accomplished as follows:

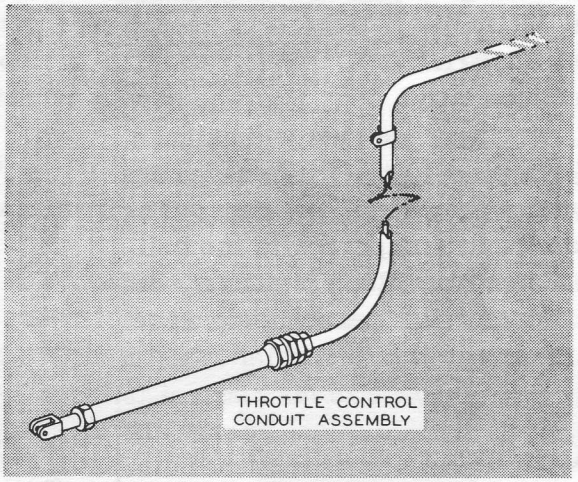
1. At the external pylon connector disconnect the affected wire from its respective pin and re-connect it to the applicable spare ring pin.

2. At the top of the pylon, disconnect the affected wire at the splice and reconnect the wire coming from the actuator to the unused wire which is connected to the spare ring. — W. H. Z.



Q. HOW ARE THE ELEMENTS OF THE TRANSMISSION OIL PUMP FILTERS REMOVED FROM THE CAP FOR CLEANING? (Applies H-43B)

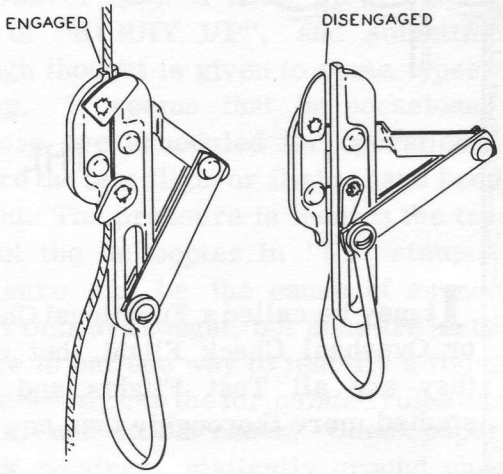
A. After removing the filter from the oil pump, use a one inch wrench to hold the cap. Insert a 1/4 inch hexagonal wrench in the socket at the center of the cap. Then turn the hex wrench to the right, clockwise. The internal thread is left hand and therefore turns clockwise to loosen. When reassembling the unit the torque on the hex bolt is 90-120 pounds-inch. — L. L.



Q. WHAT WOULD PREVENT THE THROTTLE CONTROL ON THE COLLECTIVE STICK TWIST GRIP FROM ROTATING TO FLIGHT IDLE POSITION DURING COLD WEATHER? (Applies H-43B)

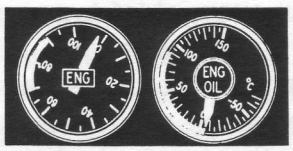
A. Check the conduit assembly, P/N K773527-1 (A5023-672) (Ref. T.O. 1H-43B-4 Sect. II, Figure 58-66) for presence of frozen oil and/or moisture condensation. If aircraft is hangared, then exposed to outside cold weather for any length of time, the flexible shaft may be frozen to the conduit.

Remove the conduit assembly. Clean it thoroughly with dry cleaning solvent (PS-661) and dry with air. Reinstall. — C. W. J.



Q. WHAT IS THE FEDERAL STOCK NUMBER FOR THE CABLE GRIP, RESCUE ASSEMBLY (CHICAGO HOOK)? (Applies HOK-1, HUK-1, H-43A, H-43B)

A. The Federal Stock Number is R1680-511-2711-LA20. This is a clamp type hook which grips the hoist cable at any point and is used as an auxiliary hook. — A. D. C.



ENGINE OIL PRESSURE ENGINE OIL TEMPERATURE

Q. WILL ABNORMAL ENGINE OIL TEMPERATURE CAUSE A DROP IN ENGINE OIL PRESSURE? (Applies H-43B)

A. No, because the output capability of the engine oil pressure pump exceeds normal engine requirements. Therefore, it will compensate for the decrease in oil viscosity caused by abnormal temperature. To obtain the true indication of engine oil operating condition, both engine oil temperature and engine oil pressure gauges should be monitored. — E. S. M.

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Report FROM THE READY ROOM

THE TEST FLIGHT

It may be called a Functional Check Flight, Maintenance Operational Check, or Overhaul Check Flight, but regardless of what technical name is used, they are all Test Flights and should be planned and studied more thoroughly than any routine flight.

PETE RUSSELL
Senior Test Pilot

Imagine the fictional Lt. Charles Rash being assigned to such a test flight. The helicopter has just come out of a high-time component change and is ready for check. Lieutenant Rash has 100 hours in type and 500 hours total time. He is eager and inquisitive, he makes inquiries about flight testing and rotor tracking (gets a brief idea on how it's done). He checks at Operations and Engineering, and flips through the paperwork, weather, weights and balance, the work sheets, check lists, etc. Next, he goes down to the ramp and looks over his helicopter. The pre-flight hastily covers the "check-off" list. The regular crew chief is at early chow, and has left two helpers with the helicopter to launch it when THE PILOT arrives. Lieutenant Rash is all set, but remembers the blades have to be tracked. None of the personnel present know anything about tracking, so a message is sent to the line chief to get a man on the scene who is a qualified flag man. The response to his request is rapid and an experienced E4 arrives. He sizes up the situation quickly and orders the crew to swing the aircraft into the wind, chock the wheels and color mark the rotor blades. He notices that one oleo is low so he tells his men to get the compressor, the jack, and the hydraulic cart so they may service the strut. Meanwhile, Lieutenant Rash, becoming restless, decides to pass the time in a nearby hangar. Here he meets a friend who is in need of some Service Manuals that are in the Technical Library at a nearby auxiliary field. It is only seven miles to the south, over the hill, so Lieutenant Rash agrees to pick up the manuals during his TEST FLIGHT.

The tracking goes as expected. The pilot had to be advised several times by the experienced track man. He was using too much cyclic once and too much collective another time——and, having Job-like patience, the old E4 gets the job done and Lt. C. Rash is ready to "screw into the blue". The rotor discs look OK, the rudders feel good, the track adjustment corrections

the crew chief recommended are "on the money". The helicopter feels real good in hover, even though the northerly wind is up to 18-20 knots. A thought then flips through the pilot's head, "Gee it's getting late, I guess I better get those manuals before everyone goes home."

"Hello, Dilbert Tower, this is helicopter Easy 2 hovering on Mat 3, request departure to the south - Maintenance Test Flight."

As he passes over the perimeter of the field, the engine oil pressure gage fluctuates and Lt. C.RASH makes a mental note of it, planning to write a squawk when he returns.

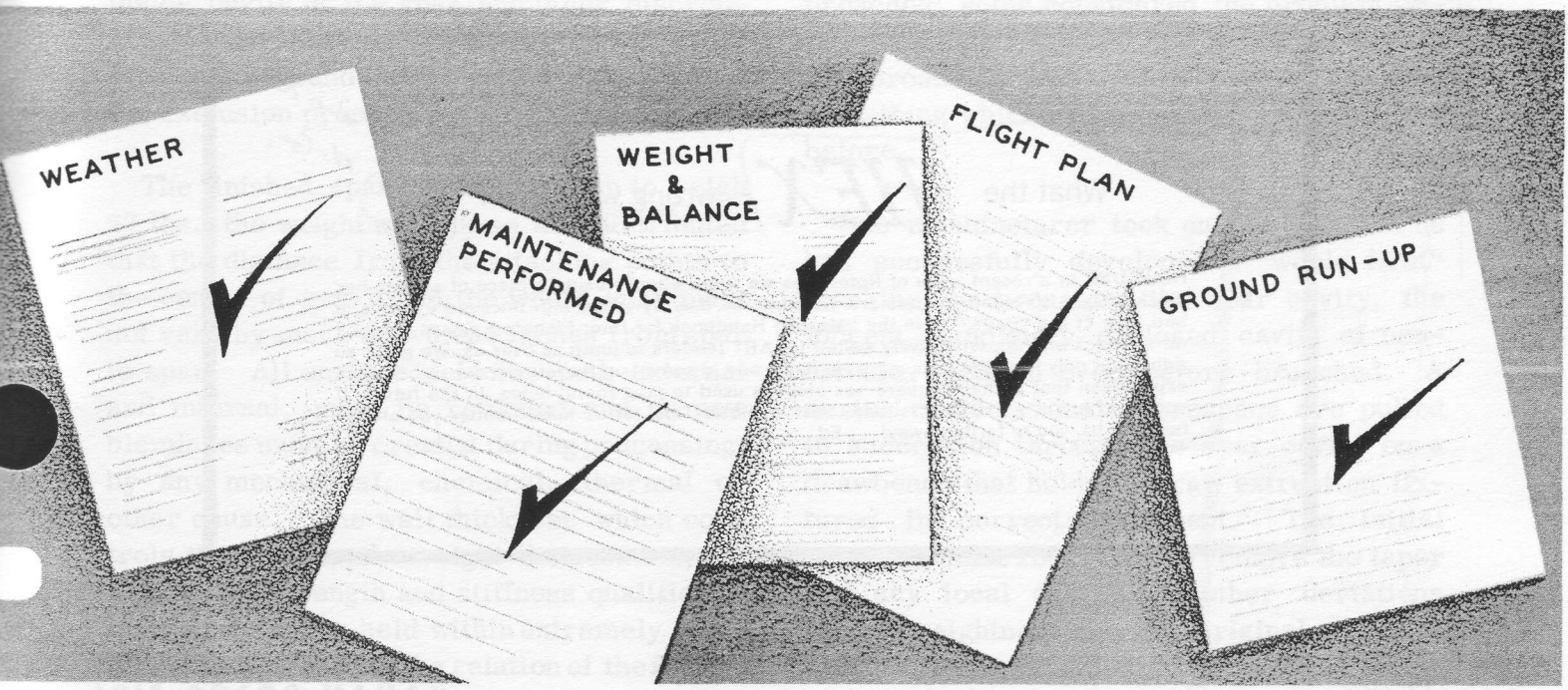
One-half hour later the home base receives a call reporting one of its helicopters has crashed on an auxiliary field to the south—— you're right, it's our boy! The low level engine oil warning light came on about one mile from his destination. He got shook and tried to stretch it, and he made a downwind autorotation into the field, touching down very fast with his auxiliary gear unlocked, lost control of the helicopter which received extensive damage.

P.S. Investigation later revealed he had one-third of the engine oil still in the system.

OF COURSE, THIS NEVER HAPPENED— I guess I have a flair for the dramatic. It is a fact that in all my travels to military bases, I have never met or heard of a maintenance engineering officer or operations officer who would assign an inexperienced pilot to a test flight. The story was just food for thought!

However, we all know we are living in an age of "HURRY UP", and sometimes not enough thought is given to some types of test flying. It seems that on occasions, helicopters are scheduled for operational work before the test flight or flights have been completed. The pressure is then on the test pilot to get the helicopter in "UP" status; such pressure can be the cause of an accident. Short cuts are sought, but none are justifiable. There is but one way to test-fly a flying machine——stick to the formulated rules of check, check, and double check. Check paperwork, check weather, statically ground check the helicopter, run-up ground check the helicopter, hover check, and then and only then, take a short local flight within the boundaries of the field (if possible). Really, whirly bird testers have it all over the jet jockeys. They can feel their birds out at six feet high and have no excuse for missing some of the telegraphed malfunctions.

I have the highest regard for our military services maintenance work and overhaul, but when a helicopter comes out of extended storage, an engine change, a periodic inspec-



tion, a high-time component change, (azimuth, gearboxes, etc.), or a rotor blade change, I believe it should be flight tested by the best qualified pilot in type. He must know the helicopter's system "cold" and have almost memorized the Pilot's Handbook. His emergency procedures must be flawless. Test flight techniques are covered in many service publications and every organization has its standard operational orders and check lists. Covering these tests step by step, a test pilot should follow these directives and procedures to the letter. He should review them before takeoff and make notes (if possible) in flight or immediately after landing. The frozen-wing jockeys all admit that airplane test flights have a higher accident potential than normal operational flying, and so it is with rotary wing. In testing, there is always potential danger, and at all times the pilot should be mentally prepared for the unusual to happen. Any attitude of boredom, impatience or irritability may cause you or the crewman to overlook a seemingly small item. This minor oversight may ruin your (allotted) days.

The pilot's first step in preparing for a test flight is to equip himself with all the data on the maintenance performed; thus, he'll have an idea of what to expect. Yes, "expect," because all good test pilots are looking for something, and his mental pre-flight should review all the steps he would take in the event of an emergency. Remember, the test pilot is checking the helicopter so others can fly it. The thoroughness of his check will reflect on the safety record of his organization. This is another good reason why only the most experienced pilots should be assigned test flights.

With the introduction of the larger jet age gas turbine helicopters, actual operational flying will be easier, because of the many advantages these birds offer, such as, a reserve of power (multi-engine), boost controls, stabilizing equipment, full instrument panels, etc. However, these sophisticated machines will require their test pilots to be very sharp, for if an emergency occurs, there are many more possible sources of trouble in their complex systems.

Nothing takes the place of experience and a good head. Hot test pilots making jump takeoffs and low level turns impress only the uninformed. The professional approach is the safe approach. The test pilot who, after a short hop, can write up an aircraft in a clear, precise manner has the admiration of the maintenance, electronics and operational personnel. They know if he is good—and that he is no superman—just a seasoned professional pilot. He is a credit to his outfit.

K

Filmotype "ZOLA" 3/8" high

12 pt N.G.

What the *HEX* wrong with Rotor Tips?

HOWCUM? In a recent issue of Rotor Tips we wrote about "using a piece of square hex stock." Since six-sided squares are encountered only by those with uncaged eyeballs, a bad case of the "botts," or in the "Martian Handbook for Inter-Planetary Space Travel," we sat back and apprehensively waited for KRT readers to jump all over us. We got it all right—but only from the boss man! He flatly, and at some length, refused our rather weak explanation that perhaps square hex stock is used to plug round holes. In the future, if you spot anything like this "square hex" in Rotor Tips, let us know—better you should holler at us, you're farther away! . . . Ed.

HU2K-1 SPAR BROACHING TECHNIQUE

by B. POSNIAK, P. E.
Chief Rotor Design
F. M. LISTER
Director, Quality Control

The blade spar is the major component of the helicopter rotor and the degree to which it is endowed with strength, lightness, durability, balance, lack of blemishes and accurate shape, reflects basically on the overall performance and reliability of the aircraft on which it is used.

For the HU2K-1 helicopter, the blade spars are fabricated from aluminum alloy extrusions. These are produced by a leading aluminum manufacturer by forcing a heated billet through a restricting shaped die and simultaneously over a shaped steel mandrel. The resulting hollow extrusion is long enough to produce, after end cutoff, a "stick" 23 feet long.

The state of the art in extruding the high-property alloy chosen for these spars has not progressed to a point where dimensions on cross section can be held much closer than 1/32 of an inch to the nominal, while generation of surface flaws cannot be controlled to the degree needed for high reliability without excessive rejection rates. Furthermore, the present process produces a slight taper in the inside cavity of the spar and other discrepancies are introduced during the stretch-straightening and heat treatment that follow the extrusion process.

The finished spar is carved down to weigh 67 lbs.; the weight must be so well distributed that the distance from the attaching points to the center of gravity of the whole spar must not vary by more than 0.030 inches from spar to spar. All surface defects, both external and internal, must be removed and no new blemishes must be created during processing, by any mechanical, chemical, thermal or other cause. The wall thickness which controls the weight, the weight distribution, as well as the strength and stiffness qualities of the spars must be held within extremely close limits by controlling the relation of the finished outer surface to the inner cavity. It is self-evident that the greater the accuracy achieved in producing the inner spar cavity, the greater will be the producibility of properly proportioned, reliable and interchangeable spars.

For the HU2K-1, Kaman Aircraft procures extrusions with enough extra stock inside and out to envelop all variations in dimensional tolerances and surface defects. Machining of the external stock to obtain uniform contours and remove surface defects presents little challenge, except for the size of the spar milling equipment and holding fixtures involved. The proper machining of the internal surface of the extrusion is obviously a much more difficult problem.

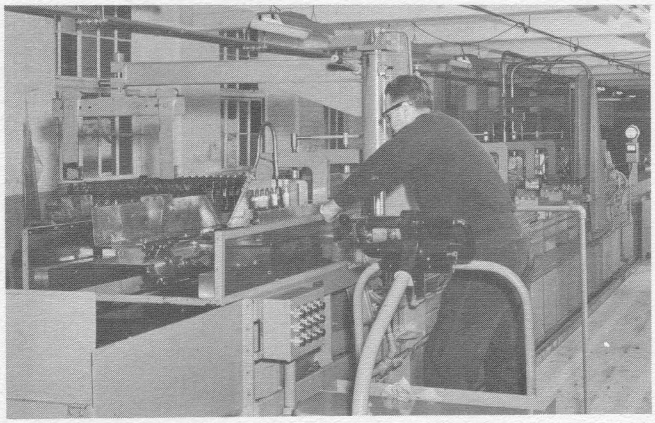
After exploring various methods of stock removal involving abrasives and other metal displacing tools, it was decided that chip cutting with broaching tools was the only method affording the accurate removal of the amount of stock that would eliminate all discrepancies from the bore of the spar. Manufacturers of broaching equipment were approached; some considered the problem impossible; all recognized that the requirements for broaching the 23-foot-long cavity was something which had never been accomplished before.

One manufacturer took on the task and he has successfully developed a "world first" machine for broaching the spar cavity, the longest completely enclosed cavity of non-circular section ever before broached. A series of 40 graduated broaches are pulled in succession through the spar cavity on a drawbench that holds the raw extrustion fixtured in correct alignment. The initial broaches make rough cuts to remove the taper and any local curves or other deviations from straightness in the original extruded cavity. Subsequent broaches produce a high

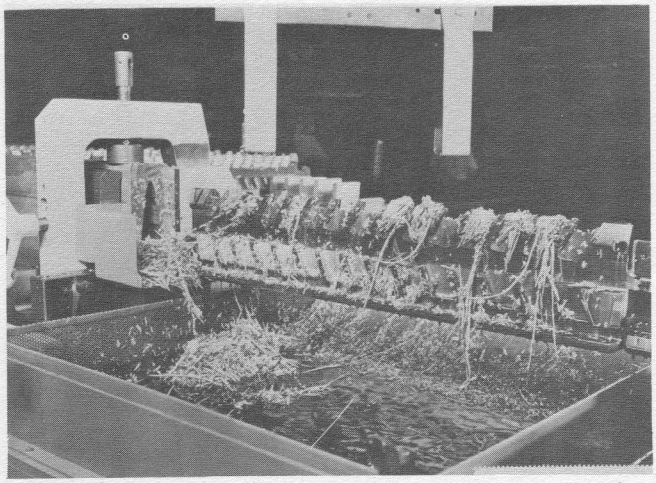
finish which is free from all surface defects caused both by the extrusion process and the preceding rough machining. Special optical, acoustical, and electronic inspection methods have been adopted and developed to perform and guarantee the needed quality control on all steps of the process.

Through the use of this broaching equipment, the goal of economically producing the precisely formed and finely finished spars required for rotor blades of the maximum structural reliability has been achieved.

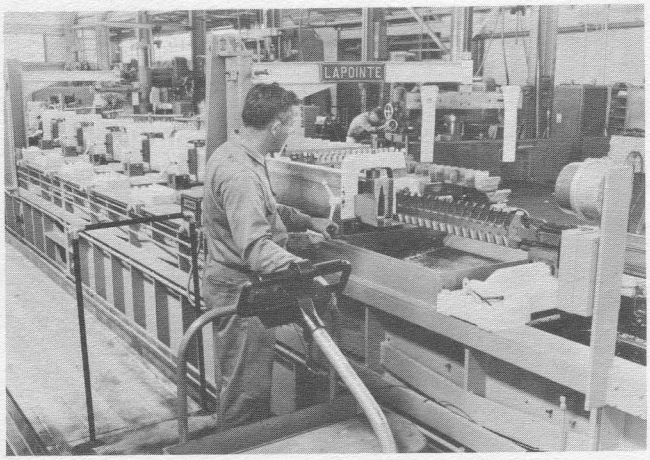
Again the "impossible" has taken just a little longer to be accomplished for another progressive step towards the achievement of greater reliability and usefulness for the Kaman HU2K-1 helicopter. K



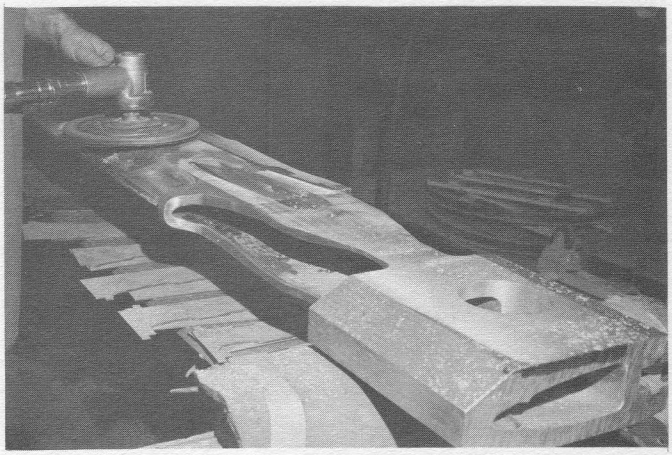
OPERATOR WATCHES as broach is started into entrance end of spar cavity.



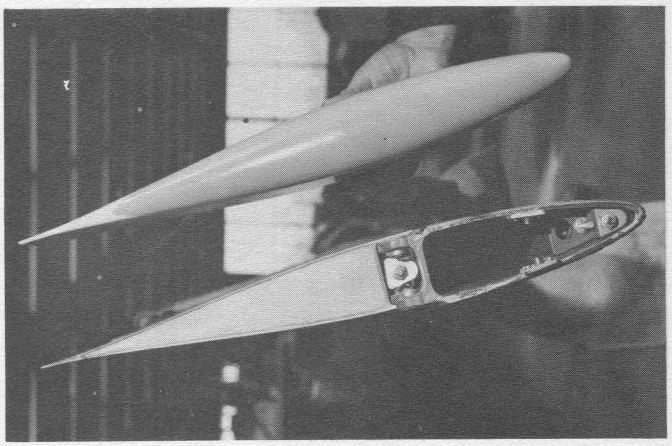
CLOSE-UP of broach as it emerges from spar cavity at end of cutting pass. Entire operation takes over 40 passes to complete each part.



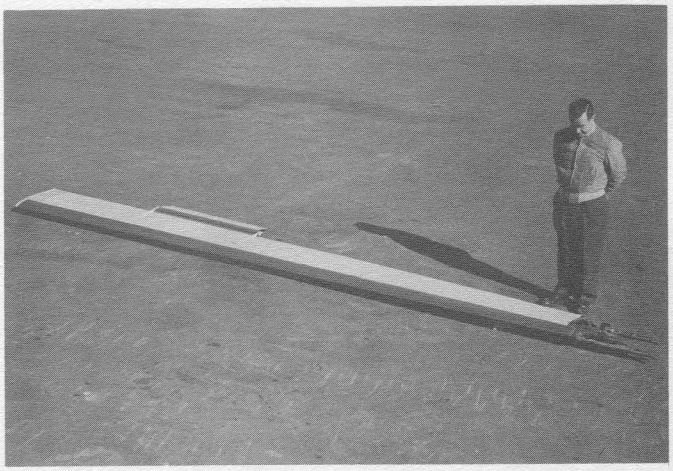
HIGH SPEED STEEL cutting broach shown at exit end of spar after being cleaned of chips and ready for removal by tool hoist.



ROOT END of semi-finished blade. Bulky piece at right is removed during finish operation. Workman is performing contour finishing operation on exterior surface.



VIEW OF TIP END of finished blade with tip cap removed showing cavity shape, extent of external machining performed and condition of finished cavity surfaces.



END RESULT is this high-precision, aerodynamically balanced rotor blade with the hollow spar performing the main load-carrying function.

WHEELS-IN-THE-TREES RESCUE

The valor and skill of crews flying two H-43B Huskie rescue helicopters from Westover Air Force Base, Mass., were credited with saving the life of a B-52 crewman who lay critically injured after parachuting from his crippled plane into the rugged, snow covered country of upper New York state in December.

The crewman, A1/C Charles E. Morris, lay in the snow below 100-foot trees most of the day. His pelvis had been broken when he bailed out of the B-52. He could not have survived the sub-freezing temperatures of the night.

At mid-afternoon a searching helicopter from Plattsburgh Air Force Base, N.Y., spotted Morris' parachute. Morris was seen lying on the ground, unmoving. The pilot did not feel the helicopter could hover over the high, dense woods to lower help to the injured man. A radio call went out just as the H-43B helicopters were arriving at the search area, flown by pilots who had received their final flight checks only the day before.

An H-43B piloted by 1st Lt. David Glick and 2nd Lt. William Deming went to the scene as the first helicopter flew around the area guiding ground parties. At the scene Glick and Deming held the H-43B in a hover above the 100-foot-high trees for several minutes trying to see if Morris was still alive. Then they saw Morris move his hand and went into action.

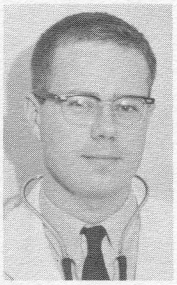
S/Sgt. Walter Stewart, the rescue team medic, climbed into the rescue sling. S/Sgt. Joseph Dodd, crew chief; lowered Sergeant Stewart with the helicopter's rescue hoist. Every inch of the 100-foot cable was reeled out and the pilots let the helicopter drop lower until all four wheels were in the tree tops. This brought Sergeant Stewart within four feet of the ground. He dropped the rest of the way, abandoning his last hold on the security of the helicopter overhead. Also aboard and ready to assist was A2/C Frederick Nehrings, a specialist in survival techniques.

As Stewart gave first aid to Morris and made him comfortable, Deming and Glick flew to a search command post located on a woodland road about two miles away. There they picked up Capt. Thomas J. Fahey, Jr., Flight Surgeon, from Plattsburgh Air Force Base. During this time the second H-43B, flown by 1st Lt. Peter Kerrigan and 1st Lt. Otto Stupka, kept watch over the scene.

Glick and Deming returned to the scene,

RESCUE CREWS FROM WESTOVER AFB—On the left, reading from left to right, 1st Lt. David Glick, pilot; 2nd Lt. William J. Deming, pilot; S/Sgt. Joseph H. Dodd, crew chief; S/Sgt. Walter J. Stewart, medic; and A/1C Frederick Nehrings, survival spcl. The picture on the right, reading from left to right is, 1st Lt. Peter J. Kerrigan, pilot; 1st Lt. Otto J. Stupka, pilot; T/Sgt. George J. Roche, survival spcl; and S/Sgt. Benjamin C. Ellis, crew chief.

repeating the difficult and hazardous job of hovering in the trees as the doctor was lowered to the ground. They maintained the H-43B in its hover in the tree tops while the doctor checked Morris. It was determined that Morris was too seriously injured to chance lifting him out by helicopter in a rescue basket.



CAPT. FAHEY, Flight Surgeon

Lieutenants Kerrigan and Stupka then moved their helicopter into place and with S/Sgt. Benjamin Ellis, the crew chief, operating the hoist, the doctor was pulled into the helicopter and returned to the command post. Standing by aboard this helicopter was another survival expert, T/Sgt. George Roche.

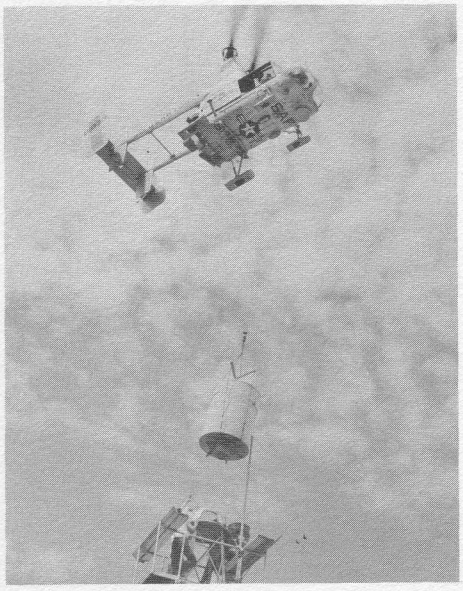
As darkness fell, Glick and Deming returned to the scene to lower food to the injured man and the medic. Using the H-43B's rescue floodlights the pilots easily located the men on the ground to effect an accurate drop of supplies. A short time later two hunters left the woods, guided ground parties back to the scene and Morris was then brought out overland by stretcher.

Lieutenant Glick later reported that the temperature during the daylight portion of the rescue was just under freezing. He said the altitude in the mountainous area was 2,500 feet above sea level.

During the ensuing 15 days the crews of the two H-43B search helicopters looking for the missing B-52 crewman checked on the parachutes of seven men who had been hurt and had walked out of the woods. At six of the chutes, the pilots hovered their helicopters while a crewman was lowered by rescue hoist to make sure the missing man was not in the area. The seventh chute was found near a road upon which the helicopter landed.

Throughout the search the two H-43B helicopters operated from a supermarket parking lot, often starting in morning temperatures of 10 degrees. Weather was difficult with gusty winds of 50 to 60 knots, extreme turbulence and visibility which was often less than a half mile in snow.

In all, the pilots flew each of their helicopters for 100 hours in vain effort to find the last remaining crewmember. The pilots praised the H-43B for its performance without incident throughout the operation. K



THIS ANTENNA, left, which furnishes pilots at James Connally Air Force Base, Tex., with distance, bearing and ID data, was due to come down for overhaul, so the job of removing it from its lofty 45-foot-high perch was taken on by the base's H-43A piloted by Lt. Pasco Parker. Lt. Alma Williams was hoist operator. The budget-conscious 2041st AAC utilized the chopper when it was found a rented crane would cost $25 to $30 an hour and the overhaul time for the 450 pound antenna would run from three to five days. Meanwhile, at Warner Robins Air Force Base, Ga., an H-43B was used to solve a construction problem. The helicopter lifted two fragile, tinted thermopane units to the roof of the hangar. The units were replacements for the glass in the control tower. Pilot was 2nd Lt. Larry Knowles and Capt. John Slattery was I.P. T/Sgt. Virgil McCord acted as load master and ground director and S/Sgt. Theodore Youngblood was crew chief. One unit weighed 600 pounds, the other, 400 pounds. (Official U.S.A.F. photos)

HUSKIE HAPPENINGS

H-43B Huskie from Kincheloe Air Force Base, Mich., flies through rain, wet snow and solid cloud cover at tree-top level to airlift injured hunter whose frozen left arm is black and swollen with gangrene. Three-hundred-fifty miles by road from location at Newberry to hospital at Ann Arbor where delicate operation must be performed within eight hours. Almost impossible to make trip by automobile in time because of road conditions. Huskie picks up hunter and delivers him to waiting C-47 at Kincheloe. Plane takes off immediately on mercy flight. Surgeons at hospital later forced to amputate because hunter's lower arm too severly damaged to respond to treatment but Air Force promptness in beating deadline by three hours credited with saving large part of arm and, compared to automobile ride, perhaps his life. Capt. Chester R. Ratcliffe and 1st Lt. Paul J. Darghty helicopter pilots on mission. Other members of mercy team included A1/C Jerald Pollice, medic; Capt. Thomas G. Johnson, Base operations officer and pilot; Maj. Casimir P. Lawry, pilot, S/Sgt. Richard L. Zoulek, crew chief; Capt. Edward J. McMurray, flight surgeon; S/Sgt. Roger L. Schmidtke, crew chief; 1st Lt. David L. Griffith, pilot; 2nd Lt. George H. Walter, officer of the day when call for assistance received.....H-43B from Brookley Air Force Base, Ala., answers call for help from Mobile Public Health Office and flys Capt. Don R. Johnson, Flight Medical Officer, to aid of seriously ill seaman aboard S.S. Atlantic Victory 20 miles offshore in Gulf of Mexico. Because of ship's rigging, 1st Lt. Floyd Lockhart holds turbine-powered helicopter in steady hover 50 feet above deck and doctor is lowered with rescue hoist. He remains aboard to treat seaman while H-43B returns to base, completing mission in one hour and seven minutes. Flying with Lieutenant Lockhart was Medic William Fulford and A1/C Lawrence Nolde, flight engineer.....Maj. Jimmy Hamill from Stead Air Force Base, Nev., flying Huskie, rescues lost hunter high in Sierras. Hunter, who walked for three days before "perching" on mountain peak, sighted 10 minutes after Huskie took off.....H-43B personnel on local flight from Cannon Air Force Base, N.M., sight burning farm house belonging to State Senator Alva J. Parker and use rotor downwash to clear path through flames for volunteer firemen at scene. Fire destroys house, but credit given 'chopper by civilian authorities for nearby buildings escaping damage. Capt. Hoyt B. Mayes, pilot; 1st Lt. James W. Langston, co-pilot.....Two children lost in swamp just south of Warner Robins Air Force Base, Ga., Capt. John Robie, pilot; and T/Sgt. Virgil McCord, crewman; answer alert and scramble in H-43B. Locate lost boys, unable to land or use hoist due to closely spaced trees, hover helicopter over them for 45 minutes directing ground search party with landing light..... Hunter lost in Maine woods. H-43B from Loring Air Force Base, Me., begins search, sights hunter and, despite rocky terrain, lands near stream and makes pick-up. Huskie manned by Capt. R.J. Brejcha, pilot; Capt. J.H. Black, co-pilot; A1/C J.D. Phillips, crew chief; A1/C W. McDougal, para-medic..... Loring AFB Huskie also aids in two other "lost hunter" missions. Both men located by ground crews, one flown back by Huskie. Flight crews consist of Capt. Brejcha, pilot; 1st Lt. J.A. Crupper and Capt. R.C. Pfadenhauer, co-pilots; A1/C Phillips, crew chief; A1/C McDougal and J.E. Glenn, para-medics.

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