KAMAN

Rotor Tips

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RELIABILITY

THE KAMAN AIRCRAFT CORPORATION

PIONEERS IN TURBINE POWERED HELICOPTERS

KAMAN

Rotor Tips

NOVEMBER, 1960

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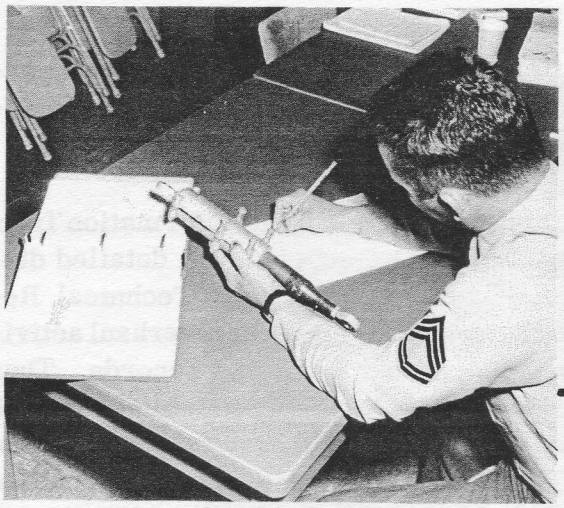
THE COVER

Reliability is a big word on this month's cover, and it's a big subject! Product reliability means aircraft availability in the field.

IN THIS ISSUE



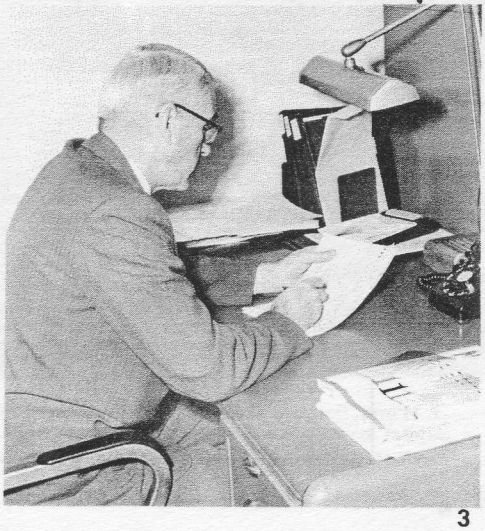
RELIABILITY

by A. E. LARRATT
Reliability Engineer

The probability that a device will perform, or operate, within specified limits for a given period of time when used in the manner and for the purpose intended." This defines one of the most important words in the aircraft industry—RELIABILITY.

The definition is not a particularly simple one, but then neither are the problems which arise in attempting to attain 100 per cent reliability in any product made and serviced by man, such as the helicopter. In order to meet this challenge, Kaman Aircraft maintains a product reliability program which has a three-fold purpose—(1) to apply past experience toward improving future design; (2) to review and improve reliability on existing design; (3) to take corrective action as quickly as possible whenever reports indicate that an aircraft or component now in operation is failing to function in a fully satisfactory manner.

The Air Force and Navy also have industry-wide programs aimed at providing greater aircraft reliability. They are requiring their contractors to improve basic or built-in reliability, even if it means sacrificing some other desirable feature such as weight or performance. The military is also urging its own personnel to improve both servicing and handling. Sparking this action are the increasing complexities of today's aircraft which have, as any pilot or mechanic knows, multiplied tremendously. A military aircraft is basically a weapon which, if grounded because of parts failure due either to malfunctioning or improper maintenance, is temporarily as useless as a rifle with a broken firing pin. Another military concern is the increasing cost of aircraft maintenance due to the added complexity of the equipment.



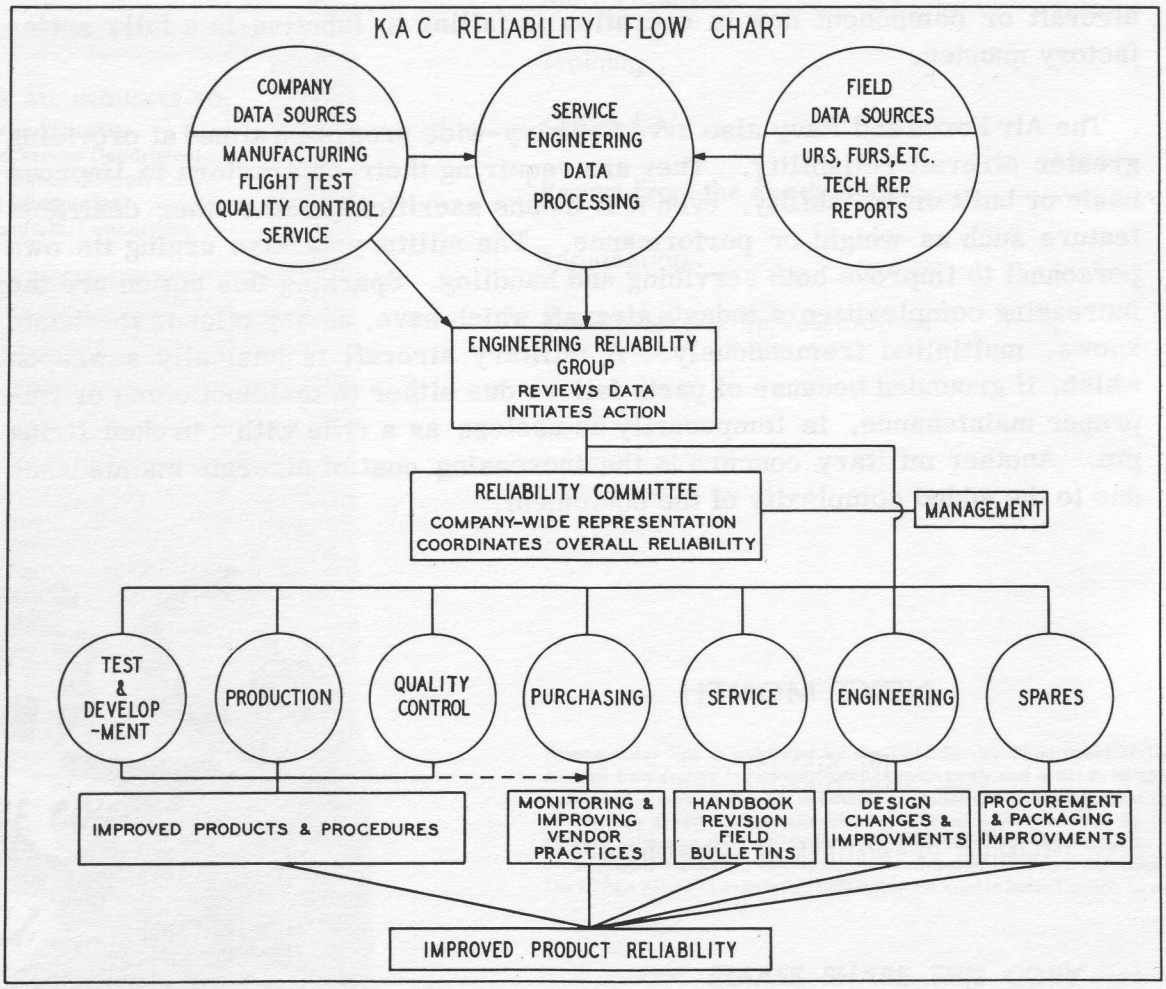
NEXT MONTH

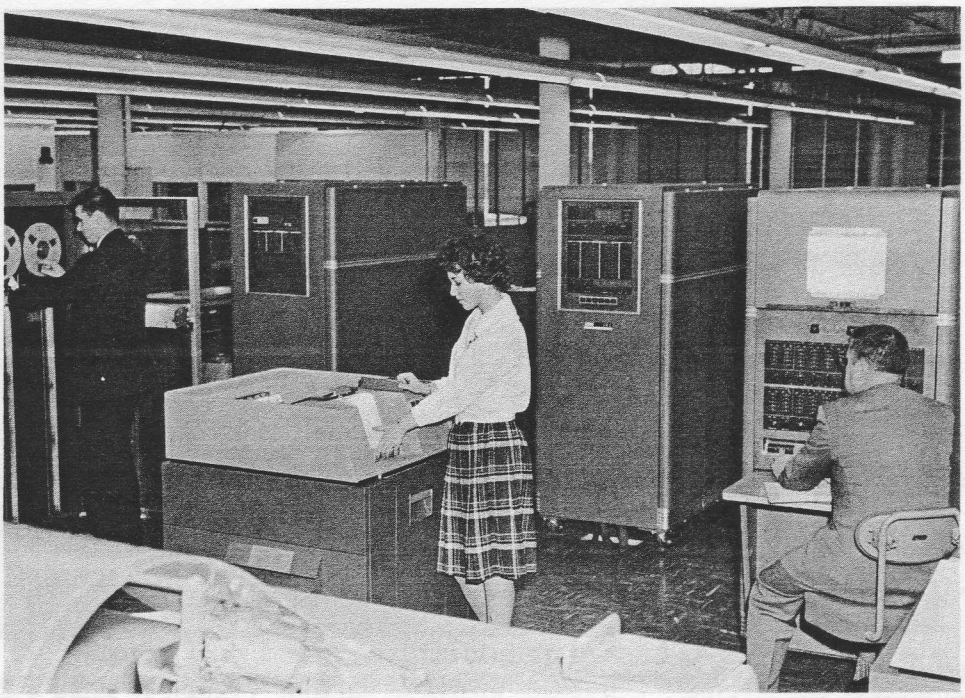
H-43-B

Cold Weather Testing

The term reliability program probably has a "top echelon" ring to many mechanics and they may feel their participation is not of any great importance. Actually, however, their contributions are extremely necessary in attaining product reliability. For example, the information which Gy/Sgt. Donald W. Peppan of HMX-1, MCAS, Quantico, Va., is shown compiling before filling out a Failure or Unsatisfactory Report (FUR) will eventually emerge as part of statistical maintenance data which will be studied by both the military and Kaman Aircraft. This is true of any data submitted by Navy, Marine and Air Force aircraft mechanics on matters involving flight safety, excessive maintenance, component failure, or unsatisfactory performance in any Kaman-produced helicopter. Since these men are specialists with practical field experience, their written observations are extremely valuable to the reliability program. The accuracy and completeness of their reports often determine how soon corrective action is taken; for if a full set of facts is supplied on a field report, there is no need for time-consuming, follow-up inquiries and the information can be processed immediately.

Within the company, this information from the mechanics is combined with detailed discrepancy reports from KAC Technical Representatives, material from overhaul activities and component historical records. Thus a complete parts history is established which covers a period from the day the component was "born" to the present time. Information such as this, combined with the histories of similar components, quickly shows trouble areas and will be the basis for an engineering change if thorough analysis and testing shows such a change is necessary. On the other hand, the study may reveal that the malfunction in this particular case was not actually due to component reliability but to some other cause, such as failure to lubricate the part properly. If this turns out to be the case, an engineering change may still be made——one that will relocate a grease fitting so that it



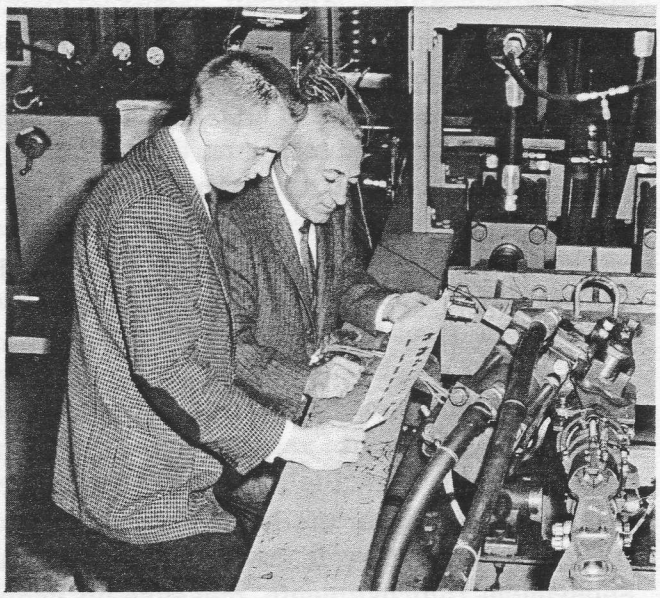


COMPOSITE PARTS HISTORIES and field performance records are analyzed by the six-fifty tape computer section of the Data processing Center which includes key punch, tab operations, programming and computer operations. Working a problem are E. B. Silk, manager, Data Processing, seated at the computer console; Miss Barbara Colton, operating the card reader; and E. J. Hayes, loading the magnetic tape unit.

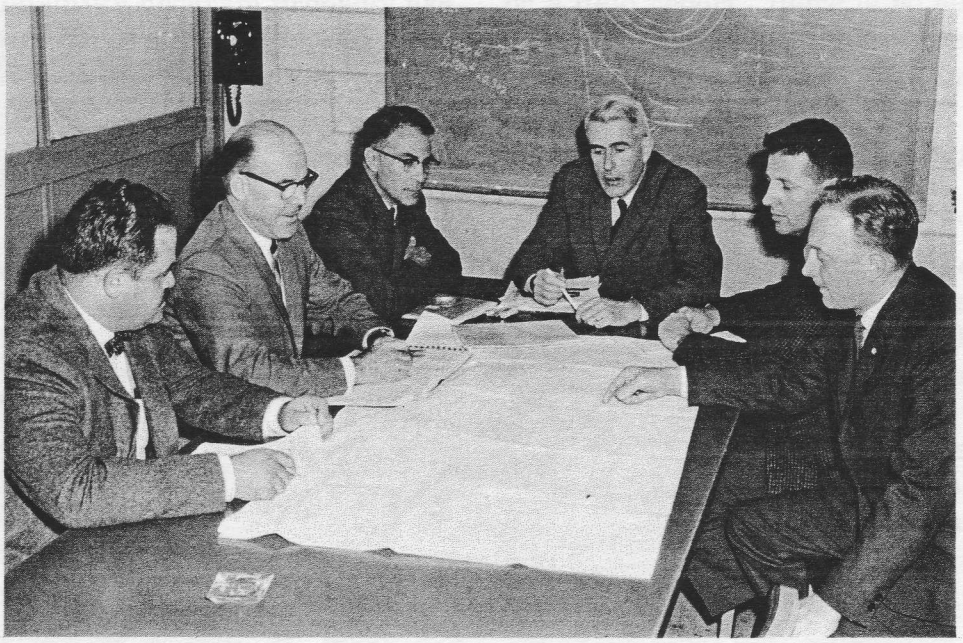
may be made more readily accessible to maintenance crews. Naturally, this change will be retained, improved upon further if possible, and certainly will be carried into the design of future models.

All of these reports from sources outside the company, as well as those within Kaman, are filtered through the Service Department. The information is, in turn, passed through the company's data processing section where it is compiled and tabulated for quicker handling. The Service Department, which studies this data and the reports from the field, may initiate suggested engineering changes based upon recommendations made by the specialists (analysts) within the section, or they may be initiated by the Reliability Group in the Engineering Department, depending upon the circumstances.

The Reliability Group is the core of the KAC reliability effort, for its prime responsibility is to accomplish the company's over-all reliability program. The Reliability Engineer evaluates reports, not only from the field, but from various activities in Kaman Aircraft and determines, in many cases, what action shall be taken. Coordinating with, and furnishing the required information to this group,



TEST ENGINEERS, D. A. Cables, dynamic test, left, and H. E. Pelletier, structural test, study results of a high cycle fatigue run on components of HU2K-1 rotor blade retention system.

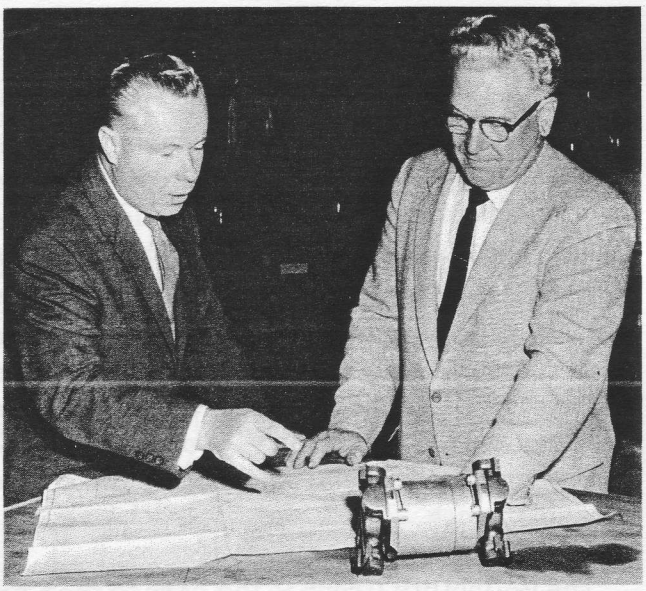


THE RELIABILITY COMMITTEE meets periodically. Shown here are the representatives of various departments involved in the KAC reliability program. Left to right: G. W. Behler, manufacturing; R. G. McKay, purchasing; E. G. Pomeroy, quality control; A. E. Larratt, engineering; (Chairman); M. N. Bernen, flight test; and R. J. Myer, service.

are various other departments within the company. First, the Engineering and Service Departments are responsible for assuring basic reliability and serviceability in new design; second, a cooperative effort is made by all departments to get the "bugs" out of, and the improvements into helicopters and components in the development stage, as well as those already in service.

As a means of coordinating the reliability effort within Kaman Aircraft, periodic meetings are held by an inter-department Reliability Committee, a subdivision of the Management Committee which is composed of top company officials. Serving on the Reliability Committee, which is headed by the Reliability Engineer, are representatives from the Engineering, Service, Industrial Relations, Purchasing, Manufacturing, Inspection and Flight Test Departments. It is the committee's job to discuss and resolve reliability problems which may have been encountered by these departments and to act on matters brought before it by the Reliability Engineer. It is also the duty of the Reliability Group to: follow through on each project, see how the subsequent improvements measure up under actual operating conditions, assure that future designs benefit from this experience.

This comparatively brief description of the KAC Reliability Program has only touched on the activities of the many departments concerned. From time-to-time articles will appear in Rotor Tips which will tell how these departments work toward Kaman Aircraft's goal of attaining the greatest possible reliability in the helicopters it produces. K

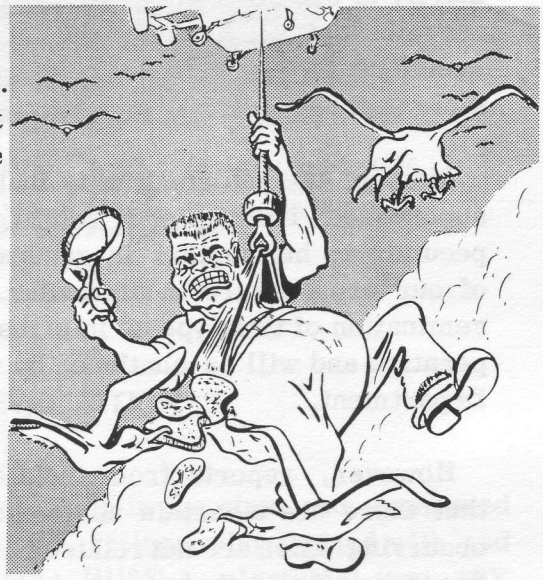


A PARTS PROBLEM is evaluated by R. W. Wilson, reliability engineer, left, and N. R. Richmond, chief, mechanical design. These men will cooperate in solving the problem with a design change or other action which their research may indicate.

Maintenance Mailbag

Dear Ed,

I'm not much on letter writing but I thought you'd like to know your old buddy Stanley the Stomach has gone on a diet. He wasn't crazy about the idea but after our fishing party the other day, he didn't have much choice. Stanley was fishing and eating when he accidentally dropped a piece of baloney over the side and then fell, or jumped, in after it. One of our choppers was nearby and picked him up almost before he hit the water. They began hauling him up in the sling and then a gang of hungry-looking seagulls spotted the salami sandwiches in his hip pockets and began making high-speed gunnery runs with Stanley's empennage as the target. They were a'swooping and a'nipping, and Stanley was kicking and hollering — it was real interesting to watch. Three of those crazy gulls followed him right into the cockpit and then started in on the crewman and pilot. For awhile I guess they weren't too sure who was doing the flying. They kept throwing birds out and the gulls would squawk and then fly right back in until Stanley heaved his last sandwich out along with some candy bars he had inside his shirt. Later, when Stanley went to the sick bay to have his ear lobe sewed back in place, the Doc put him on the diet — I think the pilot suggested it.



We had something else happen the other day when one of our 'copter pilots landed and complained of a metallic tapping or clicking noise in flight. We checked that aircraft right down to the bare bones and couldn't find anything wrong, but every time he test-hopped it, the noise started again. Finally we found out the big mystery was caused by the metal end of the pilot's safety belt banging against the side of his seat. It's a simple thing, but it took a lot of time to find out.

Here's a maintenance tip Dave Rush, the Kaman tech rep, came up with recently. When pre-oiling HOK/HUK engines, install a Wiggins quick disconnect on the pre-oiler hose and then attach it to the aircraft's oil line disconnect. This will eliminate air in the oil line and the possibility of having to bleed the oil gauge line to eliminate fluctuating pressure.

Dave.

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

BASIC MAINTENANCE

A great deal of time and effort is constantly being exerted by the Kaman Service Department in the form of articles in this magazine, Field Information Digests, manual revisions and so on. These activities are aimed primarily at one objective——to assist those who operate and service the helicopters of our manufacture in maintaining the greatest possible degree of airworthiness in the aircraft.

Most of the information is in the form of specialized instructions relative to things peculiar to helicopters in general and those of our manufacture in particular. The dissemination of this type of information is imperative and will be continued by the Service Department.

However, reports from the field indicate that there are a certain number of incidents occurring which are not related to specialized knowledge, but rather to a lack of attention to the basic aircraft mechanic skills. By this we mean the proper and accepted methods of doing simple things like installing a cotter pin, correctly torquing bolts, selecting the proper hand tools for a given job, policing the part of an aircraft where work has been done, securing loose cowling on the ramp so it will not be blown around and damaged, etc. These skills are basic and are learned in the mechanics' primary schooling. Then, in some cases, they do not continue to receive the attention they should.

Certainly this is not done intentionally, but is a result of such things as pressure for completion of the job, poor working conditions, such as rain and snow, and not THINKING. Sometimes habit is allowed to take over the brain. For example, it can get to be a habit to use a crescent wrench instead of the proper size box end, to install a bolt without making certain that the head end is up instead of down, or inboard on a rotating system, instead of outboard. Failing to take steps to protect two dissimiliar metals which are in contact with each other and are subject to electrolytic corrosion, is another habit which may be formed. These, and the like, are elementary parts of an aircraft mechanics' background of skills.

Numerous magazines are published by the military dealing with aircraft safety and maintenance which constantly stress the importance of paying attention to the small details, the correct use of hand tools and so on. For example, in a recent U. S. Air Force publication, Aerospace Accident and Maintenance Review, four pages were devoted to the care and use of hand tools with emphasis on the fact that they "are helpers, but they can cause accidents if improperly used." Another example: - The Naval Aviation Safety Center has just distributed a 70-page study on accidents or incidents involving maintenance and servicing, which concludes in part: "It appears that few lessons have been learned from past mistakes."

KAC joins with the military in urging that a little extra thought be spent on the easy jobs. When reaching for a wrench, make sure it is the proper wrench for the job. When installing a bolt, be sure it is installed correctly, torqued correctly and secured correctly. There are several sources such as the USAF and USN training manuals, the 1-1A series of technical orders and Civil Aeronautics Manual 18, for those wishing to brush up on basic skills.

There are two major reasons for Kaman Aircraft's interest in this subject of basic maintenance. One is safety: a bolt improper-

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TRAINING

ALL BUT ONE of the Marines pictured above are destined for an overseas assignment. They are, left to right, from MAG-26, New River, North Carolina, Cpl. T. K. O'Connor; GySgt. R. W. Westman; Sgt. R. O. Jacks; GySgt. C. B. McAllister; S/Sgt. A. D. Cadiente; Sgt. J. F. Greshle; Sgt. S. J. Foster III; Cpl. L. Samson; from HMX-1, Quantico, Va., GySgt. D. W. Peppan; and from MAG-26, New River, N. C., Pfc. J. L. McCauley; Cpl. N. E. Richer; and D. P. Alexander, KAC.

SUMMARY OF 1st NAMT CLASS EVALUATION

The newly designed, full-scale HU2K-1 Naval Air Mobile Trainer (NAMT) is an effective unit with many favorable features——this evaluation was given by the first class of U.S. Navy personnel to complete the maintenance factory training program being conducted at Kaman Aircraft.

Along with these comments, made after intensive use of the trainer by personnel from the Naval Air Test Center, NAS, Patuxent River, Md.; were suggestions aimed at providing additional facilities in one particular area.

This class consisted of AE, AT, AD, and AM ratings, most of whom have had extensive experience with helicopters, various designs of Automatic Stabilization Equipment (ASE), AC generator systems, etc. Therefore, their comments after working with the trainer for more than a month are of great value, especially since this equipment is the first which KAC has designed and manufactured for use in full-scale formal training.

The first group in the class was composed of AT and AE ratings who trained with and evaluated the HU2K-1 electrical and ASE systems. It was their opinion these systems would be easy to maintain and trouble shoot because of the component accessibility. The Kaman design test unit for the ASE met with special approval since it is composed of one unit as opposed to four or five on other aircraft. Good component visibility was also noted. For example, the control system components, from the cockpit through the servos and azimuth assembly and hub to the blade, can be seen throughout their entire length. Also considered a strong point by the Navy men is the fact that when a circuit is energized, not only do the relays pull down, but red indicator lights show clearly which circuit and relays are energized.

The reaction of the second group, made up of AD and AM ratings, was also good. They commented specifically on the accessibility of the different system components, the sim-

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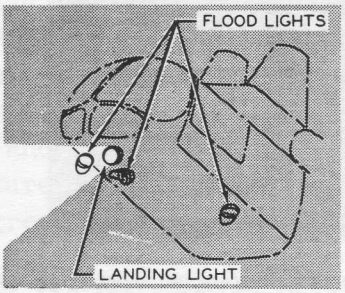
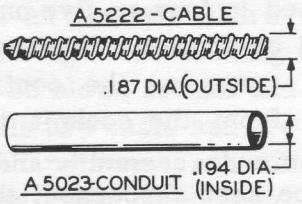
Q's AND A's

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.



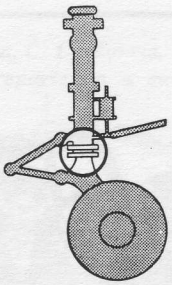
Q. WHAT ACTION CAN BE TAKEN BY THE PILOT TO PREVENT THE FLOODLIGHTS FROM REFLECTING ON THE NOSE BUBBLE WHEN OPERATING AT LOW ALTITUDES? (Applies HUK-1, H-43A)

A. Our records on night operation have proven that the existing arrangement of lights is very satisfactory. However, in night operations at altitudes below 20 feet, in order to minimize glare, only landing lights should be used. Above 20 feet there should be no glare problem. — D. P. G.



Q. WHAT IS THE CORRECT I. D. SIZE OF THROTTLE CONDUIT TO ORDER DURING REPLACEMENT? (Applies HOK-1, HUK-1, H-43A)

A. To ensure correct size of throttle conduit during replacement, order teleflex P/N A5023 conduit (I. D. - .194 Dia.) in lengths as required. The bend radii for A5023 conduit are minimum 3 inch and optimum 5 inches. — E. S. M.



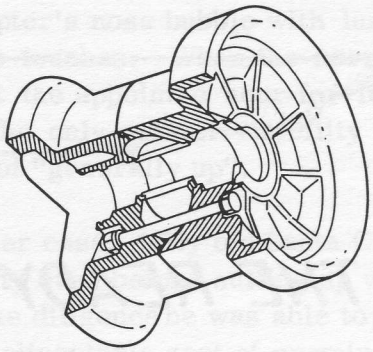
Q. WHAT IS THE PURPOSE OF THE TWO LOCK NUTS AT THE BASE OF THE AUXILIARY STRUT CYLINDER? (Applies HOK-1, HUK-1, H-43A, H-43B)

A. The lower nut is the gland nut which retains the piston wiper seal; and the upper nut establishes the freedom of the swivel of the strut and should never be over-tightened or strut-bind will occur. — R. S. W.

Q. DOES THE K711501-201 AND -202 ROTOR BLADE WITH THE SHORT STEEL LEADING EDGE REACT DIFFERENTLY TO TRACKING ADJUSTMENTS WHEN COMPARED WITH THE -1 AND -2 BLADES? (Applies H-43B)

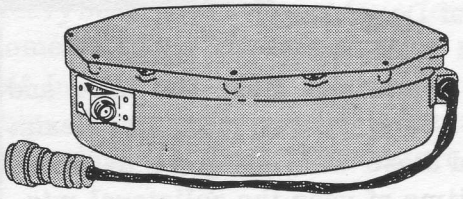
A. Flight testing experience has proved that the -201 and -202 blades react similarly to -1 and -2 blades when tracking adjustments are made. For instance: A 1/2 turn of the flap clevis will alter the blade tip path approximately 1-5/8 inch on either the -1 and -2 or the -201 and -202 rotor blades.

The -201 and -202 rotor blades have a fiberglas wrapped spar which adds to their strength and stiffness. This added resistance to flexing is compensated for by the use of a shorter steel leading edge guard. The total effect of the short steel and the fiberglas wrapped spar, gives a spring constant, or torsion rate, equal to the earlier -1 and -2 rotor blades. — N. E. W.



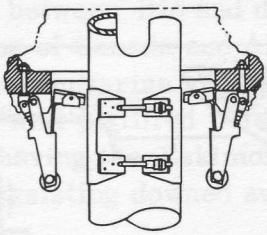
Q. WHAT IS THE PROPER TORQUE ON ALL WHEEL HALF HUB BOLTS, AND WHAT IS THE RECOMMENDED TIRE PRESSURE? (Applies H-43B)

A. The proper torque is 83 pounds/inch applied to the wheel hubs prior to servicing the tire with air. The proper tire air pressures are 160 psi for the main wheels, and 88 psi for the nose gear tires. — D. P. G.



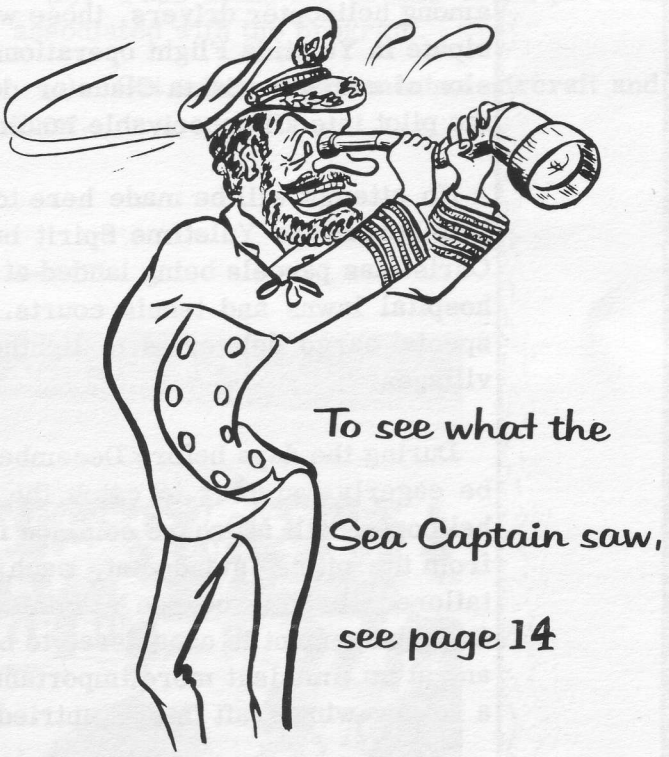
Q. SHOULD ANY SPECIAL PRECAUTIONS BE TAKEN WHEN INSTALLING OR REPLACING THE AS578A/ARA-25 UHF DIRECTION FINDING ANTENNA TO AVOID TROUBLE? (Applies HUK-1, H-43A, H-43B)

A. Definite precautions should be taken. The CO-AX connector on the ARA-25 ADF antenna may cause trouble if extreme care is not taken upon installation. Close examination of several ARA-25 antennas revealed that the center pin of the CO-AX connector (J-202) may be tilted from side to side slightly. There is more freedom of this pin on some antennas than on others. It is possible to push this pin aside when connecting the male plug to J-202. This will short out the antenna and make reception very weak with little or no ADF action. It would be wise to check this connection if very weak reception is encountered on the ADF position. — W. H. Z.



Q. IS IT PERMISSIBLE TO USE A 3° DROOP STOP P/N K317017-9 ON ONE ROTOR AND A 1-1/2° DROOP STOP P/N K317017-103 ON THE OPPOSITE ROTOR? (Applies HOK-1)

A. Yes. However, it is recommended that like droop stops be used on both rotors of a given aircraft. The 3° droop stop requires the use of teeter lock P/N K304023-29 whereas the 1-1/2° droop stop requires the use of teeter lock P/N K304023-9 or K304033-1. Aside from the above there would be no other consequences in using stops with different part numbers. — N. E. W.



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ANALYSTS—*R. A. Berg, R. T. Chaapel, C. W. Jenkins, C. J. Nolin, A. Savard, N. E. Warner, L. Lynes, R. S. Wynott, W. J. Wagemaker, E. S. Mah, W. H. Zarling, A. D. Cutter, J. McMahon.*

Report FROM THE READY ROOM

FLYING THE YULETIDE MISSION

by C. R. McMILLAN
Test Pilot

From the Ready Room window, I see the last dead leaf hanging on a frosty scrub oak branch and only yesterday the pilots were discussing their preference in cold weather flight gear. Telltale omens such as these cannot be overlooked; winter is coming!

Regardless if you operate HUKs around the Philippines or fly a HUSKIE in Maine, the winter month of December brings forth unique flight requirements. In fixed wing philosophy, it is said there are two kinds of pilots; (a) those who have and (b) those who are going to drag a wing tip. Likewise, two pilot types exist among helicopter drivers, those who have and those who are going to participate in Yuletide Flight operations. At this time of year the collateral mission of carrying Santa Claus or delivering gifts to remote locations brings the pilot into all conceivable landing areas.

No attempt will be made here to list all the cases where helicopters may help spread the Yuletime Spirit but a common sight will be St. Nicholas or Christmas parcels being landed at ball fields, theater lots, shipboard decks, hospital lawns and tennis courts. Lesser known Christmas missions are special cargo deliveries to lighthouses, small islands and remote Eskimo villages.

During the days before December 25th, the thousands of children who will be eagerly watching to catch the first glimpse of their particular holiday helicopter will all share common feelings regardless of location. However, from the pilots' standpoint, each landing approach will likely be a custom-tailored obstacle course and this is where sound forethought can pay off. Good judgement is considered to be one of the ABCs of professional aviation and at no time is it more important than when the pilot is called upon to bring a rotary wing craft into an untried, restricted location.

There are human-induced complications which also have given pilots moments for concern. One overzealous artist continued painting right across

the helicopter's nose bubble with last minute decorative touches. When the harried pilot arrived at the appointed hour for launching, he found the only cockpit visibility was in a direction of "generally up".

In another case, jolly old Santa Claus was rather hefty even before suiting up with pads, but with due diligence he was able to get seated in the helicopter's seat of prominence. No self-respecting Santa could arrive in public without his impressive sack of gifts and this was no exception. On arrival, when St. Nick endeavored to extract himself from the aerial vehicle and go join the kiddies, his basic volume, combined with pads and packages, prevented a quick egress. Being a cook by profession, this Santa Claus was drastically non-conversant in the ways of rotary wing aircraft and so the strong action he took to gain exit was full forward displacement of cyclic stick. The pilot quickly countered with heavy back pressure and for a few strained moments there appeared to be a bit of cockpit Indian wrestling underway. Fortunately, the worst thing that occurred was rotor roughness and pilot discomfort.

In some areas the arrival of food gift packages at the Holiday Season may well be the difference between life and death, as among the Eskimos of Canada and Alaska. Not only from the humanitarian standpoint have these gifts been well justified but it has also been helpful in having the Eskimos fully cooperative when assisting downed aviators.

When a flight is to be made into some new, small area, the most beneficial single preparation is the pilot making a walk-around check of the physical layout. There is no substitute for personal ground viewing of telephone wires, light poles, trees, superstructure and other obstructions encountered on once-a-year Yuletime Flights. If the pilot is satisfied with safety margins permitted by the area's physical layout, remaining plans can then be arranged. The details to be confirmed will naturally vary in each Holiday project but the following pilot's check list is offered as having been useful in the past.

(a). Hold thorough discussion with the person having authoritative liaison over entire operation.

(b). Pass along the details to all persons associated with the program.

(c). Get a firm assignment of aircraft and crew.

OKINAWAN KIDS doing what comes naturally. Although this is not a Christmas crowd, it is typical of the problem pilots encounter in landing at out of the way sites during the Yule season.

(d). Consider fuel requirements in light of gross weight and weather variables.

(e). Notify State, Federal, and Military Aeronautics authorities as applicable.

(f). Contact person or activity that owns landing site.

(g). Confer with Civil or Military police regarding safe distance for viewers.

(h). Brief the passengers not familiar with helicopter characteristics.

No matter how careful your preparations might be, some dark horse can slip a genuine hooker into the arrangement. I recall a Christmas flight in California where the only landing spot was the squared-off top of a steep conical hill. Looking around beforehand, I decided to touchdown on grass sod away from a gravel parking lot and passed that word along accordingly. The big day came and, because of television coverage, I was sitting high in the seat during the approach when suddenly I saw that the grass area was covered by picnic tables! There was no place to go but into the dusty parking lot, so in I went for a landing. About fifteen feet off the ground, the helicopter was swallowed in a cloud of dust and all I could see were fluttering skirts, upturned picnic tables, and soaring paper plates. As soon as the rotors were stopped, order was quickly restored and the program continued without incident except for the celebrants eating gritty ice cream.

Another example is this anecdote related by a friend of mine who has several Yuletide Missions to his credit. "In one Santa Claus flight that I made, the guards themselves became so intrigued with the helicopter that they joined about 2000 kids in running across the lot to greet Santa — while the rotors were still flailing around! Fortunately, I had kept the engine running and revved up, so I bounced back into the air and waited until the crowd got back where they would be safe — the tip in this incident is, don't shut down until positive that everything is under control".

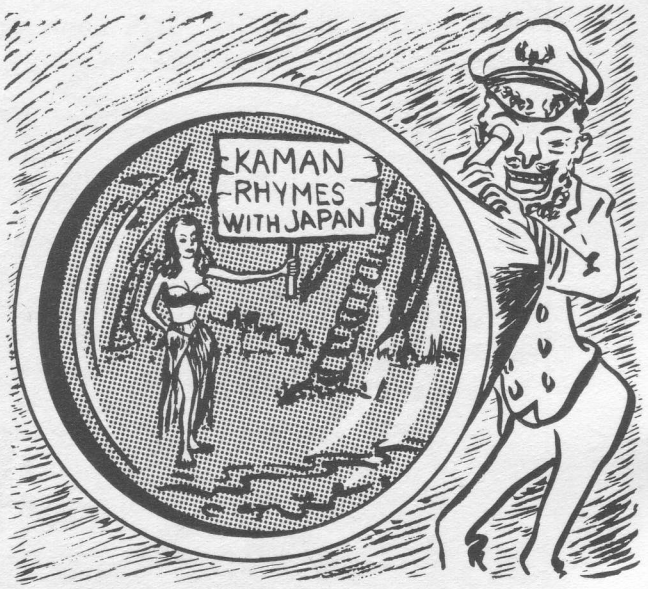
When a helicopter arrives at a landing site where many eyes watch admiringly, the majority of pilots are tempted to indulge in some manner of showmanship. Contingent with safety and good head work, there is no harm in smartly executing a flight in front of a crowd, but beware of the abnormal factors involved. Some examples of pertinent caution areas are:

(a). Cold weather problems such as lengthy warmup periods, carburetor ice, and blowing snow.

(b). Landing patterns flown relative to wind, obstructions, and observing personnel.

(c). Well-briefed guards to maintain safety of on-watchers during ground rotor operation.

In summation, I would like to leave this reminder: When the rotors commence turning, YOU, THE PILOT are the man-in-charge and it behooves you to be doubly alert when performing the unusual missions of Yuletide flying. Merry Christmas!!! (And watch out for winter icing). K



THE DIRECTIONAL STABILITY SYSTEM IN THE H43-B

by N. JOHNSON
Chief, Electronics Development

ENGINEERING

You're cruising at 1500 feet——rough air but the H-43B Huskie holds course nicely. Nose yaws off occasionally due to air buffeting but she "dead-beats" right back on course. You sight your destination and turn——the ball stays centered with very little effort. Destination dead ahead at 340° with strong cross wind from the west. Limited flight path and mission task requires autorotative descent on present ground track. You kick in a little left rudder pedal, pointing the 'copter's nose into the wind, roll right and sideslip down in autorotation. You're indicating 40 knots with about 20° of yaw holding nice and steady. Now——you bring her into the wind, flare-out and mission is accomplished.

No fish-tailing, dead-beats back from yaw, coordinates easily, steady sideslips in autorotation even at high yaw angles——if you have flown the H-43B helicopter you probably have experienced these characteristics of directional stability. Adding to these characteristics is the Directional Stability Augmentation System in the aircraft. To those of you who are not familiar with the DSAS, it is not an auto-pilot, nor is it a substitute for pilot skill and experience; it does, however, improve the flying qualities and expand the flight envelope of the basic helicopter through automatic sensing of stability requirements with corresponding automatic control of the rudder surface. In fact, it could be termed an automatic rudder-surface control system.

Note that "rudder-surface" is stressed rather than simply "automatic rudder control". Since this is a possible point of confusion, it will be clarified before proceeding. In the H-43B the rudder pedals mechanically produce differential rotor cyclic and collective control inputs; however, there is no mechanical connection between the rudder pedals and the rudder surface, nor is there any mechanical input to the rudder pedals from the Directional Stability Augmentation System. The augmenter, however, does utilize the rudder pedals' position as a signal. The rudder surface is positioned by an electro-mechanical actuator which is installed (in the left hand fin rudder surface) just forward of the rudder. The power and positioning information for the actuator is supplied by a control unit which is installed beneath the pilot's seat.

The rudder pedal position transducer, the rudder-surface actuator and the control unit are the three basic assemblies comprising the Directional Stability Augmentation Equipment. The control unit contains a rate gyro oriented to sense the aircraft's rate of yaw, an accelerometer which senses lateral accelerations and roll angle, an airspeed transducer and a servo amplifier.

HOW IT WORKS

THE YAW RATE GYRO: This element generates a signal proportional in magnitude to the angular yaw velocity of the ship; it does not indicate yaw attitude, only rate of yaw. The signal from this unit drives the servo rudder actuator in such a manner that a right turn results in a deflection of the rudder surfaces to the left and a left turn produces a right rudder surface deflection. The function of the yaw rate gyro is to provide damping about the yaw axis for good dynamic stability.

THE LATERAL ACCELEROMETER: Although this device is a spring-mass system, it may be considered to function somewhat like a pendulum with its axis of rotation aligned with the fore and aft axis of the aircraft. It also might be compared to the "ball" in the "ball-turn" indicator. Thus, if the lateral axis of the aircraft is level and the aircraft is flying straight, the pendulum will hang straight down; this is the zero signal condition 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

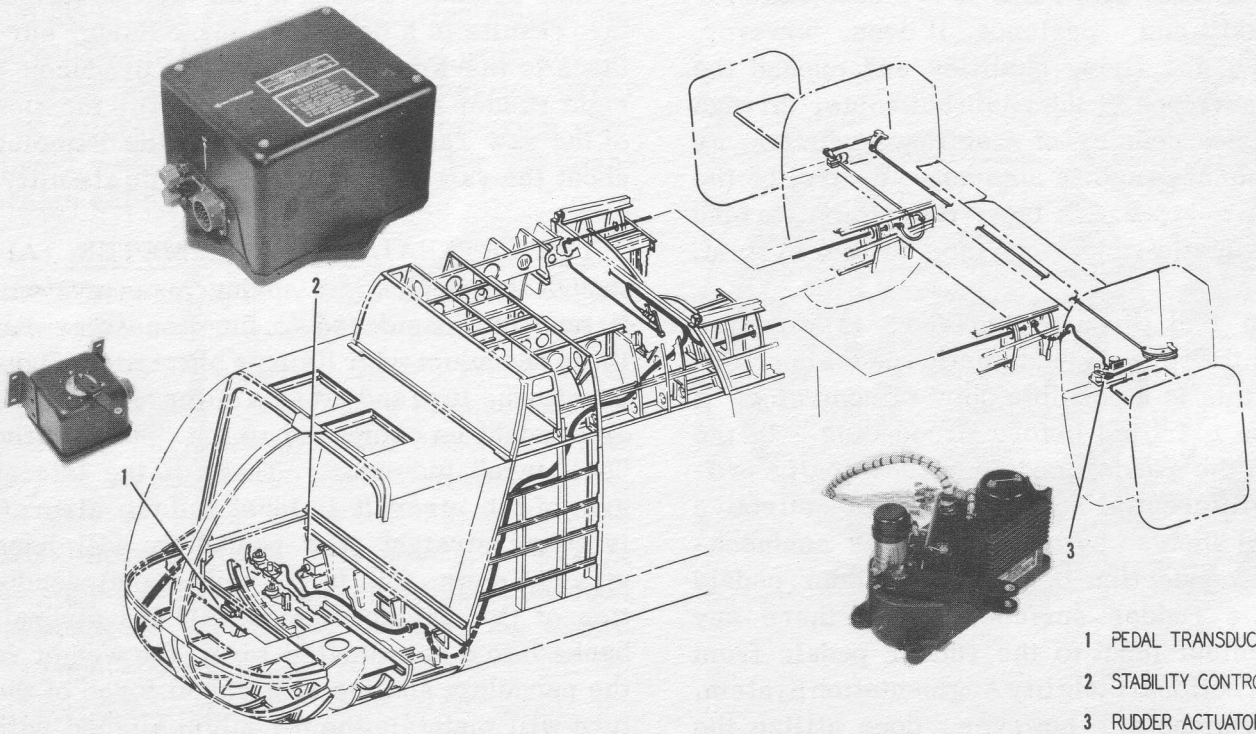
the aircraft's vertical axis and no signal will be generated. However, if the turn is not coordinated and skidding occurs, the centrifugal force will move the pendulum towards the outside of the turn and a signal will be generated which will position the rudder surfaces so as to reduce the rate of turn. If sideslipping occurs, the pendulum will swing toward the inside of the turn and the generated signal will position the rudder surfaces so as to increase the turning rate. Thus, under dynamic flight conditions, the accelerometer functions to coordinate the flight mode and maintain the "ball" centered.

The lateral accelerometer also functions to increase the static directional stability. For example, assume that a cross-wind approach requires holding a nose-left yaw attitude with right roll. In this case, the static right roll attitude of the aircraft causes the pendulum to generate a signal which positions the rudder surfaces to the right. This results in a right turning moment which balances the rotor turning moment required to establish the left yaw. Thus, as you apply left pedal for nose-left yaw, simply rolling the aircraft in the direction of ground track introduces the stabilizing action of the rudder surfaces. This is true in autorotation as in power-on flight.

THE PEDAL POSITION TRANSDUCER: This device generates a signal proportional to the position of the rudder pedals. Right pedal would position the rudder surfaces to the right and left pedal to the left if no other signals were present.

THE AIRSPEED TRANSDUCER: This unit contains a non-linear variable resistive element which is actuated by a bellows connected to the ship's pitot system. The function of this device is to attenuate (decrease) the signals from the rudder pedals and lateral accelerometer as the indicated airspeed increases to compensate for the increased effectiveness of the rudder surface at higher airspeeds.

THE SYSTEM: The stability control, or command, signal to the rudder surfaces is a composite signal consisting of the yaw rate gyro, lateral accelerometer and pedal position signals. This may be somewhat confusing in that it is difficult to visualize which direction the rudder surfaces are being driven and from which signal source. In general, the pedal signal may be considered as reducing or "washing-out" the effects of the other two signals. For example, assume you are making a coordinated turn to the right. Under this condition, the accelerometer signal



1 PEDAL TRANSDUCER
2 STABILITY CONTROL UNIT
3 RUDDER ACTUATOR

would be zero but the yaw rate gyro would generate a signal commanding left rudder surface; however, since the right pedal input required for the turn would generate a signal commanding the rudder surfaces to move to the right, the pedal signal would cancel or "wash out" the rate gyro signal so that excessive rotor turning moment or pedal input would not be required. In side-slipping or yawed flight, the pedal position signal "washes out" part of the accelerometer signal to prevent the system from providing too much directional stability which would limit the yaw angles obtainable.

SAFETY FEATURES: The utilization of an automatic control system in an aircraft always raises the question of reliability. In the case of the Directional Stability Augmentation System in the H-43B, it is important to realize that this equipment is a secondary control system designed to aid the aircraft's performance and is not essential for safe flight. Consequently, two safety devices are utilized for locking the rudder surfaces in their neutral position thus providing the aircraft with its basic directional stability characteristics in the event of malfunction in the system.

The first is a servo locking feature which may be manually engaged by the pilot at anytime in the event of abnormal performance from the rate gyro, lateral accelerometer, pedal transducer or airspeed attenuator. This lock will hold the rudder surfaces in neutral against maximum anticipated air loads.

The second safety feature is a solenoid-operated hydraulic locking mechanism which is installed in the right hand fin rudder surface and is capable of rigidly locking the rudder surfaces in their neutral position. This lock engages automatically when the pilot engages the servo lock or will engage without pilot action if the Directional Stability System blows its circuit breaker or the aircraft loses DC power. Indicated airspeeds above 80 knots also automatically engage this lock. This feature was introduced to avoid any possible flight difficulties due to system malfunctions at higher airspeeds. K

Training . . .

continued from page 9

plicity of the gear box, and the comparative ease of rigging the control system and folding the rotor blades. We agreed with their comment that more workstand area on the aircraft at, and forward of, the rotor head would be desirable; however, they recognized the problems involved and said the provisions are reasonably adequate.

Inasmuch as this is the first venture in the design and manufacture of mobile trainers made by Kaman Aircraft, we are reassured that the planning and ideas incorporated, and our production practices and shop work, were sound. As a result of this experience, we look forward to the challenge of additional mobile trainer developments that may be related to future contracts. K

More From Les . . .

continued from page 8

ly installed or secured can cause a fatal accident just as easily as an engine failure. The Navy reports that maintenance-error accidents claimed an average of one fatality per month on all Naval aircraft during a recent 15-month period——not to mention other personnel injuries and many more stricken or badly damaged aircraft.

The second reason for our interest is the knowledge that a mechanic who is not thoughtful of the little things, as well as the big ones, never becomes a good, dependable mechanic—the greatest deterrent to accidents there is. K

SCROLL OF HONOR

Four pilots, one crewman and a civilian patrolman have been awarded Kaman Scrolls of Honor for the parts they played in accomplishing helicopter rescues in widely separated parts of the world.

1st Lt. John D. Friske, USMC, attached to VMO-2, 3rd Marine Division, began patroling and rescue operations with an HOK-1 after a typhoon in the Philippines brought wind, rain and floods to the island and left thousands of persons homeless. Lieutenant Friske rescued four boys who were stranded; the survivor of a crashed A3D, and then picked up still another survivor with an HUK-1 when the HOK-1 was not available. Members of VMO-2, which is stationed on Okinawa, were taking part in a training exercise when the storm struck. It was described as one of the worst in 11 years.

Lt. Frank Heggood, USN, of Station Operations, NAS Jacksonville, Fla., and County Patrolman John Britts, were awarded Scrolls for the part they played in rescuing a retired Navy chief petty officer stricken with a heart attack while in a fishing boat 15 miles offshore.

When the call for assistance was received, Lieutenant Heggood was flying an HOK-1 during a local traffic safety program in which a running commentary of traffic conditions was relayed through local radio stations from this and another helicopter. Britts, who was acting as traffic observer, was on his first helicopter ride. Enroute to the boat, the pilot briefed the patrolman on the use of the hoist. The problem of pickup was compounded by the fact that the disabled man's arms were paralyzed, creating the possibility he might slide out of the horsecollar. Adding to this was the fact he had to be hoisted into the helicopter with the co-pilot's seat installed. By unbuckling his seat belt and kneeling in the seat, Patrolman Britts was able to get the semi-conscious man, Robert H. Walker, safely into the cabin.

Only hairy part of the rescue, according to the pilot, was when Britts braced himself against the stick to get more leverage. The rescuee was flown to a hospital where he received emergency treatment. During the entire mission the other helicopter followed along and a running description of the entire rescue was broadcast over the radio.

Also receiving Scrolls were Lt. Cmdr. Robert E. Long and Aviation Machinist's Mate 3rd Class R. E. Ross, Naval Air Station, Barber's Point, Hawaii; for the rescue of two Navy airmen whose jet fighter flamed out on a landing approach and crashed into the water. The rescue, made with an HUK-1, was accomplished so quickly the survivors didn't use the life rafts they had just inflated.

Ralph Lee, KAC's chief test pilot on the HTK drone program, was awarded a Scroll for his part in a mercy mission in which an injured sailor was flown through 10 miles of coastal fog from the U. S. S. Hazlewood to the Naval Hospital at Newport, R.I., in a remote controlled helicopter.

In order to qualify for a Kaman Scroll of Honor, the rescue must involve flying over water, rugged terrain, at night, or during adverse weather conditions. Because of this personal hazard stipulation Lt. (jg) James Julian, operations officer on the Hazlewood, did not qualify. However, the successful completion of the mission was directly attributable to his skill in flying the helicopter by radio signals, as he watched its path on the ship's radar screen. This skill brought the HTK over the shoreline within 100 yards of the selected spot. Lee, who took off and landed the helicopter, later described this rescue as a "No Sweat Mission" because of Lieutenant Julian's already proven ability with remote controlled flight. K

CURRENT CHANGES

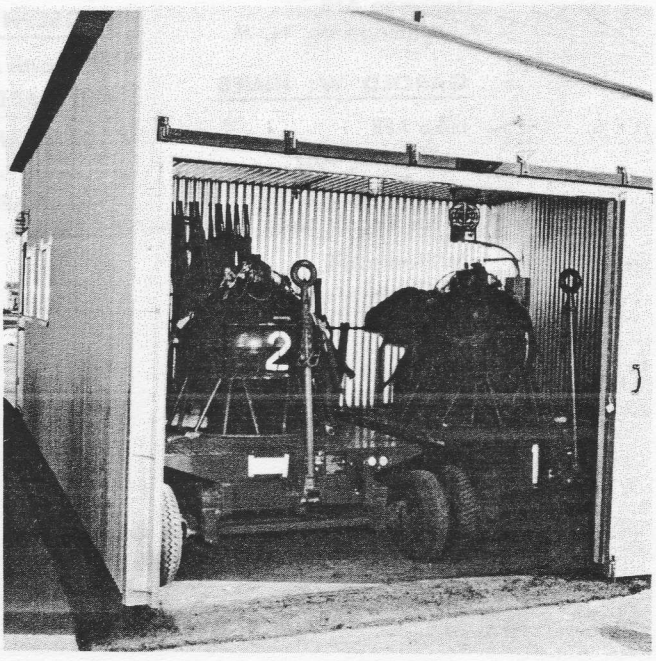
FIELD INFORMATION DIGESTS (KAMAN)

Applies — No. A-52, 31 October, 1960
HOK-1 Electronic Rotor Tracking, Installation and Operation Procedure.
HUK-1

AIRCRAFT SERVICE CHANGES (USN)

Applies — HOK/HUK ASC No. 105, 21 October, 1960
HOK-1 Transmission System, Modification of Clutch Details.
HUK-1 ROUTINE ACTION

HOK/HUK ASC No. 106, 21 October, 1960
Furnishings, Installation of Air Intake Duct Cover Assembly.
URGENT ACTION.



PROTECTION FROM THE ELEMENTS for both pilots and equipment is provided by this air-conditioned structure used by the 3576th Field Maintenance Squadron at Vance Air Force Base, Okla. One section of the building houses the "Sputniks" and is especially valuable during winter months in keeping this fire-fighting equipment free from ice and snow. While the chopper is on alert, one Sputnik is kept by the aircraft and the other under shelter; their positions are changed periodically. The air-conditioning in the building helps relieve pilot fatigue from summer temperatures which sometimes hit the 102° mark. Suggestion for the shelter was made by Capt. Frederick C. Faust.

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