

AIRCRAFT ACCIDENT REPORT

ADOPTED: June 15, 1964

RELEASED: June 24, 1964

NEW YORK AIRWAYS, INC.
BOEING-VERTOL 107-II, N 6673D
NEW YORK INTERNATIONAL AIRPORT
JAMAICA, NEW YORK
OCTOBER 14, 1963

SYNOPSIS

New York Airways, Inc., Flight 600, a Boeing-Vertol 107-II helicopter, N 6673D, crashed and burned seconds after lift-off at New York International Airport (Idlewild) at 1233 e.d.t., October 14, 1963. It was operating as a regularly scheduled helicopter flight from Idlewild to Newark International Airport with an en route stop at the Wall Street Heliport in Manhattan.

All occupants, three passengers and three crew members, were fatally injured. The helicopter was destroyed by impact and fire.

The Board determines the probable cause of this accident was fatigue failure of the drive quill shaft due to contamination of the lubrication system in the aft transmission assembly.

Investigation

New York Airways, Inc., Boeing-Vertol 107-II, N 6673D, operating as Flight 600, crashed seconds after lift-off at New York International Airport (Idlewild) at 1233, ^{1/} October 14, 1963. All occupants, three passengers and three crew members, were fatally injured. This flight was regularly scheduled from Idlewild to Newark International Airport, with an intermediate stop at the Wall Street Heliport in Manhattan.

In order to effect a change of equipment on Flight 600, N 6673D was ferried from La Guardia Airport to Idlewild. The captain stated that nothing unusual was noted in the operation of the helicopter during this seven minute flight, which arrived at 1213.

The scheduled crew and passengers then boarded the helicopter, departing the ramp on schedule at 1230. The flight received clearance and took off at 1233. Ten seconds later an unintelligible static or clatter effect was heard on the Idlewild Tower frequency. The local controller in the tower cab observed the separation of a rotor blade or blades and subsequent impact of the helicopter with the ground. The prescribed emergency procedures were initiated immediately

^{1/} All times herein are eastern daylight time based on the 24-hour clock.

oy tower personnel. A local weather observation made at 1236 reported high scattered clouds, visibility 8 miles. The wind was south-southwest at 12 knots.

New York Airways voluntarily suspended all passenger flights when notification of the accident was received.

Examination of company records revealed that the crew was qualified for this flight, and the helicopter had been maintained in accordance with applicable regulations of the Federal Aviation Agency (FAA). Computations indicated it was loaded with a center of gravity at 291.6 inches, and a gross weight of 13,985 pounds, both well within the allowable limits.

Over 45 eyewitnesses to the accident were interviewed. A consensus of their accounts indicates that the flight climbed to an altitude of approximately 150 feet where structural failure occurred. Seventeen of the 25 who described this as rotor failure indicated that it was the aft rotor which separated. There was less agreement on the final maneuver; however, impact was described as tail first.

Examination of the wreckage indicated that the helicopter crashed tail first in a left bank of 45 degrees, approximately 800 feet from the lift-off point. The major portion of the fuselage was consumed by fire. Separation of the aft rotor assembly, aft rotor drive shaft assembly, and aft pylon had occurred in flight. The forward green^{2/} rotor blade, and aft yellow and green rotor blades had collided and disintegrated in flight. The outboard section of the forward green blade was located 3,020 feet on an azimuth of 321 degrees from the crash site. There was no evidence of fatigue on any failed section of any of the six rotor blades.

The two General Electric CT 58-110-1 jet engines which provide the power for the Vertol 107-II were subjected to detailed examination and no evidence of pre-impact operational distress was found.

Following the accident, the entire drive system^{3/} of N 6673D was taken to the Vertol Division of the Boeing Company at Morton, Pennsylvania. Teardown and detailed examination, supervised by Board personnel, revealed that quill shaft P/N 107D2067-1,^{4/} S/N TA-102,^{5/} which transmits the drive force from the mix box to the aft transmission, had failed in fatigue. Three of the six stepped studs P/N AN150832 which hold the mix box collector gear bearing retainer in place had also failed in fatigue. In addition, it was discovered that the two jets^{6/} designed to lubricate the quill shaft were plugged with metal shavings. These

^{2/} The forward and aft rotors each contain color-coded red, yellow, and green blades.

^{3/} The drive system consists of: (1) a mix box which is a gearing assembly to mix the power from the twin turbine engines into a single drive system, (2) a forward transmission to transmit power to the forward rotor head, (3) an aft transmission to which the mix box is bolted, and which transmits power to the aft rotor head, and (4) a synchronizing shaft which provides synchronization between the rotor heads, and transmits power from the mix box to the forward transmission.

^{4/} The identifying part number for this part.

^{5/} The identifying serial number for this part.

^{6/} P/N 107D2268-1 is a finger jet which provides lubrication through an .040 inch orifice directly onto the unsplined area of the quill shaft, and P/N 107D2214-1 is a plug jet which provides lubrication through an .040 inch orifice into the inner diameter of the quill shaft.

metal shavings were identified as AISI^{7/} 4130 steel. The only parts in the mix box and aft transmission containing this grade of steel are the bearing liners.

Although subsequent examination of the quill shaft disclosed that it met metallurgical design specifications, wear steps ranging from .010 inch to .014 inch had formed on the drive side of each of the rear splines. Two fatigue cracks, 180 degrees apart, had started at the wear steps of two splines at points where the splines end to accommodate a retainer pinhole. (See Attachment A.) These two cracks progressed about 1.5 inches helically and stopped. Two other cracks, also 180 degrees apart, initiated at the pinhole, and one of them continued into the central unsplined area of the shaft, where ultimate overload failure occurred.

As a result of its initial findings, the Board made a preliminary announcement on October 23, 1963, which revealed the discovery of a failed quill shaft. Further, it stated in part: ". . . The Civil Aeronautics Board is conducting a detailed study of the design, manufacture, maintenance and overhaul of the helicopter's transmission system. The Board investigators will focus their efforts on the history of this failed part (the quill shaft) to ascertain, if possible, the cause of the fatigue" ^{8/}

The manufacture of aft transmission and mix box components, and initial assembly was accomplished by York Gears, Ltd., of Toronto, Canada, and Steel Products Engineering Company of Springfield, Ohio. The processes included drilling oil passages,^{9/} bolt holes, etc., in the transmission and mix box castings. The cases and covers of both mix boxes and transmissions were then heated, liners of AISI 4130 steel were "frozen," and pressed into the castings. The transmission casting, and the cases and covers of the mix box are mounted on jig mills, and the liners are bored and ground to the correct diameter. Early in the production history of these cases, machine shavings were found. Consequently Vertol's quality control department established a new procedure for the inspection and cleaning of these assemblies. Specifically, prior to the installation of any plugs or jets in the lubrication passages, the inspector was to witness flushing of these cases with water and detergent, then a water rinse, and finally with blast air. This was to be followed by the installation of lubricating jets, a flush with oil, and then all holes were to be plugged and jet orifices blocked with grease. All final assembly of aft transmission and mix box components in use by New York Airways prior to the accident, including the above flushing, and the final mating of the aft transmission with the mix box, occurred at York Gears, Ltd., and Vertol. Prior to the accident

^{7/} American Iron and Steel Institute.

^{8/} On November 1, 1963, the FAA issued an emergency Airworthiness Directive which established a 120-hour maximum service life for the quill shaft, and required immediate removal of all quill shafts, inspection for any wear on the spline faces of the quill shafts or input pinion and collector gears, and the inspection of oil jets P/N 107D2268-1 and P/N 107D2214-1. Following compliance with this directive, New York Airways restored passenger operation on November 4, 1963.

^{9/} Lubrication of the mix box and aft transmission is provided by a pressure system which jets oil into 41 needed areas. The mix box case and cover form the sump. The oil flows through a pump, strainer, cooler, and finally enters the lubrication network at the top of the mix box. From this point the oil flows through passages and jets of the mix box and aft transmission and drains back to the sump.

the overhaul of these units, which occasionally required the installation and boring of new liners, differed from the initial build-up in that the plug jets remained installed during the flushing. During the Board's investigation, Vertol changed its procedures to require insertion of plastic plugs in all oil passages during any liner boring operation, and the removal of plug jets at overhaul prior to flushing.

Responsibility for FAA surveillance of the manufacturing operations at Vertol is vested in the Engineering and Manufacturing District Office (EMDO) #45. The Supervising Inspector of EMDO #45 testified that men of his office spent 625 man hours at Vertol in fiscal 1963. However, none of these men had ever witnessed the boring, flushing, or inspection procedures for aft transmissions or mix boxes because ". . . the frequency was so low . . ." The Principal FAA Air Carrier Maintenance Inspector assigned to New York Airways testified that visits to Vertol by representatives of the Air Carrier District Office (ACDO) #34 averaged approximately two per month. He stated, ". . . The primary purpose, of course, is for malfunction investigation of . . . any problems that have been incurred in service to the transmissions or any component that is returned to Vertol for analysis." He also indicated that he had an opportunity to observe and evaluate the Vertol overhaul procedure. While this overlap of surveillance activity was characterized by both inspectors as a coordinated effort, there was no communication between the ACDO and EMDO when machine shavings were found in aft transmission assembly S/N TA 9-10, the one subsequently involved in the accident.

Aft transmission number S/N TA 9-10 had been built by York Gears, Ltd., and mated to mix box S/N TA 11-11. This combination was installed in N 6675D which, on May 1, 1962, was the first Vertol 107-II delivered to New York Airways. At this time these components had a total time (TT) of 123:39 and a time since overhaul (TSO) of 54:34. They were removed on May 28, and became the first of two exhibits for the 150-hour sample overhaul.^{10/} Following this overhaul the assembly was returned to service until July 27, 1962, when a sprag clutch failure occurred. The necessary repairs were effected and this unit continued in operation until September 12, 1962, when it became an exhibit for the 200-hour sample overhaul. At this time a notation was made, ". . . Quill Shaft P/N 107D2067-1, S/N TA-102; splines distorted and mix box end evidenced metal pickup Nothing was noted that would have prevented further operation. . . ." The assembly was then operated until December 8 when it was removed because of gear difficulties in the mix box. At this time aft transmission S/N TA 9-10 was given a "convenience" overhaul. Mix box S/N TA 11-11 was retired from aircraft service. Mix box S/N A 11-102 was built up, bored, flushed, inspected, and load run tested by Vertol.^{11/} During this test of this assembly, metal shavings were found in the sump,^{12/} a sample portion of which was taped in the Vertol transmission overhaul logbook.^{12/} Mix box S/N A 11-102 was then mated with aft transmission S/N TA 9-10 to form a new assembly.

^{10/} The 150-hour sample overhaul was part of the FAA system of increasing overhaul intervals.

^{11/} Hereafter TT listed refers to aft transmission S/N TA 9-10 portion of the assembly only. TT for mix box S/N A 11-102 coincides with the TSO of the assembly.

^{12/} The transmission overhaul logbooks kept by Vertol contain the records of initial assembly, and all disassemblies, reassemblies, repairs, overhauls and load run tests.

This new assembly was operated in N 6675D from January 23, 1963, until February 18, 1963, when it was removed by New York Airways, because of a machining curl on the sump plug. The assembly was returned to Vertol for repair. The specimen was again taped in the transmission overhaul logbook. Accumulated times were TSO 94:55 and TT 823:23. The final comment to Mechanical Reliability Report (MRR) 63-6¹³/ regarding this discrepancy stated in part, ". . . They were isolated as being foreign particles possibly originating from a previous machining operation. . . ." Following return to service February 23, 1963, it was operated for one week and again removed for metal on the sump plug and broken gear teeth in the sump. This discrepancy was MRR 63-9. The closing report on this occasion stated, ". . . Disassembly of the mix box revealed failure of the Helical Gear P/N 107D2059-2 installed on the input pinion shaft P/N 107D2058-2. Twenty-three (23) of the twenty-eight (28) teeth on this gear were sheared off. Three of the teeth evidenced fatigue, the remainder were ultimate failures . . . Boeing-Vertol conclude(s) that this failure is (attributable) to gear misalignment caused by excessive bearing liner wear . . ." On April 23, 1963, the assembly was installed in N 6674D where it operated until August 6, 1963, when it was again removed. MRR 63-32 described this discrepancy as steel particles found on the sump plug and strainer. TT was now 1170:16 and TSO 441:48. Vertol reported that spalling had occurred through approximately a 30-degree periphery of the roller path outer race on the aft collector gear bearing, P/N D2-45365. Following repair this assembly was installed in N 6673D September 5, 1963, where it remained until the accident when the TT was 1,338:35 and TSO 610:06.

The metal shavings found in aft transmission S/N TA 9-10 during the initial load run, and at TSO 94:55 were removed from the transmission overhaul log sheets where they were taped, and submitted for metallurgical tests. It was determined that they were both AISI 4130 steel. Additional tests were made on a metal machining curl taken from aft transmission S/N TA 9-9 on November 3, 1963. This was identified as AISI 4340 steel, a substitute grade for AISI 4130.

In an effort to duplicate the fatigue failure of the quill shaft, a test run was performed at Vertol. An aft transmission was mounted on the test stand which has an adapter to represent the mix box. A tapered shim was utilized to introduce one-half degree of misalignment on the quill shaft.¹⁴ Normal lubrication was provided for 35 hours at 100 percent of torque. This produced some fretting and slight wear of the silver plate on the quill shaft. The test conditions were then altered to provide only one-quarter degree of misalignment for the next 50 hours. Examination at the end of this time revealed the silver plate was worn off in a single spot on each of three teeth. A magnaflux inspection failed to indicate any cracks. The normal lubrication was then stopped, and the one-half degree misalignment shim was reinstalled. Following 50 hours operation under these conditions with only 50 percent torque, the subject quill shaft evidenced transverse cracks across three of the spline teeth. The quill shaft had now accumulated 135 hours on the test stand. Sixteen more hours of operation produced additional cracks and a previous crack had propagated through the wall of the shaft

¹³/ All MRR numbers are those of New York Airways and not those later assigned by the FAA.

¹⁴/ Warping of the castings of mix box S/N A 11-102 by post impact fire prevented a determination of misalignment. The maximum misalignment found in checking other transmissions was 1/8 degree.

and was visible around 90 degrees of the inner circumference. The test continued another 10 hours to a total of 161 hours. At this time the largest crack had turned 90 degrees and traversed the unsplined center portion of the shaft, running into the splines on the forward end. A 10-percent loss in developed torque was experienced during this 10 hours and the test of this quill shaft was discontinued. A Vertol staff engineer testified at the public hearing that the test equipment had no provision for reversing or altering the loads on the shaft splines while the equipment was operating, thus precluding the simulation of a typical flight spectrum. Consequently, a direct relationship between the test hours and actual flight hours does not exist.

The initial operating time limitations governing the overhaul intervals on new aircraft and components is a determination of the FAA. A Maintenance Review Board performs this function. It is composed of the Air Carrier Maintenance Branch Chief or his designated representative, who acts as chairman, and other specialists as deemed necessary. Representatives of the manufacturer and air carriers proposing to use the product may be invited to attend in an advisory capacity. The Component Sampling Program of the Maintenance Review Board Report for the Boeing-Vertol 107-II states, ". . . Overhaul periods will be increased or substantiated on the basis of satisfactory service experience and satisfactory disassembly inspections as specified in each of the following notes. . . ." The aft transmission schedule requires two samples each at 150 and 200 hours, and three samples each at 400, 600, 800, and 1,000 hours of operation.

The chairman of the Maintenance Review Board for the Vertol 107-II testified that the sampled quantity of aft transmissions was approximately 75 percent of the New York Airways fleet, whereas normally the percentage sampled varies from 10-25. Also, there is an allowable deviation in accumulated time on the exhibits to be sampled, not to exceed an average of 50 hours below the desired plateau for each.

The actual inspection of disassembled transmissions at Vertol is accomplished by representatives from New York Airways, Vertol, and inspectors from ACDO #34. The first aft transmission assemblies to accumulate the desired number of hours of operation are removed from service and sent to the Vertol plant. Each is then disassembled and examined. If the exhibits sampled are found satisfactory, the overhaul limitation on all aft transmission assemblies is then increased to the next plateau. It is the responsibility of the FAA Maintenance Inspector who attends this inspection to recommend approval or disapproval of the revision to the Operations Specifications^{15/} Maintenance. Authority for the actual approval for New York Airways' requests is vested in the Supervising Inspector of ACDO #34; however, it has been the practice of the FAA inspector present at the final sampling of each plateau, to grant verbal approval for an immediate increase in the overhaul period. He then recommends that the Supervising Inspector sign the revision request submitted by the carrier.

The Principal Air Carrier Maintenance Inspector for New York Airways, and the Supervising Inspector of ACDO #34 testified at the public hearing that the in-service experience of all parts in use, and not just those which are used as exhibits in the sampling process, are evaluated before deciding whether an increase in overhaul time should be granted. They both indicated that there did not appear to be any history of time-related failures or malfunctions in aft transmission assemblies.

^{15/} Operations Specifications are rules of particular applicability issued to an air carrier by the FAA Administrator.

A compilation of the overhaul records for the six aft transmission assemblies operated by New York Airways, indicates that there were 17 unscheduled removals prior to the next prescribed overhaul time. These occurred between July 27, 1962, and September 30, 1963. With the exception of the selected samples, no transmission assemblies operated to their scheduled 200-hour or 400-hour overhauls without premature removal. In addition, only one of the three samples used reached the 400-hour plateau without prior removal for repair. Following the approval of the 600-hour overhaul time there were eight instances of early removals of the six transmissions involved. Three of the eight occurred below 200 hours and one was between 200 and 400 hours of each TSO. The last revised Operations Specifications-Maintenance, which increased the overhaul interval to 800 hours, was effective October 11, 1963.

Analysis

The investigation revealed that the quill shaft which transmits the drive force from the mix box to the aft transmission had failed in fatigue. Based on the physical evidence and the tests performed subsequent to the accident, the Board concludes that this fatigue was precipitated by a lack of lubrication following blockage of the quill shaft's two lubrication jets by metal shavings. The Board further concludes that the fatigue failures of the three stepped studs did not contribute to the quill shaft failure but rather were the result of fatigue progression in the shaft.

The tests performed on a quill shaft with exaggerated conditions of one-half and one-quarter degree misalignment failed to produce significant wear. Therefore, it is felt that a misalignment condition, if such existed in S/N TA 9-10, did not significantly affect quill shaft S/N TA-102. However, during the subsequent operation at only 50 percent torque, with the lubrication jets blocked, the fatigue cracks developed within 50 hours of operation.

Since the first shavings in mix box S/N A 11-102 were found during the initial load run, but prior to mating it with aft transmission S/N TA 9-10, it follows that shavings were introduced into the lubrication system as a result of the initial boring operation by the manufacturer. It is possible that additional shavings may have been introduced during subsequent boring operations on either the aft transmission or mix box. It is significant that following discovery of the plugged lubrication jets two changes were incorporated in the manufacture and overhaul of transmission assemblies. Plastic plugs were inserted in the oil passages during the boring operation on the liners, and all plug type lubrication jets were removed prior to the flushing of cases during overhaul. These changes were accomplished to reduce the possibility of metal shavings becoming lodged in the narrow passages of the case, or in the orifices of the jets during the boring or flushing procedure.

The Board believes that the number of premature removals of aft transmissions was excessive. A review of the overhaul records of sampled and unsampled assemblies reflects that an increase beyond a 400-hour TSO, without additional operating experience, was unwarranted. It is acknowledged that the sprag clutch failures and excessive wear of bearing liners, which in the Board's opinion presented a time-related correlation, were remedied. However, the operating experience of the aft transmissions in general did not present a satisfactory performance record. Only one of the six assemblies reached its initially scheduled 400-hour overhaul without premature removal. Following the increase in overhaul time to 600 hours, there

were eight instances of early removals. Half of these had not attained the previously prescribed overhaul interval without needed repair. Additional importance must be attached to this record of reliability when it is realized that there is no secondary or backup provision for the mix box, synchronizing shaft, or either transmission. The satisfactory performance of these components is essential to the safe operation of this helicopter. On November 6, 1963, the Board recommended a 200-hour overhaul limitation on aft transmissions and mix boxes. (See Attachment B.) To date this recommendation has not been fully implemented. (See Attachment C.)

It was acknowledged by the FAA witnesses at the public hearing that verbal approval of revisions to the Operations Specifications-Maintenance, which was given New York Airways orally by an FAA maintenance inspector was not in compliance with existing regulations which required written approval of the supervising inspector. The requirement for written approval does insure that the supervising inspector, removed from the day-to-day contact with the carrier, will be able to exercise an independent check on the recommendations of the inspector in charge with respect to liberalizations in the carrier's Operations Specifications.

Probable Cause

The Board determines the probable cause of this accident was fatigue failure of the drive quill shaft due to contamination of the lubrication system in the aft transmission assembly.

BY THE CIVIL AERONAUTICS BOARD:

/s/ ALAN S. BOYD
Chairman

/s/ ROBERT T. MURPHY
Vice Chairman

/s/ CHAN GURNEY
Member

/s/ G. JOSEPH MINETTI
Member

/s/ WHITNEY GILLILLAND
Member

S U P P L E M E N T A L D A T A

Investigation

The Civil Aeronautics Board was notified of this accident at 1250 on October 14, 1963. Investigators were immediately dispatched to the scene, and an investigation was conducted in accordance with provisions of Title VII of the Federal Aviation Act of 1958, as amended. A public hearing was held by the Board at the United States Mission to the United Nations in New York City, January 14-16, 1964.

Air Carrier

New York Airways, Inc., is a scheduled air carrier incorporated in the State of Delaware, operating under a currently valid certificate of public convenience and necessity issued by the Civil Aeronautics Board, and an air carrier operating certificate issued by the Federal Aviation Agency. Their principal office is located at La Guardia Airport, New York.

The Crew

Captain Frank LoTurco, age 42, possessed airline transport pilot certificate No. 329874 with ratings in the Sikorsky S-55, S-58, the Vertol 44 and, Vertol 107 (VFR only); commercial privileges, airplane single and multiengine land, and instrument. He had a total pilot time of 7,850:23 hours, with 1,049:51 hours in the Vertol 107-II. His last flight check was accomplished on September 25, 1963, and his FAA medical certificate was dated September 18, 1963.

First Officer Joseph G. Giambatista, age 37, held airline transport pilot certificate No. 1229306, with ratings for the Vertol 44, Vertol 107 (VFR only); commercial privileges, airplane single engine land and sea, instrument. He had accumulated a total pilot time of 5,717:48 hours, with 853:14 hours in the Vertol 107-II. His last flight check was accomplished on September 25, 1963, and his FAA medical certificate was dated July 29, 1963.

Flight Attendant Maria Fourquet completed her training in June 1962. Her last periodic check given by the company was on December 27, 1962.

Aircraft

N 6673D, a Boeing-Vertol 107-II, manufacturer's serial No. 3, owned and operated by New York Airways, Inc., P. O. Box 426, La Guardia Airport Station, Flushing 71, New York, was manufactured in May 1962, and had a total accumulated flight time of 1,861:41 hours. The rotorcraft was powered by two General Electric GT58-110-1 engines as follows:

| <u>Engine Position</u> | <u>S/N</u> | <u>Time Since Overhaul</u> | <u>Total Time</u> |
|------------------------|------------|----------------------------|-------------------|
| 1 | 280248 | 133:27 | 1130:55 |
| 2 | 280202 | 806:58 | 806:58 |

NYA AIRCRAFT $\frac{A}{C}$ FAILED QUILL SHAFT P/N 107D2067



FIG. AS RECEIVED SHAFT- QUADRANTS I & II $\frac{1}{2}X$



FIG. AS RECEIVED SHAFT-QUADRANTS II & III $\frac{1}{2}X$
HOLE AT TOOTH 18



FIG. AS RECEIVED SHAFT QUADRANTS III & IV $\frac{1}{2}X$
HOLE AT TOOTH 1

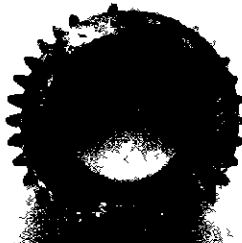


FIG. CIRCUMFERENTIAL CRACK LOOKING TO H X BOX END $1\frac{1}{2}X$

TOOTH 17
TOOTH 18
TOOTH 19



FIG. CONDITION OF HOLE AT TOOTH 18 $5\frac{1}{2}X$

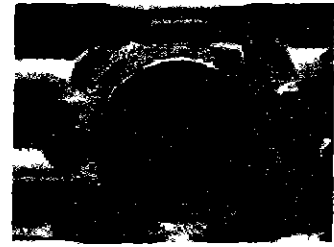


FIG. CONDITION OF HOLE AT TOOTH 1 $5\frac{1}{2}X$

TOOTH 24
TOOTH 1
TOOTH 2

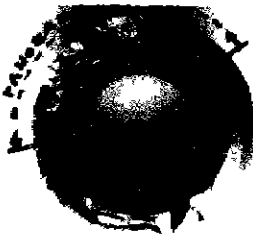


FIG. CIRCUMFERENTIAL CRACK LOOKING TO XMSN END $1\frac{1}{2}X$



FIG. WEAR PATTERN-XMSN END $1\frac{1}{2}X$

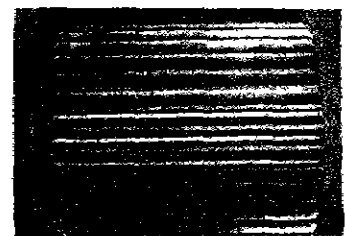


FIG. WEAR PATTERN-MIX BOX END $1\frac{1}{2}X$

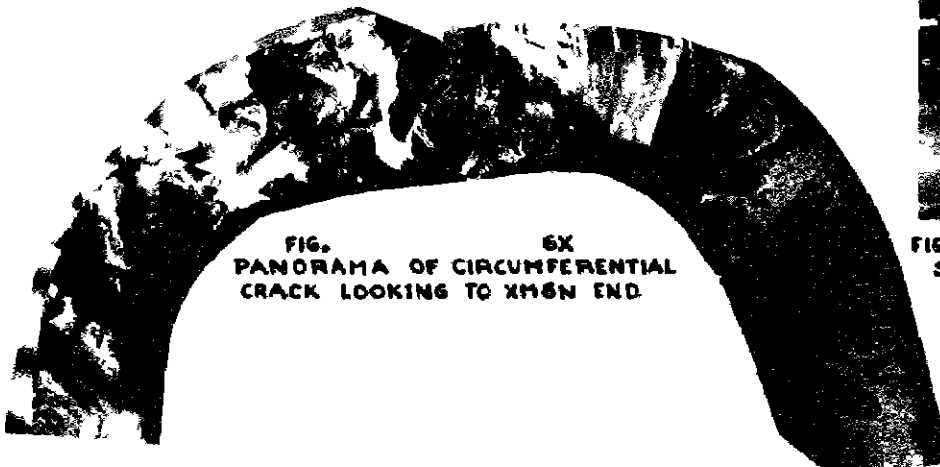


FIG. PANORAMA OF CIRCUMFERENTIAL CRACK LOOKING TO XMSN END $6X$

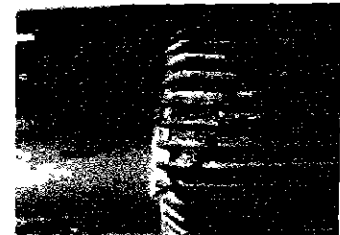
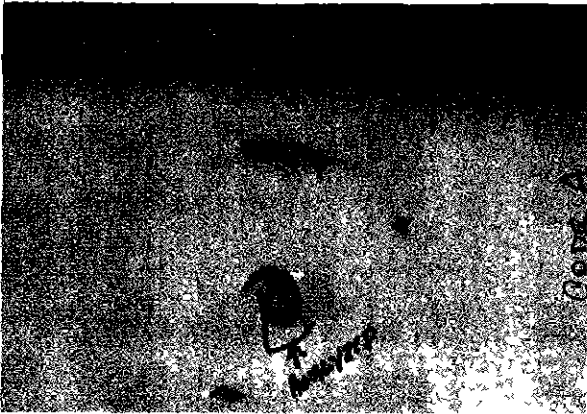
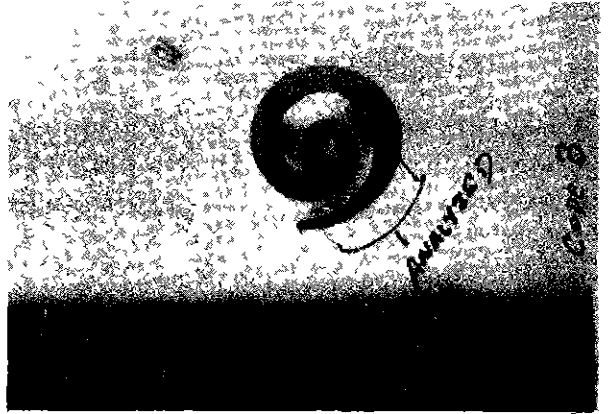


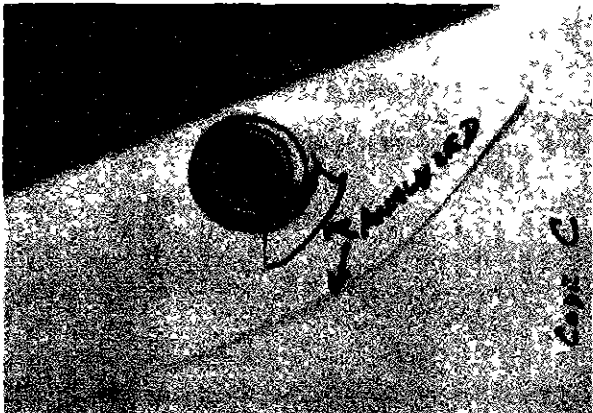
FIG. SPALLED TEETH 4, 5 & 6 XMSN END $1\frac{1}{2}X$



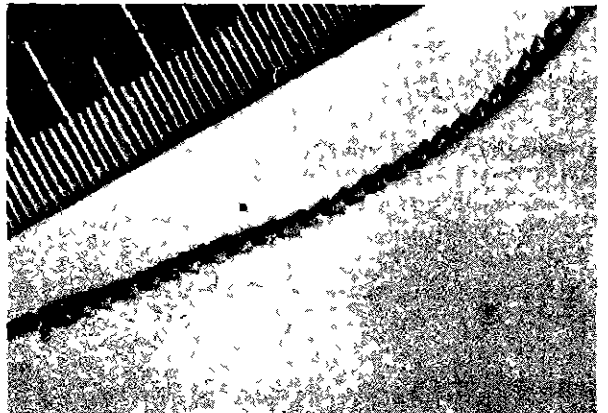
Chips from .040 inch hole at bottom of lube nozzle, P/N 107D2268, in aft transmission.



Chips from mix box following initial load run 0 hours TSO



Chips found in mix box on February 18, 1963, at 94:55 TSO



Chips removed from oil jet, P/N 107D2214, in aft transmission



Random sampling of chips from Liner Boring Operation.

November 6, 1963

Honorable N E Halaby
Administrator
Federal Aviation Agency
Washington, D. C , 20553

Dear Mr. Halaby:

On October 14, 1963, a New York Airways helicopter, Vertol 107, N 6673D, crashed at New York International Airport as the result of a fatigue failure in the quill shaft, P/N 107D2067-1, S/N TA102, which connects the mix box to the aft transmission.

Since many representatives of the Federal Aviation Agency are working with us intensely, it is unnecessary to include in this letter numerous details relative to the facts disclosed by the investigation to date. Should the Administrator permit resumption of passenger operation in New York Airways helicopters, it is recommended that the following action be accomplished as outlined in paragraphs A, B, and C below, until the cause of the abnormal wear in the splines of the quill shaft is determined and appropriate changes are made on the helicopters or in pertinent procedures affecting the safety of operation.

- A Overhaul of aft transmission and mix box, including installation of a new quill shaft P/N 107D 2067-(?), prior to resumption of operations
- B. Reduction of overhaul period for above assemblies to 200 hours.
- C Overhaul of above assemblies prior to next flight in case of sudden engine stoppage or other abnormal loading of aft transmission and/or mix box.

*** Material omitted which is not pertinent to the accident ***

Finally, it also appears most desirable that the FAA keep foreign operators of Vertol 107 helicopters fully advised, by the fastest means practicable, of conditions necessary for safe operation pending the final fix

Honorable N. W Halaby (2)

These matters were discussed by Mr William H Weeks of your Flight Standards Service and Mr John F Pahl of our Bureau of Safety on October 22 Our staff is available if we can be of further assistance in your consideration of matters presented in this letter.

Sincerely yours,

/s/ Alan S Boyd

Chairman

FEDERAL AVIATION AGENCY
Washington, D C 20553

December 31, 1963

Honorable Alan S. Boyd
Chairman
Civil Aeronautics Board
Washington, D. C 20428

Dear Mr Chairman:

Your letter to the Administrator of November 6, 1963, reference B-1-96, concerning a fatigue failure of the quill shaft that transmits power from the mix box to the aft transmission of the Vertol Model 107 helicopter, has been referred to this office for reply. A failure of this quill shaft occurred in the accident at New York International Airport on October 14, 1963, involving New York Airways Vertol 107, N6673D.

As you pointed out in your letter, representatives of the Federal Aviation Agency have been working closely with your people during the investigation of this accident. As a result of the facts disclosed by the investigation, we prepared and issued an emergency airworthiness directive on November 1, 1963, which subsequently was published for general circulation on November 25, 1963, as AD 63-24-4. A copy of this airworthiness directive is enclosed. A copy of the emergency directive was mailed to Mr. Tanguay of your Bureau of Safety on November 4, 1963. It is considered that the inspections and mandatory parts replacements specified by this airworthiness directive will preclude a recurrence of the quill shaft failure that was involved in the accident.

With reference to your specific recommendations, the following comments are offered:

- A. The transmissions and mix boxes of the Vertol 107 helicopters operated by New York Airways were all overhauled prior to the resumption of operations. There are no other civil domestic operators of this helicopter.

- B. A replacement life of 120 hours established for the quill shaft has been made mandatory by the airworthiness directive. A reduction in the overhaul period of the transmission and mix box is being considered

- C The problems of sudden stoppage and other abnormal loadings have been carefully investigated. Measurement of stresses during such occurrences have indicated that local stresses in drive system components do not exceed design stresses in such cases. Although such loadings are characterized by sharply defined peaks, it is not considered that the occurrence of these loads is of sufficient frequency to introduce a fatigue problem from this source

*** Material omitted which is not pertinent to the accident ***

The FAA concurs that it is necessary to keep all operators, foreign and domestic, advised of the situation in this case. To this end, copies of the emergency airworthiness directive were provided to the governments of other countries using Vertol 107 helicopters and to the United States military services. In addition, the manufacturer has directly provided information concerning the necessary corrective procedures to all operators to whom they had delivered Model 107 helicopters.

Sincerely yours,

/s/ D. D. Thomas

D. D. Thomas
Associate Administrator
for Programs

Enclosure

FEDERAL AVIATION AGENCY
Washington, D. C. 20553

ATTACHMENT C
Page 3 of 3

March 12, 1964

In Reply
Refer To. FS-323

Mr. Leon H. Tanguay
Director, Bureau of Safety
Civil Aeronautics Board
Washington, D. C. 20428

Dear Mr. Tanguay:

*** Material omitted which is not pertinent to the accident ***

Mr. Boyd's letter of November 6, 1963 (also reference B-1-96), concerning the New York Airways accident of a Vertol 107 aircraft, referred to this suggestion and recommended that the investigation be extended to cover overhaul time limits on "all pertinent parts and assemblies."

*** Material omitted which is not pertinent to the accident ***

*** Material omitted which is not pertinent to the accident ***

The investigation findings of the New York Airways accident indicate that the failure which precipitated the accident was not related to the manner in which the overhaul times were established.

Sincerely yours,

/s/ W Lloyd Lane

for George S. Moore
Director
Flight Standards Service