Aviation Investigation Final Report

Location:	Moberly, Missouri	**Incident Number:**	CHI03IA033
Date & Time:	December 5, 2002, 09:00 Local	**Registration:**	N353RK
Aircraft:	Hughes OH-6	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Public aircraft		

Analysis

The helicopter lost tail rotor effectiveness during cruise flight, and the pilot executed a run on landing to a paved runway. The pilot reported that he was in cruise flight for approximately one hour when the helicopter "entered an estimated 20 degree uncommanded yaw to the right." Applying pressure to the anti-torque pedals had no effect. The pilot reported that there had been no advance auditory indications or unusual vibrations prior to the yaw occurring. The pilot flew to an airport about 12 nautical miles away, and executed a successful run on landing. The inspection of the helicopter revealed that the tail rotor bellcrank pivot pin was dislodged from the non-rotating swashplate and was rotated inboard towards the boom. The plain brass liner, which is a pressed liner internal to the non-rotating swashplate and surrounds the tail rotor gearbox output shaft, was broken into 15 identifiable pieces. No evidence of fatigue or abnormal wear was found on the pieces of the plain liner. The splined brass liner within the non-rotating swashplate was damaged. Eight of the seventeen splines of the swashplate splined liner had fractured areas and one of the splines was cracked. No evidence of fatigue was found on any of the fractures. The splined liner was still riveted to the rotating swashplate and was still capable of bearing a load. The tail rotor gearbox was replaced with an overhauled gearbox 29.4 flight hours prior to the time of the incident. There was no record of any mechanical discrepancies to the tail rotor assembly, including the non-rotating swashplate, when the overhauled tail rotor gearbox was installed.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: The loss of tail rotor effectiveness during cruise flight due to the bellcrank pivot pin becoming separated from the non-rotational swashplate. The plain brass liner of the non-rotating swashplate and the bellcrank pivot pin were worn.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE

Findings
1. (C) ROTOR SYSTEM,TAIL ROTOR HUB PITCH CHANGE MECHANISM - FAILURE,TOTAL
2. (C) ROTOR SYSTEM,TAIL ROTOR HUB PITCH CHANGE MECHANISM - WORN

Factual Information

On December 5, 2002, at 0900 central standard time, a Hughes OH-6, N353RK, operated by Freelance Air, Inc., lost tail rotor effectiveness during cruise flight and executed a run on landing at the Omar N Bradley Airport (MBY), Moberly, Missouri. The helicopter was not damaged and the pilot was not injured. The 14 CFR Part 91 repositioning flight departed the Spirit of St. Louis Airport (SUS), St. Louis, Missouri, at 0810, en route to Trenton, Missouri. Visual meteorological conditions prevailed. No flight plan was filed.

The pilot reported that he was in cruise flight for approximately one hour when the helicopter "entered an estimated 20 degree uncommanded yaw to the right." Applying pressure to the anti-torque pedals had no effect. The pilot reported that there had been no advance auditory indications or unusual vibrations prior to the yaw occurring. The pilot reported he applied left cyclic and maintained airspeed. He flew to MBY, which was about 12 nautical miles away. Once he arrived at MBY, he executed a successful run on landing to runway 31.

The inspection of the helicopter revealed that the tail rotor bellcrank pivot pin was dislodged from the non-rotating swashplate and was rotated inboard towards the boom. The non-rotating swashplate spherical bearing boss was found damaged and there appeared to be fine ferrous material around the bellcrank area. The non-rotating swashplate had abnormal play around the tail rotor gearbox output shaft. Excess vertical play was found in the bellcrank arm at the bellcrank attachment bolt.

The tailrotor gearbox and the non-rotating swashplate assembly were sent to Boeing Product Integrity, Mesa, Arizona, for further inspection and teardown. The inspection revealed the following:

1. The plain brass liner, which is a pressed liner internal to the non-rotating swashplate and surrounds the tail rotor gearbox output shaft, was broken into 15 identifiable pieces. No evidence of fatigue or abnormal wear was found on the pieces of the plain liner.

2. The splined brass liner within the non-rotating swashplate was damaged. Eight of the seventeen splines of the swashplate splined liner had fractured areas and one of the splines was cracked. No evidence of fatigue was found on any of the fractures. The splined liner was still riveted to the rotating swashplate and was still capable of bearing a load.

3. The bellcrank assembly was undamaged, however, both bellcrank bolt holes showed evidence of distortion or elongation.

4. After the removal of the outer boot, swashplate assembly and the bellcrank from the tail rotor drive shaft, both the tail rotor gearbox output shaft and in input shaft rotated freely

without binding. (See Boeing Engineering Laboratory Report, 03L0312, included in the docket)

Maintenance records indicated that the last 100 hour inspection occurred on April 25, 2002, at 3,700.3 hours aircraft total time. The total time on the aircraft at the time of the accident was 3,781.1 hours.

The non-rotational swashplate was installed as an overhauled unit on November 23, 1999. The swashplate had 385.4 flight hours since the time of overhaul.

The tail rotor gearbox was replaced with an overhauled gearbox on October 25, 2002. The helicopter had a total time of 3,760.8 hours. The tail rotor gearbox had 29.4 flight hours since overhaul at the time of the incident. There was no record of any mechanical discrepancies to the tail rotor assembly, including the non-rotating swashplate, when the overhauled tail rotor gearbox was installed.

Pilot Information

Certificate:	Commercial	**Age:**	40,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	January 22, 2002
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 31, 2002
Flight Time:	2230 hours (Total, all aircraft), 237 hours (Total, this make and model), 1920 hours (Pilot In Command, all aircraft), 128 hours (Last 90 days, all aircraft), 25 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Hughes	**Registration:**	N353RK
Model/Series:	OH-6	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	701435
Landing Gear Type:	Skid	**Seats:**	4
Date/Type of Last Inspection:	December 3, 2002 Continuous airworthiness	**Certified Max Gross Wt.:**	2550 lbs
Time Since Last Inspection:	1.8 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	3791 Hrs at time of accident	**Engine Manufacturer:**	Allison
ELT:	Not installed	**Engine Model/Series:**	250-C20C
Registered Owner:	U.S. Drug Enforcement Agency	**Rated Power:**	420 Lbs thrust
Operator:	Freelance Air Inc.	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SUS,463 ft msl	**Distance from Accident Site:**	130 Nautical Miles
Observation Time:	08:54 Local	**Direction from Accident Site:**	160°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	330°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.34 inches Hg	**Temperature/Dew Point:**	-3°C / -7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	St. Louis , MO (SUS)	**Type of Flight Plan Filed:**	None
Destination:	Omaha, NE	**Type of Clearance:**	None
Departure Time:	08:10 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Omar N Bradley Airport MBY	**Runway Surface Type:**	Asphalt
Airport Elevation:	867 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	31	**IFR Approach:**	None
Runway Length/Width:	4681 ft / 100 ft	**VFR Approach/Landing:**	Precautionary landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Minor
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	39.46389,-92.427497

Administrative Information

Investigator In Charge (IIC):	Silliman, James
Additional Participating Persons:	Harvey Haynes; FAA-St. Louis FSDO; St. Ann, MO
Original Publish Date:	April 28, 2004
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=56189