Aviation Investigation Final Report

Location:	Millen, Georgia	**Accident Number:**	ERA21LA386
Date & Time:	September 29, 2021, 10:30 Local	**Registration:**	N430NR
Aircraft:	Hiller UH-12E	**Aircraft Damage:**	Substantial
Defining Event:	Sys/Comp malf/fail (non-power)	**Injuries:**	1 Minor
Flight Conducted Under:	Part 137: Agricultural		

Analysis

During cruise flight, the pilot heard a “pop” sound followed by the engine accelerating to a high rpm. According to the pilot, the helicopter began spinning counterclockwise at a high rate; the cyclic stick would not move; and collective and pedal control inputs had no effect. The pilot continued his attempts to counteract the helicopter’s rotation as it descended to ground impact.

Postaccident examination of the wreckage revealed that airframe damage was consistent with ground impact and that main rotor blade deformation and damage were consistent with powered impact with terrain. Damage to the tail rotor blades was consistent with the tail rotor not being under power at impact, and the tail rotor gearbox input pinion bevel gear was found fractured from its gear shaft.

Metallurgical examination of the input pinion gear shaft revealed that it had fractured from fatigue. The fatigue cracking initiated at gouge marks on the outer surface of the cylindrical shaft and propagated through nearly the entirety of the shaft cross-section. The length of the fatigue cracks and the fine spacing of the striations were indicative of high cycle fatigue crack propagation.

Review of maintenance records revealed that the tail rotor gearbox was disassembled, visually inspected, and reassembled about 330.3 hours before the accident. Based on the high cycle fatigue crack propagation and the presence of fatigue cracking on the majority of the fracture cross-section, it is likely the gouge marks on the input pinion gear shaft were created during reassembly of the tail rotor gearbox during this maintenance action.

A loss of drive to the tail rotor would result in a clockwise, nose-right yaw of the helicopter due to the torque effect on the fuselage of the counterclockwise rotation of the main rotor. The

sudden loss of tail rotor drive due to the fracture of the input pinion bevel gear would unload the powertrain of the power being used by the tail rotor, leading to a temporary increase of rotor rpm as well as engine rpm, consistent with the pilot's report. Although the pilot reported that the helicopter began to spin counterclockwise, it is likely he misidentified the direction of yaw.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The improper reassembly of the tail rotor gearbox following maintenance, which resulted in fatigue failure of the input pinion gear shaft, and the subsequent loss of tail rotor drive.

Findings

Aircraft	Tail rotor gearbox - Incorrect service/maintenance
Personnel issues	Scheduled/routine maintenance - Maintenance personnel
Aircraft	Tail rotor gearbox - Fatigue/wear/corrosion
Aircraft	Tail rotor gearbox - Failure

Factual Information

History of Flight

Enroute-cruise	Sys/Comp malf/fail (non-power) (Defining event)
Enroute-cruise	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On September 29, 2021, about 1030 eastern daylight time, a Hiller UH-12E helicopter, N430NR, was substantially damaged when it was involved in an accident near Millen, Georgia. The pilot sustained minor injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 137 aerial application flight.

The pilot reported that he was enroute to his next jobsite at 500 ft above ground level and 70 knots airspeed when he heard a “pop” sound. The engine accelerated to a high rpm, and the helicopter began to spin counterclockwise at a high rate. The pilot reported that the cyclic stick would not move and that pedal and collective control inputs had no effect. The pilot continued his attempts to counteract the helicopter’s rotation as it descended to ground impact.

The helicopter came to rest on its left side in a field. Examination by a Federal Aviation Administration inspector revealed that the impact sheared the right skid and that the outer sections of the two main rotor blades separated. The separated sections of the two main rotor blades were found about 225 ft west-northwest and 180 feet north-northwest of the main wreckage site, respectively. The ‘yellow’ control rotor had separated and was found about 270 ft southwest of the main wreckage site. The main rotor head, containing the main rotor hub, gimbal ring assembly, collective ballast assembly, the upper portion of the main rotor mast, the ‘blue’ and ‘yellow’ main rotor blade inboard ends, and the ‘blue’ control rotor, had separated and was found about 135 ft south of the main wreckage site.

Postaccident examination of the wreckage revealed that airframe damage was consistent with ground impact and that main rotor blade deformation and damage were consistent with powered impact with terrain. Examination of the main rotor system and the flight control system revealed no evidence of preimpact anomalies that would have prevented normal flight. Damage to the tail rotor blades was consistent with the tail rotor not being under power at impact, and the tail rotor gearbox input pinion bevel gear was found fractured from its gear shaft.

The National Transportation Safety Board Office of Research and Engineering, Materials Laboratory Division, performed metallurgical examinations of the main rotor hub, the ‘yellow’ control rotor and trunnion, and pieces of the tail rotor gearbox input pinion. Examination revealed that the fractures and separations of the ‘yellow’ control rotor and trunnion studs

occurred due to overload and that the tail rotor gearbox input pinion bevel gear shaft had fractured from fatigue. Examination revealed that the fatigue cracking initiated at gouge marks on the outer surface of the cylindrical shaft and propagated through nearly the entirety of the shaft cross-section.

Review of maintenance records revealed that the tail rotor gearbox was disassembled, visually inspected, and reassembled on August 28, 2018, about 330.3 hours before the accident. Attempts to contact the mechanic who performed this maintenance action were unsuccessful.

Pilot Information

Certificate:	Commercial; Private	**Age:**	51,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 23, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	April 7, 2021
Flight Time:	2300 hours (Total, this make and model), 130 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Hiller	**Registration:**	N430NR
Model/Series:	UH-12E	**Aircraft Category:**	Helicopter
Year of Manufacture:	1961	**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	2074
Landing Gear Type:	None; High skid	**Seats:**	3
Date/Type of Last Inspection:	September 3, 2021 100 hour	**Certified Max Gross Wt.:**	2800 lbs
Time Since Last Inspection:		**Engines:**	1
Airframe Total Time:	9466 Hrs as of last inspection	**Engine Manufacturer:**	
ELT:	Not installed	**Engine Model/Series:**	
Registered Owner:	On file	**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	Agricultural aircraft (137)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	TBR,187 ft msl	**Distance from Accident Site:**	16 Nautical Miles
Observation Time:	13:55 Local	**Direction from Accident Site:**	120°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	Unknown / None
Wind Direction:	300°	**Turbulence Severity Forecast/Actual:**	Unknown / Unknown
Altimeter Setting:	30.02 inches Hg	**Temperature/Dew Point:**	29°C / 16°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Metter, GA	**Type of Flight Plan Filed:**	None
Destination:	Metter, GA	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	32.615,-82.002222

Administrative Information

Investigator In Charge (IIC):	Spencer, Lynn
Additional Participating Persons:	Rodney Hood; FAA/FSDO; Atlanta, GA
Original Publish Date:	August 15, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=103994