



# **Aviation Investigation Final Report**

Location:	Arnaudville, Louisiana	Accident Number:	CEN21LA389
Date & Time:	August 27, 2021, 08:00 Local	Registration:	N827SH
Aircraft:	ROBINSON HELICOPTER R22 BETA	Aircraft Damage:	Substantial
Defining Event:	Sys/Comp malf/fail (non-power)	Injuries:	1 Minor
Flight Conducted Under:	Part 91: General aviation - Positioning		

# Analysis

While attempting to land at a staging location for a planned aerial application flight, the helicopter began to rotate to the right. The pilot was unable to regain control. The helicopter skids impacted a dirt field, and the helicopter rolled over onto its right side. The helicopter sustained substantial damage to its main rotor blades and fuselage. Disassembly of the helicopter for recovery revealed the tail rotor output shaft was fractured into two pieces.

Examination of the output shaft revealed the fracture occurred between the mating tapered roller bearing and the bevel gear. The bevel gear side surface displayed progressive crack arrest marks consistent with fatigue cracking. Due to smear damage on the other fracture, it could not be determined if the fatigue cracking was the result of unidirectional bending fatigue (one origin) or reverse bending fatigue (two origins).

The tail rotor output shaft function is to drive the tail rotor blades. A failed tail rotor output shaft would result in the loss of drive to the tail rotor blades, which in turn would cause a loss of tail rotor thrust to counter main rotor torque and loss of yaw control.

### **Probable Cause and Findings**

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

The loss of tail rotor drive due to a fatigue failure of the tail rotor gearbox output shaft, which resulted in a loss of control during landing.

#### Findings

Aircraft Personnel issues Tail rotor drive shaft - Fatigue/wear/corrosion Aircraft control - Pilot

# **Factual Information**

History of Flight	
Landing-flare/touchdown	Sys/Comp malf/fail (non-power) (Defining event)
Landing-flare/touchdown	Loss of tail rotor effectiveness

On August 27, 2021, about 0800 central daylight time, a Robinson R22 Beta helicopter, N827SH, sustained substantial damage when it was involved in an accident near Arnaudville, Louisiana. The pilot was not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 positioning flight.

According to the pilot, while attempting to land at his staging location for a planned aerial application flight, the helicopter began to rotate to the right. The pilot was unable to regain control; the helicopter skids impact a dirt field, and the helicopter rolled over onto its right side.

The helicopter sustained substantial damage to its main rotor blades and fuselage. While disassembling the helicopter for recovery, the tail rotor output shaft was found fractured into two pieces. The shaft was retained for further examination by the National Transportation Safety Board (NTSB) Materials Laboratory.

According to Robinson Helicopters, the tail rotor gearbox contains a splash-lubricated spiralbevel gear set. The function of the tail rotor output shaft is to drive the tail rotor blades. A failed tail rotor output shaft results in the loss of drive to the tail rotor blades, which in turn causes a loss of tail rotor thrust to counter main rotor torque and loss of yaw control.

A review of the helicopter records revealed a serviceable tail rotor gearbox (serial number 3242) was installed on April 18, 2020, at a total helicopter time of 4,255.6 hours. The helicopter total time at the time of the accident was not reported.

NTSB Material Laboratory examination of the output shaft revealed the fracture occurred between the mating tapered roller bearing and the bevel gear. Heavy smearing damage was observed on both fracture surfaces. The damage was likely secondary and due to contact of the fracture surfaces post-separation. The bevel gear side surface displayed progressive crack arrest marks consistent with fatigue cracking. Due to smear damage on the other fracture, it could not be determined if the fatigue cracking was the result of unidirectional bending fatigue (one origin) or reverse bending fatigue (two origins).

#### **Pilot Information**

Certificate:	Commercial	Age:	63,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	3-point
Instrument Rating(s):	Helicopter	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	
Medical Certification:	Class 2 Without waivers/limitations	Last FAA Medical Exam:	March 22, 2021
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	June 25, 2020
Flight Time:	19000 hours (Total, all aircraft), 1000 Command, all aircraft), 10 hours (Las	00 hours (Total, this make and model), st 90 days, all aircraft), 1 hours (Last 2	18000 hours (Pilot In 4 hours, all aircraft)

### Aircraft and Owner/Operator Information

Aircraft Make:	ROBINSON HELICOPTER	Registration:	N827SH
Model/Series:	R22 BETA	Aircraft Category:	Helicopter
Year of Manufacture:	2005	Amateur Built:	
Airworthiness Certificate:	Restricted (Special)	Serial Number:	3780
Landing Gear Type:	None; Skid	Seats:	2
Date/Type of Last Inspection:	January 10, 2021 Annual	Certified Max Gross Wt.:	1370 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	4301 Hrs as of last inspection	Engine Manufacturer:	Lycoming
ELT:	Not installed	Engine Model/Series:	0-360-J2A
Registered Owner:	1 ACADIANA HELICOPTERS COMPANY LLC	Rated Power:	180 Horsepower
Operator:	1 ACADIANA HELICOPTERS COMPANY LLC	Operating Certificate(s) Held:	Agricultural aircraft (137)

### Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
<b>Observation Facility, Elevation:</b>	KLFT,42 ft msl	Distance from Accident Site:	12 Nautical Miles
Observation Time:	06:53 Local	Direction from Accident Site:	194°
Lowest Cloud Condition:	Clear	Visibility	7 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	3 knots / None	Turbulence Type Forecast/Actual:	/
Wind Direction:	40°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.96 inches Hg	Temperature/Dew Point:	23°C / 22°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	New Iberia, LA	Type of Flight Plan Filed:	None
Destination:	Arnaudville, LA	Type of Clearance:	None
Departure Time:	07:50 Local	Type of Airspace:	Class G

# Wreckage and Impact Information

Crew Injuries:	1 Minor	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	1 Minor	Latitude, Longitude:	30.395296,-91.934586(est)

#### **Administrative Information**

Investigator In Charge (IIC):	Sauer, Aaron
Additional Participating Persons:	Paul Marks; FAA; Baton Rouge, LA
Original Publish Date:	January 19, 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=103773

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person" (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available <u>here</u>.