National Transportation Safety Board
Aviation Accident Final Report

Location:	Port O'Connor, TX	**Accident Number:**	CEN15LA395
Date & Time:	08/21/2015, 1530 CDT	**Registration:**	N429AR
Aircraft:	BELL HELICOPTER TEXTRON CANADA 429	**Aircraft Damage:**	Substantial
Defining Event:	Flight control sys malf/fail	**Injuries:**	3 None
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The commercial pilot reported that, during cruise flight in the helicopter, he felt a "slight vibration" and heard a "very faint bumping sound." A flight control check revealed no anomalies, and the pilot continued the flight to the destination heliport. While in a 4-ft hover, just before touching down, the helicopter began a slow, uncommanded right turn. The pilot applied full left anti-torque pedal, and the turn stopped. He then lowered the collective and landed without incident. A post-flight inspection of the helicopter revealed that one of the tail rotor outboard pitch change links (PCL) was broken. An examination of the failed PCL revealed fatigue fractures due to pitting corrosion between the spherical bearing and the bearing housing. The fatigue fractures propagated during operation until the PCL bearing housing fractured, separating the PCL from the blade pitch horn end spherical bearing, resulting in a loss of pitch control to the affected blade.

The PCL was installed on the helicopter 12 days before the manufacturer issued an alert service bulletin (ASB) introducing a 50-hour recurrent inspection of the tail rotor PCLs for axial and radial bearing play. About 6 months later, the Federal Aviation Administration (FAA) subsequently issued an emergency airworthiness directive (EAD) based on the ASB. The tail rotor PCLs on the accident helicopter were inspected in accordance with the ASB and the EAD 9 days after the EAD was issued. The PCL failed 6.6 flight hours after the inspection. The EAD did not require an inspection of the bearing housing portion of the PCL for corrosion, and it could not be determined if the fatigue cracks were present when the inspection was performed.

Following the accident, the manufacturer updated the original ASB to include inspections for bearing cracks, corrosion, and anti-corrosion sealant. The FAA also updated the airworthiness directive to reflect the additional inspections.

Probable Cause and Findings

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

The fatigue failure of the tail rotor pitch change link spherical bearing housing as a result of corrosion pitting.

Findings

Aircraft	Flight control system - Failure (Cause)

Factual Information

On August 21, 2015, at 1530 central daylight time, a Bell Helicopter 429, N429AR, experienced a tail rotor pitch change link (PCL) failure during flight and landed uneventfully at a private heliport in Port O'Connor, Texas. The pilot and two passengers were not injured. The helicopter sustained substantial damage that was limited to the PCL. The helicopter was registered to and operated by Roberts Ranch & Investments LLC, under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual flight rules conditions prevailed for the flight, which was not operated on a flight plan. The flight originated from Giddings, Texas, at 1450.

The pilot reported that during cruise flight he felt a "slight vibration" and heard a "very faint bumping sound." He checked the flight controls and they functioned normally so he continued the flight. While in a four-foot hover, just before touching down, the helicopter began a slow, uncommanded right turn. The pilot applied full left anti-torque pedal and the turn stopped. He then lowered the collective and landed without incident. A post flight inspection of the helicopter revealed that one of the tail rotor PCLs was broken.

The helicopter's tail rotor system was comprised of a four-bladed stacked teetering tail rotor that provided main rotor anti-torque and directional control. The tail rotor PCL, part number 429-012-112-103, assembly had a single-pieced forged aluminum body with two circular ends, each contained a spherical bearing. One end of the PCL attached to the pitch change crosshead; the other PCL end attached to its respective tail rotor pitch change horn. The tail rotor assembly contained four PCL's, one for each blade; two short-length "outboard" PCL's and two long-length "inboard" PCL's.

The fractured inboard tail rotor PCL, serial number TE-0168, was examined at Bell Helicopter under the supervision of a Federal Aviation Administration (FAA) inspector. The pitch horn-side of the PCL contained two fractures, which were about 180 degrees, opposed to each other. The fractures were through the circular end, which houses the spherical bearing. The primary fracture exhibited fatigue signatures through most of the cross-section of the circular end. The secondary fracture exhibited fatigue signatures through about half of the cross-section, with the remaining portion of the exhibiting overload signatures. Both of the fatigue cracks were located on the same chamfer, which is used to stake the spherical bearing into the circular end of the PCL. Pitting corrosion was visible at the fatigue fracture origins. The separated circular end of the PCL and the pitch change horn bushing showed evidence of mechanical contact wear. The pitch horn-side spherical bearing exhibited wear though a portion of the outer ring and on the surface of the ball. Although the spherical bearing was damaged, an axial and radial bearing play inspection was conducted. The axial play was measured to be 0.100 inches, which exceeded the published limit of 0.010 inches. The radial play was within limits.

The intact cross-head side of the PCL showed corrosion on the staking chamfer. Removal of the spherical bearing revealed fretting and wear on both the bearing outer ring and adjacent to the staking chamfer. An axial and radial bearing play inspection of the cross-head side revealed the amount of play was within limits. The spherical bearing was removed and evidence of corrosion and fretting was visible on the inner diameter surfaces.

A material composition analysis of the PCL revealed the material was within specifications.

The remaining PCLs were examined and all showed evidence of corrosion on the bearing staking chamfer surfaces. The axial and radial bearing play inspection revealed all but one bearing was within limits.

On February 18, 2015, Bell Helicopter issued Alert Service Bulletin (ASB) 429-15-16 affecting PCL part numbers 429-012-112-101/-103. The ASB introduced a 50-hour recurrent inspection of the tail rotor PCLs for axial and radial bearing play. On July 2, 2015, Transport Canada issue Emergency Airworthiness Directive (EAD) CF-2015-16, referencing the Bell Helicopter ASB. The AD required compliance with the ASB within 10 hours of airtime from the date of the AD. The AD also called for repeated inspections, as outlined in the ASB, not to exceed 50-hour airtime intervals. On August 6, 2015, the FAA issued EAD 2015-16-51. This EAD referenced the Transport Canada EAD and the Bell Helicopter ASB . The difference between the FAA EAD and the Transport Canada EAD was that the FAA EAD required the inspection before further flight instead of within 10 hours. On August 6, 2015, Transport Canada revised their EAD. The revision called for the inspection as outlined in Bell Helicopter ASB to be conducted within 10 hours air time of the EAD date, or before 60 hours air time if new, which ever occurred first. The EAD also stated that the corrective actions specified in paragraph 1 of the ASB were to be complied with at intervals not to exceed 50 hours airtime.

Maintenance records showed the fractured PCL was installed on the helicopter on February 6, 2015, at an aircraft total time of 1,062.9 hours. The tail rotor PCLs were inspected on August 15, 2015, at a total PCL time of 1,235.3 hours, in accordance with EAD 2015-16-51. The helicopter had 1,241.9 hours total time at the time of the accident. The tail rotor PCLs had a total airtime of 179 hours and had been inspected 6.6 hours before the accident.

Post-Accident Corrective Actions

On December 7, 2015, Bell Helicopter issued ASB 429-15-26, affecting tail rotor PCL part number 429-012-112-101/-103. The ASB called for an inspection of the PCL for corrosion and the application of a corrosion preventative sealant along with a repetitive 50-hour inspection of the sealant. If corrosion was present, the PCL needed to be replaced.

On February 2, 2016, the FAA issued Airworthiness Directive (AD) 2016-02-06. The AD required inspection of the tail rotor PCLs, part numbers 429-012-112-101, -101FM, -103, and -103FM, for corrosion. The AD also required the application of a corrosion preventative sealant.

On June 18, 2016, Bell Helicopter updated ASB 429-15-16 with Revision B. The ASB contained two parts. Part 1 called to inspect the PCL assembly and bearing for wear, cracks, and adequate sealant. If outside of specified limits, the PCL was to be replaced. Part 2 advised to replace any bearing manufactured before January 13, 2015, that reached 250 flight hours in service.

History of Flight

Enroute-cruise	Flight control sys malf/fail (Defining event)

Pilot Information

Certificate:	Flight Instructor; Commercial; Private	**Age:**	48, Male
Airplane Rating(s):	Single-engine Land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without Waivers/Limitations	**Last Medical Exam:**	05/18/2015
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	02/03/2015
Flight Time:	9300 hours (Total, all aircraft), 22 hours (Total, this make and model), 9000 hours (Pilot In Command, all aircraft), 70 hours (Last 90 days, all aircraft), 23 hours (Last 30 days, all aircraft), 1.7 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	BELL HELICOPTER TEXTRON CANADA	**Registration:**	N429AR
Model/Series:	429	**Aircraft Category:**	Helicopter
Year of Manufacture:	2011	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	57035
Landing Gear Type:	Skid	**Seats:**	7
Date/Type of Last Inspection:	06/19/2015, Continuous Airworthiness	**Certified Max Gross Wt.:**	7000 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo Shaft
Airframe Total Time:	1168.8 Hours	**Engine Manufacturer:**	Pratt & Whitney
ELT:	Installed, not activated	**Engine Model/Series:**	207D1
Registered Owner:	On file	**Rated Power:**	621 hp
Operator:	On file	**Air Carrier Operating Certificate:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	PKV, 32 ft msl	**Observation Time:**	1522 CDT
Distance from Accident Site:	22 Nautical Miles	**Direction from Accident Site:**	337°
Lowest Cloud Condition:	Clear	**Temperature/Dew Point:**	23°C / 23°C
Lowest Ceiling:	None	**Visibility**	7 Miles
Wind Speed/Gusts, Direction:	5 knots, 70°	**Visibility (RVR):**	
Altimeter Setting:	29.9 inches Hg	**Visibility (RVV):**	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Giddings, TX (PVT)	**Type of Flight Plan Filed:**	None
Destination:	Port O'Connor, TX (PVT)	**Type of Clearance:**	None
Departure Time:	1450 CDT	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	28.427500, -96.455278 (est)

Administrative Information

Investigator In Charge (IIC):	Pamela S Sullivan	**Adopted Date:**	05/01/2017
Additional Participating Persons:	Scott Tyrrell; FAA; Ft. Worth, TX William Randall; Bell Helicopter; Ft. Worth, TX John Britten; Transportation Safety Board of Canada; QC		
Publish Date:	05/01/2017		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=91900		