



Aviation Investigation Final Report

Location:	Tracy, California	Accident Number:	WPR24LA134
Date & Time:	April 23, 2024, 10:50 Local	Registration:	N17592
Aircraft:	Bell 206L-3	Aircraft Damage:	Substantial
Defining Event:	Sys/Comp malf/fail (non-power)	Injuries:	2 None
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

During a pipeline inspection flight, the pilot and passenger of the accident helicopter heard a loud noise, followed by a shudder and an uncontrolled descent. The pilot was unable to stop the helicopter's descent with collective control inputs and he completed a forced landing into an orchard, which resulted in substantial damage to the tailboom.

Postaccident examination of the helicopter revealed fractures in the upper and lower arms of the cylinder extension to the collective control servo. All the linkages and securing hardware for the collective control system were in place.

Metallurgical examination revealed the collective servo arm fractured due to fatigue cracking that had initiated in the lower cylinder extension arm at corrosion pits along the inside surface. Once the crack had propagated through more than 80% of the arm's cross section, the remainder carrying the loads fractured from overstress. The upper arm also fractured from fatigue initiating at corrosion pits along the radii at the forward and aft ends of the open section in the middle of the arm. Composition testing determined that the elements in the corrosion pitting were consistent with compounds found in marine environments. The helicopter had been periodically flown about 50 nm from salt water. However, the undamaged cyclic servo had also been installed in the accident helicopter at the same time as the collective servo. It is unclear why the cylinder extension arms of the collective servo failed, and the cyclic servo cylinder extension arms remained intact, both having been exposed to the same environmental conditions; the extension arms for both the collective and cyclic servos were contained within a protective housing above the cockpit.

The fracture surfaces were also examined to count the fatigue striations and correlate the fatigue crack growth with the 59 hours that the helicopter operated with newly installed

composite blades. However, the number and pattern of crack arrest features could not be linked to any specific loading events, and the linking of the individual striations to the two-vibrations-per-blade revolution was inconsistent with the 59-hour propagation time. Therefore, the fatigue crack initiation or propagation could not be attributed to the blade installation.

Probable Cause and Findings

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

A loss of collective control authority due to fatigue failure of the collective servo cylinder extension arms from corrosion pitting.

Findings

Aircraft	(general) - Failure
Aircraft	Main rotor control - Failure

Factual Information

History of Flight

Maneuvering-low-alt flying	Sys/Comp malf/fail (non-power) (Defining event)
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On April 23, 2024, about 1050 Pacific daylight time, a Bell 206 L-3, N17592, was substantially damaged when it was involved in an accident near Tracy, California. The pilot and passenger were not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 aerial observation flight.

According to the pilot, they were inspecting a pipeline from about 280 ft above ground level (agl). While flying on a northerly heading, the pilot began a left turn to the west to continue the inspections. The pilot and passenger, who was observing the flight, then heard and felt a loud pop followed by a shudder. The helicopter then started an uncontrolled descent that the pilot was unable to correct with collective control inputs. At the time, engine power and rotor rpm were normal, and no annunciations or warning lights were observed. Most of the nearby landing areas were obstructed by wires, so the pilot selected an orchard with small trees to complete the forced landing. The helicopter descended over the trees, and the pilot was able to use cyclic inputs to keep the helicopter level before it dropped to the ground from about 12 to 15 ft agl.

The helicopter sustained substantial damage to the tailboom.

Postaccident examination of the helicopter revealed that collective control authority was continuous from the collective stick to the collective servo through the collective servo input arms. The collective servo exhibited two fractures at the cylinder extension lower arm and upper arm (referred to as the output support upper and lower leg in the NTSB materials laboratory report). The cyclic control system was continuous from the cyclic stick through the servos to the swashplate assembly.

An NTSB materials laboratory examination of the collective servo showed that both fractures were relatively flat and oriented 90° relative to the longitudinal direction of each arm. Both cracks on the fracture surfaces had propagated from the interior surfaces outward and exhibited fatigue striations that were consistent with fatigue crack propagation. Dimpled rupture features were observed outside the fatigue cracking regions, consistent with subsequent overstress fracture of each arm following the end of the fatigue crack propagation.

Cylinder Extension Lower Arm

The lower arm crack had propagated through 80% of the arm before it transitioned to overload. The initiation site contained a prominent corrosion pit about 1.1 mm wide by 0.34 mm deep (0.043 by 0.013 inches). This and other corrosion pits served as individual initiation sites for multiple fatigue cracks, separated by small ratchet marks. The compounds that comprised the corrosion pit included elements consistent with corrosion products in a marine environment such as sodium, potassium, calcium, chlorine and sulfur with an elevated amount of chlorine in the deepest regions of the pit. The base material of the servo arm was consistent with 7075 aluminum alloy composition.

Cylinder Extension Upper Arm

The upper arm contained two thumbnail cracks with three major initiation regions. The crack initiation site for the smaller of the two thumbnail cracks contained a corrosion pit and fatigue striations emanating from the pit. A wider corrosion pit was found within the larger thumbnail crack that measured 0.30 mm wide by 0.14 mm deep (0.012 inch by 0.0055 inch). Fatigue striations were present near the corrosion pit with propagation into the arm cross section away from the corrosion pit. The corrosion pits on the upper arm also exhibited a chemical composition consistent with aluminum oxide with elements associated with salt compounds, like the lower arm.

A follow-up materials laboratory examination at Bell Engineering Laboratories revealed that the collective inputs, especially during <1G maneuvers, were initially driving the crack and creating fatigue band features. Towards the end of the fatigue crack, the two-per-revolution main rotor loads were contributing to the crack growth, consistent with the attributes of the individual striations. The laboratory examination group attempted to perform a fatigue band count to correlate the fatigue band striations with the two-vibrations-per-blade revolution to determine if the crack initiation started after Van Horn composite blades were installed 10 days (59 flight hours) before the accident. However, due to the non-uniform fatigue band structure, an accurate fatigue band count could not be performed.

Maintenance records showed that the collective and cyclic servos were removed from another Bell 206 (s/n 51036, N170AM) on September 29, 2021, at 1,897.2 hours since overhaul and the "reason for removal" was noted as "conv. [convenience]." N170AM was involved in an accident on July 9, 2021, due to a dynamic rollover. According to the maintenance logbook of N17592, the servos were installed in the accident helicopter on October 27, 2021.

The pilot reported that he had accumulated 159.2 flight hours in the accident helicopter between 2021 and the day of the accident. During this time, the helicopter was routinely operated in eastern California (Modesto, Fresno, Victorville), about 50 nm from the Pacific Ocean.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	45, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	4-point
Instrument Rating(s):	Helicopter	Second Pilot Present:	
Instructor Rating(s):	None	Toxicology Performed:	
Medical Certification:	Class 2 Without waivers/limitations	Last FAA Medical Exam:	January 29, 2024
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	December 14, 2023
Flight Time:	2789 hours (Total, all aircraft), 232 hours (Total, this make and model), 2628 hours (Pilot In Command, all aircraft), 108 hours (Last 90 days, all aircraft), 44 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	Registration:	N17592
Model/Series:	206L-3	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	51535
Landing Gear Type:	High skid	Seats:	7
Date/Type of Last Inspection:	April 6, 2024 100 hour	Certified Max Gross Wt.:	4150 lbs
Time Since Last Inspection:	59.4 Hrs	Engines:	1 Turbo shaft
Airframe Total Time:	22826 Hrs	Engine Manufacturer:	Rolls Royce
ELT:	Not installed	Engine Model/Series:	250-C30P
Registered Owner:	PREMIER ROTORS LLC	Rated Power:	435 Horsepower
Operator:	PREMIER ROTORS LLC	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:	KTCY, 193 ft msl	Distance from Accident Site:	8 Nautical Miles
Observation Time:	10:55 Local	Direction from Accident Site:	278°
Lowest Cloud Condition:	Scattered / 3100 ft AGL	Visibility	
Lowest Ceiling:	Broken / 5000 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	5 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.96 inches Hg	Temperature/Dew Point:	17°C / 10°C
Precipitation and Obscuration:			
Departure Point:	Modesto, CA (MOD)	Type of Flight Plan Filed:	None
Destination:	Tracy, CA (TCY)	Type of Clearance:	None
Departure Time:	08:30 Local	Type of Airspace:	Class G

Airport Information

Airport:	NEW JERUSALEM 1Q4	Runway Surface Type:	
Airport Elevation:	76 ft msl	Runway Surface Condition:	Vegetation
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	1 None	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	2 None	Latitude, Longitude:	37,-121(est)

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Douglas Harding; Federal Aviation Administration; Oakland, CA Gary Howe; Textron Aviation (Bell); Fort Worth, TX
Original Publish Date:	July 16, 2025
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=194163

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