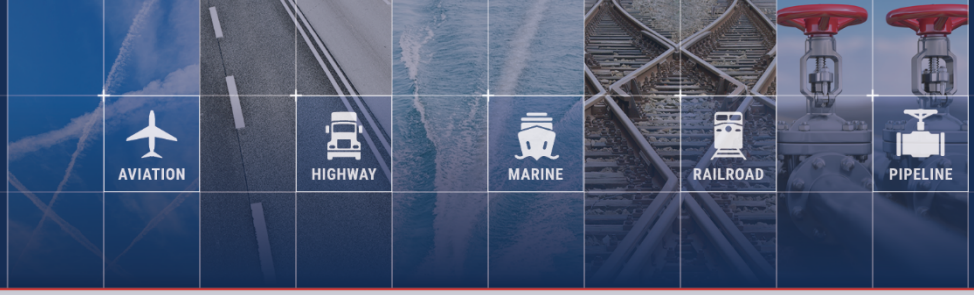

Aviation Investigation Final Report

Location:	Azusa, California	**Accident Number:**	WPR19LA255
Date & Time:	September 11, 2019, 13:00 Local	**Registration:**	N1168U
Aircraft:	Sikorsky S58	**Aircraft Damage:**	Substantial
Defining Event:	Part(s) separation from AC	**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Ferry		

Analysis

The pilot was conducting a ferry flight. During cruise flight while at an altitude of about 1,000 ft above ground level and at an airspeed of about 110 knots, one of the helicopter's tail rotor blades separated, which resulted in a partial separation of the remaining tail rotor assembly and a forced autorotation. The remaining tail rotor assembly subsequently impacted the vertical stabilizer. The mechanic who performed the daily inspection of the helicopter before the accident flight did not observe any evidence of a crack on the tail rotor blades.

The separated section of the tail rotor blade was not recovered. Postaccident fractographic examination of the tail rotor blade piece containing the root end revealed that most of the blade had cracked due to fatigue. No nicks, gouges, damage, or contamination were observed. Further examination revealed that the blade met the design specifications of the engineer drawings.

Maintenance records revealed that the rotor blade was most recently repaired in April 2007, but details of the repair work were not available.

Probable Cause and Findings

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

The in-flight separation of a section of the tail rotor blade due to a fatigue crack, which resulted in the pilot's forced autorotation into a field.

Findings

Aircraft	Tail rotor blade - Fatigue/wear/corrosion

Factual Information

History of Flight

Enroute	Part(s) separation from AC (Defining event)
Enroute	Off-field or emergency landing

On September 11, 2019, about 1300 Pacific daylight time, a Sikorsky S-58ET helicopter, N1168U, was substantially damaged when it was involved in an accident near Azusa, California. The pilot was not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 ferry flight.

The pilot reported that he was ferrying the helicopter from Shafter Airport-Minter Field (MIT), Shafter, California, to Corona Municipal Airport (AJO), Corona, California. During cruise flight, when the helicopter was about 1,000 ft above ground level and at an airspeed of about 110 knots, the pilot "heard and felt a loud bang without the onset of noise or vibration." Subsequently, the helicopter began to yaw to the right, and the pilot conducted an immediate autorotation and landed the helicopter in a baseball field.

A postflight inspection revealed that one tail rotor blade had separated from the tail rotor assembly and that the remaining three tail rotor blades, which remained attached to the tail rotor assembly, exhibited dents and chordwise bends, The 90° gearbox had fractured, exposing the internal gears, and the vertical stabilizer was impact damaged. (See figure 1.)

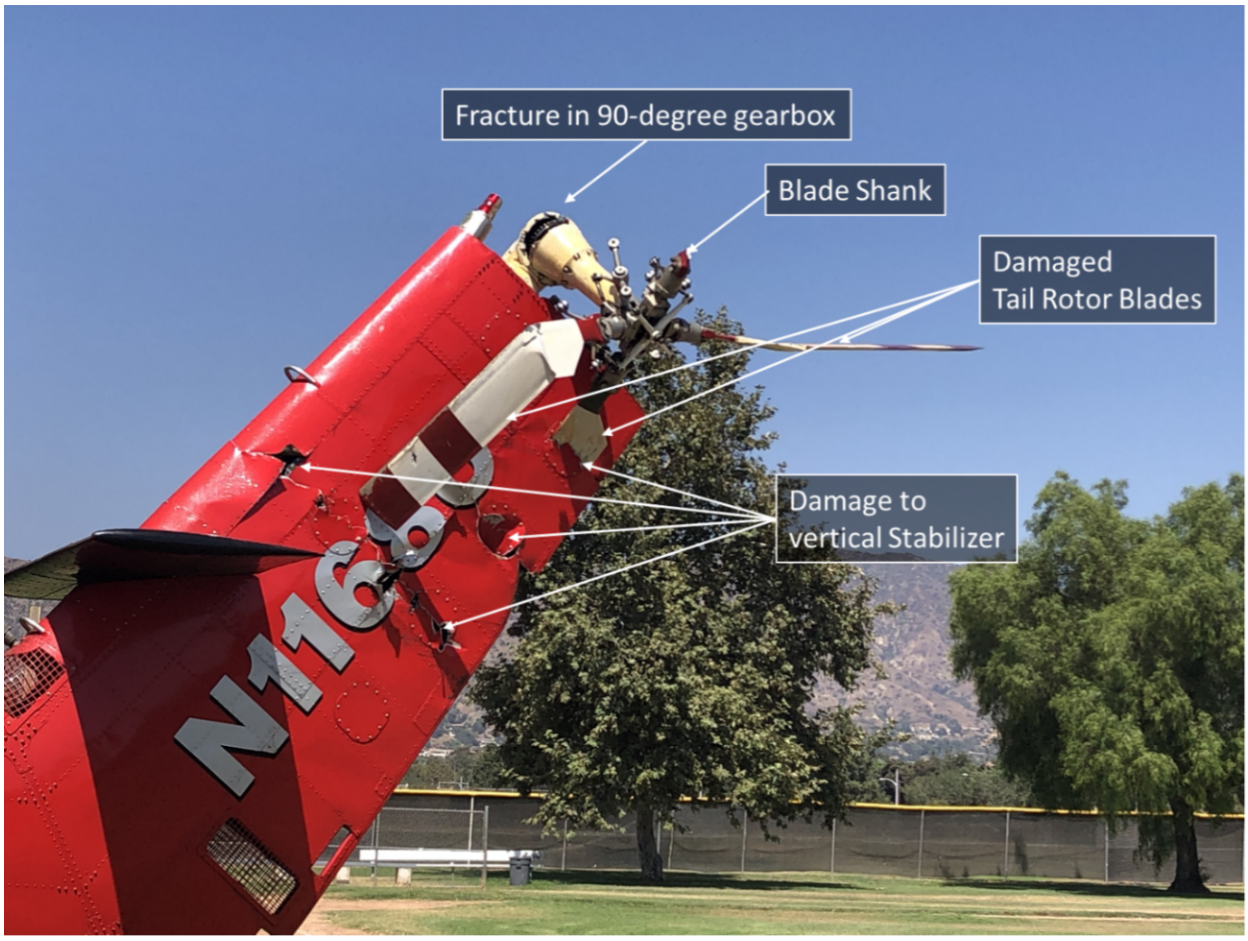

Figure 1. Left-side view of the tail rotor assembly, 90° degree gear box, and the vertical stabilizer (Source: Pilot).

Pilot Information

Certificate:	Commercial	**Age:**	49,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	April 1, 2019
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	May 6, 2019
Flight Time:	(Estimated) 9819 hours (Total, all aircraft), 1022 hours (Total, this make and model), 9700 hours (Pilot In Command, all aircraft), 43 hours (Last 90 days, all aircraft), 22 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Sikorsky	**Registration:**	N1168U
Model/Series:	S58 ET	**Aircraft Category:**	Helicopter
Year of Manufacture:	1959	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	58-1070
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	August 1, 2019 Continuous airworthiness	**Certified Max Gross Wt.:**	13000 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo shaft
Airframe Total Time:	19929 Hrs as of last inspection	**Engine Manufacturer:**	Pratt & Whitney
ELT:	C91 installed, not activated	**Engine Model/Series:**	PT6T-6
Registered Owner:	On file	**Rated Power:**	970 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	Rotorcraft external load (133), On-demand air taxi (135), Agricultural aircraft (137)

A review of the maintenance records revealed that, on April 20, 2007, the blade that had separated from the tail rotor assembly was repaired. According to documents, details of the repairs were on file at the repair station that performed the work. The maintenance records also indicated that the paint on the blade was removed and that the blade was refinished and static balanced. After completion of the work, the blade was deemed to be in an airworthy condition. The company that performed the last repair stated that it retained no documents related to the work performed on the blade and could provide no additional information.

The tail rotor blade was installed on the accident helicopter on May 13, 2013, when the helicopter had accumulated a total time of 18,897 hours. The blade had a total time of 885 hours and an “on condition” retirement life and was in compliance with all applicable airworthiness directives and service bulletins.

According to the mechanic who performed the daily inspection of the helicopter on the morning of the accident flight, he wiped down the tail rotor blades and saw no working metal, cracks in the paint, or evidence of a crack.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KPOC,1014 ft msl	**Distance from Accident Site:**	7 Nautical Miles
Observation Time:	12:47 Local	**Direction from Accident Site:**	108°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	24°C / 13°C
Precipitation and Obscuration:			
Departure Point:	Shafter, CA (MIT)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Corona, CA (AJO)	**Type of Clearance:**	None
Departure Time:	11:38 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	34.123889,-117.898612(est)

The separated section of the tail rotor blade was not recovered. The shank and the other three blades of the tail rotor assembly were shipped to the National Transportation Safety Board's Materials Laboratory for examination. Fractographic examination of the shank revealed the blade had separated perpendicularly to the blade length along a chord plane located about 3 inches from the bottom of the blade. (See figure 2.)

Figure 2. Side view of tail rotor blade shank.

Examination of the tail rotor shank revealed a thumbnail-shaped pattern emanating from one side of the blade that was consistent with fatigue that had propagated through about three-quarters of the blade. No nicks, gouges, damage, or contamination were observed at the fatigue origin. Further examination of the tail rotor blade shank and the other three tail rotor blades revealed that they met the design specifications identified in the engineering drawings.

Administrative Information

Investigator In Charge (IIC):	Salazar, Fabian
Additional Participating Persons:	Robert W Michaelson; RAL FSDO; Riverside, CA
Original Publish Date:	June 1, 2022
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=100235

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 here.