National Transportation Safety Board
Aviation Accident Final Report

Location:	Welsh, Louisiana	**Accident Number:**	CEN20LA286
Date & Time:	July 2, 2020, 10:00 Local	**Registration:**	N7511D
Aircraft:	Robinson R44	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was flying the helicopter to a local area farm to wash and clean the helicopter. During the flight, the low rotor RPM horn activated, and the helicopter sustained a partial loss of engine power. The pilot immediately lowered the collective and applied power to no avail, so he elected to land the helicopter immediately. During the off-field emergency landing, about 3 to 5 ft off the ground, the helicopter started to spin to the right. The pilot applied the left pedal and "rolled off" the throttle to arrest the spin; however, the helicopter continued to spin. The helicopter impacted a flat grass field and came to rest on its left side. The helicopter sustained substantial damage to the fuselage, tailboom, and empennage.

The camshaft and tappet bodies from the engine were examined and it was determined that they were worn and had spalled areas on the camshaft lobe for the No. 1 cylinder exhaust valve and its associated tappet body. Various particles were found in the engine oil filter. The oil suction screen had deterioration and holes in it due to corrosion. These conditions would have allowed debris to bypass the screen.

It is likely the camshaft lobe for the No. 1 cylinder exhaust valve and its associated tappet body sustained corrosion pitting and some of the particles found in the engine oil filter were from these components. The oil suction screen failed from erosion-corrosion, preventing it from performing its function of filtering debris. The degradation and failure of these engine components resulted in a partial loss of engine power while in flight. When the corrosion sequence initiated on these various engine parts could not be determined based on the available evidence.

Probable Cause and Findings

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

A partial loss of engine power while in flight due to corrosion of engine components, which resulted in a loss of control and a subsequent impact with terrain.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Prop/rotor parameters - Attain/maintain not possible
Aircraft	Recip engine power section - Malfunction
Aircraft	Recip engine power section - Fatigue/wear/corrosion
Aircraft	Recip eng oil sys - Malfunction
Aircraft	Recip eng oil sys - Fatigue/wear/corrosion
Environmental issues	High temperature - Effect on equipment

Factual Information

On July 2, 2020, about 1000 central daylight time, a Robinson R44 helicopter, N7511D, was substantially damaged when it was involved in an accident near Welsh, Louisiana. The commercial pilot sustained minor injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 91 personal flight.

The pilot was flying the helicopter, which was equipped with an aerial application spraying system, at the Welsh Airport (6R1), Welsh, Louisiana, for about 20 minutes. During this time, the pilot was performing a chemical tank flush by spraying water, to prepare for an upcoming aerial application job. The pilot completed the chemical tank flush and landed. The pilot then departed to land at a local area farm to wash and clean the helicopter. During the 5-mile flight to the farm, the low rotor RPM horn activated, and the helicopter sustained a partial loss of engine power.

The pilot immediately lowered the collective and applied power with no avail. The pilot decided to land the helicopter immediately. During the off-field emergency landing, about 3 to 5 ft off the ground, the helicopter started to spin to the right. The pilot applied the left pedal and "rolled off" the throttle to arrest the spin, however the helicopter continued to spin. The pilot was unsure how many times the helicopter rotated during the spin cycle. The helicopter impacted a flat grass field and came to rest on its left side. The pilot was able to egress from the helicopter without further incident. The helicopter sustained substantial damage to the fuselage, tailboom, and empennage.

A postaccident airframe and engine examination was conducted. The camshaft and 12 tappet bodies (which all had "DL 26" vibropeened into the side of the head) were removed from the engine for further examination. The camshaft was intact, but the lobe associated with the number 1 cylinder exhaust valve was substantially worn. The contact face on the head of the tappet body from the number 1 cylinder exhaust valve train (1E, with no additional markings observed) was spalled and worn. The remaining camshaft lobes and tappet bodies were intact, free of corrosion pits, and appeared undamaged with normal wear patterns on most of the heads. The 6E tappet body (with marking "AEL-72877/L FAA-PMA N010") had relatively deeper circumferential wear and scuff marks and the 6I tappet body had relatively heavy contact marks on their camshaft lobe contact faces.

During the examination of the engine, various particles were found in the engine oil filter. Examination of these particles found them to contain matter mostly consistent with either organic compounds or combustion products. These particles did exhibit minor amounts of lead and bromine, consistent with combustion products from avgas containing tetraethyllead additives. Other particles were found to be consistent with either commercial aluminum alloys or consistent with copper alloys.

On November 23, 2012, the Australian Civil Aviation Safety Authority issued Airworthiness Bulletin (AWB) 85-014, applicable to all Lycoming and Continental piston engines, to alert

operators and maintainers to the potential flight hazard resulting from undetected valve tappet body / lifter and camshaft lobe wear.

In AWB 85-014, instances of severe spalling damage were noted in tappet bodies of now-superseded Lycoming part number 15B26064 tappet bodies. Additional images in AWB 85-014 show a spalled tappet body part number SL72877 from a Lycoming engine and spalled Continental part number 653877 hydraulic valve lifters. AWB 85-014 further states, "Aside from possible manufacturing problems identified in various manufacturers' service information, tappet body and hydraulic lifter contact surface failures are commonly attributed to corrosion pitting. ...Such corrosion commonly results from infrequent flight activity, particularly in moisture laden environments, without adequate engine preservation." AWB 85-014 further notes the importance of diligently inspecting the oil filter paper at each oil change for fine metallic particles that can be generated from excessive camshaft lobe wear and tappet face spalling.

The engine oil suction screen, which consisted of a perforated cylindrical tube, with small concave webs of interconnected material, was removed for further examination. Some of the fractured webs exhibited areas of localized deformation or necking adjacent to their fractures. Others, though, exhibited a flatter or jagged fracture appearance. Many of the webs and material near the circular holes exhibited areas of thinning consistent with eroded material.

On May 25, 2017, Lycoming Engines issued Service Bulletin (SB) 480F applicable to all Lycoming direct drive engines, to alert operators and maintainers on procedures on oil servicing, progressive inspection of metallic solids from filtered oil, guidelines for possible sources of metallic solids, and recommended corrective action. This document states that the oil suction screen is to be cleaned and inspected every 50 hours of engine operation or every 4 months (whichever occurs first). This document further states that:

Oil change intervals must not exceed 4 months if the aircraft has not been flown for at least 25 hours in a 4-month period. More frequent oil changes are recommended if the engine has been exposed to volcanic ash, particulate, sand, dust debris, extreme weather conditions, or salt spray in coastal environments.

According to the pilot, the helicopter was recently purchased in mid-May 2020. The helicopter had 8.5 hours of flight time since the annual examination was completed on June 9, 2020. The collective-activated hour meter (that records collective-up flight time and does not include engine warm up and cool down times) showed 1,843.3 hours at the time of the accident. A review of the helicopter's maintenance records showed that the helicopter had flown 11.3 hours during the previous year and the helicopter was based in Louisiana and utilized by a 14 *CFR* Part 137 aerial application operator. According to Federal Aviation Administration (FAA) Advisory Circular (AC) 43-4B Corrosion Control for Aircraft, Louisiana is classified as an area of severe for the corrosive attack on aircraft structures and engine materials.

This document discusses the inspection, identification, and treatment of corrosion and states in part:

Corrosion inspection frequency, corrosion identification, and especially corrosion treatment continues to be the responsibility of the operator. These inspections should be accomplished per this AC, the manufacturer's recommendations, or the operator's own maintenance program. The procedures in this AC are an acceptable means, but not the only acceptable means, of corrosion treatment. The information in this AC is applicable to aircraft for which the manufacturer has not published corrosion control information. Where the airframe or engine manufacturer has published a recommended corrosion inspection schedule and treatment program, the applicable program must take precedence over the recommendation of this AC.

Compliance with the Australian Civil Aviation Safety Authority AWB 85-014, Lycoming Engines SB 480F, FAA AC 43-4B Corrosion Control for Aircraft, is not required by the FAA for 14 *CFR* Part 91 or 14 *CFR* Part 137 operations.

History of Flight

Enroute-cruise	Powerplant sys/comp malf/fail
Enroute-cruise	Loss of engine power (partial) (Defining event)
Enroute-cruise	Emergency descent initiated
Emergency descent	Off-field or emergency landing
Emergency descent	Loss of control in flight
Landing-flare/touchdown	Collision during takeoff/land

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	44,Male
Airplane Rating(s):	Single-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):	Airplane single-engine; Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	June 1, 2020
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 1, 2020
Flight Time:	(Estimated) 2600 hours (Total, all aircraft), 1800 hours (Total, this make and model), 2000 hours (Pilot In Command, all aircraft), 150 hours (Last 90 days, all aircraft), 75 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Robinson	**Registration:**	N7511D
Model/Series:	R44 Undesignat	**Aircraft Category:**	Helicopter
Year of Manufacture:	2002	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1252
Landing Gear Type:	N/A; Skid	**Seats:**	4
Date/Type of Last Inspection:	June 9, 2020 Annual	**Certified Max Gross Wt.:**	2401 lbs
Time Since Last Inspection:	8.5 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1834.8 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming Engines
ELT:	C91A installed, not activated	**Engine Model/Series:**	O-540-F1B5
Registered Owner:		**Rated Power:**	235 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None
Operator Does Business As:	None	**Operator Designator Code:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KLCH,9 ft msl	**Distance from Accident Site:**	21 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	244°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 2200 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	280°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	29°C / 26°C
Precipitation and Obscuration:	Moderate - None - Haze		
Departure Point:	Welsh, LA (6R1)	**Type of Flight Plan Filed:**	VFR
Destination:	Welsh, LA	**Type of Clearance:**	None
Departure Time:	10:00 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:**	30.280049,-92.855578(est)

Administrative Information

Investigator In Charge (IIC):	Liedler, Courtney		
Additional Participating Persons:	Harold Aycock; FAA Baton Rouge FSDO; Baton Rouge, LA Thom Webster; Robinson Helicopter Company; Torrance, CA Troy Helgeson; Lycoming Engines; Williamsport, PA		
Original Publish Date:	March 18, 2022	**Investigation Class:**	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=101611		