Aviation Investigation Final Report

Location:	Louisa, Virginia	**Accident Number:**	ERA14LA193
Date & Time:	April 11, 2014, 18:00 Local	**Registration:**	N156SA
Aircraft:	Cessna U206G	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	1 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Other work use		

Analysis

The pilot reported that, during the flight before the accident flight, he noted that the oil pressure was slowly fluctuating, so he chose to change the engine oil and filter. Airport personnel provided the supplies and observed the pilot perform the maintenance. The pilot removed and then opened the oil filter and "an excessive amount of metal" was observed. The pilot's mechanic had replaced four cylinders about 4 months earlier, and the pilot assumed that the metal was chrome from the overhauled cylinders and was the result of "break-in." Although airport personnel expressed concerns about the metallic debris, the pilot chose to finish the oil change and continue with his next flight. About 30 minutes after departure, the engine made "a strange sound," and it lost power about 20 seconds later. The pilot conducted a forced landing, and the airplane landed hard in an open field, which resulted in structural damage to the airframe.

Disassembly and examination of the engine revealed that the engine cylinder through bolts on the Nos. 1 through 5 cylinders were significantly undertorqued. The crankshaft was fractured near the No. 2 main bearing. The areas adjacent to the No. 2 bearing on the inside of the engine case exhibited rotational scoring, indicating that bearing movement had occurred before the crankshaft failure. The Nos. 1 and 3 main bearings also exhibited evidence that bearing movement had occurred before the engine failure. It is likely that the mechanic did not properly torque the through bolts when he replaced the four cylinders, which allowed the bearings to move and led to the eventual failure of the crankshaft.

Probable Cause and Findings

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

The pilot's decision to continue operation of the airplane with known mechanical issues (fluctuating oil pressure and metal in the oil filter), which was the result of undertorqued cylinder through bolts. Contributing to the accident was the mechanic's failure to properly torque the engine through bolts, which led to the eventual failure of the crankshaft.

Findings

Aircraft	Recip engine power section - Incorrect service/maintenance
Personnel issues	Replacement - Maintenance personnel
Personnel issues	Understanding/comprehension - Pilot
Personnel issues	Decision making/judgment - Pilot

Factual Information

History of Flight

Enroute-cruise	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing
Landing-flare/touchdown	Hard landing

On April 11, 2014, about 1800 eastern daylight time (EDT), a Cessna U206G, N156SA, force landed following a total loss of engine power near Louisa, Virginia. The commercial pilot received serious injuries, one passenger received minor injuries, and the airplane was substantially damaged. The airplane was operated by Laser Mapping Specialists, Inc. under the provisions of 14 Code of Federal Regulations Part 91. Day, visual meteorological conditions prevailed for the aerial laser mapping flight, and no flight plan was filed. The flight originated at Louisa County Airport (LKU) about 1730.

The pilot reported the following. During a flight prior to the accident, the engine oil pressure slowly fluctuated up and down, but within the normal range. He elected to change the engine oil and noted "a great deal of chrome" inside the oil filter. He placed a magnet inside the metallic particles and found no ferrous material. Four cylinders were replaced in December, 2013, so he attributed the particles in the oil to "break-in." After consulting the pilot's operating handbook, he believed that the oil pressure fluctuations were due to a gauge problem or a clogged pressure relief valve. He elected to continue with his planned flight. After routine ground operations, the flight departed. About 30-40 minutes into the flight, the engine started making "a strange sound" and then "quit" about 20 seconds later. He force landed the airplane in an open field. The airplane landed hard and came to rest, resulting in structural damage to the airframe.

According to personnel at LKU, prior to the accident flight, the pilot requested supplies for an oil and filter change following a reported anomaly with the airplane's oil pressure gauge. The pilot performed the engine oil and filter change himself. The pilot opened the oil filter and "an excessive amount of metal" was observed inside the filter. The local airport personnel expressed their concerns about the metallic debris, and the pilot stated that he would contact his personal mechanic and obtain his opinion and advice. The pilot completed the oil change and prepared to depart the airport. After topping off the fuel tanks, the pilot and passenger departed on runway 27.

A review of the engine maintenance records revealed that, on December 20, 2013, the numbers 2, 3, 4, and 5 cylinders were removed and replaced with overhauled cylinders provided by the customer. The cylinders were replaced due to low compression.

Following the accident, the engine was removed and shipped to the manufacturer's facility for examination. Prior to disassembly, it was noted that, after rotation of the propeller flange, internal continuity was not established to the rear accessory pad. The crankshaft would only rotate through 90 degrees of travel.

Disassembly of the engine revealed that the breakaway torque values of the through bolts at the cylinder flanges were at various values; however, only the torque bolts associated with the number 6 cylinder were at or above the manufacturer's recommended torque value. The torque values in the loosen direction for the numbers 1-5 top through bolts ranged from 534 to 705 inch-pounds (790 to 810 inch-pounds recommended). The torque values in the loosen direction for the numbers 1-5 bottom through bolts ranged from 458 to 675 inch-pounds (790 to 810 inch-pounds recommended).

The engine oil pan and oil cooler were removed from the engine. The oil pan revealed metal particulates of various sizes and the oil cooler revealed metal particulates inside the unit. The engine exhibited substantial internal damage in the area of the number 2 main bearing. The crankshaft was observed fractured in the immediate vicinity of the number 2 main bearing. According to Continental Motors personnel, a crankshaft failure associated with a bearing shift will usually fail in fatigue and this crankshaft failure exhibited failure signatures consistent with fatigue. The adjacent areas around the number 2 main bearing exhibited scoring on the inside of the engine case, and the numbers 1 and 3 main bearings also exhibited evidence of bearing movement prior to the engine failure.

Pilot Information

Certificate:	Commercial; Private	**Age:**	60
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	April 26, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	October 15, 2012
Flight Time:	2795 hours (Total, all aircraft), 500 hours (Total, this make and model), 2664 hours (Pilot In Command, all aircraft), 105 hours (Last 90 days, all aircraft), 8 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N156SA
Model/Series:	U206G	**Aircraft Category:**	Airplane
Year of Manufacture:	1980	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	U20605670
Landing Gear Type:	Tricycle	**Seats:**	3
Date/Type of Last Inspection:	December 21, 2013 Annual	**Certified Max Gross Wt.:**	3612 lbs
Time Since Last Inspection:	110 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3370 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-520 Series
Registered Owner:	LASER MAPPING SPECIALISTS INC	**Rated Power:**	285
Operator:	LASER MAPPING SPECIALISTS INC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LKU,492 ft msl	**Distance from Accident Site:**	6 Nautical Miles
Observation Time:	17:55 Local	**Direction from Accident Site:**	290°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots / 15 knots	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.94 inches Hg	**Temperature/Dew Point:**	26°C / 4°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Louisa, VA (LKU)	**Type of Flight Plan Filed:**	None
Destination:	Louisa, VA (LKU)	**Type of Clearance:**	None
Departure Time:	17:30 Local	**Type of Airspace:**	

Airport Information

Airport:	Louisa County LKU	**Runway Surface Type:**	
Airport Elevation:	493 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 1 Minor	**Latitude, Longitude:**	38.048053,-78.093887(est)

Administrative Information

Investigator In Charge (IIC):	Hicks, Ralph
Additional Participating Persons:	Jay Venable; FAA/FSDO; Richmond, VA Ernie Hall; Textron Aviation; Wichita, KS Kurt Gibson; Continental Motors; Mobile, AL
Original Publish Date:	April 27, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89048