Continental Motors

ENGINE FIELD INSPECTION REPORT

ENGINE MODEL	IO-520-L46B
ENGINE SERIAL	1000795
AIRCRAFT MAKE & MODEL	Cessna 210L
AIRCRAFT SERIAL NUMBER	21061454
AIRCRAFT REGISTRATION	N732EJ
FILE NUMBER	13-386

NAME	SIGNATURE	DATE
Nicole L. Charnon		03/06/2014

GENERAL INFORMATION

EXAMINATION		ACCIDENT DATA	
DATE	02/19/2014	**NTSB ACCIDENT #**	ERA14FA120
FACILITY	Atlanta Air Recovery & Storage	**NTSB INVESTIGATOR**	Timothy Monville
ADDRESS	[redacted]	**FAA INVESTIGATOR**	Robert Bullock
CITY	Griffin	**LAW ENFORCEMENT**	Jefferson County Sheriff
STATE & ZIP	Georgia [redacted]	**CORONER or MEDICAL EXAMINER**	Jefferson County Coroner - Bill Yates

ENGINE INFORMATION

MAKE	Continental Motors
MODEL	IO-520-L46B
SERIAL NUMBER	1000795
ENGINE POSITION	Single-Engine
TOTAL TIME	Unknown
TIME SOH	Unknown
TIME SLI	Unknown
BUILD DATE	07/23/2009
IN SERVICE DATE	Unknown

AIRCRAFT / ACCIDENT INFORMATION

AIRCRAFT MAKE	Cessna
AIRCRAFT MODEL	210L
AIRCRAFT SERIAL #	21061454
REGISTRATION #	N732EJ
ACCIDENT DATE	02/14/2014
ACCIDENT LOCATION	Clay, Alabama

Significant logbook information:

At the time of this report's writing, the aircraft maintenance records were not reviewed. The NTSB investigator-in-charge (IIC) requested copies of aircraft and engine records and will provide them to the party members at a later date.

Report Summary: Search Code: 15-12-68

The engine sustained impact-related damage that fractured the crankshaft aft of the propeller flange and deformed the crankcase, cylinders, and oil sump, all of which precluded crankshaft rotation. However, examination of identified components did not reveal any pre-existing anomalies that would have prevented normal engine operation and production of rated power.

Disposition of engine following exam:
NTSB IIC retained wreckage until completion of all examinations.

INSPECTION WITNESSES			
NAME	Nicole L. Charnon	**NAME**	Timothy Monville
ADDRESS	Mobile, Alabama	**ADDRESS**	Ashburn, Virginia
ORGANIZATION	Continental Motors	**ORGANIZATION**	NTSB – Eastern Region
PHONE	[redacted]	**PHONE**	[redacted]
NAME	Steve Miller	**NAME**	Robert Bullock
ADDRESS	Wichita, Kansas	**ADDRESS**	Vestavia Hills, Alabama
ORGANIZATION	Cessna Aircraft Company	**ORGANIZATION**	FAA – Birmingham FSDO
PHONE	[redacted]	**PHONE**	[redacted]

EXTERNAL INSPECTION OF ENGINE

The engine came to rest in a deep impact crater in an upright position with its left side low. The propeller was separated from the crankshaft aft of the propeller flange. The separation featured rough, angular shear lips. The propeller came to rest approximately 6 feet from the engine at the leading edge of the impact crater. All of the engine's exterior components were separated from the engine with the exception of the oil pump housing, the starter adapter housing, portions of the left and right exhaust risers, and one fuel injector line. Portions of all but the #2, #4, #5, and #6 bottom sparkplugs remained attached to their cylinders. The #2 and #6 rocker covers were destroyed and the #4 rocker cover was fractured. The #6 cylinder head was fractured, the barrel was dented, and the rocker arms and pushrods were missing.

ENGINE TEARDOWN AND COMPONENT EXAMINATION

EXHAUST SYSTEM	
Condition:	The exhaust risers remained attached to the engine, but sustained deformation damage that flattened the tubes. The exhaust manifolds were also flattened and located within the debris field. Only one exhaust muffler was located at the accident site and it too sustained deformation damage.

INDUCTION SYSTEM	
Condition:	The induction system was destroyed. Portions of intake manifolds were identified at the accident site. The intake filter sustained deformation damage, but its foam filter remained in place. The throttle body was fractured and the throttle lever remained attached to the shaft of the throttle valve.

IGNITION SYSTEM

RIGHT MAGNETO	Manufacturer: Continental Motors S6RN-1225	P/N: BL-349350-5	S/N: F09FA235R
Condition:	Both magnetos were separated from the engine and all ignition leads were separated from the magnetos. The magneto housings were fractured, the distributor caps were separated, and some of the internal components were missing. Functional testing was not possible. One data plate was observed on the remains of a magneto housing. The part number and serial number of that magneto matched the numbers for what was listed as the right magneto on Continental Motors' Engine Component Information Sheet for the accident engine.		

LEFT MAGNETO	Manufacturer: Unknown	P/N: Unknown	S/N: Unknown
Condition:	Both magnetos were separated from the engine and all ignition leads were separated from the magnetos. The magneto housings were fractured, the distributor caps were separated, and some of the internal components were missing. Functional testing was not possible.		

IGNITION HARNESS	Manufacturer: Unknown	P/N: Unknown	S/N: Unknown
Condition:	The ignition harnesses were destroyed and only portions were observed at the accident site and during the engine examination.		

SPARK PLUGS	Manufacturer: Tempest	P/N: URHB32E
Condition:	The #2, #4, #5, and #6 bottom sparkplugs were separated from their respective cylinders. Some of the sparkplugs that remained attached to the engine sustained deformation damage or were fractured. The top sparkplugs were removed and examined. The sparkplugs displayed a normal worn condition and no signs of lead or carbon fouling. The #2 and #5 top sparkplugs contained some organic debris on the electrodes and the #6 top sparkplug was rusted.	


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FUEL SYSTEM

FUEL PUMP	Manufacturer: Unknown	P/N: Unknown	S/N: Unknown
Condition:	The fuel pump was fractured with only the fuel pump adapter remaining attached to the engine. The adapter was fractured and the sheered remains of the fuel pump assembly bolts remained with the adapter. The fuel pump drive coupling remained inserted in the drive gear. Removal of the drive coupling from the adapter revealed that it was intact but bent, with fresh scrape marks visible on one end of the drive. The remaining fuel pump components were not observed at the accident site and were not located within the retrieved components at the salvage facility.		

FUEL MANIFOLD VALVE	Manufacturer: Continental Motors	P/N: R-631351-17A6	S/N: C09GA145R

Condition:	The fuel manifold was separated from the engine and all of the fuel injector lines were separated from the manifold body. The manifold valve cap remained attached to the housing. Three of the four screws securing the housing remained intact but were deformed. The forth screw was sheered. The manifold valve was disassembled. The diaphragm was intact and pliable. The plunger remained secured to the diaphragm and the spring was intact and in place. Removal of the diaphragm revealed that a screen that was in place, intact, and free from blockage.




FUEL NOZZLES AND LINES	Manufacturer: Continental Motors					
Position	#1	#3	#5	#2	#4	#6
Size (S/N)	047 (6250)	047 (1250)	047 (4250)	047 (2250)	047 (5250)	047 (3250)
Condition:	All of the fuel injector nozzles were fractured, except the #3, and all sustained bending deformation. Light was observed through all of the nozzles with the exception of the #3 and #6, which were bent to a greater degree. No pre-existing anomalies were noted with the remains of the nozzles.					


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1 2 3 4 5 6


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THROTTLE BODY METERING UNIT	Manufacturer: Continental Motors	P/N: R-629703-2A3	S/N: A09FA096R

Condition:	The throttle body was fractured and the metering unit was separated. The throttle valve remained intact within the fractured throttle body housing and the throttle control lever remained attached, though it was bent. The mixture control lever remained attached to the mixture control shaft, but the mixture shaft and cam were partially pulled out from the housing, past its retaining screw. All of the fittings were fractured from the metering unit housing. The inlet fuel screen was removed and organic material was found inside the fuel screen, clumped on one side. The organic material was consistent with that found at the accident site. The fuel metering unit was disassembled. The fuel metering plug was intact and its o-rings were in place. No anomalies were noted with the mixture and throttle cams.






LUBRICATION SYSTEM

OIL PUMP	
Condition:	The oil pump housing remained intact and attached to the backside of the engine. The pump was removed and the gears were intact and the oil pump walls were free from contaminants. There was light scoring on the oil pump walls. A ½-inch arch of material was shaved from the housing wall in an area adjacent to the drive gear. Residual oil was found in the oil pump housing.

OIL SUMP	
Condition:	The oil sump was fractured and deformed around the bottom side of the engine.

OIL FILTER	Manufacturer: Tempest	P/N: A48109
Condition:	The oil filter was separated from the oil filter adapter and sustained deformation damage. The oil filter was cut open to remove the pleated paper filter element. There were no visible signs of contamination or metallic particulates within the pleats.	

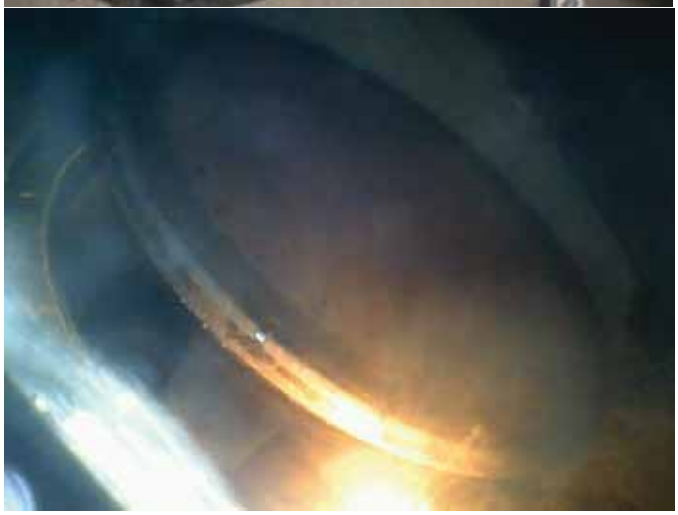
OIL PICK-UP TUBE & SCREEN	
Condition:	The oil pickup tube and screen were separated from the bottom side of the engine. The tube and screen sustained deformation damage. No pre-existing anomalies were noted.

OIL COOLER	Manufacturer: Niagara	P/N: Unknown	S/N: Unknown
Condition:	The oil cooler and oil cooler adapter were separated from the engine. The oil cooler was deformed.		

CYLINDERS

Note: All photos listed under each cylinder represent the external image of the cylinder, followed by the piston, exhaust valve, and intake valve, in that order, unless otherwise noted.

CYLINDER #1	P/N: Unknown	S/N: Unknown	Head Date: Unknown
Work Orders:	Unknown		
Condition:	Cylinder #1 remained attached to the engine and the rocker cover was in place. Numerous cooling fins were cracked and deformed. Removal of the rocker cover revealed that the head was cracked through the pushrod entry holes. The crack was irregular in shape and jagged. The cylinder was borescoped and no anomalies were noted with the piston, barrel, or valves.		



CYLINDER #3	P/N: ECi AEC65385	S/N: 83684-15	Head Date: Unknown
Work Orders:	H7399H, A346117		
Condition:	The #3 cylinder remained attached to the crankcase and was intact. Numerous cooling fins were cracked and deformed. No pre-accident external or internal anomalies were noted with the cylinder, piston, barrel, or valves.		

CYLINDER #5	P/N: ECi AEC65385	S/N: 83725-07	Head Date: Unknown
Work Orders:	H7399H, A321118		
Condition:	The #5 cylinder remained attached to the crankcase and was intact. Numerous cooling fins were cracked and deformed. No pre-accident external or internal anomalies were noted with the cylinder, piston, barrel, or valves.		

CYLINDER #2	P/N: ECi AEC65385	S/N: 83684-1?	Head Date: Unknown
Work Orders:	[H]7399H, A321118		
Condition:	The #2 cylinder remained attached to the crankcase. Numerous cooling fins were cracked and deformed. The rocker cover was destroyed. The cylinder was borescoped and no anomalies were noted with the piston, barrel, or valves.		

CYLINDER #4	P/N: ECi AEC65385	S/N: 83617-30	Head Date: Unknown
Work Orders:	Not legible		
Condition:	The #4 cylinder remained attached to the crankcase. Numerous cooling fins were cracked and deformed. The rocker cover was fractured and dirt was located in the rocker area. No pre-accident external or internal anomalies were noted with the cylinder, barrel, piston or valves.		

CYLINDER #6	P/N: ECi AEC65385	S/N: Unknown	Head Date: Unknown
Work Orders:	Unknown		
Condition:	The #6 cylinder was fractured and the rocker arms were missing. The exhaust valve stem was bent and the guide was fractured and displaced from the cylinder head. The exhaust valve springs remained with the valve. The intake rocker shaft remained attached to the cylinder. The cylinder barrel was depressed inward on the topside. A borescope inspection of the cylinder revealed dirt in the cylinder barrel. No pre-accident anomalies were noted with the piston, or valves.		

CRANKCASE ASSEMBLY

CRANKCASE	Casting Number:	1-3-5: 653961	2-4-6: 653960	S/N: Unknown
Condition:	The crankcase halves remained attached, but both were fractured on the front and bottom sections, exposing some of the internal engine components. No pre-accident anomalies were noted with the crankcase.			

CRANKSHAFT ASSEMBLY

CRANKSHAFT	Forging Number: Unknown	S/N: Unknown	Heat code: Unknown
Condition:	The crankshaft was fractured aft of the propeller mounting flange in the area where the crankshaft enters the crankcase. The fracture surfaces were irregular in shape and displayed 45° shear lips. Examination of the crankshaft through the bottom of the engine did not reveal any pre-accident anomalies with the crankshaft. The crankshaft gear remained attached and secured to the crankshaft.		

INTERNAL TIMING	
Condition:	The internal engine timing was correct.

CONNECTING RODS	P/N: Unknown	Forging or Serial Number: Unknown
Condition:	The connecting rods were examined through the bottom of the engine. Using a lighted borescope it appeared that all six connecting rods remained attached to their respective connecting rod journal and piston pins. There was no sign of operational or heat distress on any of the connecting rods (the photos below are of the connecting rods #1 through #6, in that order).	

CAMSHAFT

CAMSHAFT	P/N: Unknown	S/N: Unknown
Condition:	The camshaft remained intact but sustained impact damage that separated the governor drive gear. No pre-impact anomalies were noted with the camshaft or the lobes.	

LIFTERS	
Condition:	The lifters remained in place adjacent to their respective lobes. No pre-accident anomalies were noted with the lifters.

ACCESSORIES

STARTER	Manufacturer: Kelly Aerospace	P/N: Not Legible	S/N: J081533
Condition:	The starter motor was separated from the starter adapter. There were no signs of pre-accident anomalies with the starter motor.		

STARTER ADAPTER	P/N: Unknown
Condition:	The starter adapter remained attached to the backside of the engine, but sustained impact damage to the housing, which fractured a section. The internal gears were visible through the fractured housing. Removal of the starter adapter from the backside of the engine revealed no signs of operational distress with the gears.

ALT/GEN #1	Manufacturer: Unknown	P/N: Unknown	S/N: Unknown
Condition:	The alternator was separated from the engine and fractured.		

VACUUM PUMP	Manufacturer: RAPCO	P/N: RAP216CW	S/N: 828531
Condition:	The vacuum pump was separated from the engine and the coupling was not observed. The vacuum pump was photographed and shipped to the manufacturer's facility for further examination under federal supervision.		

PROPELLER

PROPELLER GOVERNOR	Manufacturer: Unknown	P/N: Unknown	S/N: Unknown
Condition:	The propeller governor was separated from the engine and was not observed at the accident site nor was it identified at the salvage facility.		

PROPELLER	Manufacturer: Hartzell	P/N: HC-J3YF-1RF	S/N: JN306B
Blade 1 S/N:	Unknown		
Blade 2 S/N:	Unknown		
Blade 3 S/N:	Unknown		
Condition:	The propeller remained bolted to the propeller flange, but the crankshaft was fractured aft of the propeller flange. The propeller came to rest at the leading edge of the impact crater with the propeller spinner displaced aft around the propeller hub. The propeller blades remained attached to the hub with one blade rotated 180 degrees from its normal position. The outboard half of the rotated blade was separated into two pieces, which were located at the accident site. Assembling the separated pieces revealed that the rotated blade sustained heavy s-bending and leading edge gouging. Another blade was missing its tip, which was later located within the impact crater. All blades displayed heavy gouging on the camber side and tip curling. In addition, numerous large pieces of wood were located at the accident site that displayed a fresh angular cut. Some of the cut surfaces contained a gray paint transfer that was similar in color to the gray paint on the camber side of the blade.