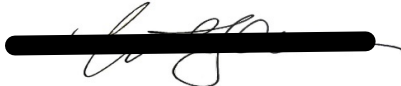




Continental Motors

ENGINE EXAMINATION REPORT

ENGINE MODEL	IO-520-M1B
ENGINE SERIAL NUMBER	1002309
AIRCRAFT MAKE & MODEL	Cessna 310R
AIRCRAFT SERIAL NUMBER	310R0506
AIRCRAFT REGISTRATION	N87297
FILE NUMBER	16-697

NAME	SIGNATURE	DATE
Nicole L. Charnon		07/12/2017

ENGINE EXAMINATION REPORT**FILE NUMBER:**

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ENGINE S/N:

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PAGE 2 of 33**GENERAL INFORMATION**

EXAMINATION		ACCIDENT DATA	
DATE	07/06/2017	NTSB ACCIDENT #	WPR17FA136
FACILITY	South West Aircraft Transportation & Recovery	NTSB INVESTIGATOR	Andrew Swick
ADDRESS	Chino Airport Hangar 47 Chino, California 91710	FAA INVESTIGATOR	Sean Houlihan
		ACCIDENT DATE	06/30/2017
		ACCIDENT LOCATION	Santa Ana, California

ENGINE INFORMATION

ENGINE POSITION	Right Engine
TOTAL TIME	748.4 hours
TIME SOH	N/A
TYPE & TIME SLI	73.7 hours since annual inspection
BUILD DATE	05/26/2010
IN SERVICE DATE	08/17/2017

Significant logbook information:

Review of the build and maintenance records revealed that the engine was built on May 26, 2010. It was installed on the accident airplane on August 17, 2010 at a Hobbs time of 742.1 hours. The engine underwent a series of oil changes and annual inspections, the last of which took place on December 21, 2016 at a Hobbs time of 1,416.8 hours. During the last annual inspection, the magnetos were removed, overhauled, and reinstalled for the 500-hour inspection. At the time of the examination, the Hobbs meter registered 1,490.5 hours (748.4 hours since installation).

Report Summary:

Search Code(s):

15-12-68

The engine sustained impact-related damage to the #5 cylinder and thermal damage to the flexible fuel lines and ignition leads. However, examination of the fuel system components revealed no pre-accident anomalies. The ignition system revealed no pre-accident anomalies, though the magnetos were sent for functional testing. Examination of the core engine components revealed no signs of operational distress with crankshaft and camshaft continuity being confirmed at each cylinder through a thumb compression tests. Borescope examination of the cylinders revealed no pre-accident anomalies with the barrels, pistons, valves and valve seats.

Disposition of engine following exam:

The magnetos were sent to Continental Motors where they were tested/examined in more detail under the supervision of a NTSB investigator (see Appendix A of this report for the findings from that examination). The engine data monitor (JPI 760) was sent to an NTSB investigator for data download. The propeller will be examined by the manufacturer under the supervision of the NTSB or FAA at a later date.

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INSPECTION WITNESSES			
NAME	Nicole L. Charnon	NAME	Andrew Swick
ADDRESS	Washington, DC	ADDRESS	Phoenix, AZ
ORGANIZATION	Continental Motors	ORGANIZATION	NTSB – Western Region
PHONE	[REDACTED]	PHONE	[REDACTED]
NAME	Kenneth Collie	NAME	Sean Houlihan
ADDRESS	Riverside, CA	ADDRESS	Riverside, CA
ORGANIZATION	FAA – Riverside FSDO	ORGANIZATION	FAA – Riverside FSDO
PHONE	[REDACTED]	PHONE	[REDACTED]
NAME	Andrew Hall	NAME	
ADDRESS	Wichita, KS	ADDRESS	
ORGANIZATION	Textron Aviation	ORGANIZATION	
PHONE	[REDACTED]	PHONE	

EXTERNAL ENGINE CONDITION

The engine was separated from the engine nacelle and was lying on the hangar floor. Residual oil seeped from punctures in the oil sump. The three-bladed propeller remained attached to the crankshaft and all three propeller blades remained attached to the hub, though one blade tip was separated about eight inches outboard of the deicing boot.

The #5 cylinder sustained impact damage that fractured the cylinder head resulting the separation of the rocker assemblies and pushrod tubes/pushrods. The left magneto was separated from the topside of the engine and its mounting flange was fractured under the attaching hardware. The magneto remained attached to the engine via the ignition harness. The backside of the engine sustained thermal damage that compromised the fuel system. The low pressure relief valve screw on the engine-driven fuel pump was bent and the fuel inlet fitting was fractured.

There were no external pre-accident anomalies noted with the engine.

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ENGINE COMPONENT EXAMINATION

EXHAUST SYSTEM

Condition:

The exhaust system remained intact with no pre-accident anomalies noted.



INDUCTION SYSTEM

Condition:

The intake filter sustained impact and thermal damage, but no blockages were evident. The throttle body was separated from the intake wye plenum and remained attached to the engine nacelle. The left intake elbow was impact damaged and deformed. No pre-accident anomalies were noted with the induction system.



ENGINE EXAMINATION REPORT

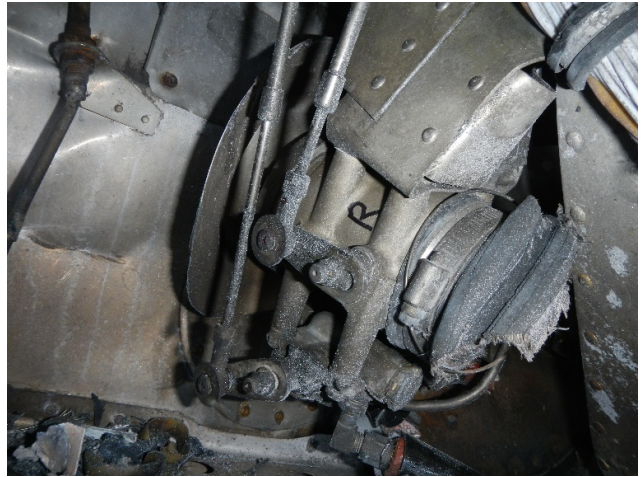
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IGNITION SYSTEM

LEFT MAGNETO	Manufacturer: Continental Motors	P/N: S6RSC-205	S/N: E10BA149R
Condition:	The left magneto was separated from its mounting pad and its mounting flange was fractured in the area of the attaching hardware. The magneto remained attached to the engine via the ignition harness. The vent cover was removed from the housing and the distributor gear was intact and rotated during drive shaft rotation. No pre-accident anomalies were noted and the magneto was retained for further testing (see Appendix A of this report for more details).		



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RIGHT MAGNETO

Manufacturer: Continental
Motors

P/N: S6RSC-205

S/N: Not Legible

Condition: The magneto remained secured to the topside of the engine and manual manipulation of the housing did not result in any slipping or rotation of the magneto on its mounting pad. It was soot covered and the vent plug was partially melted. The ignition harness remained in place on the magneto. The vent cover was removed from the housing and the distributor gear was intact and rotated during crankshaft rotation, with no pre-accident anomalies noted. The magneto was removed from the engine and its drive shaft was manually rotated with no binding noted. The magneto was retained for further testing (see Appendix A of this report for more details).



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IGNITION HARNESS

Manufacturer: Continental
Motors

P/N: Not Legible

S/N: Not Legible

Condition: The ignition harness remained attached to both magnetos and each lead remained attached to their respective ignition harness. The right side leads were thermally damaged beyond functional testing. No pre-accident anomalies were noted with the ignition harness.



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SPARK PLUGS

Manufacturer: Tempest

P/N: URHB32E

Condition: The sparkplugs remained secured to their respective cylinders and each ignition terminal remained attached to its sparkplug. The top sparkplugs were removed from the cylinders and each displayed a normal worn condition with no evidence of carbon or lead fouling. The bottom sparkplugs were examined/photographed via lighted borescope.



1T



1B



2T



2B

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3T



3B



4T



4B



5T



5B

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6T



6B

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FUEL SYSTEM

FUEL PUMP

Manufacturer: Continental
Motors

P/N: R-646212-27A1

S/N: B10CA240R

Condition: The engine-driven fuel pump remained secured to the backside of the engine and all of the fuel lines remained secured to their respective fittings, though the fuel inlet fitting was fractured. The pump was removed and the drive coupling was intact. The pump could not be functionally tested due to the thermal damage, but disassembly revealed that the pump vanes were intact and no pre-accident anomalies were observed with the pump's internal components.



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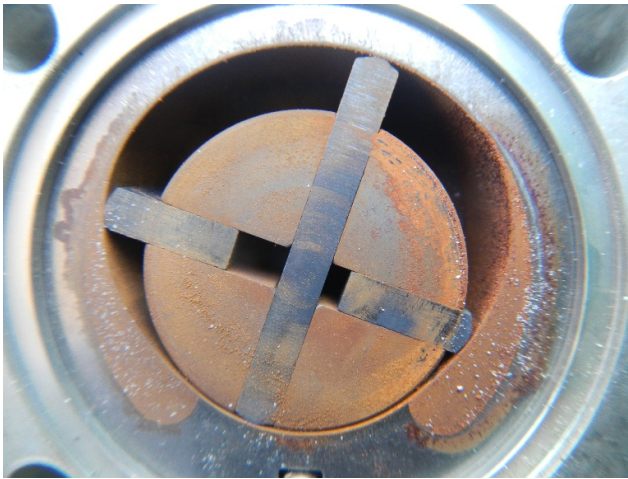
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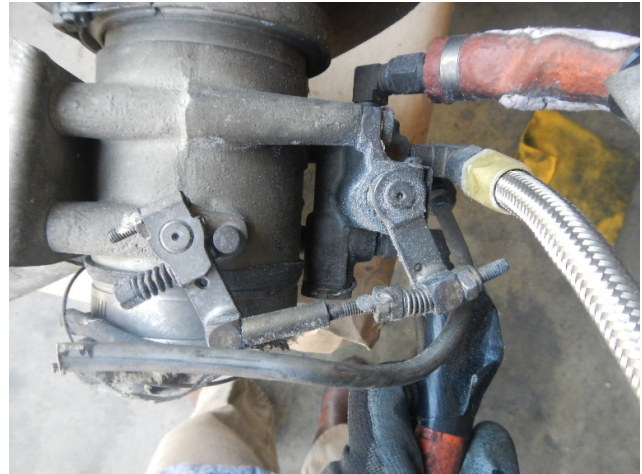
THROTTLE BODY METERING UNIT

Manufacturer: Continental
Motors

P/N: R-657018A2

S/N: A10CA230R

Condition: The throttle body/fuel metering unit was separated from the wye plenum and remained secured to the engine nacelle via the throttle and mixture control cables. The fuel lines leading to and from the fuel metering unit remained secured to their respective fittings, though the lines were cut by recovery personnel. Manual manipulation of the mixture and throttle control levers resulted in a coinciding movement in their control cams. The interconnect between the throttle valve shaft and the throttle metering cam was distorted. The fuel inlet screen was removed and no obstructions were observed; however, there was some debris noted on the edges of the screen.



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FUEL MANIFOLD VALVE

Manufacturer: Continental Motors

P/N: R-641032-21A2

S/N: C09LA020B

Condition: The fuel manifold valve remained secured to the topside of the engine and all lines to and from the manifold valve remained secured in place. The cap was removed and the diaphragm was intact and the plunger was in place. The screen was clear.



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FUEL NOZZLES AND LINES

Manufacturer: GAMI

Condition: The fuel injector nozzles remained secured to their respective cylinders and the fuel injection lines remained intact. The nozzles were removed and there were no obstructions or blockages noted in any of the nozzles.



1



3

ENGINE EXAMINATION REPORT

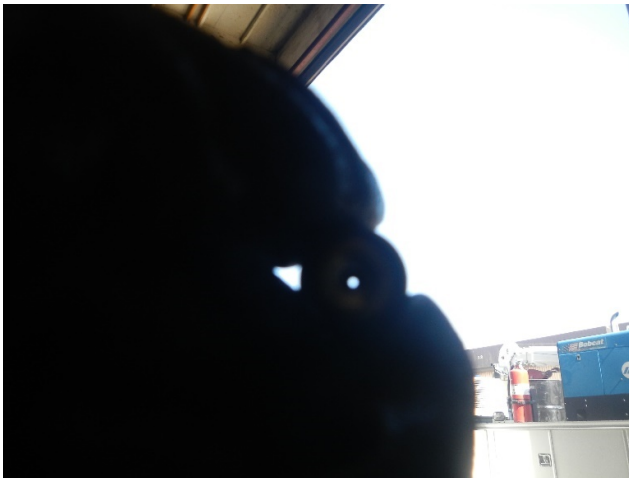
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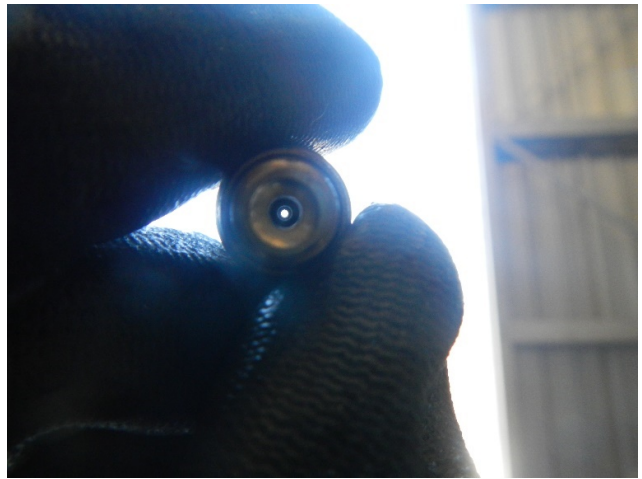
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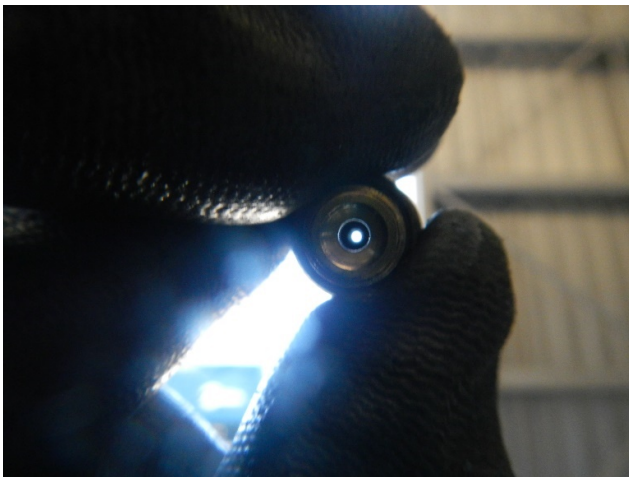
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5



2



4



6

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LUBRICATION SYSTEM

OIL SUMP

Condition: The oil sump remained secured to the bottom side of the engine and sustained deformation damage and punctures. The oil drain plug remained in place with no pre-accident anomalies noted.



OIL PICKUP TUBE & SCREEN

Condition: The oil pickup tube and screen were not observed.

OIL PUMP

Condition: The oil pump remained attached to the backside of the engine with no evidence of oil leaks or pre-accident anomalies noted. Disassembly of the oil pump revealed residual oil in the housing. The gears were intact with light surface corrosion and wear noted in areas. The oil pressure relief valve and valve seat did not display and sign of abnormal seating.



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OIL FILTER

Manufacturer: Champion

P/N: Not Recorded

Condition:

The oil filter remained attached to the oil filter adapter, but it sustained deformation damage and was offset from the mount slightly. The safety-wire was intact. Hand-written information on the side of the filter was partially burned away. No pre-accident anomalies were noted with the filter.



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OIL COOLER

Manufacturer: Niagara
Thermal Products

P/N: 654572

S/N: B10-8562-79

Condition: The oil cooler remained attached to the back left side of the engine. It sustained slight deformation damage, but did not show any signs of leaking or pre-accident anomalies.



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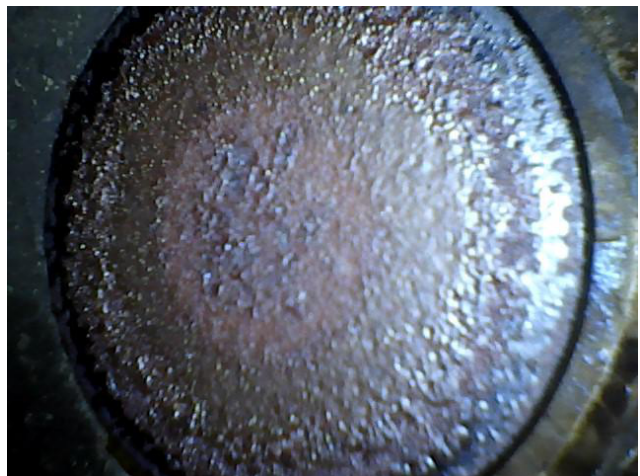
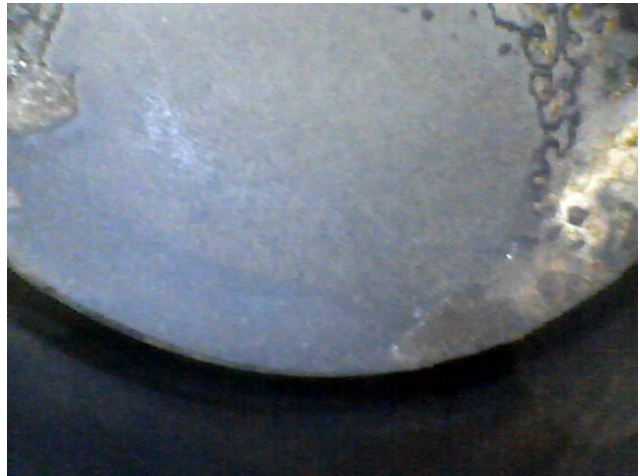
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CYLINDERS

NOTE: The photographs that follow each cylinder condition description represent the cylinder overhead components, the piston, the intake valve, and the exhaust valve in that order unless otherwise specified.

CYLINDER #1

Condition: The cylinder remained attached to the engine and the original torque putty appeared to be intact on the attaching hardware (the serial number matched that on the build record). The rocker cover was removed and no pre-accident anomalies were observed with the rockers or valve springs. A borescope inspection of the cylinder's internal components did not reveal any pre-accident anomalies with the barrel, piston, valves or valve seats. A thumb compression test resulted in compression and confirmed connecting rod, piston, and rocker arm movement.



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CYLINDER #3

Condition: The cylinder remained attached to the engine and the original torque putty appeared to be intact on the attaching hardware (the serial number matched that on the build record). The rocker cover was removed and no pre-accident anomalies were observed with the rockers or valve springs. A borescope inspection of the cylinder's internal components did not reveal any pre-accident anomalies with the barrel, piston, valves or valve seats. A thumb compression test resulted in compression and confirmed connecting rod, piston, and rocker arm movement.



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CYLINDER #5

Condition: The cylinder sustained impact damage that fractured the cylinder head and separated the rocker cover, rockers, and rocker shafts along with the pushrods and pushrod housings. The cylinder was displaced aft toward the #3 cylinder and the intake valve and valve spring sustained deformation damage. A borescope inspection of the cylinder's internal components did not reveal any pre-accident anomalies with the barrel, piston, valves or valve seats. A thumb compression test did not result in compression, which was attributed to the offset intake valve; however, piston movement during crankshaft rotation was confirmed.



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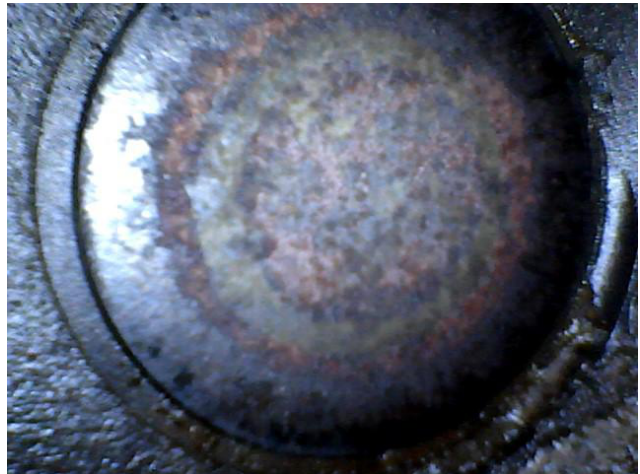
ENGINE S/N:

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CYLINDER #2

Condition: The cylinder remained attached to the engine and the original torque putty appeared to be intact on the attaching hardware (the serial number matched that on the build record). The rocker cover was removed and no pre-accident anomalies were observed with the rockers or valve springs. A borescope inspection of the cylinder's internal components did not reveal any pre-accident anomalies with the barrel, piston, valves or valve seats. A thumb compression test resulted in compression and confirmed connecting rod, piston, and rocker arm movement.



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CYLINDER #4

Condition: The cylinder remained attached to the engine and the original torque putty appeared to be intact on the attaching hardware (the serial number matched that on the build record). The rocker cover was removed and no pre-accident anomalies were observed with the rockers or valve springs. A borescope inspection of the cylinder's internal components did not reveal any pre-accident anomalies with the barrel, piston, valves or valve seats. A thumb compression test resulted in compression and confirmed connecting rod, piston, and rocker arm movement.



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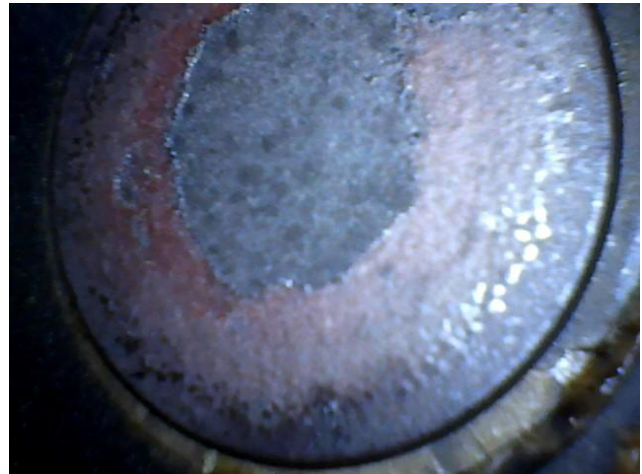
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CYLINDER #6

Condition: The cylinder remained attached to the engine and the original torque putty appeared to be intact on the attaching hardware (the serial number matched that on the build record). The rocker cover was removed and no pre-accident anomalies were observed with the rockers or valve springs. A borescope inspection of the cylinder's internal components did not reveal any pre-accident anomalies with the barrel, piston, valves or valve seats. A thumb compression test resulted in compression and confirmed connecting rod, piston, and rocker arm movement.



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CRANKCASE ASSEMBLY

CRANKCASE

Condition:

The crankcase remained intact with no pre-accident anomalies noted.



CRANKSHAFT ASSEMBLY

CRANKSHAFT

Condition:

Though the crankshaft was not viewed in its entirety, crankshaft continuity was confirmed from the propeller flange aft to the crankshaft gear and out to each connecting rod/piston during a thumb compression test. The crankshaft gear bolts were safety-wired and in place. There was no binding noted during crankshaft rotation.



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CAMSHAFT

CAMSHAFT

Condition: The camshaft was not observed; however, camshaft continuity was confirmed by the movement of all intake and exhaust rockers (with the exception of the #5 cylinder) during crankshaft rotation. No pre-accident anomalies were noted.

ACCESSORY GEARS

Condition: The accessory gears rotated during crankshaft rotation, with no pre-accident anomalies noted.



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ACCESSORIES

STARTER

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition:

The starter motor remained attached to the adapter with no pre-accident anomalies noted.



STARTER ADAPTER

Condition:

The starter adapter remained intact and in place. No anomalies were noted during crankshaft rotation.



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ALT/GEN #1

Manufacturer: Hartzell

P/N: ALT-9522R

S/N: H-0060029

Condition:

The engine-driven alternator remained attached to the front right side of the engine with no pre-accident anomalies noted with the unit.



VACUUM PUMP

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition:

The vacuum pump remained attached to the accessory pad on the backside of the engine and was not examined as part of the investigation.



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Manufacturer: McCauley

P/N: DCF329ODTAT3

S/N: 80122

Condition:

The propeller governor remained secured to the front left side of the engine and the control cable remained attached to the control lever.

**PROPELLER**

Manufacturer: McCauley

P/N: 3AF32C87-N2R

S/N: 733240

Condition:

The propeller remained attached to the engine crankshaft and all three propeller blades remained attached to the hub, though one was loose in the hub. The loose blade was bent aft and displayed chord-wise scrapes inboard of the tip that were overlaid by diagonal scrapes. Another blade tip was torn away from the blade about eight inches outboard of the deicing boot. That blade displayed gouges consistent in spacing as the grooves observed on the concrete road surface at the accident site. The separated blade tip displayed an s-bend and curled tip. The third blade displayed s-bending at the tip and as curled toward low pitch. The propeller will be sent to the manufacturer for a more detailed examination under NTSB or FAA supervision.



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APPENDIX A

Magneto Examination/Testing



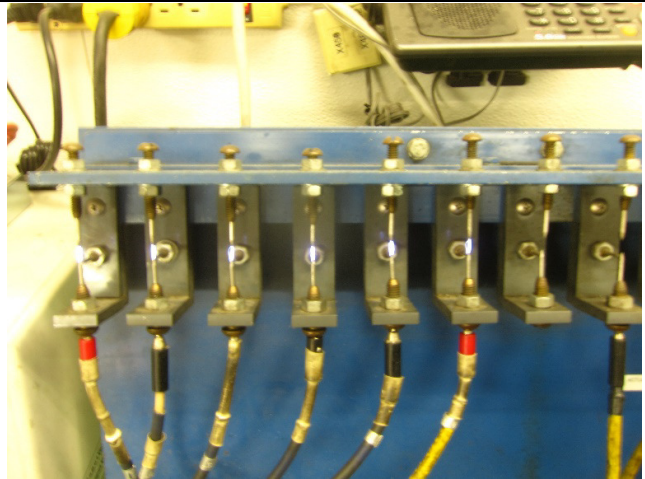
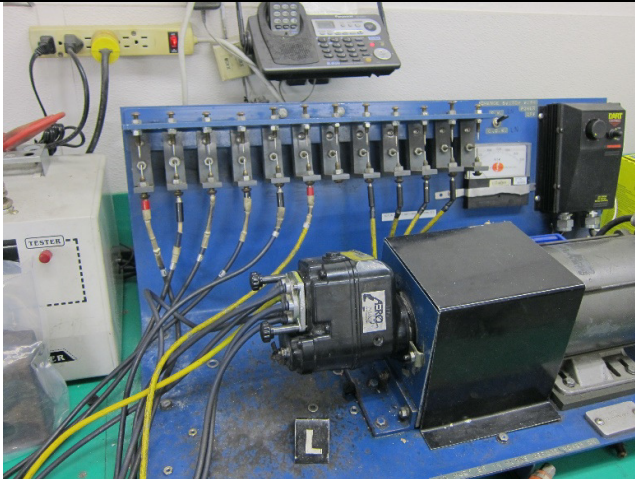
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Component Examination Report

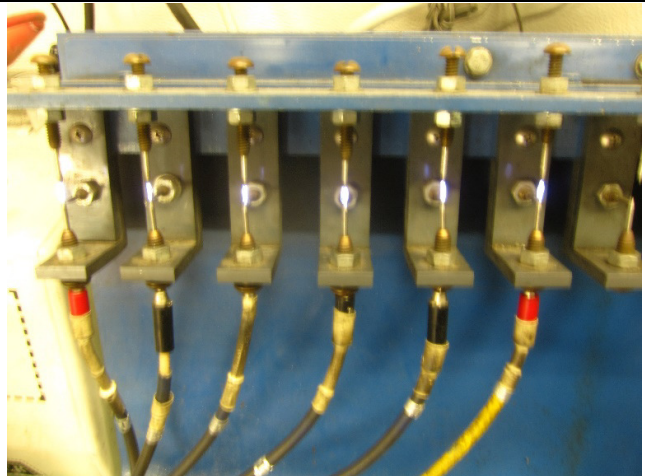
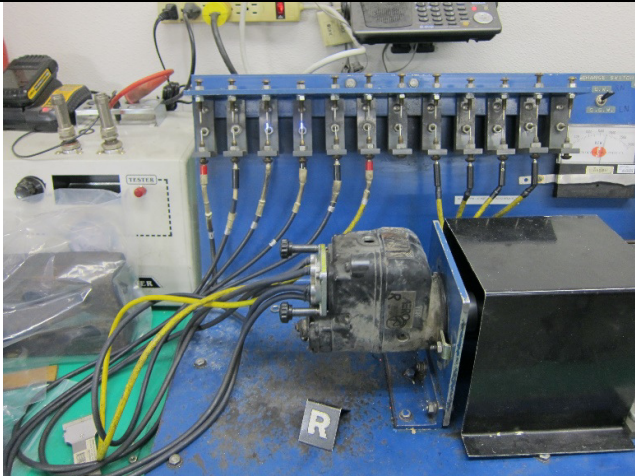
N/R = Not Reported / N/A = Not Applicable

Date Received:	07/10/2017		Analytical Date:	07/10/2017	
File Number:	16-697		NTSB Accident:	WPR17LA136	
Engine Model:	IO-520-M		Engine S/N:	1002310	
Engine:		Component:	☒		
Aircraft Make/Model:	Cessna 310R		Aircraft S/N:	310R0506	Reg. #: N87297
Engine Position:	Single:	Left:	Right:	☒	Front: Rear:
Engine Build Date:	05/26/2010	Date in Service:	Unknown		
Occurrence Date:	06/30/2017		Date Received:	07/10/2017	
Occurrence Location:	Santa Ana, California		Returned By:	NTSB	
Inspection Performed By:	Kurt Gibson			Search Code:	15-12-68
Summary:	The magnetos were both put on a test bench and were capable of normal operation at all tested RPM settings. There were no anomalies noted that would have prevented normal operation.				

LEFT MAGNETO	Manufacturer: CMI	P/N: BL-600606-?	S/N: E10BA149R
Condition:	The left magneto displayed minor thermal damage signatures and displayed impact damage signatures to the flange. The magneto was placed on a test bench and was tested at multiple RPM settings. The magneto was capable of producing a spark on all six posts in the correct order at all tested RPM settings. There were no anomalies noted with the magneto.		



RIGHT MAGNETO	Manufacturer: CMI	P/N: Illegible	S/N: Illegible
Condition:	The right magneto displayed minor thermal damage and minor impact damage signatures. The magneto was placed on a test bench and was tested at multiple RPM settings. The magneto was capable of producing a spark on all six posts in the correct order at all tested RPM settings. There were no anomalies noted with the magneto.		



Engine / Component Disposition

Release for core salvage:		Date/Sign:	
Release to Repair Station:		Date/Sign:	
Scrap:		Date/Sign:	
Return to storage facility:	X	Date/Sign:	07/12/2017
Customer Name/Company:	Jack Vandeman		
Address:	South West Aviation Transportation and Recovery Attn: Jack Vandeman 866 Bing Spring Court Corona, California 92880		