Continental Motors

ENGINE EXAMINATION REPORT

ENGINE MODEL	TSIO-520-NB
ENGINE SERIAL NUMBER	503140
AIRCRAFT MAKE & MODEL	Cessna 414A
AIRCRAFT SERIAL NUMBER	414A0495
AIRCRAFT REGISTRATION	N789UP
FILE NUMBER	14-488

NAME	SIGNATURE	DATE
Phillip Grice	[redacted]	09/02/2015
Nicole Charnon	[redacted]	09/02/2015

GENERAL INFORMATION

EXAMINATION		ACCIDENT DATA	
DATE	09/02/2015	**NTSB ACCIDENT #**	CEN15FA190
FACILITY	Continental Motors	**NTSB INVESTIGATOR**	Todd Fox
ADDRESS	[redacted] Mobile, AL 36615	**FAA INVESTIGATOR**	Stanley Swank II
		ACCIDENT DATE	04/07/2015
		ACCIDENT LOCATION	Bloomington, IL

ENGINE INFORMATION

ENGINE POSITION	Left Engine
TOTAL TIME	4,881.5 hours at time of accident*
TIME SOH	556.7 hours at time of accident*
TYPE & TIME SLI	Last Annual Inspection 10/01/2014, 43.3 hours prior to accident*
BUILD DATE	11/13/1973
IN SERVICE DATE	Unknown

Report Summary: Search Code(s): 15-12-68

There were no pre-impact anomalies observed with the engine or engine-related components that would have affected the engine's ability to produce full, rated power.

Disposition of engine following exam:

The NTSB investigator-in-charge released the engine and its turbocharger components to be returned to the facility where the remaining wreckage is being stored.

Significant logbook information:

*According to the NTSB investigator-in-charge (IIC) the Hobbs meter was not legible at the accident site. However, the NTSB IIC indicated that at the time of the accident, the Hobbs meter should have read 2111.6 hours (this time was calculated using the maintenance entry from the point of Hobbs meter replacement, plus the Hobbs times listed in the maintenance entries since the Hobbs meter replacement, the flight log observed at the accident site, as well as the two legs of the accident flight).

The engine was built on November 13, 1973. Review of the engine maintenance records revealed that the engine underwent a RAM Aircraft Corporation conversion/overhaul at an engine total time of 4,324.8 hours on March 20, 2008, and was installed in the accident airplane's left nacelle on April 17, 2008, at a Hobbs meter time of 1,554.9 hours.

On December 3, 2010, at a Hobbs time of 1,946.3 hours (391.4 hours since the last overhaul and an engine total time of 4,716.2 hours), the engine was "disassembled" to overhaul the crankshaft and replace a number of core components. The reason for disassembly was not indicated in the maintenance entry.

On December 31, 2013, at a Hobbs meter time of 2,020.4 hours, the engine was removed from the accident airplane and was disassembled, cleaned, inspected, and repaired as needed before being reassembled on February 27, 2014, 465.5 hours since the last overhaul. The engine was reinstalled on the accident airplane in the left nacelle on March 11, 2014.

The engine then underwent an oil change and an annual inspection, the last of which took place on October 1, 2014, at a Hobbs meter time of 2,068.3 hours (513.4 hours since the last overhaul). There were no additional maintenance entries.

INSPECTION WITNESSES

NAME	Phillip Grice	**NAME**	Matthew Phillips
ADDRESS	Mobile, AL	**ADDRESS**	Mobile, AL
ORGANIZATION	Continental Motors	**ORGANIZATION**	Continental Motors
PHONE	[redacted]	**PHONE**	[redacted]
NAME	Greg Eastburn	**NAME**	Nicole L. Charnon
ADDRESS	Mobile, AL	**ADDRESS**	Washington, DC
ORGANIZATION	Continental Motors	**ORGANIZATION**	Continental Motors
PHONE	[redacted]	**PHONE**	[redacted]
NAME	Todd Fox	**NAME**	David Slaybaugh
ADDRESS	Chicago, IL	**ADDRESS**	Springfield, IL
ORGANIZATION	NTSB – Central Region	**ORGANIZATION**	FAA – Springfield FSDO
PHONE	[redacted]	**PHONE**	[redacted]
NAME	Les Doud	**NAME**	Rick Roper
ADDRESS	Piqua, OH	**ADDRESS**	Waco, TX
ORGANIZATION	Hartzell Propellers, Inc.	**ORGANIZATION**	RAM Aircraft
PHONE	[redacted]	**PHONE**	[redacted]
NAME	Ernie Hall	**NAME**	
ADDRESS	Wichita, KS	**ADDRESS**	
ORGANIZATION	Textron Aviation	**ORGANIZATION**	
PHONE	[redacted]	**PHONE**	

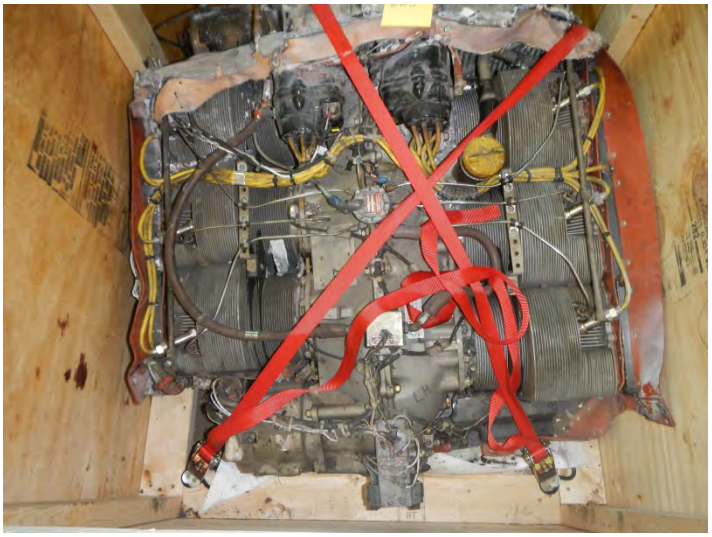
EXTERNAL INSPECTION OF ENGINE

The engine was shipped to Continental Motors in a wooden crate with a number of components, such as the vacuum pump, turbocharger/wastegate, turbo controller, throttle body/fuel metering unit, engine-driven fuel pump and fuel pump coupling, removed from the engine and boxed separately within the crate. The propeller flange was separated from the crankshaft at the crankcase and was included with the boxed components. The portion of crankshaft that remained with the separated propeller flange displayed a bend in one direction with circumferential cracks noted on the tension side of the bend. The fracture surface associated with the tension side of the bend displayed a 45-degree lip. The fracture surface on the compression side of the bend was irregular and jagged in shape.

The left and right magneto remained secured to their mounting flanges and the ignition harnesses remained attached. According to the NTSB IIC, the top sparkplugs were removed from the engine during the on-scene portion of the investigation.

The bottom side of the engine nacelle was crushed upward around the oil sump and remained with the engine. The intercooler remained attached to the engine/nacelle and was displaced upward into the backside of the engine. The oil sump was crushed from the bottom side up as were the exhaust manifolds and front side exhaust risers. The exhaust manifolds on both sides were flattened. The intake manifolds also sustained impact, puncture, and deformation damage on the bottom sides. The induction balance tube was flattened.

The backside of the engine and its related components sustained thermal damage.

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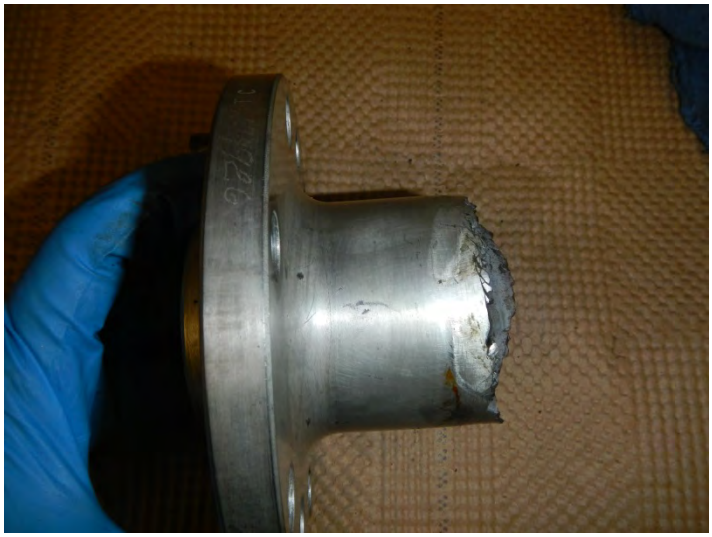

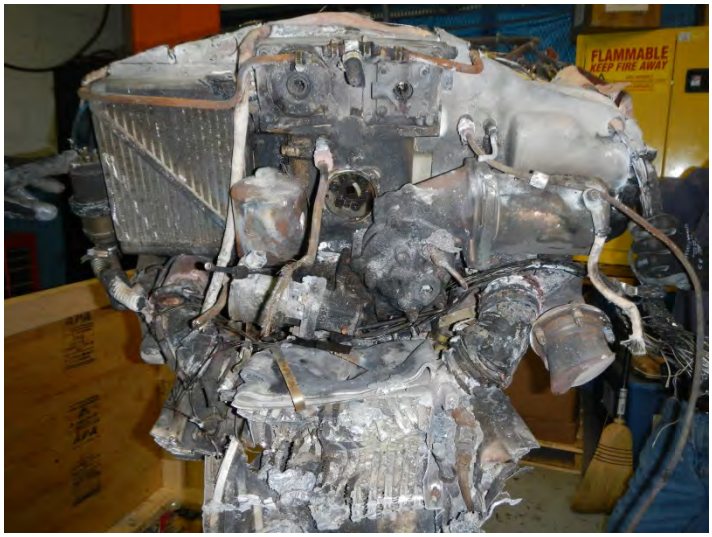
FLAMMABLE
KEEP FIRE AWAY


AIRCRAFT ENGINES
MADE IN U.S.A.
RPM
2700
GRADE MIN.
503140
OR MORE OF THE FOLLOWING U.S. PATENTS
2,913,231
2,913,233
2,983,491
2,991,055
AND FOREIGN PATENTS


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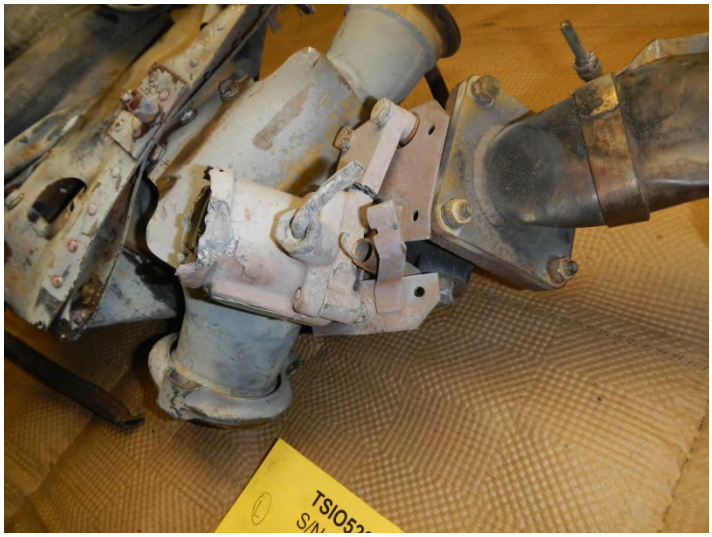


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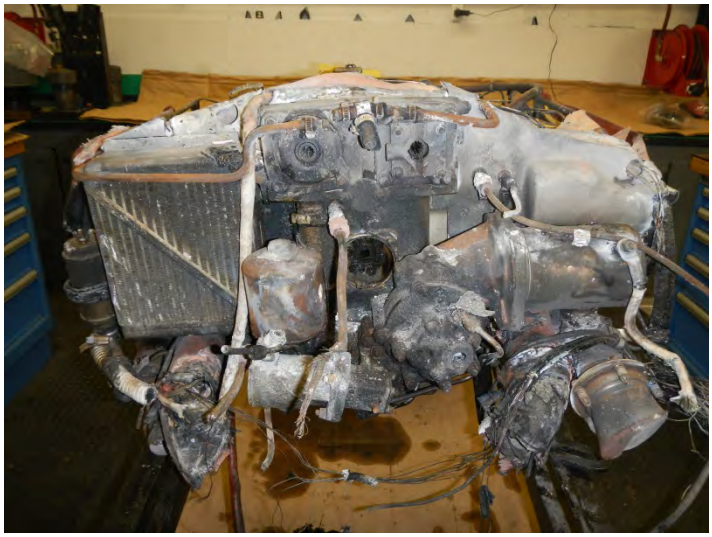

INTERNAL INSPECTION OF ENGINE

FUEL SYSTEM COMPONENTS

According to the NTSB IIC, the engine-driven fuel pump was partially separated from the backside of the engine at the accident site. The NTSB IIC rotated the crankshaft prior to the complete removal of the engine-driven fuel pump. The drive coupling was found fractured. Close examination of the drive coupling revealed that the fracture surface was irregular in shape with bending observed adjacent to the fracture surfaces. There was no soot noted on the fracture surface. Examination of the fracture surface by a Continental Motors metallurgist revealed that the fracture was a result of overload.

The engine-driven fuel pump's aneroid housing was thermally damaged, exposing the thermally damaged aneroid. Re-solidified molten metal was adhering to the safety wire. The pump was exposed the thermal stresses significant enough to char the diaphragm and compromise the insulator. Disassembly of the fuel pump revealed that the pump vanes were intact and no pre-accident anomalies were noted with the internal components.

The throttle body/fuel metering unit was thermally damaged and the mixture and throttle levers were bent. The throttle housing was partially melted away and the valve was loose and detached from the housing remnants. The fuel metering unit was removed from the throttle body and the fuel inlet screen was removed. Some debris consistent with soot and dirt was observed in the inlet area; however, the screen was clear and free from any obstructions. The throttle and mixture cams were removed and charred debris was observed in the metering unit body, but the metering plug holes were not obstructed. Besides the thermal damage and debris, no pre-accident anomalies were noted with the observed components.

The fuel injection nozzles were removed from the cylinders. The #1, #3, and #5 nozzles contained dirt and debris that was blown out with compressed air. There were no signs of obstructions. The nozzles were reattached to their respective lines and the fuel manifold valve and nozzles were taken to the production test stand for a flow test. The unit did not meet the production test standards as it flowed slightly lower than new standards throughout all test ranges; however, it did function properly

throughout the test.


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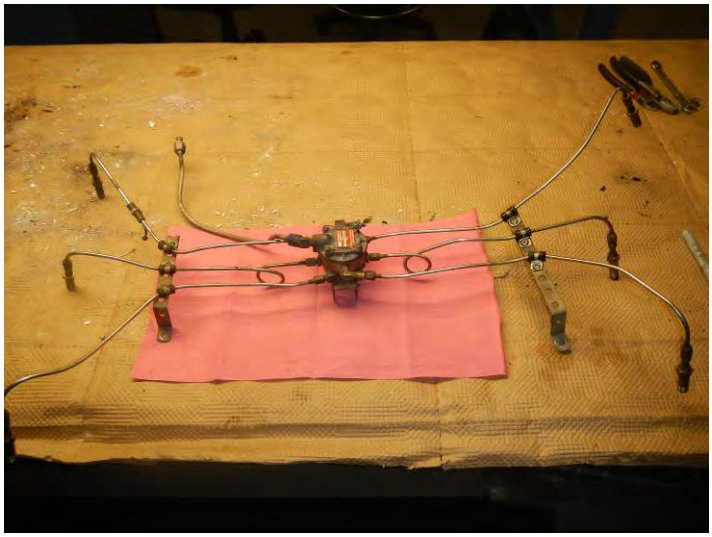

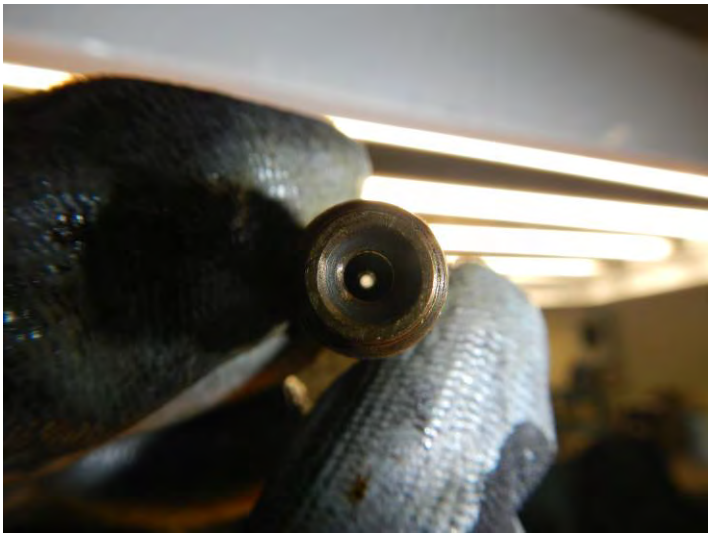

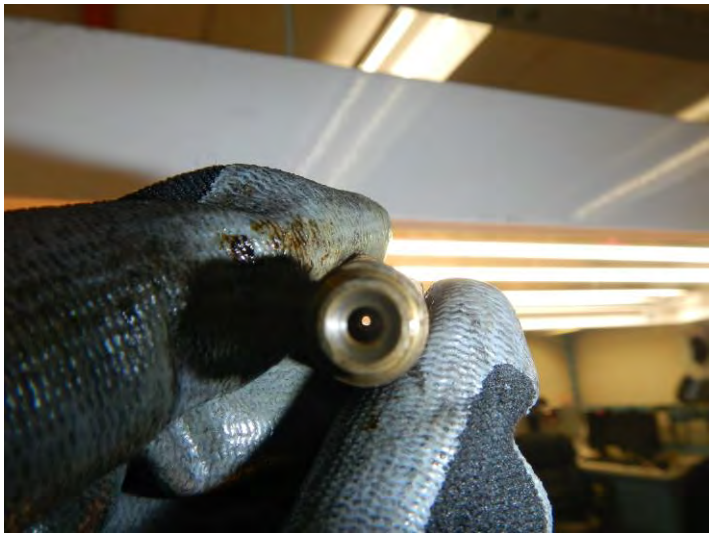

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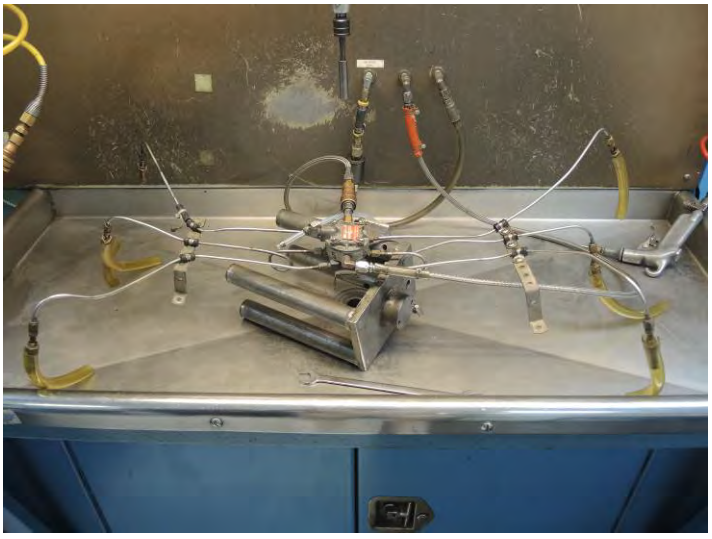
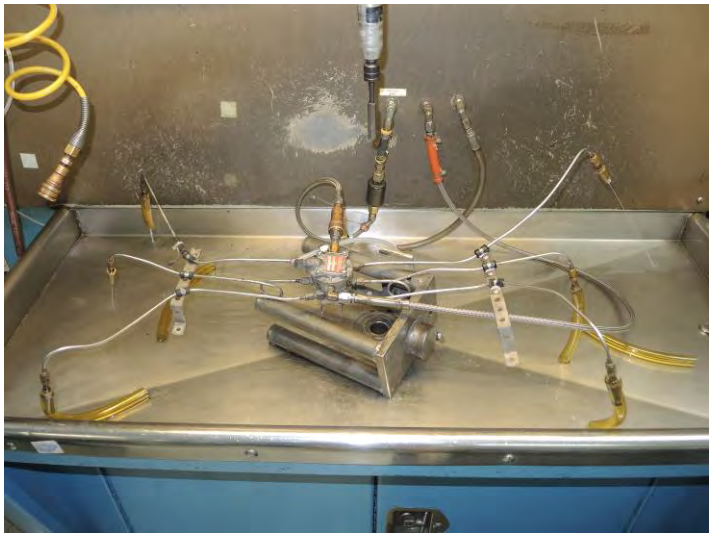
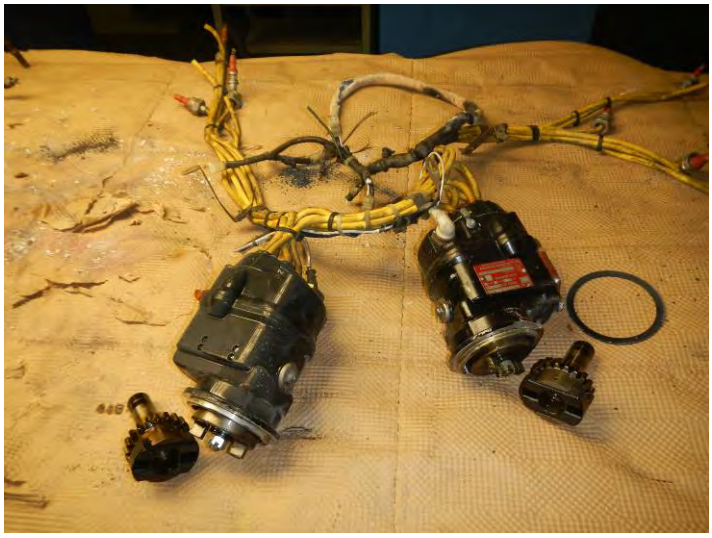


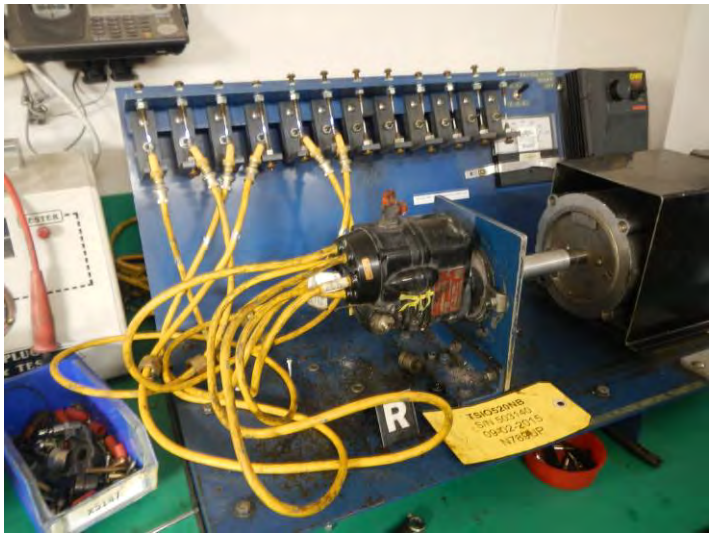


IGNITION SYSTEM

The magnetos remained in place and secured to the mount flanges. The ignition harness sustained damage in the accident that separated a few leads. The terminal ends remained attached to their respective sparkplugs and the sparkplugs remained secured to their cylinders. The ignition harnesses were removed and the magnetos were placed on a test bench with replacement ignition harnesses. Both magnetos produced a blue spark across a 7mm gap during all RPM ranges. No pre-accident anomalies were noted with either magneto.

The top sparkplugs were removed during the on-scene portion of the investigation. All of the sparkplugs were removed and they all displayed little-to-no wear. They were all covered with normal combustion deposits. The #1 and #5 bottom sparkplugs were oil coated and the #1, #3, and #5 sparkplugs bottom sparkplugs were covered with debris; however, there was no sign of fouling.



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SPARK PLUGS
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SPARK

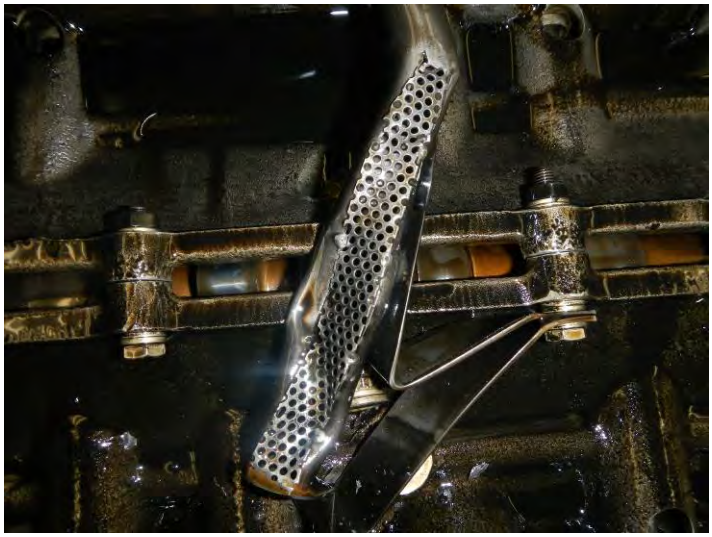

SPARK PLU


SPARK PLUGS
1 3 5 2 4


SPARK PLUGS
3 5 2 4

LUBRICATION SYSTEM

The oil sump was crushed from the bottom side up and was punctured. Removal of the oil sump revealed residual oil. The oil pickup screen and tube were displaced upward. The screen was not obstructed and there were no signs of blockage. The oil pump was removed and the gears and drive shaft were intact. The oil filter was thermally damaged. It was cut open and the filter element and canister did not display any signs of significant contamination or blockage. All of the engine components appeared to be well lubricated and there was no sign of lubrication distress.

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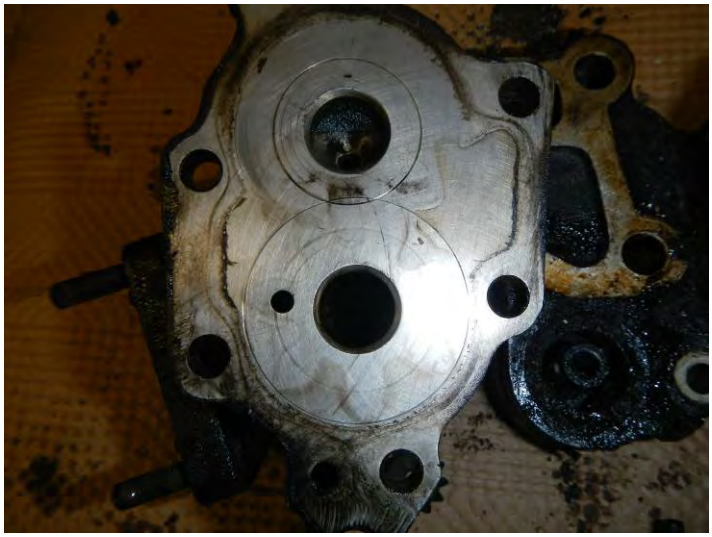

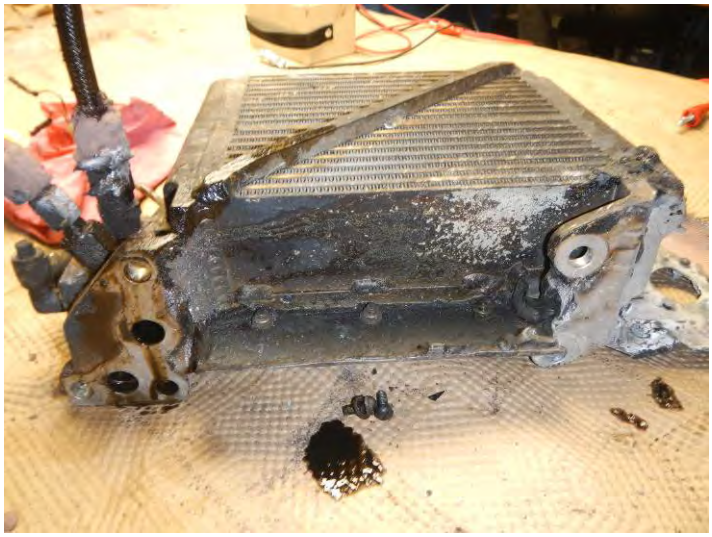

CYLINDERS

No pre-accident anomalies were noted with any of the cylinders or their associated components.


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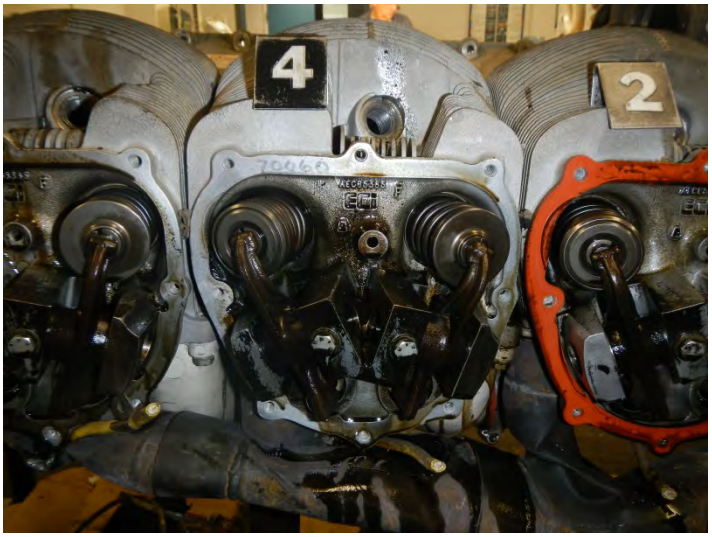
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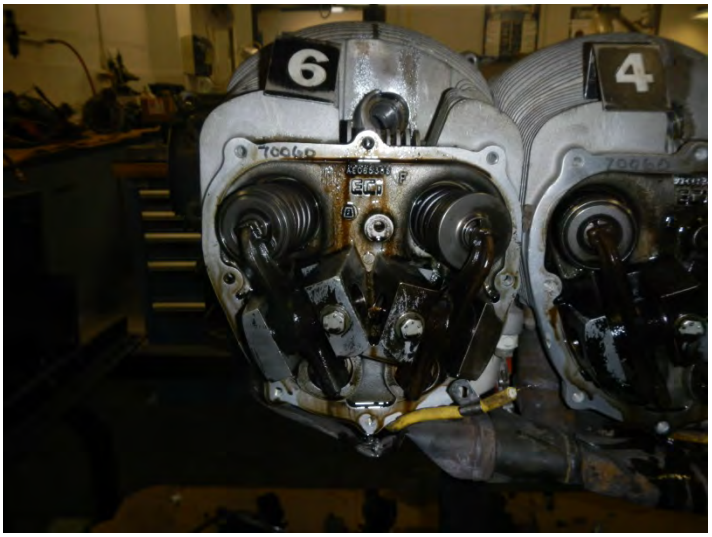
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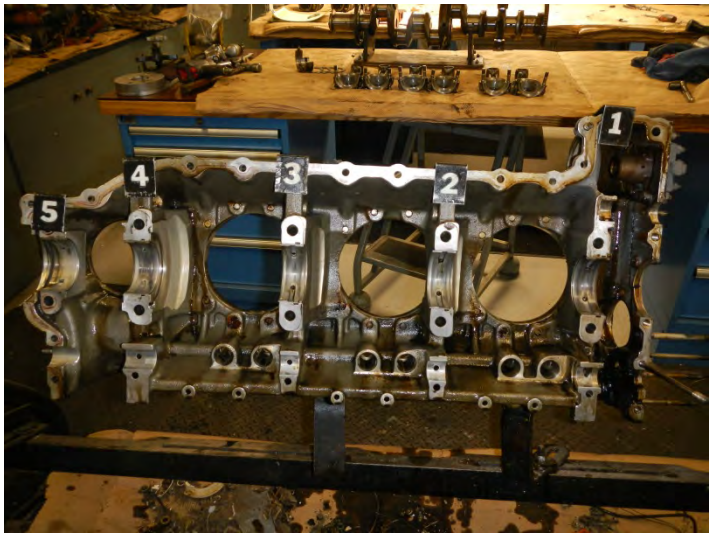
CRANKCASE

The crankcase halves remained secured to each other and no pre-accident anomalies were noted with either crankcase half. Disassembly of the crankcase revealed that the main bearings were in place and there was no sign of bearing movement. The bearing saddles and saddle mating surfaces did not reveal any sign of fretting or gouging.



CRANKSHAFT & CONNECTING RODS

The crankshaft was intact with the exception of the fracture noted aft of the propeller flange. There were no pre-accident anomalies noted on any of the crankshaft main journals, connecting rod journals, crankshaft gear, or counterweights.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CAMSHAFT & LIFTERS

No anomalies were noted with the hydraulic lifters. The camshaft lobes did not display any anomalies or signs of excessive wear. The camshaft gear did not display any pre-accident anomalies.

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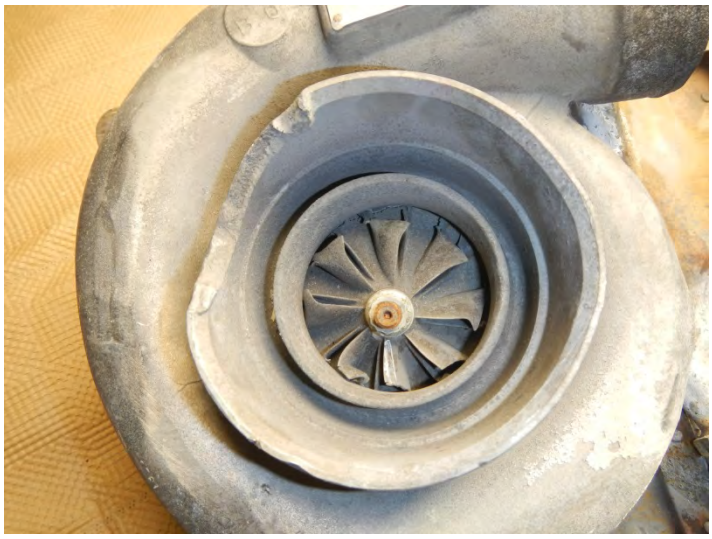
TURBOCHARGER COMPONENTS

The turbocharger components were visually examined and readied for transport to the Hartzell facility. The overboost valve was not observed and is presumed destroyed. No external pre-accident anomalies were noted with any of the components.

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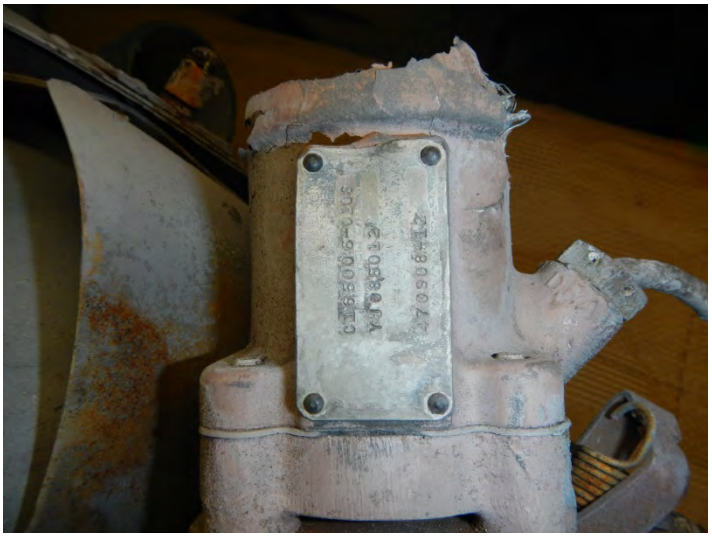


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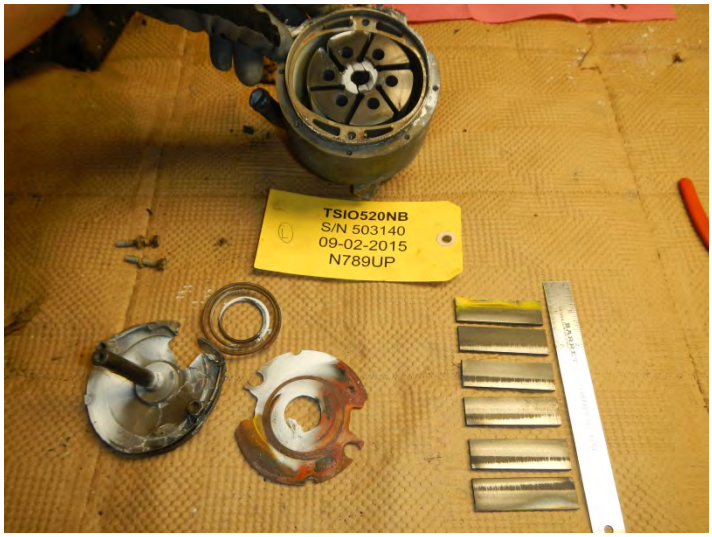
VACUUM PUMP

The vacuum pump was removed from the engine prior to the examination and it sustained impact and thermal damage that exposed some of the internal components. Removal of the cap revealed that all of the vanes were intact, but the rotor was fractured.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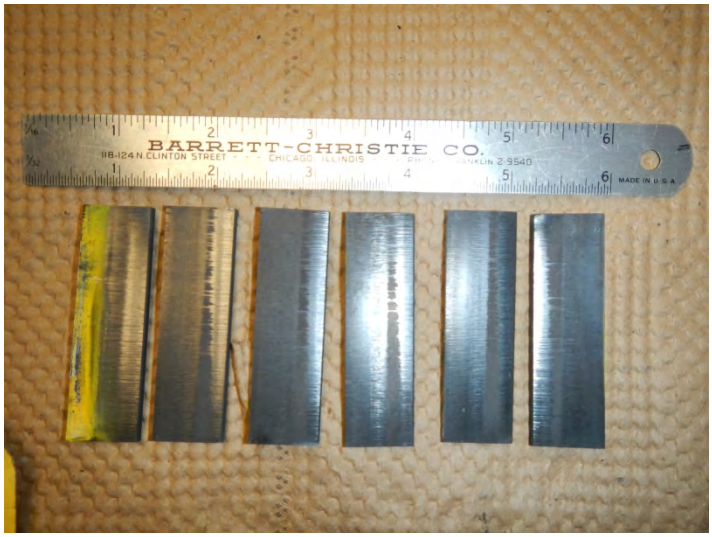
BARRETT-CHRISTIE


BARRETT-CHRISTIE CO.
118-124 N. CLINTON STREET CHICAGO, ILLINOIS
MADE IN U.S.A.

ACCESSORIES

No pre-accident anomalies were noted with the alternator, starter motor and starter adapter, or the propeller governor.