




Continental Motors

ENGINE EXAMINATION REPORT

| | |
|------------------------|-------------|
| ENGINE MODEL | TSIO-520-NB |
| ENGINE SERIAL NUMBER | 244794-R |
| AIRCRAFT MAKE & MODEL | Cessna 414A |
| AIRCRAFT SERIAL NUMBER | 414A0821 |
| AIRCRAFT REGISTRATION | N414RS |
| FILE NUMBER | 18-357 |

| NAME | SIGNATURE | DATE |
|-------------------|--|------------|
| Nicole L. Charnon |  | 03/21/2019 |

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PAGE 2 of 31**GENERAL INFORMATION**

| EXAMINATION | | ACCIDENT DATA | |
|--------------------|--------------------------------------|--------------------------|-------------------------|
| DATE | 03/07/2019 | NTSB ACCIDENT # | WPR19FA079 |
| FACILITY | Air Transport | NTSB INVESTIGATOR | Maja Smith |
| ADDRESS | [REDACTED] Phoenix, Arizona 85009 | FAA INVESTIGATOR | Benjamin Harris |
| | | ACCIDENT DATE | 02/03/2019 |
| | | ACCIDENT LOCATION | Yorba Linda, California |

ENGINE INFORMATION

| | |
|----------------------------|--|
| ENGINE POSITION | Right Engine |
| TOTAL TIME | 4,714.5 hours |
| TIME SOH | 95.7 hours |
| TYPE & TIME SLI | 22.3 hours since last oil change (see information below) |
| BUILD DATE | 07/26/1983 |
| IN SERVICE DATE | Unknown |

Significant logbook information:

Excerpts of maintenance records were provided by the NTSB investigator-in-charge (IIC). Review of the records revealed that the engine was modified by RAM Aircraft in accordance with Supplemental Type Certificate (STC) SE4327SW-D Rev. 4 and underwent an overhaul on June 26, 2018 at an engine total time of 4,618.8 hours. On August 7, 2018, the engine was installed in the accident airplane's right engine nacelle at a Hobbs time of 2,258.9 hours with an overhauled propeller governor, turbocharger, controller, and wastegate. On October 1, 2018 at a Hobbs time of 2,283.0 hours, the engine oil was changed and the oil filter was inspected with no noted anomalies. The oil filter had a date of January 4, 2019 and a Hobbs time of 2,332.3 hours handwritten on the side, but an associated entry was not observed in the provided records. The Hobbs meter read 2,354.6 hours during the wreckage examination.

Report Summary:

Search Code(s):

15-12-68

The engine sustained significant impact-related damage that precluded the functional testing of most components. However, examination of the recovered engine items revealed no signs of pre-accident anomalies that would have precluded its ability to produce full, rated power.

NOTE: The propeller and turbo components were examined by a representative of Hartzell Engine Technologies (HET) under the supervision of the NTSB IIC. Please see the reports from HET for more information regarding those components.

Disposition of engine following exam:

The engine was retained at the aircraft recovery facility pending final release by the NTSB IIC.

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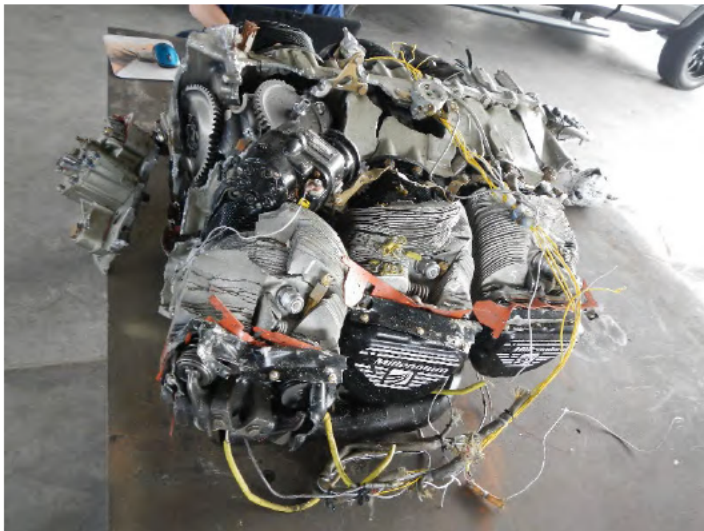
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| | | | |
|---------------------|--------------------|---------------------|-----------------------|
| NAME | Nicole L. Charnon | NAME | Maja Smith |
| ADDRESS | Washington, DC | ADDRESS | Seattle, WA |
| ORGANIZATION | Continental Motors | ORGANIZATION | NTSB – Western Region |
| PHONE | | PHONE | |
| NAME | Andrew Hall | NAME | |
| ADDRESS | Wichita, KS | ADDRESS | |
| ORGANIZATION | Textron Aviation | ORGANIZATION | |
| PHONE | | PHONE | |

EXTERNAL ENGINE CONDITION

The engine was separated from the nacelle and all systems but the fuel manifold valve housing and oil pump were separated from the engine. The crankcase was fractured in multiple locations and the nose of the case was displaced to the bottom of the oil sump. The crankshaft was fractured in the same area as the crankcase nose fracture (at the oil transfer collar). All fracture surfaces were jagged and irregular, consistent with overload. The #2, #4, and #6 cylinders heads were separated from the barrels and the barrels were deformed down around their respective pistons. There was no evidence of lubrication distress on any of exposed components.



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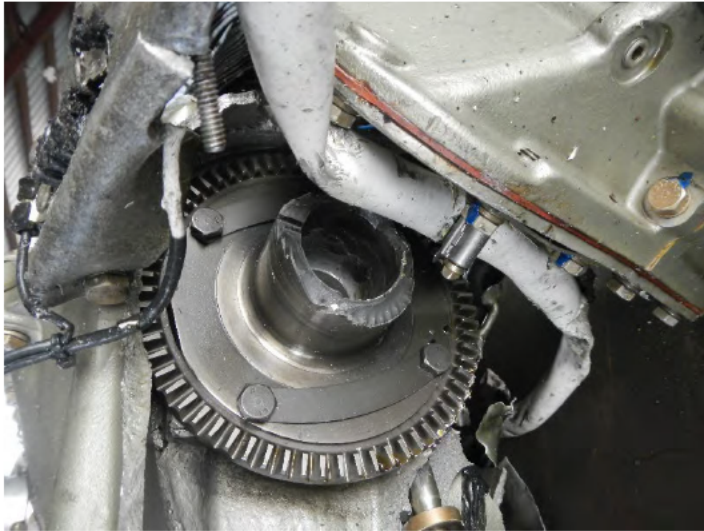
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PAGE 5 of 31**ENGINE COMPONENT EXAMINATION****EXHAUST
SYSTEM****Condition:**

Sections of exhaust components were attached to the fractured left side cylinder heads, and the cylinders on the right. No pre-accident anomalies were noted with the observed components.

**INDUCTION
SYSTEM****Condition:**

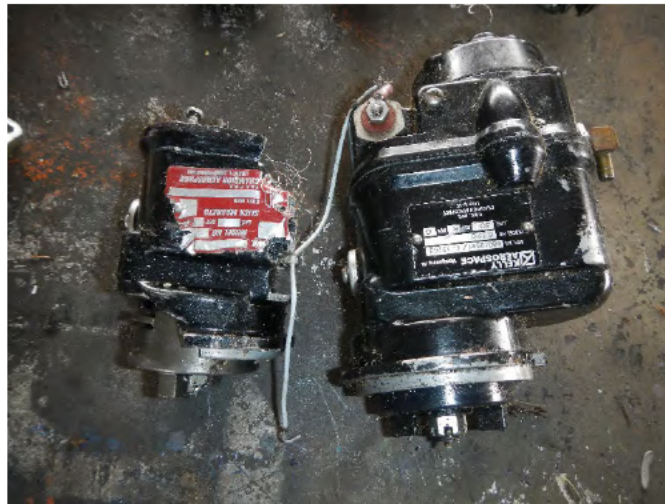
The induction system was fragmented.

IGNITION SYSTEM**MAGNETO**

Manufacturer: Champion
(O/H by Kelly Aerospace)

P/N: 6320**S/N:** 98012591 / F-12263**Condition:**

The magneto was separated from the engine. The drive shaft could be manually rotated, and the impulse coupling made an audible snap. A spark was obtained from the distributor towers during manual rotation of the shaft.



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Manufacturer: Champion

P/N: 6320

S/N: Not Legible

Condition:

The magneto was separated from the engine and the housing was fragmented with only the drive shaft and magnet observed.

**IGNITION HARNESS**

Manufacturer: Slick by Champion

P/N: Unknown

S/N: Unknown

Condition:

The ignition harness was fragmented.

**SPARK PLUGS**

Manufacturer: Champion

Condition:

Many of the sparkplug barrels were fractured. The portions that remained with the cylinder heads were examined. Some of the center electrodes were displaced, but there were no pre-accident anomalies noted and all observed sparkplugs displayed normal combustion deposits and wear. The #6 cylinder head was fractured in numerous locations and its sparkplugs were not observed.

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FUEL SYSTEM

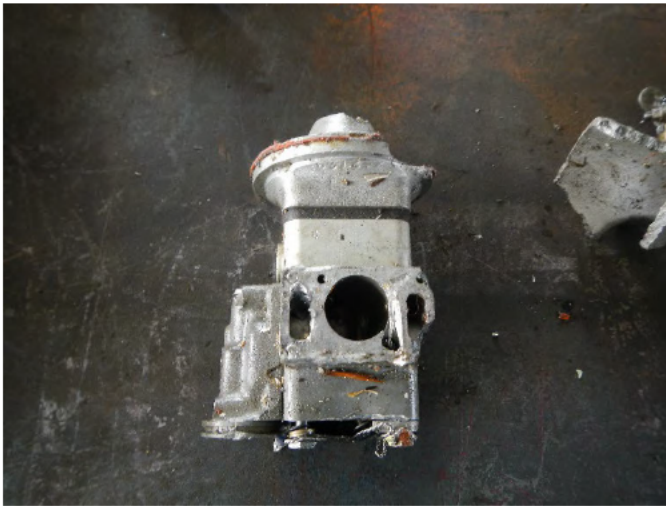
FUEL PUMP

Manufacturer: Data Plate
Destroyed

P/N: Data Plate
Destroyed

S/N: Data Plate
Destroyed

Condition: The engine driven fuel pump was separated from the engine and the drive coupling was not observed; however, witness marks of the coupling were observed on the fuel pump. The pump drive shaft was manually rotated using a screw driver with no binding noted. The vapor return cap was missing, the aneroid bellow and housing were separated, and the low pressure relief valve cap was fractured. Disassembly of the pump revealed no pre-accident anomalies with the internal components.



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FUEL PRESSURE REGULATOR

Manufacturer: Continental Motors

P/N: Unknown

S/N: Unknown

Condition:

The fuel pressure regulator's reference line fitting was separated. The fuel lines remained secured in place.



THROTTLE BODY METERING UNIT

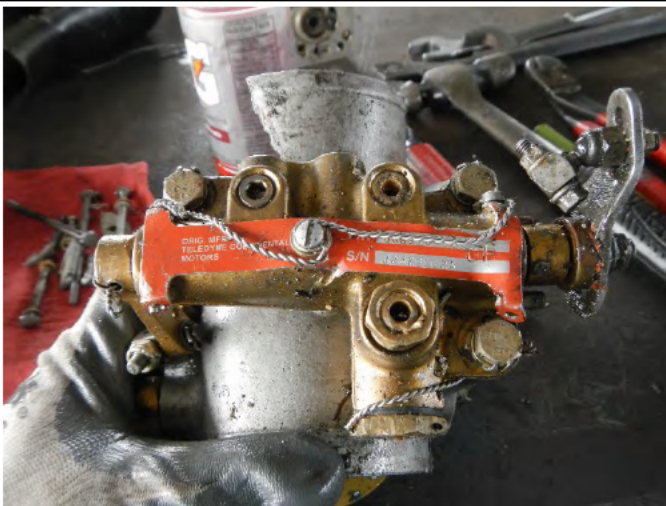
Manufacturer: Continental Motors (overhauled)

P/N: 652910-11

S/N: J247916RA

Condition:

The throttle body was fractured and separated from the engine. The throttle interconnect linkage was fractured and one half of the arm was bent 180 degrees. The unit was disassembled, and no pre-accident anomalies were noted with the throttle and mixture cams, the metering plug, and the inlet fuel screen.



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FUEL MANIFOLD VALVE

Manufacturer: Data Plate Destroyed

P/N: Data Plate Destroyed

S/N: Data Plate Destroyed

Condition: The fuel manifold housing remained attached to the engine, but the cap, diaphragm, plunger and screen were separated as were all the injector lines.



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FUEL NOZZLES AND LINES

Condition:

The upper deck reference lines were separated from the engine and were not observed. The nozzles were bent and/or fractured and the lines were separated from the engine, with the exception of the #5.



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LUBRICATION SYSTEM

OIL SUMP

Condition: The oil sump was punctured, torn, and bent in half at the large crankcase fracture near the nose.



OIL PICK-UP TUBE & SCREEN

Condition: The pickup tube and screen were deformed and displaced up toward the bottom of the engine. Not pre-accident anomalies or blockages were noted.



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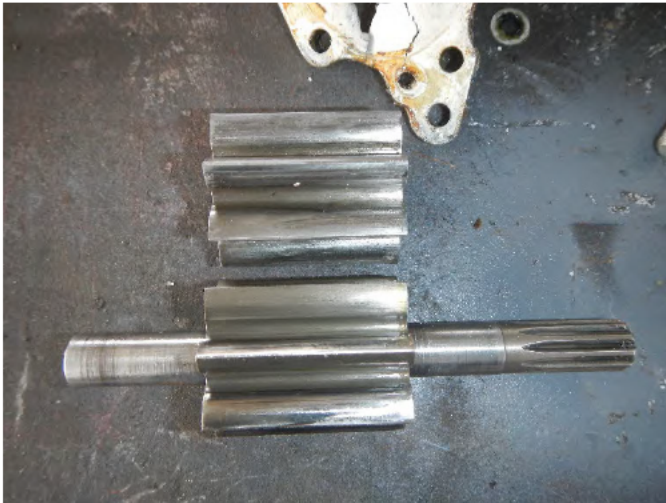
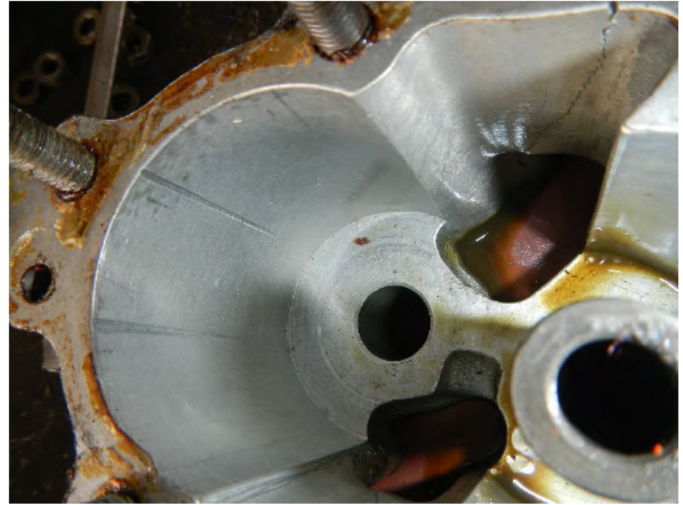
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OIL PUMPS

Condition: The oil pump remained attached to a fractured segment of the crankcase. The pump was disassembled and all components were covered with residual oil. The gears were intact and there was no sign of hard particle passage on the pump walls.

The scavenge pump remained attached to the separated starter adapter. The pump was disassembled and no pre-accident anomalies were noted.



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| | | |
|-------------------|------------------------|----------------|
| OIL FILTER | Manufacturer: Champion | P/N: CH48108-1 |
|-------------------|------------------------|----------------|

| | |
|------------|---|
| Condition: | The oil filter remained attached to its separated adapter. The filter was torn open exposing the filter element. No pre-accident anomalies were noted. A date of January 4, 2019 and a Hobbs time of 2,332.3 hours were hand written on the filter. |
|------------|---|



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OIL COOLER

Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition:

The oil cooler was separated and deformed with the top and bottom casings separated.



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CYLINDERS

CYLINDER #1

Condition: The #1 cylinder sustained impact damage that fractured numerous cooling fins, the bottom pushrod area of the cylinder head, the rocker cover, and the top sparkplug barrel. The tip of the exhaust valve and valve springs were displaced slightly from the rocker. The valve springs did not display any pre-accident anomalies. The fuel injector nozzle was bent. The cylinder was partially displaced from the fractured crankcase with some of the studs and through-bolts pulled away from the case. The cylinder was removed and no pre-accident anomalies were noted with the sparkplugs, piston, barrel, valves or valve seats. One side of the piston skirt was fractured as was the oil control ring in that area.



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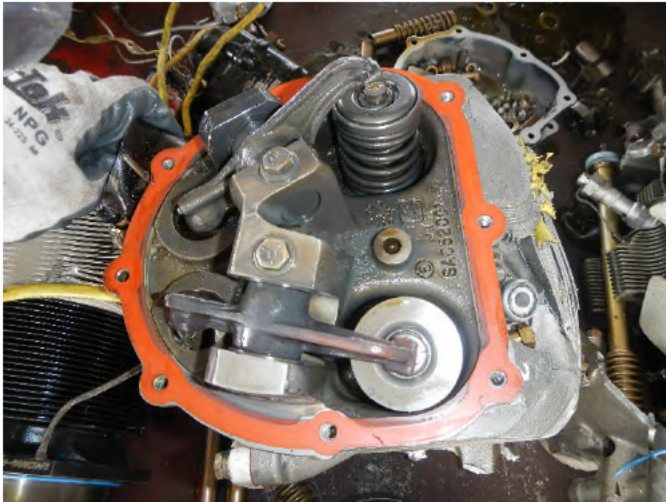
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CYLINDER #3

Condition: The #3 cylinder sustained impact damage that fractured numerous cooling fins, the top sparkplug barrel, and the fuel injector nozzle. Removal of the rocker cover revealed no pre-accident anomalies with the rockers and valve springs. Some of the attaching hardware was displaced due to the fractured crankcase, but the top studs retained their torque putty. The cylinder was removed and no pre-accident anomalies were noted with the sparkplugs, piston, barrel, valves or valve seats. One side of the piston skirt was fractured as was the oil control ring in that area.



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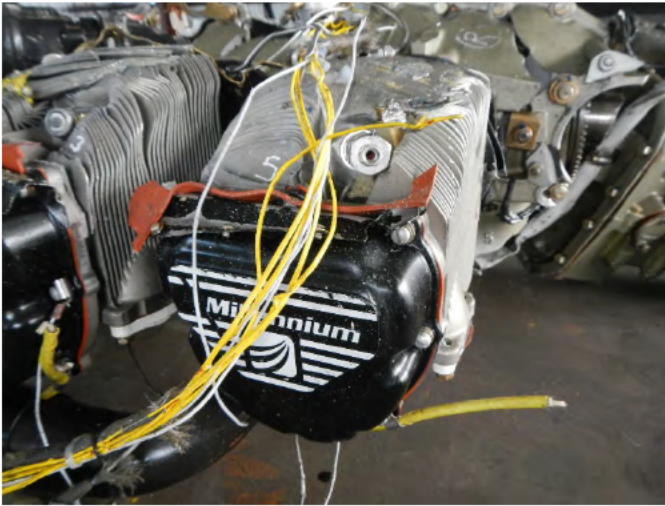
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CYLINDER #5

Condition: The #5 cylinder sustained impact damage that fractured numerous cooling fins and bent the fuel injector nozzle. Some of the attaching hardware was displaced due to the fractured crankcase, but the top studs retained their torque putty. The cylinder was removed and no pre-accident anomalies were noted with the sparkplugs, barrel, valves or valve seats. The piston face displayed two semi-circular indentations consistent with valve strikes.



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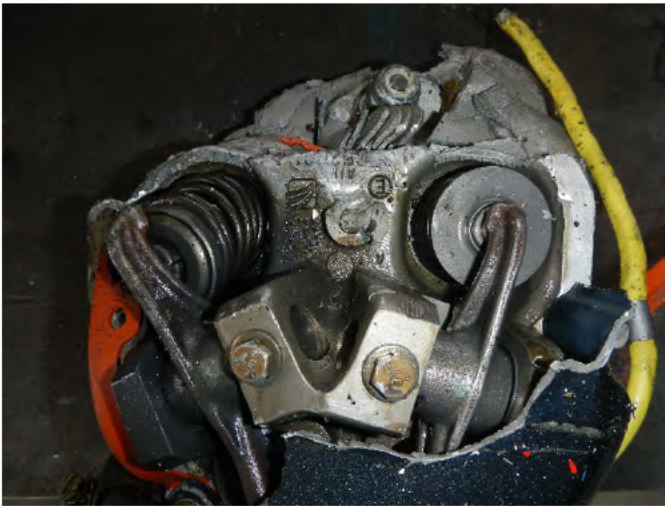
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CYLINDER #2

Condition: The #2 cylinder remained partially attached to the fractured crankcase. The attaching hardware retained its torque putty. The barrel was bent down over the piston and the top cooling fins displayed deformation damage. The cylinder head was separated and found in the debris. The remnants of the cylinder head revealed no pre-accident anomalies with the rockers, valves, valve seats, and valve springs. The barrel and piston revealed no pre-accident anomalies.



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CYLINDER #4

Condition: The #4 cylinder remained partially attached to the fractured crankcase. Only one of the top attaching studs remained intact. The barrel was bent down over the piston and the top cooling fins displayed deformation damage. The cylinder head was separated and found in the debris. The remnants of the cylinder head revealed no pre-accident anomalies with the rockers, valves, valve seats, and valve springs. The barrel and piston revealed no pre-accident anomalies.



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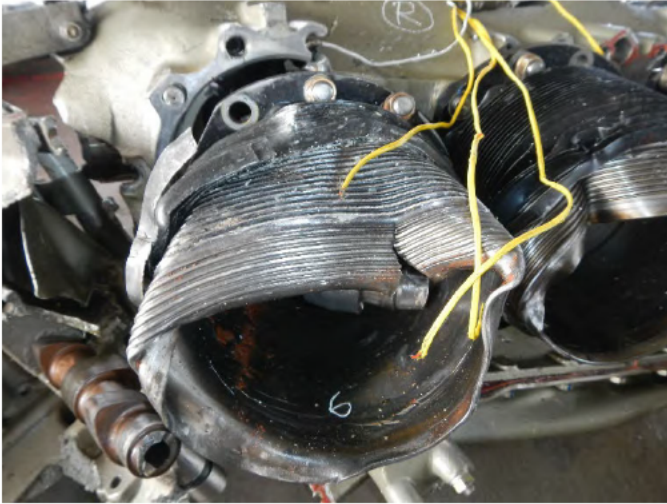
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CYLINDER #6

Condition: The #6 cylinder remained in position but all of the attaching hardware was separated from the crankcase. The barrel was bent down and many of the top cooling fins were separated and displayed deformation damage. The piston was separated from the connecting rod and a portion was found in the debris. The observed piston segment sustained impact-related deformation damage. The piston pin remained attached to the connecting rod with no pre-accident anomalies noted. The cylinder head was separated and found in the debris. The remnants of the cylinder head revealed no pre-accident anomalies with the valves the rockers or the intake valve springs. The barrel revealed no pre-accident anomalies.



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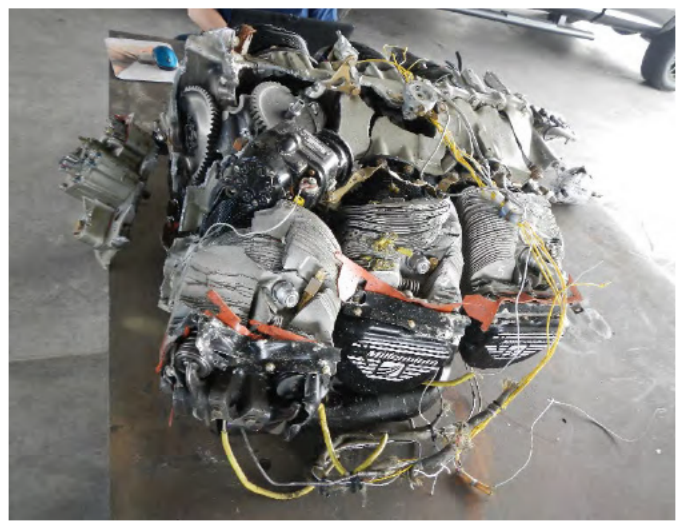
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CRANKCASE ASSEMBLY

| CRANKCASE | Casting Number: | 1-3-5: Unknown | 2-4-6: AEC653920 | S/N: Unknown |
|------------|---|----------------|------------------|--------------|
| Condition: | The crankcase was fractured in numerous locations and many of the mounting studs and through-bolts were torn free or displaced. All the fractures appeared to be impact related. The #1 main bearing was exposed with no pre-impact anomalies noted. There were no signs of any pre-accident anomalies and all components appeared to be well lubricated. | | | |



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CRANKSHAFT ASSEMBLY

CRANKSHAFT

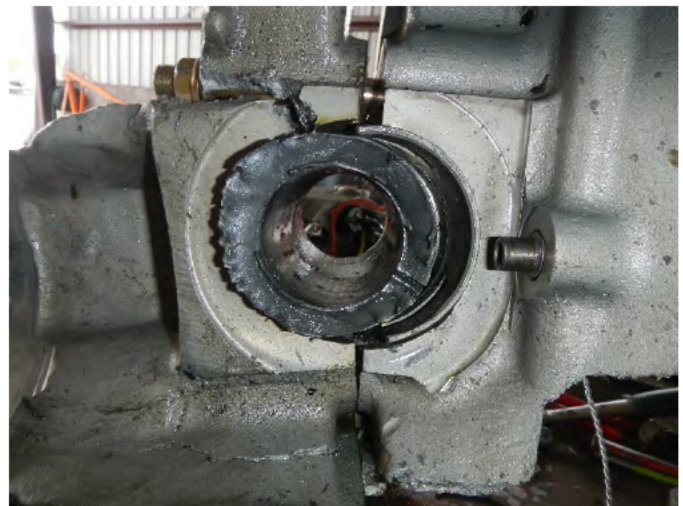
Forging Number: 649878

S/N: G249311N

Heat code: VAR

Condition:

The crankshaft was fractured at the oil transfer collar area. The fracture was irregular and jagged and appeared to be displaced toward one side. The alternator face gear remained attached to the crankshaft and no pre-accident anomalies were noted with the gear teeth. The crankshaft gear was bolted in place and the safety-wire was intact, but the gear was bent forward on the topside. There were no pre-accident anomalies noted with the gear teeth. The connecting rods remained secured in place and all rotated freely on the crankshaft when they were manually manipulated (with the exception of the #2) with no signs of discoloration or thermal distress.



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TRANSFER COLLAR

Condition:

The crankshaft was fractured at the oil transfer collar area and the collar was not observed.



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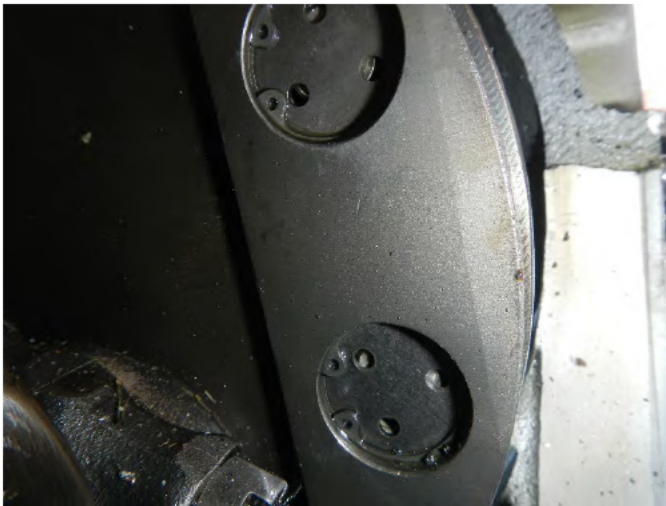
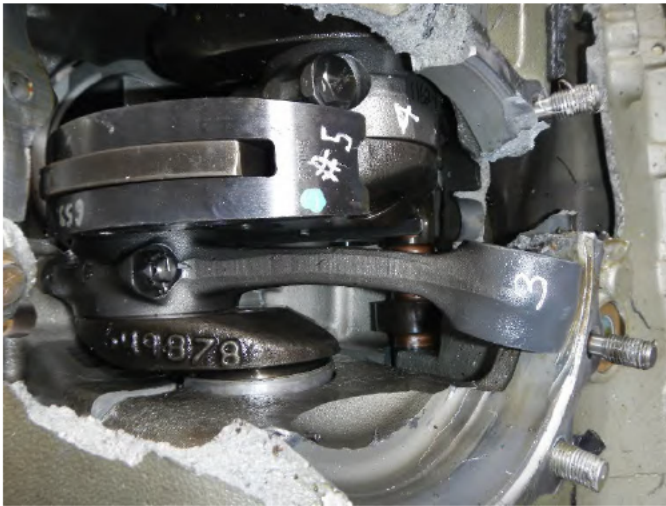
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COUNTER WEIGHTS

Condition:

The counterweights remained secured to the crankshaft. There were impact marks noted on the edges, consistent with contact with the fractured crankcase. There were no pre-accident anomalies noted with the counterweights.



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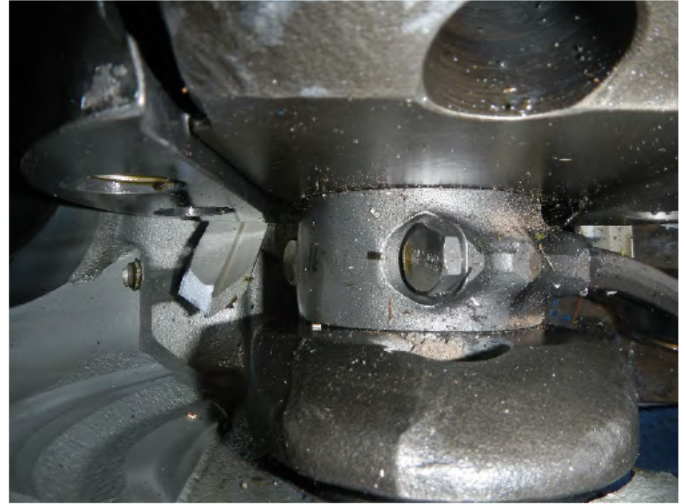
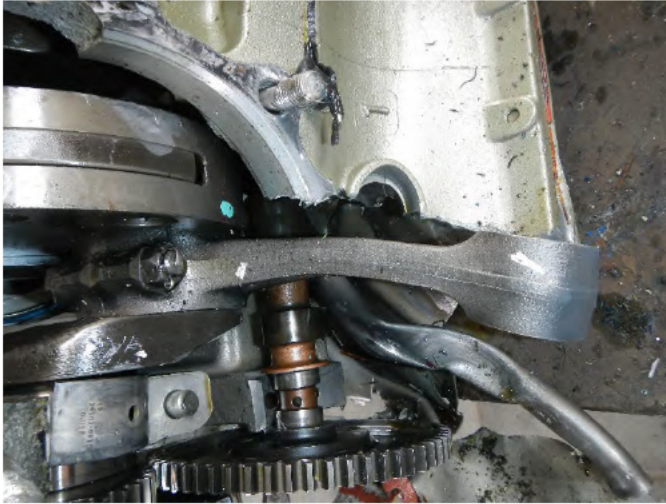
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#1 CONNECTING ROD

Forging or Serial Number: 632042

Condition:

The connecting rod remained attached to the crankshaft and the piston pin. It was bent aft with no sign of thermal discoloration. Manual manipulation of the connecting rod revealed no binding of the connecting rod bearing.

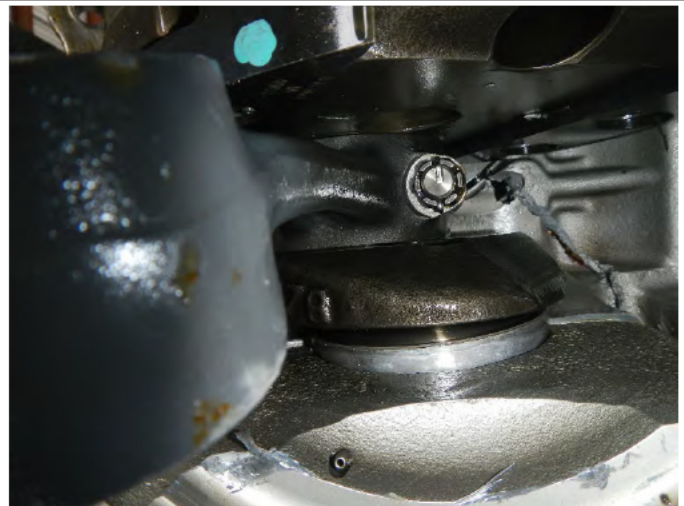


#3 CONNECTING ROD

Forging or Serial Number: 632042

Condition:

The connecting rod remained attached to the crankshaft and the piston pin. It was bent aft with no sign of thermal discoloration. Manual manipulation of the connecting rod revealed no binding of the connecting rod bearing.



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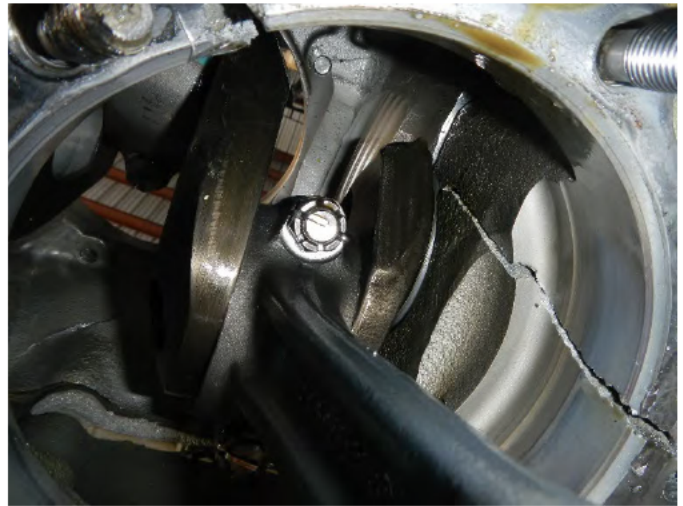
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#5 CONNECTING ROD

Forging or Serial Number: 632042

Condition:

The connecting rod remained attached to the crankshaft and the piston pin. It was bent aft slightly with no sign of thermal discoloration. Manual manipulation of the connecting rod revealed no binding of the connecting rod bearing.



#2 CONNECTING ROD

Forging or Serial Number: 632042

Condition:

The connecting rod remained attached to the crankshaft and the piston pin. There was no sign of thermal discoloration. The connecting rod could not be manipulated because the #2 cylinder could not be removed.



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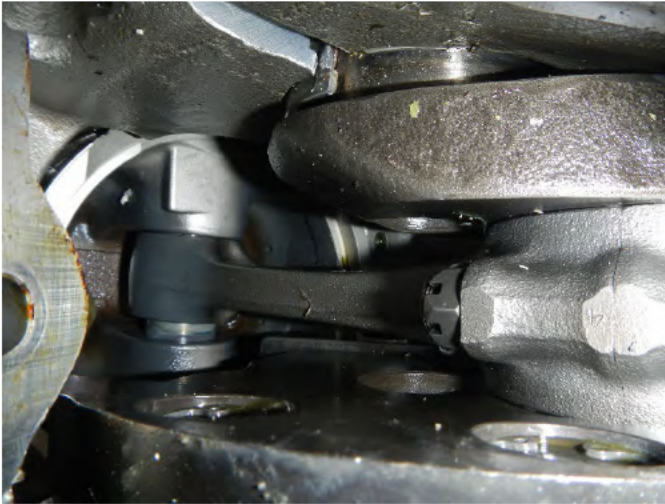
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#4 CONNECTING ROD

Forging or Serial Number: 632042

Condition:

The connecting rod remained attached to the crankshaft and the piston pin. The connecting rod was bent slightly, but there was no sign of thermal discoloration. Manual manipulation of the connecting rod revealed no binding of the connecting rod bearing.



#6 CONNECTING ROD

Forging or Serial Number: 632042

Condition:

The connecting rod remained attached to the crankshaft and the piston pin. The connecting rod displayed s-bending with no sign of thermal discoloration. Manual manipulation of the connecting rod revealed no binding of the connecting rod bearing.



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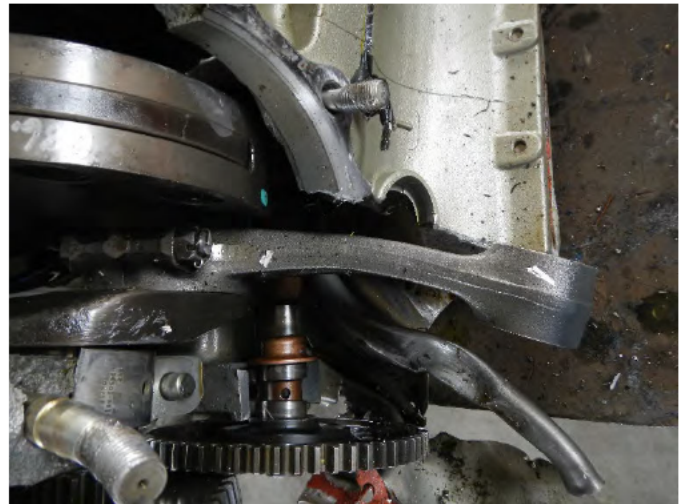
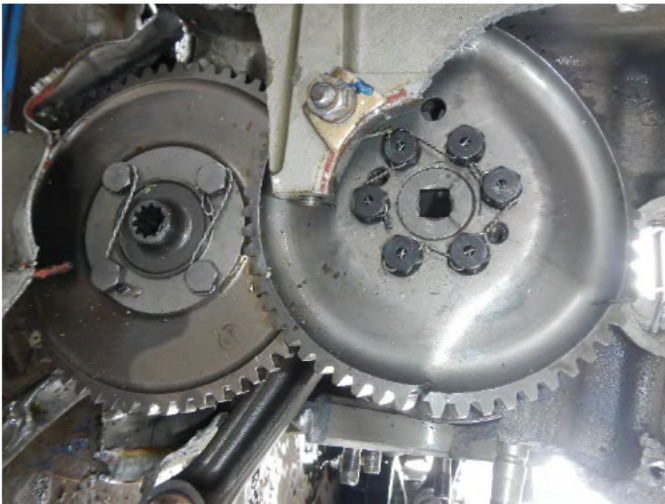
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CAMSHAFT

CAMSHAFT

Condition: The camshaft was fractured and bent in numerous locations. The camshaft gear remained attached and the safety-wire was intact. There were no pre-accident anomalies noted with the lobes.



LIFTERS

Condition: The many of the lifters were separated from the engine due to the fractures in the crankcase. The lifter faces displayed light wear with one showing light surface corrosion and one showing some minor spalling.

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ACCESSORY GEARS

Condition:

The accessory gears sustained impact-related damage with the idler gear being separated from the crankcase. There were no pre-accident anomalies noted.



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| | | | |
|------------------------|---|--------------|--------------|
| STARTER | Manufacturer: Unknown | P/N: Unknown | S/N: Unknown |
| Condition: | The starter motor was separated from the adapter and was not examined as part of this investigation. | | |
| STARTER ADAPTER | | | |
| Condition: | The starter adapter was separated from the engine and sustained impact related damage. There were no pre-accident anomalies noted. The scavenge pump remained attached to the housing and no anomalies were noted when it was disassembled. | | |



| | | | |
|-------------------|---|--------------|--------------|
| ALT/GEN #1 | Manufacturer: Unknown | P/N: Unknown | S/N: Unknown |
| Condition: | The alternator was separated from the engine and a portion of the crankcase remained attached. The unit sustained impact damage. There were no external pre-accident anomalies noted with the alternator. The drive coupling remained secured in place. | | |



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VACUUM PUMP

Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition:

The vacuum pump was separated from the accessory end of the engine and it sustained significant impact deformation damage that fractured the housing and separated the drive mechanism. The drive coupling remained intact

