CONTINENTAL™
AEROSPACE TECHNOLOGIES

# ENGINE EXAMINATION REPORT

| | |
|---|---|
| **ENGINE MODEL** | GTSIO-520-D |
| **ENGINE SERIAL NUMBER** | 219099-72-D-R |
| **AIRCRAFT MAKE & MODEL** | Cessna 421 |
| **AIRCRAFT SERIAL NUMBER** | 421-0164 |
| **AIRCRAFT REGISTRATION** | N731PF |
| **FILE NUMBER** | 19-104 |

| NAME | SIGNATURE | DATE |
|---|---|---|
| Kurt Gibson | [redacted] | 11/15/2019 |

## GENERAL INFORMATION

| **EXAMINATION** | | **ACCIDENT DATA** | |
|---|---|---|---|
| **DATE** | 10/02/2019 | **NTSB ACCIDENT #** | ERA19FA283 |
| **FACILITY** | Florida Air Recovery | **NTSB INVESTIGATOR** | Eric Alleyne |
| **ADDRESS** | 7403 Philips Hwy<br>Jacksonville, FL 32256 | **FAA INVESTIGATOR** | Antonia Gonzalez |
| | | **ACCIDENT DATE** | 09/29/2019 |
| | | **ACCIDENT LOCATION** | Deland, Florida |

## ENGINE INFORMATION

| | |
|---|---|
| **ENGINE POSITION** | Left |
| **TOTAL TIME** | Unknown |
| **TIME SOH** | 883.3 (time taken from the last 100-hour inspection) |
| **TYPE & TIME SLI** | Unknown |
| **BUILD DATE** | 02/21/1972 (shipped date) |
| **IN SERVICE DATE** | Unknown |

**Significant logbook information:**
The last 100 hour/annual inspection was performed on 02/15/2014 at a Hobbs time of 858.3.

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

There were no anomalies observed that would have prevented normal operation or production of rated horsepower.

**Disposition of engine following exam:**
The engine remained at Florida Air Recovery in Jacksonville, Florida.

## INSPECTION WITNESSES

| | | | |
|---|---|---|---|
| **NAME** | Kurt Gibson | **NAME** | Eric Alleyne |
| **ADDRESS** | Mobile, Alabama | **ADDRESS** | Eastern Region |
| **ORGANIZATION** | Continental Aerospace | **ORGANIZATION** | NTSB |
| **PHONE** | [redacted] | **PHONE** | ([redacted] |
| | | | |
| **NAME** | Casey Love | **NAME** | |
| **ADDRESS** | Wichita, Kansas | **ADDRESS** | |
| **ORGANIZATION** | Textron Aviation | **ORGANIZATION** | |
| **PHONE** | [redacted] | **PHONE** | |
| | | | |
| **NAME** | | **NAME** | |
| **ADDRESS** | | **ADDRESS** | |
| **ORGANIZATION** | | **ORGANIZATION** | |
| **PHONE** | | **PHONE** | |

# EXTERNAL INSPECTION OF ENGINE

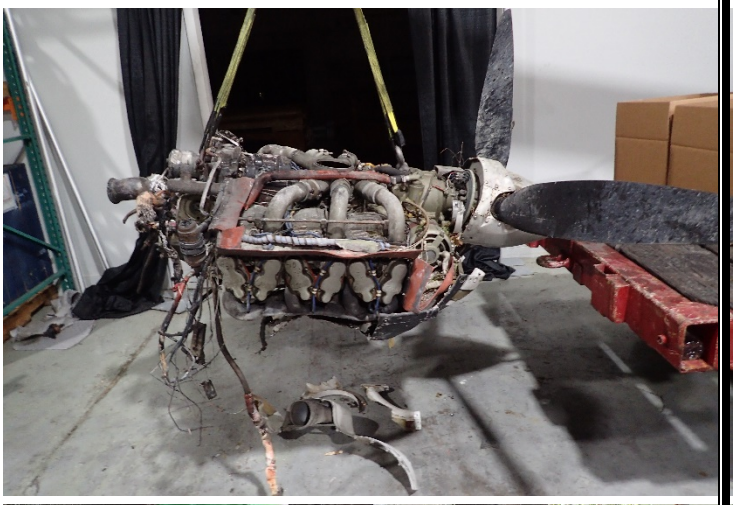
The engine remained partially attached to the airframe and displayed impact and thermal damage signatures; the majority of the impact damage was concentrated to the bottom of the engine. The crankcase remained intact and displayed thermal discoloration towards the rear of the crankcase. There were no holes in the crankcase that would indicate a catastrophic internal engine failure. The propeller flange remained attached to the propeller shaft and displayed impact damage signatures. All six cylinders remained attached to their cylinder bays and displayed varying amounts of impact and thermal damage. The three-blade, constant speed propeller remained attached to the propeller shaft and displayed impact damage signatures.

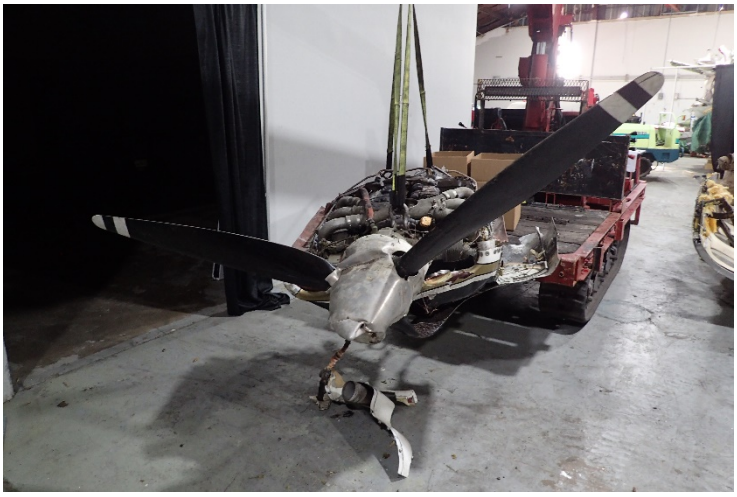
The right magneto had broken free from its installation point and displayed impact and thermal damage signatures. The left magneto remained attached to its installation point and displayed thermal damage signatures. The ignition harness remained attached to both magnetos and to each spark plug and displayed impact damage signatures. All twelve spark plugs remained installed in their cylinders and displayed varying amounts of impact damage with the bottom spark plugs displaying the most damage.

The fuel pump remained attached to its installation point and displayed impact and thermal damage signatures. The throttle and metering assembly remained attached to its installation point on the engine nacelle and displayed significant thermal damage signatures. The fuel manifold valve remained attached to its installation point and displayed thermal damage signatures. There were no visible signs of fuel leaks observed around any of the fuel components.

The induction system displayed thermal damage signatures with the induction tubing at the rear of the engine showing the most damage. There were no visible signs of induction leaks observed around any of the intake tubes or the manifold. The exhaust system displayed impact damage signatures, several of the risers and tubes were bent and crushed. There were no visible signs of exhaust leaks observed around any of the exhaust components.

The turbocharger remained partially attached to its installation point and displayed impact and thermal damage signatures; the V-band clamp was observed to be in place and secure. The wastegate and slope controller remained attached to their installation points and displayed thermal damage signatures.





# ENGINE TEARDOWN AND COMPONENT EXAMINATION

| **EXHAUST SYSTEM** | |
|---|---|
| Condition: | The exhaust system displayed significant impact damage with most of the damage occurring to the exhaust risers. There were no signs of exhaust leaks or blockages observed. |

| **INDUCTION SYSTEM** | |
|---|---|
| Condition: | The induction system displayed impact and thermal damage signatures. There were no signs of induction leaks or blockages noted. The induction air filter displayed significant thermal damage signatures and portions of the induction air filter housing had melted onto the filter element. |

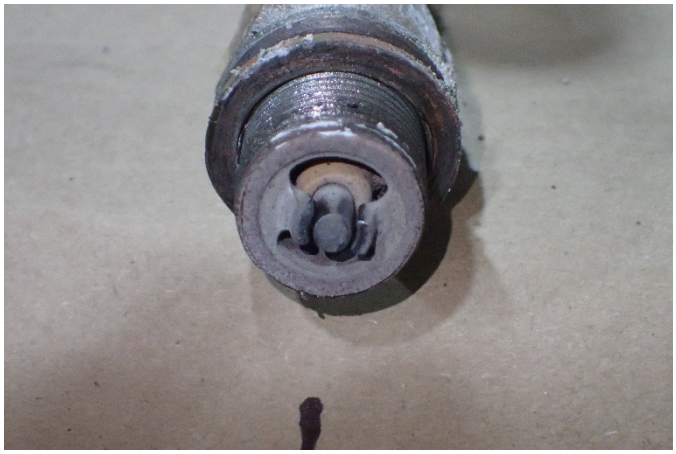
## IGNITION SYSTEM

| **LEFT MAGNETO** | Manufacturer: TCM | P/N: 10-349220-4R | S/N: B061619 |
|---|---|---|---|
| Condition: | The magneto remained attached to its installation point and displayed thermal damage signatures. The magneto was removed, and it was noted that the driveshaft was capable of rotation. The magneto drive was rotated using a drill and it was observed that the magneto was capable of producing a spark to each ignition lead in the correct firing order. There were no anomalies observed. | | |

| **RIGHT MAGNETO** | Manufacturer: TCM | P/N: 10-349260-7R | S/N: B060105 |
|---|---|---|---|
| Condition: | The magneto remained attached to its installation point and displayed thermal damage signatures. The magneto was removed, and it was noted that the driveshaft was capable of rotation. The magneto drive was rotated using a drill and it was observed that the magneto was capable of producing a spark to each ignition lead in the correct firing order. There were no anomalies observed. | | |

| **IGNITION HARNESS** | Manufacturer: Skytronics | P/N: Not observed | S/N: Not observed |
|---|---|---|---|
| Condition: | The ignition harness displayed impact and thermal damage signatures. During magneto operation, it was observed that the ignition harness was capable of conducting a spark from the magneto to each ignition lead end or to the first portion of impact damage. There were no anomalies observed. | | |

| **SPARK PLUGS** | Manufacturer: Champion | P/N: RHB32E |
|---|---|---|
| Condition: | The spark plugs displayed varying amounts of impact and thermal damage signatures. The top spark plugs were removed for examination and the bottom spark plug electrodes were examined using a lighted borescope. The electrodes displayed normal operating and some of the spark plugs were in a normal worn out condition. There were no anomalies observed. | |

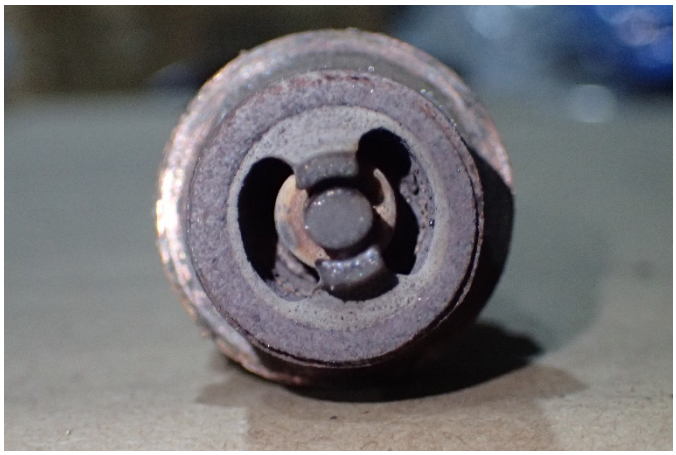


#1 Top Spark Plug

#1 Bottom Spark Plug

#3 Top Spark Plug

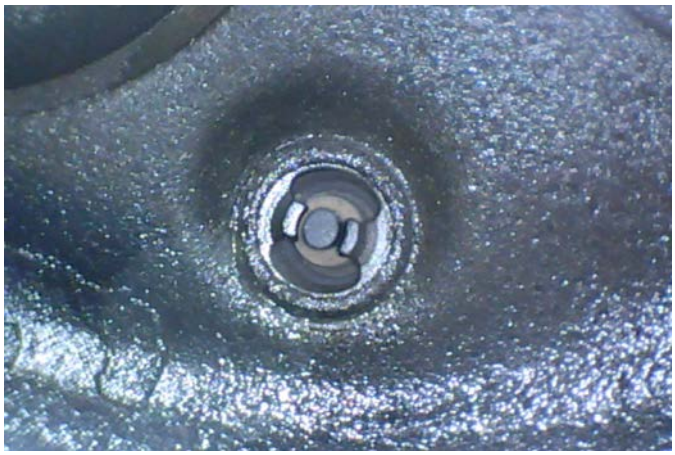
#3 Bottom Spark Plug



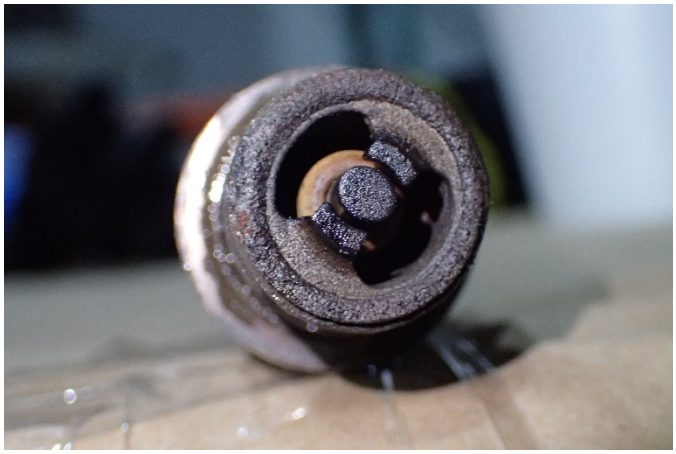
#5 Top Spark Plug

#5 Bottom Spark Plug

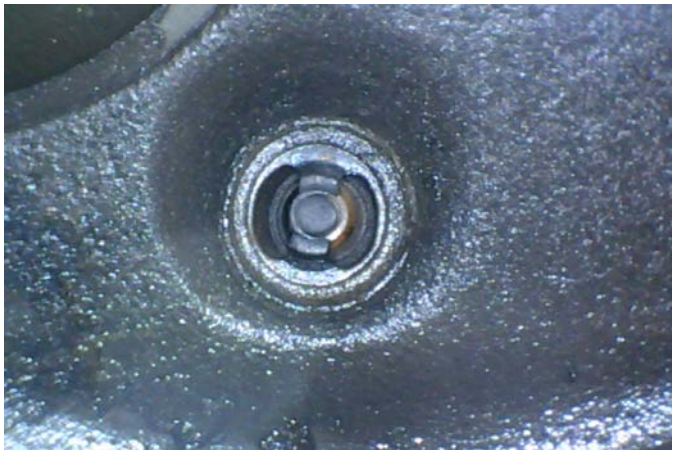
#2 Top Spark Plug



#2 Bottom Spark Plug

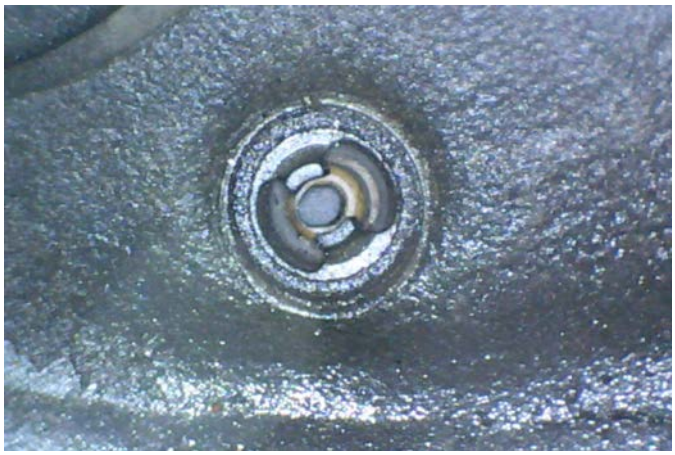


#4 Top Spark Plug



#4 Bottom Spark Plug

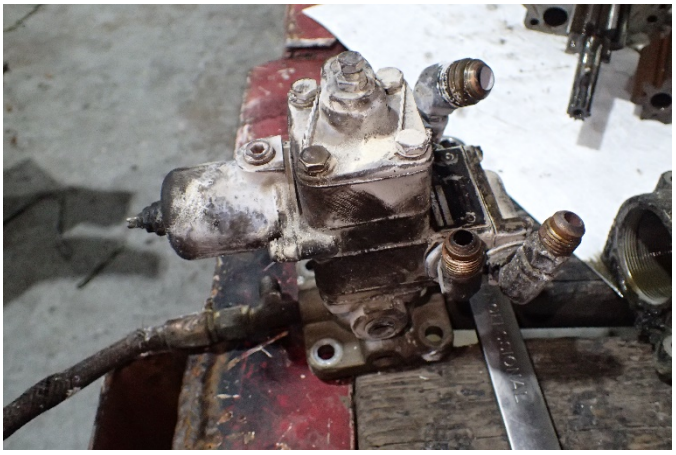
#6 Top Spark Plug

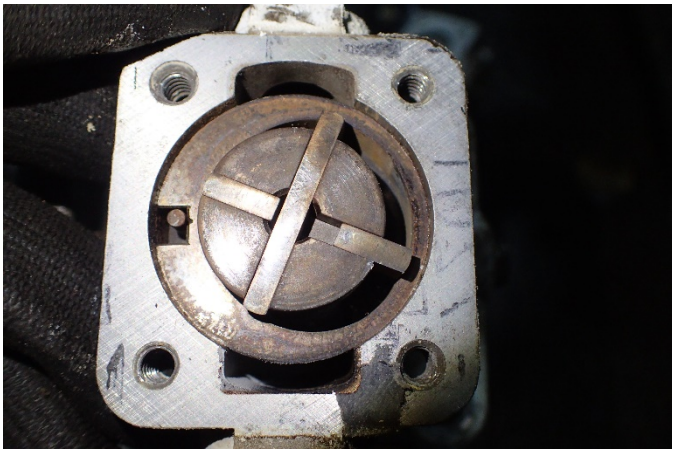


#6 Bottom Spark Plug

# FUEL SYSTEM

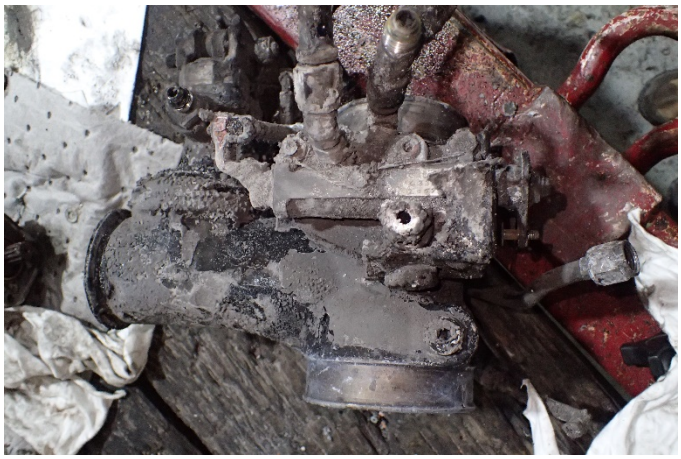
| **FUEL PUMP** | Manufacturer: TCM | P/N: 630751-4 | S/N: I137204 |
|---|---|---|---|
| Condition: | The fuel pump remained attached to its installation point and displayed thermal and impact damage signatures. The fuel pump was removed, and it was noted that the drive coupling remained intact. The fuel pump was disassembled, and the internal components displayed thermal damage signatures as well as normal operating signatures. | | |

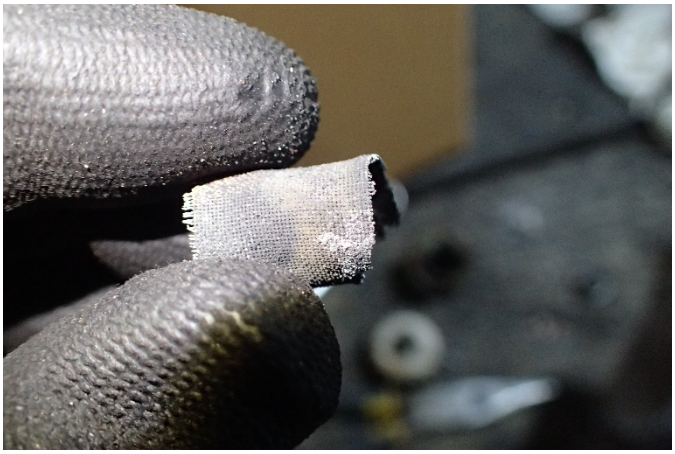




| **THROTTLE BODY METERING UNIT** | Manufacturer: Not observed | P/N: 633473-9 | S/N: I057204R |
|---|---|---|---|

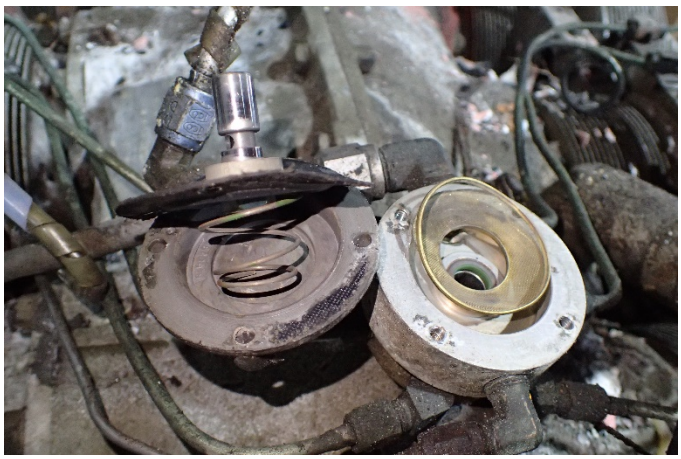
| | |
|---|---|
| Condition: | The throttle and metering assembly remained attached to its installation point in the engine nacelle. The assembly displayed significant thermal damage signatures to the entire assembly. The mixture and throttle control cable rod ends remained attached to the control arms and were properly secured. The assembly was removed and disassembled; the internal components displayed thermal damage signatures as well as normal operating signatures. The fuel inlet screen was removed and was noted to be significantly damaged by thermal forces. There were no anomalies observed. |





| **FUEL MANIFOLD VALVE** | Manufacturer: TCM | P/N: 634326-7A1 | S/N: D287509? |
|---|---|---|---|

| Condition: | The fuel manifold valve remained attached to its installation point and displayed thermal damage signatures. The valve was disassembled, and the internal components displayed some thermal damage as well as normal operating signatures. |
|---|---|



| **FUEL NOZZLES AND LINES** | Manufacturer: Not observed |
|---|---|

| Condition: | The nozzles remained installed in their cylinders and displayed varying amounts of thermal damage. The nozzles were removed and were observed to be clear of any obstructions. There were no anomalies observed. |
|---|---|

#1 Nozzle

#3 Nozzle

#5 Nozzle

#2 Nozzle

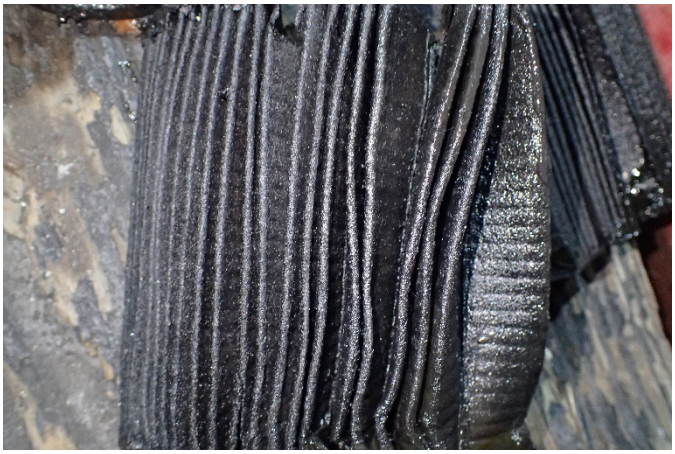
#4 Nozzle

#6 Nozzle

# LUBRICATION SYSTEM

| | |
|---|---|
| **OIL SUMP** | |
| Condition: | The oil sump displayed significant impact damage signatures and was crushed upwards. There were no anomalies observed |
| **OIL PICK-UP TUBE & SCREEN** | |
| Condition: | Due to the type of inspection performed the oil pick-up tube and screen were not observed. |
| **OIL PUMP** | |
| Condition: | The oil pump was removed and visually inspected. The oil pump gears, and oil pressure relief valve displayed normal operating signatures. The oil pump housing displayed minor scoring consistent with hard particle passage. |

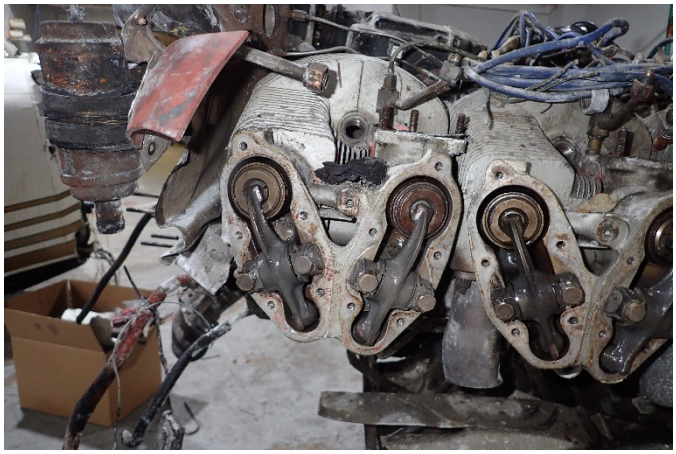
| **OIL FILTER** | Manufacturer: Illegible | P/N: Illegible |
|---|---|---|
| Condition: | The oil filter and adapter had broken free from its installation point and displayed significant thermal damage. The oil filter housing was cut open and the filter pleats were removed. The pleats were thermally damaged; however, there were no signs of metallic material within the filter pleats. | |



| **OIL COOLER** | Manufacturer: Not observed | P/N: Not observed | S/N: Not observed |
|---|---|---|---|
| Condition: | The oil cooler remained attached to its installation point and displayed thermal damage signatures. There were no oil leaks noted around the oil cooler. | | |

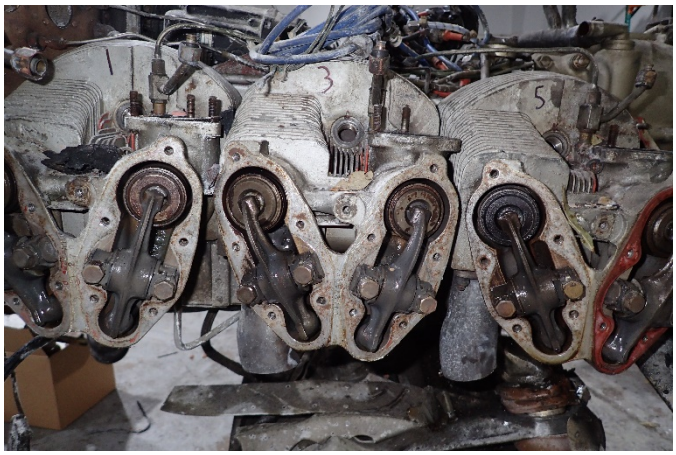
# CYLINDERS

| **CYLINDERS** | |
|---|---|
| Condition: | All six cylinders remained attached to their cylinder bays and displayed varying amounts of thermal and impact damage. The cylinders were inspected using a lighted borescope; the piston faces, cylinder bores, and valve heads displayed normal operating and combustion signatures. During crankshaft rotation the #5 cylinder did not have any compression, it was noted that the exhaust pushrod housing was impact damaged and was significantly bent; the rocker arm was tapped closed and the cylinder would then display thumb compression and suction. The rest of the cylinders displayed good thumb compression and suction during crankshaft rotation. |



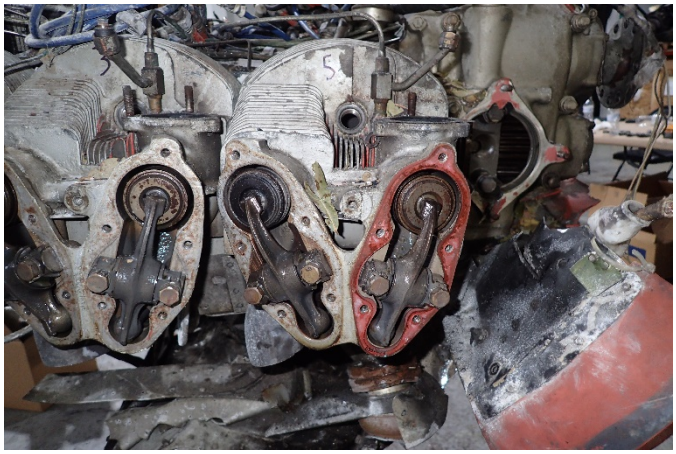
#1 Cylinder Overhead

#1 Cylinder Bore

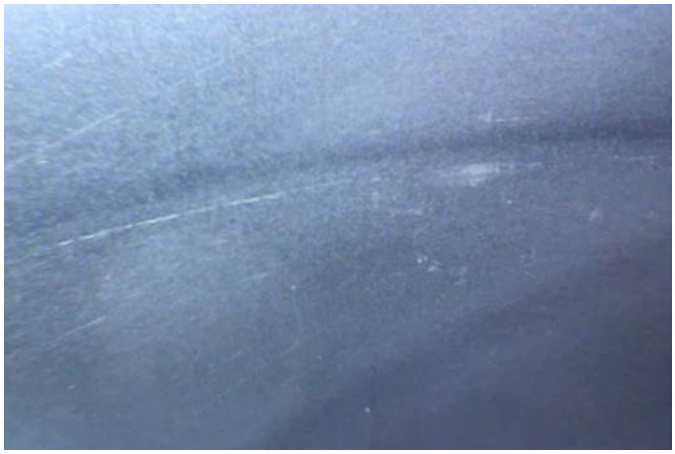


#3 Cylinder Overhead

#3 Cylinder Bore



#5 Cylinder Overhead

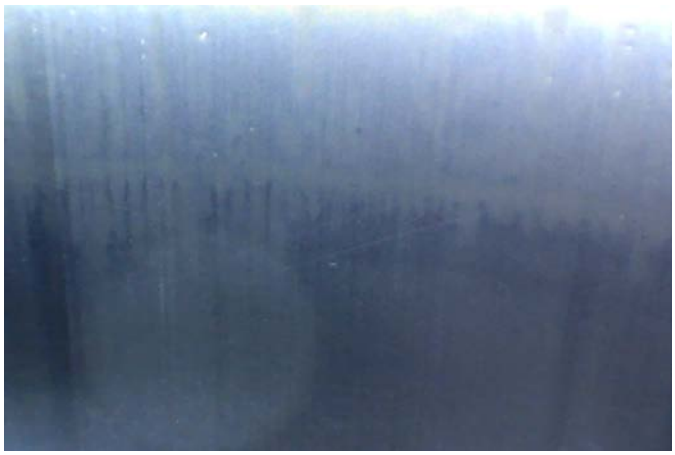


#5 Cylinder Bore

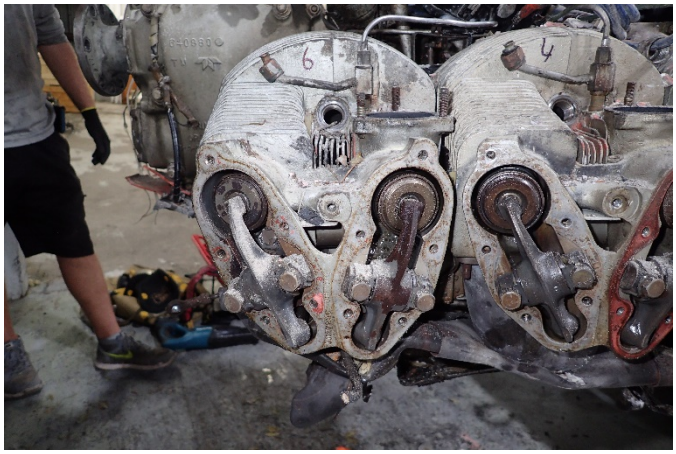
#2 Cylinder Overhead

#2 Cylinder Bore

#4 Cylinder Overhead



#4 Cylinder Bore

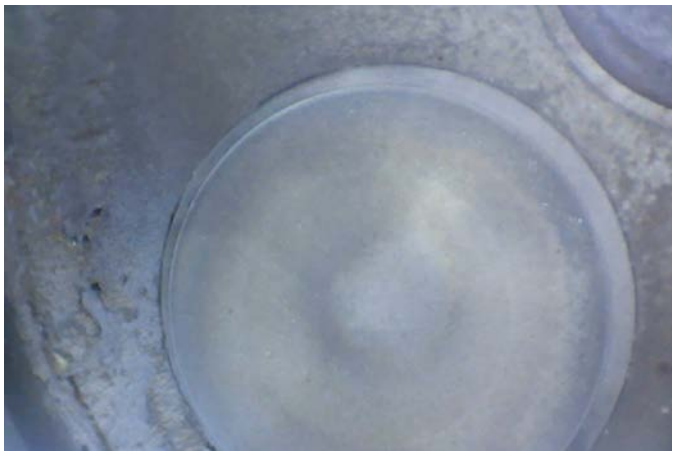


#6 Cylinder Overhead

#6 Cylinder Bore

| **VALVES AND GUIDES** | |
|---|---|
| Condition: | The valve heads were inspected using a lighted borescope. The valve heads displayed normal operating and combustion signatures. During crankshaft rotation, the #5 exhaust valve would not close completely which was consistent with impact damage to the push rod, the rest of the valves operated normally. |

#1 Exhaust Valve

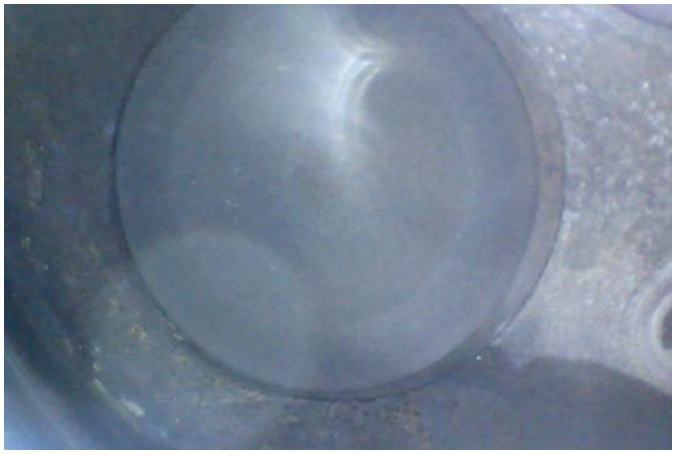


#1 Intake Valve

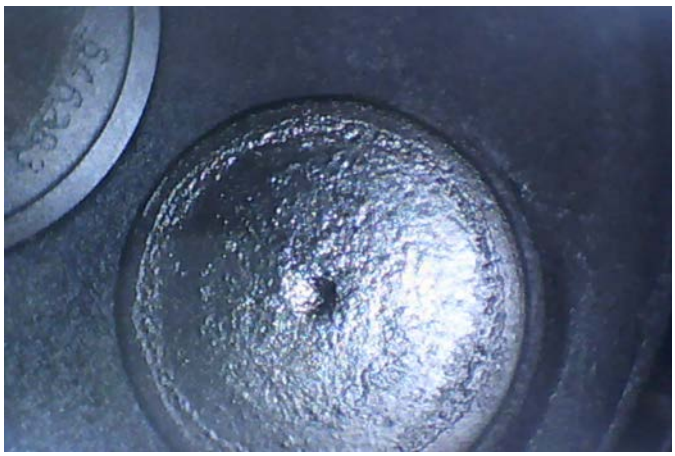
#3 Exhaust Valve

#3 Intake Valve

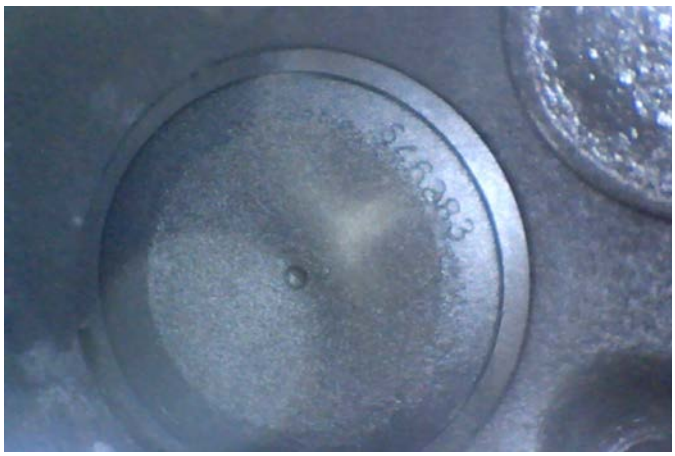
#5 Exhaust Valve



#5 Intake Valve



#2 Exhaust Valve



#2 Intake Valve

#4 Exhaust Valve

#4 Intake Valve

#6 Exhaust Valve

#6 Intake Valve

| **ROCKER ARMS AND SHAFTS** | |
|---|---|
| Condition: | The rocker arms displayed normal operating and lubrication signatures. During crankshaft rotation, the #5 exhaust rocker arm would not move completely to the closed position which was consistent with the impact damage to the #5 exhaust pushrod and housing; the rest of the rocker arms operated normally during crankshaft rotation. |

| **PISTONS** | Piston P/N: Inaccessible |
|---|---|
| Condition: | All of the piston faces were inspected using a lighted borescope; the piston faces displayed normal operating and combustion signatures. During crankshaft rotation all of the pistons operated normally. |

#1 Piston

#3 Piston

#5 Piston

#2 Piston

#4 Piston

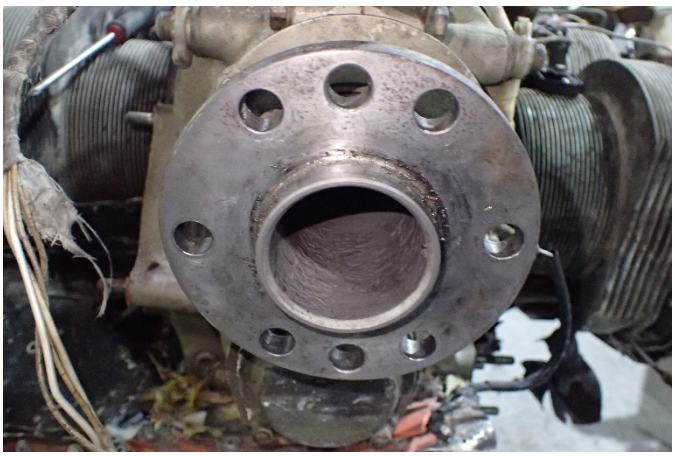
#6 Piston

# CRANKCASE ASSEMBLY

| **CRANKCASE** | Casting Number: | 1-3-5: Not observed | 2-4-6: 640980 | S/N: J6A-861 0 R |
|---|---|---|---|---|
| Condition: | The crankcase remained intact and displayed impact and thermal damage signatures. There were no holes in the crankcase that would indicate a catastrophic internal engine failure. There were no anomalies observed. | | | |

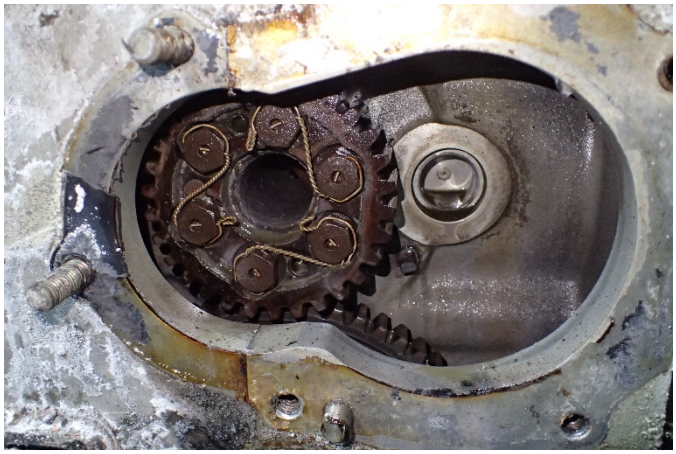
# CRANKSHAFT ASSEMBLY

| **PROPELLER SHAFT** | Forging Number: Inaccessible | S/N: Not observed | Heat Code: Inaccessible |
|---|---|---|---|
| Condition: | The propeller flange remained attached to the propeller shaft and displayed impact damage signatures. The propeller shaft gear was partially visible after removing the alternator and displayed normal operating signatures. The propeller shaft was rotated using a hand tool and continuity was established between the propeller shaft, reduction gear, quill shaft, crankshaft, camshaft, connecting rods, and associated components. There were no anomalies observed. | | |

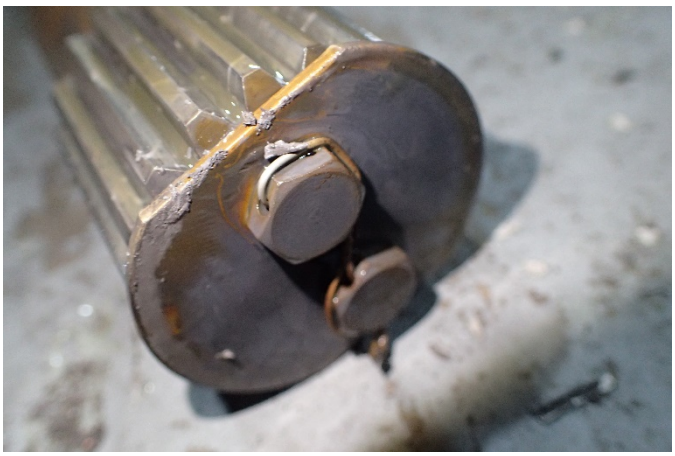


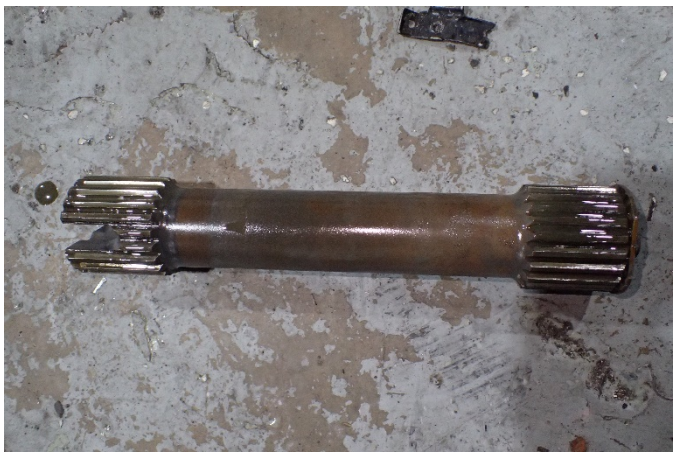
| **REDUCTION GEAR** | Forging Number: Inaccessible | S/N: Inaccessible | Heat Code: Inaccessible |
|---|---|---|---|
| Condition: | The reduction gear was partially visible after removing the alternator and the gear displayed normal operating signatures. During propeller shaft rotation the reduction gear operated normally. | | |

| **CRANKSHAFT** | Forging Number: Inaccessible | S/N: Inaccessible | Heat code: Inaccessible |
|---|---|---|---|
| Condition: | The crankshaft gear was observed after removing the starter adapter; the gear remained secure, was undamaged, and displayed normal operating signatures. Operation of the crankshaft was verified by rotating the propeller flange and observing piston movement; the crankshaft operated normally. | | |



| **QUILL SHAFT** | |
|---|---|
| Condition: | Operation of the quill shaft was verified by rotating the quill shaft and observing the crankshaft gear operation; the quill shaft operated normally. The quill shaft was removed, and the shaft displayed normal operating signatures. |

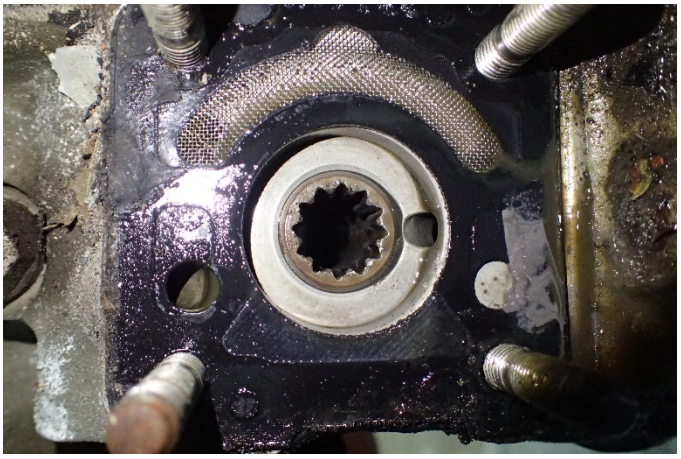




| | | |
|---|---|---|
| **INTERNAL TIMING** | | |
| Condition: | The internal timing was verified to be correct by the alignment of the crankshaft and camshaft gear teeth marks. | |
| **CONNECTING RODS** | P/N: Inaccessible | Forging or Serial Number: Inaccessible |
| Condition: | Operation of the connecting rods was verified by rotating the propeller shaft and observing piston movement. The connecting rods operated normally. | |

# CAMSHAFT

| **CAMSHAFT** | P/N: Inaccessible | S/N: Inaccessible |
|---|---|---|
| Condition: | Operation of the camshaft was verified by rotating the propeller shaft and observing rocker arm movement. The camshaft operated normally. | |
| **ACCESSORY GEARS** | | |
| Condition: | The magneto drive gears were observed after the magnetos were removed and displayed normal operating signatures. The propeller governor gear was observed after removing the governor and it displayed normal operating signatures. The accessory gears operated normally during propeller shaft rotation. | |



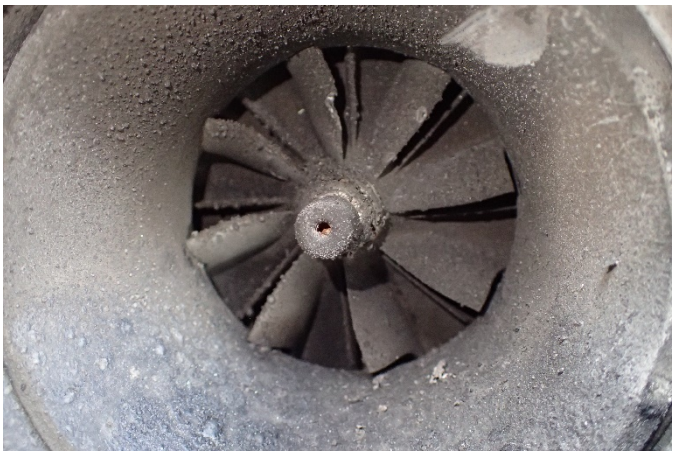
# ACCESSORIES

| **STARTER** | Manufacturer: Not observed | P/N: Not observed | S/N: Not observed |
|---|---|---|---|
| Condition: | The starter had broken free from its installation point and displayed impact and thermal damage signatures. | | |
| **STARTER ADAPTER** | P/N: Illegible | | |
| Condition: | The starter adapter remained attached to its installation point and displayed impact damage and some thermal damage signatures. The dampener remained secured to the starter adapter shaft and displayed thermal damage signatures. The starter adapter was removed, and it was observed that the drive gear was undamaged, and the shaft was capable of normal movement. | | |

| **ALTERNATOR** | Manufacturer: Electrosystems | P/N: AVL-9510 | S/N: C070960 |
|---|---|---|---|
| Condition: | The alternator remained attached to its installation point and displayed impact damage signatures. The alternator was removed, and it was observed that the alternator drive remained intact; however it was not capable of rotation which was consistent with impact damage. | | |

| **VACUUM PUMP** | Manufacturer: Pesco Aircraft | P/N: 3P207JA | S/N: 2728 |
|---|---|---|---|
| Condition: | The vacuum pump remained attached to its installation point and displayed thermal damage signatures. The vacuum pump was removed, and the driveshaft was noted to have remained intact. | | |

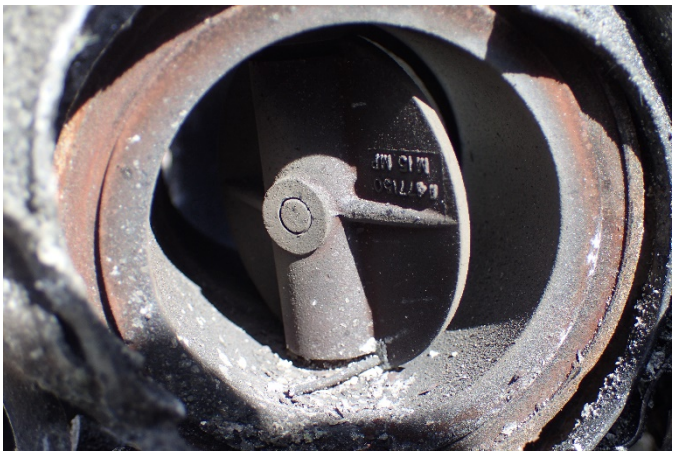
| **TURBO** | Manufacturer: Not observed | P/N: Not observed | S/N: Not observed |
|---|---|---|---|
| Condition: | The turbocharger displayed impact and thermal damage signatures and remained partially attached to its installation point. The tailpipe and compressor inlet were removed, and the turbocharger was examined. It was observed that the compressor wheel was partially displaced and several of the blades were bent in the opposite direction of rotation and there was a gouge in the leading edges of one of the blades. The turbine blades were undamaged and displayed normal operating signatures. The turbocharger turbine and compressor were incapable of rotation consistent with the observed impact damage. | | |



| **TURBO RATE CONTROLLER** | Manufacturer: Garrett | P/N: C165004-0301 | S/N: 00914 |
|---|---|---|---|
| Condition: | The turbocharger controller remained attached to its installation point and displayed significant thermal damage signatures. | | |

| **TURBO CONTROLLER** | Manufacturer: Not observed | P/N: Not observed | S/N: Not observed |
|---|---|---|---|
| Condition: | The turbocharger controller remained attached to its installation point and displayed significant thermal damage signatures. | | |

| **WASTEGATE** | Manufacturer: Not observed | P/N: Not observed | S/N: Not observed |
|---|---|---|---|
| Condition: | The wastegate remained attached to its installation point and displayed thermal damage signatures. It was observed that the wastegate actuator arm remained attached to the wastegate valve. The wastegate valve was observed in a midrange opening position. | | |



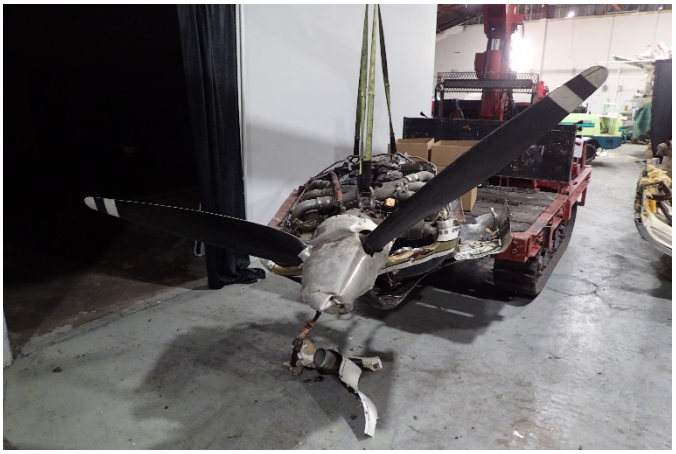
## PROPELLER

| **PROPELLER GOVERNOR** | Manufacturer: Woodward | P/N: 210595 | S/N: 1292580 D |
|---|---|---|---|

| Condition: | The governor remained attached to its installation point and displayed significant impact damage signatures. The governor was removed, and the governor's gasket screen was observed to be clear of any contaminates. The governor was partially disassembled, and the internal components displayed normal operating signatures as well as impact damage signatures. |
|---|---|

| **PROPELLER** | Manufacturer: McCauley | P/N: Not observed | S/N: 779619 |
|---|---|---|---|

| Condition: | The three-blade, constant speed propeller remained partially attached to the propeller flange and displayed impact damage signatures. The propeller blade marked "A" displayed minor damage to the rubber boot. The propeller blade marked "B" displayed minor impact damage near the root of the blade. Propeller blade marked "C" displayed minor S-bending as well as significant aft bending deformation. During the on-scene portion of the investigation, several tree branches were found with clean approximate 45-degree angle cuts and appeared to have black paint transfer. |
|---|---|



Propeller Blade “A”

Propeller Blade “B”

Propeller Blade “C”