



Continental Motors

ENGINE EXAMINATION REPORT

ENGINE MODEL	IO-550-N50B conv. to turbo-normalized TAT STC
ENGINE SERIAL NUMBER	691489
AIRCRAFT MAKE & MODEL	Cirrus SR22
AIRCRAFT SERIAL NUMBER	2908
AIRCRAFT REGISTRATION	N764CT
FILE NUMBER	17-630

NAME	SIGNATURE	DATE
Nicole L. Charnon	 	07/15/2018

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EXAMINATION		ACCIDENT DATA	
DATE	07/11/2018	NTSB ACCIDENT #	WPRLA18174
FACILITY	Air Transport	NTSB INVESTIGATOR	Tealeye Cornejo
ADDRESS	3011 W Buckeye Road Phoenix, AZ	FAA INVESTIGATOR	Steve Meisner
		ACCIDENT DATE	06/19/2018
		ACCIDENT LOCATION	Aguila, AZ

ENGINE INFORMATION

ENGINE POSITION	Single-Engine
TOTAL TIME	1,955.4 hours at time of last maintenance entry
TIME SOH	N/A (see significant logbook information below)
TYPE & TIME SLI	Unknown (Hobbs meter was destroyed)
BUILD DATE	11/18/2007
IN SERVICE DATE	01/09/2008

Significant logbook information:

Review of the aircraft maintenance records revealed that the engine was modified with a Tornado Alley Turbo (TAT) Supplemental Type Certificate (STC) and installed on the accident airplane in January 2008. On June 9, 2011, at a total time of 671.3 hours, the magnetos underwent a 500-hour inspection and were reinstalled on the engine and timed to 21.5° BTDC. On July 27, 2012, at a total time of 817.6 hours, the #3 cylinder was removed and replaced as was the magneto filter. The magnetos were timed to 22° BTDC. On August 8, 2014, at a total time of 979.1 hours, the cylinders underwent a borescope inspection and the sparkplugs were replaced. Again, on May 24, 2017, at a total time of 1,713.2 hours, the sparkplugs were replaced. The last entry was dated May 9, 2018, at a total time of 1,955.4 hours when an annual inspection was conducted. Many of the maintenance entries indicated that a magneto-to-engine timing check was conducted, but nowhere did it list an additional 500-hour inspection of the magnetos, which accumulated 1,284.1 hours since their last comprehensive inspection in 2011.

Report Summary:

Search Code(s):

15-12-74, 43-01-29, 15-12-65, 10-10-03

The engine sustained significant thermal damage that destroyed many of the engine-related systems. The left magneto was separated from its mounting pad and remained attached to the engine via the burnt remains of the ignition leads. The crankcase had a hole in the top aft section affiliated with the #2 connecting rod. The rusted crankshaft was visible through the hole as were the remains of the separated #2 connecting rod. Some crankcase cracking was noted in the vicinity of the #1 connecting rod. Removal of the top sparkplugs revealed that all experienced heavy erosion of the electrodes and the insulators were fractured and missing significant portions. Borescope examination of the cylinders revealed that all the pistons displayed operational signatures consistent with elevated temperatures. The #5 piston was eroded around the outer circumference and there was a hole present with a portion of the top piston ring land visible. Additionally, examination of the exhaust system revealed what appeared to be re-solidified melted metal particles with the greatest concentration being found in the low point of the right exhaust manifold.

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The engine was retained by the NTSB investigator-in-charge (IIC) and will undergo additional teardown examination at the factory at a later date.

INSPECTION WITNESSES

NAME	Nicole L. Charnon	NAME	Tealeye Cornejo
ADDRESS	Washington, DC	ADDRESS	Los Angeles, CA
ORGANIZATION	Continental Motors	ORGANIZATION	NTSB – Western Pacific Region
PHONE		PHONE	
NAME	Brannen Mayer	NAME	Steven Meisner
ADDRESS	Duluth, MN	ADDRESS	Scottsdale, AZ
ORGANIZATION	Cirrus Aircraft	ORGANIZATION	FAA – Scottsdale FSDO
PHONE		PHONE	

EXTERNAL ENGINE CONDITION

The engine sustained significant thermal damage that destroyed many of the engine-related systems. The engine remained attached to the firewall and the engine mount. The throttle, mixture, and propeller control cables remained intact and attached to their respective control levers; however, the cockpit controls were destroyed. The left magneto was separated from its mounting pad and remained attached to the engine via the burnt remains of the ignition harness. The crankcase in the vicinity of the #2 cylinder displayed a large hole. The rusted crankshaft and fractured #2 connecting rod pieces were visible through the hole.



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ENGINE COMPONENT EXAMINATION

EXHAUST SYSTEM

Condition:

The exhaust system remained intact and attached to the engine. It was cut away to facilitate examination of the engine/turbochargers. Both exhaust manifolds displayed re-solidified beads of molten metal, with the largest cluster noted in the low point of the right exhaust manifold. The wastegate controller was thermally damaged.



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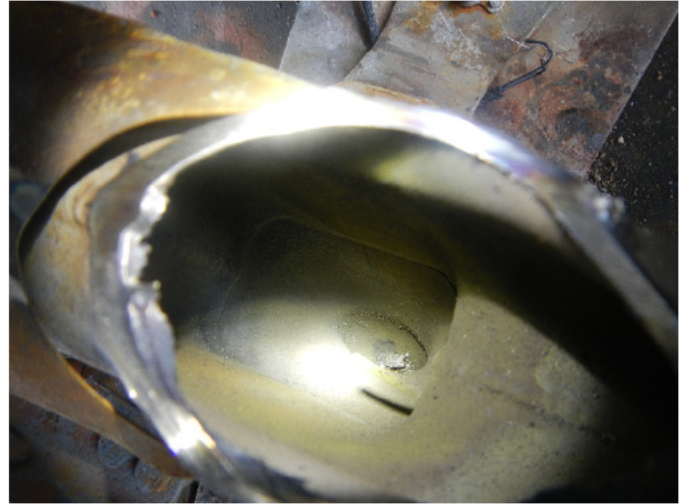
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INDUCTION SYSTEM

Condition:

The thermally damaged remains of the induction system remained intact. The left turbocharger's impeller was damaged with the blades bent opposite the direction of rotation. The impeller housing was deformed and thermally damaged. Otherwise, the induction system was unremarkable.



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IGNITION SYSTEM

LEFT MAGNETO

Manufacturer: Continental
Motors

P/N: Not Legible

S/N: Not Legible

Condition: The left magneto was separated from its mounting pad and remained attached to the engine via the ignition harness. The mounting flange was fractured and the housing sustained thermal deformation damage that partially melted the capacitor and point cover. Disassembly of the magneto revealed that internal components were destroyed. The distributor gear was melted away and the distributor finger was positioned between the #2 top and #5 bottom distributor poles.



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RIGHT MAGNETO

Manufacturer: Continental Motors

P/N: Not Legible

S/N: Not Legible

Condition:

The right magneto remained attached to the mounting pad and manual manipulation of the magneto did not result in any slipping or rotation of the magneto. The housing sustained thermal deformation damage that partially melted the capacitor and point cover. Disassembly of the magneto revealed that internal components were destroyed. The distributor gear was melted away and the distributor finger was positioned at the #3 top distributor pole.



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IGNITION HARNESS

Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition:

The ignition harness sustained thermal damage that destroyed the leads/terminals and precluded functional testing.



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SPARK PLUGS

Manufacturer: Champion

P/N: RHB32E

Condition:

All of the sparkplugs remained secured to their respective cylinders and their ignition terminals remained attached. Removal of the top sparkplugs revealed that their electrodes were significantly worn, the insulator core noses were fractured and missing material (consistent with detonation as per the Champion AV6-R Aviation Service Manual), and re-solidified molten metal beads were observed on the metallic surfaces. The bottom sparkplugs, which were observed via a lighted borescope, displayed similar signatures as the top. The #5 top sparkplug displayed a large clump of solid material on one side and the #6 sparkplugs were discolored green. Initial visual examination of the terminal end insulators in the top sparkplugs revealed they were intact.



1T



1B



2T



2B

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3T



3B



4T



4B



5T

No Image
5B

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6T



6B

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FUEL SYSTEM

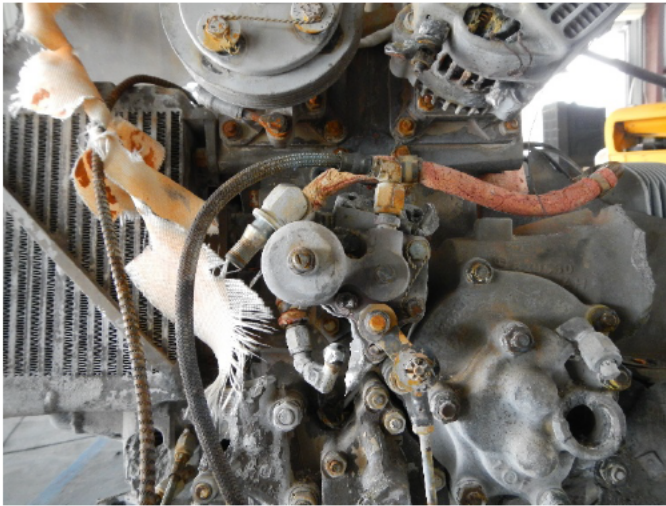
FUEL PUMPManufacturer: Continental
Motors

P/N: Not Observed

S/N: Not Observed

Condition:

The fuel pump remained secured to the backside of the engine and the mixture lever was in place. The unit sustained significant thermal damage that distorted the fuel pump housing. It will be examined in more detail at a later date.

**THROTTLE
BODY
METERING UNIT**Manufacturer: Continental
Motors

P/N: Not Observed

S/N: Not Observed

Condition:

The throttle body remained attached to the topside of the engine with the throttle lever in place. The unit sustained thermal damage and was not examined in detail. The fuel lines to and from the metering unit were attached.



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VALVE**Manufacturer: Continental
Motors

P/N: Unknown

S/N: Unknown

Condition: To be examined at a later date.

**FUEL NOZZLES
AND LINES**

Manufacturer: GAMI

Condition: The upper deck reference lines remained attached to the nozzles and the fuel injector lines remained secured in place. The nozzles will be inspected at a later date.

**LUBRICATION SYSTEM****OIL SUMP**

Condition: The oil sump remained secured to the bottom of the engine and it was intact with no punctures noted. No oil registered on the dipstick.



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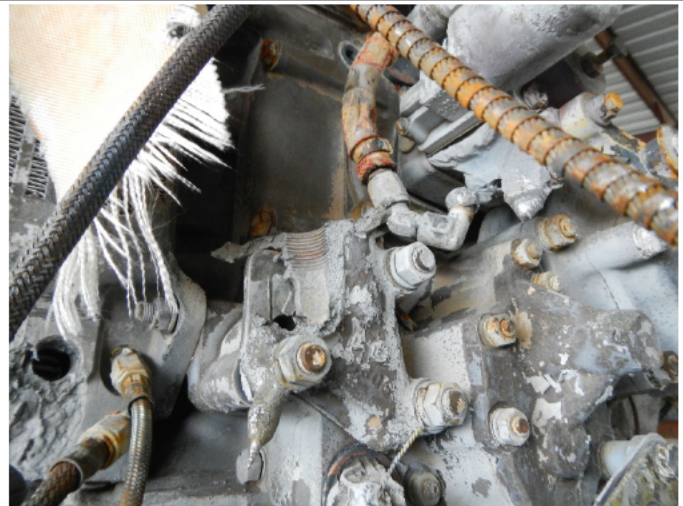
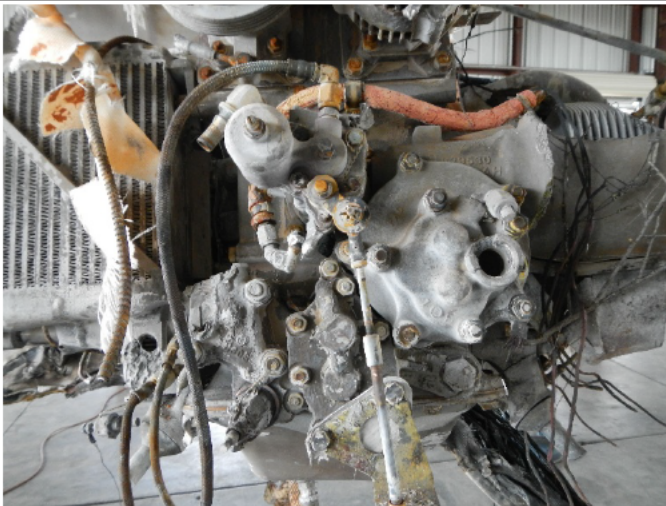
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OIL PICKUP TUBE & SCREEN

Condition: To be examined at a later date.

OIL PUMP

Condition: To be examined at a later date.



OIL FILTER

Manufacturer: Unknown

P/N: Unknown

Condition: The oil filter was separated from the adapter as the housing was partially melted away. The oil filter will be examined at a later date.

OIL COOLER

Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition: The oil cooler remained attached to the aft left side of the engine. The bottom side sustained thermal damage that partially melted away portions of the cooler and deformed the fittings that remained attached.



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CYLINDERS

NOTE: The photos that follow each cylinder condition description represent the overhaul cylinder condition, the piston, the intake valve and the exhaust valve, in that order unless otherwise noted.

CYLINDER #1

Condition: The cylinder remained attached to the crankcase with no external anomalies noted with the exception of the post-crash fire damage. Examination of the internal components with the use of a lighted borescope revealed that the piston was almost devoid of its normal combustion deposits, the face displayed incipient piston erosion, and there were two patches that appeared to be re-solidified pools of molten metal. The valves and valve seats were intact and also appeared to be devoid of normal combustion deposits. The barrel showed linear scrape marks over the typical honing pattern.



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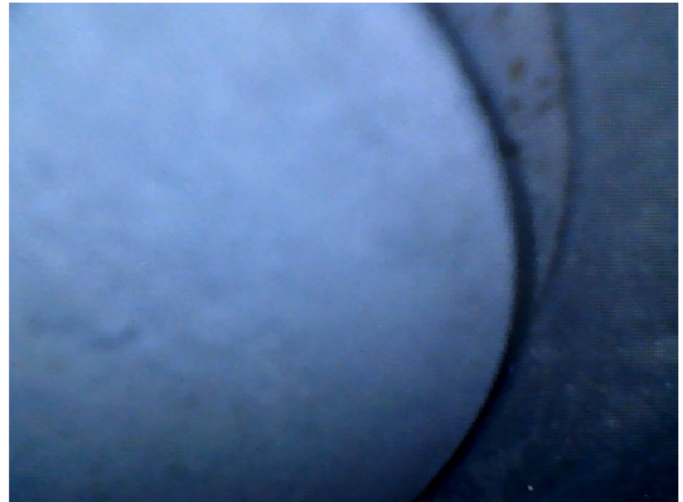
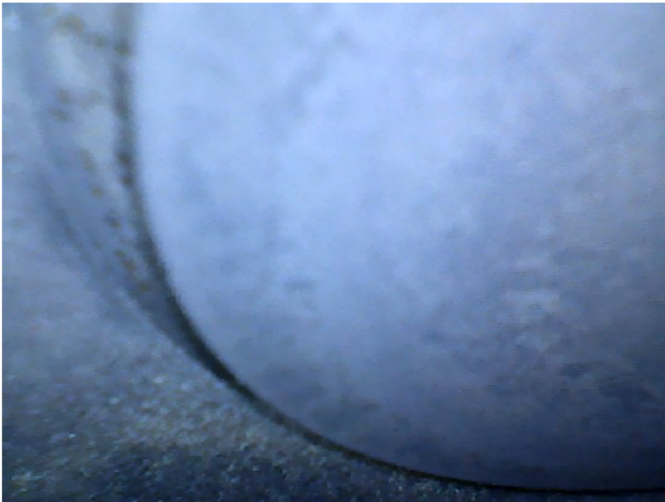
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CYLINDER #3

Condition: The cylinder remained attached to the crankcase with no external anomalies noted with the exception of the post-crash fire damage. Examination of the internal components with the use of a lighted borescope revealed that the piston was almost devoid of its normal combustion deposits and the face displayed incipient piston erosion. The valves and valve seats were intact and also appeared to be devoid of normal combustion deposits. The barrel could not be observed due to the position of the piston.



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CYLINDER #5

Condition: The cylinder remained attached to the crankcase with no external anomalies noted with the exception of the post-crash fire damage. Removal of the top sparkplug revealed re-solidified molten metal around the sparkplug hole. Examination of the internal components with the use of a lighted borescope revealed that the piston was heavily eroded. The outer circumference of a piston ring land was visible and the piston erosion extended inboard of the piston ring land in one area. Heavy scrapes were observed on the barrel walls. The valves and valve seats will be examined in more detail at a later date.



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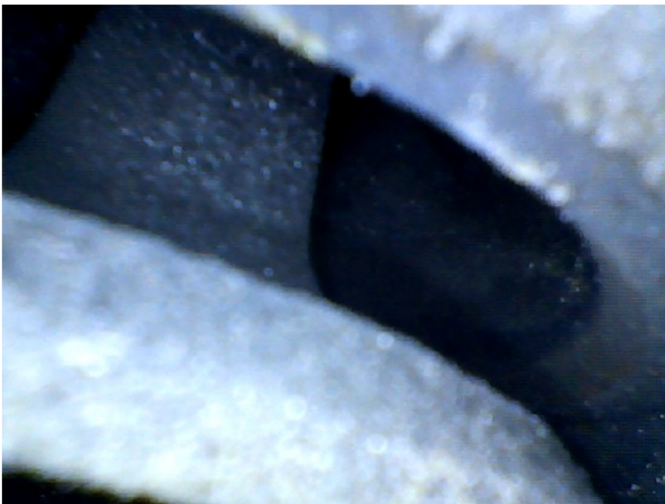
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CYLINDER #2

Condition: The cylinder remained attached to the crankcase with no external anomalies noted with the exception of the post-crash fire damage. Examination of the internal components with the use of a lighted borescope revealed that the piston was almost devoid of its normal combustion deposits and the face displayed incipient piston erosion. The valves and valve seats were intact and also appeared to be devoid of normal combustion deposits. The barrel could not be observed due to the position of the piston.



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CYLINDER #4

Condition: The cylinder remained attached to the crankcase with no external anomalies noted with the exception of the post-crash fire damage. Examination of the internal components with the use of a lighted borescope revealed that the piston was almost devoid of its normal combustion deposits and the face displayed incipient piston erosion. The valves and valve seats were intact and also appeared to be devoid of normal combustion deposits. The barrel could not be observed due to the position of the piston.



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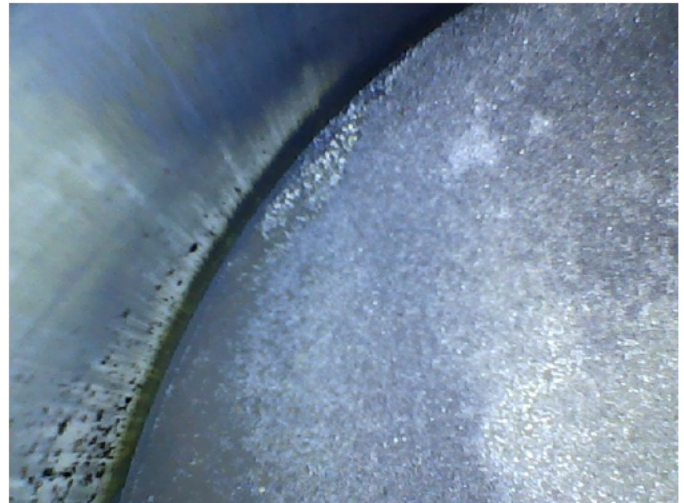
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CYLINDER #6

Condition: The cylinder remained attached to the crankcase with no external anomalies noted with the exception of the post-crash fire damage. Examination of the internal components with the use of a lighted borescope revealed that the piston was almost devoid of its normal combustion deposits, the face displayed piston erosion. The valves and valve seats were intact and also appeared to be devoid of normal combustion deposits. Portions of the valve and valve seats were green in color (as was the case with the sparkplugs). The barrel showed linear scrape marks over the typical honing pattern.



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CRANKCASE	Casting Number:	1-3-5: Unknown	2-4-6: Unknown	S/N: Unknown
Condition:	The crankcase halves remained attached to each other and the cylinders remained attached to the crankcase. The top left side of the crankcase displayed a large hole that permitted a view of the crankshaft and separated #2 connecting rod. Another crack was noted in the vicinity of the #1 connecting rod.			

**CRANKSHAFT ASSEMBLY**

CRANKSHAFT	Forging Number: Not Observed	S/N: Not Observed	Heat code: Not Observed
Condition:	The crankshaft and connecting rods will be examined in more detail at a later date.		

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CAMSHAFT

CAMSHAFT	P/N: Not Observed	S/N: Not Observed
Condition:	The camshaft and lifters will be examined at a later date.	

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ACCESSORY GEARS

Condition: A portion of the idler gear was observed through the magneto mounting pads. It was corroded and thermally discolored. There were no noted pre-accident anomalies with the gear teeth; however, it will be examined in more detail at a later date.



ACCESSORIES

STARTER

Manufacturer: Unknown

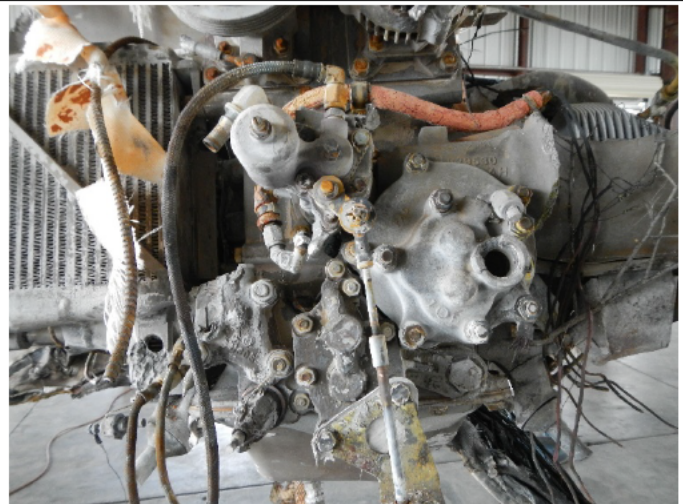
P/N: Unknown

S/N: Unknown

Condition: The starter was separated from the adapter and was not observed.

STARTER ADAPTER

Condition: The starter adapter was fractured and partially melted. It will be examined in more detail at a later date.



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ALT/GEN #1

Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition:

The alternator was attached to the front right side of the crankcase. It sustained thermal damage and was not a part of this examination.



ALT/GEN #2

Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition:

The #2 alternator remained attached to the right accessory mounting pad. It was not examined as part of this inspection.



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L TURBO

Manufacturer: TAT

P/N: Not Recorded

S/N: Not Recorded

Condition:

The left turbocharger remained attached to the mounting bracket. The oil line to the bearing feed fitting remained in place as did the return oil line. The impeller housing sustained significant thermal damage that distorted the housing and impeller. Debris was found in the impeller inlet and appeared to be a result of the post-crash fire damage.



R TURBO

Manufacturer: TAT

P/N: Not Recorded

S/N: Not Recorded

Condition:

The right turbocharger remained attached to the mounting bracket. The oil line to the bearing feed fitting remained in place as did the return oil line. Debris was found in the impeller inlet, but there was no sign of FOD on the impeller. The debris appeared to be a result of the post-crash fire damage.



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CONTROLLER**

Manufacturer: Not Observed

P/N: Not Observed

S/N: Not Observed

Condition: The turbo controller was destroyed.

WASTEGATE

Manufacturer: Not Legible

P/N: Not Legible

S/N: Not Legible

Condition: The wastegate actuator was destroyed and the internal springs were visible.

**OVERBOOST
VALVE**

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition: The overboost valve was attached to the intake wye between the intercoolers and before the throttle body. The overboost valve was thermally damaged.



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PROPELLER

PROPELLER GOVERNOR

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition:

The governor remained attached the front left side of the engine with the control cable attached to the control lever.



PROPELLER

Manufacturer: Hartzell

P/N: Not Recorded

S/N: Not Recorded

Condition:

The propeller remained attached to the crankshaft's propeller flange. The three composite blades remained attached to the hub. The blades were thermally damaged. The propeller was removed to facilitate the examination of the engine and was not examined in detail.

