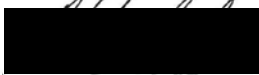




Continental Motors

ENGINE EXAMINATION REPORT

ENGINE MODEL	IO-470-K
ENGINE SERIAL NUMBER	86011-0-K
AIRCRAFT MAKE & MODEL	Beech 35-A33
AIRCRAFT SERIAL NUMBER	CD-311
AIRCRAFT REGISTRATION	N486T
FILE NUMBER	17-548

NAME	SIGNATURE	DATE
Kurt Gibson		05/25/2018

ENGINE FIELD INSPECTION REPORT

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GENERAL INFORMATION

EXAMINATION		ACCIDENT DATA	
DATE	05/13/2018 – 05/15/2018	NTSB ACCIDENT #	ERA18FA146
FACILITY	Atlanta Air Recovery	NTSB INVESTIGATOR	Ralph Hicks
ADDRESS	[REDACTED] Griffin, GA 30224	FAA INVESTIGATOR	Dale White
		ACCIDENT DATE	05/12/2018
		ACCIDENT LOCATION	Jacksonville, Alabama

ENGINE INFORMATION

ENGINE POSITION	Front (single engine)
TOTAL TIME	Unknown
TIME SOH	1355.6 (time at last maintenance entry on 03/20/2018)
TYPE & TIME SLI	Unknown
BUILD DATE	10/31/1960
IN SERVICE DATE	Unknown

Significant logbook information:

The last annual inspection was performed on 01/15/2018 at a tachometer time of 193.5. On 03/20/2018 at a tachometer time of 196.3 the left side exhaust stack was removed and replaced.

Report Summary:

Search Code(s):

98-13-08

The engine had broken free from the airframe and was clear of the post-crash fire; the rear portion of the engine displayed thermal damage signatures. The upper cowling displayed soot streaking and thermal damage from the inside of the cowling. The left side exhaust system displayed several cracks and the assembly was sent to the NTSB materials laboratory for analysis. The fuel inlet AN fitting displayed thermal damage signatures and was found loose.

Disposition of engine following exam:

The engine remained at Atlanta Air Recovery in Griffin, Georgia

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NAME	Kurt Gibson	NAME	Ralph Hicks
ADDRESS	Mobile, Alabama	ADDRESS	Eastern Region
ORGANIZATION	Continental Motors	ORGANIZATION	NTSB
PHONE		PHONE	
NAME	Henry Soderlund	NAME	
ADDRESS	Wichita, Kansas	ADDRESS	
ORGANIZATION	Textron Aviation	ORGANIZATION	
PHONE		PHONE	
NAME		NAME	
ADDRESS		ADDRESS	
ORGANIZATION		ORGANIZATION	
PHONE		PHONE	

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The engine came to rest upside down and was resting against a tree several feet away from the primary wreckage and post-crash fire site. The engine sustained impact damage signatures and displayed thermal damage signatures to the aft portion of the engine; the area of thermal damage corresponded with the thermal damage and sooting patterns on the upper cowling. The cowling displayed soot streaking towards the aft of the cowling.

The engine was transported to and inspected at Atlanta Air Recovery in Griffin, Georgia. The crankcase remained intact and displayed minor impact damage signatures and significant thermal damage signatures to the aft portion of the crankcase. The propeller flange remained attached to the rest of the crankshaft and there were no visible cracks noted in the crankshaft. All six cylinders displayed minor impact damage signatures and cylinders #1, and #2 displayed minor soot discoloration towards the aft of the cylinders.

Both of the magnetos remained attached to their installation points and displayed minor impact damage signatures; there were no signs of oil leaks noted around the magnetos. The ignition harness remained attached to both of the magnetos and to each of the spark plugs; the harness displayed impact damage signatures and several of the ignition leads were partially severed. All of the spark plugs remained installed in their cylinders and were undamaged.

The fuel pump remained attached to its installation point and displayed thermal damage signatures; the entire fuel pump was discolored, the vapor return fuel line had been completely destroyed by thermal forces and the fuel inlet fuel line was partially destroyed by thermal forces. The fuel pump outlet and mixture return fuel lines displayed thermal damage signatures near the fuel pump end of the fuel lines. The throttle and metering assembly remained attached to its installation point and displayed impact damage signatures; there were no thermal damage signatures to the assembly. The fuel manifold valve remained attached to its installation point and displayed minor impact damage signatures; there were no thermal damage signatures to the valve. There were no signs of fuel leaks noted around the fuel manifold valve. All of the fuel nozzles remained installed in their cylinders and were undamaged. There were no anomalies noted with the fuel nozzles.

The induction system remained attached to the engine and displayed impact damage signatures and thermal damage signatures concentrated at the induction Y-tube. There were no signs of induction leaks noted.

The exhaust system remained attached to the engine and displayed impact damage signatures in the forms of tearing, crushing, and bending.

ENGINE FIELD INSPECTION REPORT

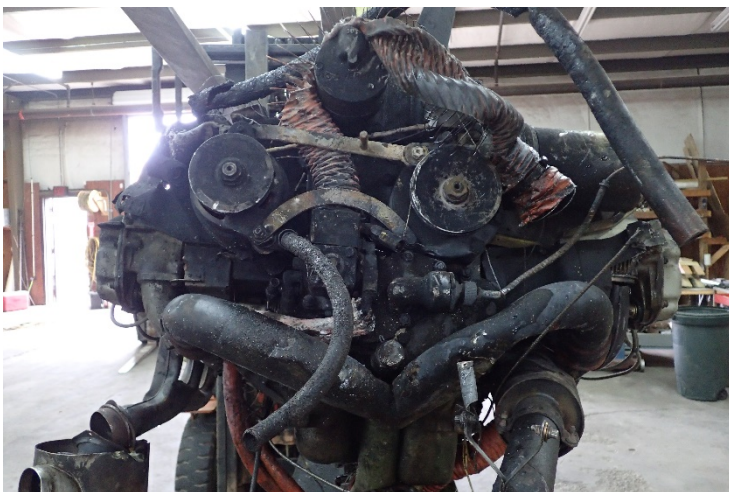
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ENGINE TEARDOWN AND COMPONENT EXAMINATION

EXHAUST SYSTEM

Condition: The exhaust system remained attached to the engine and displayed impact damage signatures. The left side exhaust muffler/heat exchanger assembly displayed several cracks in multiple locations. The left side exhaust muffler/heat exchanger was retained by the NTSB to be examined by the NTSB materials laboratory.



INDUCTION SYSTEM

Condition: The induction system displayed impact damage signatures and some thermal damage signatures; the thermal damage signatures were concentrated to the induction Y-tube towards the aft of the engine. There were no signs of induction leaks or blockages noted.



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PAGE 7 of 29**IGNITION SYSTEM****LEFT MAGNETO**

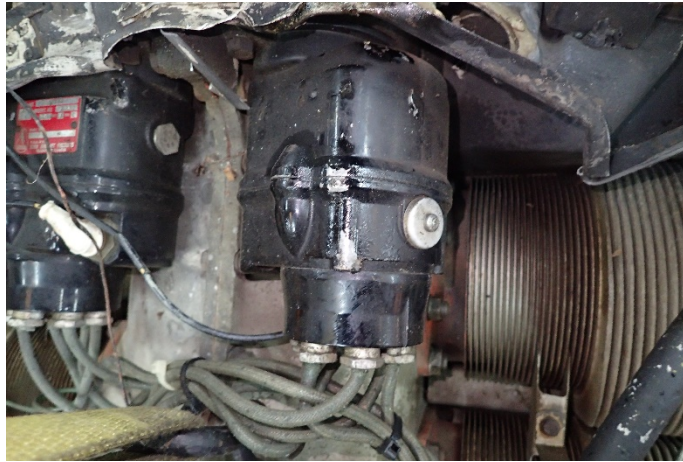
Manufacturer: Slick

P/N: 6362

S/N: 96090709

Condition:

The magneto remained attached to its installation point and displayed minor impact damage signatures; there were no thermal damage signatures noted to the magneto. During crankshaft rotation it was noted that the impulse coupling would operate normally. The magneto was capable of creating a spark to each ignition lead in the correct order and was in sync with the right magneto.

**RIGHT MAGNETO**

Manufacturer: Slick

P/N: 6362

S/N: 95100006

Condition:

The magneto remained attached to its installation point and displayed minor impact damage signatures; there were no thermal damage signatures noted to the magneto. During crankshaft rotation it was noted that the impulse coupling would operate normally. The magneto was capable of creating a spark to each ignition lead in the correct order and was in sync with the left magneto.



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IGNITION HARNESS

Manufacturer: Not observed

P/N: Not observed

S/N: Not observed

Condition:

The ignition leads remained attached to the magnetos and to the spark plugs. Several of the ignition leads displayed impact damage signatures and were partially severed. There were no signs of thermal damage to the ignition leads. There were no anomalies noted with the ignition harness.



SPARK PLUGS

Manufacturer: Champion

P/N: REM40E

Condition:

All of the spark plugs remained in their cylinders. The top spark plugs were removed and the electrodes were visually inspected; the electrodes displayed normal operating and wear signatures. The bottom spark plugs were inspected using a lighted borescope. The #1 spark plug was submersed in engine oil; the rest of the electrodes displayed normal operating and wear signatures.



#1 Top



#1 Bottom

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#3 Top



#3 Bottom



#5 Top



#5 Bottom



#2 Top



#2 Bottom

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#4 Top



#4 Bottom



#6 Top



#6 Bottom

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FUEL SYSTEM

FUEL PUMP	Manufacturer: Romec	P/N: 638156-9R?	S/N: 24334 RA
Condition:	The fuel pump remained attached to its installation point and displayed thermal damage signatures. The fuel lines were inspected and checked for security. The fuel inlet AN fitting was noted to be loose and was able to be turned approximately 90 degrees to be tight; the vapor return, fuel pump outlet, and the mixture return AN fittings were all tight. The vapor return fuel line displayed significant thermal damage signatures and the hose was completely destroyed. The fuel pump inlet fuel line displayed significant thermal damage and the majority of the fuel line had burned away. The fuel pump outlet and mixture return fuel line displayed significant thermal damage near the AN fittings at the fuel pump. The fuel pump was removed and it was noted that the pump drive was capable of rotation. After removal, 100LL fuel was poured into the fuel pump inlet with the inlet AN fitting set in the position it was found at the recovery facility. It was noted that fuel leaked from the AN fitting as well as multiple locations along the thermally damaged fuel line. After the fuel was poured into the pump the pump drive was rotated by hand; it was noted that the fuel pump was capable of pumping the residual fuel.		



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THROTTLE BODY METERING UNIT

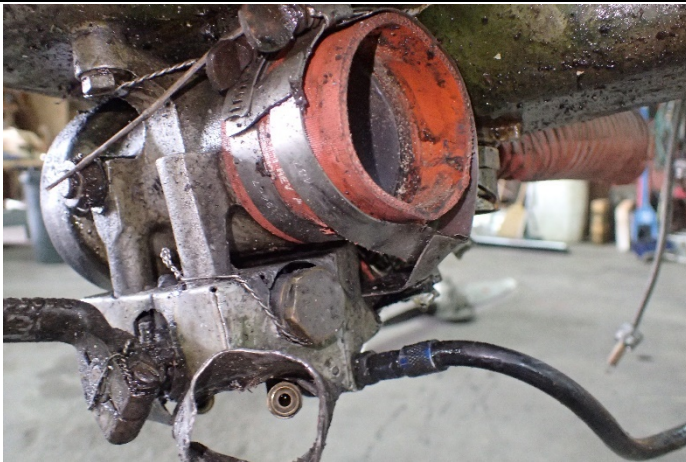
Manufacturer: Not observed

P/N: 623219-1R

S/N: 9018R

Condition:

The throttle and metering assembly remained attached to its installation point and displayed impact damage signatures; there were no thermal damage signatures noted. The fuel lines were checked for security and it was noted that all of the lines were secure. The fuel inlet screen was removed and it was noted to be clear of any contaminants. There were no anomalies noted with the assembly.



FUEL MANIFOLD VALVE

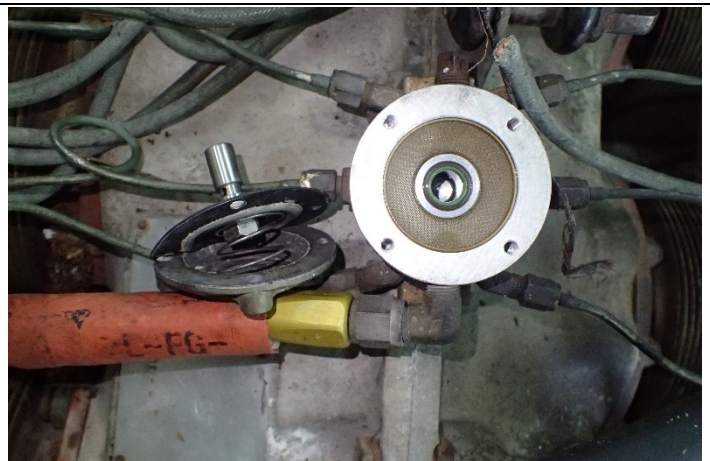
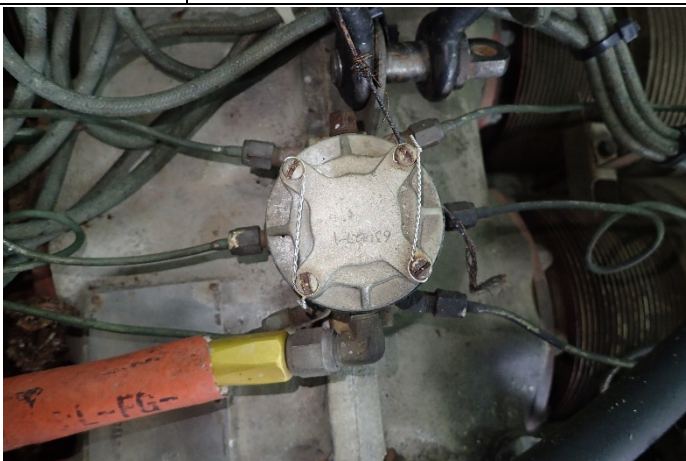
Manufacturer: Dataplate missing

P/N: 631427-1

S/N: Not marked

Condition:

The manifold valve remained attached to its installation point and displayed minor impact damage signatures; there were no thermal damage signatures noted. All of the fuel lines were checked for security; the lines were all secure. The manifold valve was disassembled and the internal components were visually inspected. The internal components displayed normal operating signatures.



FUEL NOZZLES AND LINES	Manufacturer: Not observed
Condition:	All of the fuel nozzles remained installed in their cylinders and were undamaged. All of the fuel lines were checked for security; the fuel lines were secure.

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LUBRICATION SYSTEM

OIL SUMP

Condition: The oil sump displayed impact damage signatures around the throttle body attach point; the oil sump was breached. There were no anomalies noted.



OIL PICK-UP TUBE & SCREEN

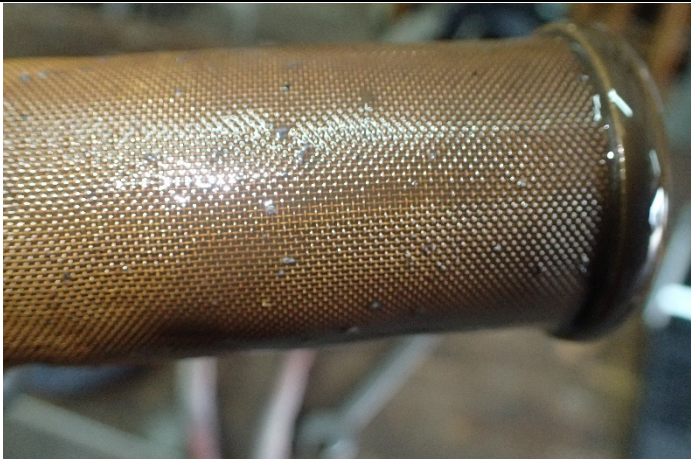
Condition: The oil pick-up tube and screen was not observed during the examination.

OIL PUMP

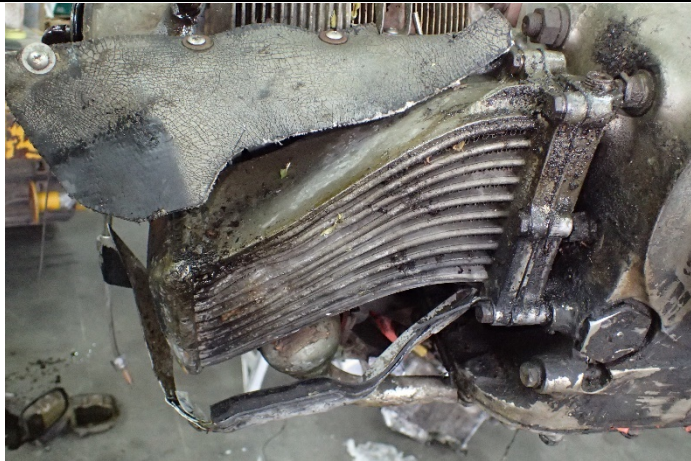
Condition: The oil pump displayed thermal discoloration and was covered in soot. There were no signs of oil leaks around the oil pump.



OIL SCREEN	
Condition:	The oil screen remained installed and was secure. The screen was removed and there were no metallic material present in the screen. There were no anomalies noted during the oil screen inspection.



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 a significant amount of impact damage. There were no anomalies noted with the oil cooler.		



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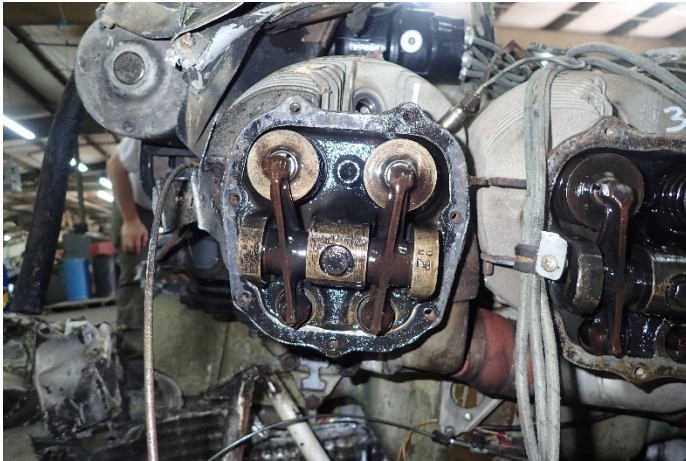
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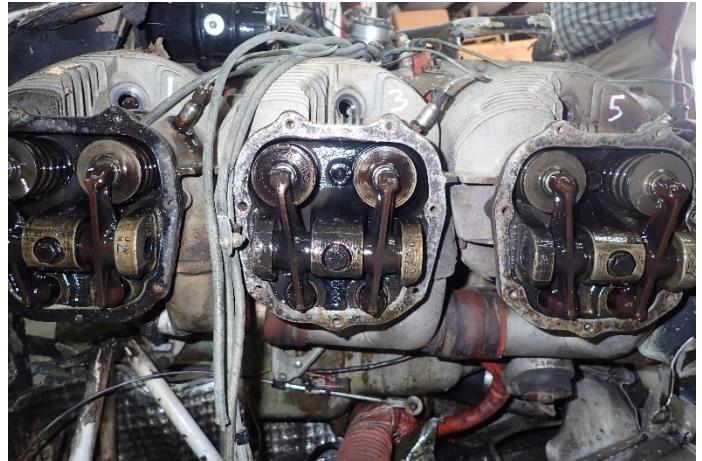
CYLINDERS

CYLINDERS

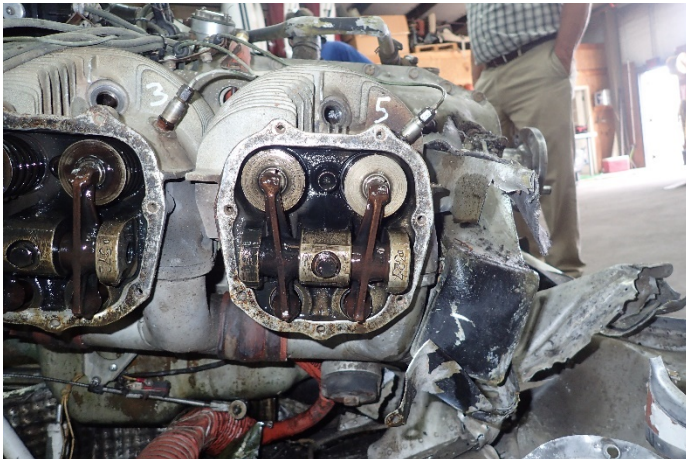
Condition: All of the cylinders were inspected using a lighted borescope. The piston faces, cylinder bores, and valve heads displayed normal operating and combustion signatures. The overhead components (valve, springs, and rocker arms) displayed normal operating and lubrication signatures. During crankshaft rotation all of the cylinders displayed good thumb compression and suction.



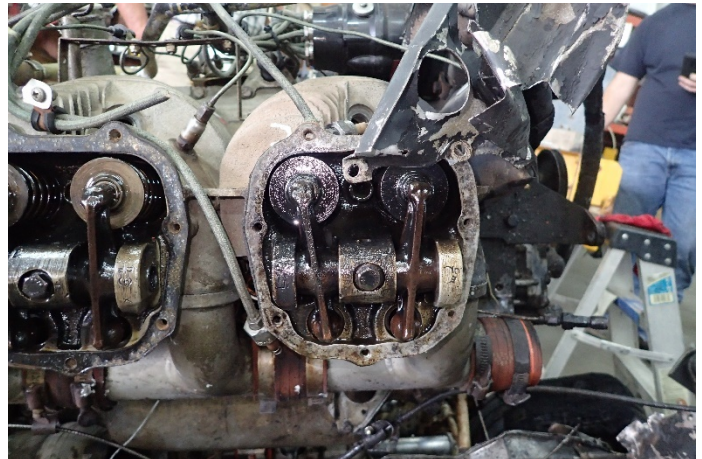
#1 Cylinder



#3 Cylinder



#5 Cylinder



#2 Cylinder

ENGINE FIELD INSPECTION REPORT

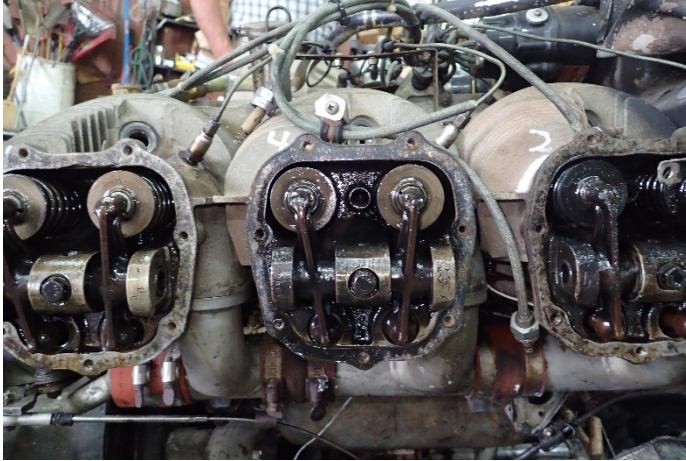
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#4 Cylinder



#6 Cylinder

VALVES AND GUIDES

Condition:

The valve heads were inspected using a lighted borescope. All of the valve heads displayed normal operating and combustion signatures. During crankshaft rotation all of the valves operated normally. There were no anomalies noted with the valves.



#1 Exhaust



#1 Intake

ENGINE FIELD INSPECTION REPORT

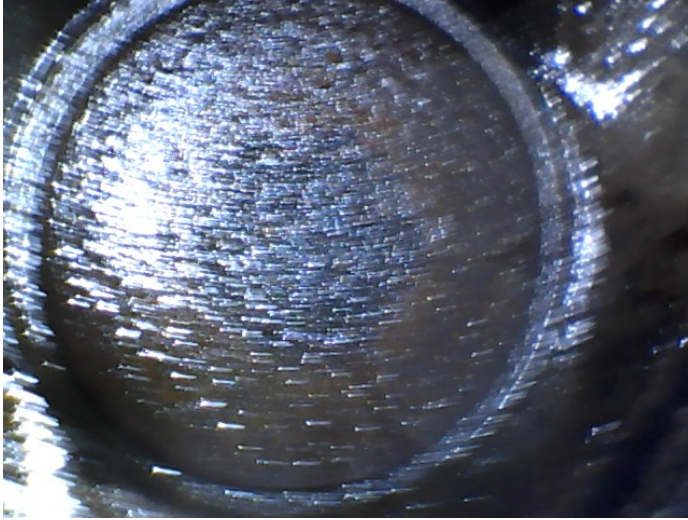
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#3 Exhaust



#3 Intake



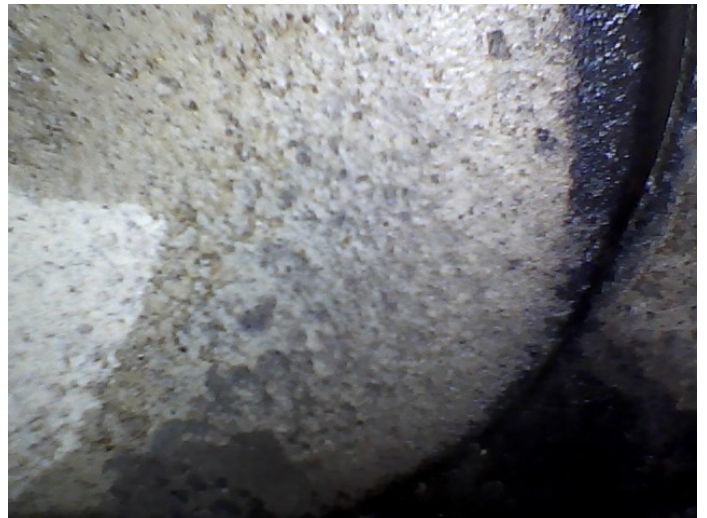
#5 Exhaust



#5 Intake



#2 Exhaust



#2 Intake

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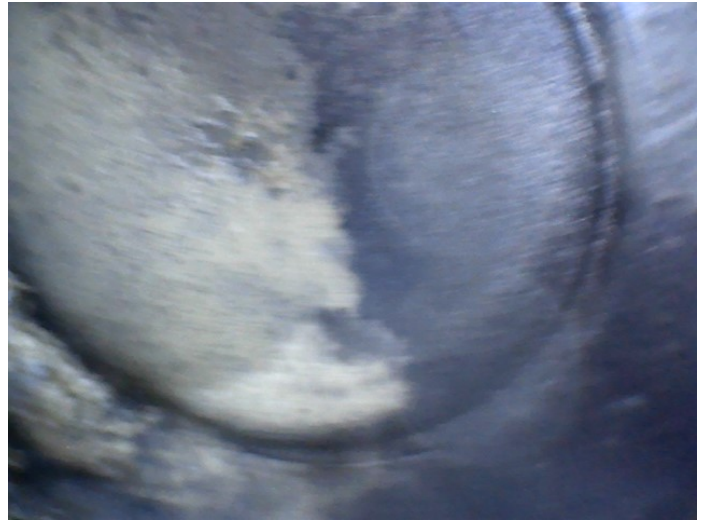
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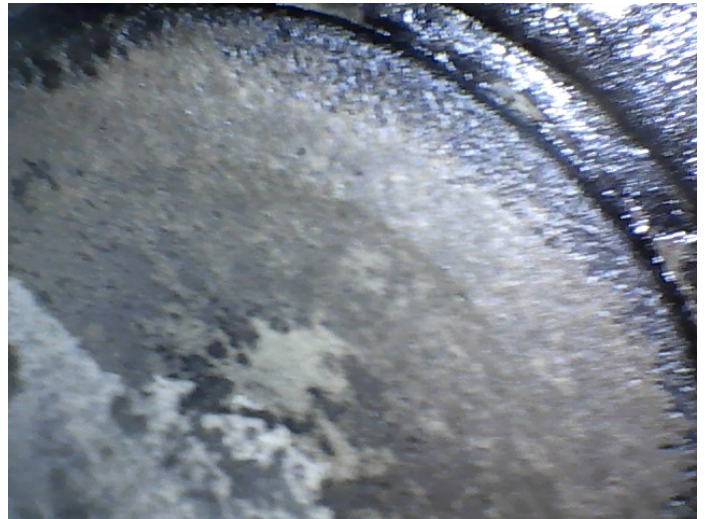
#4 Exhaust



#4 Intake



#6 Exhaust



#6 Intake

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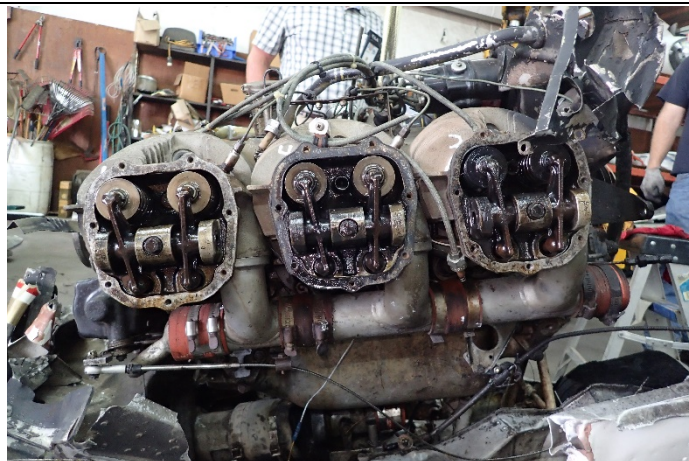
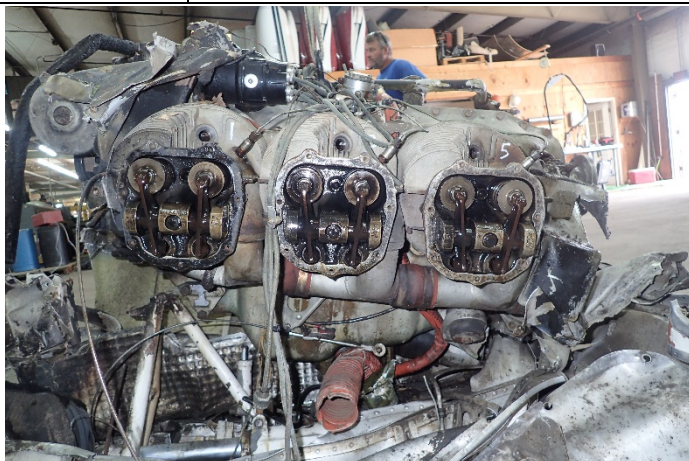
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ROCKER ARMS AND SHAFTS

Condition:

All of the rocker arms remained secured to their installation points and were undamaged. The rocker arms displayed normal operating and lubrication signatures; during crankshaft rotation all of the rocker arms operated normally.



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PISTONS

Piston P/N: Illegible

Condition:

The pistons were inspected using a lighted borescope. The piston faces displayed normal operating and combustion signatures; there were no signs of detonation or pre-ignition. During crankshaft rotation all of the pistons operated normally. There were no anomalies noted with the pistons.



#1 Piston



#3 Piston



#5 Piston



#2 Piston

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#4 Piston



#6 Piston

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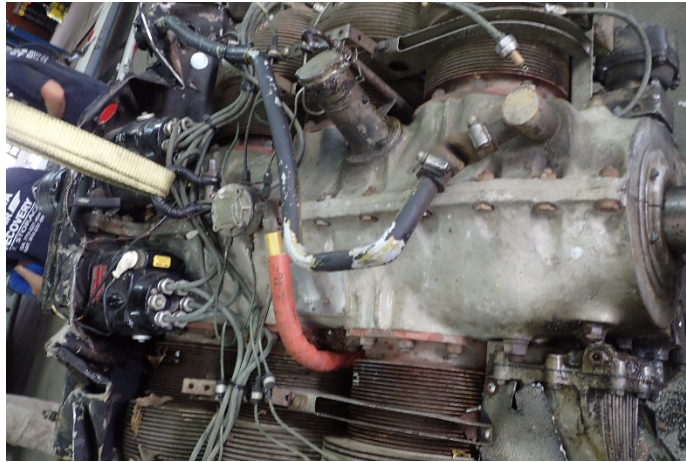
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CRANKCASE ASSEMBLY

CRANKCASE	Casting Number:	1-3-5: Not observed	2-4-6: Not observed	S/N: 604
Condition:	The crankcase remained intact and displayed minor impact damage signatures. The aft portion of the engine displayed thermal discoloration and sooting. There were no signs of oil leaks around the crankcase.			



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PAGE 24 of 29**CRANKSHAFT ASSEMBLY****CRANKSHAFT**

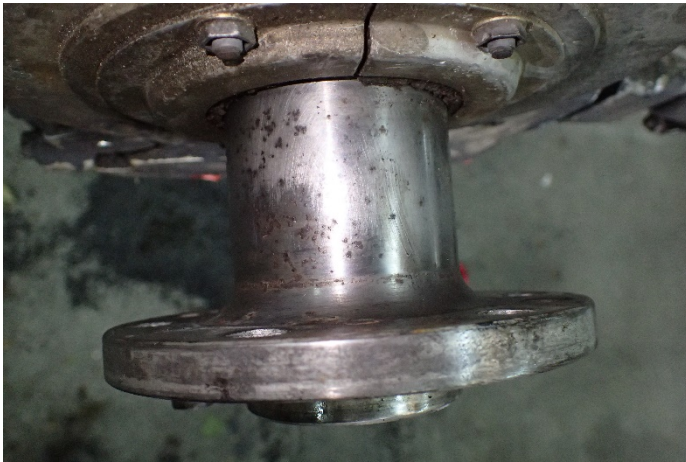
Forging Number: Inaccessible

S/N: Inaccessible

Heat code: Inaccessible

Condition:

The propeller flange remained attached to the rest of the crankshaft; there were no cracks noted in the external portion of the crankshaft. Continuity was established between the crankshaft, camshaft, connecting rods, and associated components. There were no anomalies noted with the crankshaft.

**CONNECTING RODS**

P/N: Inaccessible

Forging or Serial Number: Inaccessible

Condition:

Operation of the connecting rods was verified by rotating the crankshaft and observing piston movement. The connecting rods operated normally.

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PAGE 25 of 29**CAMSHAFT****CAMSHAFT**

P/N: Inaccessible

S/N: Inaccessible

Condition:

Operation of the camshaft was verified by rotating the crankshaft and observing rocker arm movement; the camshaft operated normally.

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ACCESSORIES

STARTER

Manufacturer: Illegible

P/N: Illegible

S/N: Illegible

Condition:

The starter remained attached to the starter adapter and displayed impact damage signatures as well as thermal damage signatures. There were no anomalies noted with the starter.



STARTER ADAPTER

P/N: Illegible

Condition:

The starter adapter remained attached to its installation point and displayed thermal damage signatures. There were no anomalies noted with the starter adapter.



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ALTERNATOR

Manufacturer: Not observed

P/N: Not observed

S/N: Not observed

Condition:

The alternator remained attached to its installation point and displayed thermal damage signatures; the alternator drive belt was not observed during the examination. The alternator drive was capable of normal rotation; there were no anomalies noted with the alternator.



VACUUM PUMP

Manufacturer: Not observed

P/N: Illegible

S/N: Illegible

Condition:

The vacuum pump remained attached to its installation point and displayed thermal damage and impact damage signatures. There were no signs of oil leaks around the vacuum pump installation. There were no anomalies noted with the vacuum pump.



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PROPELLER

PROPELLER GOVERNOR

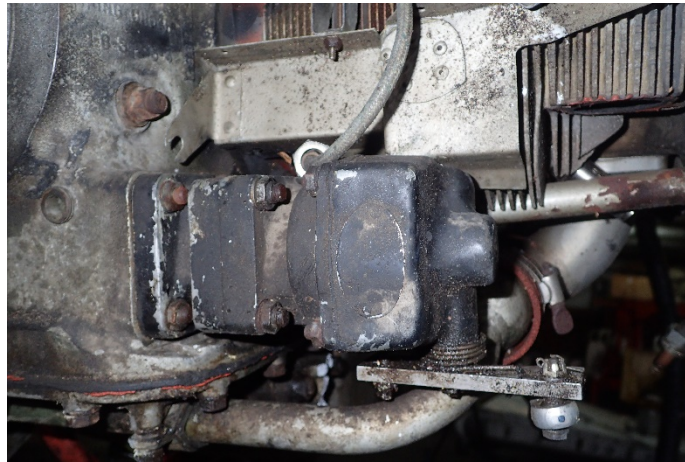
Manufacturer: Illegible

P/N: Illegible

S/N: Illegible

Condition:

The propeller governor remained attached to its installation point and displayed minor impact damage signatures; there were no thermal damage signatures to the governor. There were no anomalies noted.



PROPELLER

Manufacturer: Hartzell

P/N: BHC 92 ZF-1D1

S/N: R?2850

Condition:

The two blade, constant speed propeller remained attached to the crankshaft and displayed impact damage signatures. Both propeller blades remained within the propeller hub; Propeller blade "A" displayed minor twisting deformation at the propeller blade tip and a portion of the tip had sheered from the rest of the blade. Propeller blade "B" displayed minor damage; there was no bending or twisting deformation noted with the blade.



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