



ENGINE EXAMINATION REPORT

ENGINE MODEL	IO-520-BA
ENGINE SERIAL NUMBER	814452-R
AIRCRAFT MAKE & MODEL	Beechcraft F33A
AIRCRAFT SERIAL NUMBER	CE-555
AIRCRAFT REGISTRATION	N4082S
FILE NUMBER	19-041

NAME	SIGNATURE	DATE
Kurt Gibson		10/21/2019

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 2 of 35

GENERAL INFORMATION

EXAMINATION		ACCIDENT DATA	
DATE	08/09/2019 – 08/10/2019	NTSB ACCIDENT #	ERA19FA240
FACILITY	Accident site	NTSB INVESTIGATOR	Adam Gerdhart
ADDRESS	4265 Minnie Ln Hatboro, PA	FAA INVESTIGATOR	Robert Harger
		ACCIDENT DATE	08/08/2019
		ACCIDENT LOCATION	Hatboro, Pennsylvania

ENGINE INFORMATION

ENGINE POSITION	Front (single engine)
TOTAL TIME	Unknown
TIME SOH	1860.3 (time at the last oil change)
TYPE & TIME SLI	≈83.7 since the last 100-hour inspection (time taken from the last oil change).
BUILD DATE	12/23/1999
IN SERVICE DATE	Unknown

Significant logbook information:

The last 100-hour inspection was performed on 11/16/2018 at a tachometer time of 4502.6. The rest of the logbooks were not examined at the time of this report's writing.

Report Summary:

Search Code(s):

15-12-68

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

Disposition of engine following exam:

The engine was recovered to Anglin Aircraft Recovery Services in Clayton, Delaware.

INSPECTION WITNESSES			
NAME	Kurt Gibson	NAME	Adam Gerdhart
ADDRESS	Mobile, Alabama	ADDRESS	Eastern Region
ORGANIZATION	Continental Motors	ORGANIZATION	NTSB
PHONE		PHONE	
NAME	Andrew Hall	NAME	Morgan Butera
ADDRESS	Wichita, Kansas	ADDRESS	Eastern Region
ORGANIZATION	Textron Aviation	ORGANIZATION	NTSB
PHONE		PHONE	
NAME		NAME	
ADDRESS		ADDRESS	
ORGANIZATION		ORGANIZATION	
PHONE		PHONE	

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

19-041

ENGINE S/N:

814452-R

PAGE 4 of 35**EXTERNAL INSPECTION OF ENGINE**

The engine was located at the primary wreckage site and displayed a significant amount of impact damage signatures. The crankcase displayed impact damage signatures with most of the damage occurring to the front of the crankcase; a large portion of the crankcase had broken free and some of the internal components were exposed. The crankcase did not display any signs of a catastrophic internal engine failure. The three-blade, constant speed propeller remained attached to the propeller flange; however, the propeller flange had broken free from the rest of the crankshaft, the damage was consistent with impact damage. All three propeller blades remained within the propeller hub and displayed impact damage signatures. The crankshaft displayed impact damage signatures; the propeller flange had broken free from the rest of the crankshaft and remained attached to the propeller hub. Portions of the internal parts of the crankshaft were visible through the broken forward crankcase. All six cylinders remained attached to their cylinder bays and displayed varying amounts of impact damage signatures.

The left magneto remained partially attached to the engine and displayed impact damage signatures, the right magneto had broken free from its installation point and displayed impact damage signatures. The ignition harness displayed a significant amount of impact damage signatures to all of the ignition leads, several of the leads were torn and severed. The #5 top spark plug had almost completely broken free from its cylinder, only the ground electrodes remained installed; the rest of the spark plugs remained installed in their cylinders and displayed varying amounts of impact damage.

The fuel pump remained attached to its installation point and displayed impact damage signatures. The throttle and metering assembly had broken free from its installation point and displayed a significant amount of impact damage; the metering assembly had broken free from the throttle body and the throttle body housing was shattered. The fuel metering assembly remained partially attached to the engine and displayed impact damage signatures. The #5 fuel nozzle had broken free from its cylinder, the rest of the nozzles remained installed in their cylinders and displayed varying amounts of impact damage. There were no signs of fuel leaks noted around any of the fuel components.

The induction system displayed a significant amount of impact damage; the majority of the intake tubes were broken and several of the tubes had broken free from the engine. The exhaust system displayed significant impact damage signatures; the risers were bent and crushed, and both of the exhaust mufflers and tailpipes had broken free from the engine.

ENGINE FIELD INSPECTION REPORT

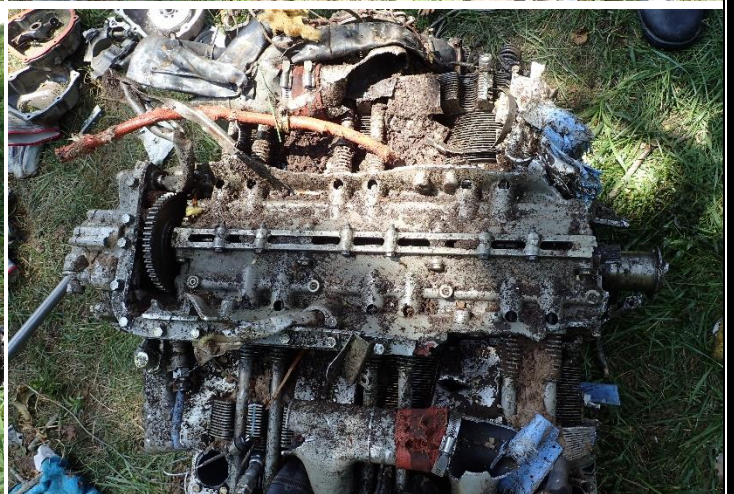
FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 5 of 35



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 6 of 35

ENGINE TEARDOWN AND COMPONENT EXAMINATION

EXHAUST SYSTEM

Condition:

The exhaust system displayed a significant amount of impact damage; the exhaust risers displayed bending and crushing damage and both mufflers and tailpipes had broken free from their installation points. It was noted that both tailpipes were crushed almost completely flat. The exhaust heat exchanger shroud was removed and visually inspected; there were no signs of an exhaust leak noted within the shroud. There were no signs of exhaust leaks noted around any of the exhaust pipes.



INDUCTION SYSTEM

Condition:

The induction system displayed a significant amount of impact damage signatures; most of the induction tubes and risers were broken and several portions of the intake system had broken free from the engine. There were no signs of induction leaks noted around any of the recovered induction tubes.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 7 of 35

IGNITION SYSTEM

LEFT MAGNETO

Manufacturer: TCM
Overhauled: Kelley Aerospace

P/N: 10-349350-4

S/N: G-12706

Condition:

The magneto remained partially attached to its installation point and displayed impact damage signatures; a portion of the housing had broken free and the installation flange was broken. The magneto was removed and it was noted that the driveshaft was capable of rotation and the impulse coupling was capable of normal operation. During impulse coupling operation it was observed that the magneto was able to produce a spark on all six posts in the correct order. There were no anomalies observed.



RIGHT MAGNETO

Manufacturer: TCM

P/N: BL-349350-5

S/N: ??A137R

Condition:

The magneto had broken free from its installation point and displayed impact damage signatures. It was noted that the driveshaft was capable of rotation and the impulse coupling was capable of normal operation. During impulse coupling operation it was observed that the magneto was capable of producing a spark on all six posts in the correct order. There were no anomalies observed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 8 of 35

IGNITION HARNESS

Manufacturer: Not observed

P/N: Not observed

S/N: Not observed

Condition:

The ignition harness displayed significant impact damage; several of the leads were torn and severed. There were no anomalies observed.



SPARK PLUGS

Manufacturer: Champion

P/N: RHB32E

Condition:

The #5 top spark plug had almost completely broken free from the engine; only the ground electrodes remained installed. The rest of the spark plugs remained installed in their cylinders and displayed varying amounts of impact damage. The top spark plugs were removed for inspection and the bottom spark plugs were inspected using a lighted borescope. The #5 bottom spark plug electrodes were obscured from view due to debris in the cylinder; the rest of the spark plug electrodes displayed normal operating signatures and most of the spark plugs were in a normal worn-out condition when compared with Champion Aviation Service Manual AV6-R. There were no anomalies noted that would have prevented normal operation.



#1 Top Spark Plug



#1 Bottom Spark Plug

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 9 of 35



#3 Top Spark Plug



#3 Bottom Spark Plug



#5 Top Spark Plug Ground Electrodes



#5 Bottom Spark Plug (obscured by debris)



#2 Top Spark Plug



#2 Bottom Spark Plug

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 10 of 35



#4 Top Spark Plug



#4 Bottom Spark Plug



#6 Top Spark Plug



#6 Bottom Spark Plug

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 11 of 35

FUEL SYSTEM

FUEL PUMP

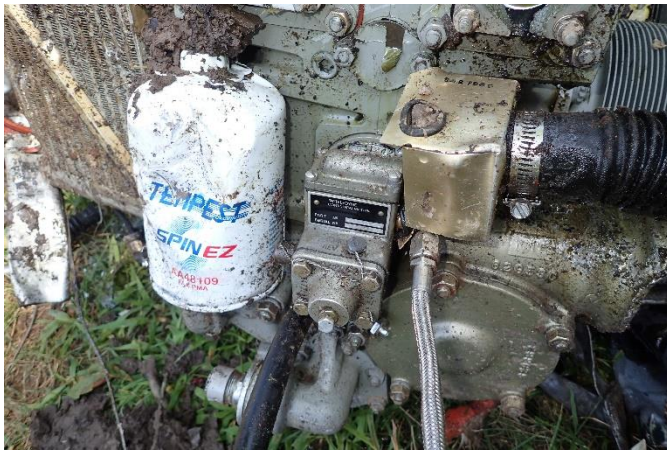
Manufacturer: TCM

P/N: 646212-2

S/N: L089902BR

Condition:

The fuel pump remained attached to its installation point and displayed impact damage signatures; there were no signs of fuel leaks around the fuel pump. The fuel pump was removed, and it was observed that the drive coupling remained intact and the driveshaft was capable of rotation. The fuel pump was disassembled, and the internal components were visually inspected; the internal components displayed normal operating signatures. There were no anomalies observed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 12 of 35

THROTTLE BODY METERING UNIT

Manufacturer: TCM

P/N: 629904-2

S/N: L089911AR

Condition:

The throttle and metering assembly had broken free from its installation point and displayed a significant amount of impact damage; the metering assembly had broken free from the throttle body and the throttle body had shattered. The metering assembly was disassembled, and the internal components were visually inspected, the components displayed normal operating signatures and the fuel inlet screen was clear of any contaminants. There were no anomalies observed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 13 of 35



FUEL MANIFOLD VALVE

Manufacturer: TCM

P/N: 631427-2?24

S/N: L089911CR

Condition:

The fuel manifold valve remained partially attached to the engine and displayed impact damage signatures. The valve was disassembled, and the internal components were visually inspected, the diaphragm displayed minor dry rot signatures; however, there were no signs of the diaphragm leaking into the dry area of the manifold valve. There were no anomalies noted that would have prevented normal operation.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 14 of 35

FUEL NOZZLES AND LINES

Manufacturer: GAMI

Position	#1	#3	#5	#2	#4	#6
Size	Not observed	GM156	GF147	GA173	GM156	GF147
Condition:	The #5 fuel nozzle had broken free from its cylinder, the rest of the nozzles remained installed in their respective cylinders. The nozzles displayed varying degrees of impact damage. The nozzles were removed and visually inspected. The #1, #3, #2, and the #4 nozzles were partially obscured and the #5 and the #6 nozzles were completely obscured consistent with the impact damage to the nozzles.					



#1 Nozzle



#3 Nozzle



#5 Nozzle



#2 Nozzle

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 15 of 35



#4 Nozzle



#6 Nozzle

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 16 of 35

LUBRICATION SYSTEM

OIL SUMP

Condition:

The oil sump displayed significant impact damage signatures and had broken apart into multiple pieces that were found along the wreckage path.



OIL PICK-UP TUBE & SCREEN

Condition:

The oil pick-up tube and screen remained partially attached to its installation point and displayed impact damage signatures. The oil pick-up screen contained a significant amount of organic contaminants consistent with dirt from the accident site.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 17 of 35

OIL PUMP

Condition: The oil pump remained attached to its installation point and displayed impact damage signatures. There were no signs of oil leaks around the oil pump.



OIL FILTER

Manufacturer: Tempest

P/N: AA48109

Condition: The oil filter remained attached to the oil filter adapter and displayed impact damage signatures. The oil filter was removed, and the oil filter housing was cut open. The filter pleats were visually inspected, there were no signs of metallic material within the filter pleats. There were no anomalies observed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 18 of 35



OIL COOLER

Manufacturer: NDM

P/N: 10278?

S/N: I99-3264-492

Condition:

The oil cooler remained partially attached to the engine and displayed impact damage signatures. There were no anomalies observed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

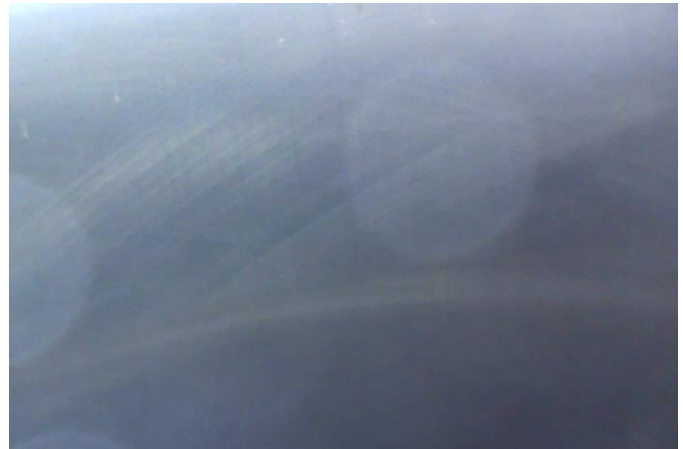
PAGE 19 of 35

CYLINDERS

CYLINDERS

Condition:

All six cylinders remained attached to the engine and displayed varying amounts of impact damage with the #5 cylinder displaying the most damage. Both rocker arms for the #5 cylinder and the intake rocker arm for the #3 cylinder had broken free from their installation points. The cylinders were inspected using a lighted borescope; the cylinder bores, piston faces, and valve heads displayed normal operating signatures. During crankshaft rotation, it was observed that the #5 cylinder did not display any compression or suction which was consistent with the impact damage to the cylinder. The #4 cylinder also did not display any compression or suction and it was observed that the exhaust rocker arm would not move and the valve was open; further examination revealed that the lifter housing contained a significant amount of material consistent with wood from the accident site and the lifter could not be moved. The #4 exhaust rocker arm was removed, and the valve seated normally, and the cylinder then displayed normal thumb compression and suction. The rest of the cylinders also displayed good thumb compression and suction and their rocker arms operated normally. The observed overhead components (rocker arms, valves, and springs) displayed normal operating and lubrication signatures.



#1 Cylinder

ENGINE FIELD INSPECTION REPORT

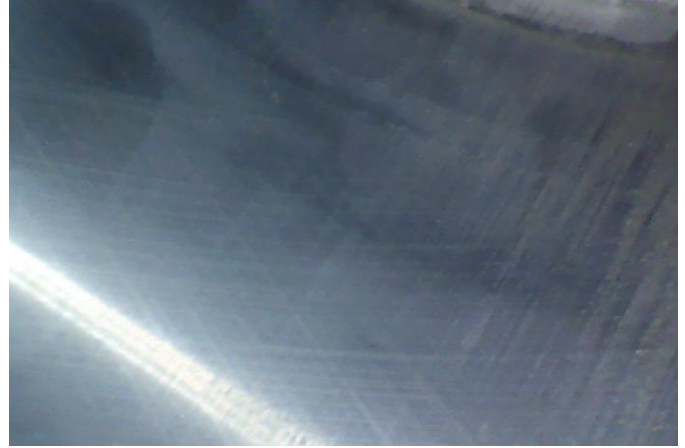
FILE NUMBER:

19-041

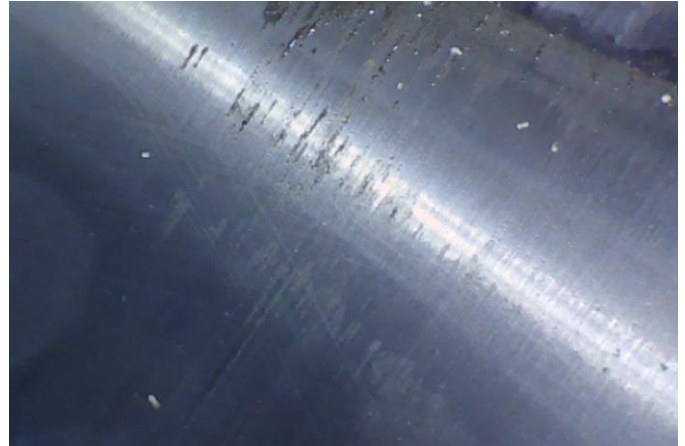
ENGINE S/N:

814452-R

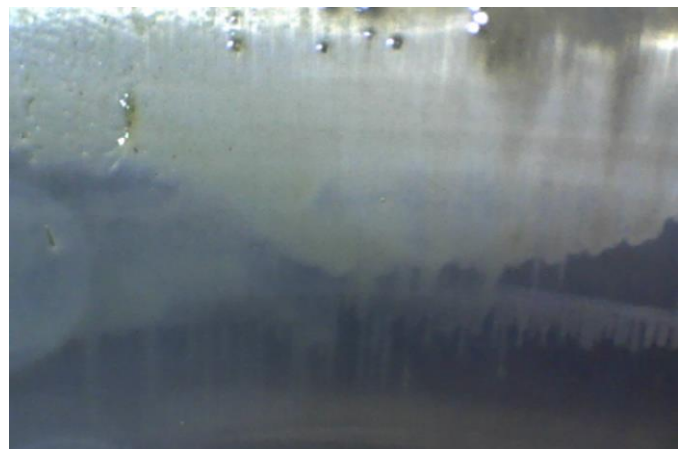
PAGE 20 of 35



#3 Cylinder



#5 Cylinder



#2 Cylinder

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 21 of 35



#4 Cylinder



#6 Cylinder

VALVES AND GUIDES

Condition:

All of the valves remained attached to their cylinders and the #5 valves displayed impact damage signatures. The valve heads were inspected using a lighted borescope, the valve heads displayed normal operating and combustion signatures. There were no anomalies observed.

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 22 of 35



#1 Exhaust Valve



#1 Intake Valve



#3 Exhaust Valve



#3 Intake Valve



#5 Exhaust Valve



#5 Intake Valve

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 23 of 35



#2 Exhaust Valve



#2 Intake Valve



#4 Exhaust Valve



#4 Intake Valve



#6 Exhaust Valve



#6 Intake Valve

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 24 of 35

ROCKER ARMS AND SHAFTS

Condition:

Both of the #5 rocker arms and the #3 intake rocker arm had broken free from their installation points and were not located at the time of the examination. During crankshaft rotation, all of the attached rocker arms moved normally with the exception of the #4 exhaust rocker arm. It was observed that the #4 exhaust lifter housing was impacted with material consistent with wood from the accident site. There were no pre-impact anomalies noted that would have prevented normal operation.



PISTONS

Piston P/N: Not observed

Condition:

The piston faces were inspected using a lighted borescope, the piston faces displayed normal operating and combustion signatures. During crankshaft rotation the pistons operated normally. There were no anomalies observed.



#1 Piston



#3 Piston

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 25 of 35



#5 Piston



#2 Piston



#4 Piston



#6 Piston

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 26 of 35

CRANKCASE ASSEMBLY

CRANKCASE

Casting
Number:

1-3-5: Not observed

2-4-6: Not observed

S/N: J149909R

Condition:

The crankcase displayed impact damage signatures concentrated to the forward portion of the crankcase; a large portion had broken free from the rest of the crankcase and portions of the internal components were visible. There were no signs of a catastrophic internal engine failure and there were no anomalies observed.



#5 MAIN BEARINGS

P/N: SA642839

Date Code: 10-04

Condition:

The #5 main bearings were able to be removed from the broken forward crankcase. The bearings displayed normal operating and lubrication signatures. There were no anomalies observed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 27 of 35

CRANKSHAFT ASSEMBLY

CRANKSHAFT

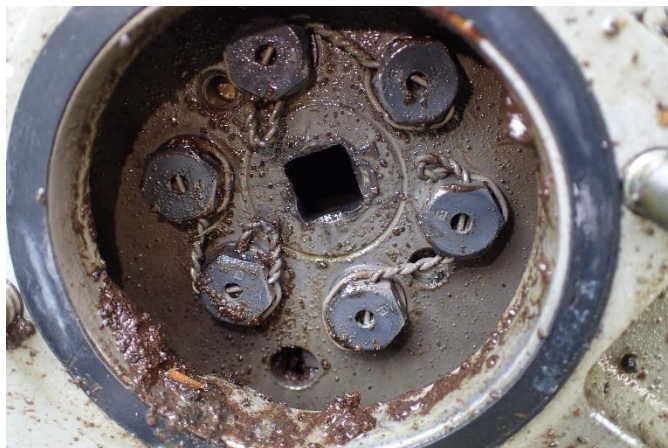
Forging: Not observed

S/N: K309906N

Heat code: Inaccessible

Condition:

The propeller flange had broken free from the rest of the crankshaft and remained attached to the propeller hub; the damage was consistent with impact damage. A portion of the crankshaft was visible through the broken crankcase. The visible portion of the crankshaft displayed normal operating and lubrication signatures. The crankshaft was rotated by using a tool inserted into the rear of the crankshaft; continuity was established between the crankshaft, camshaft, connecting rods and associated components. There were no anomalies observed.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

19-041

ENGINE S/N:

814452-R

PAGE 28 of 35**TRANSFER COLLAR****Condition:**

The transfer collar displayed impact damage signatures and the collar halves had separated. The transfer collar displayed normal operating and lubrication signatures, there were no anomalies observed.

**CONNECTING RODS**

P/N: Inaccessible

Forging or Serial Number: Inaccessible

Condition:

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

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 29 of 35

CAMSHAFT

CAMSHAFT

P/N: Not observed

S/N: Not observed

Condition:

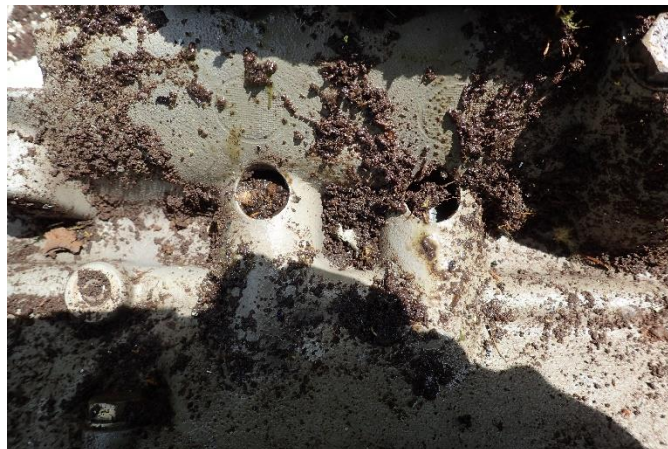
The camshaft was partially visible through the broken oil sump. The visible portions of the camshaft displayed normal operating signatures and the camshaft operated normally during crankshaft rotation. There were no anomalies observed.



LIFTERS

Condition:

It was observed that the #4 exhaust lifter would not move during crankshaft rotation; it was observed that the #4 exhaust lifter housing was impacted with material consistent with wood and dirt from the accident site. The rest of the lifters operated normally.



#4 Lifter Housings

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 30 of 35

ACCESSORY GEARS

Condition:

One of the magneto drive gears and the governor drive gear were located and displayed normal operating signatures. The second magneto drive gear was not observed at the time of the examination.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 31 of 35

ACCESSORIES

STARTER

Manufacturer: Illegible

P/N: Illegible

S/N: Illegible

Condition:

The starter had broken free from its installation point and displayed impact damage signatures.



STARTER ADAPTER

P/N: Not observed

Condition:

The starter adapter remained attached to its installation point and displayed impact damage signatures. The adapter was removed, and the visible gear displayed normal operating signatures and was capable of rotation.



ALT/GEN #1

Manufacturer: Not observed

P/N: Not observed

S/N: Not observed

Condition:

The primary alternator had broken free from its installation point and was not observed at the time of the examination.

ALT/GEN #2	Manufacturer: B&C Specialty Products	P/N: ??410-1	S/N: ???D2W55K
Condition:	The standby alternator had broken free from its installation point and displayed impact damage signatures.		



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 33 of 35

PROPELLER

PROPELLER GOVERNOR	Manufacturer: Woodward	P/N: Not observed	S/N: Not observed
Condition:	The propeller governor displayed a significant amount of impact damage, the governor was broken into several pieces. There were no anomalies observed with the recovered portion of the governor.		



PROPELLER	Manufacturer: Hartzell	P/N: PHC-C3YF-1RF	S/N: B27551B
Condition:	The three-blade, constant speed propeller remained attached to the propeller flange; however, the propeller flange had broken free from the rest of the crankshaft consistent with impact damage. The three propeller blades remained within the propeller hub and all three propeller blades displayed impact damage signatures. The propeller blade marked "A" displayed aft bending, leading-edge gouges, and minor polishing. The propeller blade marked "B" displayed aft bending and minor twisting deformation, polishing of the blade, and chordwise scratches and a leading-edge gouge. The propeller blade marked "C" had sheared approximately in half and the blade tip was ground down; the blade also displayed chordwise scratches, blade polishing, and twisting deformation.		

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 34 of 35



Propeller



Propeller Hub



Propeller Blade "A"



Propeller Blade "B"



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

19-041

ENGINE S/N:

814452-R

PAGE 35 of 35



Propeller Blade "C"