



Continental Motors

ENGINE FIELD INSPECTION REPORT

ENGINE MODEL	IO-470-L21A
ENGINE SERIAL NUMBER	454399
AIRCRAFT MAKE & MODEL	Beech 95-B55 (T42A)
AIRCRAFT SERIAL NUMBER	TC-1726
AIRCRAFT REGISTRATION	N413D
FILE NUMBER	16-180

NAME	SIGNATURE	DATE
Nicole L. Charnon		11/01/2016

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454399

PAGE 2 of 32**GENERAL INFORMATION**

EXAMINATION		ACCIDENT DATA	
DATE	10/25-27/2016	NTSB ACCIDENT #	WPR16FA182
FACILITY	Auto Storage by Osterman's (rented by Arlin's Aircraft Services)	NTSB INVESTIGATOR	Tealeye Cornejo
ADDRESS	234 Arden Drive Belgrade, MT 59714	FAA INVESTIGATOR	Troy McClanahan
		ACCIDENT DATE	09/17/2016
		ACCIDENT LOCATION	Broadus, Montana

ENGINE INFORMATION

ENGINE POSITION	Left Engine
TOTAL TIME	4,337.5 (at time of last annual inspection)
TIME SOH	653.2 (at time of last annual inspection)
TYPE & TIME SLI	16 hours (since last annual inspection)
BUILD DATE	05/16/1974
IN SERVICE DATE	Unknown

Significant logbook information:

Only excerpts of the aircraft maintenance records have been provided at the point of this report's writing. Review of those excerpts revealed that the aircraft and engines underwent an annual inspection on May 25, 2016 at a Hobbs Time of 1,410.3 hours. Photographs from the accident site show the Hobbs meter numbers aligned on 1,426.3 hours. The entry for the annual inspection indicated that the #2 cylinder was replaced at that time along with three sparkplugs. The total time in service and time since overhaul listed for the left engine at the time of the last annual inspection were 4,337.5 and 653.2 hours, respectively.

Report Summary:

Search Code(s):

15-12-68

The engine sustained impact-related damage that fractured the bottom crankcase and bent the camshaft's governor drive gear. However, crankshaft and camshaft continuity were confirmed during a compression test with no pre-accident anomalies or signs of operational distress noted on any of the core engine components. The magnetos produced a spark through their respective ignition systems when the drive shafts were manually rotated. Disassembly of the fuel system components did not reveal and pre-accident anomalies with the internal components.

No pre-accident anomalies were noted that would have precluded the engine's ability to produce full, rated power.

Disposition of engine following exam:

The engine and the associated components were left with the remaining wreckage at the examination facility, awaiting final disposition from the NTSB investigator-in-charge (IIC).

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454399

PAGE 3 of 32**INSPECTION WITNESSES**

NAME	Nicole L. Charnon	NAME	Tealeye Cornejo
ADDRESS	Washington, DC	ADDRESS	Western Pacific Region
ORGANIZATION	Continental Motors	ORGANIZATION	NTSB
PHONE	██████████	PHONE	██████████
NAME	Clifford W. Carpenter	NAME	Ernie Hall
ADDRESS	Helena, MT	ADDRESS	Wichita, KS
ORGANIZATION	FAA – Helena FSDO	ORGANIZATION	Textron Aviation
PHONE	██████████	PHONE	██████████
NAME	Les Doud	NAME	
ADDRESS	Piqua, OH	ADDRESS	
ORGANIZATION	Hartzell Propellers	ORGANIZATION	
PHONE	██████████	PHONE	

EXTERNAL INSPECTION OF ENGINE

The left engine was separated from the aircraft and was lying upside down on the storage facility floor. The two-bladed propeller was separated from the crankshaft aft of the propeller flange. The fracture surface was jagged and irregular in shape and displayed localized thermal discoloration at isolated areas of the fracture surface. The propeller flange remained attached to the propeller hub.

Portions of the airframe mount were displaced into the bottom side of the engine and the engine mounts were fractured. The intake tubes were fractured and the balance tube was flattened along the bottom side of the engine. The exhaust system was deformed up and aft.

The oil pan was flattened and displaced into the bottom of the engine. The bottom front portion of the crankcase was fractured. The oil pan was removed providing visual access to the engine's core components (camshaft, lifters, crankshaft, counterweights, connecting rods, and camshaft gears). All components appeared to be well lubricated with no pre-impact anomalies or signs of operational distress noted with any components. The bevel gear attached to the camshaft was bent aft.

The engine was rolled over to an upright position. The upper crankcase remained intact and all six cylinders remained attached. The right magneto was separated from its mounting flange and remained attached to the engine via the ignition harness. The left magneto remained in place on its mounting pad and did not rotate or slip during manual manipulation. The engine-driven fuel pump, throttle body/fuel metering unit, fuel manifold valve and fuel injection nozzles remained in place though they sustained varying degrees of impact-related damage.

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 4 of 32



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 5 of 32



ENGINE TEARDOWN AND COMPONENT EXAMINATION

EXHAUST SYSTEM

Condition:

The exhaust system remained attached to the cylinders, but the risers and manifolds sustained cracking and deformation damage. The exhaust pipes were cut away by the aircraft recover crew to facilitate transport.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 6 of 32

INDUCTION SYSTEM

Condition: The intake filter and induction air box sustained deformation damage. The intake tubes were deformed and/or fractured. The balance tube was flattened against the oil pan. The throttle body remained attached to the backside of the engine and the throttle valve was found in a near full open position. The throttle lever remained attached to the throttle body and fuel metering unit. No pre-accident anomalies were noted with the induction system.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 7 of 32

IGNITION SYSTEM

**LEFT
MAGNETO**Manufacturer: Continental
Motors S6RN-1225

P/N: 10-349350-1

S/N: Not Legible

Condition:

The left magneto remained secured to its mounting pad. Manual manipulation of the magneto did not result in any rotation or slipping. The ignition harness remained attached to the magneto. The magneto was removed and the top sparkplugs were inserted in the undamaged ignition terminals and the damaged terminal leads were cut to remove any impact-related shorts. The magneto's drive shaft was manually rotated and the impulse coupling made an audible snap with a corresponding spark from all of the sparkplugs or cut ignition leads. No pre-accident anomalies were noted with the magneto.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454399

PAGE 8 of 32**RIGHT
MAGNETO**Manufacturer: Continental
Motors S6RN-1225

P/N: 10-349350-1

S/N: 8106184

Condition:

The right magneto was separated from its mounting pad and its flange was fractured in the area of the securing hardware. The ignition harness remained secured to the magneto. The top sparkplugs were inserted in the undamaged ignition terminals and the damaged terminal leads were cut to remove any impact-related shorts. The magneto's drive shaft was manually rotated and the impulse coupling made an audible snap with a corresponding spark from all of the sparkplugs or cut ignition leads. No pre-accident anomalies were noted with the magneto.

**IGNITION
HARNESS**

Manufacturer: Champion

P/N: Unknown

S/N: Unknown

Condition:

The ignition harness remained secured to the magnetos. The terminal ends remained secured to their respective sparkplugs. A couple of the bottom leads sustained impact-related pinching damage, but otherwise the leads were unremarkable. Each of the leads produced a spark during the magneto test with no pre-accident anomalies noted.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454399

PAGE 9 of 32**SPARK
PLUGS**

Manufacturer: Champion

P/N: RHB32E

Condition:

The sparkplugs remained secured to their respective cylinders and the ignition leads remained attached to the sparkplugs via their terminal ends. The #6 bottom sparkplug was fractured in the middle with one half remaining secured in the cylinder and the other remaining attached to the terminal end. The top sparkplugs were removed from the cylinders. The #1, #3, #5, and #2 sparkplugs displayed a normal worn condition and the #4 and #6 sparkplugs appeared relatively new. All six sparkplugs displayed normal combustion deposits with no signs of lead or carbon fouling.



1



3

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 10 of 32



5



2



4



6

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 11 of 32

FUEL SYSTEM

FUEL PUMP

Manufacturer: Continental
Motors

P/N: 638156-3

S/N: 5997RA

Condition: The engine-driven fuel pump remained attached to the backside of the engine and the fuel lines to and from the pump remained attached. The pump's low pressure relief valve adjusting screw was impinged by the left intake elbow. The low pressure relief valve cap was fractured. Manual rotation of the intact drive coupling resulted in a free and unbound rotation of the drive shaft. The fuel pump was disassembled and the low pressure relief valve diaphragm was torn. No obstructions or blockages were noted and the pump vanes were intact with no pre-accident anomalies noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 12 of 32



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 13 of 32

THROTTLE BODY METERING UNIT

Manufacturer: Continental
Motors

P/N: 625219-2

S/N: J049630AR

Condition: The throttle body remained attached to the backside of the engine and the fuel metering unit remained attached. The throttle and mixture control cables remained attached to the throttle and mixture control levers though the levers and cable rod ends were deformed. Rotation of the fuel metering unit's control levers resulted in a coinciding rotation of the shafts. The inlet fuel fitting was fractured. The inlet fuel screen was removed and no blockages or obstructions were noted. The fuel metering unit was disassembled and no pre-accident anomalies were noted with the internal components.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 14 of 32



FUEL MANIFOLD VALVE

Manufacturer: Continental Motors

P/N: 631427-1

S/N: F129501CR

Condition:

The fuel manifold valve remained attached to the topside of the engine and the fuel lines to and from the manifold valve remained attached. The manifold valve was disassembled and the plunger remained attached to the diaphragm and the screen was clean and unobstructed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 15 of 32



FUEL NOZZLES AND LINES

Condition:

The fuel injector lines remained attached to the fuel nozzles and all of the nozzles remained attached to their respective cylinders. The nozzles were removed and examined. Almost all of the nozzles contained debris consistent with organic material found at the accident site. The debris was easily cleared from the nozzles and no signs of lead fouling or obstruction were noted.



1



2

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 16 of 32



3



4



5



6

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 17 of 32

LUBRICATION SYSTEM

OIL SUMP

Condition: The oil sump remained attached to the bottom side of the engine. It was displaced upward and flattened and sustained puncture damage. The oil sump was removed and no pre-accident anomalies were noted.



OIL PICKUP TUBE & SCREEN

Condition: The oil pickup tube and screen were intact but they sustained deformation damage. The screen was clear and unobstructed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 18 of 32

OIL PUMP

Condition: The oil pump remained attached to the backside of the engine, though all but one of the mounting studs were sheered where the pump housing meets the crankcase. The pump was removed and examined. Oil coated all of the components. Surface corrosion was noted on the pump gears. Slivers of metal consistent with fresh shavings from the internal pump walls was observed on the gears. There were no signs of operational distress noted with the pump gears or housing.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 19 of 32



OIL FILTER

Manufacturer: Champion

P/N: CH48110-1

Condition:

The oil filter remained attached to the oil filter adapter but it sustained deformation damage. The filter remained safety wired to the adapter. There was no sign of pre-existing leaks or anomalies.



OIL COOLER

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition:

The oil cooler remained attached to the front right side of the engine with no pre-accident anomalies noted.

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 20 of 32

CYLINDERS

NOTE: The photographs that follow the cylinder condition description represent the cylinder rocker area, 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 signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted. Thumb compression was obtained during crankshaft rotation and valve operation was confirmed during the compression test.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 21 of 32

CYLINDER #3

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted. Thumb compression was obtained during crankshaft rotation and valve operation was confirmed during the compression test.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 22 of 32

CYLINDER #5

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted. Thumb compression was obtained during crankshaft rotation and valve operation was confirmed during the compression test.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 23 of 32

CYLINDER #2

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted. Thumb compression was obtained during crankshaft rotation and valve operation was confirmed during the compression test.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 24 of 32

CYLINDER #4

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted. Thumb compression was obtained during crankshaft rotation and valve operation was confirmed during the compression test.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 25 of 32

CYLINDER #6

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was fractured on the bottom side. It was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted. Thumb compression was obtained during crankshaft rotation and valve operation was confirmed during the compression test.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 26 of 32

CRANKCASE ASSEMBLY

CRANKCASE

Condition:

The crankcase halves remained attached but the bottom and front ends sustained impact-related fractures. Internal views of the crankcase with the oil sump removed revealed no signs of operational distress. During a crankshaft continuity check there was no binding noted with the main bearings or main bearing journals.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 27 of 32

CRANKSHAFT ASSEMBLY

CRANKSHAFT	Forging Number: Not Observed	S/N: B334	Heat code: J18
Condition:	The crankshaft's propeller flange was separated just aft of the flange. The fracture surface was jagged and irregular with small areas of thermal discoloration on the fracture features. One of the propeller bolt holes was torn open. The flange remained attached to the propeller hub. The rest of the crankshaft remained intact and crankshaft continuity was confirmed from the accessory end forward to the front fracture area and out to each connecting rod during a crankshaft continuity check. The crankshaft was manually rotated utilizing a tool that was inserted into the accessory gear. No binding or anomalies were noted.		



TRANSFER COLLAR	
Condition:	The crankcase around the transfer collar sustained impact-related damage, but there were no signs of operational distress or pre-accident anomalies.
COUNTER WEIGHTS	
Condition:	The counterweights remained secured to the crankshaft and no pre-accident anomalies were noted.

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 28 of 32

#1 CONNECTING ROD

Condition:

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



#3 CONNECTING ROD

Condition:

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454399

PAGE 29 of 32

#5 CONNECTING ROD

Condition:

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



#2 CONNECTING ROD

Condition:

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

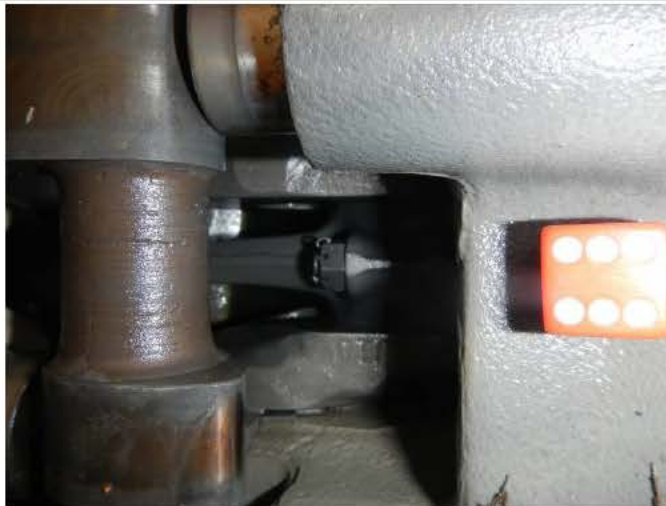
454399

PAGE 30 of 32**#4 CONNECTING
ROD****Condition:**

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.

**#6 CONNECTING
ROD****Condition:**

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454399

PAGE 31 of 32**CAMSHAFT****CAMSHAFT**

Condition: The camshaft remained intact from the accessory end to the governor drive gear, though the latter was bent aft on the bottom side. The lifters remained in place and all appeared well lubricated with no signs of pre-accident anomalies besides light surface corrosion on the side walls. Camshaft continuity was confirmed during a compression test with continuity confirmed from the camshaft, through the lifters, pushrods, rockers and valves.

**ACCESSORY
GEARS**

Condition: The accessory gears remained intact and well lubricated. No signs of operational distress were noted.

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454399

PAGE 32 of 32**ACCESSORIES**

STARTER	Manufacturer: Not Recorded	P/N: Not Recorded	S/N: Not Recorded
Condition:	The starter was separated from the starter adapter and no external anomalies were noted.		
STARTER ADAPTER			
Condition:	The starter adapter remained attached to the backside of the engine and its drive pulley was fractured. Rotation of the crankshaft presented a coinciding rotation of the drive pulley.		
ALT/GEN #1	Manufacturer: Not Recorded	P/N: Not Recorded	S/N: Not Recorded
Condition:	The alternator remained attached to the engine and the drive belt was in place. There were no external anomalies noted.		
VACUUM PUMP	Manufacturer: Aircraft Accessories	P/N: G455	S/N: 73486
Condition:	The vacuum pump remained attached to the backside of the engine. Removal of the vacuum pump and manual rotation of the drive shaft resulted in free rotation of the vacuum pump.		





Continental Motors

ENGINE FIELD INSPECTION REPORT

ENGINE MODEL	IO-470-L21A
ENGINE SERIAL NUMBER	454385
AIRCRAFT MAKE & MODEL	Beech 95-B55 (T42A)
AIRCRAFT SERIAL NUMBER	TC-1726
AIRCRAFT REGISTRATION	N413D
FILE NUMBER	16-180

NAME	SIGNATURE	DATE
Nicole L. Charnon		11/01/2016

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 2 of 34**GENERAL INFORMATION**

EXAMINATION		ACCIDENT DATA	
DATE	10/25-27/2016	NTSB ACCIDENT #	WPR16FA182
FACILITY	Auto Storage by Osterman's (rented by Arlin's Aircraft Services)	NTSB INVESTIGATOR	Tealeye Cornejo
ADDRESS	234 Arden Drive Belgrade, MT 59714	FAA INVESTIGATOR	Troy McClanahan
		ACCIDENT DATE	09/17/2016
		ACCIDENT LOCATION	Broadus, Montana

ENGINE INFORMATION

ENGINE POSITION	Right Engine
TOTAL TIME	4,326.3 (at time of last annual inspection)
TIME SOH	1,410.3 (at time of last annual inspection)
TYPE & TIME SLI	16 hours (since last annual inspection)
BUILD DATE	05/16/1974
IN SERVICE DATE	Unknown

Significant logbook information:

Only excerpts of the aircraft maintenance records have been provided at the point of this report's writing. Review of the excerpts revealed that the aircraft and engines underwent an annual inspection on May 25, 2016 at a Hobbs time of 1,410.3 hours. Photographs from the accident site show the Hobbs meter numbers aligned on 1,426.3 hours. The total time in service and time since overhaul listed for the right engine at the time of the last annual inspection were 4,326.3 and 1,410.3 hours, respectively.

Report Summary:

Search Code(s):

15-12-68

The engine sustained impact-related damage that fractured both crankcase halves, bent and fractured the camshaft, and fractured the #6 connecting rod into three pieces. Due to the extent of the impact damage, a compression test was not possible. However, no pre-accident anomalies or signs of operational distress were noted with any of the core engine components. The magnetos produced a spark through their respective ignition systems when the drive shafts were manually rotated. Disassembly of the fuel system components did not reveal and pre-accident anomalies with the internal components.

No pre-accident anomalies were noted that would have precluded the engine's ability to produce full, rated power.

Disposition of engine following exam:

The engine and the associated components were left with the remaining wreckage at the examination facility, awaiting final disposition from the NTSB investigator-in-charge (IIC).

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 3 of 34**INSPECTION WITNESSES**

NAME	Nicole L. Charnon	NAME	Tealeye Cornejo
ADDRESS	Washington, DC	ADDRESS	Western Pacific Region
ORGANIZATION	Continental Motors	ORGANIZATION	NTSB
PHONE	██████████	PHONE	██████████
NAME	Clifford W. Carpenter	NAME	Ernie Hall
ADDRESS	Helena, MT	ADDRESS	Wichita, KS
ORGANIZATION	FAA – Helena FSDO	ORGANIZATION	Textron Aviation
PHONE	██████████	PHONE	██████████
NAME	Les Doud	NAME	
ADDRESS	Piqua, OH	ADDRESS	
ORGANIZATION	Hartzell Propellers	ORGANIZATION	
PHONE	██████████	PHONE	

EXTERNAL INSPECTION OF ENGINE

The right engine was separated from the aircraft and was lying on the storage facility floor. A large irregular and jagged fracture was observed in the front portion of the crankcase from the #5 cylinder's leading edge, over the topside of the crankcase, to the #6 cylinder's trailing edge. The two-bladed propeller was separated from the crankshaft aft of the propeller flange. The fracture surface was jagged and irregular in shape and displayed localized thermal discoloration at isolated areas of the fracture surface. The propeller flange remained attached to the propeller hub.

Portions of the airframe mount were displaced into the bottom side of the engine and the engine mounts were fractured. The intake tubes were fractured and the balance tube was flattened along the bottom side of the engine. The exhaust system was deformed up and aft and the exhaust pipes were flattened.

The engine was rolled over to facilitate oil pan removal. The oil pan was flattened and displaced into the bottom of the engine. The fracture noted on the top side of the crankcase continued to the bottom front portion of the crankcase. Numerous irregular fractures were noted in the bottom side of the crankcase halves with the predominance of damage being on the front right side. A portion of connecting rod cap was protruding through the oil pan but it was not discolored.

The oil pan was removed providing visual access to the engine's core components (camshaft, lifters, crankshaft, counterweights, connecting rods, and camshaft gears). All components appeared to be well lubricated. The #6 connecting rod bolt were fractured, the connecting rod cap was separated from the connecting rod, and the connecting rod was fractured near the piston pin. The #6 connecting rod bearing halves were found within the crankcase and they did not display any signs of thermal discoloration. The bearing halves sustained impact-related deformation damage. The #6 connecting

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 4 of 34

rod journal displayed normal operating signatures with no signs of operational distress or thermal discoloration. The camshaft was bent between the #6 exhaust cam lobe and the #5 and #6 intake cam lobes. The camshaft was fractured aft of the #5 exhaust cam lobe and the fracture was irregular in shape. The #5 and #6 hydraulic lifters were displaced from their normal positions and were found within the crankcase.

The engine was rolled over to an upright position. The upper crankcase remained intact and all six cylinders remained attached. The magnetos were separated from their mounting flange and remained attached to the engine via the ignition harness. The engine-driven fuel pump, throttle body/fuel metering unit, fuel manifold valve and fuel injection nozzles remained in place though they sustained varying degrees of impact-related damage.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 5 of 34



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 6 of 34

ENGINE TEARDOWN AND COMPONENT EXAMINATION

EXHAUST SYSTEM

Condition: The exhaust system remained attached to the engine via the exhaust risers but the exhaust pipes were flattened and the left side sustained deformation damage.



INDUCTION SYSTEM

Condition: The induction air box remained attached to the engine but it sustained deformation damage to it and the air filter. The air box was displaced from the throttle body and the throttle body was fractured as were many of the intake tubes and risers. The balance tube was flattened.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 7 of 34

IGNITION SYSTEM

LEFT MAGNETO

Manufacturer: Continental
Motors S6RN-1225

P/N: 10-349350-1

S/N: 8112191

Condition:

The left magneto was separated from its mounting pad and its flange was fractured in the area of the securing hardware. The ignition harness remained attached to the magneto but the harness cap sustained impact damage that deformed a few of the terminal towers. The top sparkplugs were inserted in the undamaged ignition terminals and the damaged terminal leads were cut to remove any impact-related shorts. The magneto's drive shaft was manually rotated and the impulse coupling made an audible snap with a corresponding spark from all of the sparkplugs or cut ignition leads, with exception of one that sustained the deformation damage. The ignition harness was removed and a piece of wire was inserted in the distributor tower and the drive shaft was again rotated. A spark was obtained from the damaged tower. No pre-accident anomalies were noted with the magneto.

NOTE: the left and right magnetos were mislabeled during the examination.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 8 of 34

RIGHT MAGNETO

Manufacturer: Continental Motors S6RN-1225

P/N: 10-349350-1

S/N: 80160?3

Condition:

The right magneto was separated from its mounting pad and its flange was fractured in the area of the securing hardware. The housing also sustained fracture damage in the area of the contact points. The coil lead flag terminal was separated from the contact point tab. The ignition harness remained secured to the magneto. The top sparkplugs were inserted in the undamaged ignition terminals and the damaged terminal leads were cut to remove any impact-related shorts. The separated flag terminal was reinstalled on its tab. The magneto's drive shaft was manually rotated and the impulse coupling made an audible snap with a corresponding spark from all of the sparkplugs or cut ignition leads. No pre-accident anomalies were noted with the magneto.

NOTE: the left and right magnetos were mislabeled during the examination.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 9 of 34**IGNITION
HARNESS**

Manufacturer: Champion

P/N: Unknown

S/N: Unknown

Condition:

The ignition harness remained attached to the magnetos though the left harness cap sustained impact-related damage that impinged upon the distributor block. Some of the ignition leads sustained impact-related pinching damage. The damaged leads were cut to remove shorted areas and the harness was tested with each lead, but one, producing a spark during the magneto test.

**SPARK
PLUGS**Manufacturer: Combination
of Unison Autolite and
Champion

P/N: URHB32E and RHB32

Condition:

The sparkplugs remained secured to their respective cylinders and the ignition leads remained attached to the sparkplugs via their terminal ends. The top sparkplugs were removed from the cylinders. The sparkplugs displayed a normal worn condition and all six sparkplugs displayed normal combustion deposits with no signs of lead or carbon fouling.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 10 of 34



1



3



5



2



4



6

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 11 of 34

FUEL SYSTEM

FUEL PUMP

Manufacturer: Continental
Motors

P/N: 638156-3

S/N: C127338RA

Condition: The engine-driven fuel pump remained attached to the backside of the engine and the fuel lines to and from the pump remained attached. The pump's low pressure release valve was slightly displaced. The adjustment screw was completely threaded into the cap. Manual rotation of the intact drive coupling resulted in a free and unbound rotation of the drive shaft. Manipulation of the fuel pump resulted in residual fuel pouring from the pump fittings. The fuel pump was disassembled and no obstructions or blockages were noted and the pump vanes were intact with no pre-accident anomalies noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 12 of 34



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 13 of 34

THROTTLE BODY METERING UNIT

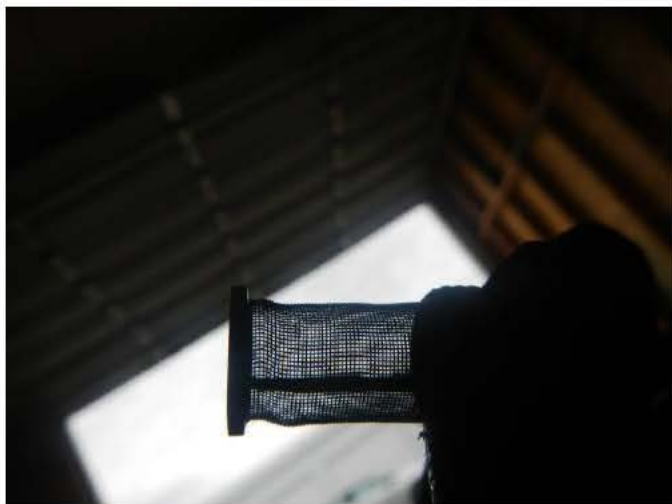
Manufacturer: Continental
Motors

P/N: 625219-2

S/N: 1?18RA

Condition:

The throttle body remained attached to the backside of the engine, but the bottom wye was fractured. The mixture lever was cut by recovery personnel, but the portion that remained attached to the shaft was secured. The throttle cable and lever remained secured. The fuel metering unit's fuel inlet fitting was fractured. The inlet fuel screen was removed and no obstructions were noted. The fuel metering unit was disassembled with no pre-accident anomalies noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 14 of 34

FUEL MANIFOLD VALVE

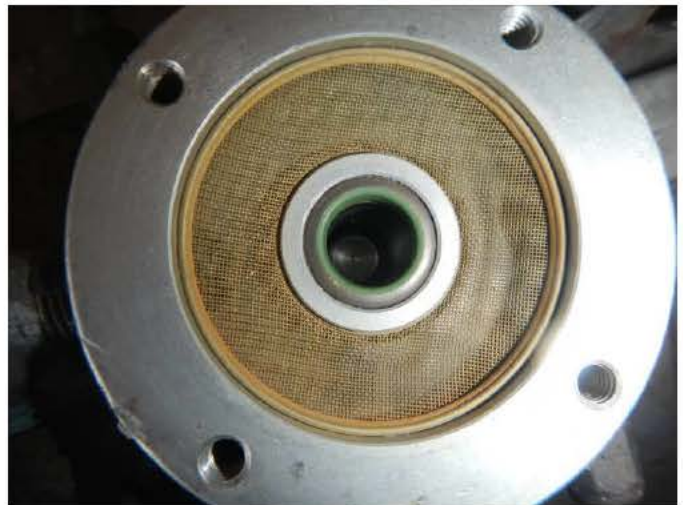
Manufacturer: Continental Motors

P/N: 631427-A1

S/N: 4314RA

Condition:

The fuel manifold valve remained attached to the engine. The #1 and #2 fuel injection line fittings and the fuel inlet fitting were fractured at the housing. The manifold valve was disassembled and the plunger remained attached to the diaphragm and the screen was clean and unobstructed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 15 of 34

FUEL NOZZLES AND LINES

Condition:

The #1 and #2 fuel injector lines were separated from the manifold, but the lines remained attached to the fuel nozzles and all of the nozzles remained attached to their respective cylinders, with the exception of the #2, which was fractured. The #1 nozzle was bent. The nozzles were removed and examined, with the exception of the #2. The nozzles were clear with no signs of lead fouling or obstruction noted.



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ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 16 of 34



2



4



6

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 17 of 34

LUBRICATION SYSTEM

OIL SUMP

Condition: The oil sump remained attached to the bottom side of the engine. It was displaced upward, flattened, and punctured. The oil sump was removed and no pre-accident anomalies were noted.



OIL PICKUP TUBE & SCREEN

Condition: The oil pickup tube and screen were intact but they sustained deformation damage. The screen was clear and unobstructed.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 18 of 34

OIL PUMP

Condition:

The oil pump remained attached to the backside of the engine. The pump was removed and examined. Oil coated all of the components. Surface corrosion was noted on the pump gears. Slivers of metal consistent with fresh shavings from the internal pump walls was observed on the gears. There were no signs of operational distress noted with the pump gears or housing.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 19 of 34**OIL FILTER**

Manufacturer: Champion

P/N: CH48110-1

Condition:

The oil filter remained attached to the oil filter adapter but it sustained deformation damage. The filter remained safety wired to the adapter. There was no sign of pre-existing leaks or anomalies.

**OIL COOLER**

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition:

The oil cooler was separated from the front right side of the engine and was not examined.

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 20 of 34

CYLINDERS

NOTE: The photographs that follow the cylinder condition description represent the cylinder rocker area, the piston, the intake valve, and the exhaust valve in that order unless otherwise noted for cylinders #1 and #3.

CYLINDER #1

Condition:

The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted.

NOTE: Borescope photos were not recorded for this cylinder.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 21 of 34

CYLINDER #3

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted.

NOTE: Only the exhaust valve borescope photos were recorded for this cylinder.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 22 of 34

CYLINDER #5

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The crankcase was fractured just forward of the #5 cylinder. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 23 of 34

CYLINDER #2

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 24 of 34

CYLINDER #4

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 25 of 34

CYLINDER #6

Condition: The cylinder remained attached to the crankcase with no external signs of operational distress. The crankcase was fractured aft of the cylinder. The rocker cover was removed from the cylinder and the rockers were intact and well lubricated. The valve springs were intact and showed no signs of operational distress. The internal cylinder components were examined with a lighted borescope and no pre-accident anomalies or signs of operational distress were noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 26 of 34

CRANKCASE ASSEMBLY

CRANKCASE

Condition: The crankcase halves remained attached. A large crack in the area of the #5 and #6 cylinders extended throughout the entirety of the crankcase circumference and fractured the #5 hydraulic lifter area. The bottom right oil sump mounting flange was also fractured. The fractures appeared to be irregular and jagged with no signs of pre-impact anomalies. The main bearings appeared to be intact with no signs of pre-impact anomalies.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 27 of 34

CRANKSHAFT ASSEMBLY

CRANKSHAFT

Forging Number: 625456F

S/N: Unknown

Heat code: Unknown

Condition:

The crankshaft's propeller flange was separated just aft of the flange. The fracture surface was jagged and irregular with small areas of thermal discoloration on the fracture features. The flange remained attached to the propeller hub. The rest of the crankshaft remained intact and crankshaft continuity was visually confirmed from the accessory end forward to the front fracture area and out to each connecting rod, with the exception of the #6 connecting rod which was fractured into three pieces. The crankshaft's #6 connecting rod journal did not display any signs of pre-accident anomalies or signs of operational distress.



TRANSFER COLLAR

Condition:

The crankcase around the transfer collar sustained impact-related damage, but there were no signs of operational distress or pre-accident anomalies.

COUNTER WEIGHTS

Condition:

The counterweights remained secured to the crankshaft and no pre-accident anomalies were noted.

ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 28 of 34

#1 CONNECTING ROD

Condition: The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



#3 CONNECTING ROD

Condition: The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 29 of 34**#5 CONNECTING
ROD**

Condition:

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.

**#2 CONNECTING
ROD**

Condition:

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 30 of 34

#4 CONNECTING ROD

Condition:

The connecting rod was viewed when the oil pan was removed from the engine crankcase. The connecting rod remained attached to both the crankshaft and piston pin with no signs of operational distress noted.



#6 CONNECTING ROD

Condition:

The #6 connecting rod was fractured into three pieces. The rod cap was displaced through the bottom of the engine and punctured the oil sump. The rod cap bolts were fractured with the bolts displaying notable necking deformation and irregular fracture surfaces. The bolt nuts remained threaded on the bolts with the cotter pin installed in each. The connecting rod i-beam was fractured approximately 2 inches from the piston pin. The fracture surfaces at the i-beam were smeared with stud a thread imprint noted on one of the fracture ends. The connecting rod was not discolored. The connecting rod bearings were found in the engine crankcase and they displayed deformation damage with no signs of pre-impact anomalies.



ENGINE FIELD INSPECTION REPORT

FILE NUMBER:

16-180

ENGINE S/N:

454385

PAGE 31 of 34



ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 32 of 34**CAMSHAFT****CAMSHAFT**

Condition: The camshaft was bent between the #6 exhaust cam lobe and the #5 and #6 intake cam lobes. The camshaft was fractured aft of the #5 exhaust cam lobe and the fracture was irregular in shape. The #5 and #6 lifters were displaced from their normal positions and were found within the crankcase. There were no signs of pre-impact anomalies with the lifters or camshaft. The camshaft's governor drive gear was displaced from the end of the camshaft and was found in the crankcase.

**ACCESSORY GEARS**

Condition: The accessory gears remained intact and well lubricated. No signs of operational distress were noted.

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 33 of 34**ACCESSORIES****STARTER**

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition:

The starter was partially separated from the starter adapter and no external anomalies were noted.

**STARTER
ADAPTER**

Condition:

The starter adapter remained attached to the backside of the engine and its drive pulley was fractured.

**ALT/GEN #1**

Manufacturer: Not Recorded

P/N: Not Recorded

S/N: Not Recorded

Condition:

The alternator remained attached to the backside of the engine and no pre-accident anomalies were noted with the unit.

ENGINE FIELD INSPECTION REPORT**FILE NUMBER:**

16-180

ENGINE S/N:

454385

PAGE 34 of 34**VACUUM
PUMP**Manufacturer: Aircraft
Accessories

P/N: Not Legible

S/N: Not Legible

Condition:

The vacuum pump remained attached to the mounting pad, but the pad was fractured. The drive gear remained attached to the vacuum pump with no anomalies noted with the gear or gear teeth. Manual manipulation of the drive gear did not result in rotation of the drive shaft. The pump was not disassembled.

