

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23FA113

ENGINE INFORMATION AND EXAMINATION SUMMARY

January 15, 2025

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A. ACCIDENT

Location: North Castle, New York
Date: January 19, 2023
Time: 1729 EST
2229 coordinated universal time (UTC)
Airplane: N19MT, Beech A36

B. ENGINE INFORMATION AND EXAMINATION SUMMARY

IIC	Timothy W. Monville NTSB-OAS/ERA Washington, DC
Member	Casey Love Textron Aviation Wichita, Kansas
Member	Phillip Grice Continental Aerospace Technologies, Inc. (CAT) Mobile, Alabama

C. SUMMARY

On January 19, 2023, about 1729 EST, a Beech A36, N19MT, was substantially damaged when it was involved in an accident near North Castle, New York. The private pilot and one passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the sole stockholder of the airplane (stockholder), the pilot and passenger had flown earlier that day from Cuyahoga County Airport (CGF), Cleveland, Ohio to John F Kennedy International Airport (JFK), New York, New York.

The purpose of the accident flight was to return to CGF.

After takeoff from JFK the pilot twice reported to Federal Aviation Administration (FAA) air traffic control that the airplane was experiencing poor climb performance. The controller advised the pilot that the flight could proceed to Westchester County Airport (HPN), White Plains, New York to have the issue checked out and he agreed. The flight was vectored to HPN for the instrument landing system (ILS) runway 16 approach which was in-use.

During a controlled descent, the airplane crashed on water supply land, owned by the City of New York and managed by the New York City Department of Environmental Protection.

Examination of the wreckage at the accident site revealed fresh oil on the bottom of the fuselage (Figures 1 and 2). The oil was predominantly on the left side of the lower fuselage and appeared to be coming from behind the left cowl flap area. Because of the final resting position of the fuselage the oil was draining down towards the ground. Oil was also noted on the inside diameter and outlet of the lower crankcase breather line (Figure 3).



Figure 1 View of the Bottom of the Fuselage. Note the Fresh Oil Clinging to the Bottom Fuselage Skin



Figure 2 View of the Bottom Portion of the Fuselage Near the Tailcone. Note the Fresh Oil Clinging to the Bottom Fuselage Skin



Figure 3 View of the Outlet of the Lower Crankcase Breather Line. Oil on Finger was from the Inner Surface Immediately Adjacent to the Opening. Note the Fresh Oil.

Examination of the engine at the accident site revealed it was separated and came to rest inverted. After rolling onto its right side a hole was noted in the engine crankcase above the No. 6 cylinder position (Figure 4). The connecting

rod cap with 2 entrapped fractured connecting rod bolts was found inside the engine below the hole opening. The cap was deformed.



**Figure 4: View Depicting the Engine After Rolling Out of its Impact Resting Spot
Note the hole in the Crankcase at the No. 6 Cylinder Position.**

Following recovery of the wreckage to Anglin Aircraft Recovery & Storage, the engine was shipped to CAT via FEDEX Freight, Tracking 7712 8866 5363 on February 13, 2023, and was received on February 15, 2023. It remained in Bonded Storage unopened until the examination scheduled for March 1, 2023 commencing at 1230 CST.

D. DETAILS OF THE INVESTIGATION

1.0. General Airframe Information

1.1 Engine Change Information

A review of the FAA Airworthiness file revealed that the airplane was modified in January 2011 by installation of a Continental IO-550B engine in accordance with Supplemental Type Certificate (STC) SA2200SW¹.

¹ The FAA Approved Pilot's Operating Handbook and FAA Approved Airplane Flight Manual Supplement specified there were no changes to the Engine Limitations, Emergency Procedures, and to the checklists in the Normal Procedures sections.

2.0. General Engine Information

2.1 Engine Description

The IO-550-B engine was a fuel injected, direct drive, air cooled, horizontally opposed, 6-cylinder, spark ignition, four-stroke engine. It was rated at 300 maximum continuous horsepower at 2,700 rpm.

2.2 Crankcase Ventilation System

The engine was equipped with a crankcase ventilation system consisting of a flexible hose that connected the breather assembly - oil filler to an upper section of an aluminum tube. The upper section of aluminum tube transitioned slightly down and aft. A flexible hose connected the upper aluminum tube to a lower aluminum tube that transitioned the left side of the engine firewall near the left cowl flap and extended into the slipstream below the fuselage. (Figures 5 and 6).

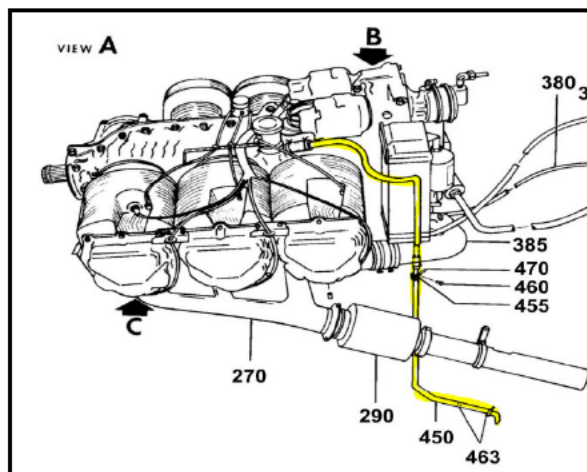


Figure 5 Highlighted Path of Crankcase Ventilation System Components



Figure 6 Left Side View of the Airplane From Internet Depicting the Crankcase Breather line Extending by Left Cowl Flap and Below the Fuselage Bottom

2.3 Approved Spark Plugs

Note 9 in Engine Type Certificate Data Sheet E3SO specified in part that Champion RHB32E, RHB32S, and RHB36S spark plugs were approved on this engine (Figure 7).

NOTE 9.	The following spark plugs and/or those listed in Section 6-4.9 of the latest revision of M-0, Standard Practice Maintenance Manual are approved on this engine:
AC	271, 273, 281, 281IR, 283, 283R, 291, 293
Auto Lite	PL350, URHB32E
Champion	RHB32E, RHB32S, RHB36S

Figure 7 Note 9 From Engine Type Certificate Data Sheet

2.4 Cylinder Head Temperature (CHT) Maximum Reading

Engine Type Certificate Data Sheet E350 specified that the maximum CHT reading from a cylinder head bayonet thermocouple was 460°F (Figure 8).

CYLINDER HEAD TEMPERATURE	
Operating Range	
(Green Arc)	200° to 460°F/93° to 238°C
Maximum Temperature	
(Red Radial)	460°F/238°C

Figure 8 Excerpt From POH/AFM Providing CHT Limitations

2.5 Oil Pressure Limitations

According to the engine limitations listed in Section II, Limitations, of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual (POH/AFM), the minimum oil pressure was specified to be 30 psi while the maximum oil pressure was specified to be 100 psi (Figure 9).

OPERATING LIMITATIONS	
Engine Speed	2700 rpm
Cylinder Head Temperature	460°F/238°C
Oil Temperature	240°F/116°C
Oil Pressure	
Minimum	30 psi
Maximum	100 psi
Fuel Pressure	
Minimum	1.5 psi
Maximum	17.5 psi
Mixture - Set per leaning instructions on performance charts.	

Figure 9 Engine Operating Limitations From POH/AFM

2.6 Oil Pressure Emergency Procedure from POH/AFM

A review of the POH/AFM revealed there was no specified procedure for a loss of oil pressure.

2.7 CHT Exceedance Emergency Procedure from POH/AFM

A review of the POH/AFM revealed there was no specified procedure for exceedance of the maximum specified CHT reading.

2.8 Propeller Overspeed Procedure from POH/AFM

A review of the POH/AFM for propeller overspeed procedures specified that the steps were to retard the throttle to rpm red line, reduce airspeed, and check oil pressure. A warning specified that if the loss of oil pressure was the cause of the overspeed, the engine will “seize after a short period of operation” (Figure 10).

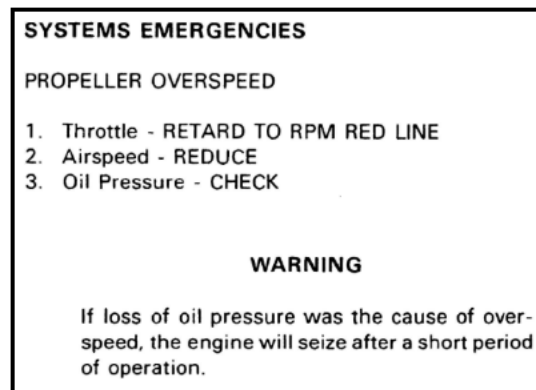


Figure 10 Excerpt From Emergency Procedures Section of POH/AFM

3.0. Engine Maintenance History

The Continental Aerospace Technology² IO-550-B (82B) engine, serial number 1037872 that was installed at the time of the accident was “rebuilt” by Continental Motors, Inc., in accordance with (IAW) approved design data and the applicable requirements of 14 Code of Federal Regulations Part 21 and 43 of the Federal Aviation Administration regulations. The engine was tested on September 13, 2019 (Figure 11).

² Formerly Continental Motors, Inc.
ENGINE INFORMATION AND EXAMINATION SUMMARY

Following rebuild, the engine was installed into the accident airplane on November 22, 2019, at tachometer time of 835.34 (Figure 12).

Date	Total Time		Time Since Last Overhaul		Engine Service and Maintenance Record
	Hours	Min	Hours	Min	
11-23-2019					Record maintenance actions including engine part removal and installation and compliance with inspections, Airworthiness Directives, Recalled Airframes, Modifications and Service Bulletins Air Tolt Cincinnati, Ohio Lunken Airport 11/22/2019 removed engine model to 850 ab s/n281783-R on bonaze a-36 s/n a-788. Install engine model IO650B82Z s/n1037872 overhauled by continental motors. Service engine with 2 qt philips20w50 mineral oil. Annual signed off in airframe books

Between the installation date and the last entry associated with an oil change dated December 16, 2022, at recorded tachometer time of 1871.3, routine inspections and minor maintenance to the engine was performed.

There was no record that the engine was removed or any engine fuel system replacement or adjustment, and there was no record of cylinder replacement since the engine was installed after rebuild.

Closer review of the maintenance records revealed that since the engine was installed in the airplane, routine servicing of the spark plugs occurred until December 9, 2021, at which time 8 new RHB32E spark plugs were installed (Figure 13). The entry did not specify which plugs were replaced.

12-9-21			601.8	Comp. test was 068/80 0261/80 072/80 0714/80 073/80
Tach-1437.1				073/80. Mag. timing good. Installed 8 new
				RHB32E plugs. Replaced oil filter
				and oil with 11 qts. of Aeroshell
				W80. I certify that this engine
				has been inspected in accordance with
				an Annual inspection and was determined
				to be in an airworthy condition. [REDACTED] AIP [REDACTED] IA

Figure 13 December 9, 2021 Entry

A subsequent entry dated January 18, 2022, at tachometer time of 1,462.5 indicated that the top and bottom spark plugs of the No. 4 cylinder were removed and replaced with new plugs. The entry also specified that the No. 4 cylinder fuel injector nozzle was removed, cleaned, checked, reinstalled and torqued (Figure 14).

1/18/2022	627.2	627.2	Remove and replaced top and bottom spark
Tach-1462.5			plugs on #4 cyl. with new spark plugs - RHB
			RHB-32E. Remove, cleaned, checked and reinstalled.
			torqued #4 cyl. fuel nozzle. [REDACTED] AIP [REDACTED] IA

Figure 14 No. 4 Spark Plug Replacement Entry

Entries dated April 21, 2022, (Figure 15) and November 9, 2022 (Figure 16), each specified that 2 new spark plugs were installed. The April entry specified the plugs to be RHB32E, but neither entry specified which position the new plugs were installed.

Carried forward				Special Inspections, Maintenance and Service
4-21-22				Comp. test was 071/80 072/80 0714/80 073/80
Tach-1562.54/727.24	727.24			073/80. Mag. timing good. Serviced
				spark plugs and installed 2 new
				RHB32E. Replaced oil filter and oil
				with 11 qts. of Aeroshell W80. I certify
				that this engine has been inspected
				in accordance with an Annual inspection
				and was determined to be in an
				airworthy condition. [REDACTED] AIP [REDACTED] IA

Figure 15 April 21, 2022 Entry

11-9-22				Comp. test was 071/80 072/80 0714/80 073/80
Tach-1889.6				073/80. Retuned left mag. Serviced spark
				plugs and installed 2 new. Cleaned
				left side fuel injectors. I certify
				that this engine has been inspected
				in accordance with an Annual inspection
				and was determined to be in an
				airworthy condition. [REDACTED] AIP [REDACTED] IA

Figure 16 November 9, 2022 Entry

At the time of the accident, the tachometer was reading 1889.21 hours. Thus, the engine had accrued 1,053.87 hours since being rebuilt and about 427 hours since the No. 4 cylinder top and bottom spark plugs were specified as being replaced and the No. 4 fuel injector nozzle was removed, cleaned, then reinstalled and torqued.

4.0. Previous Flight Experience From Airplane Stockholder

The stockholder of the airplane reported flying it for 12.8 hours during the previous two days before the accident. He reported he normally operated the airplane at 23 inches of manifold pressure and 2,400 rpm. He leaned the fuel to air ratio to about 25° rich of peak, but he was not sure how the accident pilot flew the airplane with respect to his leaning procedures. He reported no engine related issues during his flights. Earlier on the accident date before the flight departed from CGF he added one or one and a half quarts of oil to the engine which brought the total capacity to 10.5 quarts, just shy of the 12 quarts full capacity³.

5.0. Detailed Engine Examination Information

5.1 Initial Engine Observations

On March 1, 2023, at 1230 CST, the examination of the engine began. As first viewed the engine shipping crate was closed and not disturbed. Following removal of the crate cover, the previously reported hole above the No. 6 cylinder was visible (Figure 17). White torque putty consistent with manufacturing processes was noted at each cylinder stud/nut or thru bolt/nut. After removal from the crate the engine was raised for photographs (Figure 18).



Figure 17 View of Hole in Crankcase



**Figure 18 View Taken Below Engine
At Start of Examination**

Because the crankshaft flange was impact separated, magneto to engine timing, crankshaft end play, crankshaft run-out, crankshaft deflection, and cold cylinder differential compression checks could not be performed. The crankshaft flange was marked with serial number "N19FA092", which matched the engine build records.

³ Refer to NTSB Record of Conversation contained in the NTSB public docket for the investigation.
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The partially impact separated left magneto, right magneto, ignition harness, fuel manifold valve with attached Insight Fuel Flow Transducer, fuel injector lines and nozzles, governor, impact damaged oil cooler, oil pump, and oil sump were removed to facilitate complete engine disassembly.

5.2 Crankcase Mechanical Damage

Further inspection of the engine crankcase halves revealed a slight extrusion on top of the crankcase above the No. 2 cylinder (Figure 19). Examination of the crankcase following removal of the oil sump revealed the crankcase near the backbone was cracked in-line with the Nos. 3 and 4 cylinders (Figure 20), and an outward displacement of the crankcase was noted near the No. 2 cylinder (Figure 21).



Figure 19 View of the Damage to the Crankcase Above the No. 2 Cylinder



Figure 20 View of the Crack in the Crankcase In-Line with the Nos. 3 and 4 Cylinders

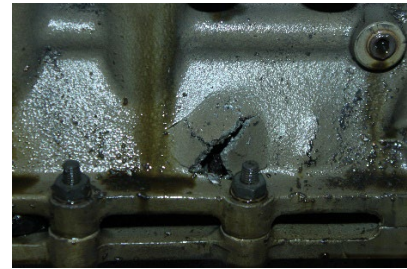


Figure 21 Outward Damage to Crankcase near the No. 2 Cylinder

5.3 Internal Engine Contamination

Following removal of the alternator, extensive particles were noted in the opening (Figure 22).



Figure 22 View of the Contamination Inside the Alternator

Following removal of the propeller constant speed governor, the screen was noted to have non-ferrous particles (Figure 23).



Figure 23 View of the Contamination on the Screen of the Propeller Governor

Following removal of the oil sump, ferrous and non-ferrous material was noted including 2 fractured connecting rod bolts without nuts attached (Figure 24).



Figure 24 View of the Ferrous and Non-ferrous Material Found in the Oil Sump

5.4 Air Induction System

Inspection of the air induction for the Nos. 1, 3, and 5 cylinders revealed it was installed properly, and all flexible ducts were in place and tightly clamped. Impact damage was noted to the No 5 cylinder induction tube at the cylinder attach location. The balance tube remained connected at both sides but exhibited an impact scratch on the right side. Inspection of the air induction for the Nos. 2, 4, and 6 cylinders revealed it was also installed properly, and all flexible ducts were in place and tightly clamped (Figure 25). The intake hose between the Nos. 2 and 4 cylinders exhibited an area of abrasion in the area where the aft clamp was located. There were no stains on the flange of the intake elbow tube for the No. 4 cylinder (Figure 26).



Figure 25 View of the Air Induction and Exhaust Systems of the Nos. 2, 4, and 6 Cylinders



Figure 26 View of the Flange of the No. 4 Cylinder Intake Elbow Note the lack of Discoloration

5.5 Exhaust System

Inspection of the exhaust of the Nos. 2, 4, and 6 cylinders revealed the EGT probe for the No. 4 cylinder was fractured but the clamp remained in place (Figure 27).



Figure 27 No. 4 Exhaust Gas Temperature Probe Mount Location with Installed Clamp and Remainder of Fractured probe

5.6 Lubrication System

Inspection of the oil sump revealed it contained about 4 to 6 ounces of oil (Figure 28).

Inspection of the oil pump revealed slight scoring of the oil pump housing (Figure 29). The oil pump drive and driven gears exhibited slight non-ferrous specs. Following removal of the oil pressure relief valve, non-ferrous debris was noted on the plunger. There was no failure or malfunction of the oil pump assembly, or oil pressure relief valve.

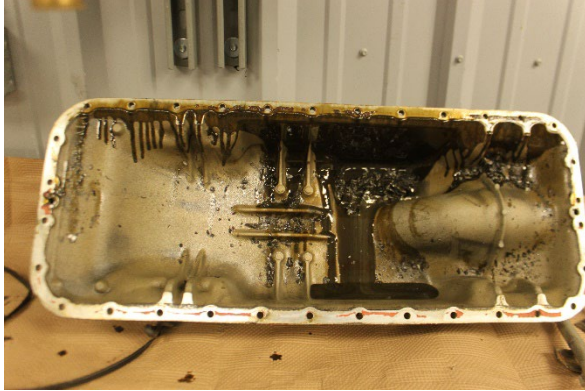


Figure 28 View of the Oil in the Oil Sump

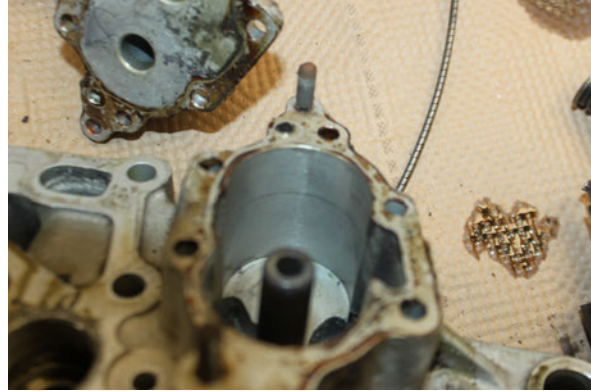


Figure 29 View of the Scoring Inside the Oil Pump Housing

The oil filter was cut open and contained non-ferrous material (Figure 30).



Figure 30 View of the Non-Ferrous Material in the Oil Filter Element

5.7 Ignition System

The left magneto, S6RN-1225, serial number F19HA182R was partially attached by one clamp, a section of magneto flange was fractured and remained secured under the lower hold down clip (Figure 31). The right magneto, S6RN-1225, serial number F19HA143R was tightly secured.

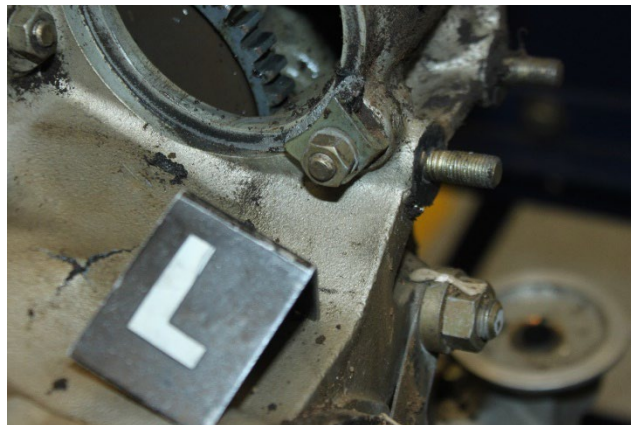


Figure 31 View of the Fractured Section of Left Magneto Flange Beneath the Lower Hold Down Clamp.

Both magnetos were placed on a test bench with a slave ignition harness installed and all leads of both magnetos produced a bright blue spark that jumped a 7mm gap when operated at 2,500 rpm. The impulse couplings of both magnetos dropped out at about 300 rpm which was correct.

The upper and lower Champion RHB32E spark plugs from the No. 4 cylinder both exhibited re-solidified material (Figure 32). The condition of the center electrode of the Nos. 4B and 4T plugs could not be reliably determined. Inspection of the remaining plugs revealed all but Nos. 1B, 2B, and 5T center electrodes were football shaped and all plugs exhibited a slightly dark color (Figure 33). The No. 1B plug contained contaminant in the center well and the No. 3B plug was oil soaked.



Figure 32 View Focused on the No. 4 Cylinder Spark Plugs



Figure 33 View of All Spark Plugs

Inspection of the No. 4 cylinder top ignition lead revealed no visible damage to the external insulation. High tension testing of the lead was performed, and it passed the testing. Inspection of the No. 4 cylinder bottom ignition lead revealed chafing of the external insulation about 12 inches from the plug end in the area of engine baffling. The chafing was to the shielding (Figure 34), but it was not damaged. Additionally, very slight chafing was noted on the external insulation about 4 inches from the cap (Figure 35), but the chafing did not extend through the external insulation. Thus, the shielding was not damaged. The lead passed high tension testing.



Figure 34 View of the Slight Chafing of the External Insulation of the 4B Ignition Lead.



Figure 35 View of the Slight Chafing of the External Insulation of the 4B Ignition Lead.

5.8 Engine Fuel System Components

Air passage through the fuel flow transducer produced rotation of the wheel with no obstructions or issues noted.

Following removal of the engine baffling, the No. 5 cylinder fuel injector nozzle was found broken in 2 pieces with the upper section secured to the fuel injector line, and the lower portion separated from the cylinder but found near the normal installation location. The lower part of the fuel injector nozzle was clear of obstructions.

The engine-driven fuel pump was removed from the engine and the drive coupling was intact with no evidence of rounded corners. Following removal and replacement of the impact damaged inlet and vapor return fittings, exemplar fittings were installed for operational testing to production standards with no adjustment. During multiple operational tests internal contamination in the vapor ejector, fixed orifice, and pressure regulator section (Figure 36) affected the test results. The internal contamination was removed from all areas and the pump was again bench tested. As part of the testing, five test points were conducted recorded as Attachment 1. Three of the test points were conducted at 600 pump rpm (repeatability), and the remaining two were performed at 2,700 rpm (also repeatability). At 2,700 rpm the pump was set by the operator to flow between 220.0 and 222.0 pounds-per-hour (PPH). At that rpm and flow during the first and second tests, the unit discharge pressure was 3.67 psi greater than the upper limit and 0.66 psi greater than the upper limit, respectively.

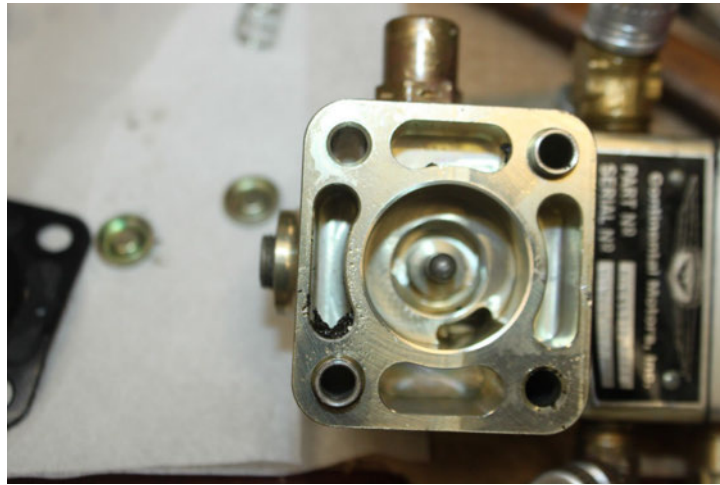


Figure 36 View of the Debris Inside the Pressure Section of the Engine-Driven Fuel Pump

Operational testing of the manifold valve with fuel injector lines and nozzles was performed to production standards. For testing, the impact damaged No. 5 fuel injector nozzle was replaced with an exemplar unit. The assembly passed all test points (Figure 37) and the pattern from all nozzles was good with no issues noted (Figure 38).



Figure 37 View of the Test Results of the Manifold Valve, Injector Lines and Injector Nozzles Operational Testing



Figure 38 View of the Spray Pattern of the Fuel Injector Nozzles During Operational Testing

Disassembly examination of the manifold valve following operational testing revealed the screen was clean (Figure 39) with only 1 very small spec of black colored material on the bottom side of the screen. The hole on the pilot

valve was clear and all injector line openings were free of obstructions. The valve was partially reassembled and not retained.

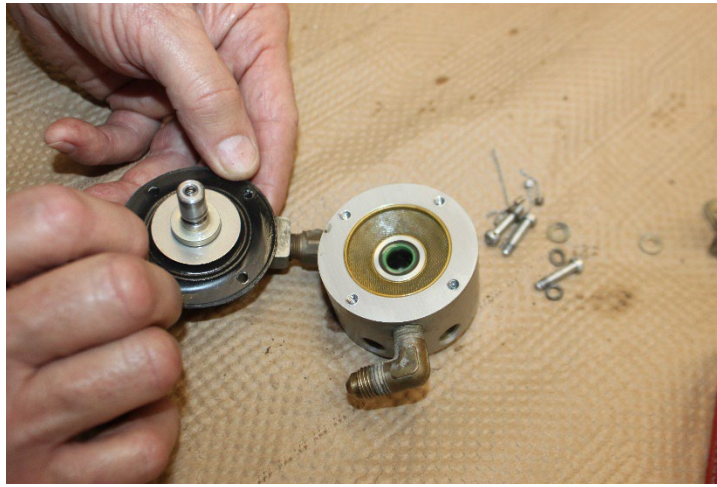


Figure 39 View of the Screen of the Manifold Valve.

Examination of the impact separated throttle body and metering valve⁴ revealed the throttle and mixture control levers remained attached. The throttle lever was tightly installed onto the shaft and was secured by a metal locking nut and a palnut. Movement of the stainless-steel throttle lever resulted in movement of the throttle shaft and valve. The throttle lever was removed for operational testing. Movement of the stainless-steel mixture control lever did not result in rotation of the mixture control shaft. Inspection of the mixture control lever revealed it was attached by 2 nuts and was not deformed when compared with an exemplar unit. Both nuts remained threaded onto the shaft. Removal of the metal locking nut by hand revealed it was semi-tight against the lever and exhibited normal tare torque during removal. Following removal of the mixture control lever, the top of the serrations on the shaft and the lever appeared damaged (Figures 40 and 41). The throttle linkage exhibited bending overload failure (Figure 42). The fuel inlet screen was clean. Further inspection of the throttle body and metering valve revealed the mixture return and outlet fittings were fractured. The fractured fittings were removed and replaced with exemplar fittings for operational testing.

⁴ By design the throttle body and metering valve is installed onto the engine with the mixture control lever on the left side. With separation of the engine the mixture control cable would pull the mixture control to idle-cutoff.



Figure 40 View of the Deformed Serrations of the Mixture Control Shaft



Figure 41 View of the Serrations of the Mixture Control Lever

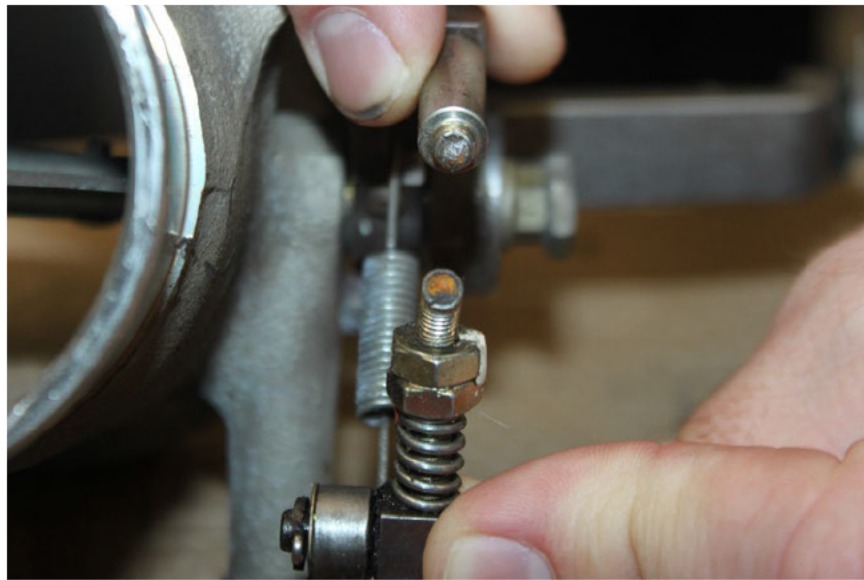


Figure 42 View of the Bending Overload Fractured Throttle Linkage

Operational testing of the throttle body and metering valve with the exemplar throttle linkage set to the accident length was performed to production standards. The unit passed three test points and failed four test points (Figure 43). The last test point which was at 73° angle of the throttle valve shaft, or full open revealed it flowed 1.02 pounds-per-hour (PPH) greater than the specified maximum limit. No adjustments were made to the accident unit, but the engine manufacturer representative reported that with adjustments the unit could be made to fall within limits at the out of tolerance test points.

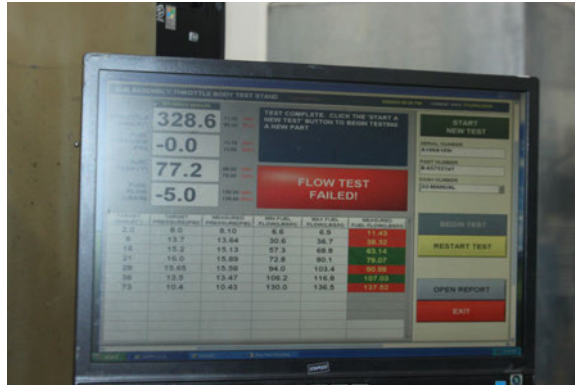


Figure 43 View of the Results of the Throttle Body and Metering Valve Operational Testing

5.9 PowerTrain Examination

Cylinder Nos. 1, 2, 3, 5, and 6 were removed from the crankcase by mechanical means. Additionally, the No. 5 cylinder skirt was cut to facilitate removal of the cylinder from the crankcase half. Following separation of each crankcase half, the crankshaft and camshafts were in position and were not fractured. Inspection of the Nos. 1, 2, 3, 4, and 5 main bearings revealed all slots in each bearing saddle and all bearing lock tangs were intact. Slight fretting was noted in the No. 4 main bearing saddle area. All main bearings of both crankcase halves exhibited early stages of lubrication distress.

The internal engine timing of the crankshaft and camshaft were correct.

Inspection of the crankshaft revealed all connecting rod journals exhibited extensive heat discoloration consistent with lubrication distress (Figure 44). The Nos. 1-, 2- and 3-cylinders connecting rod journals also exhibited extensive mechanical damage. Inspection of each oil galley of the crankshaft which supply oil to the connecting rod bearings revealed all passages were clear.

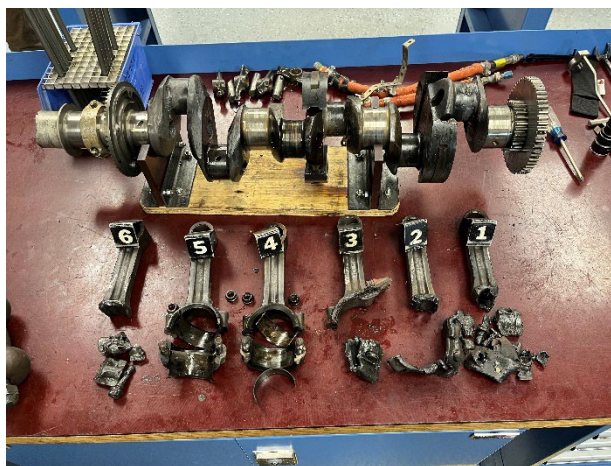


Figure 44 View of the Crankshaft and Connecting Rods, Rod Ends and Connecting Rod Bearings

Examination of the camshaft revealed all bearing saddles were satisfactory. The internal portion of the camshaft which is a path of oil from the oil pump to the main bearings then the connecting rod bearings was free of obstructions.

5.9.1 Connecting Rods and Bearings

No. 1 - Connecting rod fractured near the beam. The connecting rod cap was deformed.

No. 2 - Connecting rod fractured near the beam.

No. 3 - Connecting rod cap separated from connecting rod. Connecting rod deformed on one end about 100°. Connecting rod cap deformed and contained 2 fractured connecting rod bolts without nuts.

No. 4 - Connecting rod and connecting rod cap intact. Connecting Rod Bearing Extruded.

No. 5 - Connecting rod and connecting rod cap intact. Connecting Rod Bearing Heavily Extruded.

No. 6 - Connecting rod fractured near the beam.

5.9.2 Pistons and Cylinders

No. 1 - Cylinder skirt was damaged. Impact damage to bottom of piston. An imprint from one valve was noted on the piston dome.

No. 2 - Cylinder skirt damaged. Cylinder skirt damaged. Signs of early detonation on piston dome. An imprint from both valves was noted on the piston dome.

No. 3 - Cylinder skirt damaged. An imprint from both valves was noted on the piston dome.

No. 4 - Had resolidified aluminum material inside the cylinder head near both spark plug holes and on both valves. The Cylinder skirt was damaged. The bottom of the piston was damaged. The piston exhibited erosion circumferentially with a visible gap in the piston extending from the dome past both compression rings and the oil control ring (Figure 45). The intake gasket remained installed on the cylinder and there were no cuts or visible damage (Figure 46). The debris by both spark plug holes was removed and both spark

plug heli-coils were properly installed and did not extend into the cylinder (Figure 47).



Figure 45 View of the No. 4 Piston



Figure 46 View of the No. 4 Cylinder Intake Port



Figure 47 View of the Interior of the No. 4 Cylinder

No. 5 - The cylinder skirt exhibited some impact damage. A section of the skirt was cut to facilitate piston removal. The bottom of the piston exhibited some damage. The intake and exhaust valves were displaced from their normal position due to impact damage to the cylinder head.

No. 6 - The cylinder skirt exhibited some impact damage from the connecting rod and other items. An imprint from both valves was noted on the

piston dome. Some erosion was noted to the chamfered area of the piston. Impact marks were noted to the bottom of the piston.

6.0. PARTS RETENTION

At the completion of the engine examination, both magnetos, the throttle body and metering valve, removed mixture and throttle levers with attaching hardware, fractured throttle linkage, and spring were secured pending a review of the data and results but were later returned to the salvage facility with no further testing⁵. The Nos. 4T and 4B Champion RHB32E spark plugs were retained for examination at the manufacturer's facility with NTSB oversight⁶.

Submitted by:

Timothy W. Monville
Sr. Air Safety Investigator

⁵ Refer to NTSB Evidence Control Forms in the NTSB public docket for this investigation.

⁶ Refer to Engine History and No. 4 Cylinder Spark Plug Examination Summary, and also NTSB Evidence Control forms in the NTSB public docket for the investigation.