



NATIONAL TRANSPORTATION SAFETY BOARD

**Office of Aviation Safety
Western Pacific Region**

ENGINE EXAMINATION

**NTSB Accident: WPR18FA035
Accident Date: November 19, 2017**

Examination Date: December 5, 2017

This document contains 17 embedded images

A. ACCIDENT

Location: Tehachapi, California
Date: November 19, 2017
Aircraft: Cessna 152, N24987, Serial # 15280496
NTSB IIC: Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
Air Safety Investigator
National Transportation Safety Board
Western Pacific Region

Mark Platt
Air Safety Investigator
Lycoming Engines
Williamsport, Pennsylvania

C. ACCIDENT SUMMARY

On November 19, 2017, about 1756 Pacific standard time, a Cessna 152, N24987, was destroyed when it impacted terrain shortly after takeoff from Tehachapi Municipal Airport (TSP), Tehachapi, California. The private pilot received fatal injuries. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91. Night visual meteorological conditions prevailed.

All components were accounted for at the accident site. No evidence consistent with in-flight fire or in-flight structural failure was observed.

D. GENERAL

Model	Serial Number	Total Time
O-235-L2C	RL-15035-15	2872.6 Hours Since Unknown
Above engine Information taken from: ☒ Dataplate ☒ Maintenance Records ☐ Other		
Dataplate Attached/Found? ☒ Yes ☐ No Experimental Engine? ☐ Yes ☒ No		
Case Match # K004	Engine S/N on Case: RL-15035-15	Crankshaft S/N: unk

Maintenance Records Attached?	☒ Yes ☐ No	On-Scene Exam?	☐ Yes ☒ No
Post Recovery Exam?	☒ Yes ☐ No	Propeller Attached?	☐ Yes ☒ No
Engine Disturbed Prior to Your Arrival?	☒ Yes ☐ No	Engine Appear to be runnable?	☐ Yes ☒ No
Does Crankshaft Rotate?	☒ Yes ☐ No	Evidence of pre-impact fire?	☐ Yes ☒ No

Last Annual Inspection by:	Barnes Aviation, Lancaster, CA	Date: 04/01/2017
Last Overhaul by:	Undetermined	Date: Unknown

The powerplant is a four cylinder, air cooled, direct drive, horizontally opposed, normally aspirated (carburetor), internal combustion engine rated at 118hp @ 2,800rpm.

The engine remained attached to the airframe by the engine mount. The engine and attached mount structure had sustained significant impact deformation, which liberated the propeller, alternator, starter, exhaust system and right magneto. Visual examination of the engine revealed no evidence of pre-impact catastrophic mechanical malfunction or fire.

The engine was separated from the attached wreckage to facilitate further examination. The top spark plugs were removed, examined and photographed. The vacuum pump was removed, and the crankshaft was rotated by hand through the drive pad utilizing a drive tool. The crankshaft was free and easy to rotate in both directions. "Thumb" compression was observed in proper order on all four cylinders. The complete valve train was observed to operate in proper order, and appeared to be free of any pre-mishap mechanical malfunction. Normal "lift action" was observed at each rocker assembly. Clean, uncontaminated oil was observed at all four rockerbox areas. Mechanical continuity was established throughout the rotating group, valve train and accessory section during hand rotation of the crankshaft.

The bottom spark plugs were not removed. The combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers and bottom spark plug electrodes remained mechanically undamaged, and there was no evidence of foreign object ingestion or detonation. The valves were intact and undamaged. There was no evidence of valve to piston face contact observed. The gas path and combustion signatures observed at the spark plugs, combustion chambers and exhaust system components displayed coloration consistent with normal operation. There was no oil residue observed in the exhaust system gas path.

There was significant ductile bending of the exhaust system components.

No evidence of pre-mishap metal contamination was observed during the engine examination.



Figure 1 - Engine with Firewall and Other Components

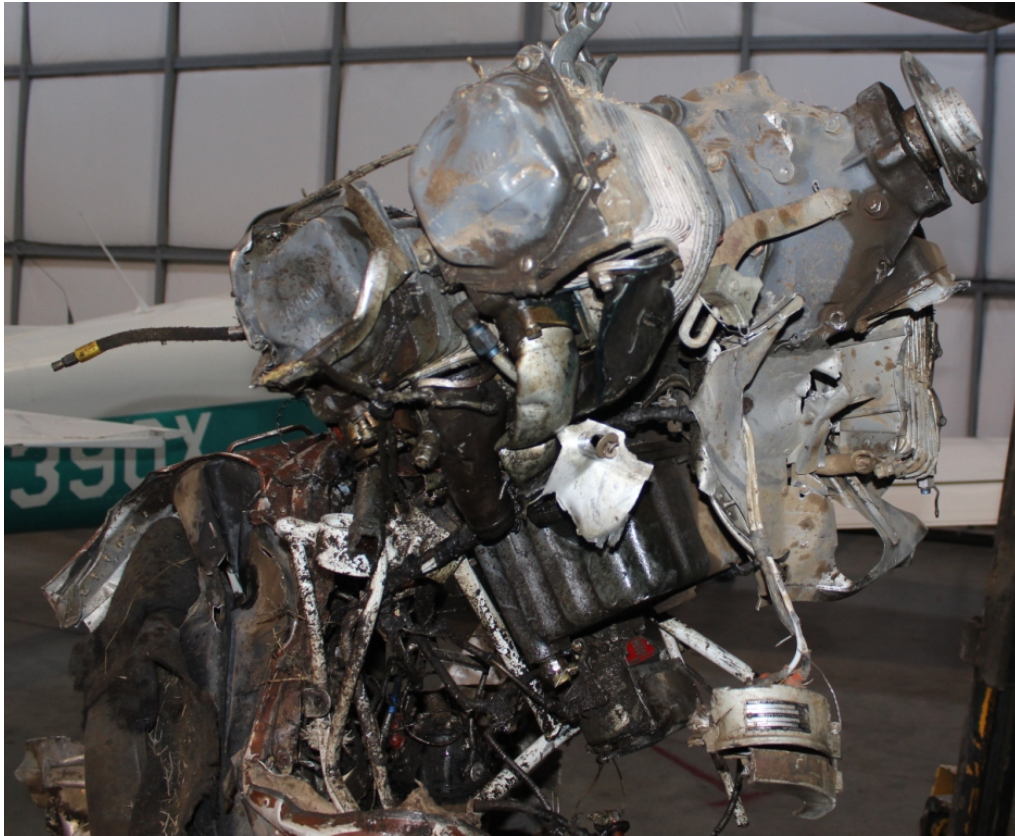


Figure 2 - Engine (Lower right)



Figure 3 - Engine Accessory Face

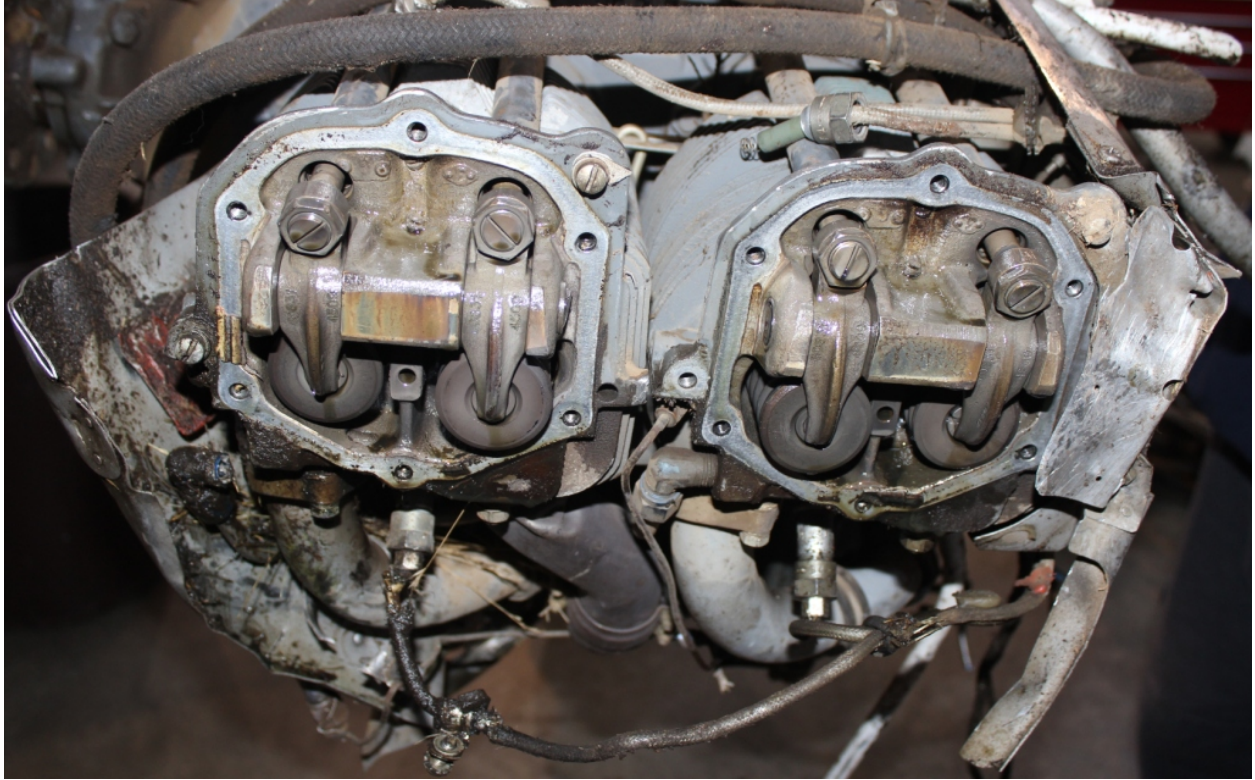


Figure 4 - Engine (Left side)

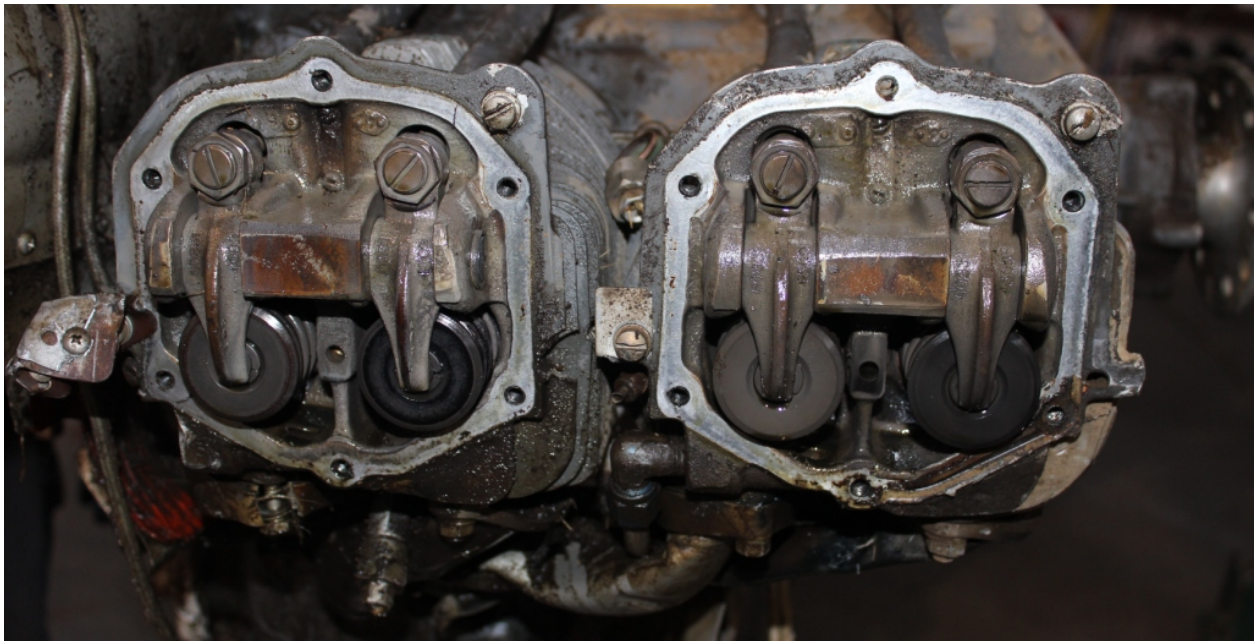


Figure 5 - Engine (Right side)

E. FUEL SYSTEM

Fuel System ☐ Injection ☒ Carburetor ☐ Electronic ☐ Destroyed				
Manufacturer: Avstar		Model: MA-3PA		Setting: 10-5267
Serial. No: 75025719		Floats: ☒ Metal ☐ Composite ☐ Plastic ☐ N/A		
Fuel Screens	Carburetor/Injector Inlet:	☐ Clean	☒ Contaminated	☐ Destroyed ☐ Unknown
	Aircraft Main Fuel Strainer:	☒ Clean	☐ Contaminated	☐ Destroyed ☐ Unknown
Control Positions				
Throttle: Unobtainable		Carburetor Heat: Unobtainable		
Mixture Control: Unobtainable		Alternate Air: N/A		

The carburetor remained undamaged and securely attached at the mounting flange. The engine compartment fuel line was found to be in place and secure at its respective “B” nuts; however, the fitting at the carburetor inlet had been fracture-separated. The fracture surface signatures were consistent with overload. The throttle control was found securely attached to the control arm of the carburetor. The mixture cable had been pulled from the end of its control arm. Reliable positions of the mixture and throttle settings at the time of impact could not be determined. The castellated nut and cotter pin remained secure and the serrated interface at the throttle arm remained securely mated.

The carburetor was opened for examination. The fuel bowl was free of visible contaminants. The float assembly remained secure at the mounting and free of damage. The metal float pontoons exhibited no evidence of rubbing against the wall of the bowl. The right float exhibited slight hydrodynamic crushing on each side. The left float appeared normal. No external fuel staining was observed on the carburetor. All internal locking tabs and safety devices of the carburetor were in place and properly secured.

The fuel inlet screen was found properly installed. The filter contained a material consistent with loosely-packed lint that constituted approximately 50% of the screen internal volume.

Additional examination of the gascolator screen and the forward and aft strainers at each wing tank found no visible contaminants.

The fuel system utilizes gravity fed fuel; there is no engine driven or airframe electric fuel pump.



Figure 6 - Carburetor on Engine



Figure 7 - Partly Disassembled Carburetor

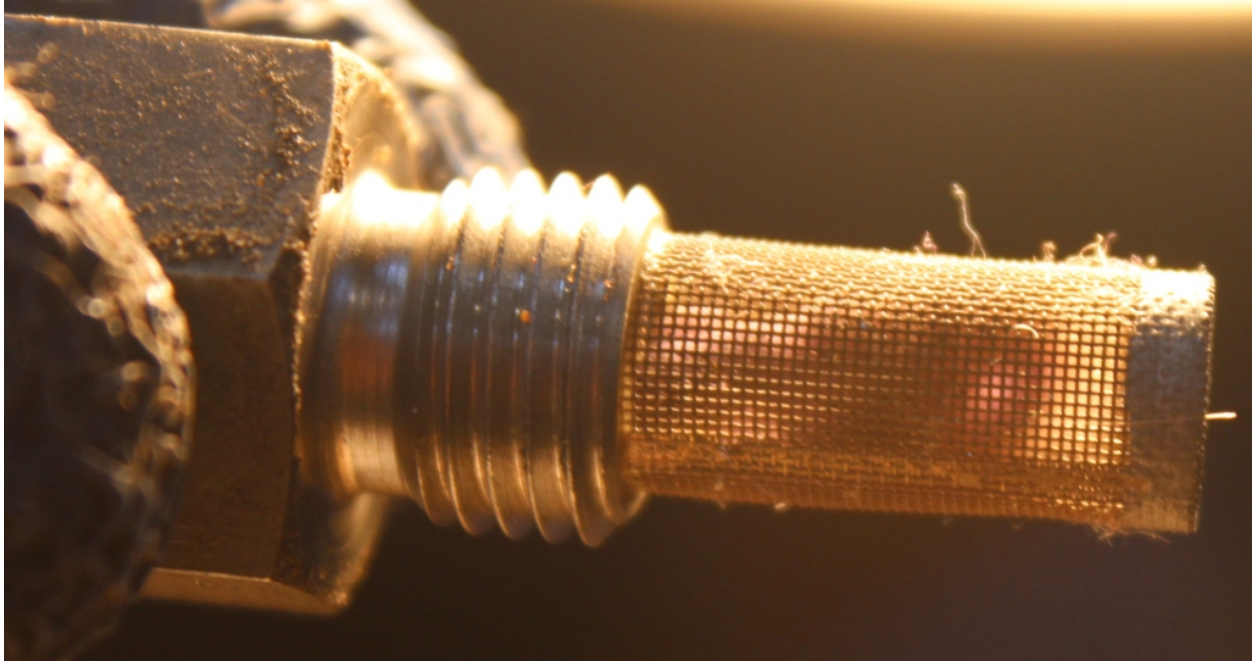


Figure 8 - Carburetor Fuel Inlet Screen

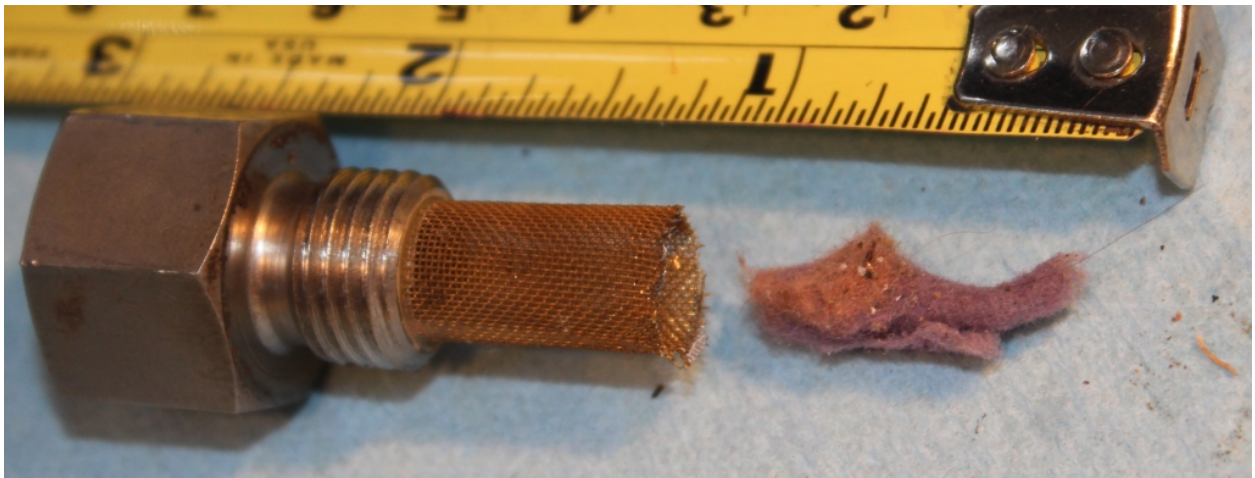


Figure 9 - Carburetor Inlet Screen & Debris

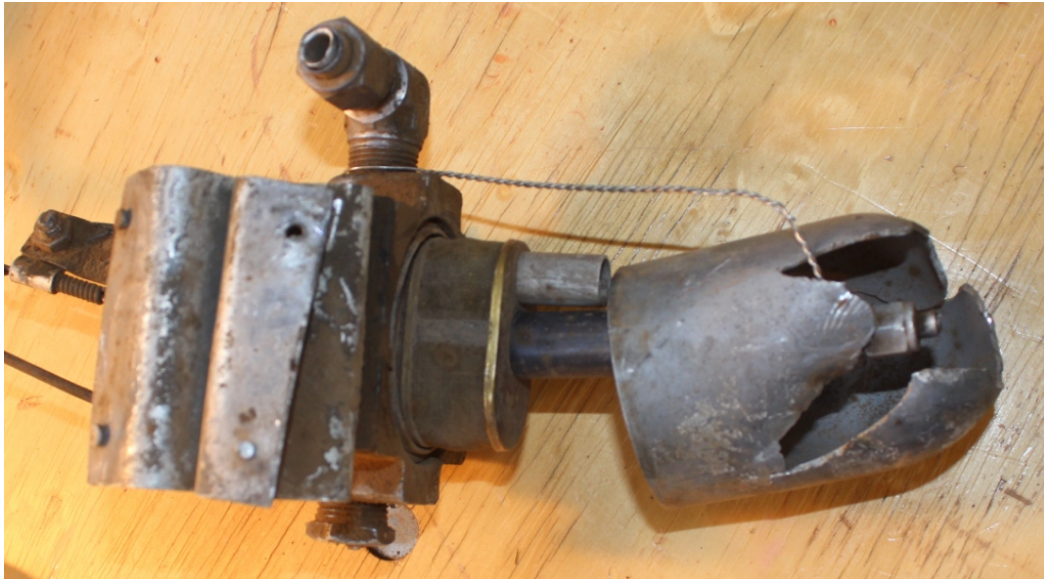


Figure 10 - Gascolator

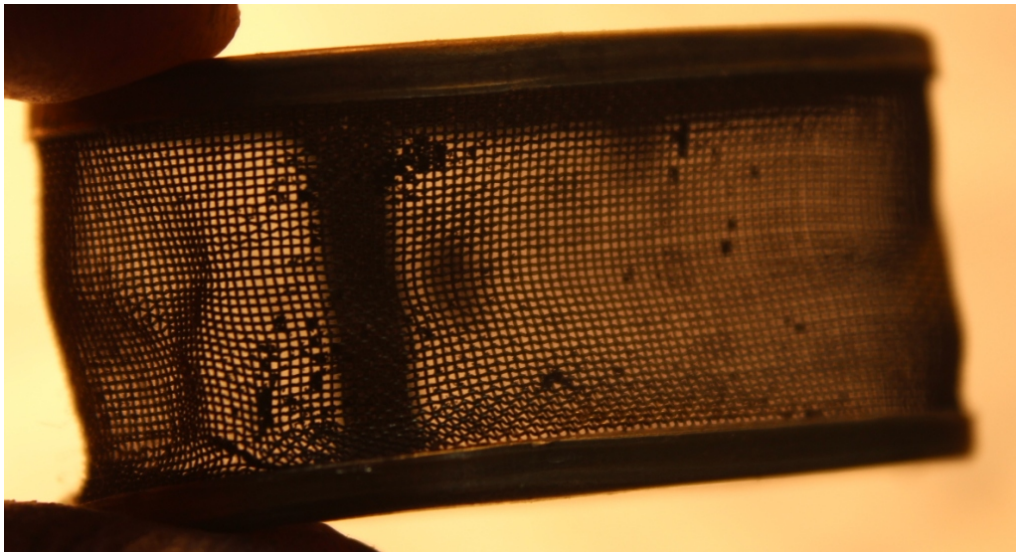


Figure 11 - Gascolator Screen with no Blockage

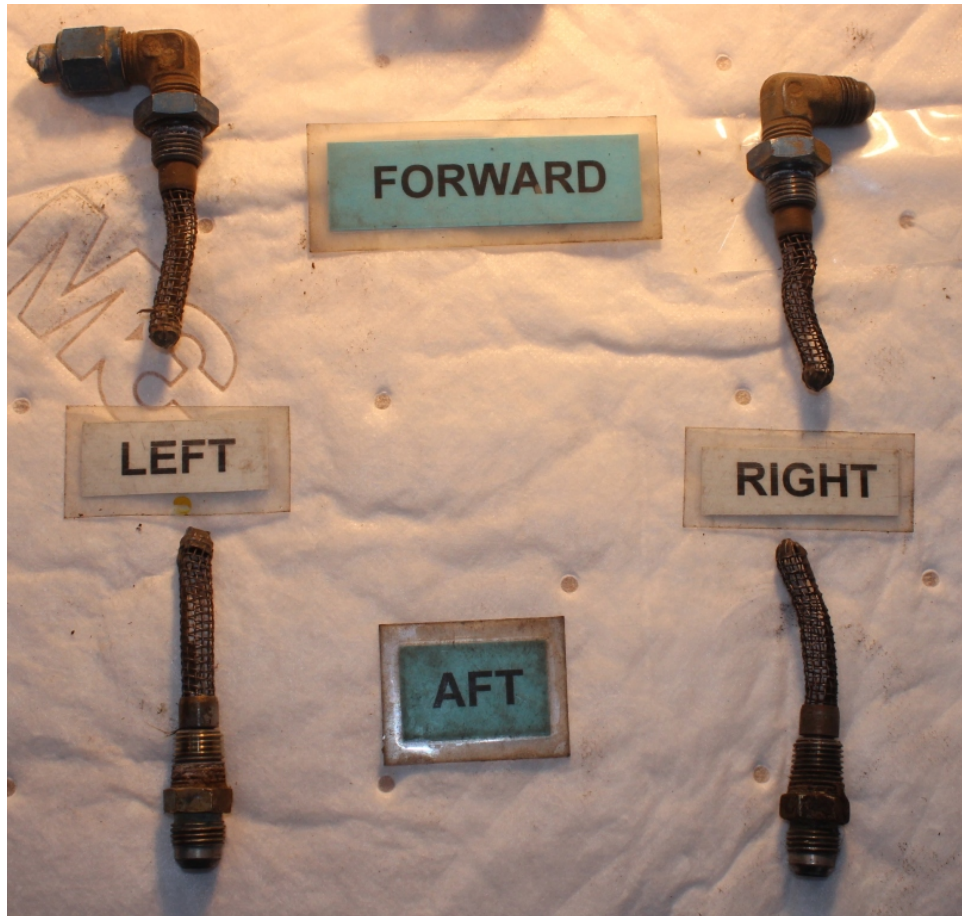


Figure 12 - Four Fuel Tank Finger Screens

F. IGNITION SYSTEM

1.0 Magnetos

☒ Left ☐ Dual Magneto ☐ Electronic ☐ Destroyed			
Manufacturer: Slick	Model: 4381	P/N:	S/N: 02101430
Impulse Coupling? ☒ Yes ☐ No	Functioning? ☒ Yes ☐ No ☐ Unknown		
Timing Checked? ☐ Yes ☒ No	Results:		
Drive Secure? ☒ Yes ☐ No ☐ Unknown	Sparks at all leads ☒ Yes ☐ No ☐ Unknown		
Damage: Minor			

Right Magneto ☐ Electronic ☐ Destroyed			
Manufacturer: Slick	Model: 4381	P/N:	S/N: 09120012
Impulse Coupling? ☒ Yes ☐ No	Functioning? ☒ Yes ☐ No ☐ Unknown		
Timing Checked? ☐ Yes ☒ No	Results:		
Drive Secure? ☒ Yes ☐ No ☐ Unknown	Sparks at all leads ☐ Yes ☒ No ☐ Unknown		
Damage: Impact damage, see narratives.			

The left magneto was found securely clamped to its engine mounting pad. Magneto to engine timing could not be ascertained, due to the destruction of the flywheel. The magneto was removed for examination. The magneto was observed to produce spark at all four plug leads during hand rotation of the drive. The impulse coupler drive was observed to be intact and properly safetied.

The right magneto had sustained impact damage, and was fracture-separated from its engine mounting pad. The fracture surface signatures at the magneto-mounting flange were consistent with overload. The pieces of magneto flange that remained at the mounting pad were securely clamped. Magneto to engine timing could not be ascertained. The right magneto would not produce spark when hand rotated at the drive. Investigation revealed that the right magneto had sustained impact damage that displaced the top cover, which repositioned internal components, rendering the magneto inoperative. The impulse coupler drive was observed to be intact and properly safetied.



Figure 13 - Magnetos

2.0 Spark Plugs & Ignition Leads

Manufacturer: Champion		Type: REM-37BY		SI 1042 Approved? ☒ Yes ☐ No	
Spark Plug Condition (per Champion Aviation Check-A-Plug Card AV-27)					
1 Top	Undamaged Electrode/Normal		1 Bottom	Undt	
2 Top	Undamaged Electrode/Oil Soaked		2 Bottom	Undt	
3 Top	Undamaged Electrode/Normal		3 Bottom	Undt	
4 Top	Undamaged Electrode/Oil Soaked		4 Bottom	Undt	

The spark plugs were secure at each position. The spark plugs (as noted) were removed, examined and photographed. The spark plug electrodes remained mechanically undamaged, and according to the Champion Spark Plugs "Check-A-Plug" chart AV-27, the spark plug electrodes displayed coloration consistent with normal operation. The static oil soaking of the spark plugs (as noted) was attributed to the engine orientation at the accident site and post recovery.

The ignition leads sustained severe impact damage; their pre-accident integrity could not be determined, and they were not tested.



Figure 14 - Top Spark Plugs

G. VACUUM PUMP

Vacuum Pump:

Manufacturer: Rapco	☐ Destroyed ☐ Unknown ☐ N/A
Part No: RAP215CC	Serial No.: A54594

The rear-mounted vacuum pump was secure at the mounting pad. The pump was removed, examined and photographed at the accident site by the Textron Aviation investigator. The drive was intact. The rotor/vane assembly was intact and undamaged. See "On-Scene" documentation.

H. PROPELLER

Manufacturer	Part Number	Serial Number
McCauley	1A103TCM6958	773961
Propeller Type: ☒ Metal ☐ Wood ☐ Composite ☐ Unknown		
Propeller Blade Serial Numbers:	Blade 1 N/A	Blade 2 N/A
	Blade 3 N/A	Blade 4 N/A

The single-piece, all-aluminum, two-bladed, fixed-pitch propeller was fracture-separated from the engine at the crankshaft flange. The fracture surfaces exhibited signatures consistent with overload due to rotation. The propeller blades displayed leading edge gouging, torsional twisting, chordwise striations across the cambered surfaces, and trailing edge “S” bending. The signatures were consistent with the rotational energy being applied to the crankshaft at the time of impact.



Figure 15 - Propeller



Figure 16 - Propeller