

National Transportation Safety Board

Office of Aviation Safety

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ENGINE EXAMINATION

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TABLE OF CONTENTS

A. ACCIDENT.....	3
B. ENGINE EXAMINATION.....	3
C. SUMMARY.....	3
D. DETAILS OF THE EXAMINATION.....	4
1.0 RIGHT ENGINE EXAMINATION.....	4
2.0 LEFT ENGINE EXAMINATION	9

A. ACCIDENT

Location: Aguadilla, Puerto Rico
Date: July 11, 2024
Time: 0923 Atlantic standard time
Airplane: N4167G, Cessna 402B

B. ENGINE EXAMINATION

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C. SUMMARY

On July 11, 2024, about 0923 Atlantic standard time, a Cessna 402B airplane, N4167G, was destroyed when was involved in an accident near the Rafael Hernandez Airport (BQN), Aguadilla, Puerto Rico. The private pilot was fatally injured, and a person on the ground sustained minor injuries. The airplane was operated by the pilot as a personal flight conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91.

The mechanic reported that following the fuel addition he estimated the left main fuel tank contained about 15 gallons and the right main fuel tank contained about 6-8 gallons but was "super low" in his visual estimation. The left auxiliary tank contained about 20 gallons, and the right auxiliary tank contained about 15 gallons. He reported that he did not observe the pilot sump the fuel tanks during the preflight inspection and the correct fuel measuring dip stick was not present with the airplane. He added that the pilot stated to him, he planned to use the main tanks for the takeoff and then would use the auxiliary tanks while enroute to San Juan.

The mechanic observed the pilot start the engines and complete a run-up, which he described as normal. He did not witness the airplane takeoff.

Both engines had separated from the airframe and were found a few feet forward of the wings. The engines exhibited impact damage and post-impact fire damage. The engine casings were free of large cracks and holes. The spark plugs

with each engine remained securely installed, in addition to the magnetos. Both propellers were equipped with a three-blade propeller configuration.

The left engine propeller blades displayed varying impact related signatures. Two blades exhibited little to no torsional twisting or bending. One blade exhibited aft bending near its tip and also had chordwise scratches near the blade root.

The right engine propeller blades exhibited varying degrees of chordwise scratching and blade polishing. One blade displayed aft bending, and one blade exhibited forward bending near its tip. The remaining blade exhibited little forward or aft bending.

The airplane's maintenance records revealed the airplane had not been signed off for a recent annual or 100-hr inspection. An annual inspection maintenance endorsement dated, April 24, 2024, denoted that the airplane was "UNAIRWORTHY." Attached to the endorsement was a "Squawk List" discrepancy sheet that had 3 pages of items to be corrected, which noted discrepancies with both engines and the airframe. According to the mechanic that wrote the list, the majority of the items had not been corrected. This mechanic advised the pilot that he needed to apply for a ferry permit from the FAA in order to complete the flight to SJU, which was not accomplished prior to the accident flight.

From November 2020 to April 2024 the maintenance records showed that the airplane had flown 1.4 hours. The most recent annual/ 100-hr inspection endorsement that found the airplane in an airworthy condition was dated June 6, 2019.

Both engines were sent to the manufacturer's facility for a teardown inspection.

The right engine rotated 720° when force was applied to the crankshaft flange. Cylinder compression and valve action movement were observed on all cylinders. Both magneto condensers were damaged by thermal forces and the magneto's produced blue spark when a replacement condenser was added. The fuel manifold was damaged by thermal forces and was opened for further investigation. Visible corrosion and remains of diaphragm material were present. Below the screen at the fuel inlet within the manifold was a large quantity of debris and foreign material that was likely present prior to the accident.

The left engine rotated 720° when force was applied to the crankshaft flange. Cylinder compression was observed on cylinders 2 through 6. Compression could not be obtained on cylinder 1 and the air applied leaked past the piston rings. Valve action movement was observed on all cylinders.

D. DETAILS OF THE EXAMINATION

1.0 Right Engine Examination

The right powerplant was a TSIO-520-E, serial number 183933-R, six-cylinder, air cooled, direct drive horizontally opposed, turbocharged, fuel injected engine with a rating of 300 HP at 2700 RPM.

The engine was mounted to a stand, and the accessories were removed. The engine rotated 720° when force was applied to the crankshaft flange. Cylinder compression and valve action movement were observed on all cylinders. All of the cylinders were removed from the engine for further examination. The tops of the pistons displaced normal combustion residue with no signatures of detonation. The cylinder walls on all cylinders were normal. No oil was present within the engine as a result of shipping and impact damage to the oil sump housing.

All the engine spark plugs were removed, and all electrodes displayed normal wear and coloration consistent with normal engine operation. Several of the spark plugs had significant lead and carbon deposits, but the deposits did not interfere with the spark plug electrodes. The engine ignition harness sustained moderate impact damage. The left magneto was damaged by thermal forces. The hold down nuts were secured to the accessory case. The magneto was placed on a test bench, but it did not produce spark. The points of the magneto opened and closed. The condenser displayed thermal damage signatures, and a replacement condenser was installed on the magneto. The unit was reinstalled on the test bench, and the magneto was then capable of producing bright blue spark at all points. The right magneto was damaged by thermal forces. The hold down nuts were secured to the accessory case. The magneto drive shaft was difficult to spin and was opened for further investigation. The points of the magneto did not open when the drive shaft was rotated as a result of the points being displaced. The condenser connector was loose and exhibited thermal damage. The points were adjusted and the condenser connection was adjusted, but the magneto did not produce spark when bench tested. A replacement condenser was installed and the magneto produced bright blue spark at all points when bench tested.

The fuel servo was not shipped with the engine. The engine driven fuel pump remained attached to the accessory case but was damaged by thermal forces. The fuel pump coupling was intact, and the drive rotated freely. The fuel manifold was damaged by thermal forces and was opened for further investigation. Visible corrosion and remains of diaphragm material were present. Below the screen at the fuel inlet within the manifold was a large quantity of debris and foreign material that was likely present prior to the accident. The fuel lines from the fuel manifold to the fuel nozzles were secured. The fuel nozzles were unobstructed.

The engine oil filter element was destroyed. There was minor debris found within the oil sump and the oil sump had impact damage. The oil pump was undamaged and there were no scoring signatures. The oil cooler was impact damaged but there were no visible leaks.

The engine air filter and air box were not returned with the engine. The cylinder induction pipes remained attached to their respective cylinder heads. Except for the number 1 cylinder intake pipe, the other remaining intake pipes remained attached but were discolored from thermal exposure. The number 1 cylinder intake pipe was partially separated from the cylinder head. The cylinder exhaust pipes remained attached to their respective cylinder heads and were discolored from thermal exposure.

The turbocharger would not rotate as a result of corrosion and damage from the postaccident fire. The exhaust bypass valve was not returned with the engine. The over boost valve remained secured to the mounting pad but was impact damaged.

The starter, alternator, and vacuum pump were not returned with the engine.

The propeller governor was broken at the mounting flange. It was removed for further examination. The drive would not rotate as a result of impact damage. The propeller governor oil gasket screen was unobstructed.



Figure 1: Overview of the Right Engine



Figure 2: Aft Section of the Right Engine



Figure 3: Damage to the Accessories as Removed



Figure 4: Damage to the Oil Sump Housing



Figure 5: Debris Found Within the Fuel Manifold



Figure 6: Bagged Debris Removed from the Fuel Manifold

2.0 Left Engine Examination

The left powerplant was a TSIO-520-E, serial number 510525, six-cylinder, air cooled, direct drive horizontally opposed, turbocharged, fuel injected engine with a rating of 300 HP at 2700 RPM.

The engine was mounted to a stand, and the accessories were removed. The engine rotated 720° when force was applied to the crankshaft flange. Cylinder compression was observed on cylinders 2 through 6. Compression could not be obtained on cylinder 1 and the air applied leaked past the piston rings. Valve action movement was observed on all cylinders. All of the cylinders were removed from the engine for further examination. The valve of the intakes and exhausts on all cylinders were normal. The tops of the pistons displaced normal combustion residue with no signatures of detonation. The cylinder walls on all cylinders were normal.

All the engine spark plugs were removed, and all electrodes displayed normal wear and coloration consistent with normal engine operation. Several of the spark plugs had significant lead and carbon deposits, but the deposits did not interfere with the spark plug electrodes. The engine ignition harness sustained moderate impact and thermal damage. The left magneto was secured to the accessory case and was undamaged. It was removed for testing, and it produced bright blue spark at

all points when bench tested. The right magneto was secured to the accessory case and was undamaged. It was removed for testing, and it produced bright blue spark at all points when bench tested.

The fuel servo was not shipped with the engine. The engine driven fuel pump remained attached to the accessory case but was damaged by thermal forces. The fuel pump coupling was intact, and the drive rotated freely. The fuel manifold was removed and disassembled. It contained minor organic debris and corrosion as a likely result of storage. The fuel lines from the fuel manifold to the fuel nozzles were secured. The fuel nozzles were unobstructed.

The engine oil filter element was destroyed by thermal forces. The oil sump was damaged by impact forces and there was no oil present. The oil pump was undamaged and there were no scoring signatures. The oil cooler was impact damaged but there were no visible leaks.

The engine air filter and air box were not returned with the engine. The cylinder induction pipes remained attached to their respective cylinder heads. The intake pipes remained attached to their respective cylinder heads but were discolored from thermal exposure. The cylinder exhaust pipes remained attached to their respective cylinder heads and were discolored from thermal exposure.

The turbocharger would not rotate as a result of corrosion and damage from the postaccident fire. The exhaust bypass valve was seized from thermal forces and was observed in the open position. The over boost valve remained secured to the mounting pad but was impact damaged.

The starter was not returned with the engine. The alternator remained installed to the front of the engine but was damaged by impact forces. The vacuum pump remained installed on the accessory case but would not rotate by hand as a likely result of thermal exposure.

The propeller governor was removed for further examination. The drive would not rotate by hand. The propeller governor oil gasket screen was unobstructed.

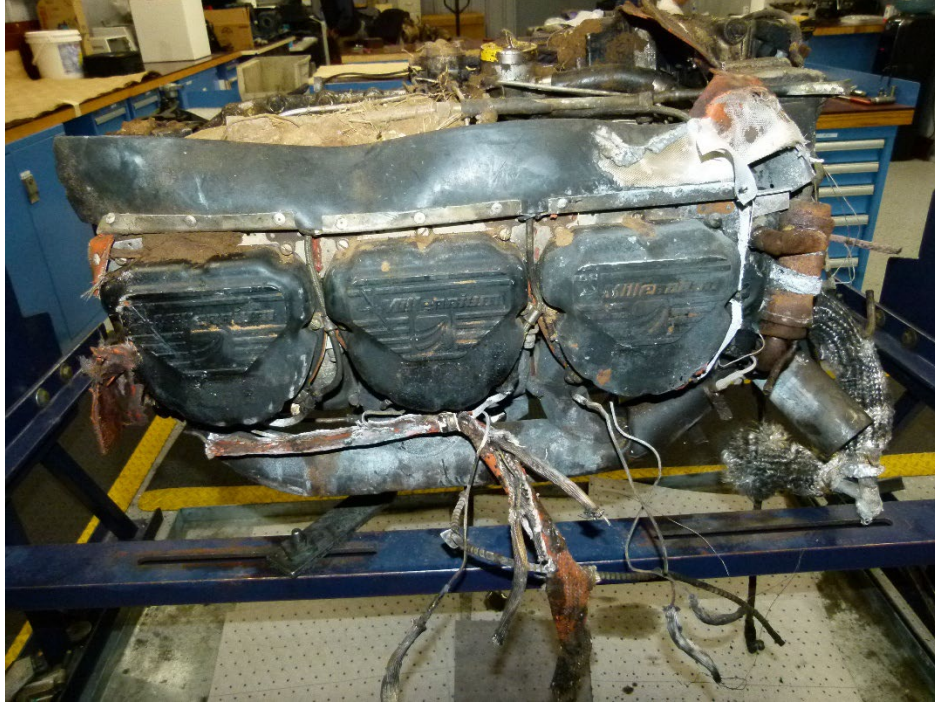


Figure 7: Left Engine Overview



Figure 8: Left Engine Overview



Figure 9: Aft Section of the Left Engine

Submitted by:

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