

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR24LA074

ENGINE EXAMINATION

Factual Report

February 13, 2024

A. ACCIDENT

Location: Auburn, Washington

Date: January 16, 2024

Airplane: Sonex N920MB

B. ENGINE EXAMINATION PARTICIPANTS

NTSB-IIC Paul Basti
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FAA Inspector Joseph Sullivan
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C. SUMMARY

Examination of the engine revealed moisture contamination on the air side of the regulator that supplies fuel to the throttle body injector. It is not known how the moisture penetrated the unit. Although there was evidence of a significant oil leak, the engine exhibited no evidence of oil starvation, seizure, or catastrophic failure.

D. DETAILS OF THE EXAMINATION

1.0 Engine Examination

At examination, the AeroConversions Aerovee engine was separated from its mounts and only attached to the airframe by hose and wiring.

The spinner remained attached to the propeller and had abrasion damage near the tip; both blades had broken away from the hub.

The engine, along with the left side of the airframe belly was coated in oil.

The oil drain plug was intact, with no evidence of leak. The right rocker valve cover was separated, and the cylinder head had partially cracked as a result of the impact. There were residual quantities of oil in the case, and photos of the accident site indicated significant oil pooling on the ground just below the engine.

The oil pump housing had sustained impact damage and contacted the forward section of the engine mount. No oil cooler had been installed, and a bypass line was installed in its place. The line had fractured on the right side of the oil pump housing (figure 1).

The engine was not configured with an oil filter, and the oil screen was removed, and was free of debris and coated in black-colored oil.

A spark plug from each cylinder was removed; the electrodes were intact and exhibited grey and black deposits on their surfaces. With the plugs removed, the engine crankshaft was rotated by hand at the propeller hub. The engine rotated smoothly, and all rockers moved with rotation of crankshaft, with exception of the no. 4 exhaust valve due to impact damage.

The oil pump cover was removed; the gears were clean but could not be rotated fully by hand. Rotation at the propeller flange did not result in movement of the oil pump. Disassembly revealed a clean shear of one of the gear input shafts. There was no evidence of smearing or rotational damage that would have indicated a failure in flight¹.

Cylinders 1 & 2 were removed and examined. Cylinder 3 & 4 were inspected by borescope, with no internal damage noted to any cylinders. The camshaft was intact, and its lifter surfaces were clean and free of gouges. There was no evidence of catastrophic internal failure or heat distress.

The induction and exhaust pipes were intact and connected. Removal of the accessory case plate, revealed that both magneto coils were intact. The ignition timing magnet was in place and undamaged.

The airplane was equipped with Rotec Throttle Body Injector (TBI) system.

The fuel tank and fuel outlet fittings were intact and undamaged. The fuel selector valve was in open position, and the fuel filter, along with the supply line from the tank to the fuel primer/regulator assembly was continuous and free of obstructions.

The primer control line was continuous from the primer arm on the throttle body diaphragm to cabin control. The mixture cable appeared to be continuous, with the arm broken away from the throttle body. The throttle body inlet filter was attached but crushed. The throttle body remained firmly attached to inlet manifold.

¹ It is likely that the gear drive shaft sheared during the early stages of the examination, when the engine was rotated at the crankshaft while the gear was impinged against the damaged oil pump case.

The fuel line fitting from the throttle body to the primer sustained damage consistent with impact and had rotated 180°.

The TBI incorporated a separate “on demand metering” fuel regulator, which included a fuel priming feature. The regulator uses air pressure tapped from within the throttle body bore for reference. A plastic line was used to connect throttle body reference nipple to the air side of the regulator’s diaphragm. Examination of the plastic line revealed that it had detached from the body, and was almost completely full of a liquid which when tested with water detecting paste, appeared to be water (figure 2, 3, 4). The regulator was disassembled, and the air side of the diaphragm was covered in water (figure 5).

The fuel inlet strainer was free of debris, and the air inlet filter was clear. A 1-inch-thick honeycomb spacer had been installed between the filter and the TBI air inlet (figure 6).

The airplane was not equipped with a carburetor heat system².

2.0 Examination Photos

² According to the ROTEC TBI installation manual, “A carburetor heat system is recommended when using the Rotec TBI fuel system. Although some customers choose not to install one to simplify their installation. Any carburetor or throttle body that restricts manifold pressure to control power output will by nature greatly reduce the local temperature at its throttle opening. Therefore the slide throttle can potentially be impeded from ice build up, if no carburetor heat system is present. Inclusion of a carburetor heat system is at the discretion of the user.”

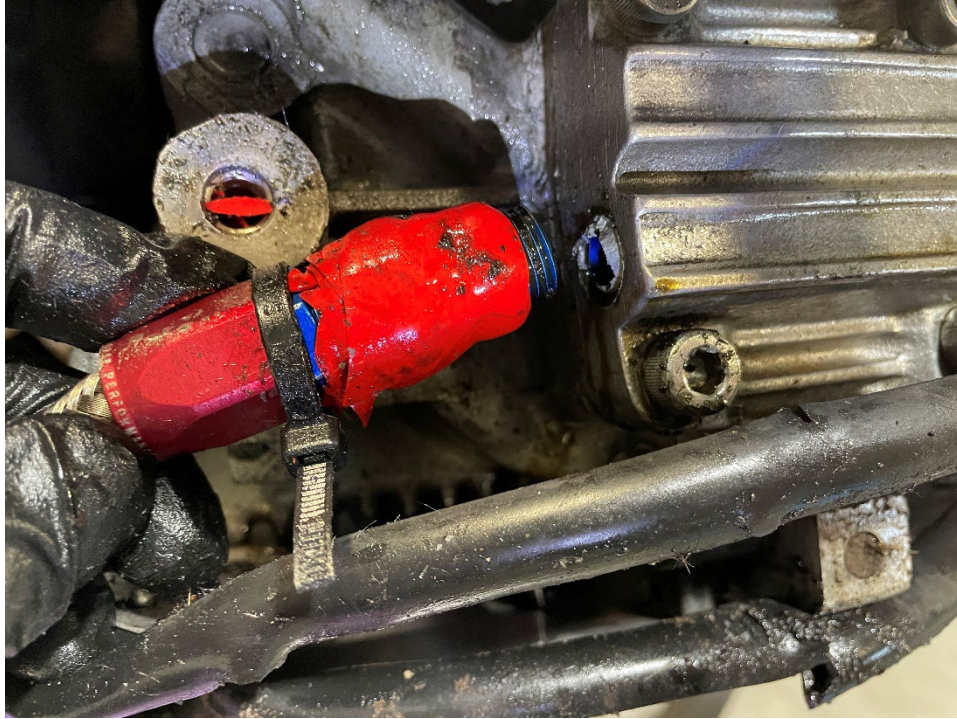


Figure 1 - Oil pump housing and broken cooler bypass fitting

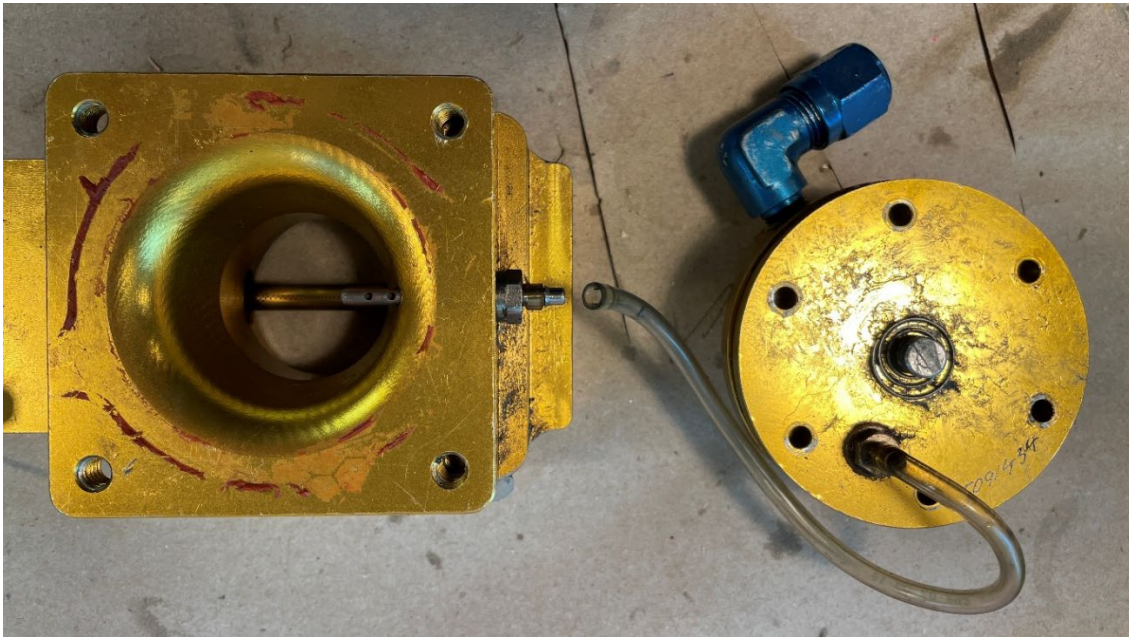


Figure 2 - TBI throttle body and regulator



Figure 3 - Throttle body-to-regulator line containing water



Figure 4 - Water in line (red indicates water)



Figure 5 - Water on air side of regulator diaphragm (red indicates water)



Figure 6 - Air filter and honeycomb spacer

Submitted by:

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Air Safety Investigator