

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



CEN23FA314

RIGHT ENGINE EXAMINATION SUMMARY

April 16, 2024

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A. ACCIDENT

Location: Kearney, Missouri
Date: July 20, 2023
Time: 0934 LCL
1434 UTC
Airplane: N200RA, Piper PA-31P, S/N 31P7400198

B. RIGHT ENGINE EXAMINATION SUMMARY

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C. SUMMARY

The examination was conducted with Lycoming and Hartzell at Dodson International in Rantoul, Kansas April 16, 2024. The examination consisted of both a visual and partial teardown inspection of the Lycoming TGIO-541-E1A engine along with the attached propeller. The examination revealed two blocked fuel injectors, corrosion along with rust and other debris in the manifold section and all fuel injectors, an oil filter installed in 2012, and no rotational signatures on the turbocharger compressor blades or housing.

D. DETAILS OF THE EXAMINATION

1.0 Engine Examination

The PA-31P was equipped with a 425 horsepower turbocharged geared Lycoming TIGO-541-E1A engine S/N RL-158-62. The engine was field overhauled on April 18, 1984. At the time of overhaul, the engine had 1141.8 hours since remanufacture. The engine had accumulated 959.2 hours since major overhaul as of June 28, 2023 which was documented in an Ferry Permit Airframe Logbook entry 22 days prior to the accident flight. The airplane had sat unused according to witnesses for a number of years. Maintenance entries show that the airplane cumulated 10.2 hours from July 18, 2007 to June 28, 2023.

The engine was located in an open-air pole barn from the accident date until a week prior to the engine exam at Dodson. The engine was observed to be undisturbed before the visual examination of the engine.

Visual examination of the engine prior to teardown showed post-impact fire damage to the entire engine with majority of the damage occurring along the accessory section. Numerous hoses and wiring had post-impact fire damage to both the fire sleeves and inner hoses or wiring. Both magnetos had post-impact fire damage with melting of the case and ignition harness. Various components along the bottom and rear of the engine had crush damage consistent with impact. The turbocharger was still attached with relatively little fire damage.



Figure 1. Engine prior to examination teardown

Oil dipstick was removed, and no oil level was observed. Oil filter was dated March 24 201X with a Hobbs of 1180.0 hours. An undated entry in the Right Engine Logbook #2 contains information regarding an oil filter change at 1179.9 hours before a subsequent entry on May 5, 2012. The filter was removed and examined with no metal observed in the media. The oil and filter media had a mostly black appearance with some clean oil. Additionally, oil was removed from the propeller governor and no debris was observed and the oil was dirty in appearance.



Figure 2. Oil Filter

Spark plugs were removed and observed to be all black, except the upper spark plug of Cylinder #3. The upper spark plug from Cylinder #3 had debris and lead fouling consistent with combustion deposits and rust.

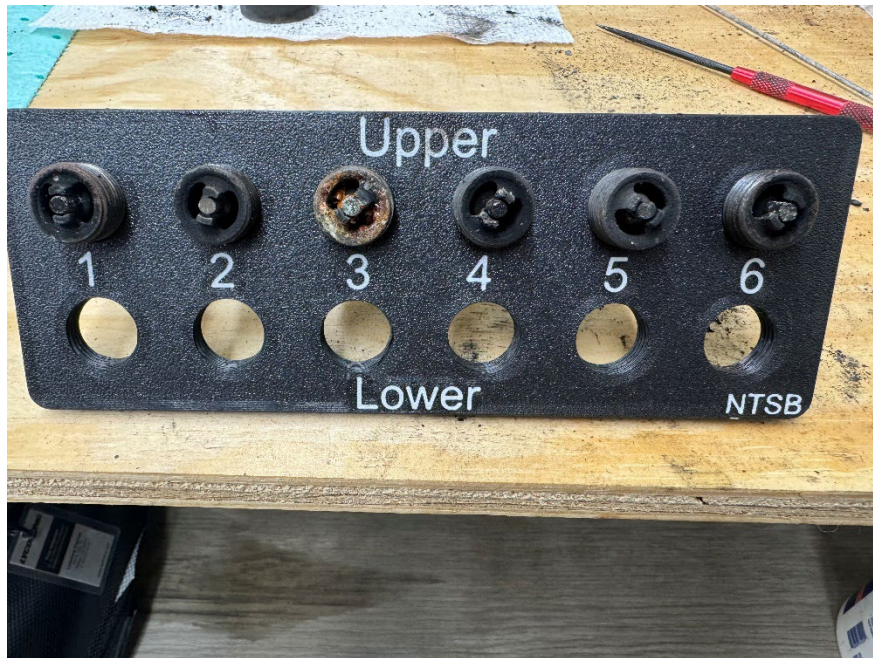


Figure 3. Spark Plugs

All six cylinders were borescope with no abnormality observed beyond rust on the cylinder walls and piston heads. Cylinder #3 contained the most observable rust on the cylinder walls and piston head.



Figure 4. Cylinder #3 rust along piston head and walls.

The left and right magnetos were removed and examined. No useful inspection or testing could be accomplished due to fire damage.

The intake tubes were removed and the fuel injectors inside the manifold housing were examined. The intake manifold housing contained foreign debris along the bottom of the housing. All the fuel injectors and manifold ports had extensive corrosion from the manifold housing.



Figure 5. Example of the corrosion in the #2 Fuel Injector port.

The fuel injectors were examined for blockages and general condition. All the fuel injectors had white powder from corrosion of the manifold housing and rust debris from an unknown source. The fuel injectors passage was examined by holding the injector to a flashlight. The #1 and #2 fuel injectors were clear, the #3 and #5 fuel injectors were partially blocked with debris, and the #4 and #6 fuel injectors were completely blocked with a semi-translucent foreign debris.

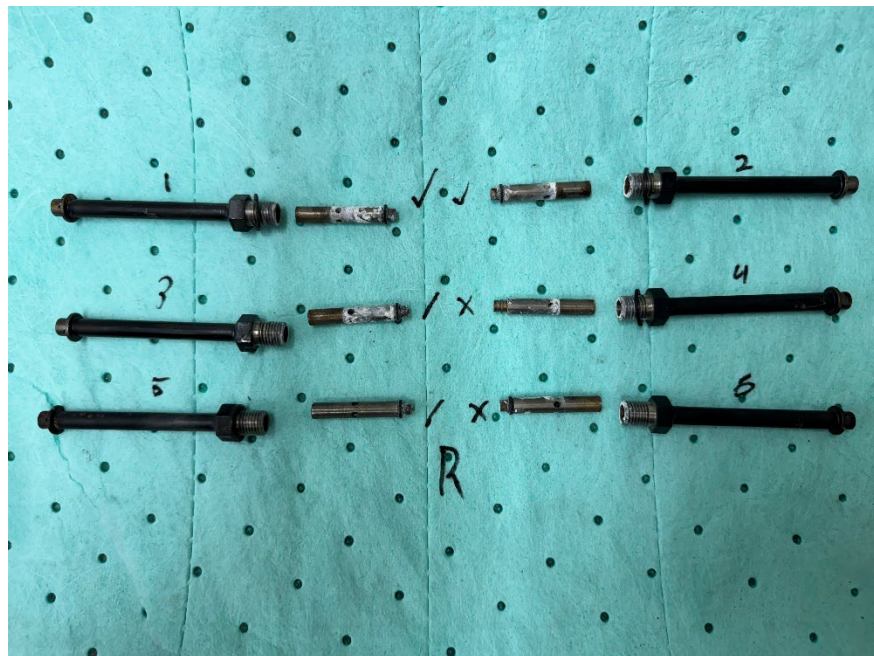


Figure 6. Fuel Injectors as removed from the manifold.

The engine was rotated by hand with the propeller and engine continuity to the accessory section was observed. Normal valve movement and thumb compression was observed on all cylinders.

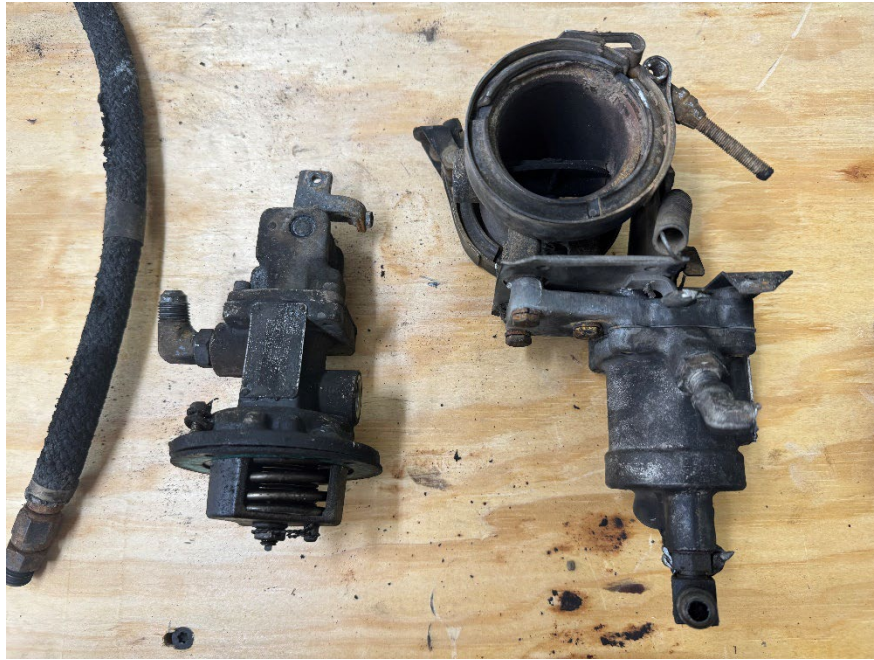


Figure 7. Turbocharger (Left) and Waste Gate (Right) Controller

The turbocharger, oil hoses, controller, waste gate, and waste gate controller were removed and teardown inspection was performed. Both controllers had sooting on the exterior surface from the post-impact fire. The waste gate was in the fully open position with no external damage to the linkage arm. The waste gate moved freely through the entire range when actuated by hand. The waste gate controller housing was removed, and the piston was found seized in the fully open position. Black tar and ash like debris were found within the housing between the piston and spring. The piston was successfully removed by turning the adjustment screw to the fully closed position. Black tar and cinder like debris were found between the piston head and oil inlet orifice. Both oil hoses contained black tar and ash like debris when gently tapped. Additionally, one hose debris contained metal shards from an unknown source.



Figure 8. Wastegate Controller Housing (Oil Inlet Side)

The turbocharger was visual inspected with numerous areas of rust present on the exterior surface. The turbocharger had continuity between the compressor and exhaust sections and rotated freely when turned by hand with a metallic grinding sound present. A teardown of the assembly was performed to inspect for rotational witness marks, the bearing and oil galleries. Rust was present on all internal components with no oil present. Additionally, no oil was present on the compressor side bearing or discoloration of the bearing. All oil galleries were clear of debris with no oil present. The compressor housing showed no rotational witness marks and the compressor had no burring or bending of the blades.



Figure 9. Internal side of the compressor housing.



Figure 10. Turbocharger bearing and bearing oil gallery.

2.0 Propeller Examination

The propeller was still attached to the gear reduction drivetrain with all three blades loose in hub. Each propeller blade could be rotated through its respective pitch range by hand. The propeller was disassembled and blades removed from the hub for inspection. All three blade pitch change knobs were fractured, and all three

blades contained cable strike gouges along the leading edge. Blade R1 was bent forward in the thrust direction. Blade R2 and R3 were bent aft and opposite rotation. The Low Pitch Stop had impact mark indicating the propeller was operating in the low pitch range and not feathered.



Figure 11. Low Pitch Stop

Submitted by:

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