



Memorandum For Record

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Examination of the wreckage and engine following recovery was performed by a technical advisor to the Accredited Representative of the airframe manufacturer, and a representative of the engine manufacturer with oversight from the Federal Aviation Administration (FAA). The examination was also attended Virtually by NTSB on January 19, 2021, beginning at 0900 EST.

The following factual observations were noted:

Examination of the airframe revealed the flap motor was in a flaps retracted position. The auxiliary fuel pump was heat damaged and the screen was melted/destroyed. The heat damaged fuel selector valve which was previously examined in the field and determined to be on the left tank position¹ was re-inspected and it was clear in "both positions." Metal shavings were noted in the filter element inside the valve.

Examination of the left fuel supply system revealed the line was damaged between the fuel tank and the selector valve. The left fuel vent line which was burnt exhibited internal contamination consistent with organic material, while the right fuel tank vent line from free of obstructions from the end of the vent tube at the bottom of the wing into the fuel tank. The right fuel supply system was continuous from the tank to the fuel selector valve. The fuel supply line was intact from the fuel selector valve to the auxiliary fuel boost pump, but the line was heat damaged between the auxiliary fuel boost pump and the engine-driven fuel pump.

Inspection of the burned cockpit and cabin area revealed no cellular phone was located. Further examination of the cockpit and cabin revealed the female portion of a lapbelt buckle was noted in the rear right side of the airplane. It was tested by hand pressure and did not open. Another female portion of buckle with attached male portion was found in the left rear portion of the cabin. Both buckles were retained for examination by the NTSB Materials Laboratory.

¹ Refer to Record of NTSB Conversations contained in the NTSB public docket for this investigation.

Examination of the Lycoming O-360-A1AD, serial number L-32804-36A, revealed the crankshaft was fractured aft of the crankshaft flange, or just forward of the crankcase nose. The crankshaft flange remained connected to the propeller flange. The engine exterior was discolored and sooty, consistent with exposure to the post-impact fire.

The crankshaft was rotated using a tool inserted in the vacuum pump drive pad. Continuity of the crankshaft to the rear gears and to the valve train was confirmed. Compression and suction were observed from all four cylinders. The engine-driven fuel pump actuator rod was observed to move normally up and down as the crankshaft was rotated. The interiors of the cylinders were observed using a lighted borescope and no anomalies noted.

The carburetor remained attached to the engine and exhibited exterior discoloration and soot consistent with exposure to the post-impact fire. When the carburetor was removed from the engine it was noted that the two right side attaching nuts were secure and required normal force to remove. The two left side nuts were finger loose. The mounting gasket exhibited gray coloration on the side where the nuts were secure and pink coloration on the side where the nuts were finger loose. No liquid drained from the carburetor when it was inverted. The throttle control cable remained attached to the carburetor throttle control arm. The arm was observed at the full throttle position. The cable was separated about 6 inches from the carburetor throttle control arm. The mixture control cable wire was separated from the mixture control arm but the securing hardware remained attached to the arm. The arm was observed in a midrange position. The mixture control cable sheath was uncoiled consistent with being pulled. The carburetor fuel inlet screen was unobstructed. The carburetor was not disassembled and was retained by the NTSB for further examination. The engine-driven fuel pump was impact fractured and the pumping section separated from the engine. The pump rubber diaphragm was fire destroyed but the internal valves were OK.

The air induction air box and air filter were crushed and fire damaged. The exhaust tubing and the muffler were impact damaged. Tan to light gray exhaust deposits were observed in the exhaust tubing. The exterior of the muffler was observed unobstructed.

Examination of the ignition system revealed the single-drive dual magneto revealed it remained securely attached to the engine and could not be rotated on its mounting pad by hand pressure. Since magneto to engine timing could not be determined, the magneto was removed and produced spark from all eight ignition towers when rotated by hand. The magneto was retained by the NTSB for further examination. The ignition harness was impact and fire damaged. The spark plug electrodes exhibited dark gray coloration. The electrodes of the No. 2 and No. 4 top and the No. 1 bottom spark plug were oily. The spark plugs were retained by the NTSB for further examination.

Examination of the lubrication system revealed an unquantified amount of oil was observed in the engine. The oil suction screen and the oil filter media were absent of debris.

The propeller governor remained attached to the engine and no damage was noted. The propeller governor control cable was separated about 6 inches from the governor control arm. The arm

remained attached to the governor and was observed in a full increase RPM position. The governor oil screen was absent of debris.

Following the engine examination, the carburetor, spark plugs, and magneto were retained for further examination.

A virtual examination of the MA-4-5 carburetor, serial number MSE56504 was performed at the manufacturer's facility with NTSB oversight. A visual inspection of the carburetor revealed the exterior was black consistent with exposure to the postcrash fire which precluded operational testing. Following removal of the throttle body, visual inspection of the heat damaged solid epoxy float revealed multiple fractures on the surface and through it; the float appeared to be deformed. The float clearance to bowl was checked using a cutaway fixture and no issues were noted to either float pontoon. Using a go-no-go gauge to measure the float height, the float was below the level of the go-no-go gauge on one side but above the same gauge on the opposite side of the float. The float was properly attached to the fulcrum pin and float bracket. No binding of the float was noted. The float was removed and the needle looked satisfactory. Inspection of the carburetor bowl revealed very slight amount of small black colored specs and material consistent with throttle body to bowl gasket material that occurred during disassembly. The mixture control sleeve and discharge nozzle were free of obstructions. No debris was noted inside the float valve. A one-piece venturi was installed and tightly installed. The accelerator pump leather was partially consumed by fire.

A virtual examination and testing of the Tempest spark plugs was performed at the manufacturer's facility with NTSB oversight. Visual inspection of all spark plugs revealed the terminal wells for all appeared good with no cracked insulators. All spark plugs resistance readings were within limits. All spark plugs were then subjected to electrical testing as first received, without cleaning or any other manipulation. The plugs were first tested with no air pressure and all passed. All spark plugs were then subjected to electrical testing at 80 psi and all plugs passed with a bright blue spark. The gaps of all spark plugs were then checked and all were within limits. Inspection of all plugs revealed the center electrode appeared normal. All plugs showed evidence of being rotated (proper and normal).

A virtual examination and operational testing of the magneto was performed at a FAA repair station with NTSB oversight. Following removal of the cap, the capacitor leads to each point tab were secured. The rubber of both capacitors was intact. The magneto was installed on the test bench with a test cap/harness installed and were set to jump a 7mm gap. The magneto was started at a low rpm and around 250 to 450 rpm the impulse coupling should skip (normal), then between 400 and 450 rpm, the impulse coupling should no longer be present. At a low speed, the 2R lead was not firing good. Because the test cap had a cutout to visually observe inside, arching was noted at the left points at 1,500 rpm, and "singing" was heard during magneto operation. The accident capacitors were checked, and both passed all tests consisting of the internal leakage, series resistance, and capacity. They were then placed in the test cap for operational testing and when operated at increasing rpm, fired strong at all gaps with no drop out at 1,000 magneto rpm. Some very intermittent arching at the right points (not deemed significant) was noted. The magneto was then placed in a hot box for heating the magneto to the estimated operational temperature and when the exterior registered 170.5°F, the magneto was placed on the

test bench with the test cap and accident capacitors installed. When the testing started the exterior temperature of the magneto registered 143.1°F. The magneto was operated to 2,000 rpm for about 5 minutes and no drop-outs was noted. A strong bright spark was noted at all leads. There was no arching at the either points. There was no indication of magneto failure. At the conclusion of the bench testing, the internal timing, or “E” gap was 4° late from nominal setting.

Further examination of the magneto revealed neither points were burned or exhibited pitting. The left and right point gaps were less than 0.010 inch which was less than the minimum specified, but the exact amount could not be determined because a tool was not available. During removal of the distributor block, one screw was tight, while the other screw for the left mag block only required 2 fingers on the tool to loosen. The loose screw was associated with the ground return path. The hardware to secure the distributor block was correct. There was no missing teeth of any gears of either magneto and normal bearing grease was noted. There was no evidence of arching in the distributor block where the leads attach. The left and right electrodes were tight, and no evidence of oil inside distributor block. Visual inspection of each distributor block revealed no evidence of carbon tracking. Both coil tabs were parallel (normal). The left and right primary coil readings and the right coil secondary resistance readings were within limits, while the left secondary coil resistance reading was 400 ohms greater than the maximum specified value. High tension testing of both coils revealed both passed with no evidence of cracks.