



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

February 16, 2022

AIRFRAME AND ENGINE EXAMINATION

WPR20LA212

This document contains 4 embedded photos.

(8 Pages)

A. ACCIDENT

Location: Lake Tahoe, California

Date: July 7, 2020

Aircraft: Cessna 172

NTSB IIC: Maja Smith

B. EXAMINATION PARTICIPANTS

Stephen Stein
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C. DETAILS OF THE INVESTIGATION

C.1 Airframe Examination

All four corners of the airplane were accounted for prior to the commencement of the exam. The fuselage displayed compression wrinkling, buckling, and the airframe skin was torn aft of the cabin. The right wing was intact while the left wing had separated into two pieces about midspan with a large concave shaped depression along the midspan leading edge. The tail, which was comprised of the horizontal stabilizer, elevators, rudder, and vertical stabilizer, were intact. The vertical stabilizer was bent several degrees left and a depression was observed on the leading edge.



Photograph 1: Cockpit and Fuselage

C.1.1 Flight Controls

Flight control continuity for the elevator, rudder, and trim wheel was confirmed from the Y bar, rudder pedals, and trim wheel, respectively, to their control surfaces at the tail. The control yokes had separated from the control column. The control cables for the elevator, right rudder, and elevator trim displayed separations near the aft fuselage, consistent with having been cut by recovery personnel. The left rudder control cable exhibited broomstrawing at the aft fuselage, consistent with overload separation.

Continuity of the aileron flight control system was traced from the Y bar pulleys at the cockpit to the control surfaces for each aileron through separations. The left main aileron control cable was separated just beyond the left wing root and displayed broomstrawing, consistent with overload separation. The right main aileron control cable was cut by recovery personnel. Both control cables for the left and right aileron were continuous from the left and right wing roots to their respective aileron bell cranks and push/pull tubes. The left wing flap cable was cut by recovery personnel. The right wing flap was in the UP position and the flap actuator display no threads, also consistent with a flap UP configuration.

C.1.2 Seats and Restraints

Both row 1 seats remained attached to the seat rails. The row 1 right seat shoulder harness and lap belt were buckled, but both belts were cut by first responders. The row 1 left seat lap belt buckle was clasped, while the belt had been cut by first responders. The shoulder harness was not connected to the phenolic at the lap belt buckle.

C.1.3 Fuel System

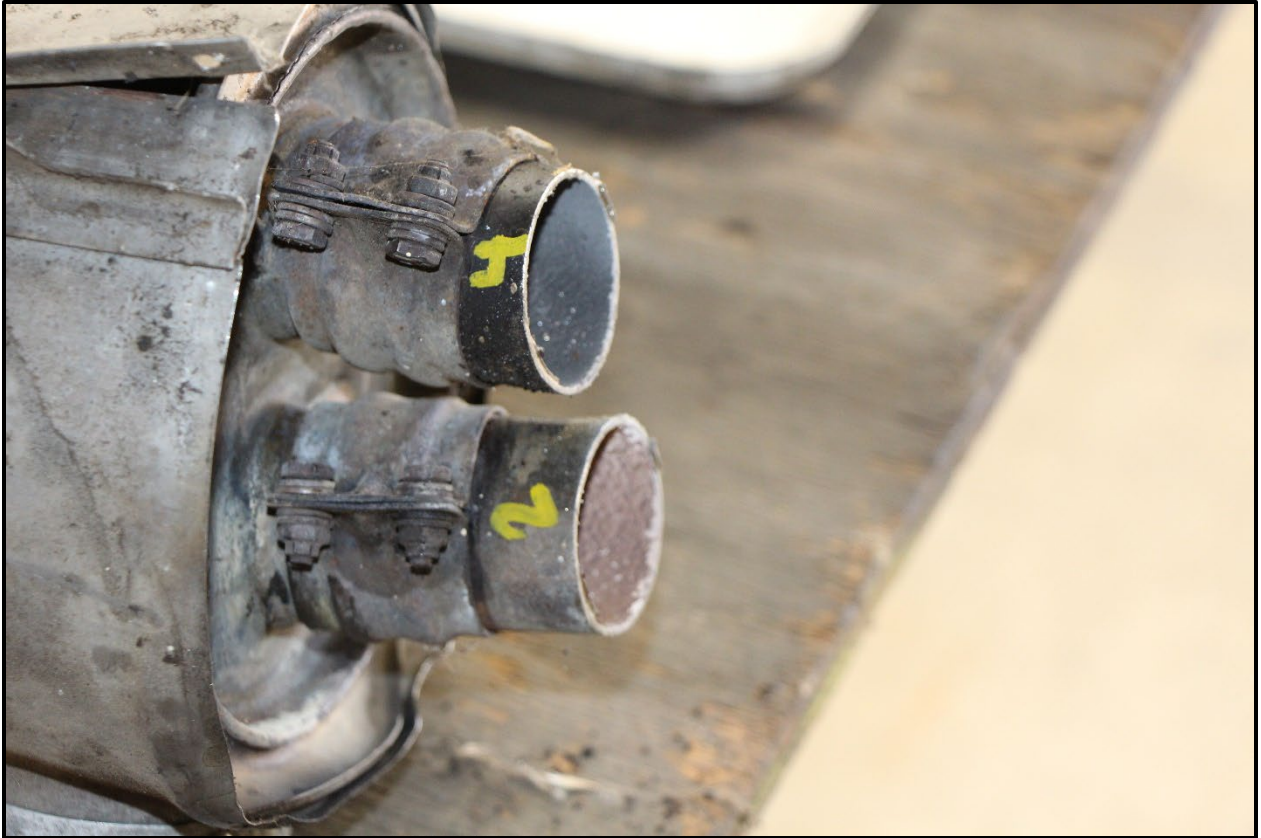
The fuel tanks were both breached during the impact sequence and no residual fuel was observed.

The fuel gascolator bowl was empty and the fuel filter screen did not display any evidence of contamination by a foreign body. The gascolator pin displayed evidence of mechanic damage. The fuel selector was intact and rotated the LEFT tank position to the RIGHT tank position through the BOTH detent with little resistance. Compressed air was blown through fuel lines located at the left and right wing roots and no obstructions were observed at any of the fuel selector positions nor did any debris exit the fuel line at the engine firewall or fuel tank return lines.

C.2 Engine

The engine baffling, starter and alternator were removed prior to the engine examination. Mechanical continuity was established throughout the rotating group, valve train and accessory section as the crankshaft was manually rotated with the propeller. During rotation, thumb compression in the proper firing order was achieved for cylinders 1 and 2 with low compression at cylinders 3 and 4. A borescope examination of the cylinder 3 and 4 exhaust valves revealed carbon deposits around the exhaust valve seats at both cylinders. Thumb compression was subsequently achieved for these cylinders after the exhaust valves seats were staked. The rocker assemblies and rocker boxes at each cylinder were heavily varnished, but each rocker arm displayed normal lift when the crankshaft was rotated by hand. Examination of the interior components using a lighted borescope revealed no indications of catastrophic engine failure.

The engine exhaust baffling was not present, but the internal walls of the muffler and the inside of the cylinder 1, 2-3 exhaust tubes were brown in appearance, consistent with normal operation. The inside of the cylinder 4 exhaust tube was black, consistent with a rich fuel/air mixture operating setting.



Photograph 2: Cylinder 2 and Cylinder 4 Exhaust Tubes at Exhaust Shroud



Photograph 3: Engine with Baffling and Exhaust Removed

Cylinder no. 4 was removed from the engine case. The cylinder barrel walls' appearance was characteristic of chrome cylinder plating. The piston face displayed significant carbon buildup, not consistent with a low time cylinder. The piston rings were intact and unremarkable.



Photograph 4: Cylinder 4 Piston

The single drive dual magneto remained securely clamped at the mounting pad. The ignition harness was secure at the magneto. Magneto to engine timing was 25° before top dead center. The magneto was removed for examination and produced spark at all eight spark plug leads, during hand rotation of the drive. The magneto internal timing (E-Gap) was found to be within the manufacturer's specification. The ignition harness was unremarkable.

The top spark plugs were Champion RHM-38S and the bottom spark plugs were Tempest UREM-38S. Each spark plug was tightly secured to its respective cylinder and the plugs electrode did not exhibit any signs of mechanical damage, with exception of the cylinder 4 bottom spark plug, which had a separated center electrode. Both the top and bottom spark plugs to cylinder 4 were dark with heavy carbon soot, consistent with a rich fuel/air mixture. The cylinder 4 top spark plug did not show a visible electrode gap. Additionally, the top spark plug to cylinder no. 1 contained an oil film. The remaining spark plugs were gray in appearance, consistent with normal wear.

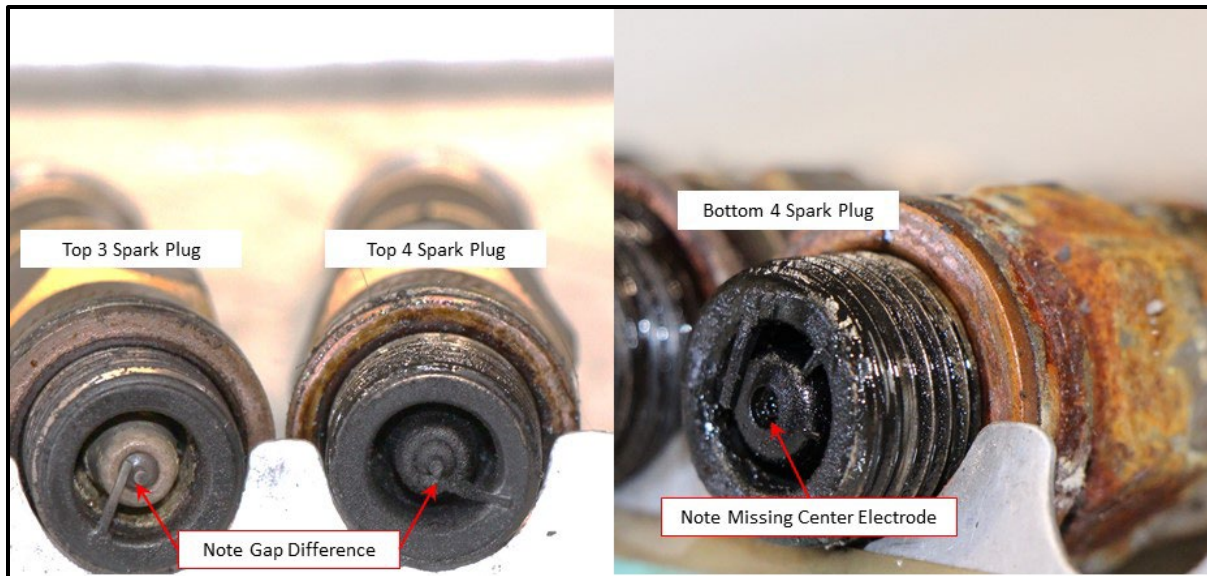


Figure 1: Cylinder 4 Spark Plugs with Top 3 Cylinder Spark Plug Reference

The carburetor had separated from its mounting pad and the fuel bowl was exposed. The throttle and mixture control rod/cable remained secure at their respective control arm. No fuel or debris were observed within the fuel bowl. The float arm was secured to the fuel bowl and rotated by hand. Both composite floats separated from the float arm. The fuel bowl did not contain any residual fuel, corrosion, or white residue consistent with water contamination. The carburetor fuel screen was free of debris.

The vacuum pump could not be rotated by hand. Disassembly of the pump did not reveal any internal damage to the rotors or vanes. The drive coupler remained intact.

C.3 Propeller

Both propeller blades remained attached to the propeller hub, which was still attached to the engine. One propeller blade was straight with some nicks along the leading edge and the other blade displayed some tip bending with nicks and gouges along the outboard leading edge.