



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

March 24, 2022

AIRFRAME AND ENGINE EXAMINATION

WPR20LA152

This document contains 23 embedded photos.

A. ACCIDENT

Location: Santa Maria, CA
Date: May 20, 2020
Aircraft: Cirrus SR20, Registration N883PJ, Serial #1217
NTSB IIC: Samantha Link

B. EXAMINATION PARTICIPANTS:

Samantha Link
National Transportation Safety Board
Denver, CO

Brad Miller
Cirrus Aircraft
Duluth, MN

C. SUMMARY

Examination of the airframe and engine was conducted on March 24, 2022, at Air Transport in Phoenix, Arizona. There were no anomalies with the airframe or engine that would have precluded normal operations.

D. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination Observations

- The airplane was mostly consumed by fire.
- The cabin area sustained extensive thermal damage and was mostly not present.
 - The instrument panel was destroyed. Instruments, radios, and other panel items were found loose within the wreckage.
 - All components sustained extensive thermal damage.
 - The front two seats were mostly consumed by fire.
 - Only the seat frames remained.
 - The rear seats were mostly consumed by fire.
 - The CAPS activation handle was found out of the holder.
 - About 4 feet of cable remained secured to the activation handle.
 - The rocket launch tube and parachute were present and examined with no anomalies noted.
- The aft fuselage and empennage were present and sustained some thermal damage.
- The wing spar sustained extensive thermal damage. (Single spar airplane)

- The left wing:
 - About 3 feet of the inboard wing/torque box was present with the main landing gear attached.
 - The flap and aileron were separated from the wing and sustained thermal damage.
 - A fragment of the aileron control cable remained in the actuation pulley
 - The flap actuator was extended about $\frac{3}{4}$ inch, which is consistent with full flaps.
- The right wing:
 - About 3 feet of the inboard wing/torque box was present with the main landing gear attached.
 - The aileron was fracture separated from the wing. The outboard portion was consumed by fire.
 - A fragment of control cable was present at the actuation pulley.
 - Flight control continuity was mostly established throughout. The flight control system was thermally damaged throughout and the center cabin area controls were not present likely due to the post-crash fire.
 - The rudder and elevator controls were established from the control surfaces to the aft cabin area.
 - When the rudder surface was manipulated by hand the actuator pulley moved accordingly.
 - Fragments from the cockpit controls were noted loose within the wreckage.
 - The aileron control cables were fragmented; however, they were present from the wings to the cabin area.
 - Hardware remained attached at the control surfaces.
 - The control yokes were found loose within the wreckage and sustained thermal damage.
 - The vertical stabilizer remained attached to empennage and sustained thermal damage.
 - The rudder remained attached by the lowest attachment point.
 - The horizontal stabilizers were cut to facilitate recovery.
 - The elevators remained secured and were able to be manipulated by hand.

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1.1 Airframe photos



Figure 1: Left Wing



Figure 2: Center Fuselage and Wing Spar



Figure 3: Right side Aileron Fragment and Wing Spar



Figure 4: Aft Fuselage Immediately Infront of the Empennage



Figure 5: Empennage



Figure 6: Rudder Pedal Assemblies



Figure 7: Forward Pulley Gang



Figure 8: Front Seat Frames



Figure 9: Avionics and Instruments



Figure 10: Flap Actuator

2.0 Engine Examination Observations

- The engine sustained extensive impact and thermal damage.
- The firewall was crushed forward around the aft portion of the engine.
 - The cooling fins on the aft side of cylinder #1 were fractured and crushed.
 - All upper engine components were shifted forward and compressed.
- The propeller assembly was completely fracture separated from the crankshaft.

- The front of the engine case, camshaft, crankshaft, and the #6 cylinder assembly were fracture separated, exposing the core of the engine.
 - All fracture surfaces were consistent with overload.
 - The crankshaft was fractured at the #6 journal.
 - The cylinder #6 assembly was found loose within the wreckage:
 - The piston arm remained attached to the crankshaft and piston.
 - The piston was seized within the cylinder.
 - The push rods were fracture separated.
- The push rod and rocker arm for the intake valve on the #5 cylinder were fracture separated from the cylinder.
- The fuel control unit was removed.
 - The throttle arm was intact, and it moved freely without binding. However, no corresponding motion was observed on the butterfly valve.
 - The butterfly valve was intact and seized in the mostly closed position. It was unable to be manipulated.
- The fuel manifold valve remained attached to its mount, but its mount was fractured from the engine case.
 - All lines remained attached at the fuel manifold valve.
 - They were removed at the manifold valve and all ports were clear of debris.
 - The lines sustained some thermal damage.
 - The fuel manifold valve was disassembled.
 - The manifold valve cover was partially damaged exposing a portion of the rubber plunger.
 - This portion of the plunger was dry, stiff, and cracking.
 - The plunger was somewhat stiff but otherwise malleable.
 - The screen was clear of debris. A small area exhibited some corrosion.
 - When the screen was removed, a small portion of rust was noted on the lower housing.
 - The fuel nozzles for cylinders: 1, 3, 5, and 6 were removed and all were bent.
 - The fuel nozzle for cylinder #3 sustained a minor bend.
 - Light could be seen through it.
 - The fuel nozzles for cylinders #1 and 5 were bent and unable to be seen through.
 - The fuel nozzle for cylinder #6 was mostly damaged and only the internal portion was present.
 - Light could be seen through it.
 - The Fuel nozzles from cylinders #2 and 4 were unable to be removed.

- All upper spark plugs were removed and were consistent with normal operations.
 - The upper spark plug for cylinder #1 was fractured in half; the lower portion remained secured in the cylinder.
 - The upper spark plug for cylinder #6 exhibited yellowy liquid corrosion and organic debris.
- The fuel pump was fracture separated from the engine and found loose within the wreckage. It sustained thermal damage.
 - The mixture arm was bent and unable to be manipulated.
 - The mixture arm was disassembled, and the grooves remained intact.
 - The fuel pump drive remained intact.
 - The fuel pump was disassembled. Yellowy liquid corrosion was noted consistent with firefighting efforts. Otherwise, no anomalies were noted with the internal components.
- The ignition harness sustained extensive thermal damage particularly on the left side of the engine (cylinders #2, 4, 6).
 - The leads on the right side of the engine (Cylinders #1, 3, 5) remained attached to the harness and the upper spark plugs.
 - The leads were removed, and no anomalies were noted.
 - The leads on the left side of the engine sustained extensive thermal damage and remained secured to the upper spark plugs.
- The magnetos were found fracture separated from their mounting pads and found loose between the firewall and accessory section of the engine.
 - They exhibited extensive thermal damage.
 - One magneto was able to be rotated.
 - The distributor cap was removed, and the harness points sustained thermal damage.
 - The magneto was disassembled further; the internal components were intact, and the gear and point operated when manipulated.
 - The second magneto was only able to be rotated about ¼ turn. Given the damage, the distributor cap was unable to be removed, and therefore unable to be disassembled further.
- The valve covers were removed from all cylinders except for:
 - The cover for the cylinder #2 intake valve was unable to be removed due to the oil cooler, which was crushed forward into the aft side of the cylinder.
 - The cover for the cylinder #6 intake valve was unable to be removed due to deformation of the cover itself.

- All exposed valve springs and rocker arms sustained thermal damage but otherwise appeared normal.
 - The exhaust valve for cylinders #2 and 4, appeared slightly discolored.
 - The intake rocker for cylinder #5 sustained impact damage.
- All cylinders were borescoped and organic debris was noted in all of the cylinders along with evidence of rust/corrosion. Which is consistent with firefighting efforts from the post-crash fire. Otherwise, the piston heads, cylinder walls, valve heads, and lower spark plugs were all consistent with normal operations.
 - Cylinder #6 was full of a yellowy liquid, but the internal components were consistent with normal operations.
- The engine was unable to be rotated by hand consistent with impact damage.
- The visible portion of the camshaft was unremarkable. The cam lobes were oblong consistent with normal operations.
- The oil filter was fracture separated from the engine and found loose within the wreckage.
 - The filter was exposed and unable to be removed from the housing
 - Organic debris and rust was noted in the filter.
- The vacuum pump was found loose within the wreckage. It was thermally damaged.
 - The pump was disassembled. The veins and internal components were cracked consistent with impact.
- The propeller governor was fracture separated from the engine and sustained extensive thermal damage.
 - The internal components sustained extensive thermal damage.
- The propeller hub fracture separated from the crankshaft. All three propeller blades remained secured at the hub and sustained thermal damage.
 - The crankshaft fracture was consistent with overload.
 - The spinner remained attached and was crushed aft over the hub itself.
 - One propeller blade was mostly straight and bent slightly forward. The Chamber side of the blade was facing the opposite direction of rotation.
 - This blade was unable to rotate within the hub.
 - A second blade was bent aft, and the outboard portion was twisted. Chordwise scratching was noted on the chamber side of the blade.
 - This blade was able to rotate within the hub.
 - The third blade was bent aft about midspan.

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2.1 Engine Photos



Figure 11: Right Side of Engine (Cylinders #1, 3, 5)



Figure 12: Front of Engine

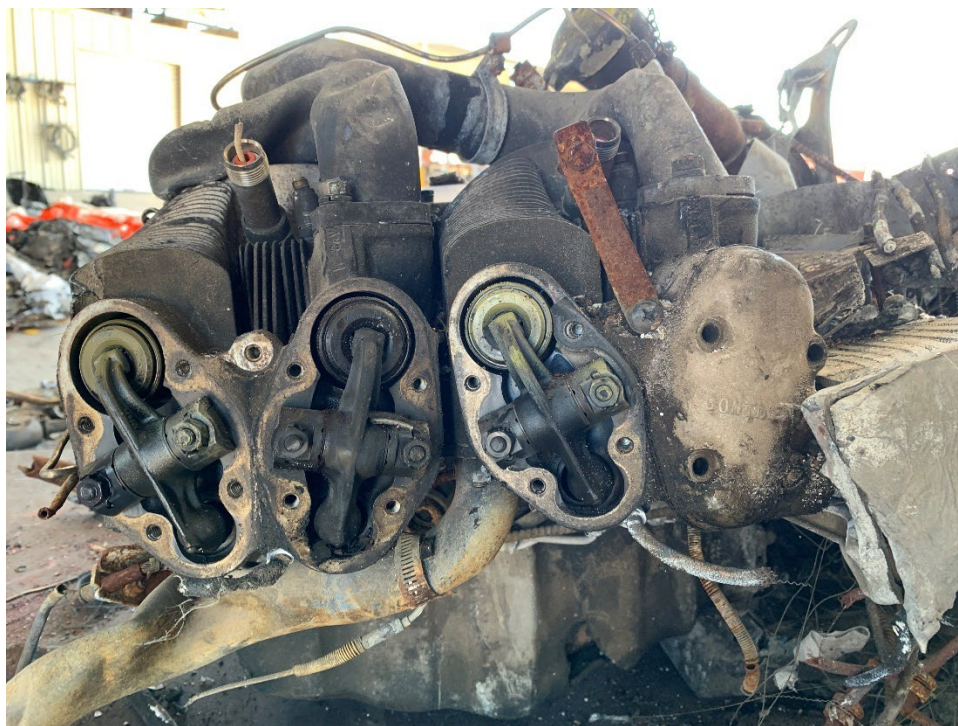


Figure 13: Left side of Engine (Cylinders #2 and 4)



Figure 14: Number 6 Cylinder Assembly and Portion of Crankshaft



Figure 15: Fuel Manifold Valve



Figure 16: Fuel Control Unit



Figure 17: Fuel Pump



Figure 18: Fuel Nozzles



Figure 19: Upper Spark Plugs



Figure 20: Vacuum Pump



Figure 21: Both Magnetos



Figure 22: Disassembled Magneto



Figure 23: Propeller Assembly

END.

Submitted by: Samantha Link