



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

AIRFRAME AND ENGINE EXAMINATION

WPR17FA120

This document contains 18 embedded photos.

A. ACCIDENT

Location: Moorpark, California
Date: June 4, 2017
Aircraft: Piper PA28-180, Registration #: N4871L, Serial #: 28-4226
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

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C. SUMMARY

Examination of the recovered airframe and engine was conducted on June 12 and 13 at the facilities of Air Transport, Phoenix, Arizona. Findings included a stiff fuel selector valve, blue fuel staining at the number 3 cylinder inlet manifold, light tan deposits on the inner surface of the number 3 cylinder exhaust pipe, with darker deposits in the exhaust pipes of the other cylinders. No fuel traces were found.

D. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

The fuselage sustained extensive crush damage through to the tailcone, and the instrument panel exhibited localized thermal damage.

The right wing remained attached at the root, and had been cut off by the recovery crew. The outboard 4 ft of right wing had separated (Photo 1), bisecting the aileron. The aileron sections remaining attached to the outboard and inboard hinges. The flap remained attached to the aft spar, and the landing gear strut remained attached to the main spar. The wing exhibited leading edge crush damage from the root through to the separation point. The outboard section of the

wing did not exhibit leading edge crush damage, and the inboard section exhibited serrations consistent with power line contact at the leading edge (Photo 2).

The aileron cables remained attached to bellcrank and had been cut at the root by recovery personnel. Move movement of the cables at the root resulted in corresponding movement of the aileron inboard rib.

The left wing had separated from all three attach points at the wing root, and exhibited leading edge crush damage along its entire span. The aileron cables remained attached to bellcrank and had been cut at the root by recovery personnel. Move movement of the cables at the root resulted in corresponding movement of the aileron.

The empennage was largely intact; the rudder and stabilator cables were continuous to the main cabin, where they had separated at the forward cabin. Move movement of the cables at the separation points responded in corresponding movement of their respective control surfaces. The rudder remained attached to the vertical stabilator by all of its hinges. The stabilator trim drum exhibited 5 exposed threads on the top, consistent with neutral trim position (Photo 3).

The forward seats were equipped with lap belts, and no shoulder harness. Both front seat buckles were locked, and the belts had been cut by first response crew to extract the occupants. Both seat backs had detached.

The flap handle was observed in the full up detent (40°). The handle was bent downward about 30 ° midspan. The flap torque tube bracket, at the cabin intersection to the wing root was in a position that corresponded to the flaps zero position. The flap control cable was continuous from the handle through to the torque tube sprocket, and back to its spring.

The cockpit controls were crushed and fragmented. The top of the T-bar had detached, with the aileron chain sprocket still in place.

The rudder cables remained attached to the rudder bar; both cables separated about 2 ft from their rudder bar fittings.

The forward stabilator cable remained attached to the forward T-bar fitting; the aft cable separated about ½ inch from the swage point of the fitting.

The left arm of the right yoke had detached. The yoke remained partially attached to the T-bar. The right arm of the left yoke had separated, the yoke remained attached to an 8-inch section of its control tube.

The aileron control chain had detached from the control column sprocket, and broken into two sections. The control cable remained attached to both chain ends.

The tab of the stall warning switch in the left wing had become crushed against the wing leading edge. The switch assembly was removed along with the red stall lamp in the cabin, and connected in series to the airplanes battery. The light illuminated when the switch was activated.

The pitot mast remained attached to the underside of the left wing. The associated ram air and static lines were free of obstruction from their separation point at the root, through to the mast.

The left-wing fuel tank was breached at the outboard rib. The fuel cap was in place and undamaged; its rubber gasket was pliable. The fuel line had been cut at the root by recovery personnel, and the fuel supply screen in the tank was free of debris. The supply line and vent line were clear and could be blown through to the tank. The fuel drain was in the closed and locked position, and when water was added to the tank, the valve did not leak.

The right-wing fuel tank was breached at the outboard and inboard ribs. The fuel cap was in place and undamaged; its rubber gasket was pliable. The fuel line had been cut at the root by recovery personnel, and the fuel supply screen in the tank was free of debris. The supply line and vent line were clear and could be blown through to the tank. The fuel drain had broken away at the tank fitting; remnants of the threaded portion of the drain remained attached to the tank.

The fuel selector valve was found in the left tank position; The backing plate exhibited transfer marks from the lever at the left tank position (Photo 4). The valve handle was loose on the fitting due to a worn D-shaped handle receptacle (Photo 5). The handle was stiff to select tanks, and could not be moved to each position without difficulty, although once moved, the detents were felt. All three fuel line b-nut fittings were attached and tight; the right tank fuel line had been severed at the b-nut. The remaining lines were separated about 12 inches from the valve. The valve was clear when blown through at all tank positions. The remaining fuel line sections had been separated both by impact and recovery in several locations, all lines were clear.

The fuel selector valve was disassembled. The inner valve body and case cavity exhibited radial score marks (Photo 6), and light tan-colored fragments of material broke away from the valve seal upon disassembly (Photo 7). The O-ring at the top of the valve was intact and pliable. Light green discoloration was observed on the outer surface of the valve body.

The fuel primer assembly had detached from the panel; however, the plunger lever was in the closed and locked position.

The gascolator bowl had detached, with its upper cap still attached to the firewall. The bowls drain was intact and in the closed position, and did not leak when the bowl was filled with water. The fuel lines forward of the firewall remained attached to their respective fittings at the electrical fuel pump; the inlet and outlet lines for the engine driven fuel pump had detached directly from the pump. All lines were clear and no fuel was observed. The electrical fuel pump was then attached to the battery, and emitted a sound consistent with operation, no fuel was observed.

The electrical fuel pump switch was observed in the on position. The ignition switch was in the off position.

2.0 Engine Examination

The engine remained attached to the firewall, and had folded aft and over the top of the instrument panel (Photo 8). The carburetor remained attached to the inlet manifold, which had separated from the engine. The intake box sustained crush damage, and was still attached to the carburetor. The carburetor heat control valve was crushed which precluded any determination of its position prior to impact. The foam filter element was crushed, but remained intact and free of visible obstruction to airflow. The magnetos, vacuum pump, oil filter, and starter motor remained firmly attached to the engine at their respective mounting pads. The alternator sustained impact damage and was still partially attached to its mounting points. The engine driven fuel pump remained attached to its mounting pad; the inlet and outlet fuel lines had broken away from the pump's along with sections of the pumps case.

The propeller remained attached to the crankshaft flange. The crankshaft flange was partially attached to the crankshaft by two webs. The hub base was attached to the crankshaft. The outer radius of the flywheel along with the ring gear, had completely detached from the hub. The ring gear was undamaged and did not exhibit rotational scoring in the area of starter drive contact (Photo 9).

The nose cone base plate had become completely formed around the hub and both blade roots. One of the blades was intact and free of significant damage, and exhibited leading edge polishing with smooth abrasions in the paint radiating about 45° relative to the rotational plane (Photo 10). The second blade was curved about 90° aft along its entire span; the blade exhibited polishing and paint abrasions almost perpendicular to the chord (Photo 11).

The throttle control cable remained attached at the throttle arm. The mixture control cable had been pulled from the arm. The carburetor was disassembled, and no fuel was present in any of the lines, the bowl, or the accelerator pump chamber. The brass floats were intact, undamaged, and did not contain fuel (Photo 12). There was no foreign debris observed within the bowl, or accelerator pump chamber. The accelerator pump seal was intact and pliable. The float valve seal was pliable and did not display any ridges or deformation, and its associated seat was free of debris (Photo 13). The fuel inlet line had broken away from the carburetor case, and the inlet screen was clear.

The top spark plugs were removed, and examined. All plugs throughout the engine were the thin-wire type, except for the top plug for cylinder number two, which was of the massive electrode type. All electrodes remained mechanically undamaged, dark-colored, and plugs 1 and 3 were wet with oil (Photo 14). The static oil soaking of the spark plugs (as noted) was attributed to the engine positioning at the mishap site and post recovery. Light tan deposits were observed on the inner surface of the number 3 cylinder exhaust pipe, with darker deposits in the exhaust pipes of the other cylinders (Photo 15, 16). No oil residue was present within the pipes, and the inner baffles of the muffler were crushed but intact, and the muffler was free of obstruction.

The crankshaft turned freely when rotated by hand at the accessory drive, and cylinder compression was noted on all cylinders in firing order. Mechanical continuity was established throughout the valve train, and accessory section. All valve lifters moved an appropriate amount

during rotation. Visual inspection of the combustion chambers was accomplished through the spark plug bores utilizing a borescope; there was no evidence of catastrophic internal damage and all combustion surfaces exhibited light grey deposits consistent with normal operation.

The left and right magnetos remained securely clamped at their respective mounting pads. The ignition harness was secure at each magneto. Magneto to engine timing could not be ascertained, due to the destruction of the flywheel. The magnetos were removed for examination. Each magneto produced spark at the end of the respective spark plug lead, during hand rotation of the drive.

Blue fuel staining was present at the number 3-cylinder inlet manifold pipe (Photo 17). The manifold was removed, and appeared to have sustained impact damage to its flange. The gasket had split at the area of flange separation (Photo 18). The fuel pump was disassembled and did not contain any fuel. All diaphragms and valves were intact and undamaged.

The oil filter was removed and cut open, the paper element was oil-soaked, and free of debris.

3.0 Airframe and Engine Examination Photos



Photo 1 – Right Wing



Photo 2 – Wire Striations on Right Wing



Photo 3 – Stabilator Trim Drum



Photo 4 – Fuel Selector Valve and Backing Plate



Photo 5 – Fuel Selector Valve Handle



Photo 6 – Fuel Selector Valve



Photo 7 – Fuel Selector Valve Cavity



Photo 8 – Engine and Instrument Panel



Photo 9 – Flywheel and Starter Ring



Photo 10 – Propeller Blade



Photo 11 – Propeller Blade



Photo 12 – Carburetor Float



Photo 13 – Float Needle



Photo 14 – Top Spark Plugs



Photo 15 – Cylinder 1 and 3 Exhaust Pipes



Photo 16 – Cylinder 2 and 4 Exhaust Pipes



Photo 17 – Cylinder 3 Blue Staining at Inlet Manifold Pipe



Photo 18 – Cylinder 3 Inlet Manifold Gasket

Submitted by: Elliott Simpson