



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

September 2016

AIRFRAME AND ENGINE EXAMINATION

WPR16FA178

This document contains 16 embedded photos.

A. ACCIDENT

Location: Reno, Nevada
Date: September 11, 2016
Aircraft: Piper PA28R-201T, Registration Number: N821ET
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

Elliott Simpson
Aviation Accident Investigator
National Transportation Safety Board
Western Pacific Regional Office

Charles Little
Piper Aircraft Company
Vero Beach, Florida

Kurt Gibson
Continental Motors Inc.
Mobile, Alabama

Lee Oscar (September 14)
Federal Aviation Administration FSDO
Reno, Nevada

James Richardson (September 14)
Federal Aviation Administration FSDO
Reno, Nevada

C. SUMMARY

Examination of the recovered airframe and engine was conducted on September 14 and 15, 2016 at the facilities of Plain Parts, Pleasant Grove, California.

D. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

The airframe sustained crush damage throughout, compressing the forward cabin through to the vertical stabilizer (Photo 1). The right wing was separated at the root. The engine remained partially attached to the firewall, which had detached from the forward cabin, and remained attached by control cables and engine supply hoses and electrical lines.

Within the cabin, the instrument panel had sustained extensive fragmentation along with all flight controls. The ignition key at the accident site was in the ignition switch, appeared bent, and set in the right magneto position (Photo 2). The fuel boost pump was in the OFF position and had become impinged against its instrument panel cutout, and the battery switches were both in ON position (Photo 3). The autopilot controller face was crushed; the roll selector set to the right position. The fuel flow transducer was opened and appeared free of obstructions. The fuel selector was in the left tank detent (Photo 4). The gascolator had been crushed, exposing the inner surface of the bowl. The bowl was free of corrosion or blockage, and the screen was free of debris.

All four seats remained attached to the cabin floor. All seat belts remained buckled. The front two belts, and the rear left belt had been cut by fire crew at the accident site to recover the occupants. The rear right seat belt was buckled such that the belts were tight against the seat. The rear seats were not equipped with shoulder harnesses. The passenger-side cabin door was located with the main wreckage, and had been cut at the window frame by first-responders. The door latch handle had broken away, and the latch was in the closed position. The rear baggage door remained attached to the airframe at its hinge. The exterior latch was in the closed position.

The battery had become detached from its mount, and was located loose within the cabin. The rear baggage area was not equipped with tie-down hooks and baggage, books, and miscellaneous airplane accessories were found loose within the aft portion of the cabin. The loose items were weighed, totaling 80 pounds.

Underneath the aft cabin floor, the auto-gear extension system appeared to have been disabled. A Piper Service Bulletin 866 allows for the disabling of the extension system, and paperwork for this service bulletin were located in the debris. Examination of airport surveillance video revealed that the landing gear was in the extended position just prior to impact. During the examination the landing gear was observed within the wing wheel wells, and the nose gear assembly had become detached.

The flap cabin control lever had become lodged against the buckled cabin floor, and was in the 10-degree flap position detent (Photo 5). The flap control torque tube remained attached to the drive sprocket, and the drive chain cables were continuous to the flap control lever assembly. The chain was close to its full travel position (Photo 6), extending the return spring; the Piper representative described the chain position as consistent with full flap deployment. The flap system design does not allow for movement of the lever down without pressing the lever button. As such, the discrepancy between the flap sprocket and flap lever most likely occurred during impact, with the most likely setting being either zero or 10 degrees flap.

Both control yokes remained attached to the left and right sprockets wheels via their flexible joints. The aileron control chain was intact and in place around each sprocket, and remained connected to the aileron control cables which were cut by recovery personnel about 12 inches aft of pulleys at the base of Tee bar.

The aileron cables were cut by recovery personnel, but all appeared continuous to the outboard wing bellcranks except for the right balance cable which had separated at both the wing root turnbuckle, and at the wing bellcrank turnbuckle arm had bent 90 degrees. The center pulley exhibited indentations consistent with contact with the autopilot roll servo bridle as the cable had become overextended during the impact sequence. The servo capstan wheel rotated freely.

The stabilator link assembly had separated at the threaded portion of the eyebolt at the base of the Tee bar, with bending damage, consistent with overload. The stabilator cable was attached at to the Tee bar assembly and link assembly, with one cable continuous to stabilator, with the other end of the cable cut by recovery personnel. The remaining cables were continuous aft, and when pulled, the stabilator moved up and down.

The stabilator trim tab along with its associated trim screw and control arm assembly remained attached to the stabilator. The trim cables were continuous through to the trim wheel. The wheel assembly had become impinged against the cabin cover, and the indicator was in the full DOWN position. The trim jack screw in the aft cabin exhibited 12 exposed screw threads on the top side. (Photo 7). According to the Piper representative zero exposed threads indicated full nose down trim, 5 threads neutral, and 16 full nose up. The trim cable, passed through the autopilot stabilator trim servo assembly on its routing through to the control wheel. The servo capstan and tension wheels were intact and moved freely by hand, with no binding noted.

The rudder remained attached to the vertical stabilizer, and the rudder cables were continuous through to their respective foot controls. The cables were cut by recovery personnel.

The right wing separated from airframe at the root; the outboard wing tip had separated at aileron bellcrank, about 5 ft from the tip. The outboard section sustained a deep square indentation through to the aft spar about the same diameter as the damaged light pole in the airport parking lot (Photo 8). The aileron remained attached at inboard and center hinges. The outboard section of the aileron had separated and was found in debris field, torn away from outboard hinge which was still attached to the wing trailing. The bellcrank had separated from the airframe, and aileron push-pull tube. The fuel tank had been breached at the leading edge; the fuel filler cap was in place, and the fuel supply screen had broken away from its fitting. The flap remained attached at all three hinge points. The flap sustained limited damage beyond an upwards bend to the trailing edge about 3 ft from the root.

The left wing remained partially attached to fuselage, and was cut free during recovery. The outboard section of the wing separated about midspan. The fuel tank had been breached at the leading edge; the fuel filler cap was in place, and the fuel supply screen was free of debris. The flap remained attached, and the aileron was still attached by the center and outboard hinges. Inboard aileron hinge was still attached to rear spar, but separated from the aileron. The aileron cables were continuous from the wing root to the bellcrank which remained partially attached to structure with push-pull tube still attached to aileron. The flap remained attached at all three hinge points. The flap sustained limited damage beyond a crush damage to the inboard flap rib.

The pitot tube had pulled away from the wing. The rubber pitot hose had broken away from the pitot outlet fitting. The hose was clear through to the wing root, and the pitot tube did not exhibit any blockages. The airspeed indicator had become crushed within the instrument panel, which had folded around its front face.

Both propeller blades remained attached to the hub. One blade exhibited an aft 5-degrees curve at the root, and the leading edge at the tip had sustained multiple nicks and chordwise abrasions at the tip (Photo 9). The second blade exhibited an aft curvature, with the tip separated about midspan. The tip exhibited nicks, and material loss along its entire leading edge with chordwise abrasions (Photo 10). The tips separation surface was jagged in appearance (Photo 11). The hub remained attached to the crankcase flange, which had separated from the crankcase at the forward oil seal. The separation surface exhibited a 45-degree sheer lip around its entire circumference (Photo 12). The propeller governor remained attached to the crankcase, but had sustained crush damage. The control arm and cable remained attached.

2.0 Engine Examination

The engine sustained impact damage, crushing the forward inlet manifold, and breaching the lower portion of the oil sump, exposing the camshaft (Photo 13). The propeller and hub assembly had become detached at the engine crankshaft forward bearing. The starter motor had broken away, with its flanges remaining firmly attached to the starter adapter. The alternator remained attached to the crankcase. The oil filler cap and dipstick were in place, and both magnetos had broken away at their mounting pads. All fuel lines, including the fuel injector lines were intact at their fittings.

The turbocharger assembly had become partially detached from the engine, and all exhaust pipes were crushed. The turbo overboost valve had separated, and appeared intact, and the V-band clamp had broken away from the inlet side of the turbine shroud (Photo 14). The inlet manifold to the compressor had broken away at the shroud. The turbine and compressor wheel blades were intact, and the wheels could be rotated freely by hand (Photo 15).

The flanges for the right (gold-colored) magneto remained firmly bolted to the crankcase. One flange of the (black-colored) magneto remained firmly bolted to the crankcase, and the second flange had fallen away. All spark plug wires exhibited cuts and crush damage and were removed.

The left magneto input shaft was rotated by hand, and sparks were observed sequentially at all posts. The right magneto case was broken, exposing the capacitor. The input shaft was rotated by hand, but no sparks were observed.

All fuel lines along with the upper deck pressure line sustained varying degrees of impact damage, but remained firmly in place at their respective fittings. The “spider” and all its associated lines were intact through to the fuel injectors.

The throttle cable remained attached to butterfly valve at metering unit, and the cable had been cut at the firewall by the recovery crew. The butterfly valve could be moved smoothly by hand. Fuel issued from metering valve fuel line when it was removed. The engine driven fuel pump flange remained attached to crankcase, but the pump had separated. The splined shear coupling had not sheared, and remained within the crankcase, however the fuel pump had fragmented and was found distributed within the debris. The mixture control arm and eyebolt fitting remained attached to the pump.

The vacuum pump broken away from its pad leaving the undamaged shear coupling in place.

Cylinders 4, 5, and 6 were silver in color, with all remaining cylinders red. Cylinder 6 exhibited forward crush damage, separating the intake and exhaust rockers. All pushrods appeared undamaged. The engine could be rotated smoothly via the vacuum pump accessory drive, all valves exhibited similar lift heights, and drive train continuity was confirmed through to the accessories. “Thumb” compression was observed on all cylinders except number 6. The upper and lower spark plugs for cylinders 2, 3, and 4 along with the lower spark plug for cylinder 6 exhibited grey deposits. The remaining plugs were coated in oil. All plugs exhibited worn out-normal signatures when compared to the Champion AV-27 Check-A-Plug chart. (Photo 16)

The oil filter was opened, and appeared free of debris, and remained coated in brown-colored oil.

3.0 Engine and Airframe Examination Photos



Photo 1 – Accident Site



Photo – 2 Ignition Switch



Photo 3 – Boost Pump



Photo 4 – Fuel Selector Valve



Photo 5 – Flap Control



Photo 6 – Flap Chain

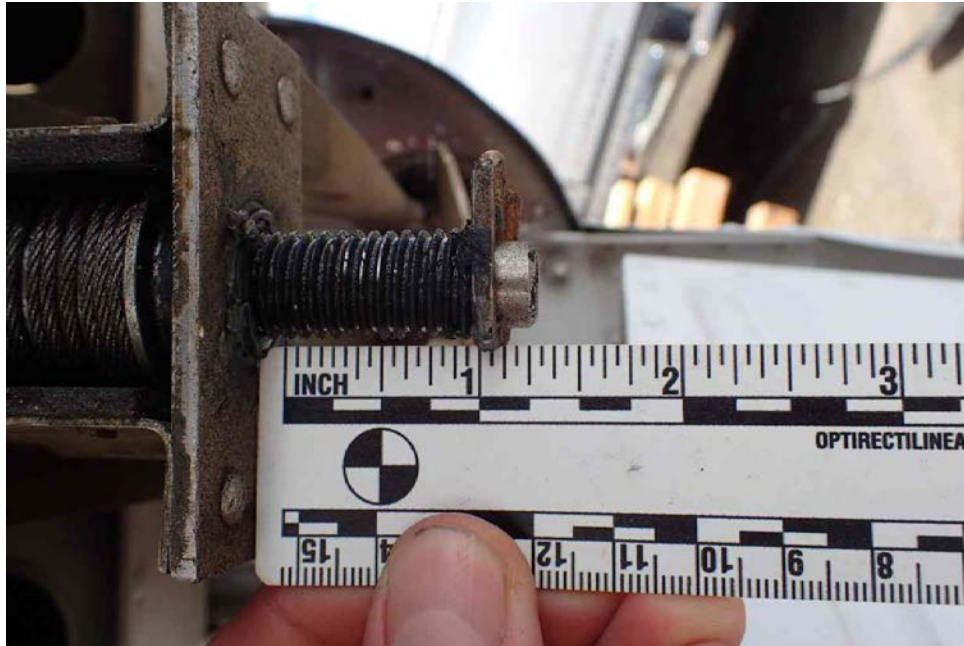


Photo 7 – Stabilator Trim Screw



Photo 8 – Right Outboard Wing Section



Photo 9 – Propeller Blade



Photo 10 - Propeller Blade Tip



Photo 11 – Propeller Blade Separation



Photo 12 – Crankshaft at Front Bearing



Photo 13 - Engine Lower Side



Photo 14 – Turbine Inlet



Photo 15 – Compressor Wheel



Photo 16 - Spark Plugs

Submitted by: Elliott Simpson