



The National Transportation Safety Board

Office of Aviation Safety
Central Region
Memorandum for the Record
Airframe and Engine
Examination Findings
CEN19FA127
Pleasant Prairie, Ohio
March 18, 2020

SUMMARY OF FINDINGS

- Flight control continuity was established from the cockpit to all flight control surfaces.
- No mechanical anomalies were found with the engine that would have precluded normal operation prior to impact.
- Propeller blade damage was consistent with rotation at the time of impact.

DETAILED FINDINGS

AIRFRAME

Fuselage

- The fuselage was mostly fragmented from impact forces. A large semi-circle impression was noted to the upper fuselage area, consistent with contact with a tree. The cabin door and baggage door were impact damaged and separated from their attach points.



Photo 1 Accident Site and Airplane Wreckage

- The pilots' seat was impact damaged and separated from its seat tracks. The lap belt assembly for the pilots' seat remained attached to the fuselage and was observed unlatched. Field test determined it to be functional. The copilots' seat was impact damaged and separated from the fuselage; its lap belt assembly remained attached to the fuselage and was observed unlatched. The copilots' seat tracks were not observed within the recovered wreckage; the fuselage was fragmented in this area. There were no shoulder harnesses installed in the aircraft. The #3 seat was impact damaged and separated from its attaching points. The #4 seat was partially separated from the fuselage with impact damage noted. The #3 & #4 seatbelts remained attached to their respective attaching points and were determined to be functional during field test.
- The pilots' control wheel horns were fractured, and the copilots control wheel was separated from its shaft. The T-bar was fragmented. The rudder, stabilator, and aileron control cables were separated at various lengths and areas of the wreckage. The separated cable ends exhibited a splayed, broom strawed appearance consistent with tension overload separation. The instrument panel was impact damaged and fragmented. Observed switch and control positions:

Magneto switch "both"
 Gear selector "up"
 Alternate air "off"
 Defrost "off"
 Heat "UK / not located"
 Throttle "forward / mid-travel"
 Propeller "forward / mid-travel"
 Mixture "forward / mid-travel"
 The throttle, propeller, and mixture controls were impact damaged.
 Nav lights "impact damaged and separated"
 Battery "off"
 Fuel pump "off"
 Landing lights "off"
 Anti-collision lights "on"
 Strokes "off"
 Flap lever "full/40°"

- The flap torque tube was separated from its mounts and impact damaged. The tachometer was impact damaged and its indicator needle was static @ 1900 RPM. The recording tach time was 4552.03. The separated airspeed indicator needle was static @ 142 knots. The fuel selector remained attached to the separated side panel and its fuel lines were fractured and separated from the selector valve. The fuel selector was observed in the "left tank" position which was confirmed during field test with low pressure air. The selector valve was noted to be stiff throughout its travel and its detents were present.
- Impact damage precluded a functional check of the electronic attitude indicator (EAI). The EAI was disassembled, and its internal gyro and housing revealed no obvious rotational scoring or scuffing. There was no vacuum driven attitude indicator observed within the recovered wreckage. Review of maintenance records showed that on January 1, 2019, the existing attitude indicator had been replaced with an owner supplied EAI.

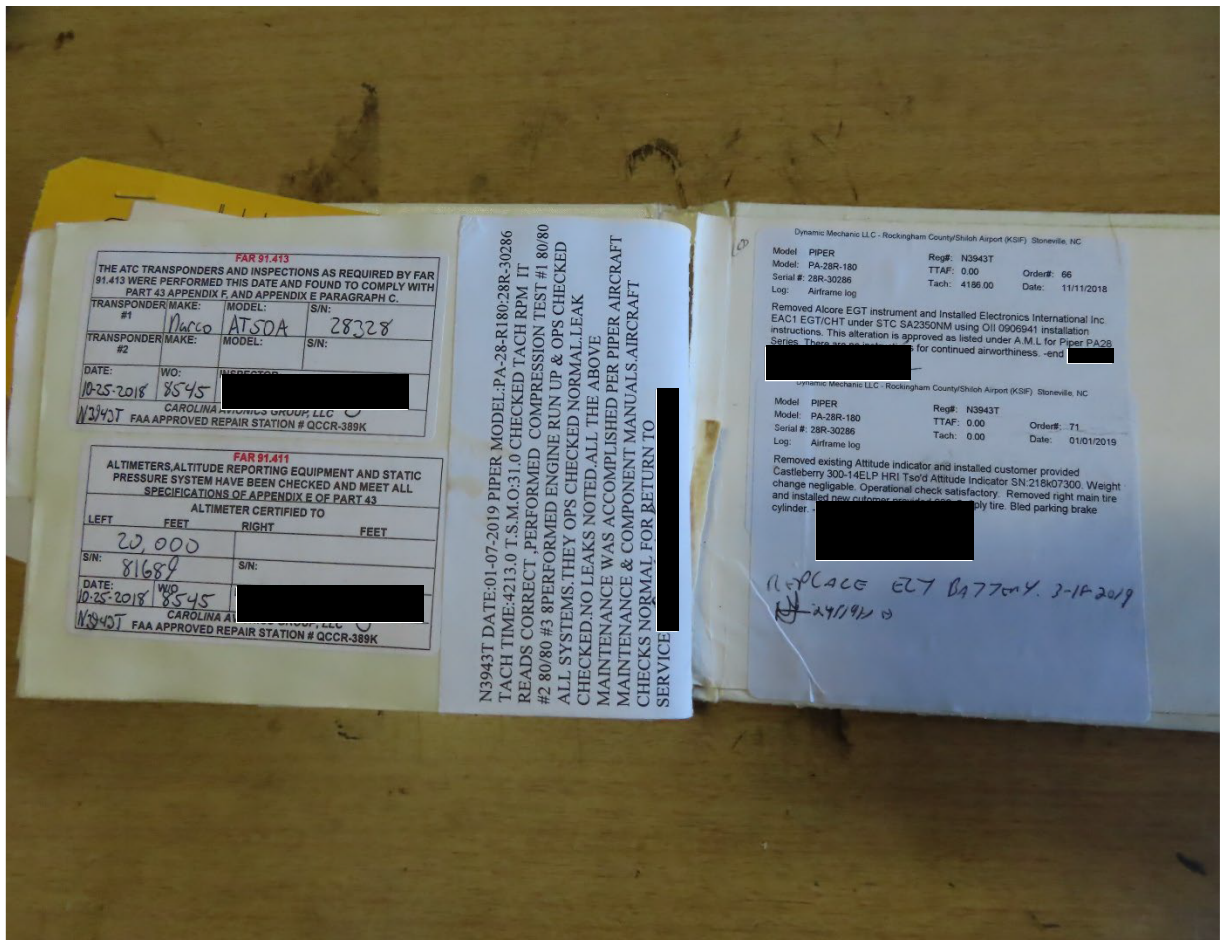


Photo 2 EAI Logbook Entry

Left Wing

- The left wing was fragmented and separated from the fuselage. A semi-circle impression, consistent with a tree strike, was on the leading edge of the wing about 1' from the wingtip. The fuel tank was destroyed; the fuel cap was installed on the tank's receptacle and the tank's pick up screen was clear of obstruction. The main gear was separated from the wing and fragmented. The main wheel was not observed within the recovered wreckage. The main gear actuator was extended indicative of the gear in the "down" position; however, the hydraulic lines were separated at various areas and the gear selector switch was in the "up" position.
- The lift detector was separated from the wing and impact damage precluded field test. The pitot mast remained attached to the wing and its static and pitot ports were clear of obstruction. The impact damaged flap remained attached to the wing in the "up/0°" position. The flap's control rod remained attached to its mounts and the fuselage mounted torque tube control arm was separated from the assembly.
- The aileron was separated from the wing and separated in 3 sections. The aileron balance weight was separated from the assembly. The aileron bellcrank was pulled inboard but the aileron control rod remained attached to the bellcrank and aileron. The aileron control Cables remained attached to the bellcrank and were separated at various lengths in the fuselage area. The separated cable ends displayed a splayed, broom strawed appearance consistent with tension overload separations.
- No anomalies were noted to the aileron travel limit stops, and flight control continuity was established through impact and overload separations.

Right Wing

- The right wing was fragmented and separated from the fuselage. A large semi-circle impression to the outboard leading-edge area of the wing was noted. The main gear was impact damaged and separated from the wing; its actuator was retracted indicative of the gear in the “up” position. The fuel tank was fragmented, and its cap was separated from its receptacle. The fuel tank pick-up screen was clear of obstruction.
- The flap was separated from the wing and fractured in 2 sections. The flaps control rod was fractured from the flap rod-end bearing and the fuselage mounted torque tube control arm. Impact damage to the control arm preclude verification of flap position. The aileron was separated from the wing and exhibited impact damage; the aileron’s balance weight was separated from the assembly and was not located within the recovered wreckage. The aileron bellcrank was separated from the wing and fractured. The aileron control cables remained attached to the impact damaged bellcrank and were separated at various lengths. The separated cable ends exhibited a splayed, broom strawed appearance consistent with tension overload separation.
- No anomalies were noted to the aileron’s travel limit stops and flight control continuity was established through impact and overload separations.

Empennage

- The vertical stabilizer was separated from its supporting structure and a semi-circle impression was observed to its leading-edge area. The rudder remained attached to its mounts and exhibited impact damage; its balance weight was pulled from its attach points. The rudder’s right control cable remained attached to the rudder and was separated about 8” with a splayed broom strawed appearance consistent with tension overload separation. The rudder’s left control cable was pulled from the attached clevis. No anomalies were noted to the rudder’s travel limit stops, and flight control continuity was established through impact and overload separations.
- The stabilator and balance weight remained attached to their respective mounts. The left stabilator exhibited impact damage with leading edge damage observed to the outboard area. The right stabilator was separated at the root area and a semi-circle leading edge impression was noted at the separated area of the stabilator. The stabilator trim tab remained attached to both sides of the stabilator with impact damage and skin separations at its control rod attach point area. The control arm remained attached to the trim tab and was pulled from the trim barrel assembly. The stabilator trim barrel’s supporting structure was separated from the fuselage and the jackscrew exposed 4 threads / $\frac{3}{4}$ ” from the top of the assembly, indicative of a partial “nose down” trim setting. The trim cables were separated at various lengths exhibiting a splayed, broom strawed appearance consistent with tension overload separation. The lower stabilator control cable remained attached to balance weight mast and was separated about 12” with a splayed broom strawed appearance at its separated end. The upper control cable weldment was fractured from the mast and was not observed within the recovered wreckage.
- No anomalies were observed to the stabilator’s travel limit stops and flight control continuity was established through impact and overload separations.

ENGINE

- The engine remained attached to fuselage section and exhibited impact damage. The exhaust system was separated and crushed. The induction air filter assembly was separated from its mounts and exhibited impact damage and exhibited no obstructions. The engine cowlings were fragmented. The gascolator bowl was separated from its receptacle and the filter screen was not found within the wreckage. The gascolator bowl contained an organic material consistent to that of the soil at the accident site.
- The fuel injector unit was impact separated from the engine, with a fragment portion of the engine sump attached, and remained attached to the firewall via control cables, the inlet hose, and the outlet return line. The throttle control cable remained attached to the unit but was impact damaged. The mixture control cable arm was impact separated from the unit, but the arm remained attached. The throttle plate opened and closed when the throttle arm was actuated. The unit was partially disassembled for further evaluation. The fuel inlet screen was found to be unobstructed. The diaphragm was safety wired in place and was opened. A small quantity of fuel was found under the diaphragm. A water finding paste was applied, no water was detected.
- The fuel manifold remained secured to the top of the engine. The fuel lines from the manifold to the cylinder injector nozzles remained attached and secured to the four cylinders. The manifold was removed and disassembled for further examination. The diaphragm was clean with no debris, corrosion, or damage. The fuel line running from the fuel injector to the manifold remained attached to both units and was not obstructed.
- The fuel injector nozzles remained installed in their respective cylinders. Cylinder #2 nozzle was impact damaged. No obstructions were noted in the undamaged nozzles.
- The fuel pump was impact separated from the engine. The fuel pump sustained impact damage to the lever-end of the unit and could not be actuated by hand due to the damage. The fuel pump vent area was impact damaged and separated from the unit. Evidence of fuel was found when the outlet house was removed from the fuel pump. No obstructions were noted in the outlet or the inlet hoses for the fuel pump. The fuel pump was disassembled for further evaluation. Corrosion was noted internally to the fuel pump on the fuel side of the unit. The corrosion was likely secondary occurrence from outdoor storage post mishap.
- The oil filter remained attached to the accessory housing but was impact damaged. The impact damage prevented standard removal. The housing was carefully cut open while installed on the engine and the element was removed and examined. The oil filter element was clean. The oil suction screen remained in the oil sump assembly. The screen was removed and found to be clean. The oil cooler was impact damaged and separated from the engine. Oil was present at the oil cooler hose ends.
- Crankshaft rotation was achieved when force was applied to the vacuum pump drive on the accessory housing. Continuity was confirmed and thumb compressions were observed on cylinders 3 and 4. A differential pressure gage was used to determine compression on cylinder number 2 and the cylinder was observed to hold 68/80 cold compression. No damage to the valves, valve springs, or rocker arms was noted on the cylinder. Cylinder #1 had impact damage to a pushrod tube, the remaining pushrod moved the corresponding valve in an expected manner. All cylinders were examined using a borescope. No obvious anomalies were found.
- The intake tubes for cylinders 1 and 2 remained partially attached to their respective cylinder heads and were impact damaged. Cylinders 3 and 4 intake tubes were impact separated from the engine. The exhaust system exhibited heavy crush damage from the impact sequence. The muffler was recovered and

impact damaged with portions of the exhaust stacks still attached.

- The engine was equipped with an air/oil separator that was impact damaged. The unit remained bracketed to the engine mounts. The hoses remained attached to their correct locations.

PROPELLER

The propeller was impact separated from the engine. The crankshaft flange remained attached to the propeller assembly.

One blade of the propeller exhibited damage on the trailing edge surface in two locations consistent with the impact damage to the starter and the engine crankcase during the mishap sequence. The opposite blade showed signs of impact damage with 'S' bending signatures, consistent with rotation at impact.

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