



NATIONAL TRANSPORTATION SAFETY BOARD

**Office of Aviation Safety
Western Pacific Region**

SITE and EXAMINATION INFORMATION

**NTSB Accident: WPR16FA158
Accident Date: August 2, 2016**

Activity Dates: August 3-6, 2016

This document contains 65 embedded images
(sources: FAA, Continental Motors, & NTSB)

NOTE: Some site images appear in the 'Recovery Facility' section because the subject components were not able to be identified until the airplane was partially reconstructed

A. ACCIDENT

Location: Flagstaff, Arizona
Date: August 2, 2016
Aircraft: Piper Seneca II, N82806, Serial # 34-8170021
NTSB IIC: Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
Air Safety Investigator
National Transportation Safety Board
Western Pacific Region

Tom Vernon
Airworthiness Inspector
Federal Aviation Administration
Scottsdale, Arizona

Michael Hicks
Air Safety Investigator
National Transportation Safety Board
AS-20 Division

Kurt Gibson
Air Safety Investigator
Continental Motors
Mobile, Alabama

C. SUMMARY

On August 2, 2016, about 2122 Mountain Standard time, a Piper Seneca II, N82806, was destroyed when it impacted trees and terrain shortly after takeoff from Flagstaff Pulliam Airport (FLG), Flagstaff, Arizona. The airline transport pilot received fatal injuries. The personal flight was being conducted as a medical delivery mission for the volunteer organization Flights for Life (FFL), under the provisions of Title 14 Code of Federal Regulations Part 91. Night visual meteorological conditions prevailed at FLG at the time of the accident.

All major components were accounted for. No evidence consistent with in-flight fire or pre-impact mechanical failure was observed.

D. RESPONSE and SITE LOCATION INFORMATION

1.0 Responses

- First responders began arriving at the accident site about 5 minutes after the accident occurred. Responding agencies included:
 - Coconino County Sheriff's Office
 - Arizona Department of Public Safety (AZ DPS)
 - DPS Air Rescue
 - Flagstaff Police
 - Highlands Fire
 - AZ Department of Transportation (DOT)

- There were no known eyewitnesses to the accident
- Several persons ("eyewitnesses") heard the airplane flying and the impact; many were from the adjacent residential neighborhood
- The FAA representative arrived about 1100 August 3
- NTSB and Continental Motors representatives arrived about 1730 August 3
- The wreckage was recovered to a secure facility (Air Transport, Phoenix AZ) the evening of August 4

2.0 Location & Geographic Information

- The accident site was located on Coconino National Forest property on the east side of AZ Hwy 89A, about 3 miles south of the junction of 89A and I-17 in Flagstaff, AZ
- The first tree strike was located 2.64 nm, on a true bearing of 236°, from the KFLG Rwy 3 threshold
- The elevation of the location of the first tree struck ("Tree 0") was 6,948 ft msl
- The wreckage trajectory/debris field was oriented on a true heading of 042°
- Geographic Coordinates

	Lat	Long
Tree 0	35° 06 22.008	111° 43 27.312
Main Wreckage	35° 06 24.798	111° 43 24.972
End	35° 06 24.942	111° 43 23.316

- The site terrain was level, with moderately spaced trees (primarily mature pines about 60 – 100 ft tall) and generally sparse undergrowth
- The debris field was oriented approximately parallel to Hwy 89A, and offset about 125 feet from the eastern edge of the highway
- A residential neighborhood, with large, widely-spaced homes and an integral golf course, was situated about one-third of a mile east of the accident site

3.0 Additional Information

- The pilot regularly used the airplane to fly volunteer missions for United Blood Services (UBS)
- UBS was a medical services company that coordinated the collection, transport, and distribution of blood and tissue
- The accident flight was a scheduled pickup of drawn blood
- The morning of August 3, it rained for a few hours at the site
- The pilot had purchased the airplane in March 2015, and had the bulk of the maintenance records on board
 - His mechanic stated that this was because the pilot was trying to organize those records
- The pilot's son reported that the pilot was a "gadget guy" who owned multiple laptop computers and other portable electronic devices (PEDs)

E. DEBRIS FIELD

1.0 General

- The wreckage was highly fragmented
- The approximate debris field shape could be contained in a long rectangle
 - Minor axis approximately 60 feet
 - Major axis approximately 600 feet
- The airplane "topped" (cut/broke off tops of) eight trees (including Tree 0)
 - These tree locations, and their remaining heights, were catalogued
- Several other trees bore minor to major impact scars, but only one of those was catalogued
- A debris field map was developed to possibly aid in determination of the impact attitude of the airplane
 - A reference line was extended Tree 0 NE, parallel to the approximate wreckage path/direction of travel, through its approximated center. This value was termed "range"
 - Offsets left (-) or right (+) of the reference line, combined with range, were used to denote the locations of components
 - About 58 significant components were tagged and their locations catalogued, for generating the debris field map
- NOTE: The 58 tagged components represented only a very small fraction of the total quantity of debris field components, and those items were selected as a function of their perceived utility in determining airplane impact attitude. Therefore the debris field map is not necessarily representative of the entire debris field in terms of either the number of components, or their distribution density.
- Refer to a separate "Debris Field" document in the NTSB public docket for this accident for detailed information



Figure 1 - Treefall from Impact



Figure 2 - View of Tree Swath, Treefall, and Debris Field (partial)



Figure 3 - Tree Swath and Debris Field (partial)



Figure 4 - Treefall and Early Debris



Figure 5 – Debris Field (partial)



Figure 6 - Debris Field (partial)



Figure 7 - Main Wreckage



Figure 8 - Main Wreckage

2.0 Wreckage Information (Generic, on-scene)

- The largest wreckage elements included:
 - Mid-forward fuselage
 - Left firewall, engine mount, wing spar section, and left main landing gear (LMLG)
 - Right wing root and aft nacelle section
 - These three elements comprised the 'main wreckage' cited above
 - Left and right engines (fracture-separated from airplane)
 - Propellers (fracture-separated from engines)
- The LMLG remained partially attached to the airframe
- The RMLG was relatively intact but fracture-separated from the airplane
- The NLG was severely disrupted/fractured into multiple sections
- The left engine had struck 'Tree 8,' and was severely damaged
- The right engine was less damaged than the left engine



Figure 9 - Main Wreckage



Figure 10 - Main Wreckage



Figure 11 - Main Wreckage



Figure 12 - Engine Fragment



Figure 13 - Engine Fragment



Figure 14 - Engine Fragment



Figure 15 - Nose Landing Gear Segment

- Both propellers had fracture-separated from their respective engines
 - Each hub retained all 3 blades
 - All three blades in each hub were significantly damaged
 - Both spinners had fracture-separated from their respective propellers/hubs
- Many portions of the wings could not be readily identified as to where on the airplane they had originated
- The two composite wing tips had fracture-separated from their respective wing ends
- The vertical stabilizer, and most flight controls, had been fracture-separated into multiple sections
- The stabilator was fractured into two nearly complete sections
- A few flight or engine instruments were identified in the wreckage
- Portions of a switch panel and a circuit breaker panel were also identified
- The ELT was completely fracture-separated from the airframe and antenna
- The pitot cover was found free in the wreckage; its condition was consistent with it not being installed at the time of impact
- A few hundred pages of maintenance records and other airplane documentation were scattered throughout the debris field
 - Some were loose, and some were partially- or wholly-contained in notebooks
- Multiple computers and PEDs were present at the accident site
 - Some were intact and in flight/travel bags, while some were extensively damaged and/or not contained in any cases

Subsequent to the cataloging and photo-documentation of the debris field, the papers and personal effects were bagged separately. The flight controls and engines/engine components were also recovered separately. All the wreckage was recovered by Air Transport personnel for transport to Phoenix and subsequent analysis.



Figure 16 - Early Right Wing Fragment and Treefall



Figure 17 - Left Stabilator Fragment



Figure 18 - Right and Center Stabilator Fragment



Figure 19 - Entire Left Flap



Figure 20 - Instrument Cluster



Figure 21 – Altimeter Face



Figure 22 - Altimeter Barometric Setting



Figure 23 - Fuel Flow Gauge Face



Figure 24 - Cockpit Switch Panel



Figure 25 - Circuit Breaker Panel



Figure 26 - Circuit Breaker Panel



Figure 27 - ELT



Figure 28 - ELT



Figure 29 - Pitot Cover

F. RECOVERY FACILITY ACTIVITY & INFORMATION

NOTE: Parenthesized numbers [eg (#3)] denote debris field/database ID numbers

1.0 Flight Controls & Airframe Information

- The separately-collected items (documentation, flight controls, and engine-related components) were segregated out for detailed evaluation
- A 2-D layout of the flight controls was executed to enabled identification of as many critical components as possible
- Nearly all field-tagged (debris field data base) components were able to be positively identified
- All flight control surfaces were accounted for
- Damage precluded determination of flight control system continuity, or the condition or airworthiness of the pre-accident airplane
- Flap setting at impact was unable to be determined
- The left flap (#19) was fracture-separated as a continuous element
- The right flap was fracture-separated into 3 approximately equal-span segments (#8, 38, 41)
- The stabilator was fracture-separated into two main spanwise pieces (#18, 20)

- The chordwise fracture was located about 1 foot left of centerline
 - The left stabilator segment had two parallel slash cuts on the upper forward surface whose origin could not be determined
- The vertical stabilizer and rudder were fragmented into multiple pieces, some of which were not located/identified.
 - Fragments of the upper rudder and stabilizer (#1, 3, 4) were the earliest items in the debris field



Figure 30 - Left Engine and Nacelle Components



Figure 31 - Left Propeller, Spinner & Engine Mount



Figure 32 - Outboard Left Wing



Figure 33 - Left Wing and Nacelle



Figure 34 - Left Flap and Nacelle



Figure 35 - Left Stabilator



Figure 36 - Vertical Stabilizer and Rudder



Figure 37 - Tops of Vertical Stabilizer and Rudder



Figure 38 - L & R Stabilator, and Vertical Stabilizer Fragments



Figure 39 - Right Flap and Nacelle



Figure 40 - Right Flap and Nacelle Segments



Figure 41 - Right Wing and Fuselage



Figure 42 - Outboard Right Wing



Figure 43 - Outboard Right Wing



Figure 44 - Right Propeller, Spinner, & Cowls

- The rudder trim actuator (drum) remained attached to the lower rudder
 - The actuator extension measurement and thread count were consistent with an approximately neutral setting of the rudder trim tab



Figure 45 - Vertical Stabilizer and Rudder Segments



Figure 46 - Vertical Stabilizer and Rudder



Figure 47 - Rudder Trim Drum

- A completely-liberated trim actuator was identified by a Piper representative as the pitch trim actuator (drum)
 - The pitch trim drum position was about "50% nose up"
 - Normal travel for the stabilator pitch trim tab is $10^{\circ} 30' \pm 1^{\circ}$ nose up (tab down) and $6^{\circ} 30' \pm 1^{\circ}$ nose down (tab up).



Figure 48 - Pitch Trim Drum

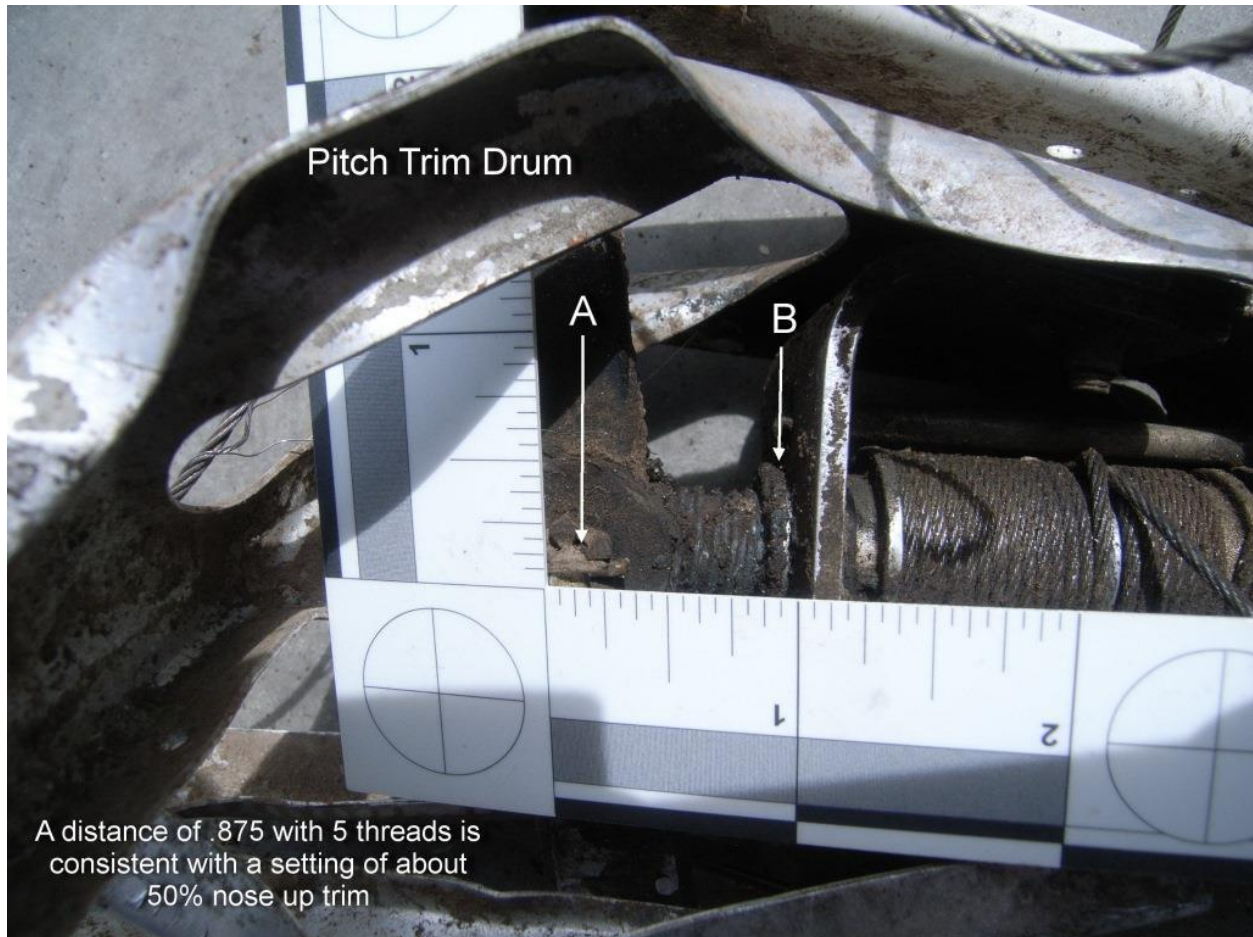


Figure 49 - Pitch Trim Drum

- Damage precluded reliable determination of engine control (throttle, mixture, propeller, ignition) settings
- Damage patterns were consistent with the landing gear being in the fully-retracted position at time of impact
- Damage precluded definitive determination of the latched/unlatched status of the three (one starboard entry, two port aft cargo) doors



Figure 50 - Starboard Entry Door (lower segment)



Figure 51 - Starboard Entry Door (upper segment)



Figure 52 - Starboard Entry Door (upper segment)



Figure 53 - Starboard Entry Door Upper Latch

2.0 Left Engine

NOTE- This engine directly impacted Tree 8, at a point about 6 ft agl.



Figure 54 - Left Engine

Core:

- Engine sustained a significant amount of impact damage
- All six cylinders remained attached and had impact damage
 - The even numbered cylinders were removed for visual inspection of the internal portion of the engine
 - Odd cylinders inspected with lighted borescope. No anomalies noted
- Crankshaft was partially rotated by hand tool and crankshaft continuity was established.
- Camshaft continuity was established by examining camshaft through even numbered cylinder bays
- Connecting rods were examined through the even numbered cylinder bays; all connecting rods were unremarkable
- Pistons displayed normal operating and combustion signatures

Fuel System:

- The fuel manifold valve was located along the wreckage path and was impact damaged. The valve was disassembled and no anomalies were noted.
- All of the fuel nozzles had varying degrees of impact damage.

Ignition System:

- All of the spark plugs had varying degrees of impact damage and several had fracture-separated from the engine.
 - Only two top spark plugs remained attached and were removed for inspection. The bottom even numbered spark plugs were inspected when the cylinders were removed and the bottom odd numbered cylinder spark plugs were inspected using a lighted borescope.
 - The inspected spark plugs displayed normal operating signatures.

Lubrication System:

- The accessory case and oil pump had fracture-separated from the rest of the engine and displayed impact damage signatures.
- The oil filter remained attached to the adapter and the adapter remained attached to the accessory housing.
- The oil filter housing was cut open and the filter pleats were inspected. There were no anomalies noted with the filter pleats.

Induction system:

- The majority of the induction system had fracture-separated from the engine.
- There were no pre-impact anomalies noted with the recovered induction components.

Exhaust System:

- A small portion of the exhaust system remained attached to the engine.
- There were no pre-impact anomalies noted with the recovered exhaust components.

3.0 Right Engine

Core:

- The engine sustained a significant amount of impact damage.
- The crankshaft was partially rotated by a hand tool and continuity was established with the crankshaft, camshaft, and connecting rods.
- The crankshaft was only capable of rotating a few degrees, which was consistent with impact damage to the engine.
- All of the cylinders remained attached to the engine and were impact damaged.
 - The cylinders were inspected using a lighted borescope; the #6 cylinder was unable to be inspected due to dirt impaction. There were no anomalies noted with the inspected cylinders.
- The pistons were inspected using a lighted borescope.
- The pistons displayed normal operating and combustion signatures.

Fuel System:

- The fuel manifold valve remained partially attached to the engine and displayed impact damage
- The manifold valve was disassembled and the internal components displayed normal operating signatures
- The fuel nozzles displayed varying degrees of impact damage. There were no anomalies noted

Ignition System:

- The spark plugs displayed varying degrees of impact damage
- The #6 top spark plug had fracture-separated from the cylinder
- The recovered spark plugs displayed normal operating signatures

Lubrication System:

- The accessory case and oil pump had fracture-separated from the rest of the engine and was impact damaged. There were no pre-impact anomalies noted
- The oil filter adapter had fracture-separated from the engine and the oil filter remained attached to the adapter
- The oil filter housing was cut open and the filter pleats were inspected; there were no anomalies noted

Induction System:

- The majority of the induction system had fracture-separated from the engine. The recovered components displayed normal operating signatures

Exhaust System:

- The majority of the exhaust system had fracture-separated from the engine. The recovered portions of the exhaust displayed normal operating signatures

4.0 Liberated Engine Components

The debris field consisted of numerous liberated components or component fragments that could not be readily associated with a particular (left or right) engine

Fuel System:

- Both fuel pumps displayed significant amount of impact damage. There were no pre-impact anomalies noted with the recovered portions of the fuel pumps
- One of the throttle and fuel metering assemblies was destroyed and only the throttle valve was located; there were no pre-impact anomalies noted with the valve
- The other throttle and fuel metering assembly displayed impact damage signatures and the throttle valve was found in the open position

Ignition System:

- All four magnetos displayed impact damage signatures

- All of the magnetos were spun by hand and the impulse couplings operated normally
- During impulse coupling operation all of the magneto posts were capable of producing a spark
- All of the ignition harnesses were severely impact damaged and all of the ignition leads were severed

Induction System:

- The majority of both engines' induction system components were located along the wreckage path
- There were no pre-impact anomalies noted with the recovered induction system components

Exhaust System:

- The majority of both engines' exhaust systems components were located along the wreckage path
- There were no pre-impact anomalies noted with the recovered exhaust components

Turbocharging system:

- Both turbochargers were located along the wreckage path and displayed impact damage
- Both turbochargers were capable of rotation
- The compressor of one of the turbochargers had fracture-separated and was not located
- Both overboost valves remained attached to the induction system and were impact damaged



Figure 55 - Turbocharger Fragment (exterior)



Figure 56 - Turbocharger Fragment (interior)



Figure 57 - Intact Turbocharger

5.0 Propellers:

There were several branches cut at clean $\sim 45^\circ$ angles, consistent with propeller cuts, located near the initial impact point



Figure 58 - Cut Limb

Left Propeller:

- The left propeller was fracture-separated from the engine and was located in the debris field
- All three propeller blades displayed bending and twisting deformation
- All of the blades had several leading edge gouges
- The blades appeared to be in normal (non-feathered) pitch positions
- The spinner was fracture-separated from the propeller



Figure 59 - Left Propeller

Right Propeller:

- The right propeller was fracture-separated from the engine and was located in the debris field
- All three propeller blades displayed twisting and bending deformation
- The blades appeared to be in normal (non-feathered) pitch positions
- The spinner was fracture-separated from the propeller, and retained the actuating piston



Figure 60 - Right Propeller

6.0 Fuel Strainers

- Two fuel strainers remained affixed to their respective (left and right) wing ribs.
- Both were relatively intact, except for displacement and some fractured fuel lines
- Both were removed from their mounts, and opened for internal examination
- Both were of the metal-cup, stacked-wafer design
- Left Strainer
 - Bowl/cap securely attached to one another
 - Devoid of fuel
 - No observed contamination or corrosion in bowl
 - Filter elements clean/unoccluded



Figure 61 - Left Fuel Strainer (in situ)



Figure 62 - Left Strainer (disassembled)

- Right Strainer
 - Bowl/cap securely attached to one another
 - Trace amounts of fuel (clear/straw-colored avgas)
 - No observed contamination or corrosion in bowl
 - Filter elements clean/unoccluded



Figure 63 - Right Fuel Strainer (in situ)



Figure 64 - Right Strainer (removed from aircraft)



Figure 65 - Right Strainer (disassembled)