

NATIONAL TRANSPORTATIONS SAFETY BOARD
Office of Aviation Safety
Washington, DC 20594

SUMMARY OF AIRCRAFT EXAMINATION

-- CEN19LA051 --

A. ACCIDENT

Location: Beaver Island, Michigan
Date: December 30, 2018
Time: 1948 central daylight time
Aircraft: Piper PA-23 (s/n 23-748), N2146P

B. PARTICIPANTS

Timothy Sorensen
Senior Aviation Accident Investigator
National Transportation Safety Board
Denver, Colorado

Jon Hirsch
Air Safety Investigator
Piper Aircraft, Inc.
Vero Beach, Florida

Troy Helgeson
Air Safety Investigator
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C. ACCIDENT SUMMARY

On December 30, 2018, about 1948 eastern standard time, a Piper PA-23 airplane, N2146P, impacted a wooded area shortly after takeoff from runway 27 at the Beaver Island Airport (SJX), Beaver Island, Michigan. The accident site was located about one-third mile north of the airport. The pilot sustained fatal injuries. The airplane was destroyed. The airplane was registered to a limited liability company and operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 flight. Dark night visual meteorological conditions prevailed. The flight was originating at the time of the accident and was destined for the Fitch H Beach Airport (FPK), Charlotte, Michigan.

Summary of Aircraft Examination

D. DETAILS OF AIRCRAFT EXAMINATION

The airplane was recovered from the accident site to the Island Airways facility at Welke Airport (6Y8) after the accident. A post-recovery examination was conducted by the NTSB investigator-in-charge on March 5, 2019.¹ Piper Aircraft and Lycoming Engines provided technical support as parties to the investigation.

E. DESCRIPTION OF ACCIDENT SITE

The accident site was located in a wooded area about one-third mile north-northeast (022°) of the departure end of runway 27 at SJX. Aerial imagery provided by the FAA indicated that the initial tree impact was located about 115 feet from the main wreckage. The impact path was oriented on an approximate 025° heading. The approximate coordinates of the main wreckage were 45.6975° north latitude and 85.5743 west longitude.

F. SUMMARY OF AIRCRAFT EXAMINATION²

Airframe – Piper PA-23 (s/n 23-748)

The fuselage was fragmented consistent with impact forces. The nose section forward of approximately fuselage station (FS) 50 was separated from the center fuselage/cabin area and fragmented. The instrument panel was separated from the surrounding structure. A majority of the instrumentation was separated and destroyed. The upper fuselage structure from the windshield aft was separated. The cabin entry door was separated and fragmented. The aft baggage compartment door remained partially attached to a fragment of the fuselage. The fuselage from FS 250 aft was separated and deformed. The horizontal stabilizers remained attached to the aft fuselage section; both exhibited aft leading-edge crushing damage. Both elevators remained attached at the inboard hinges; the outboard hinge points were separated. The outboard portions of the elevators were separated consistent with impact forces. The elevator torque tube assembly remained attached to both elevators. The torque tube was separated from the centerline hinge. The elevator stops were intact and unremarkable. The vertical stabilizer was separated at the root consistent with impact forces. The rudder remained attached to the vertical stabilizer through the rudder trim mechanism; both rudder hinge points were separated. The stabilizer and rudder were deformed. The rudder trim tab remained secured to the rudder. The rudder torque tube assembly was separated from the rudder consistent with impact forces.

The pilot and co-pilot control wheel assemblies remained with the instrument panel. The pilot control wheel was separated from the control column at the universal hinge. The co-pilot control wheel remained attached to the control column. The control column was separated from the fuselage. The aileron chain assembly was not present with the recovered wreckage. A portion of the aileron control cable assembly, including the center fuselage swages, was observed passing through the left side pulley near the wing attach point. The aileron cable was separated outboard of the pulley and exhibited fraying consistent with tension overstress. The forward ends of the aileron cables forward of the main wing spar were separated with signatures consistent with recovery cuts. The

¹ The NTSB did not respond to the site at the time of the accident due to a temporary lapse in agency funding.

² Directions related to accident site placement and component damage/deformation are with respect to an intact airframe unless otherwise noted.

Summary of Aircraft Examination

F. SUMMARY OF AIRCRAFT EXAMINATION *(continued)*

forward elevator control tube assembly was separated from the control column at the rod end which was fractured consistent with impact; the rod end bearing remained secured to the control column. The recovered elevator control tubes were deformed and separated consistent with impact forces or cut to facilitate recovery. The rear elevator control tube assembly remained attached to the aft fuselage bellcrank and to the elevator control torque tube. The rudder pedal assembly was separated from the fuselage and separated into three segments. The rudder cables remained attached to the left and right rudder pedal torque tube arms. The rudder cables exhibited separations consistent in appearance with overstress. Rudder cable segments remained attached to the rudder torque tube bellcrank. Elevator and rudder trim control cables were separated consistent with the observed airframe damage. The elevator trim actuator extension was about 2.25 inches (14 threads).³ The rudder trim jackscrew extension was approximately 1 inch (9 threads).⁴ The flap actuator was not observed with the recovered wreckage and, as a result, the flap position could not be determined.

The throttle quadrant and the fuel control panel were damaged and separated from the mating airframe structure. The left fuel selector handle was observed in the "MAIN" tank position. The right fuel selector handle was observed in the "AUX" position. The crossfeed lever and the crossfeed drain knob were both in the "OFF" position. Both primer pump knobs were in the stowed and locked position.

The left wing was separated from the fuselage at the root and damaged consistent with impact forces. The engine was separated from the wing. The main landing gear was partially extended, and the strut was fractured. The wing structure outboard of the main fuel tank and the wing tip were separated. The aileron remained attached to the wing by one hinge. The aileron was impact damaged and folded approximately midspan. The aileron cable and balance cable remained attached to the bellcrank. The bellcrank remained attached to its surrounding structure but was separated from the wing. The bellcrank stops were unremarkable. The flap was separated from the wing and exhibited impact damage. The inboard end of the flap was cut off during the recovery process. The separated piece was not observed among the wreckage. The pitot mast remained attached to the wing and was damaged. The fuel strainer was not located among the wreckage. The fuel shutoff valve and aux tank valve were separated and damaged consistent with impact forces.

The right wing was separated from the fuselage at the root and damaged consistent with impact forces. The engine was separated from the wing. The main landing gear was partially extended, and the strut was damaged. The outboard end of the wing was separated outboard of the main fuel tank. The aileron separated from the wing and fractured approximately mid-span. The outboard portion of the aileron exhibited impact damage to the leading edge. The aileron bellcrank was fractured and destroyed. The aileron cable and balance cable remained attached to their respective bellcrank fragments. The bellcrank stops were not observed. The flap was separated from the wing and all of the hinges exhibited cuts consistent with the recovery processes. The fuel strainer cap

³ A representative of the airframe manufacturer reported that elevator trim position corresponded to a slight nose down setting.

⁴ A representative of the airframe manufacturer reported that the rudder trim position corresponded to a neutral setting.

Summary of Aircraft Examination

F. SUMMARY OF AIRCRAFT EXAMINATION *(continued)*

was fractured. The fuel strainer bowl and screen were not observed with the recovered wreckage. The fuel shutoff valve and aux tank valve were damaged consistent with impact. The wing tip was separated from the wing.

Left Engine – Lycoming O-360-A1D (s/n L-16551-36A)

Left Propeller – Hartzell HC-C2YK-2CUF/FC7666A-4Q (s/n AU15234B)

The left engine was separated from the airframe at the time of the post-recovery examination. The engine cowling had been removed; the baffling remained attached. The forward portion of the engine mount remained attached to the engine. Portions of the engine mount had been cut presumably to facilitate recovery. The engine assembly exhibited minor damage consistent with impact forces, but otherwise appeared to be intact. The exhaust was deformed consistent with impact forces. The intake appeared to be intact. The carburetor was separated from the engine but was partially retained by the throttle cable. The remaining components remained secured to the engine assembly.⁵ The oil pickup screen was clear.

Internal engine continuity was confirmed through rotation of the crankshaft via the vacuum pump drive. Compression and suction were obtained on all cylinders. Borescope examination of each cylinder did not reveal any anomalies consistent with a loss of engine power. The upper spark plugs were intact and exhibited normal operating signatures. The lower spark plugs were observed as part of the borescope examination. Normal operating signatures were observed. The ignition harness common to the lower spark plugs was damaged. The magnetos remained secured to the engine. Both magnetos produced a spark on all leads when rotated by hand.

The carburetor housing was fractured near the mounting flange consistent with overstress. The component was retained by the throttle cable. The throttle cable installation appeared to be non-standard with a turnbuckle securing the cable end fitting to the throttle lever clevis. Safety wire was installed between the turnbuckle, the end fitting, and the clevis fitting. The threaded stud appeared to have been braised to the body of the turnbuckle. The braised joint was intact; however, the threaded stud was bent and fractured consistent with an overstress separation. The throttle lever and butterfly valve appeared intact and were free to rotate. The mixture lever appeared undamaged and was free to rotate. The mixture cable had separated from the lever; although, a portion of the rod end remained attached to the lever. The carburetor floats, needle valve, mixture control and accelerator pump appeared intact and functional. The fuel screen was intact and free of debris or sediment. The carburetor bowl exhibited minor corrosion consistent with storage after the accident. It was free of sediment or debris.

The engine driven fuel pump remained secured to the engine and appeared undamaged. The pump drive lever was free to move and provided suction/compression at the fuel inlet/outlet when actuated. The electric backup fuel pump was recovered from the airframe and ran when electrical power was applied.

The hydraulic pump and propeller governor remained secured to the engine. The input drive of both components rotated freely by hand. The propeller governor inlet oil screen

⁵ The components were removed during the examination.

Summary of Aircraft Examination

F. SUMMARY OF AIRCRAFT EXAMINATION *(continued)*

was intact and free of debris. Neither component was disassembled or examined further. The oil filter was secured to the engine and intact. The engine oil screen was removed; it was intact and free of debris or sediment.

The left propeller assembly had separated from the engine. The crankshaft was fractured immediately aft of the propeller flange, in line with the forward face of the crankcase. The fracture surface exhibited 45° shear lips consistent with a bending overstress failure. The spinner remained attached and was deformed. The hub and dome were intact and appeared undamaged. The starter ring gear was fractured with the outer circumference remaining securely attached. Both propeller blades remained secured to the hub. The counterweights remained secured to the blades. Both blades were curled aft near the tip and exhibited localized chordwise scratches and abrasions. Small portions of each blade tip had separated.

Right Engine – Lycoming O-360-A1D (s/n L-21431-36A)⁶

Right Propeller – Hartzell HC-C2YK-2CUF/FC7666A-4Q (s/n AU15241B)

The right engine was separated from the airframe at the time of the post-recovery examination. The engine cowling had been removed; the baffling was damaged. The forward portion of the engine mount remained attached to the engine. The engine assembly exhibited damage consistent with impact forces. The no. 1 cylinder valve cover, rocker arms, push rods, and shroud tubes were separated. The outboard portion of the cylinder head common to the rocker arm pivot was fractured. The no. 2 cylinder exhibited impact damage to the cooling fins and forward push rod shroud tube. The no. 3 cylinder exhibited impact damage to the valve cover and cylinder head. The no. 4 engine cylinder appeared intact. The intake and exhaust were deformed and/or separated consistent with impact forces. The forward portion of the oil sump was fractured. The carburetor was separated and not recovered with the wreckage. The remaining components remained secured to the engine assembly.⁷ The oil pickup screen was clear.

Internal engine continuity was confirmed through rotation of the crankshaft via the vacuum pump drive. Compression was not obtained on cylinder nos. 1 and 3, which was consistent with the impact damage noted previously. Compression and suction were obtained on cylinder nos. 2 and 4. Borescope examination of each cylinder did not reveal any anomalies consistent with a loss of engine power. The upper spark plugs were intact and exhibited normal operating signatures. The lower spark plugs were observed as part of the borescope examination. Normal operating signatures were observed. The ignition harness was damaged. The left magneto remained secured to the engine; the right magneto was separated and recovered with the wreckage. Both magnetos produced a spark on all leads when rotated by hand.

The carburetor was separated and not recovered with the wreckage. The engine driven fuel pump remained secured to the engine and appeared undamaged. The pump drive lever was free to move and provided suction/compression at the fuel inlet/outlet when

⁶ A data plate was not present on the engine at the time of the exam. The serial number noted was taken from the airplane maintenance records.

⁷ The components were removed during the exam.

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F. SUMMARY OF AIRCRAFT EXAMINATION *(concluded)*

actuated. The electric backup fuel pump was recovered from the airframe and ran when electrical power was applied. The vacuum pump remained secured to the engine and appeared intact. The drive coupling was intact and free to rotate. Upon disassembly, the vanes and rotor were intact.

The right propeller assembly had separated from the engine. The crankshaft was fractured immediately aft of the propeller flange, in line with the forward face of the crankcase. The fracture surface exhibited 45° shear lips consistent with a bending overstress failure. The spinner remained attached and was deformed. The hub and dome were intact and appeared undamaged. The starter ring gear was fractured with the outer circumference remaining securely attached. The propeller flange remained securely attached to the assembly. Both propeller blades remained secured to the hub. The counterweights remained secured to the blades. One blade was curled aft near the tip; it appeared otherwise intact. The second blade was deformed over the outboard half of the span. Both blades exhibited localized chordwise scratches and abrasions.