

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

SUMMARY OF AIRCRAFT EXAMINATION

-- CEN18FA216 --

A. ACCIDENT

Location: Monroe, Wisconsin
Date: June 10, 2018
Time: 1201 central daylight time
Aircraft: Cessna T182T (s/n T18209078), N1880B

B. PARTICIPANTS

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

Peter Hupfer
Principal Maintenance Inspector
Federal Aviation Administration
Milwaukee, Wisconsin

Peter Basile
Senior Air Safety Investigator
Textron Aviation
Wichita, Kansas

Troy Helgeson
Air Safety Investigator
Lycoming Engines
Williamsport, Pennsylvania

C. ACCIDENT SUMMARY

On June 10, 2018, at 1201 central daylight time, a Cessna T210T airplane, N1880B, was destroyed during an in-flight collision with trees and terrain about $\frac{3}{4}$ mile north of the Monroe Municipal Airport (EFT), Monroe, Wisconsin. The pilot and three passengers were fatally injured. The airplane was registered to and operated by a private individual as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Day instrument meteorological conditions prevailed. The flight was operated on an instrument flight rules flight plan. The flight originated from the Kenosha Regional Airport (ENW) at 1126 and was destined for EFT.

Summary of Aircraft Examination

D. AIRCRAFT DESCRIPTION

Airframe

The Cessna T182T was a single-engine, high-wing, four-place airplane, with a fixed tricycle landing gear. It incorporated a conventional flight control arrangement, with the flight control surfaces directly actuated by cables from the cockpit controls. The accident airplane was issued a normal category standard airworthiness certificate in June 2012.

Engine / Propeller

The Lycoming TIO-540-AK1A was a six-cylinder, horizontally-opposed engine capable to developing 235 horsepower. The engine was a turbocharged, fuel-injected, air-cooled design. Thrust was provided by a three-blade McCauley B3D36C442/80VSB-1 constant speed (variable pitch), hydraulically actuated propeller assembly. The engine and propeller were controlled through direct cable linkages from the cockpit controls to the engine throttle body and propeller governor.

E. DETAILS OF AIRCRAFT EXAMINATION

An on-scene examination was conducted on June 11, 2018, under the direct supervision of the NTSB investigator-in-charge. The Federal Aviation Administration, Textron Aviation, and Lycoming Engines provided technical support as parties to the investigation. The airplane was recovered to Wentworth Aircraft on June 12, 2018.

F. DESCRIPTION OF ACCIDENT SITE

The accident site was located in a wooded ravine about $\frac{3}{4}$ mile north-northwest of EFT. The debris path was oriented on an approximate 120-degree magnetic bearing. The initial tree strike was about 80 feet above ground level and located at approximate coordinates 42.6278° north / 89.5979° west. A second tree strike about 12 feet above ground level was located approximately 32 feet from the initial strike. An impact crater about 6 feet in diameter and 2 feet deep was located about 15 feet from the second tree strike.

The main wreckage came to rest near the top of the ravine at approximate coordinates 42.6277° north / 89.5975° west. The main wreckage was located about 114 feet from the initial tree impact. The terrain rose about 20 feet from the initial tree impact to the top of the ravine. The wooded area ended near the top of the ravine; the area east of the woods was open and consisted of tall grass. The left cabin door was separated and located about 74 feet from the main wreckage along the debris path. The left main wheel had separated from the strut and was located about 143 feet northeast from the main wreckage, left of the main debris path.

G. SUMMARY OF AIRCRAFT EXAMINATION¹

Airframe – Cessna T182T (s/n T18209078)

The airframe was fragmented. Minor debris was located in the vicinity of the initial tree strike. Portions of the outboard right wing and right aileron were located between the initial tree strike and the impact crater. The aileron was separated into three segments. The outboard aileron segment remained attached to the wing structure at the hinge. The outboard wing structure exhibited crushing damage and a semi-circular impression

¹ Directions related to accident site placement and component damage/deformation are with respect to an intact airframe unless otherwise noted.

Summary of Aircraft Examination

G. SUMMARY OF AIRCRAFT EXAMINATIONS *(continued)*

consistent with a tree impact. No evidence of fire damage was observed on these wing/aileron segments.

The inboard section of the right wing was wedged upright against a tree adjacent to the impact crater. The wing section was deformed and the leading edge exhibited crushing damage. In addition, the inboard wing section exhibited thermal damage. The damage was concentrated near ground-level; although, a majority of the wing section displayed discoloration and sooting. Portions of the wing skin had been consumed.

The main wreckage consisted of the fuselage, empennage, and engine. The fuselage was fragmented and exhibited thermal damage which had consumed a majority of the structure from the firewall to the aft fuselage. The vertical and horizontal stabilizers remained attached to the aft fuselage. The engine had separated from the airframe and was located adjacent to the fuselage.

The left horizontal stabilizer and elevator were deformed. The left elevator was partially separated. The elevator torque tube had separated from the arm assembly consistent with overstress. The inboard right horizontal stabilizer was deformed and the outboard portion was separated. The right elevator was partially separated. The vertical stabilizer and rudder exhibited aft, downward crushing. The rudder remained attached at the lower hinge. Portions of the vertical and the right horizontal stabilizers exhibited discoloration consistent with thermal exposure.

Fragments of the outboard right stabilizer were located in the debris path. The outboard end of the right elevator with the counter-weight attached was located near the impact crater. None of these fragments displayed any evidence of thermal damage.

The left wing separated from the fuselage near the root. It came to rest inverted about 15 feet beyond the main wreckage. The wing was deformed and exhibited impact damage over the entire assembly, with discoloration and sooting consistent with thermal damage concentrated near the wing root. The aileron remained attached to the wing. The wingtip had separated and was fragmented. The flap had separated and was located about 20 feet north of the main wreckage; left of the debris path centerline. The aileron, flap and wing tip did not display any evidence of thermal damage.

The aileron control system exhibited multiple separations which appeared consistent with overstress due to impact forces. The left and right wing bellcranks appeared to be intact. The aileron control and balance cables remained attached to the bellcranks. The left aileron control rod between the bellcrank and the aileron was separated consistent with overstress; the right-wing aileron control rod was bent but was otherwise intact. A portion of the firewall, which included the aileron interconnect pulleys, was imbedded into the aft side of the engine. Aileron control and interconnect cable segments remained attached to the pulleys.

Elevator control cable continuity was verified from the aft elevator arm assembly to the cockpit area. The control cable corresponding to up elevator remained attached to the cockpit arm assembly; the control cable corresponding to down elevator was separated at the cockpit arm assembly consistent with overstress. Both arm assemblies had separated from the torque tube consistent with impact forces. The elevator trim push-pull tube

Summary of Aircraft Examination

G. SUMMARY OF AIRCRAFT EXAMINATIONS *(continued)*

remained attached to the trim tab and to the actuator. The elevator trim cable remained attached to chain at the trim actuator; the chain remained engaged on the sprocket. Actuator extension was about 1.7 inches.² The trim cables were continuous to the cockpit trim control chain. The chain had separated from the trim wheel sprocket consistent with impact damage. Rudder control cable continuity was confirmed from the rudder horn at the control surface to the cockpit rudder pedal torque tubes.

The flap actuator was separated and located with the right wing. The actuator was in the retracted position consistent with a flaps-up position. The actuator remained attached to the sector assembly and flap cable segments remained attached to the sector. The cable separations appeared consistent with overstress failures.

The fuel selector assembly was deformed consistent with impact forces and discolored consistent thermal exposure. The selector handle was separated. The valve appeared not to be in a specific detent. Air flow was detected at the left tank position when air was blown into the engine outlet.

The standby attitude indicator was separated from the instrument panel and located in the debris path. The instrument case was crushed. The gyro housing was displayed a dent on one side. The housing cavity exhibited rotational scoring and rub marks. The gyro exhibited an impression consistent with the dent in the housing. It also displayed rotational scoring consistent with rotation at impact. The vacuum pump was separated and located in the debris path. The drive shaft and coupling were intact. The rotor was fractured; the vanes appeared intact.

The observed thermal damage appeared consistent with a post-impact fire. No evidence of soot trails or thermal damage consistent with an in-flight fire was observed.

Engine – Lycoming TIO-540-AK1A (s/n L-13805-61A)

Propeller – McCauley B3D36C442/80VSB-1 (s/n 111102)

The engine came to rest inverted with the main wreckage. It was separated from the airframe and exhibited damage consistent with impact forces. The engine was located adjacent to the fuselage at the accident site. It did not exhibit any evidence of thermal damage due to an external fire source.

The fuel injection servo, alternator and starter had separated from the engine and were located in the debris path. The engine driven fuel pump remained secured to the engine. The auxiliary fuel pump was separated from the airframe and located in the debris path. The gascolator remained attached to the firewall and exhibited thermal damage. The gascolator bowl was clean; the screen appeared to be intact and free of contamination.

Each cylinder remained secured to the crankcase. The forward intake/exhaust ducting was separated. The ducting to the remaining cylinders was deformed and/or partially separated. Push rod tubes on multiple cylinders were bent. Borescope examination did not reveal any anomalies. Internal engine and accessory section continuity was confirmed by rotation of the crankshaft. Compression was obtained on each cylinder.

² The airframe manufacturer noted that a 1.7-inch actuator extension corresponded to a 15° tab trailing tab up position.

Summary of Aircraft Examination

G. SUMMARY OF AIRCRAFT EXAMINATIONS *(concluded)*

The valve rocker arms and springs remained in place, appeared undamaged and were oil wetted. The oil screen was intact and free of debris. A portion of the oil sump adjacent to the lower right engine mount was broken out.

The right magneto remained attached to the engine. The left magneto was separated and located in the debris path. Both magnetos provided a spark at all leads with exception of one lead on the left magneto which had been pulled out of the housing. The ignition harness was damaged and could not be evaluated. The spark plugs were damaged consistent with impact. The upper spark plugs were removed; they exhibited normal combustion signatures.

The fuel injection servo exhibited damage consistent with impact. The butterfly valve and throttle arm were in place; although, the arm was bent. The rod end common to the throttle control linkage remained attached to the arm; however, the remainder of the linkage was separated. The throttle arm and butterfly valve rotated with difficulty. The fuel screen was intact and appeared free of contamination and sediment.

The turbocharger was separated from the engine; although, it was retained by the oil lines and located adjacent to the engine at the accident site. The housing was displaced relative to the compressor/turbine assemblies. The compressor blades were curled and damaged consistent with rotation at impact. The wastegate assembly remained attached to the turbocharger. The wastegate controller linkage appeared intact. The butterfly valve remained in position and rotated with difficulty. Both the turbocharger and the wastegate assemblies displayed damage consistent with impact. Neither exhibited any discoloration, sooting or erosion damage consistent with a fire.

The propeller hub remained attached to the engine propeller flange; however, the hub had fractured, and the propeller blades were separated. One blade was embedded into the ground at the impact crater. The other two blades were located in the debris path. Portions of the fractured hub and the piston were also recovered in the debris path. The propeller blades were intact over the length of the blade. Two blades displayed gradual forward bending near mid-span with minor scraping damage. The third blade appeared to be undeformed; however, it did exhibit a trailing edge gouge near mid-span.