

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

SUMMARY OF AIRCRAFT EXAMINATION

-- CEN19FA259 --

A. ACCIDENT

Location: Sumner, Iowa
Date: August 8, 2019
Time: 0721 central daylight time
Aircraft: Air Tractor AT-502B (s/n 502B-0275), N6113C

B. PARTICIPANTS

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C. ACCIDENT SUMMARY

On August 8, 2019, at 0721 central daylight time, an Air Tractor AT-502B, N6113C, impacted power lines, a power line support pole, a road, a tree, and terrain near Sumner, Iowa. The pilot was fatally injured. The airplane was destroyed by impact forces and a postimpact fire. The airplane was registered to and operated by Air Advantage Inc., Mt. Pleasant, Iowa, as a Title 14 *Code of Federal Regulations* Part 91 repositioning flight. Visual meteorological conditions prevailed, and the flight was not operated on flight plan. The flight originated from Mt. Pleasant Municipal Airport (MPZ), Mt. Pleasant, Iowa, about 0615 and was destined for Oelwein Municipal Airport (OLZ), Oelwein, Iowa.

Summary of Aircraft Examination

D. AIRCRAFT DESCRIPTION

Airframe

The Air Tractor AT-502B is a single-place, single-engine airplane, with a conventional (tailwheel) landing gear arrangement. The airplane was designed for agricultural operations. It is certificated as a restricted category airplane, with a maximum gross takeoff weight of 9,400 lbs.

Engine

The Pratt & Whitney Canada PT6A-34AG turboprop engine is capable of producing up to 750 shaft horsepower (shp) at an output speed of 2,200 rpm. The engine is a reverse flow, free turbine design, consisting of a four-stage axial compressor, a single-stage centrifugal compressor, an annular combustion chamber, a single-stage gas generator turbine, and a two-stage power turbine.

Propeller

The Hartzell HC-B3TN-3D propeller assembly is a three-blade, hydraulically actuated, constant speed design, with feathering and reverse pitch capability. The propeller blades are constructed of aluminum alloy. The hub is constructed of alloy steel. Propeller rotation is clockwise as viewed from the rear (pilot seat). Propeller blade operating angles corresponded to: -8.0° for reverse (beta), 18.0° at low pitch position, and 87.0° at feather/high pitch position.

E. DETAILS OF AIRCRAFT EXAMINATIONS

An airframe examination was conducted at the accident site on August 9~10, 2019. Air Tractor provided support as a party to the investigation. The airplane was recovered to Wentworth Aircraft on August 10, 2019. An engine examination was conducted at Wentworth Aircraft on November 5, 2019. Pratt & Whitney Canada provided support as a technical advisor to the Transportation Safety Board of Canada. Both examinations were completed under direct oversight of the NTSB investigator-in-charge.

F. DESCRIPTION OF ACCIDENT SITE

The airplane initially struck power lines about 420 yards west-southwest of the accident site. The power lines paralleled a north-south gravel road and were approximately 40 feet off the ground. Corn fields were located on both sides of the power lines/roadway; the corn crop was about 8 feet high at the time of the accident. The location of the power line contact was along Whitetail Avenue about 325 feet south of Highway 93/First Street; a two-lane, east-west oriented roadway.¹

The airplane struck a second set of power lines and a small rooftop antenna about 200 yards west-southwest of the accident site. The roof top antenna was located about 120 feet south of Highway 93/First Street. A power line support pole was struck about 130 yards west-southwest of the accident site. It was broken off near ground level with the support pole fragments located nearby. The support pole was located along the south side of Highway 93/First Street. The outboard section of the left wing and the left aileron were located about 130 yards and 90 yards southwest of the accident site, respectively. The roadway pavement exhibited gouges and scrapes consistent with airframe contact

¹ The power lines had been repaired at the time of the on-scene examination. The local authorities (Bremer County Emergency Management) provided the information related to the power line damage.

Summary of Aircraft Examination

F. DESCRIPTION OF ACCIDENT SITE *(continued)*

and propeller strikes beginning about 90 yards southwest from the accident site. The path of the marks was oriented northwest in the direction of the accident site.

The airplane came to rest against a tree about 42 yards north of Highway 93/First Street in the yard of a combined use (residential/commercial) building. The approximate coordinates were 42°50'51.9" north / 092°07'01.1" west. The right wing was supported by the tree. The inboard portion of the left wing was resting on the ground. The main wreckage consisted of the fuselage, right wing, inboard portion of the left wing, and empennage. The left main landing gear spring had separated from the fuselage and was located in the yard. The left main wheel had separated and was located approximately 208 yards east of the main wreckage. The engine assembly, with the propeller attached, had separated from the airframe and was resting against the building about 12 yards north-northwest of the fuselage. A propeller blade tip fragment was recovered about 150 yards west of the main wreckage.

G. SUMMARY OF AIRCRAFT EXAMINATION²

Airframe – Air Tractor AT-502B (s/n 502B-0275)

The fuselage structure was intact with exception of the nose section, which was fragmented. The engine mount was fragmented. The engine cowling was separated, deformed and fragmented. The fuselage structure in the area of the hopper was deformed consistent with impact forces. The cockpit structural tubing exhibited localized damage but appeared otherwise intact. The aft fuselage structural tubing appeared intact. The entire fuselage exhibited thermal damage. The skin panels were consumed by the post-impact fire.

The pilot seat frame remained intact and securely attached to the fuselage seat rails. The left seat rail was bent. Both seat rails remained attached to the fuselage structure. The seat cushions were consumed. The seat belt anchors remained attached to the seat rail brackets; the belt webbing had been consumed. The belt buckles were laying on the ground near the cockpit area; the buckles were not latched at the time of the exam. The instrument panel and instruments were destroyed by the post-impact fire.

The right main landing gear remained attached to the fuselage. The left main gear spring was separated and located near the main wreckage. The left main tire/wheel was separated from the main gear spring and located at the accident site. The right main landing gear remained attached to the fuselage. The tail gear remained attached at the aft fuselage and appeared to be intact.

The left wing was fragmented. The outboard section, about 7 feet in length, was separated and deformed consistent with impact. The aileron was separated and fragmented. No evidence of thermal damage or sooting was observed on the outboard wing section or the aileron. The inboard portion of the left wing remained with the fuselage and was consumed by the post-impact fire. The left-wing spar was continuous from about mid-span to the center wing splice and remained attached to the fuselage structure. It was deformed and exhibited thermal damage. A section of the spar about

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

G. SUMMARY OF AIRCRAFT EXAMINATION *(continued)*

3 feet in length and common to the aileron bellcrank was separated from the inboard section and located adjacent to the main wreckage. The outboard section, about 2 feet in length, of the left flap was located with the main wreckage. It was discolored consistent with the post-impact fire. The remainder of the flap was consumed.

The right wing remained attached to the fuselage. It was damaged consistent with impact; the inboard portion was partially consumed by the post-impact fire. The aileron and flap remained attached to the wing; however, the inboard portion of the flap was consumed by the post-impact fire.

The left horizontal stabilizer remained attached to the fuselage, and the elevator was attached to the stabilizer. The inboard section exhibited thermal damage; the remainder of the assembly appeared intact. The right horizontal stabilizer remained attached to the fuselage at the bracing struts. The inboard sections of the stabilizer and elevator were consumed by the post-impact fire; the outboard sections exhibited thermal damage. The vertical stabilizer was consumed with exception of the upper portion which was thermally damaged. The rudder exhibited thermal damage and was partially consumed; it remained attached to the vertical stabilizer at the upper hinge point and to the aft fuselage at the lower hinge point. The wire deflector remained attached to both the cockpit canopy and the vertical stabilizer. The deflector cable exhibited minor abrasion near the aft end of the cable consistent with a wire strike.

All of the flight control system components exhibited thermal damage with exception of the outboard left- and right-wing components. In addition, several components were deformed consistent with impact forces. The cockpit control stick remained attached to the torque tube; the torque tube remained attached to the airframe. The aileron controls were continuous to the left- and right-wing roots. The left aileron main push rod was connected to the left fuselage bellcrank assembly. The push rod was separated consistent with impact forces in the area of the inboard wing section. The outboard portion of the push rod remained attached to the wing bellcrank. The bellcrank remained attached to the wing spar and appeared undeformed with exception of the attachment flanges. The bellcrank-to-aileron push rod was separated at the rod end common to the bellcrank. The push rod was deformed but remained attached to the aileron. The right aileron main push rod was connected to the right fuselage bellcrank assembly. The push rod was separated near the wing root consistent with impact forces. The right aileron control continuity was confirmed from the wing root to the control surface.

Flap control continuity was confirmed from the actuator to each flap assembly with exception of the right flap torque tube arm which had sustained thermal damage and was separated. The right flap push rod remained attached to control surface. The flap actuator motor remained attached to the airframe structure. The actuator was fully retracted consistent with a flaps up (retracted) control surface position. The aileron droop system was continuous; however, multiple push rods and links common to the system were deformed consistent with impact.³

³ The aileron and flap systems are interconnected through a mechanical system that causes both ailerons to be deflected downward slightly (drooped) when the wing flaps are extended in order to enhance airplane performance during takeoff and landing.

Summary of Aircraft Examination

G. SUMMARY OF AIRCRAFT EXAMINATIONS *(continued)*

The rudder control cables were continuous from the cockpit to the aft fuselage. The cables remained attached to the rudder horn and the horn was secured to the control surface. The right cable was abraded with several severed cable strands at the right horizontal stabilizer strut assembly.⁴ The forward ends of the cables remained connected to the attachment plates; however, the mating pedal adjustment channels had been consumed by the post-impact fire. In addition, the left rudder pedal was also consumed.

Engine – Pratt & Whitney PT6A-34AG (s/n PCE-57527)

The engine was separated from the airframe with the propeller assembly attached. The exhaust case was compressed and deformed. Both exhaust stacks were deformed. The gas generator case exhibited compressional and torsional deformation near the front of the case and compressional deformation towards the rear of the case in the 6 o'clock region. The inlet case with the accessories gearbox (AGB) attached had separated from the gas generator case at the "F" flange. The engine data plate was present on the AGB. The plate indicated the engine model as a PT6A-34AG and the serial number as PCE-57527.

The rod linkage from the fuel control unit (FCU) to the CAM box was bent but remained securely attached at both ends. The FCU and the FCU control lever sustained damage consistent with impact. The control lever could not be rotated. The CAM box was separated from the AGB. The push/pull cable from the CAM box to the power quadrant was separated. The reversing linkage was separated at the CAM box adjacent to the propeller governor. The front terminal clevis to the reversing lever was fractured. The reversing lever was displaced over the guide pin, which was damaged consistent with impact forces. The carbon block at the reversing lever end was separated. The propeller governor cable was fractured and the propeller governor sustained damage consistent with impact.

The P3 line to the P3 filter housing was separated; however, the P3 line fittings from the P3 filter housing to the FCU were secured. The P3 filter was removed; it appeared to be intact and was free of any sediment or debris.⁵ The Py line to the FCU was damaged and fractured at the fitting. The Py line fittings at the propeller governor and firewall appeared intact and were secure. A few metal slivers were present on the reduction gear box (RGB) magnetic chip detector. The engine did not have an AGB MCD. The main oil filter appeared intact and was free of any sediment or debris.

The ignitor leads were securely attached to the gas generator case. The leads were fractured and separated from the ignitor box which was not present. The fuel nozzles were in place except on the bottom of the gas generator case which was deformed consistent with impact forces; the flow divider and one adjacent fuel nozzle were separated. The bleed off valve remained attached but sustained damage consistent with impact forces with the housing partially exposed from the gas generator case.

The engine was split at the "C" flange. The compressor turbine (CT) blades appeared to be intact and showed no distress. Circumferential witness marks were present on the CT

⁴ The cable damage appeared consistent with pinching of the cable due to rotation of the strut during the accident sequence.

⁵ A smudge was introduced to the filter element during handling. It was not present when the filter was initially disassembled.

Summary of Aircraft Examination

G. SUMMARY OF AIRCRAFT EXAMINATIONS *(continued)*

blades and disc firtrrees consistent with contact from the power turbine (PT) vane ring inner shroud wall during operation. The CT disc bolt hole lip showed circumferential rubbing consistent with contact from the PT baffle. The CT rotated with difficulty; however, continuity was confirmed between the CT and the first stage compressor rotor. The first stage compressor housing was deformed consistent with impact forces. The first stage compressor blades appeared intact and exhibited minor foreign object damage consistent with debris ingestion during the impact sequence. The first stage compressor blades showed circumferential tip rubbing with raised material at the tips of several blades. The first stage compressor rotor input hub was fractured. The fracture surface appeared indicative of rotational shear. The CT was removed and no leading-edge blade damage was observed. Circumferential witness marks were observed on the CT blades and disc firtrrees consistent with contact from the CT vane ring inner shroud wall during rotation. The CT blade tips and shroud segments displayed circumferential rubbing marks, predominantly in the 3:00 to 6:30 o'clock region, consistent with mutual contact during rotation.

The combustion liner was deformed consistent with impact but was otherwise unremarkable. The trailing edge of the CT vane ring appeared undamaged. The CT vane ring inner shroud wall showed partial circumferential rubbing consistent with contact from the CT disc firtree region and blades during rotation.

The thermal couple probes appeared intact. The leading edges of the PT vane ring airfoils appeared intact. The PT vane ring inner shroud wall and baffle exhibited circumferential rubbing marks consistent with contact from the CT blades and disc firtrrees during rotation. The center region of the baffle exhibited a circumferential rubbing mark consistent with contact from the CT disc bolt hole lip. The PT vane ring exhibited rubbing marks consistent with contact from the first stage PT disc and blades. The shroud housing displayed circumferential rubbing marks consistent with contact from the PT blade shroud tips.

The first stage PT rotated with difficulty and only through a small arc. The PT blades were displaced rearwards. The upstream⁶ side of the first stage PT disc and blade firtrrees, as well as the side face of the shroud tips displayed circumferential rubbing marks consistent with contact from the PT vane ring shroud walls. The PT blades shroud tips exhibited circumferential rubbing marks consistent with shroud housing contact. The trailing edge of the PT blades appeared intact and undamaged.

The propeller could not be rotated. The RGB was split at the "A" flange. The first and second stage planet gears appeared intact, were oil wetted, and rotated freely.

The AGB was fractured at the "F" flange; the fracture surface appeared consistent with an overstress separation. The AGB fuel control/pump unit, fuel oil heater exchanger, starter, and air conditioning drive remained attached to the AGB housing. They exhibited varying degrees of damage, all of which was consistent with impact forces.

After removal of all accessories from the AGB, the assembly could not be rotated. The AGB was subsequently disassembled. The gearshafts and bearings appeared intact and

⁶ Upstream and downstream references are used with respect to the airflow through an intact engine.

Summary of Aircraft Examination

G. SUMMARY OF AIRCRAFT EXAMINATIONS *(concluded)*

were oil wetted. The main oil pump housing remained securely attached to the gear box and appeared undamaged; however, the pump could not be rotated. The main oil pump was disassembled. The pump housing cover exhibited scrape/gouge marks and circumferential witness marks consistent with contact from the oil pump impellers during rotation. The engine and gearbox components did not display any evidence of oil starvation.

Propeller – Hartzell HC-B3TN-3D (s/n BUA26343)⁷

The propeller assembly remained attached to the engine. All three propeller blades remained attached to the hub. The spinner was attached and was deformed consistent with impact forces. Each blade was bent aft with distinct curling at the blade tips. The blade faces exhibited extensive scraping damage, and the blade tips were gouged and deformed. One blade tip was separated and recovered at the accident site.

⁷ The propeller model and serial number information was obtained from the airplane maintenance records.