

**National Transportation Safety Board**

Office of Aviation Safety

Washington, DC 20594



CEN24FA220

## EXAMINATION SUMMARY

October 8, 2024

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## **A. ACCIDENT**

Location: Broseley, Missouri  
Date: June 15, 2024  
Time: 0830 central daylight time  
Aircraft: Air Tractor AT-602, N115AA

## **B. PARTICIPANTS**

|                              |                                                                                                                               |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Investigator-in-Charge (IIC) | Timothy Sorensen <sup>1,2</sup><br>Aviation Accident Investigator<br>National Transportation Safety Board<br>Denver, Colorado |
| Investigator                 | Laura Abraham <sup>2</sup><br>Air Safety Investigator<br>National Transportation Safety Board<br>Denver, Colorado             |
| Party Representative         | Norman Loftsgard <sup>1</sup><br>Principal Maintenance Inspector<br>Federal Aviation Administration<br>St. Ann, Missouri      |
| Participant                  | Lee Lane <sup>1</sup><br>Aviation Safety Technician<br>Federal Aviation Administration<br>St. Ann, Missouri                   |
| Party Representative         | Kyle Schroeder <sup>1,2</sup><br>Director of Engineering<br>Air Tractor, Inc.<br>Olney, Texas                                 |
| Participant                  | Nick Miller <sup>2</sup><br>Engineer<br>Air Tractor, Inc.<br>Olney, Texas                                                     |

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<sup>1</sup> Present for the on-scene examination.

<sup>2</sup> Present for the follow-up examination.

|                         |                                                                                                                  |
|-------------------------|------------------------------------------------------------------------------------------------------------------|
| Party Representative    | Les Doud <sup>2</sup><br>Air Safety Investigator<br>Hartzell Propeller Inc.<br>Piqua, Ohio                       |
| Technical Advisor (TSB) | André Doyon <sup>2</sup><br>Air Safety Investigator<br>Pratt & Whitney Canada Corp.<br>Longueuil, Quebec, Canada |

## **C. ACCIDENT SUMMARY**

On June 14, 2024, about 0700 central daylight time, an Air Tractor AT-602 airplane, N115AA, was destroyed when it was involved in an accident near Broseley, Missouri. The pilot was fatally injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 137 agricultural application flight.

An on-scene examination was conducted on June 15, 2024, with the assistance of the FAA and Air Tractor representatives. The wreckage was recovered from the site by AMF Aviation following the examination. Follow-up airframe, engine, and propeller examinations were completed at AMF Aviation on October 8, 2024, with the assistance of Air Tractor, Pratt & Whitney, and Hartzell Propeller representatives.

## **D. EXAMINATION SUMMARY**

### **1.0 Accident Site**

The accident site was located about 3 miles north-northwest of the departure airstrip. The airplane impacted a wooded area immediately north to a soybean field and a postimpact fire ensued. The soybeans were 2 - 3 feet high. The trees were 20 - 30 feet tall. There were no power lines, towers, or guy wires observed in the immediate vicinity of the accident scene. The approximate coordinates were 36.68675° north latitude / 97.6871° west longitude. The elevation of the site was about 329 feet.

Multiple tree propeller cuts and tree breaks were present in the immediate vicinity of the wreckage. One tree, about 14-inches in diameter near the base, was broken off about 12 feet above ground level. It also exhibited five propeller cuts beginning about seven feet above ground level and progressively increasing in depth moving lower on the tree.

A ground impact crater about 3 feet by 3 feet by 1-1/2 feet deep was located immediately east of the tree with multiple propeller cuts/slashes noted above. The

propeller assembly with the engine power section module attached was located adjacent to the impact crater. The power section had separated from the remainder of the engine assembly.

The airplane came to rest upright about 35 feet from the south edge of the woods oriented on an approximate 200° heading. This was immediately east of the propeller assembly. The wreckage was resting on a ground impact crater about 20 feet by 4 feet by 2 feet deep.

A portion of the left wingtip including the navigation/strobe light assembly was located approximately 160 feet east of the main wreckage at the edge of the wooded area.

## **2.0 Airframe Examination<sup>3</sup>**

Air Tractor AT-602 (s/n 602-1210)

The fuselage was upright with extensive fire damage to the cockpit/cabin area and aft fuselage. The forward fuselage was crushed upward and aft. The engine was dislocated and oriented about 180 degrees relative to its installed position. The aft fuselage from the cockpit to the aft fuselage appeared to be straight with no significant impact damage.

The cockpit structure was intact; however, the interior furnishings, instrument panel, and avionics were consumed by the post-impact fire. The preimpact position of the powerplant control levers could not be determined due to impact forces and fire/heat damage. The harness and lap belt were consumed. The harness and lap belt attach points were attached in the proper location with attachment hardware installed. The restraint buckles were not identified in the wreckage. The airplane was equipped with Inflatable (airbag) restraints in the shoulder harnesses. However, the system was destroyed by fire and the operation or deployment of the airbags could not be determined. The seat frame structure was damaged with the seat pan was bent downward and to the left. A structural tube in the left side of the seat pan was separated.

The cockpit doors were separated and mostly consumed by fire. A portion of the left door was found about 2 feet from the fuselage. A portion of the right door was next to the fuselage.

The main landing gear springs were both separated and located under the fuselage wreckage. Both appeared to be rotated aft of their normal positions. The tires, wheels, and brakes remained installed on each gear spring. The tail wheel was attached to the fuselage and appeared intact.

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<sup>3</sup> Directions related to accident site placement and component damage/deformation are with respect to an intact airframe unless otherwise noted.

Both wings were in position relative to the fuselage.<sup>4</sup> The wing spar centersplice connection was intact. The ailerons and flaps remained in their proper locations on both wings. Both wings exhibited significant crush damage.

The left-wing leading edge was bent aft and upward along the entire span. No damage consistent with wire or tree strikes was noted. However, the wing was dented and deformed over the entire span consistent with impact forces. The wing spar was continuous from the root outboard. The inboard portion of the left wing and flap were partially consumed by the post-impact fire. The left-wing tip was separated and located about 160 feet from the main wreckage. The aileron and flap remained attached to the wing; both were damaged consistent with impact forces and the post-impact fire. The aileron counterweight was intact and secure.

The right-wing leading edge was crushed aft along the entire span and the outboard portion of the wing was twisted leading edge downward. The wingtip remained installed. No damage consistent with wire or tree strikes was noted, although there was a portion of the inboard leading edge that was damaged from an undetermined cause. The right wing exhibited minor post-impact fire damage near the root. The aileron and flap remained attached to the wing; both were damaged consistent with impact forces and the post-impact fire. The aileron counterweight was intact and secure.

The vertical stabilizer and rudder remained attached to the aft fuselage and exhibited minor localized damage but appeared otherwise intact. The rudder control horn was securely attached to the control surface. The wire deflector cable remained attached to the vertical stabilizer and cockpit attachment with no damage or deflection noted.

The left horizontal stabilizer and elevator were separated from the aft fuselage suspended about 10-12 feet high in a tree near the left side of the fuselage. The elevator remained attached to the stabilizer. The inboard portion of the stabilizer exhibited fire/heat damage. The inboard portion of the rear spar connection was separated from the stabilizer consistent with impact forces and remained attached to the fuselage. The front spar connection was separated at the fuselage lug consistent with impact. The outboard span of the stabilizer and elevator was deflected downward near mid-span in relation to the inboard portion. Portions of the internal stabilizer brace was separated. The elevator torque tube was separated at the control horn consistent with impact forces.

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<sup>4</sup> Each wing was equipped with a 117-gallon fuel tank for a total fuel capacity (including header tank fuel) of 236 gallons.

The left stabilizer V-strut remained attached to the fuselage. The aft eyebolt of the strut common to the stabilizer was fractured. The forward eyebolt remained in place with a portion of the internal stabilizer brace still attached.

The right horizontal stabilizer was separated from the aft fuselage. A portion of the aft spar remained attached to the fuselage. The right elevator was separated from the stabilizer at the hinges, but all attachment hardware remained in place. The elevator torque tube was separated at the control horn consistent with impact forces. Both the stabilizer and elevator were located immediately adjacent to the right side of the aft fuselage. The right V-strut remained attached at the fuselage and at the stabilizer.

Elevator control was continuous from the control stick to the fuselage mounted aluminum pushrod. The forward portions of the aluminum pushrod were consumed by the post-impact fire; however, both rod ends were in their proper locations with all hardware, including roll pins, installed. Elevator control was continuous from the remaining aft portion of the push rod to the elevator horns. The elevator horns were separated at the welded interface with the elevator control torque tubes. The deformation and separation appeared consistent with impact forces.

Both rudder cables remained attached at the rudder control horn and were continuous to the rudder cable attach plates in the cockpit. The rudder control horn was damaged consistent with impact forces. The aluminum rudder pedal attach/adjustment channels were consumed by post-impact fire. The attachment hardware remained attached to the cable attach plates and the rudder pedal mount assemblies. The pulleys in the rudder control system were consumed by the post-impact fire. However, the cables were located in a normally routed position with the pulleys in place.

Left aileron control continuity from the control stick to the left wing-mounted pushrod was confirmed. The inboard pushrod rodend (located at the wing/fuselage interface) was destroyed by the post-impact fire. However, the rodend bearing and all hardware was observed to be intact and installed in its normal position. The wing-mounted pushrod was continuous from this point to the wing mounted bellcrank.<sup>5</sup> The rodend bearing common to the bellcrank was fractured consistent with impact forces. The bearing inner race remained attached to the bellcrank with the hardware intact. The controls were continuous from the bellcrank to the aileron.

Right aileron control continuity from the cockpit control stick to the right aileron fuselage bellcrank was confirmed. The right fuselage mounted bellcrank was separated about 11 inches from the upper end. From the wing root outboard, the

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<sup>5</sup> The left aileron pushrod was cut about 4 feet from the inboard end to facilitate recovery of the airplane from the accident site.

aileron controls were continuous to the aileron control horn.<sup>6</sup> However, the control horn was separated from the right aileron consistent with impact forces.

The flap actuator was separated from the airframe and located on the ground below the fuselage with the wreckage debris. It exhibited extensive thermal damage consistent with the post-impact fire. The actuator extension was 3.0 inches.<sup>7</sup>

The flap torque tube and associated hardware remained in place. The left end of the flap torque tube was consumed by the post-impact fire. The lower bolt that secured the left flap arm was in place. The upper bolt attachment area of the torque tube was torn out in an aft direction consistent with the impact sequence. The left flap pushrod and control horn were connected with all hardware in place. The inboard portion of the left flap was consumed by the post-impact fire. The right flap control was continuous from the flap torque tube to the flap pushrod. The remainder of the right flap controls were observed in the proper locations.

The left aileron drooping system was continuous from the flap torque tube to a separation in the #2 pushrod. The separation appeared consistent with impact forces. The remainder of the left aileron drooping system was found in their correct respective locations. The right aileron drooping system was found with two separations. One separation was located in the #1 pushrod and the other separation was in the #2 pushrod. Both separations appeared consistent with the impact sequence.<sup>8</sup>

### **3.0 Engine Examination**

Pratt & Whitney PT6A-65AG (s/n PCE-PN0147)

The power section was separated from the engine assembly and remained attached to the propeller. The remainder of the engine was dislocated from its normal installed position relative to the airframe and rotated approximately 180°.

The engine airframe mounting structure and several airframe components (cowling, oil cooler, exhaust stacks, fire seals, hoses, harness and wires) were still attached to the engine. The forward section of the reduction gearbox (RGB) was separated from the engine and remained attached to the propeller.

The exhaust case and the gas generator case (GGC) were deformed. The inlet case to GGC retaining bolts were fractured over a 270° arc. The rear fire seal, the inlet screen, and the compressor wash ring were torn and deformed. The inlet case was punctured at two locations (approximately 2 inches diameter holes) about 180° apart.

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<sup>6</sup> The right aileron pushrod was cut about 4 feet from the inboard end to facilitate recovery of the airplane from the accident site.

<sup>7</sup> According to the airframe manufacturer, the corresponding flap deflection was 22°. The maximum flap deflection for the airplane was 28°.

<sup>8</sup> The left and right #3 pushrods were cut to facilitate recovery.

The accessory gearbox (AGB) housing appeared to be in good condition. The front-to-rear RGB housing "A" flange was fractured.

The propeller control arm was fractured and deformed. The propeller reversing control linkage was fractured at two locations: 2 inches behind the rear fire seal, and at the exhaust case to RGB flange. The beta valve arm reversing guide pin was bent upwards towards the port side.

The P3 lines were deformed and burnt. The lockwires were present at the connectors. The Py line was separated and not received with the engine wreckage. The AGB chip detector was free of magnetic debris. The RGB chip detector displayed a couple small magnetic particle. Both the oil filter and fuel filter were intact, clean, and free of debris or sediment.

The compressor turbine vane (CTV) ring airfoils appeared to be intact. Contact indication were observed at the CTV inner rim trailing edge side and at the No.2 bearing baffle outside and inside diameters consistent with contact to the compressor turbine (CT) disk and blades. The CT disk and blades leading- and trailing-edge sides displayed circumferential contact indications.

The inner and outer combustion liners, the small exit duct, the fuel nozzles, and the igniters appeared to be in normal operating condition. The T5 housing was deformed at the exhaust case mating flange, but otherwise appeared to be in normal operating condition. Soot deposits were observed at deformation between the exhaust case and T5 housing flange consistent with post-impact accretion.

Contact indications were observed at the power turbine vane (PTV) ring leading- and trailing-edge sides consistent with contact to the CT disk and the 1<sup>st</sup> stage power turbine (PT) disk, respectively.

The 1<sup>st</sup> stage PT disk leading- and trailing-edge, and the 1<sup>st</sup> stage PT blades displayed indications consistent with contact to the 1<sup>st</sup> and 2<sup>nd</sup> stage PTV, respectively. A majority of the 2<sup>nd</sup> stage PT blades were fractured approximately 2 inches above the blade platform and were bent opposite the direction of rotation. The PT blade fragments were found in the exhaust case. The 2<sup>nd</sup> stage PTV displayed a 100° arc rubbing indication at the airfoil leading edge consistent with contact to the 1<sup>st</sup> stage PT blade tip shroud. The 2<sup>nd</sup> stage PTV airfoil displayed deformation and impact damage at trailing edge side. The PT shaft, the PT shaft housing, and the no. 3 & 4 bearings were not accessed.

The inlet case no.1 bearing support flange was fractured. Due to inaccessibility of three retaining bolts, the compressor rotor was not accessed. Borescope examination revealed raised material indication at the 1<sup>st</sup> stage rotor

blades tip, and environmental debris was observed at the inlet area and to compressor 4th stage stator P 2.5 bleed slot area.

The front reduction gear box (RGB) housing was fractured at the "A" flange, and a section of the housing approximately 7 by 9 inches was missing. Observed damage was consistent with impact forces. The propeller shaft was free to rotate. The rear RGB housing flange was fractured and separated from the engine exhaust case. The rear RGB was still attached to the PT shaft housing and rotation was not possible due to secondary damage to the PT rotor.

The accessory gear box (AGB) housing and diaphragm appeared intact and undamaged. The oil pump pack did not show indication of distress. The AGB was free to rotate without abnormal noise.

The igniter plugs, the ignition leads, and the exciter box appeared intact.

The fuel control unit (FCU) housing was fractured exposing the internal bellows and bearing. The remaining portion of the housing was still secured to the fuel pump. The FCU control arm was distorted, the connecting rod and stop arm were deformed, and the control lever bushing retaining housing was fractured and missing. The manual override control arm was deformed, and one of the two manual override stop was fractured and missing. The fuel pump remained attached to the AGB housing and was free to rotate by hand. The fuel-oil heat exchanger (FOHE) attachment flange was fractured. The component appeared to be otherwise intact. The fuel nozzles and flow divider appeared intact and undamaged.

Soot and fire damage were observed at the insulated P3 tubes. The compressor bleed valve (BOV) piston moved freely with hand pressure.

The propeller governor, the overspeed governor, and the tachometer were still mounted to the RGB front housing. The propeller governor control lever was separated and not present with the engine. The propeller governor Beta valve moved freely with hand pressure.

#### **4.0 Propeller Examination**

Hartzell HC-B5MP-3F / M11276NS (s/n EVA3167)

The propeller assembly remained attached to the propeller shaft flange. The engine RGB impact-separated from the engine at the A-Flange. The spinner dome was crushed and torn with only fragments remaining jammed in the propeller assembly. The spinner dome was not compressed against the propeller assembly components suggesting the gearbox separated before the propeller impacted soil/terrain. The spinner aft bulkhead remained attached and was bent aft. The propeller assembly had some earthen debris inside the dome, but it was not packed around the components.

All five blades remained attached to their respective clamps. All five clamps were secure with all four fasteners secure in each clamp. All five counterweight assemblies were present. The Blade #3 counterweight arm was loose consistent with impact forces. There were no discernable slip indicators, and it was undetermined if the blades slipped in the clamps. The piston was fractured and fragmented. Blades #1, #2, #4 and #5 link arms remained attached at both the piston link pin and clamp link screw. Only one link arm (Blade #3) remained attached at the piston link pin, it had separated from the clamp link screw.

The beta arm was dislodged from the beta ring and the block was fractured/fragmented. The beta arm retention pin was bent upward. The beta valve moved freely with hand force with no evidence of binding.

Blade #1 was bent in the forward/thrust direction near the tip and a cable cut/notch in the leading edge approximately 30" from the blade butt. Blade #2 exhibited an S-bend. Blades #3, #4 and #5 were remarkably bent in the forward/thrust direction. Blade #3 had a tip fracture; the outboard approximately 6 inches were missing and not presented for examination.

The piston was fractured and fragmented with a section between blades #3 and #4 missing. The beta rods were bent, and the beta rod guide ring was bent/fractured. There were no discernable circumferential marks on the internal piston wall but there was a crease/bulge in the cylinder all indicating piston position at impact (Photo #3). The crease was located at approximately 2.3-2.4" from the top shoulder. This distance translates to a blade angle of approximately 19 degrees. This is above the flight idle blade angle and in the normal range of operation.

The link arms were removed and compared to a full-sized drawing. Link arms #1, 2, 4, 5 were unremarkable but #3 appeared stretched and the link screw hole elongated consistent with forceful blade rotation towards high pitch. The link screw on clamp #3 also exhibited bending opposite high pitch. With the link arms detached from the piston all five blades rotated smoothly with hand force.

The beta ring was actuated with light pry-bar force. It moved freely and returned to the "home" position under return spring force with no evidence of binding between the beta rods and guide lugs.

The blades were removed from the assembly. All five blades had pilot tube shoulder impact impressions and hub arm flange impact crescent marks in Blades #1-#4. Pilot tubes #1-4 were fractured, #5 was intact. There were no visible fractures or cracks of the hub spider. The feathering spring was removed and was intact and undamaged. The pitch change rod appeared undamaged. The feather stop screws were undamaged indicating the propeller was not near or in the feathered position.

There was chordwise/rotational abrasion and scoring on some blades with leading edge wave bends on all five blades, consistent with tree strikes. There was light, chordwise/rotational abrasion on the face side of each blade consistent with impact at a positive angle of attack and producing thrust. The blades exhibited bending and twisting damage consistent with impact while rotating at moderate-to-high power and producing thrust at initial impact; Blades #3-5 bent forward in the forward, thrust direction and forceful rotation towards high pitch. Photo #4 shows the bending patterns of all five blade.

An analysis of tree trunk propeller strike marks revealed the first two strikes air fairly consistent with an average of 9.5". Assuming 1500 RPM and zero-angle between flight path and tree trunk, airspeed calculates to ~59 Kts. If assuming 1700 RPM (rating) then airspeed is 66 kts. A cut section of a tree limb was found in the wreckage (Photo #6) with a length of 9.75". This is somewhat consistent with the tree trunk marks also indicating a low airspeed.

----- *end of summary* -----