

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



CEN23FA353

EXAMINATION SUMMARY

October 17-19, 2023

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A. ACCIDENT

Location: Gilman City, Missouri
Date: August 8, 2023
Time: 1150 CDT
Airplane: Air Tractor AT-802, N804AA

B. EXAMINATION PARTICIPANTS

IIC	Joshua Lindberg National Transportation Safety Board Dallas, Texas
Deputy IIC	Brian Rutt National Transportation Safety Board Aurora, Colorado
Party Member	Les Doud Hartzell Propeller Inc. Piqua, Ohio
Technical Advisor	Michel Pitsikoulis Pratt & Whitney Canada Montreal, Quebec, Canada
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C. ACCIDENT SUMMARY

On August 8, 2023, about 1150 CDT, an Air Tractor AT-802 airplane, N804AA, was destroyed when it was involved in an accident near Gilman City, Missouri. The pilot was fatally injured. The flight was conducted under 14 *Code of Federal Regulations* Part 137 as an aerial application flight.

D. DETAILS OF THE EXAMINATION

1.0 Engine Examination

Engine: Pratt & Whitney PT6A-65AG, s/n PCE-PN0306

The engine was embedded deep in the nacelle, separate from the airplane. A handheld power circular saw was used to remove the airframe hardware from the engine. Upon the removal of the airframe hardware, it was noticeable that the engine was covered in post fire soot. The engine had substantial damage to the reduction gear box (RGB) and accessory gear box (AGB). The bottom of the engine was covered in soot and ground debris from the accident site.

Reduction Gearbox (RGB): The RGB with the propeller attached, had fractured from the impact at the engine "A" flange and separated from the engine exhaust case. Second stage carrier hub shear is observed inside the RGB which is indicative that the engine was outputting power at the time of impact.

Exhaust Duct: The exhaust duct shows torsional twist with wrinkles at an angle of 45 degrees to the engine rotational axis, indicative that the engine was outputting power at the time of impact.

Gas Generator Case (GGC): The GGC exhibits areas of crumpled and crushed metal indicative of impact with the ground.

Accessory Gearbox (AGB) and Inlet Case: About $\frac{3}{4}$ of the AGB exterior case has fractured off along with most of the gears, exposing the remaining bearings and internal surfaces to the environmental debris.

Compressor Discharge Air (P3) and P3 Filter: The P3 tubing was crushed fractured from the impact. The P3 filter bowl was removed and visually free from debris.

Chip Detector(s): AGB chip detector showed environmental debris due to the fractured AGB housing cover.

The Power Section was split at the "C" flange exposing the CT disc on the GGC and the first stage power turbine in the Power section. Continuity was confirmed between the CT disc and the compressor pack. The compressor pack was free to rotate. A light metal rattling can be heard when rotating the CT disc assembly. The CT blades are all intact showing slight rubbing on the visible blade tips. Circumferential rubbing is visible at the firtree portion of the CT disc which is in the same approximate location of the baffle on the compressor turbine vane.

Attempts to untorque the CT disc retaining nut were made with no success therefore, the CT Vane Ring, Shroud Segments, Combustion Chamber Liner, Large Exit Duct and Small Exit Duct were not evaluated.

Given the extent of the damage on the RGB and exhaust case the power turbine disc assembly was jammed and unable to rotate. Circumferential metallic rubbing is visible along the 1 stage power turbine firtree area. The power turbine shaft was sheared inside the 1 stage power turbine splines.

The Inter Turbine Temperature (ITT) Probes, Busbar, and Harness were intact and showed no distress.

2.0 Propeller Examination

The propeller examined is a 115.2" diameter, Steel Hub Turbine Series, 5-blade, feathering, reversing, and pressure to decrease pitch. Oil pressure from the propeller governor is used to move the blades to the low pitch (blade angle) direction. A spring and counterweights move the blades to the high pitch/feather direction in the absence of governor oil pressure. The blades are of aluminum construction. The hub and clamps are made of steel alloy. The application is defined on Hartzell Installation Data Sheet #1642.

Model: HC-B5MP-3F / M11276NS

Assembly S/N: EVA3528 (DOM 1/30/2017)

Blades S/Ns:

No. 1 - L76318 / No. 2 - L76316 / No. 3 - L76315 / No. 4 - L76313 / No. 5 - L76312

The latest propeller logbook entry revealed that a 100-hr inspection was completed on May 11, 2023, at Hobbs time 3,026.8. The entry indicated that the propeller hub housing was lubed with Aeroshell 5 grease in accordance with Hartzell manual 139 and the blades were dressed as needed. The two previous logbook entries related to the propeller were 100-hr inspections on October 26, 2022, and June 27, 2022. All three entries were the same in that the propeller hub housing was lubed with Aeroshell 5 grease in accordance with Hartzell manual 139 and the blades were dressed as needed.

A decal on the propeller piston indicated it was last serviced/repaired (possibly overhauled) at Memphis Propeller. Another decal indicated it was serviced with NYCO grease.

The propeller was presented for examination as shown in Figure 1. The propeller remained partially attached to the propeller shaft flange. The engine RGB impact-separated from the engine. The spinner dome was crushed and torn with only

fragments remaining jammed in the propeller assembly. The spinner aft bulkhead remained attached and was bent aft. The propeller assembly was packed with dry, hard, rock-free soil. All five blades remained attached to their respective clamps. There were no discernable slip indicators, so it was undetermined if the blades slipped in the clamps. The piston was displaced approximately 1.7" forward of the beta guide collar. All link arms remained attached at the piston link pin. Only one link arm (blade No. 5) remained attached at the clamp link screw, all others were detached at the clamp link screw. Blade No. 5 was in a normal blade angle range, all other clamps/blades appeared to be near feather.

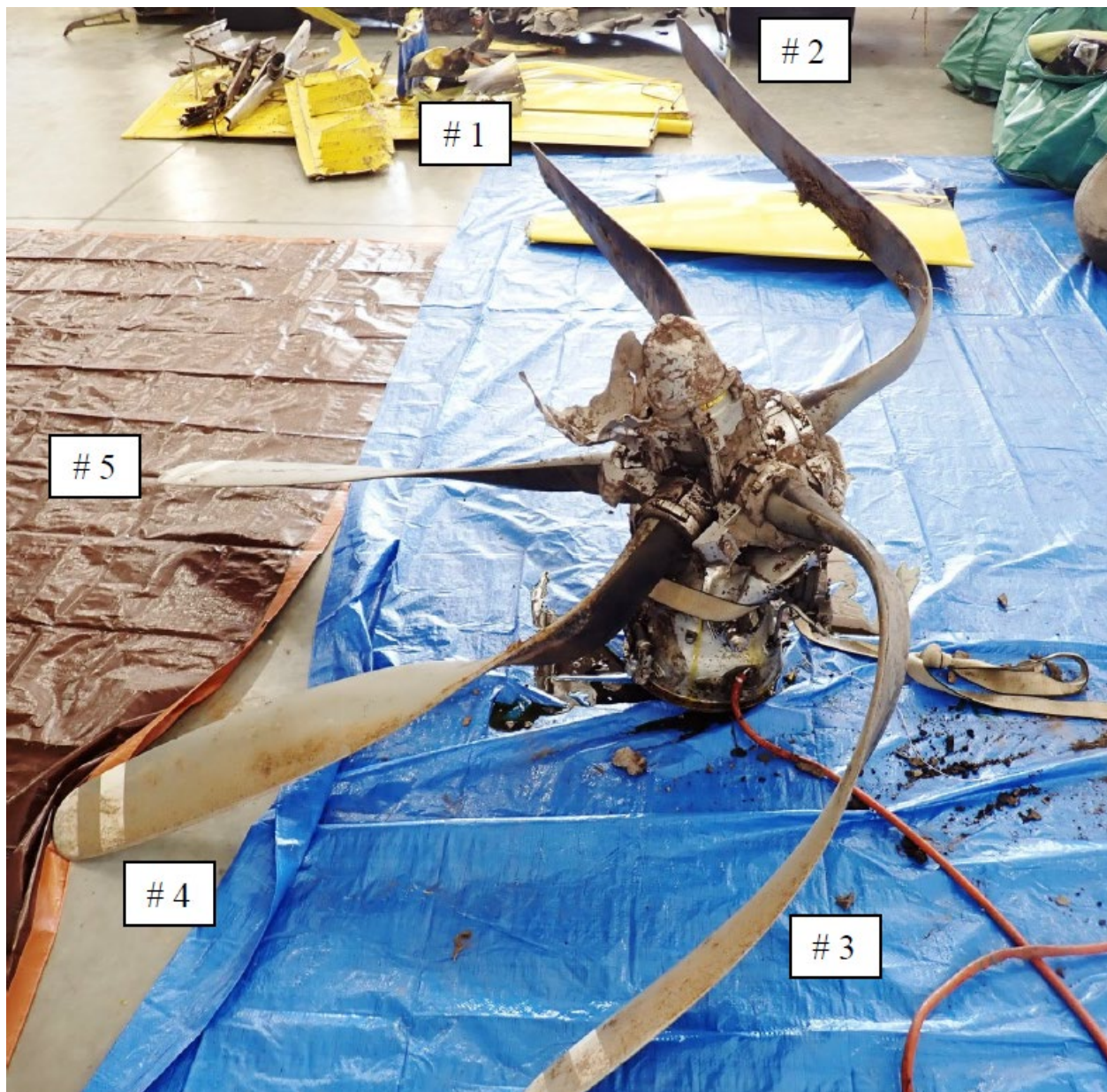


Figure 1. Propeller as presented.

Blade Nos. 3, 4 and 5 were bent in the forward/thrust direction and blade Nos. 1 and 2 were bent in the aft direction. The piston was removed, and a circumferential impact mark was present at approximately 2.45" from the bottom edge (Figure 2). This distance translates to a blade angle of approximately 22 degrees, in the normal range of operation.

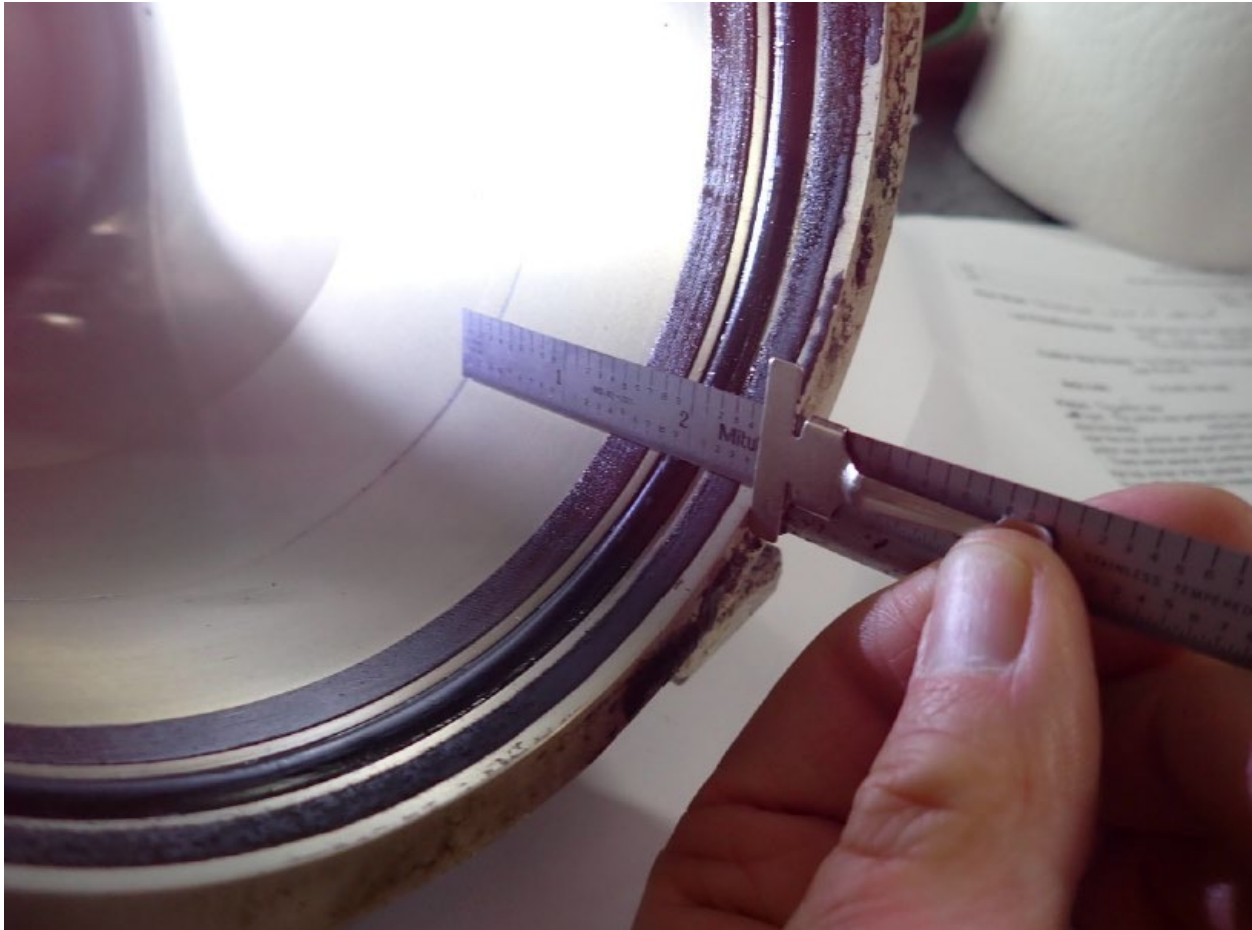


Figure 2. Piston ID impact signature.

The cylinder exhibited a bulge and crease at approximately 2.5" from the top corner, consistent with the internal mark on the piston (Figure 3). The link arms were removed and compared to a full-sized drawing. Link arms Nos. 1-4 exhibited stretch, consistent with forceful blade rotation towards high pitch (Figure 4). The link screws on the corresponding clamps exhibited bending opposite high pitch. All five blade clamps remained attached with all bolts secure. The link screws on clamps Nos. 1-4 were bent opposite high pitch with link screws Nos. 2-4 partially fractured at the cotter pin holes. All counterweight arms and slugs remained attached and secure. Except for the No. 4 pilot tube, 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 to be in the feathered position. The blades were removed from the assembly. The pilot tube for blade No. 4 was fractured and a portion remained

jammed in the blade bore. All five blades had pilot tube shoulder impact impressions in the blade butt. Blade Nos. 2, 4 and 5 had blade-to-hub impact crescent impressions. There was no remarkable leading-edge gouging or deep chordwise/rotational scoring on any blade, consistent with impact into soft, rock-free, moist/wet farm field soil. There was light, chordwise/rotational abrasion on the face side of each blade, primarily isolated to the leading edge and trailing edge areas (Figure 5). The blades exhibited bending and twisting damage consistent with impact while rotating at moderate-to-high power and producing thrust at initial impact; blade Nos. 3-5 bent forward in the forward, thrust direction and forceful rotation towards high pitch. Figure 6 shows the progressive bending pattern in the blades.



Figure 3. Cylinder bulge at 2.5" below top corner



Figure 4. Link arm comparison showing stretch on No. 1-4



Figure 5. Light, face-side abrasion on blade No. 5, similar on all blades



Figure 6. Propeller blades trailing edge view 3-4-5-1-2 left-to-right.

There were no visible discrepancies noted that would prevent or degrade normal propeller operation prior to impact. All visible damage was consistent with high impact forces while rotating at moderate-to-high power and producing thrust, with a blade angle in the normal range of operation. Signatures that indicate rotation at moderate-to-high power are:

1. Chordwise/rotational abrasion isolated to the face side.
2. Forward/thrust direction bends.
3. Forceful rotation of the pitch change components towards high pitch.
4. Blade angle impact signatures at approximately 22 degrees at low airspeed.

3.0 Airframe Examination

Air Tractor provided an email assessment of the power quadrant lever positions as found on-scene, which were:

Fuel Condition Lever: ground idle

Prop: medium-high to high rpm

Power: high power



Figure 7. The power quadrant lever positions during the examination.

Submitted by:

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