

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



CEN23FA173

ENGINE EXAMINATION SUMMARY

November 17, 2023

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A. ACCIDENT

Location: Ennis, Texas
Date: May 6, 2023
Time: 1522 central daylight time
Aircraft: Cessna 310D, N6798T

B. PRESENT DURING EXAM

Investigator-in-Charge (IIC)	Laura Abraham Air Safety Investigator National Transportation Safety Board Denver, Colorado
Investigator	Tim Sorensen Aircraft Accident Investigator National Transportation Safety Board Denver, Colorado
Party Coordinator	Phillip Grice Manager, Product Field Performance Continental Aerospace Technologies Mobile, Alabama

C. ACCIDENT SUMMARY

On May 6, 2023, at 1522 central daylight time, a Cessna 310D, N6798T, was destroyed when it was involved in an accident in Ennis, Texas. The pilot and front seat passenger were seriously injured, and the backseat passenger was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

Automatic Dependent Surveillance - Broadcast (ADS-B) data revealed that the airplane departed David Wayne Hooks Memorial Airport (DWH), Houston, Texas, at 1424 and proceeded to Ennis Municipal Airport (F41) and arrived at 1522. ADS-B data also revealed that the airplane began a descent on final approach for runway 16 at F41. After the airplane crossed the runway threshold, the flight track data showed the flight path shift to the right and the airplane began to climb on runway heading. The track data then showed the airplane veer to right.

The airplane impacted cedar trees and terrain about 1,300 feet southwest of the center of the runway. The impact path was on a southwest course, about 234° heading. A ground impact mark was located about halfway between the initial tree strike and the main wreckage and was consistent with the right wing and right engine impacting the ground first.

The airplane came to rest upright with the forward fuselage oriented on a southeast heading. The left and right wingtips were separate from the main wreckage. Most of the left wing, instrument panel, and forward and aft cabin area were consumed by fire. The right wing and empennage were intact and not burned. Except for the left aileron (consumed by fire), all primary and secondary control surfaces were intact and attached to the airplane, and control cable continuity was confirmed from each control surface to the cockpit.

Engine teardown examinations were conducted between November 15th and 17th 2023 at Continental facilities (Mobile, Alabama) under direct oversight of NTSB investigators.

D. EXAMINATION SUMMARY

1.0 Right Engine Examination

Continental IO-470D (s/n 88443-5-D-R)

The engine exhibited soot deposits consistent with a post-impact fire but appeared otherwise intact. The cylinders appeared to be intact. The magnetos sparked, and the magneto timing was 24°. According to the manufacturer, the proper timing for this engine is 20°. Rotation of the crankshaft confirmed internal engine and accessory section continuity. The spark plugs were clean and had normal/even wear. They did not appear to be fouled or damaged. Compressions were obtained on all cylinders. The compressions were as follows:

1. 55
2. 58
3. 60
4. 64
5. 55
6. 60

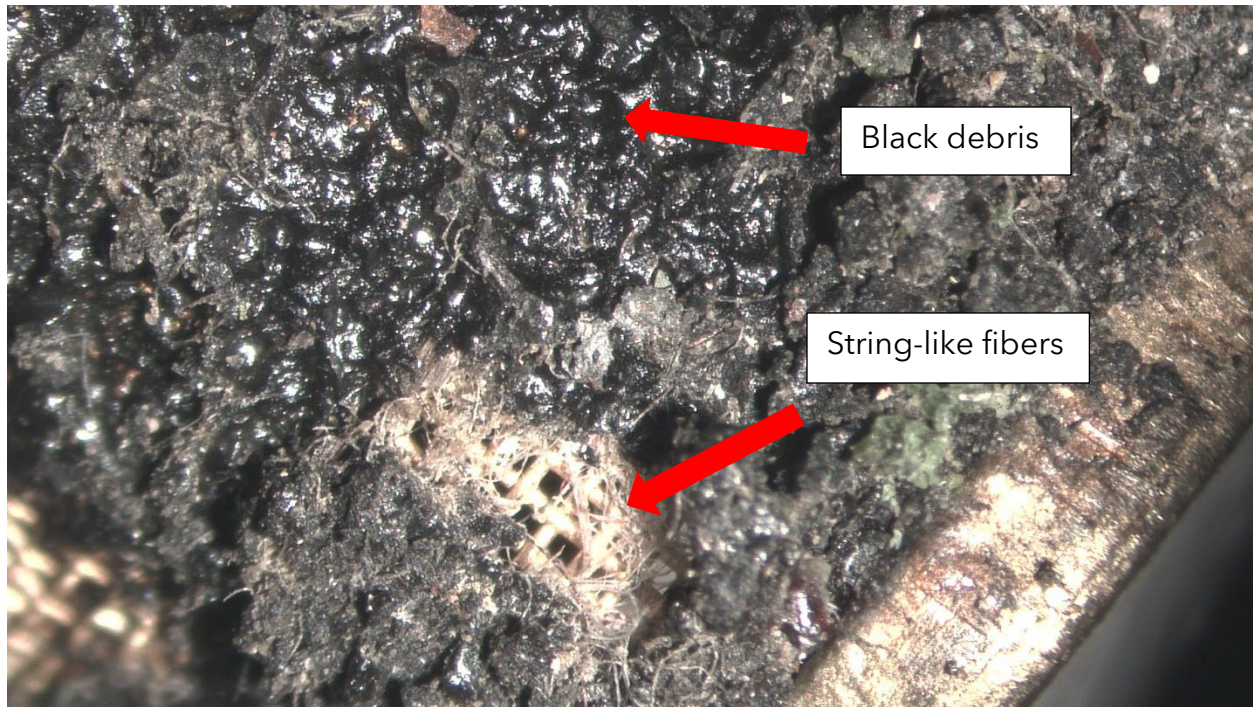
The engine initially ran rough in a test cell.

The throttle and control assembly were removed from the engine and examined. The "O" rings on the throttle metering cam and the mixture metering cam were inspected and found to be unremarkable. The fuel plug and screen assembly were removed from the fuel injection control assembly and the screen was obstructed with black

debris and string-like fibers. The screen was removed and sent to the materials lab in Washington, DC to identify the debris. The fuel screen was replaced with a clean, exemplar component. During the second test run, the engine started without hesitation and ran smoothly.



Photograph 1. Fuel plug and screen assembly from right engine (Photo from NTSB)



Photograph 2. Magnified image of fuel plug and screen assembly from right engine
(Photo from NTSB)

---end summary---

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A. ACCIDENT

Location: Ennis, Texas
Date: May 6, 2023
Time: 1522 central daylight time
Aircraft: Cessna 310D, N6798T

B. EXAMINATION SUMMARY

Investigator-in-Charge (IIC)	Laura Abraham Air Safety Investigator National Transportation Safety Board Denver, Colorado
Investigator	Timothy Sorensen Aviation Accident Investigator National Transportation Safety Board Denver, Colorado
Party Coordinator	Phillip Grice Manager, Product Field Performance Continental Aerospace Technologies Mobile, Alabama

C. ACCIDENT SUMMARY

On May 6, 2023, at 1522 central daylight time, a Cessna 310D, N6798T, was destroyed when it was involved in an accident near Ennis, Texas. The pilot and front seat passenger were seriously injured, and the backseat passenger was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

An engine teardown examination was conducted on November 17th at Continental facilities (Mobile, Alabama) under direct oversight of NTSB investigators.

D. EXAMINATION SUMMARY

1.0 Left Engine Examination¹

Continental IO-470-D15 (s/n 88439-5-D-R)

The engine exhibited soot deposits and debris consistent with the post-impact fire. The cylinder air intake ducting was secure and appeared intact. The exhaust ducting was secure and deformed consistent with impact damage. The engine crankcase appeared intact, and the cylinders appeared undamaged and secure. The #1-cylinder valve cover exhibited a hole at the aft/lower area of the cover consistent with impact forces; the #1 valve cover was secure. The remaining valve covers were intact and secure. The rocker arms and valve springs were intact.

Internal engine and accessory section continuity were confirmed via crankshaft rotation. Compression and suction were obtained on all cylinders. Cylinder compression was measured as: #1-15/80, #2-15/80, #3-60/80, #4-55/80, #5-30/80, and #6-60/80.

The cylinder barrels were smooth with exception of the upper portion which exhibited some corrosion. The pistons were intact and exhibited moderate combustion signatures. The piston rings were installed and unremarkable. The crankshaft appeared undamaged, and the counterweights were intact. Each connecting rod was intact and secured to the crankshaft. The main journal bearings were in place and exhibited normal wear signatures. The camshaft was intact and appeared undamaged. The camshaft gear was secured to the camshaft with safety wire properly installed. The forward camshaft beveled spline exhibited excessive play to the propeller governor drive shaft spline; however, both appeared functional. The idler gear appeared intact. The interior of the engine crankcase was oil wetted consistent with sufficient lubrication.

The fuel manifold was undamaged. The manifold cover was secure, and safety wire properly installed. No data plate was installed. The diaphragm was continuous, and the screen was undamaged. The spring was intact and exhibited normal compressive (spring rate) force. The screen contained minor debris.² Each injector line was securely attached to the manifold and to each injector. The fuel pump was secure, and the drive shaft was intact. The drive shaft rotated freely under hand pressure.

Both magnetos were secure. The housings were discolored and sooted consistent with the post-impact forces but appeared otherwise undamaged.

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

² The debris may have inadvertently introduced upon removal of the manifold cover. Regardless, the extent of the debris was not consistent with a reduction of fuel flow or the ability of the engine to produce rated power.

Magneto timing was set at 20.5° (left) and at 20.0° (right). The ignition harness exhibited minor thermal damage. It remained secured to the magnetos and to each respective spark plug. Both magnetos, with the airplane ignition harness installed, provided spark across each lead when run on a test bench. The harness lead corresponding to the #1 cylinder top spark plug exhibited a spark from the conductor to the shield or spark plug attachment nut. The spark plugs were secure. They were discolored and exhibited minor corrosion but appeared otherwise intact. The electrodes exhibited normal combustion signatures. *Several* of the electrodes appeared to be worn but operational.

The throttle and control unit was discolored and sooted. The assembly appeared to be otherwise intact. The throttle and mixture control rod control linkage remained attached to the control arms. The butterfly valve appeared intact and was free to rotate with the throttle control arm. The fuel screen was securely installed and properly safety wired. When removed, the screen was intact and free of debris or sediment. The air intake ducting was deformed consistent with impact. The air filter appeared intact and operational. The bypass air valve appeared undamaged.

The oil pump housing was secure and intact. The impellers and drive shaft were intact. The housing cavity was oil wetted and free of debris or sediment. Minor circumferential machining marks were present on the one side of the housing cavity. No evidence of hard particle was observed. An after-market oil filter adapter was installed. The oil filter was secure, and the housing was dented consistent with impact damage.

The engine-driven fuel pump was secure and appeared undamaged. It was sooted consistent with the post-impact fire. The input drive coupling was intact and rotated freely under hand pressure. Disassembly of the unit was unremarkable. The cavity was clean and free of debris. The drive shaft and vanes were intact.

The propeller governor was secure and appeared intact. The input drive shaft and splines were undamaged. The drive shaft rotated freely. The control arm was free to rotate, and the spring was operational. Gasket was intact, and the gasket oil screen was in place and free of debris. The component was not examined further.

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PROPELLER EXAMINATIONS

June 23, 2023

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A. ACCIDENT

Location: Ennis, Texas
Date: May 6, 2023
Time: 1522 central daylight time

Airplane: Cessna 310D, N6798T

B. PROPELLER EXAMINATIONS

Investigator in Charge (IIC) Laura Abraham
Air Safety Investigator
National Transportation Safety Board
Denver, Colorado

Investigator Mitchell Gallo
Air Safety Investigator
Denver, Colorado

Party Coordinator Les Doud
Hartzell Propeller Inc
Piqua, Ohio

C. SUMMARY

On May 6, 2023, at 1522 central daylight time, a Cessna 310D, N6798T, was destroyed when it was involved in an accident in Ennis, Texas. The pilot and front seat passenger were seriously injured, and the backseat passenger was fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

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heading. A ground impact mark was located about halfway between the initial tree strike and the main wreckage and was consistent with the right wing and right engine impacting the ground first.

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The propeller examinations were performed at Air Salvage of Dallas (Lancaster, Texas) on June 20-21, 2023, under direct oversight of NTSB Investigators.

D. EXAMINATION SUMMARY

1.0 Right and Left Propellers

The propellers remained attached to their respective engine crankshaft flanges during the impact sequence. The airplane flew through trees and impacted grass-covered soil. Other than blade impact damage, the propeller hub assemblies appeared relatively undamaged with the pitch change components intact.

Right Propeller

All mounting hardware appeared intact and secure. The spinner was crushed and formed around the piston and piston nut and partially formed around the hub and clamps. The dome was torn with spiral scoring and deformation. The counterweights for both blades punctured through the spinner dome. Both clamps appeared intact with only impact scoring damage. The clamp bolts were secure with safety mechanisms intact. Both blade clamps/start lock plates were resting on the start lock pins. The blade R1 slip indicator suggested the blade slipped in the clamp approximately 35° toward high pitch (Photo #1). The R2 slip indicator appeared relatively unchanged, possible slight movement toward low pitch (Photo #1).

Blade R1 was bent forward with no remarkable twisting (Photo #2). Blade R2 was bent aft with no remarkable twisting (Photo #2). Blade R1 had some angled rotational scoring and abrasion on the face side (Photo #3) and minor chordwise abrasion on the camber side (Photo #4). Blade R2 had remarkable chordwise/rotational scoring on the camber side from mid-blade to tip (Photo #4) and chordwise/rotational scoring along the leading edge near the tip (Photo #3). Neither blade had any remarkable leading edge gouging or damage.

The link arms for both blades were secure at the link screw and pin and appeared undamaged. The piston appeared intact with only impact scoring damage. The cylinder also appeared intact and undamaged.

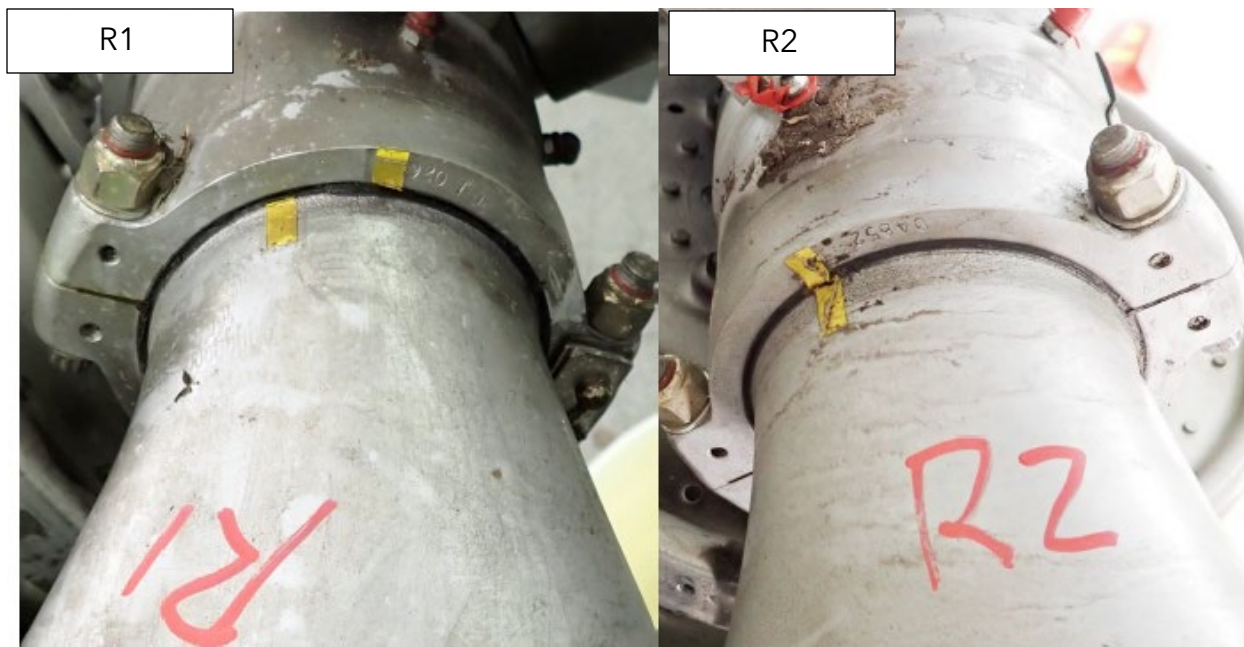


Photo 1. Right propeller blade/clamp slip indicators

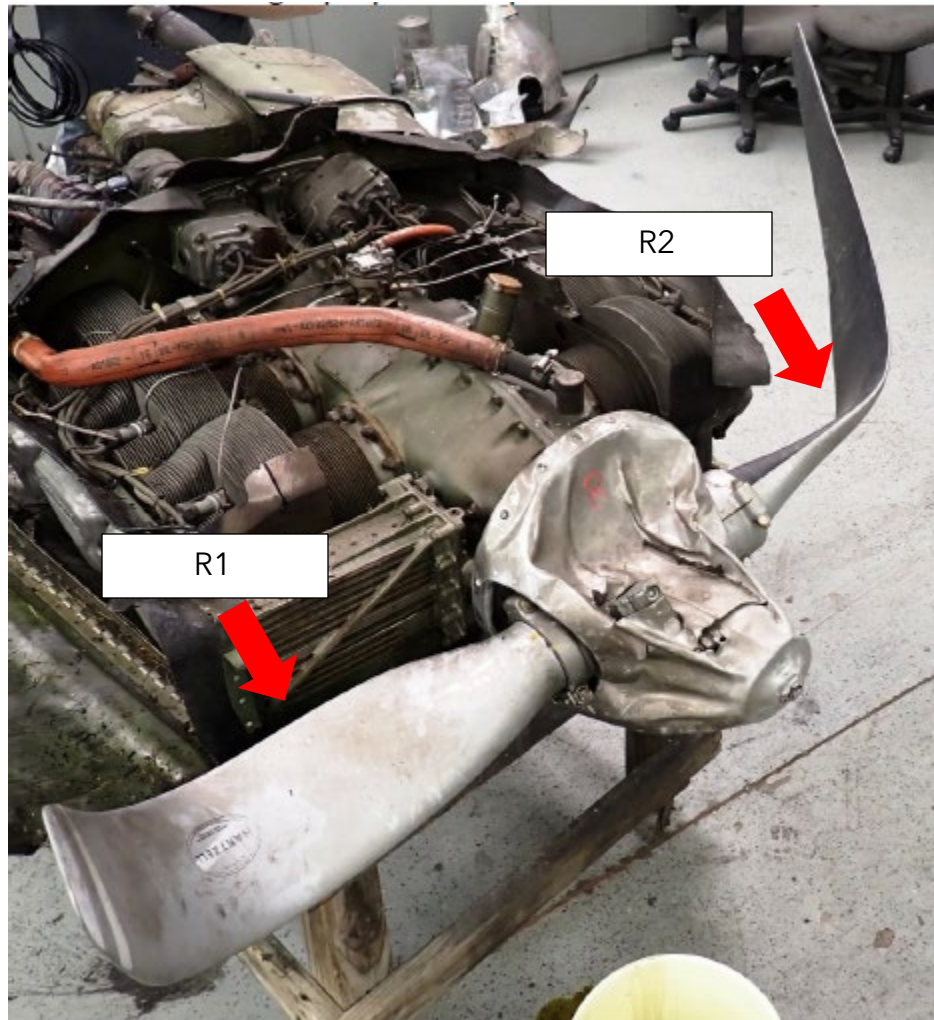


Photo 2. View of right propeller



Photo. 3 Right propeller blades face sides



Photo 4. Right propeller blades camber sides

Propeller Cycling: The propeller governor was removed from the engine to gain access to the governor oil port leading to the crankshaft transfer bearing. Air pressure at approximately 100 psi was used to cycle the prop off the start locks forward to the low pitch stop. The start lock pins were retracted by a blade screwdriver and secured with safety wire. The air pressure was then removed, and the prop smoothly transitioned to feather under feathering spring force only. The prop was cycled two times between feather and the low pitch stop. There were no air leaks detected in the propeller pitch change system. The propeller was not disassembled any further

Left Propeller

All mounting hardware appeared intact and secure. The spinner crushed and formed around the piston and piston nut, and partially formed around the hub and clamps. The dome is torn with spiral scoring and deformation. The counterweights for both blades punctured through the spinner dome at a position consistent with a blade angle in the lower range of normal operation. Both clamps are intact with only impact scoring damage. The clamp bolts were secure with safety mechanisms intact.

Neither the L1 nor L2 blade/clamp start lock plate was resting on the start lock pin, indicating the propeller actuation was bound between the start lock angle and low pitch angle. The L1 clamp appeared to be at slightly lower blade angle than L2

and the piston appeared cocked on the cylinder. Both blade slip indicators showed no rotational displacement (Photo #5).

The link arms for both blades were secure at the link screw and pin and appeared undamaged. The piston appeared intact with only impact scoring damage. The cylinder also appeared intact and undamaged.

Blade L1 was predominantly bent aft with an approximate 3" section of the tip bent forward. There was no remarkable twisting except for the last 2" of the tip that was twisted toward high pitch. There were two, remarkable tree-strike wave bends in the leading edge (Photo #6), one at the tip that bent the leading edge toward high pitch and another at approximately 6" from the tip that bent the leading edge toward low pitch. There was remarkable chordwise/rotational scoring on camber side (Photo #6) from the mid-blade to the tip and on the face side near the tip (Photo #7).

Blade L2 was bent forward/folded approximately 170° in the mid-blade area with spanwise scoring in the bend on the face side. There was a tree-strike wave bend approximately 4" from the tip with the leading edge deformed toward low pitch (Photo #6). The blade was twisted towards low pitch in the tip region. There was chordwise/rotational scoring on both the camber and face sides (Photo #9 and Photo #8), most notably along the leading edge back to 10-30% chord.

The propeller was not cycled with air pressure due to the cocked piston and blades not resting on the start lock pins. The feathering spring tension was released by removing the piston nut. This allowed disconnecting the link arms and removal of the piston. Both blade clamps moved freely after disconnecting the link arms. The piston did not have any discernable circumferential marks that would provide blade angle information. There was also no mark on the piston ceiling that indicated the propeller was at/near feather. The propeller was not disassembled any further.

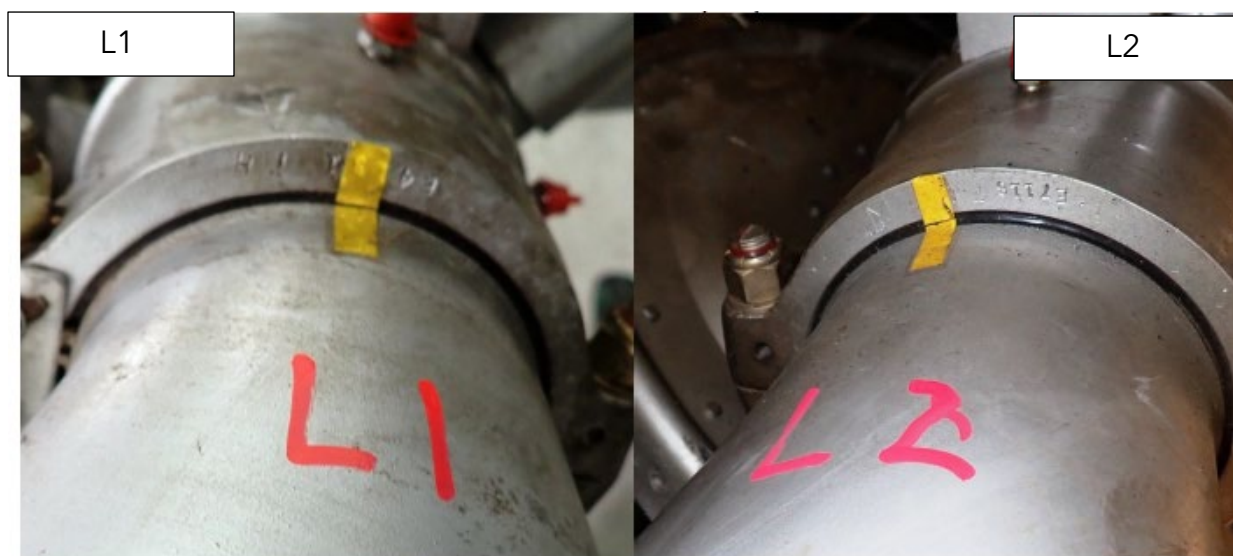


Photo 5. Left propeller blade/clamp slip indicators



Photo 6. Tree strike bends in L1 and L2 leading edges

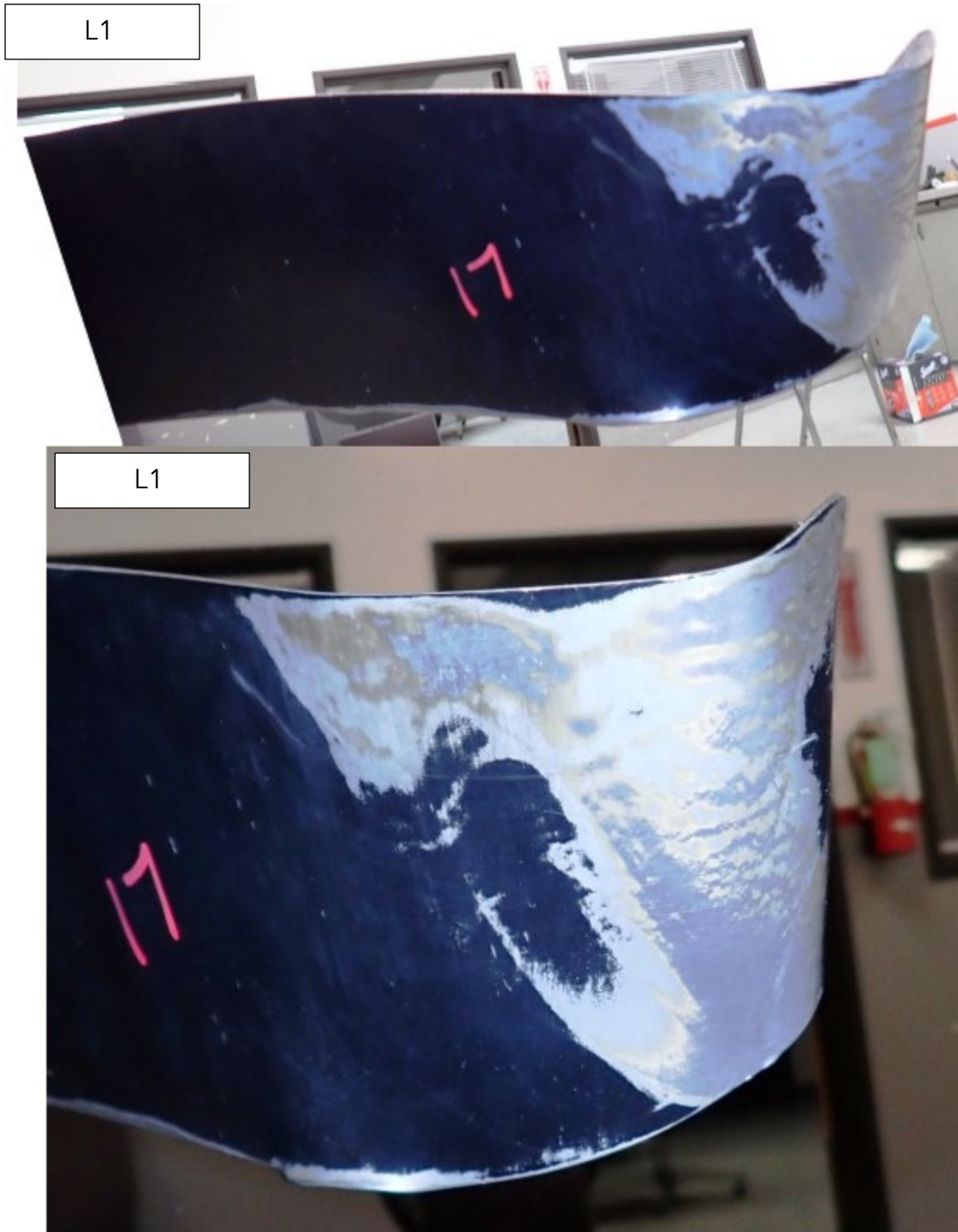


Photo 7. L1 blade face side



Photo 8. L2 blade face side

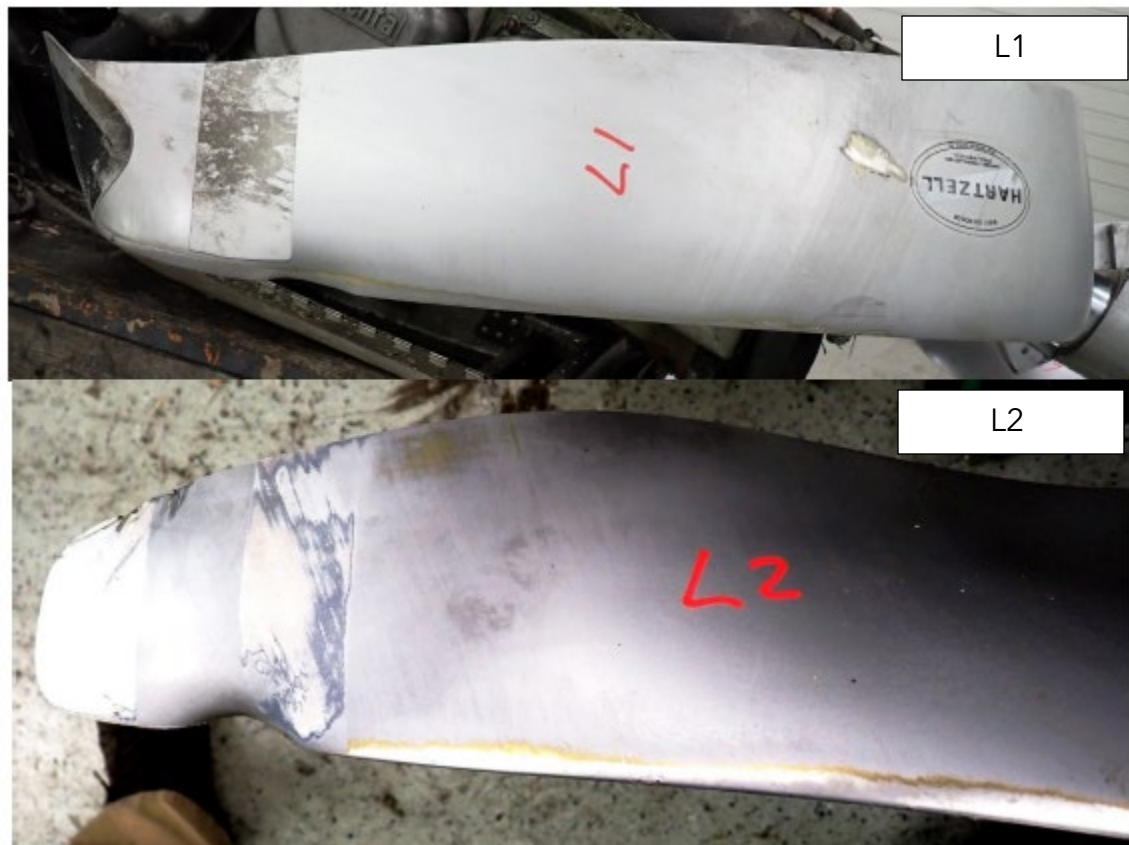


Photo 9. L1 and L2 camber sides

E. CONCLUSIONS

There were no discrepancies noted that would preclude or degrade normal operation on either propeller. All damage was consistent with high impact forces. Both propellers exhibited damage consistent with rotation at a low blade angle; neither was in a feathered position. The left propeller exhibited damage consistent with rotation at a higher power level when compared to the right, although a definitive power level could not be determined on either propeller.

Submitted by:

Laura Abraham
Air Safety Investigator