

NTSB File No. CEN23LA145

Hartzell Air Safety Investigator Examination Notes

June 4, 2023

Accident Date: March 29, 2023

Location: Lincoln, IL

Aircraft: Piper PA-32-260

Aircraft Registration: N56793

Aircraft Hobbs: Unknown

Propeller Examination

Location: AMFAviation

Springfield, TN 37172

Exam Date: May 17, 2023

Participants: Les Doud – Hartzell Air Safety Investigator

Jason Aguilera – NTSB Central Region

Tom Miller – FAA Springfield, IL FSDO ASI

Mike Childers – Lycoming ASI

Kathryn Whitaker – Piper ASI

Propeller Description

Propeller Model and S/N

Model: HC-C2YK-1BF/F8477-2

Assembly S/N: CH34771B

Date of Manufacture: 10/23/2000

Blade S/Ns: D74616, D74633 (DOM 2/1/78)

The propeller is an 82” diameter, 2-blade, single-acting, hydraulically operated constant speed model. Oil pressure from the propeller governor moves the blades to the high pitch (blade angle) direction. Centrifugal twisting moments from the blades and a small return spring move the blades to the low pitch stop in the absence of governor oil pressure. The propeller utilizes aluminum blades and an aluminum hub. Rotation is clockwise as viewed from the rear.

Installation Data: Reference Hartzell Installation Data Sheet No. 827 and TC A3SO for additional installation data.

Propeller Governor

Hartzell Model No.: F-4-4A

S/N: 7949U

Accident Summary and Exam Findings

The purpose of the flight was to conduct instrument flight training in visual meteorological conditions. A preliminary review of Automatic Dependent Surveillance-Broadcast data showed the airplane departing from the Logan County Airport (AAA), Lincoln, Illinois, about 1823. The

airplane departed to the east of the airport where it performed the training. The airplane flew back to the airport where it performed training in the traffic pattern. While on final approach to runway 3, the airplane sustained a total loss of engine power. The flight instructor maneuvered the airplane for a forced landing. The airplane impacted a church parking lot and came to rest upright against a block wall garden structure.

The aircraft wreckage was recovered to AMF Aviation in Springfield, TN and examined on May 17, 2023. The propeller remained attached to the engine crankshaft flange as shown in Photo #1 with all six mounting studs secure and lockwired. Both blades appeared to be in a feathered position. The blades were numbered #1 and #2 with #1, Assembly S/N, and #2 in sequence of rotation. Blade #1 was predominantly bent aft with approximately 3-4" of the tip curled forward and was rotationally loose indicating fractured pitch change mechanisms. Blade #2 had a slight, simple bend aft with no other remarkable damage and was rotationally secure. Photo #2 shows the damage on the bottom side of the spinner consistent with impact into a block wall after rotation had stopped.

Photo #1 – Propeller



Photo # 2 – Bottom haft of spinner indicating cylinder and piston crushed aft



After removal of the spinner dome the propeller cylinder, the piston and a fragment of the pitch change rod fell off the assembly with the spinner forward bulkhead; they had impact separated but were loosely retained by the spinner dome. The cylinder and piston were crushed aft and partially sheared across as shown in Photo #3. The starter ring gear was fractured circumferentially and the propeller cylinder mounting boss was partially fractured and crushed. Photo #4 shows the propeller prior to removal from the engine.

Photo #3 – Cylinder, piston and pitch change rod fragment

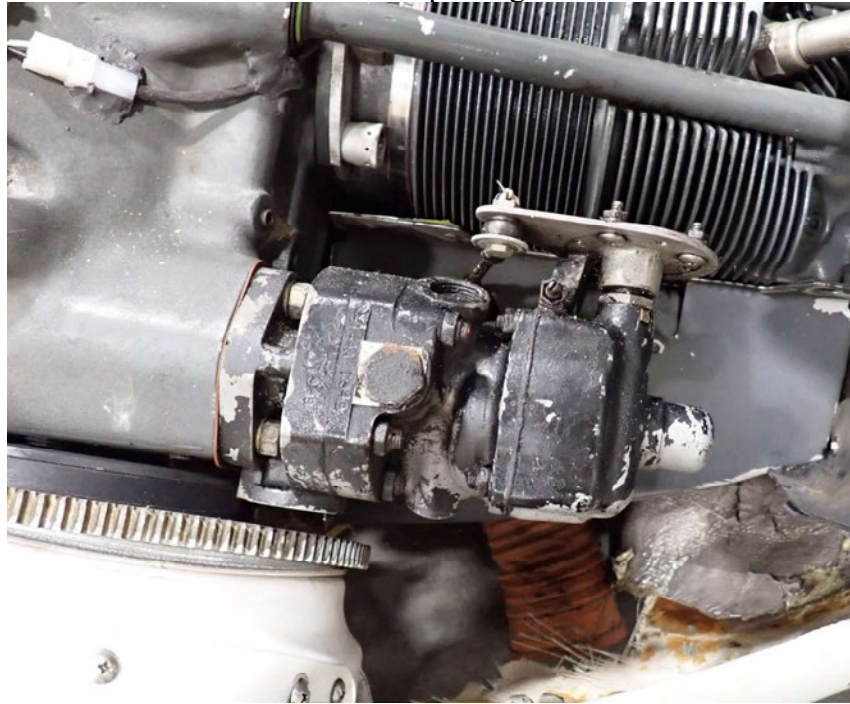


Photo #4 - Propeller prior to removal from engine (Blade #1 to the left)



There were no indications of oil leaking from the propeller, propeller mounting flange or governor and governor mounting pad. The governor control arm rotated smoothly and control cable continuity was confirmed back to the point where it was intentionally cut for recovery. The governor (Photo #5) was removed and the pump shaft rotated smoothly by finger force and produced gurgling sounds. The governor gasket did not incorporate a screen but all ports were clear with no indication of debris or improper sealants.

Photo #5 – Propeller governor



Propeller Examination

The propeller was removed from the engine mounting flange for further disassembly as shown in Photo #6. Both blades were securely retained in the hub. The pitch change rod fractured forward of the fork, eliminating the high pitch stop and allowing the blades to travel into a feathered position. Neither blade exhibited any leading edge damage signatures consistent with powered rotation or high RPM. Blade #2 had some leading edge “flats” favoring the camber side leading edge suggesting a scraping from asphalt/concrete after rotation stopped or recovery/transport damage. There was no remarkable trailing edge damage.

Blade #1 was predominantly bent aft with no remarkable twisting. It had some chordwise/rotational abrasion on the face side near the tip bend but limited in chordwise extent. Blade #2 was bent aft to a lesser degree than Blade #1 and had no remarkable twisting. Photos #7 through #10 illustrate the blade damage.

The blade #1 pitch change knob fracture-separated from the butt. Photo #11 (butt side) and Photo #12 knob fracture surfaces indicate shear/overload type fractures due to forceful rotation towards low pitch. Blade #2 pitch change knob was bent (Photo #13) also indicating forceful rotation towards low pitch.

Photo #14 shows the preload plates for each blade. Both preload plates exhibited a knob block/bumper mark at 34° forward of the split line mark which is approximately equal to 11° blade angle (IDS 827 defines the low pitch stop as 12 +/- 0.2°).

Photo #15 shows the pitch change rod point of contact with the low pitch stop screw. The damage suggests the propeller was on or near the low pitch stop when impact occurred. Additionally, the low pitch stop screw was damaged and displaced forward in the cylinder threads.

Photo #6 – Propeller removed and prior to disassembly (Blade #1 to the right)

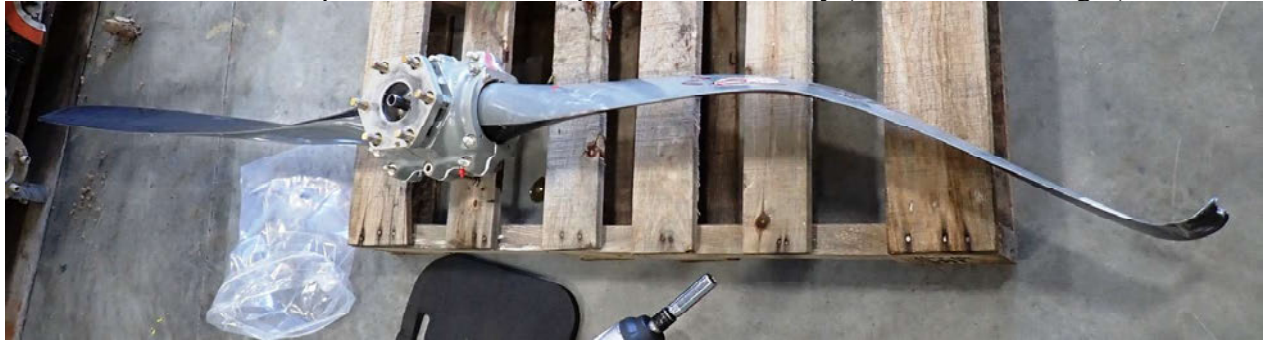


Photo #7 – Blades, leading edge view (left) and trail edge view (right)



Photo #8 – Blades, camber side



Photo #9 – Blades, face side



Photo #10 – Face side of blade tips



Photo #11 – Blade #1 pitch change rod fracture surface on blade butt

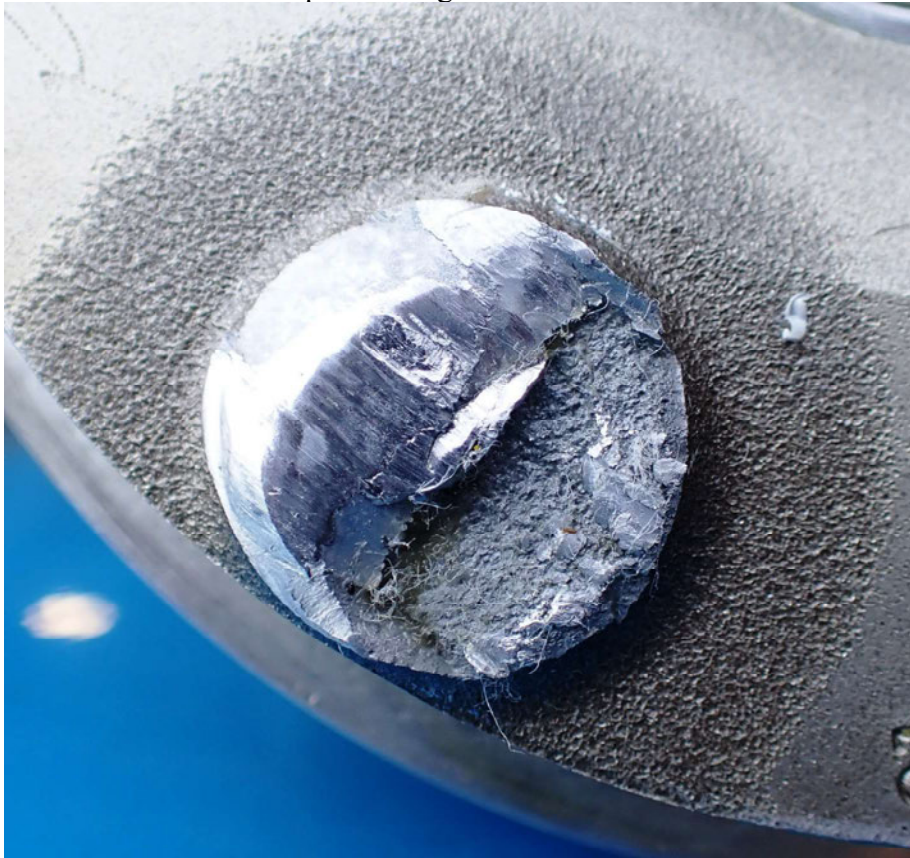


Photo #12 – Blade #1 pitch change knob fracture surface



Photo #13 - Blade #2 shank/butt with impact mark and bent pitch change knob

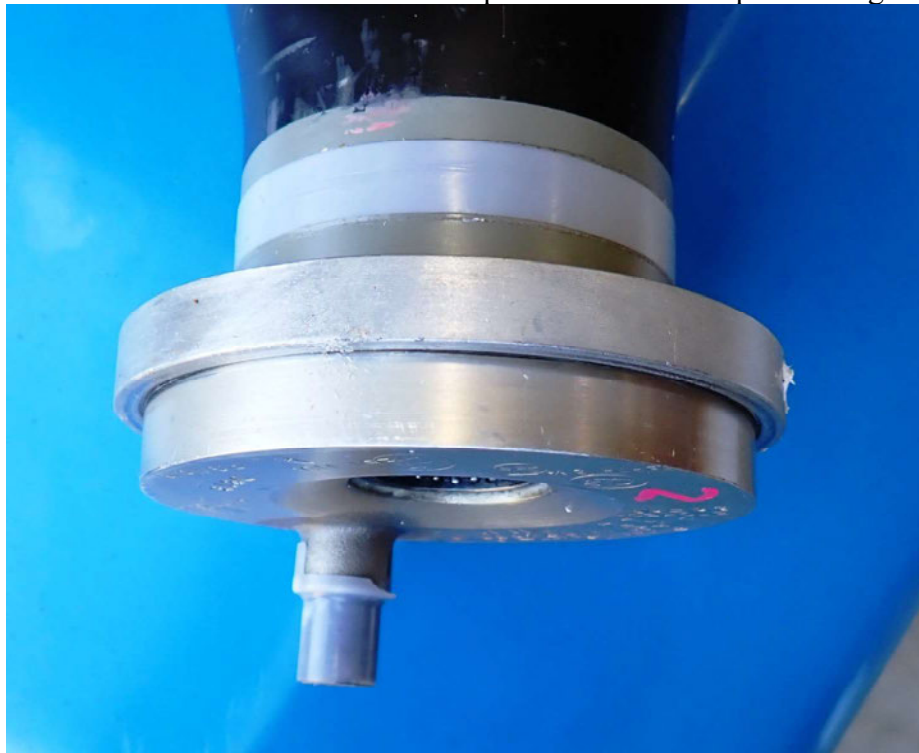


Photo #14 - Preload plates



Photo #15 - Pitch change rod at low pitch stop contact point



Conclusions

The propeller damage (minimal chordwise/rotational abrasion, one fractured pitch change knob, relatively minor blade bending) is consistent with a propeller windmilling power OFF, at or near the low pitch stop blade angle when it struck objects during the forced landing. There were no discrepancies noted on the propeller that would prevent or degrade normal operation. All damage was consistent with high impact forces.

[REDACTED]

Les Doud
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Hartzell Propeller Inc./Hartzell Engine Technologies LLC

O: [REDACTED]

C: [REDACTED]

[REDACTED]