

Hartzell Air Safety Investigator Examination Report

September 5, 2024

Accident Date: September 2, 2023

Location: Toms River, NJ near Ocean County Airport (MJX)

Aircraft: Cirrus SR20

Aircraft Registration: N420PB

Propeller Examination

Location: Anglin Aircraft Recovery

Clayton, DE 19938

Exam Date: September 5, 2024

Participants: Les Doud – Hartzell Air Safety Investigator

Aaron McCarter – NTSB Eastern Region

Mark Haroldson – Cirrus ASI

Propeller Description

Propeller Model and S/N

Model: BHC-J2YF-1BF / F7694

Assembly S/N: EF439B

Date of Manufacture: 12/10/2005

Blade S/Ns: K31100, K31101 (DOM 12/2/2005)

The propeller is a 76" diameter, 2-blade, single-acting, hydraulically operated constant speed model. Oil pressure from the propeller governor modulates the blade angle between the low pitch stop of 14.6° and the high pitch stop of 35°. 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. 1486 and TC A00009CH for additional installation data.

Accident Summary and Initial Exam Observations

The following is an excerpt from the NTSB Preliminary Report. *“According to the student pilot’s flight instructor, the purpose of the flight was for the student pilot to perform solo takeoffs and landings at night. Preliminary Automatic Dependent Surveillance – Broadcast (ADS-B) track data indicated that the accident occurred during the student pilot’s fourth takeoff following three full-stop landings.*

During the climb over the runway, the airplane’s first ADS-B target was acquired at 275 ft mean sea level (msl) and 62 knots groundspeed. The airplane climbed to 425 ft before it leveled for about 30 seconds between 425 and 500 ft. The airplane’s groundspeeds in the climb slowed and

were steady at 56 knots and once level, the airplane accelerated slowly to about 90 knots groundspeed, where it initiated a descending, accelerating westerly turn until the target disappeared. Two separate airport surveillance videos captured the airplane; the first video showed the airplane in a shallow climb after takeoff before the airplane continued out of frame. The second showed the airplane in a descent below the tree line, followed by a post-impact fire.”

The aircraft wreckage was recovered to Anglin Aircraft Recovery in Clayton, DE. According to other NTSB Party Members, the propeller remained attached to the engine crankshaft flange throughout the impact sequence with all six mounting studs and nuts secure. The spinner dome crushed and tore with torsional deformation and impact compression damage to the cylinder. The spinner bulkhead remained attached to the hub and the flanges were bent aft on either side of the hub.

The propeller spinner dome was removed from the propeller and the propeller removed from the engine crankshaft flange by other Party Members prior to this propeller exam. The propeller and spinner were presented for examination as shown in Photos #1 and #2 on September 5, 2024. Both blades remained retained by the hub with no remarkable hub fractures. All hub thru- bolts were present and secure. Both blades exhibited thermal damage from the post-crash fire; the blades were charred outboard of the mid-blade and the tips partially consumed. The blades were numbered #1 and #2 with the S/N following #1 in the sequence of rotation.

Blade #1 was rotationally loose and appeared to be in a feathered position and Blade #2 in a normal blade angle range of operation. Photos #9 through #12 show the blade damage described below. Blade #1 exhibited S-bending; forward/thrust direction at the tip and aft in the mid-blade area as well as bending opposite rotation in the major axis. The blade forcefully twisted towards high pitch and rotated by hand force in the hub indicating the pitch change mechanism fractured. The leading edge exhibited wave bends consistent with tree strikes as well as nicks and blunt impact damage consistent with rotation. There were also wave bends in the trailing edge.

Blade #2 bent aft and forcefully twisted towards low pitch. The leading edge exhibited wave bends consistent with tree strikes as well as nicks and blunt impact damage consistent with rotation.

Propeller Teardown Examination Findings

The cylinder unthreaded from the hub without difficulty and the mounting boss appeared intact and undamaged. The cylinder was crushed aft and punctured (Photo #3). The piston, pitch change rod and fork appeared intact (Photo #4). The pitch change rod bent in the fork section but unthreaded from the fork without difficulty. The low pitch stop and pitch change rod contact surfaces had damage from forceful contact (Photo #5). The high pitch stop was intact and appeared undamaged. The hub halves separated without difficulty. There was excessive grease in the hub cavity and the bearings were intact (Photo #6). There is a shank impact mark in aft hub aperture for Blade #1. Both blade retention pockets had impact damage to the preload plate shelves.

Photo #1 – Propeller as presented for examination



Photo # 2 – Spinner dome crushed and torn



Photo #3 – Cylinder crushed/punctured



Photo #4 - Cylinder, piston, pitch change rod and fork



Photo #5 - Pitch change rod and low pitch stop contact surfaces

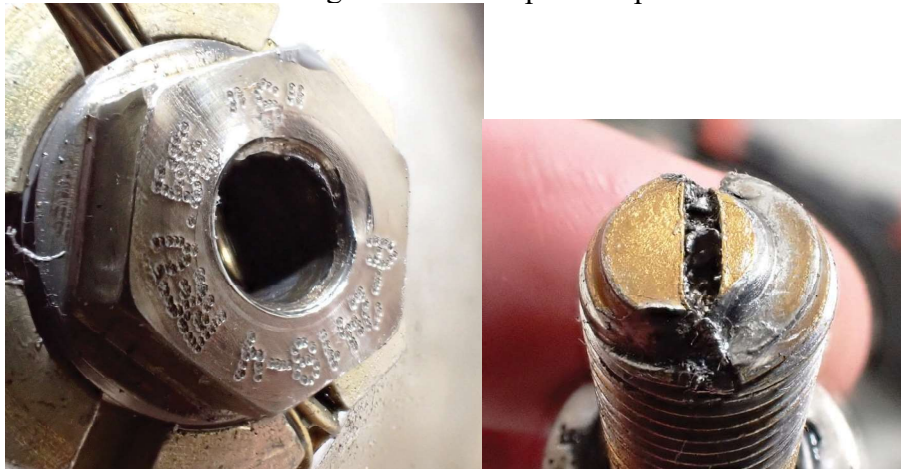


Photo #6 - Hub internal condition



Both preload plate retention lips smashed and/or partially sheared. There was a remarkable pitch change knob block impact mark at 23° forward of the split line on preload plate #2 (Photo #7) which is approximately equal to 24° blade angle (IDS 1486 defines the low pitch stop as 14.6 +/- 0.1°). There were no remarkable impact marks on preload plate #1 but the low pitch end of the knob slot had contact damage, consistent with the fracture of the #1 knob.

The Blade #1 pitch change knob fracture-separated from the butt with shear/overload fracture features, indicating forceful blade rotation towards high pitch (Photo #8). Blade #2 pitch change knob was intact but bent indicating forceful rotation towards high pitch.

Photo #7 - Preload plates



Photo #8 – Blade #1 pitch change rod fracture surfaces

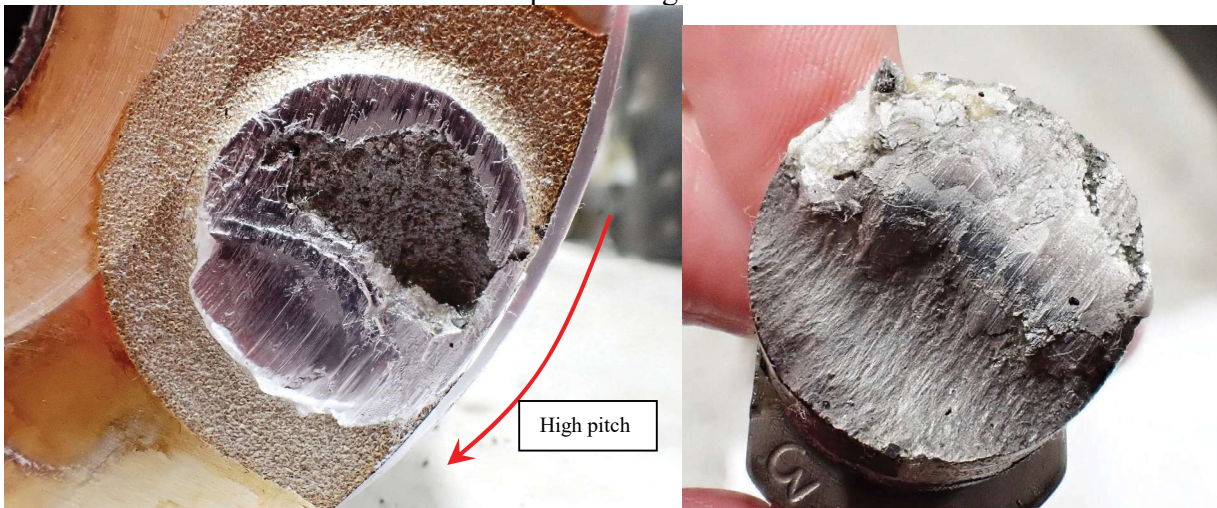


Photo #9 – Blades, leading edge view (left) and trail edge view (right)



Photo #10 – Blades, camber side



Photo #11 – Blades, face side

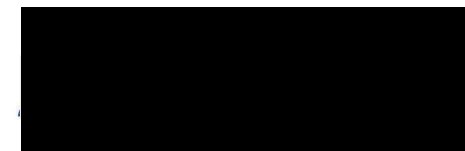


Photo #12 – Leading edge wave/tree strike bends (Blade #1 left, #2 right)



Conclusions

The propeller blade damage (compound bending forward/thrust direction and twisting toward high pitch on Blade #1, bending opposite rotation, tree strike wave bends) is consistent with a propeller rotating with POWER ON. The mark on preload plate #2 suggests the propeller governing at a blade angle consistent with moderate-to-high power. There were no discrepancies noted on the propeller that would prevent or degrade normal operation. All damage was consistent with high impact forces.



Les Doud
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Hartzell Propeller LLC/Hartzell Engine Tech LLC

O: [REDACTED]

C: [REDACTED]

[REDACTED]