Date of Accident: October 18, 2022

Location: Marietta, OH
Near Mid-Ohio Valley Regional Airport (KPKB)

NTSB File No.: ERA23FA024

Aircraft: Beechcraft King Air E90

Registration No.: N515GK

Serial No.: LW-108

Owner/Operator: (per FAA Registry)
Avintel Management LLC
[redacted]
Dublin, OH 43017-5301

Written by: Les Doud
Air Safety Investigator

Report Date: November 22, 2022

Contents:

ACCIDENT SYNOPSIS

Below is excerpted from the NTSB Preliminary Report:

"On October 18, 2022, at 0709 eastern daylight time, a Beech E-90, N515GK, was substantially damaged when it was involved in an accident in Marietta, Ohio. The two commercial pilots were fatally injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 positioning flight.

The flight originated at the John Glenn Columbus International Airport (CMH), Columbus, Ohio about 0640 and was enroute to Mid-Ohio Valley Regional Airport (PKB), Parkersburg, West Virginia. Preliminary Automatic Dependent Surveillance - Broadcast (ADS-B) data revealed that after takeoff from CMH, the airplane climbed and turned on a ground track of 115° then leveled off at 11,000 ft mean sea level (msl) where it remained for most of the enroute portion of the 75-nautical mile flight.

Preliminary air traffic control communication information revealed that the flight crew were in communication with the Indianapolis Air Route Traffic Control Center during the enroute portion the flight and that all communications with the air traffic controllers were normal with no indication of any irregularities.

As the airplane approached PKB, the controllers cleared the flight to descend and maintain 4,000 ft msl, then subsequently cleared it for the RNAV RWY 21 approach into PKB. Shortly after, the flight was instructed to contact the PKB control tower. The subsequent exchanges with the controllers there were normal. About 1109, as the airplane was on a 3-mile final approach, the controllers cleared the flight for landing, which was acknowledged by the flight crew. There were no additional communications received from the flight crew.

Multiple eyewitnesses located on the airport and area surrounding the accident site reported that the airplane, while flying straight and level, suddenly began a steep descent and spun near vertically to the ground. Security camera footage from multiple sources showed the airplane's descent through impact, which was generally consistent with the eyewitness's accounts.

Preliminary weather information at the time of the accident indicated that there were pilot reports throughout the area for trace to moderate icing conditions and AIRMETs moderate icing. Weather satellite data showed supercooled liquid water clouds from 1,300 ft agl to about 8,000 ft agl.

The airplane impacted a car dealership parking lot at an elevation of 614 ft msl, about 3 miles northeast of the approach end of runway 21 at PKB. The airplane struck a vehicle before coming to rest on level pavement. The wreckage path was oriented on a heading of 305° magnetic. All major components of the airplane were accounted for at the accident site. The cockpit and forward portions of the fuselage were crushed aft.

A significant post-impact fire ensued, consuming a majority of the fuselage and the cockpit area. The fuselage above the floorboards was totally consumed by fire. The instrument panel and all associated instrumentation, gauges and switches were severely impact damaged and thermally damaged. The left and right flaps, which were significantly damaged by impact and post impact fire, remained attached to their respective mounts; the actuators indicated a flap

position of 15°.

Partial flight control continuity from the cockpit to the ailerons, elevator, and rudder was established through cables, bell cranks, and push pull rods. All breaks in the cables and push/pull rods were consistent with heat and overload damage.
The pneumatic anti-icing system was consumed by post impact fire; the switches were impact and thermally damaged, and a reliable determination of their post impact positions could not be made.

Both engines were located in the wreckage path, and both displayed significant impact and thermal damage. There were no indications of any pre-impact mechanical anomalies to any of the engine components that would have precluded normal engine operation.

Both left and right propeller assemblies were detached from their respective engines. All 4 blades remained attached to their respective hubs. All four blades on both sides exhibited severe s-bending, chordwise scraping, and leading edge gouges.

The wreckage was retained for further examination."

SUMMARY AND ANALYSIS OF FINDINGS

The accident aircraft is shown in Photo #1 with the Raisbeck STC SA3593NM 4-blade propeller models that were installed at the time of the accident.

Photo #1 – Accident Aircraft (obtained from Flight Aware)

The accident propellers were recovered from the accident scene and presented for examination at Anglin Aircraft Recovery on November 16-17, 2022. The propellers were disassembled to remove the preload plates and blades. Measurements of impact marks on the preload plates were recorded and analyzed to aid in blade angle determination. Blade damage was assessed to aid in determination of blade section impact angles and thus engine power state at initial impact.

Both propellers exhibited similar impact damage but the left propeller was more heavily heat damaged; three blades on the left propeller were partially consumed. The montage in Photo #2 shows the relative damage between the left and right blades. Blade damage that included chordwise/rotational scoring on both camber and face sides, bending forward/thrust direction, bending opposite rotation, and leading edge gouging was consistent with impact while rotating with power ON. There was no damage to indicate either propeller was feathered or at low pitch/idle power at the time of impact.

Fork anti-rotation bumper marks on the preload plates indicated both propellers were in a similar blade angle range at impact (Photo #3). Bumper impact marks on the L3 and L4 preload plates suggested the blade angle was in the range of 26-30°. At 3100 ft, 1900 RPM, and 135 KTAS those blade angles would be consistent with power levels between 166 Hp to 404 Hp. At 150 KTAS the estimated power levels are 62 Hp to 304 Hp. Similar bumper marks on the R3 and R4 preload plates indicated a blade angle range of 30-32° which is consistent with power levels of 304 Hp to 542 Hp. The Raisbeck STC SA3593NM AMFS states maximum power is 1520 ft-lbs. @ 1900 RPM which is equivalent to 550 Hp.

Additionally, blades R1, R2 and L1, L2 were bent forward in the thrust direction indicating blade section angles of attack were positive at impact and the propellers were generating thrust. Blades bending forward and impact marks on the aft fork tangs on blades R1/L1, R2/L2 indicated forceful rotation toward high pitch which is also consistent with the propellers generating thrust at initial impact.

CONCLUSIONS

There were no discrepancies noted in the components examined that would prevent or degrade normal operation prior to impact with terrain. All damage was consistent with high impact forces. Impact signatures indicated the blade angle for both propellers was approximately 30° while rotating with power and generating thrust.

Photo #2 - Montage of left-right blade damage comparison

Blades R2 – L2

Blades R1 – L1

Blades R4 – L4

Blades R3 – L3

Photo #3 – Similarity of preload plates R3-L3 and R4-L4

PROPELLER TEARDOWN EXAM – FACTUAL INFORMATION

Date of Investigation: November 16-17, 2022

Location: Anglin Aircraft Recovery
[redacted]
Clayton, DE 19938

Propeller Model: HC-D4N-3C with D9290K blades

Representatives:

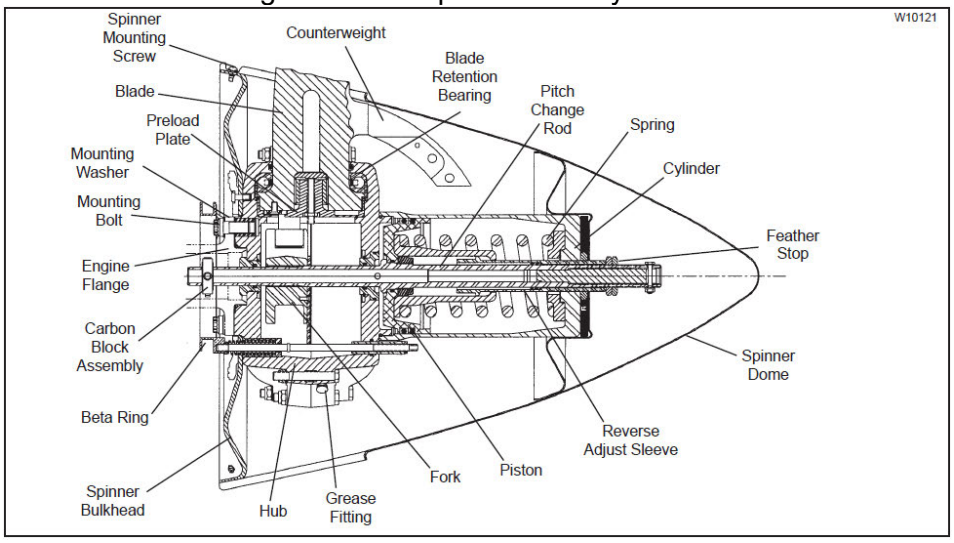
Les Doud	Hartzell Propeller Inc.
Aaron McCarter	NTSB Investigator in Charge
Josh Young	NTSB Air Safety Investigator
Casey Love	Textron ASI

General Comments: The propellers examined were 93" diameter, 4-blade, single-acting, hydraulically operated constant speed model with feathering and reverse pitch capability. Oil pressure from the propeller governor is used to move the blades to the low pitch (blade angle) direction. A feathering spring and blade counterweight forces are used to move the blades to the high pitch/feather direction in the absence of governor oil pressure. The propeller incorporates a Beta mechanism that actuates when blade angles are lower than the flight idle position. The propeller utilizes an aluminum hub with aluminum blades. Rotation is clockwise as viewed from the rear. A cutaway sketch is shown in Figure 1. The propellers were installed on the aircraft via Raisbeck Supplemental Type Certificate SA3593NM.

Installation Data: See Hartzell Installation Data Sheet No. 1165 (Blade angles defined at the 30-inch radius) and STC SA3593NM for additional details.

Reverse:	-9.0 ± 0.5	degrees
Beta Pick-up:	20.1 ± 0.1	degrees
Flight Idle:	See SA3593NM	
Feather:	84.5 ± 0.5	degrees

Figure #1 – Propeller cutaway sketch



Position: **LEFT**

Propeller Model: HC-D4N-3(C) with D9290K blades ("C" was not stamped on hub)

Propeller Assembly Serial Number: FY5026

Service History: According to the logbooks the propeller was overhauled on 6/6/2022 by East Coast Propeller and installed on the left side of the accident airplane on 6/7/2022 with a TTSN of 4751.1. Both the hub and blades were replaced at overhaul. TTSN/TSO on the day of the accident are unknown.

	S/N	Date of Manufacture	TTSN	TSO
Hub/Factory	B36851	12/2/2020	UNK	UNK
Blade L1	L53137	9/12/2014	UNK	UNK
Blade L2	L53140	9/12/2014	UNK	UNK
Blade L3	L53138	9/12/2014	UNK	UNK
Blade L4	L53139	9/12/2014	UNK	UNK

Blade Orientation: The blades were identified L1-L2-L3-L4 counterclockwise as viewed from the rear of the propeller. The hub serial number was between the L1 and L2 blades.

As Received: The left propeller fractured from the propeller shaft during the impact sequence, was recovered and presented for examination at Anglin's as shown in Photos #4 and #5. The propeller shaft flange remained attached to the hub with all mounting bolts present and lockwired. The entire propeller exhibited heat damage and discoloration. Three blades were partially consumed by the post-crash fire. Two blades appeared to be bent forward in the thrust direction, two blades appeared to be bent aft. The L1 counterweight was missing. The L2 counterweight had pulled from the blade but was retained by the de-ice wires. The hydraulic unit (cylinder, piston, pitch change rod, pitch stops, and feathering spring) fractured from the propeller assembly and was not presented for examination. The cylinder mounting boss was fractured and the pitch change rod was fractured in the fork thread area. The spinner dome was crushed, torn and mostly consumed. The spinner bulkhead was partially consumed. The beta ring remained attached via the beat rods but had localized bending/crushing and fractures. The beta rods were present but the forward ends were either fractured or bent as they exited the forward hub half. The de-ice boots were consumed and the de-ice wire insulation was consumed.

Spinner Dome: The spinner dome was mostly consumed by the post-crash fire, what small fragments remained were crushed, torn and remained attached to the bulkhead.

Spinner Bulkhead: The spinner bulkhead was partially consumed by the post-crash fire and was bent. The de-ice slip ring remained attached with the slip rings displaced due to impact forces and heat damage.

Propeller Cycling: Propeller cycling was not possible due to damage.

Engine/Propeller Mounting: The propeller shaft flange remained attached to the aft hub half with all mounting bolts present and lockwired.

Pitch Change Mechanism: The majority of the pitch change mechanisms (fork, pitch change knobs/brackets) were fractured or exhibited heat damage (Photo #6).

Cylinder: Not observed.

Piston: Not observed.

Pitch Change Rod: The pitch change rod fractured in the fork threaded area. The forward end was not observed. The aft end was present. The forward pitch change rod bushing was not present and the aft bushing was heavily heat damaged.

Fork: See Photo #7. The pitch change fork exhibited remarkable heat discoloration. All four legs of the beta fork were bent forward. Two forward tangs were fractured in the forward direction. Three aft tangs exhibited denting/gouging from the pitch change knob/cam follower. Two anti-rotation bumpers fractured from the fork assembly.

Feathering Spring/Guides: Not observed.

Pitch Stops: Not observed.

Hub Assembly: The hub assembly exhibited heat discoloration/charring/sooting on both external and internal surfaces (Photos #9 and #10). The forward pitch change rod bushing was missing; the aft bushing was partially melted. The cylinder mounting boss was mostly fractured from the forward hub half. The preload plate pockets and webs were damaged in varying degrees. Otherwise there were no remarkable fractures in the blade retention arms. There were contact marks in the blade aperture in the aft/trailing edge quadrant for blades L1 and L2.

Preload Plates: See Photo #8. All four preload plates exhibited heat discoloration/shooting/charring and had varying degrees of the retention lip smashed or fractured.

NOTE: For this propeller model, when the blade knob is aligned with the hub parting line the blade angle at the reference station is approximately 40.6°. With the blade knob at the parting line, the fork bumper is approximately 0.120” behind the hub parting line. During impact the fork anti-rotation bumper can make impact marks on the preload plate. The location of those marks can indicate blade angle at impact.

Preload Plate	Condition
L1	There were no discernable fork bumper marks.
L2	There were no discernable fork bumper marks.
L3	Fork bumper mark 8.5° forward of the parting line progressing to 32° aft of the parting line which translate to blade angles of approximately 30° to 61°.
L4	Fork bumper mark 14° forward of the parting line progressing to 3-4° forward of the parting line which translate to blade angles of approximately 26° to 33°.

Propeller Blade Properties: See Photos #11 through #13.

Blade # L1 – Consumed 20” outboard of butt

Camber side	Heat damage and discoloration
Face side	Heat damage and discoloration
Bend	Forward/thrust direction
Twist	Not discernable on remaining portion of blade.
Lead edge damage	Not remarkable on remaining portion of blade.
Trail edge damage	Not remarkable on remaining portion of blade.
Knob condition	Bracket bent, screws pulled, cam follower bearing fractured
Counterweight	Fracture separated.
Blade bearings	Intact, charred, ball spacer melted, grease hardened
Butt/shank impact marks	Heat discoloration, charred, marks in the hub aperture and shank indicating impact loads in the lead-to-trail direction at an operational blade angle
De-Ice boot	Consumed

Blade # L2 – Consumed 30” outboard of butt

Camber side	Chordwise/rotational scoring
Face side	Chordwise/rotational scoring
Bend	Forward/thrust direction
Twist	Not discernable on remaining portion of blade
Lead edge damage	Gouging
Trail edge damage	Local, bends and tears
Knob condition	Cam follower bearing fractured
Counterweight	Fracture separated, counterweight remained attached to propeller via the de-ice wires
Blade bearings	Intact, charred, ball spacer melted, grease hardened
Butt/shank impact marks	Heat discoloration, charred, no discernable marks
De-Ice boot	Consumed

Blade # L3 – Consumed 13” outboard of butt

Camber side	Charred, heat discoloration
Face side	Charred, heat discoloration
Bend	Appears to be aft
Twist	Not discernable in remaining portion
Lead edge damage	Not remarkable
Trail edge damage	Not remarkable
Knob condition	Cam follower fractured
Counterweight	Intact, displaced from boss
Blade bearings	Intact, charred, ball spacer melted, grease hardened
Butt/shank impact marks	Heat discoloration, charred, no discernable marks
De-Ice boot	Consumed

Blade # L4

Camber side	Charred, heat discoloration
Face side	Charred, heat discoloration
Bend	Aft
Twist	Not remarkable
Lead edge damage	Nicks
Trail edge damage	Heat damage, partially consumed
Knob condition	Cam follower bearing fractured
Counterweight	Intact
Blade bearings	Intact, charred, ball spacer melted, grease hardened
Butt/shank impact marks	Heat discoloration, charred, no discernable marks
De-Ice boot	Consumed

Photo #4 – Left propeller as-presented for examination (aft side)

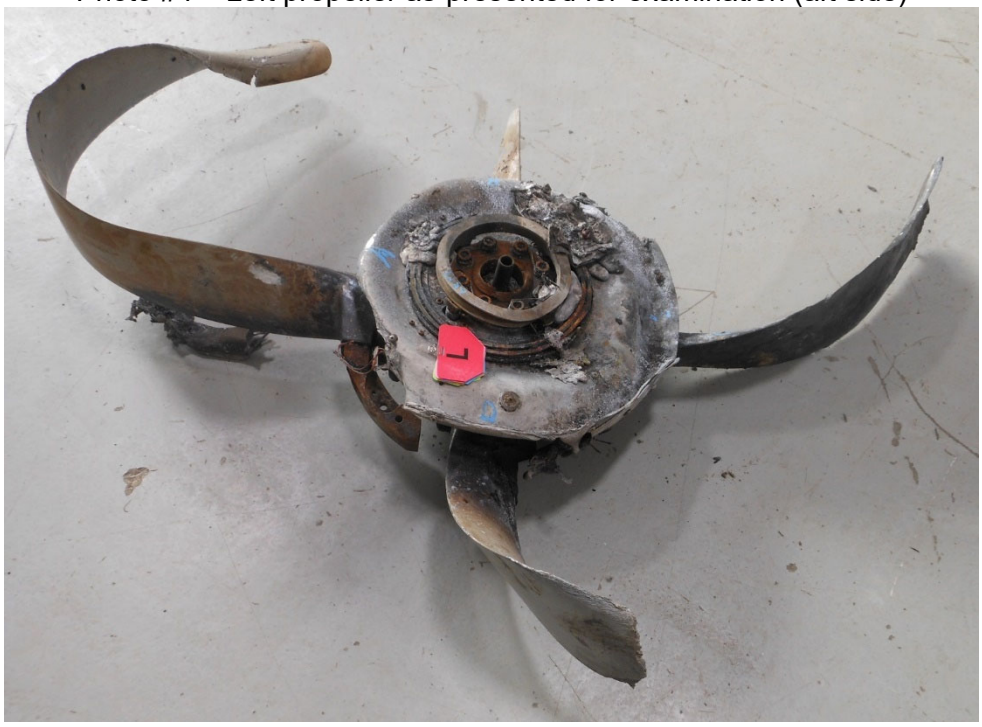


Photo #5 – Left propeller as-presented (front side)

Photo #6 – Pitch change mechanisms condition

Photo #7 – Left propeller pitch change fork

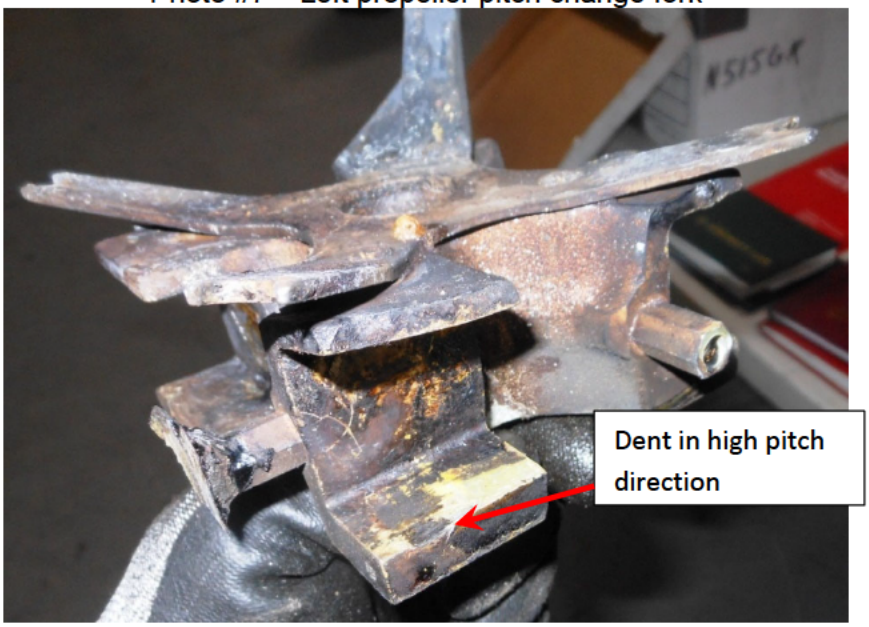


Photo #8 - Left propeller preload plates

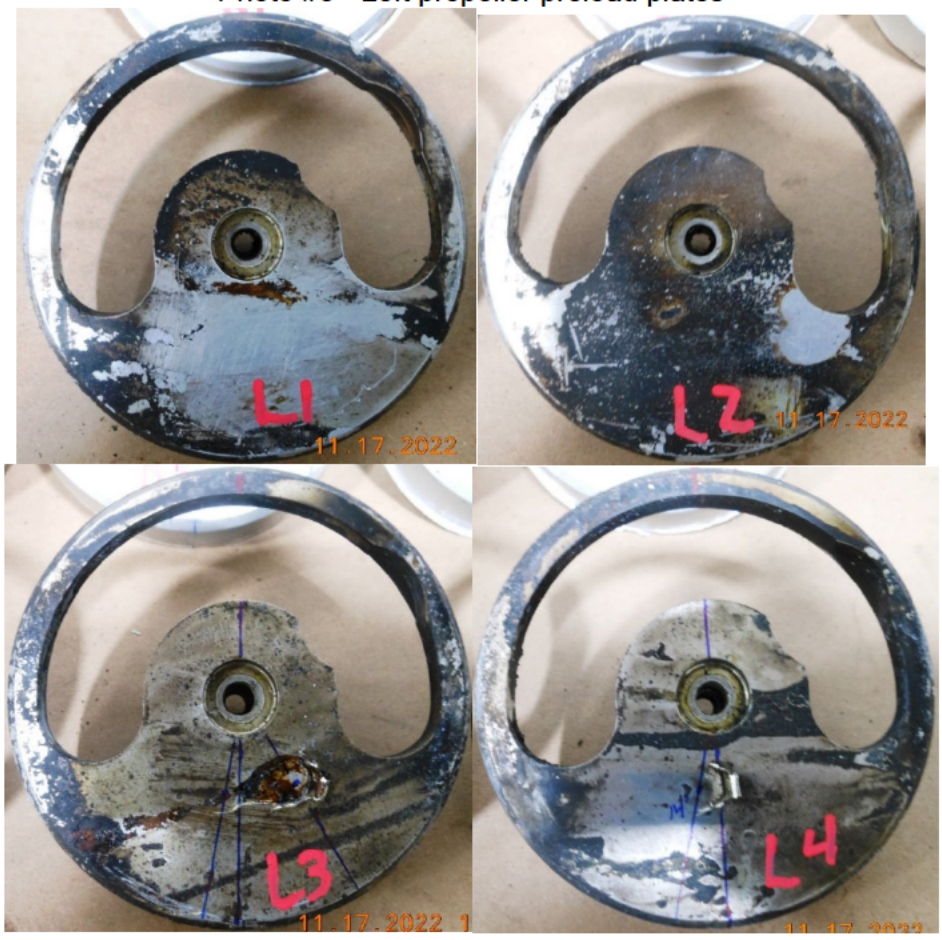


Photo #9 – Left forward hub half internal surface

Photo #10 – Left aft hub half internal surface

Photo #11 – Left blades camber side

Photo #12 – Left blades face side

Photo #13 – L1, L2 and L3 relative heat damage

Position: **Right**

Propeller Model: HC-D4N-3C with D9290K blades

Propeller Assembly Serial Number: FY2341

Service History: According to the logbooks the propeller was overhauled on 9/21/2021 by East Coast Propeller. TTSN/TSO on the day of the accident are unknown.

	S/N	Date of Manufacture	TTSN	TSO
Hub/Factory	K58248	1/17/2002	UNK	UNK
Blade R1	K86707	4/2/09	UNK	UNK
Blade R2	K86710	4/2/09	UNK	UNK
Blade R3	K86709	4/2/09	UNK	UNK
Blade R4	K86708	4/2/09	UNK	UNK

Blade Orientation: The blades were identified R1-R2-R3-R4 counterclockwise as viewed from the rear of the propeller. The hub serial number was between the R1 and R2 blades.

As Received: The right propeller fractured from the propeller shaft during the impact sequence, was recovered and presented for examination at Anglin's as shown in Photos #14 and #15. The propeller shaft flange remained attached to the hub with all mounting bolts present and lockwired. The forward hub half exhibited a complete fracture across the R1-R3 blade arms (Photo #16). The propeller exhibited heat damage, sooting and discoloration but did not exhibit as much heat exposure as the left propeller. Two blades (R2 and R3) were partially melted/consumed by the post-crash fire. Blades R1 and R2 appeared to be bent forward in the thrust direction, R3 and R4 blades appeared to be bent aft. Several blades had leading edge gouging. The R1 and R4 counterweights fractured from the blades but were retained by the de-ice wires. Blade R1 was intentionally cut across the Hartzell decal to facilitate recovery from the crash scene. Blade R4 could be partially rotated by hand force indicating pitch change damage. The hydraulic unit (cylinder, piston, pitch change rod, pitch stops, and feathering spring) fractured from the propeller assembly and was not presented for examination. The cylinder mounting boss was partially fractured and the pitch change rod was fractured forward of the fork. The spinner dome was crushed, torn and partially consumed. The spinner bulkhead was bent. The beta ring remained attached via the beat rods but had localized bending/crushing and fractures. The beta rods were present but the forward ends were either fractured or bent as they exited the forward hub half.

Spinner Dome: See Photo #17. The spinner dome was crushed and torn with small fragments attached to the spinner bulkhead. There were no discernable counterweight impact marks in the fragments.

Spinner Bulkhead: The spinner bulkhead remained attached to the hub with the de-ice slip ring and beta ring in place. The bulkhead exhibited heat discoloration and localized bending of the flanges and a fracture/tear adjacent to R1.

Propeller Cycling: Cycling the propeller with air pressure was not feasible due to damage and missing components.

Engine/Propeller Mounting: The propeller shaft flange remained attached to the aft hub half with all mounting bolts present and lockwired.

Pitch Change Mechanism: The pitch change mechanisms were either missing/not presented or heavily damaged.

Cylinder: Not observed.

Piston: Not observed.

Pitch Change Rod: The pitch change rod fractured forward of the fork/aft of the piston at the oil transfer hole location. The aft end was present. The forward pitch change rod bushing was not present and the aft bushing was mostly consumed/melted.

Fork: See Photo #20. The pitch change fork exhibited heat discoloration. All four legs of the beta fork were bent forward. Two forward tangs were fractured in the forward direction, the R1 forward tang was missing. Three aft tangs (R1, R2 and R3) exhibited denting/gouging from the pitch change knob/cam follower. One anti-rotation bumpers fractured from the fork assembly.

Feathering Spring/Guides: Not observed.

Pitch Stops: Not observed.

Hub Assembly: See Photos #18 and #19. The hub assembly exhibited heat discoloration/charring/sooting on both external and internal surfaces. The forward hub half was completely fractured across the R1-R3 blade arms (Photo #19). The aft hub half was fractured apart in the blade R1 aperture across the hub and partially through the blade R3 aperture. The R1 aperture was displaced opposite rotation (Photo #18). The forward change rod bushing was missing and the aft bushing was mostly melted/consumed. The cylinder mounting boss was partially fractured from the forward hub half. The preload plate pockets and webs were damaged in varying degrees. There were contact marks in the blade aperture in the aft/trailing edge quadrant for blades R1, R2 and R3.

Preload Plates: See Photo #21. All four preload plates had varying degrees of the retention lip smashed or fractured.

NOTE: For this propeller model, when the blade knob is aligned with the hub parting line the blade angle at the reference station is approximately 40.6°. With the blade knob at the parting line, the fork bumper is approximately 0.120" behind the hub parting line. During impact the fork anti-rotation bumper can make impact marks on the preload plate. The location of those marks can indicate blade angle at impact.

Preload Plate	Condition
R1	No discernable bumper marks. The aft/face quadrant of the plate was fractured.
R2	Fork bumper mark 27° aft of the parting line which translates to a blade angle of approximately 56°.
R3	Fork bumper mark 8.5° forward of the parting line progressing to 7.5° aft of the parting line which translate to blade angles of approximately 30° to 41°.
R4	Fork bumper mark 6° forward of the parting line progressing to 7° aft of the parting line which translate to blade angles of approximately 32° to 41°.

Propeller Blade Properties: See Photos #22 through #27.

Blade # R1 – Blade intentionally cut at the decal to facilitate recovery

Camber side	Chordwise/rotational scoring (Photo #25)
Face side	Chordwise/rotational scoring (Photo #26)
Bend	Forward/thrust direction at shank and mid-blade, aft at the tip (S-bend shape). Remarkable bending opposite rotation in the edgewise/major axis direction (Photo #27).
Twist	Toward low pitch at tip
Lead edge damage	Gouging
Trail edge damage	Localized bending
Knob condition	Bracket intact, cam follower bearing fractured
Counterweight	Fracture separated, holes opposite rotation
Blade bearings	Fractured, some ball imprints (Photo #22).
Butt/shank impact marks	Contact marks in the hub aperture and shank indicating impact loads in the lead-to-trail direction at an operational blade angle. Bearing race retention ring fractured.
De-Ice boot	Torn off, separated

Blade # R2 – Tip partially consumed

Camber side	Asphalt appears to be melted onto the surface, some chordwise/rotation scoring
Face side	Asphalt appears to be melted onto the surface, some chordwise/rotation scoring
Bend	Forward/thrust direction
Twist	Not remarkable
Lead edge damage	Gouging
Trail edge damage	Localized bending damage near tip
Knob condition	Intact
Counterweight	Intact, displaced from mounting boss
Blade bearings	Intact, some ball imprints
Butt/shank impact marks	Contact marks in the hub aperture and shank indicating impact loads in the lead-to-trail direction at an operational blade angle. Bearing race retention ring displaced.
De-Ice boot	Split, torn and charred

Blade # R3 – Partially consumed along the trailing edge

Camber side	Heat discoloration, heat distress/signs of creep
Face side	Chordwise/rotational scoring
Bend	Predominately aft, some in-direction of rotation
Twist	Towards low pitch at tip
Lead edge damage	Nicks and some gouging
Trail edge damage	Partially consumed
Knob condition	Intact
Counterweight	Intact, displaced from mounting boss
Blade bearings	Intact
Butt/shank impact marks	Bearing retention ring lip fractured. Contact marks in the hub aperture and shank indicating impact loads in the lead-to-trail direction at an operational blade angle.
De-Ice boot	Charred, torn, partially consumed.

Blade # R4

Camber side	Charred, heat discoloration
Face side	Charred, heat discoloration
Bend	Aft
Twist	Towards low pitch
Lead edge damage	Nicks
Trail edge damage	Not remarkable
Knob condition	Bracket intact but bent opposite high pitch, aft/TE screw pulled
Counterweight	Fracture separated
Blade bearings	Intact
Butt/shank impact marks	Contact mark on shank indicating impact loads mostly aft at an operational blade angle.
De-Ice boot	Charred, torn, partially consumed

Photo #14 – Right propeller as-presented for examination (aft side)

Photo #15 – Right propeller as-presented (front side)

Photo #16 – Right propeller forward hub fracture

Photo #17 – Right spinner dome fragments

Photo #18 – Right aft hub half internal surface

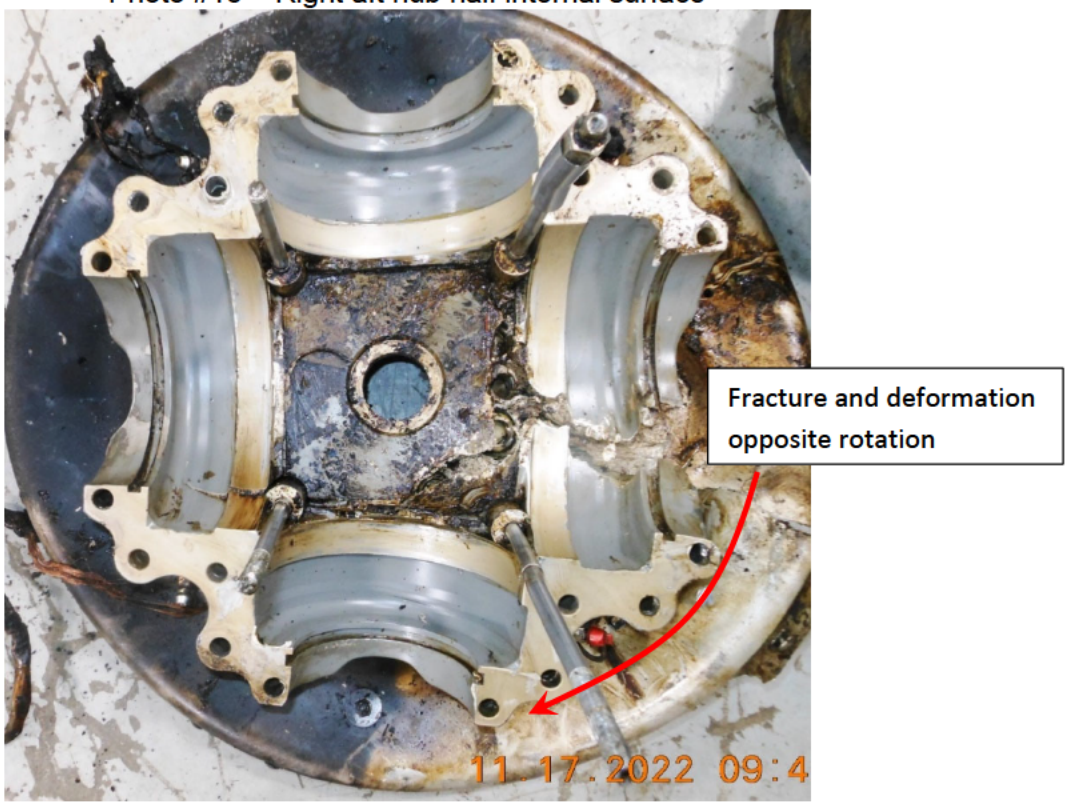


Photo #19 – Right forward hub half internal surface

Photo #20 – Right pitch change fork

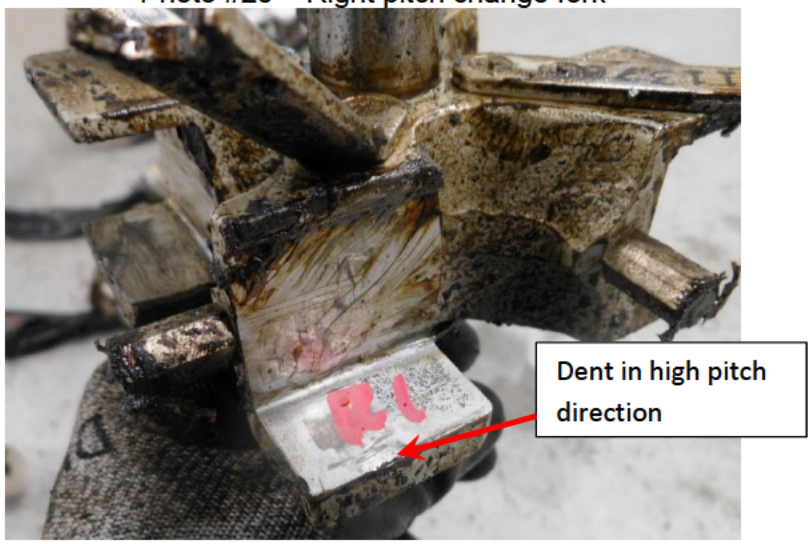


Photo #21 - Right propeller preload plates

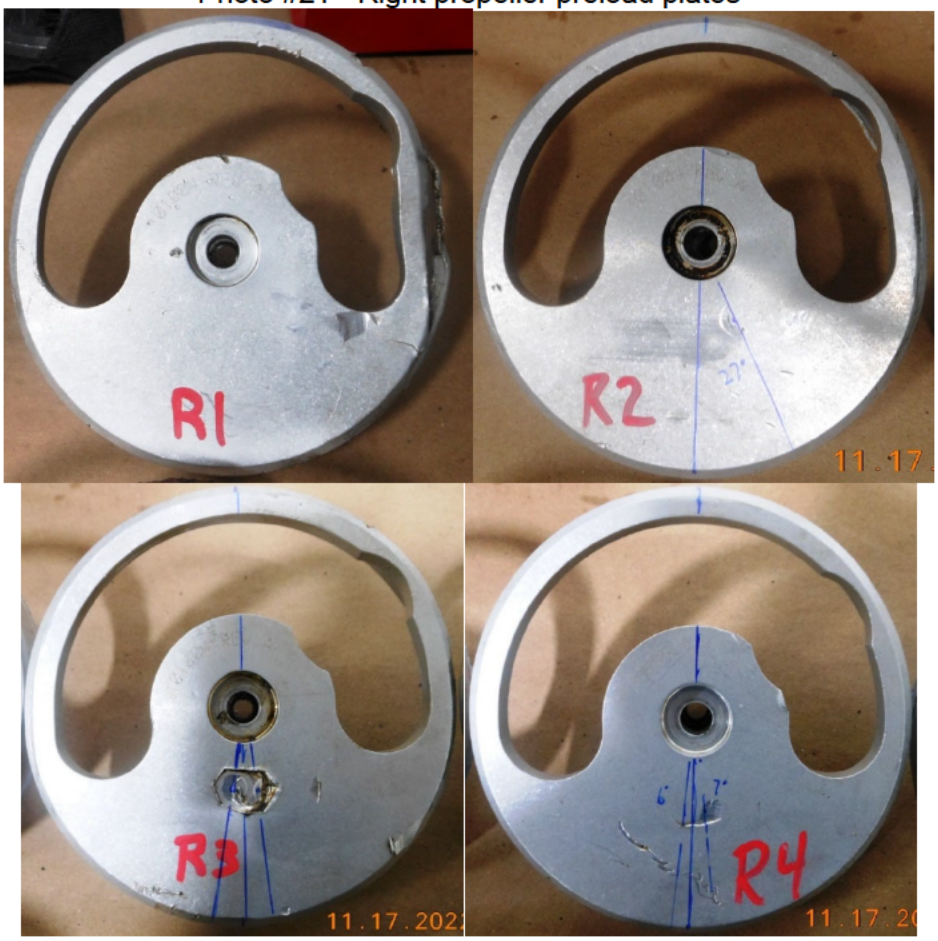


Photo #22 - Blade R1 bearing race fractures

Photo #23 – Right blades camber side

Photo #24 – Right blades trail edge view, progressive bending

Photo #25 - Blade R1 camber side damage

Photo #26 – Blade R1 face side damage

Photo #27 - Blade R1 remarkable bending opposite rotation