

Date of Accident: May 27, 2021

Location: Celina, OH (near Lakefield Airport, KCQA)

NTSB File No.: CEN21LA237

Aircraft: Schweizer/Grumman G-164B Ag Cat
With Honeywell TPE331 conversion

Registration No.: N8376K

Serial No.: 675B (year of manufacture 1982)

Operator: per FAA registry:
Gaerte Ag Service LLC
[REDACTED]
Defiance, OH 43512-6764

Written by: Les Doud
Air Safety Investigator – Hartzell Propeller Inc.

Report Date: December 20, 2021

Contents:	Page
Propeller Teardown Report	2
Accident Synopsis	2
Summary and Analysis of Findings	3
Conclusions	3
General Information	4
Propeller Factual Findings	5

PROPELLER TEARDOWN REPORT

Date of Investigation: June 18, 2021

Location: Lakefield Airport, KCQA
Civil Air Patrol Hangar
[REDACTED]
Celina, OH 45822

Propeller Model: HC-B3TN-5M with T10282N+0 Blades
(blades were re-stamped with a "+0" to indicate a diameter reduction sometime during service)

Representatives:

Les Doud	Hartzell Propeller Inc. ASI
Eric Fetterhoff	FAA ASI, Columbus OH FSDO
Bill Cummins	FAA ASI, Columbus OH FSDO
Dana Metz	Honeywell Air Safety Investigator
Steve Reindel	Hartzell Sr. Tech Rep
John Jefferies	Ohio Civil Air Patrol

ACCIDENT SYNOPSIS

The following is excerpted from the NTSB preliminary report.

"On May 27, 2021, about 0750 central daylight time, a Grumman G-164B airplane, N8376K, was substantially damaged when it was involved in an accident near Celina, Ohio. The pilot sustained serious injuries. The airplane was operated as a Title 14 Code of Federal Regulations Part 137 aerial-application flight.

The pilot stated that he departed on the local flight with about 80 gallons of Jet-A aviation fuel and a 240-gallon mixture of fungicide and insecticide. The winds were light out of the east with a few clouds 3,000-4,000 ft above ground level. The pilot stated that shortly after takeoff from runway 8 he felt the engine lose thrust, but the engine speed remained at 100% according to the airplane's cockpit indicator. The pilot established best glide speed and began a slight right turn to avoid trees. He then jettisoned the chemical load in attempt to maintain altitude, but the airplane descended into a waterway about 200 yards south of the departure end of runway 8.

An examination of the propeller revealed it remained attached to the engine propeller shaft flange, and all three blades remained attached to the propeller assembly. All three blades exhibited leading edge gouging, chordwise/rotational scoring on both camber and face sides, bending aft and twisting towards low pitch (Figure 1). All three blades had 3-5 inches of the tip fractured/separated. All observed damage was consistent with impact while the propeller was rotating under power and with high impact forces.

An examination of the engine revealed the control linkage to the propeller pitch control (PPC) was not connected. The associated bracket was not attached to

the splined shaft of the PPC, the retaining bolt was loose, and the bolt was not secured by safety wire. The engine was retained for additional examination at the manufacturer."

SUMMARY OF FINDINGS

The propeller remained attached to the engine propeller shaft flange during the impact sequence and was recovered with the main wreckage from the accident scene to the Civil Air Patrol hangar at Lakefield airport. It was presented for examination as shown in Photo #1 on June 18, 2021. The propeller was removed from the engine and disassembled primarily to remove this piston and blades to search for impact damage that may indicate propeller blade angle at impact. Blade damage was assessed to aid in determination of blade section impact angles and thus engine power state at initial impact.

A counterweight puncture mark on the spinner dome suggested the propeller was operating in the normal range of operation at approximately 24° blade angle at impact. There was no damage to indicate the propeller was feathered or in the beta/reverse range at the time of impact. All three blade shanks remained attached via the retention clamps and no pilot tubes were fractured. All three blades were fractured near the tip. Blade damage that included chordwise/rotational scoring on both camber and face sides, bending opposite rotation, leading edge gouging with material deformation towards high pitch and progressive compound bent/twisting was consistent with impact while rotating at a moderate power setting.

CONCLUSIONS

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. Blade damage and impact signatures on the cylinder and spinner dome indicate the propeller was rotating in the normal blade angle range of operation at moderate power.

GENERAL INFORMATION

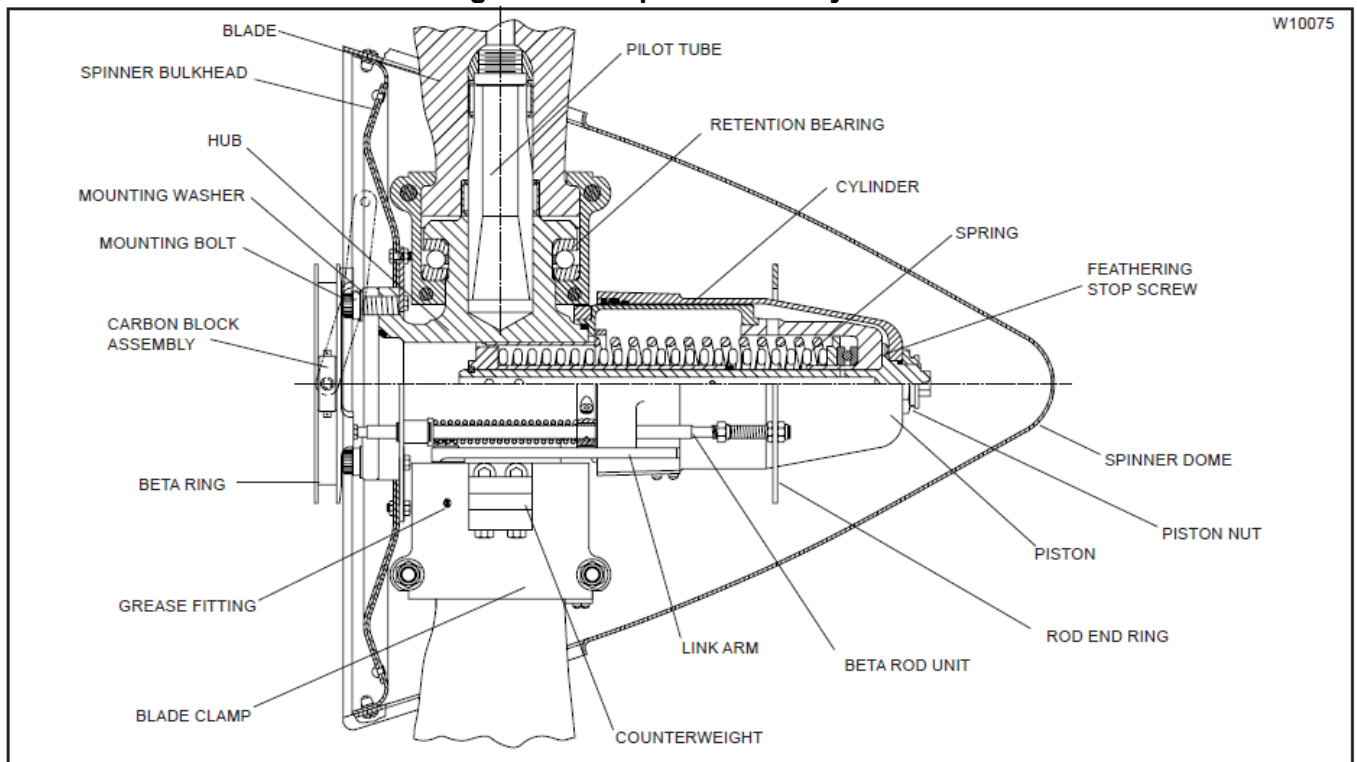
Propeller Description: The propeller examined was a 102.5" diameter, Steel Hub Turbine Series, 3-blade, feathering, reversing, pressure-to-decrease pitch. Oil pressure from the propeller governor is used to move the blades to the low pitch (blade angle) direction. A spring and counterweights move the blades to the high pitch/feather direction in the absence of governor oil pressure. The propeller incorporates start locks to keep propeller blade angle low to minimize the starting torque. The blades are of aluminum construction. The hub and clamps are made of steel alloy. Installation Data Sheet No. 1735 provides additional propeller installation data. Propeller rotation is clockwise as viewed from the rear. A propeller cutaway sketch is shown in Figure 1.

Installation Data: Refer to Hartzell Installation Data Sheet No.1735 and Agri-Jet Power STC SA7987SW for the propeller settings referenced below:

(Angles referenced at the 30-inch radius)

Reverse:	-8.0 ± 0.5 degrees
Flight Idle:	See STC Installation Instructions
Start Lock:	2.0 ± 0.2 degrees
Feather:	81.0 ± 0.5 degrees
Counterweight:	Positive

Figure 1 – Propeller Cutaway Sketch



PROPELLER EXAM FACTUAL FINDINGS

Propeller Model: HC-B3TN-5M with T10282N+0 blades

Propeller Assembly S/N: BUA19488

Service History: The propeller assembly S/N was sold as a replacement hub with a date of manufacture 10/28/1996. All three blade S/Ns were manufactured as T10282N+4 models on 5/5/1999. The propeller logbook indicated the blades were overhauled as T10282N blades on 9/16/2004 by Memphis Propeller as part of a propeller overhaul on 10/19/2004. The propeller was overhauled on 2/17/2010 by Mid America Specialized Services. The propeller was installed on the accident airplane on 3/24/2015 with a TSO of 301.0. According to the logbook the propeller was sent to H&S Propeller for repair on 11/12/2015 and re-installed on 3/4/2016. The installation was dynamically balanced on 4/1/2016. The propeller was removed on 12/10/2016 and re-installed on 3/31/2017 at a TSO of 714.2. The propeller was removed on 11/2/2018 and re-installed on 4/16/2019 at a TSO of 1162.2. The propeller was inspected on 5/19/2021 at a TSO of 1669.3.

	<u>S/N</u>
Blade 1	J28319
Blade 2	J28323
Blade 3	J28315

Blade Orientation: The blades were identified as 1-2-3 counter-clockwise (sequence of rotation) as viewed from the rear of the propeller. The hub serial number was between the #1 and #2 blades.

Propeller Examination

The propeller remained attached to the engine propeller shaft flange and was presented for examination as shown in Photo #1. All eight propeller mounting bolts were present, secure and lock-wired. The spinner dome was crushed and torn in various locations with spiral scoring marks and deformation opposite rotation. The hydraulic unit was fractured from the hub (Photo #2) and found loose inside the spinner dome. All three link arms had detached from their respective clamps/link screws. All three blades remained secure in their clamps with no indication of slippage. The spinner bulkhead had impact marks at blades #1 and #3 consistent with counterweights contacting due to forceful rotation towards low pitch. The guide collar with the start locks was missing and presumed not recovered from the crash scene. All three blades exhibited tip fractures that varied in length. All three blade/clamp assemblies could be rotated on the hub by hand force. All three blades exhibited bending aft, bending opposite rotation, twisting toward low pitch and chordwise/rotational scoring on both camber and face side. The mounting flange surface was intact and undamaged. The feathering spring assembly was intact and loaded with the forward and aft spring retainers in-place. The beta rod was bent and fractured aft of the pitch change rod (Photo #2); there was no attempt to remove the feathering spring assembly, pitch change rod and low pitch stop sleeve.

Photo #1 –Propeller as-presented



The piston nut was removed to remove the piston. All three link arm attachment points on the piston were damaged. Two of the three guide rods were bent, the third guide rod was missing and was fractured at its piston attachment point. There were no remarkable marks on the internal surface of the piston that would indicate a blade angle at impact (Photo #3). The cylinder appeared undamaged but had scuff marks starting at approximately 2.01" from the top corner (Photo #5) and progressing toward low pitch (approximately equivalent to a 9° blade angle). The ceiling of the piston and the feather stop screws were not remarkably damaged indicating the propeller was not feathered at impact (Photo #4). The pitch change rod appeared bent at the aft end with the feathering spring retained and compressed. The spring sleeve was bent/dented/creased and split near the aft end.

Photo #2 – Hydraulic unit as-recovered from spinner dome



Photo #3 – Piston internal surface



Photo #4 – Feather stop screws (4) undamaged



Photo #5 - Cylinder scuff marks measured



All three link arms were bent in compression and the link screw holes elongated (Photo #6).

Photo #6 – Link arms



The propeller was removed from the engine for disassembly as shown in Photo #7. The mounting flange appeared undamaged. The hub unit was intact and exhibited clamp contact marks on the forward side of the hub arm. All three bearing assemblies were intact and rotated smoothly. All three pilot tubes appeared intact and undamaged. There were thread whiskers on the cylinder mounting threads.

The link screws were pulled from clamps #2 and #3 and not recovered. The link screw on clamp #1 was bent opposite low pitch. Otherwise all three clamps and counterweight assemblies were intact with all bolts present and secure.

All three blades had chordwise/rotational scoring on the camber side similar to those on Blade #3 shown in Photo #9. Blade #3 had leading edge gouging with material deformation toward high pitch (Photo #10). All three blades had some chordwise/rotational scoring on the face side (Photo #11). Three tip fragments were recovered at the crash scene (Photo #12). Photo #13 shows the progressive aft bending in the 2-3-1 sequence (right-to-left). Photo #14 shows the degree of bending opposite rotation. Photo #15 shows the Blade #3 butt with an impact impression around the circumference of the pilot tube bore bearing, and the re-stamping of the diameter designation.

There was a counterweight puncture in the spinner dome measured to be approximately 33-35° as shown in Photo #16. This counterweight angle is approximately equivalent to a 24° blade angle.

Photo #7 – Propeller removed for disassembly



Photo #8 – Hub assembly



Photo #9 – Blade #3 camber side (typical of all three blades)



Photo #10 – Blade #3 leading edge gouging



Photo #11 – Propeller blades face side



Photo #12 – Fractured tip segments recovered at crash scene



Photo #13 – Progressive aft bending in 2-3-1 sequence (right-to-left)



Photo #14 – Bending opposite rotation



Opposite rotation

Photo #15 – Blade #3 butt (similar damage on #1 and #2) with diameter re-stamping

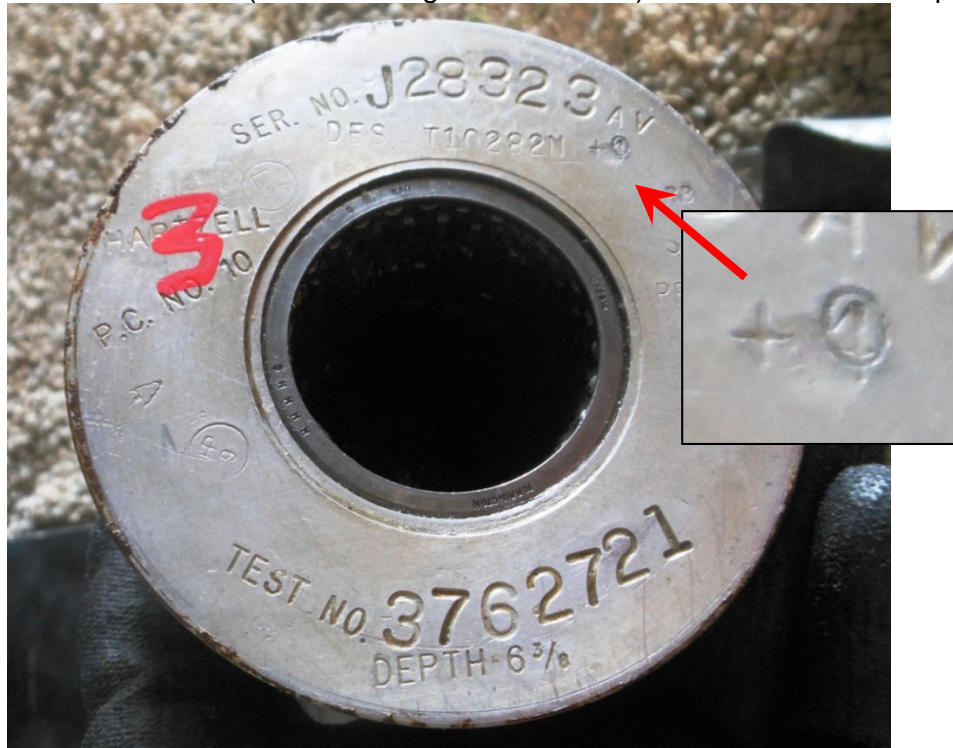


Photo #16 – Counterweight puncture in spinner dome

