

**Date of Accident:** July 13, 2017

**Location:** Marineland, FL

**NTSB File No.:** WPR17FA151

**Aircraft:** Piper PA-44-180 Seminole

**Registration No.:** N2173S

**Serial No.:** 44-7995245 (Year of Manufacture 1979)

**Operator:** (per FAA Registration Database)  
Sunrise Aviation Inc.  
[REDACTED]  
Ormond Beach, FL 32174-8755

**Written by:** Les Doud – Hartzell Propeller Air Safety Investigator

**Report Date:** February 8, 2018

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**Aircraft Accident/Incident report No.: 170713B**

**ACCIDENT SYNOPSIS**

The following is an excerpt from the NTSB Preliminary Report. A picture of the accident aircraft is shown in Photo #1.

“On July 13, 2017, about 2300 eastern daylight time, a Piper PA-44-180, N2173S, was destroyed during a descent and subsequent inflight breakup near Marineland, Florida. The flight instructor and private pilot receiving instruction were fatally injured. The airplane was registered to and operated by Sunrise Aviation Inc., Ormond Beach, Florida, as a 14 Code of Federal Regulations Part 91 instructional flight. Visual meteorological conditions prevailed and no flight plan was filed for the cross-country flight which originated from Brunswick, Georgia, at an undetermined time with an intended destination of the Ormond Beach Municipal Airport (OMN), Ormond, Florida.

Information provided by the Federal Aviation Administration (FAA) revealed that the flight reported to Air Traffic Control that they had OMN in sight while at an altitude of about 5,400 feet mean sea level (MSL). Shortly after, radar and radio communication was lost with the accident airplane. The FAA issued an alert notice (ALNOT) shortly after. The main wreckage was located by air units about 1141 on July 14, 2017.

The main wreckage came to rest inverted within a heavily wooded area. The outboard portions of the left and right wings, baggage door, and a portion of the right stabilator were located throughout a 0.5-mile-long and 0.2-mile-wide debris path that spanned across water and marshland northwest of the main wreckage.

The located wreckage was recovered to a secure location for further examination.”

Aircraft Damage: Destroyed  
Injuries: Two onboard; two fatal

**Photo #1 – Accident Aircraft PA-44-180, N2173S**



## SUMMARY AND ANALYSIS OF FINDINGS

The propellers were recovered with the aircraft wreckage to Florida Air Recovery in Jacksonville, FL for a wreckage layout and teardown examination. The left propeller had been removed from its engine by aircraft recovery personnel. The right engine crankshaft fractured just aft of the propeller mounting flange. The spinner domes had been removed from both propellers by recovery personnel. The propellers were disassembled to examine the propeller components and assess the damage.

The left and right propellers had very similar damage indicating power symmetry at time of impact. Photo #2 shows the similarity in damage between left-right L1-R1 blades. Photo #3 shows the symmetry between the face side of the left and right blades. Both propellers also had fractured pitch change knobs on L1 and R1 blades as well as counterweight punctures in the spinner dome. Impact marks on the preload plates indicated blade angles in the low range of normal operation at or near the low pitch stop angle. Impact marks between the hub and blades, chordwise/rotational abrasion and blade bending all indicated rotation at impact.

## CONCLUSIONS

There were no discrepancies noted that would preclude normal operation prior to impact. All damage was consistent with high impact forces. Damage on both propellers was consistent with impact into sandy soil while rotating in a low power condition.

**Photo #2 – Blades R1 and L1 bend and twist comparison**



Photo #3 – Left vs. Right blade face side comparison



**Propeller Teardown Report****Date of Investigation:** January 24-25, 2018**Location:** Florida Air Recovery  
[REDACTED]  
Jacksonville, FL 32225

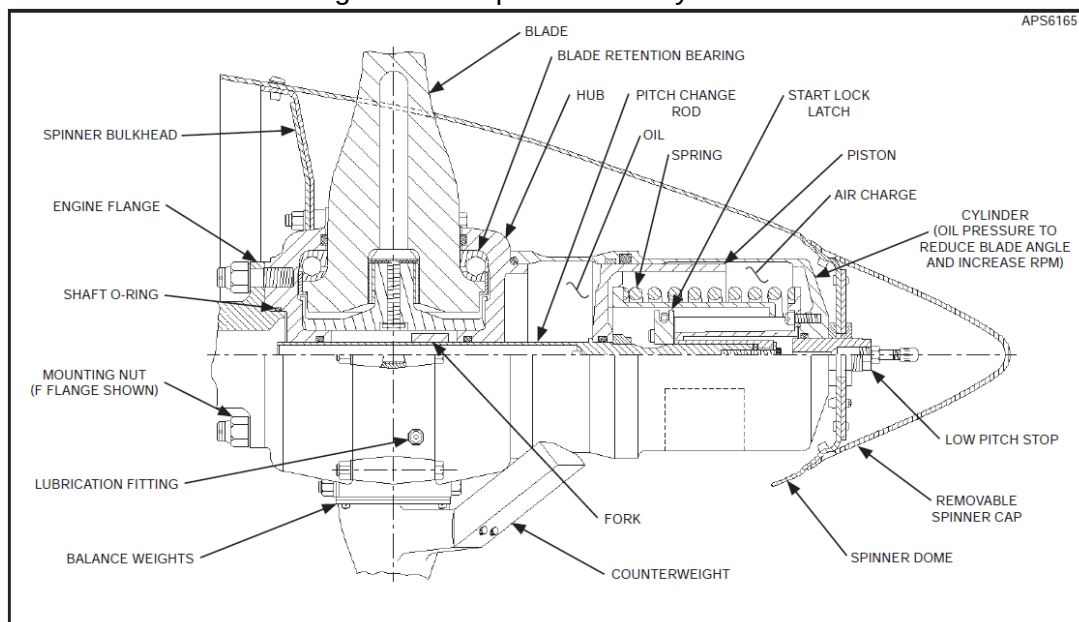
|                         |                   |                             |
|-------------------------|-------------------|-----------------------------|
| <b>Representatives:</b> | Les Doud          | Hartzell Propeller Inc.     |
|                         | Josh Cawthra      | NTSB Investigator in Charge |
|                         | Clint Crookshanks | NTSB Structures Engineer    |
|                         | Damian Galbraith  | Piper Safety Investigator   |

**General Comments:** The Piper Seminole propellers examined are 74" diameter, 2-blade single-acting, hydraulically operated, constant speed models with feathering capability. Oil pressure from the propeller governor is used to move the blades to the low pitch (blade angle) direction. A spring, counterweights, and an air charge 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 and hub are of aluminum construction. The Piper Seminole uses counter-rotating propellers; rotation is clockwise on the left engine and counterclockwise on the right engine as viewed from the rear. A cutaway sketch of the propeller is shown in Figure 1.

**Installation Data:** Refer to Hartzell Propeller Installation Data Sheets No. 865 and 866 for additional information (Blade angles referenced at the 30-inch radius).

|             |                        |
|-------------|------------------------|
| Low Pitch:  | $12.4 \pm 0.2$ degrees |
| Start lock: | $17.9 \pm 1.5$ degrees |
| Feather:    | $80.0 \pm 1.0$ degrees |

Figure 1 – Propeller Cutaway Sketch



**Position:** LEFT

**Propeller Model:** HC-C2YR-2CUEF with FC7666A-2R blades

**Propeller Assembly Serial Number:** AU13651B

**Service History:** The logbooks were not presented at this examination so the propeller service history is unknown.

|             | <u>S/N</u> | <u>Date of Manufacture</u> | <u>TTSN</u> | <u>TSO</u> |
|-------------|------------|----------------------------|-------------|------------|
| Hub/Factory | A94697B    | 5/29/08                    | UNK         | UNK        |
| Blade L1    | K74285     | 5/14/08                    | UNK         | UNK        |
| Blade L2    | K74290     | 5/14/08                    | UNK         | UNK        |

**Blade Orientation:** The blades were arbitrarily identified L1-L2 counter-clockwise as viewed from the rear of the propeller. The hub serial number was between the L1 and L2 blades.

**As Received Condition:** The propeller was recovered to Florida Air Recovery in Jacksonville, FL and presented for examination in the condition shown in Photo #4. All six mounting studs were present with no apparent damage to the propeller mounting flange. Both blades were bent aft and twisted leading edge down in varying degrees. The propeller pitch change mechanism appeared to be on the start lock. Blade L1 was rotated beyond the low pitch stop angle and the counterweight punctured the cylinder. The air charge valve was fractured and all the air charge was released.

**Spinner Dome:** The spinner dome was crushed, punctured and torn. There was a counterweight puncture visible on the internal surface in the low pitch blade angle range (Photo #5).

**Spinner Bulkhead:** The spinner bulkhead was intact with spinner dome mounting flanges bent (Photo #6).

**Propeller Cycling:** Propeller cycling via air pressure was not attempted.

**Cylinder:** The cylinder remained attached to the hub. The cylinder was punctured by the blade L1 counterweight when the blade was forcefully rotated towards low pitch (Photo #7).

**Piston:** The piston appeared intact and undamaged but was trapped within the cylinder by the puncture/deformation caused by the L1 counterweight impact (Photo #8). No effort was made to remove the piston from the damaged cylinder.

**Pitch Change Rod:** The portion of the pitch change rod aft of the piston appeared intact and undamaged (Photo #8). There was no attempt to remove the piston and rod due to damage to the cylinder.

**Fork:** The fork was intact and appeared mostly undamaged; one of the plastic bumpers was cracked around a retaining pin hole.

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**Spring/Spring Guides:** The spring, spring seats and spring guide remained trapped and compressed in the cylinder due to cylinder damage preventing piston removal. No effort was made to cut open the cylinder and remove the compressed spring due to safety concerns.

**Pitch Stops:**

**Low Pitch Stop:** The low pitch stop had an impact mark from the cap screw (Photo #9) suggesting forcible contact with propeller at/near low pitch.

**Feather Stop:** The feather stop washer was intact and undamaged.

**Start Lock:** The start lock assembly remained trapped between the piston and cylinder, no effort was made to remove it for inspection.

**Engine/Propeller Mounting:** The propeller mounting flange and hardware appeared intact and undamaged (Photo #6).

**Hub Assembly:** The hub unit appeared intact with no visible cracks or fractures. There was visible preload plate shelf damage/deformation in the L1 and L2 blade pockets in the aft/trailing edge quadrant (Photo #10). There was one discernable blade impact mark on the aft hub half blade aperture corresponding to an impact mark on the blade in the trailing edge quadrant seen in Photo #13. The cylinder mounting boss appeared undamaged.

**Preload Plates:** Both preload plates exhibited knob block or block bumper contact marks in the low pitch range of normal operation (Photo #11).

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  $46^{\circ}$  (knob  $10^{\circ} + 36^{\circ} - 0^{\circ}$  difference between blade Station 30 and the 30" reference radius =  $46^{\circ}$ ).

| Preload Plate | Condition                                                                                                                                                                      |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| L1            | Lip deformed, sheared/fractured in aft/trailing edge quadrant, knob block bumper marring in the low pitch range                                                                |
| L2            | Lip deformed, sheared/fractured in aft/trailing edge quadrant. Knob block impact mark at approximately $32^{\circ}$ corresponding to a blade angle of $14^{\circ}$ (Photo #12) |

**Propeller Blade Properties:** (Photos #13 through #15)

## Blade # L1

|                         |                                                                                                                                  |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Camber side             | Chordwise/rotational paint abrasion concentrated along leading edge                                                              |
| Face side               | Paint abrasion near tip/trailing edge area. An oval-shaped abraded area near mid-blade                                           |
| Bend                    | Aft and opposite rotation                                                                                                        |
| Twist                   | Leading edge down                                                                                                                |
| Lead edge damage        | Not remarkable                                                                                                                   |
| Trail edge damage       | Not remarkable, paint transfer mark where contacted hub aperture near shank (Photo #13)                                          |
| Knob condition          | Fractured/sheared; fracture surface appeared to be overload                                                                      |
| Counterweight           | Intact, punctured cylinder and removed to facilitate disassembly                                                                 |
| Blade bearings          | Intact                                                                                                                           |
| Butt/shank impact marks | Contact mark with preload plate aft/trailing edge quadrant, the blade bearing lip sheared/fractured, smashed/torn seal rub strip |
| De-Ice boot             | NA                                                                                                                               |

## Blade # L2

|                         |                                                         |
|-------------------------|---------------------------------------------------------|
| Camber side             | Not remarkable                                          |
| Face side               | Paint abrasion near tip/trailing edge area.             |
| Bend                    | Approximately last 2" of tip bent aft                   |
| Twist                   | Not remarkable                                          |
| Lead edge damage        | Not remarkable                                          |
| Trail edge damage       | Not remarkable                                          |
| Knob condition          | Not remarkable                                          |
| Counterweight           | Intact                                                  |
| Blade bearings          | Intact                                                  |
| Butt/shank impact marks | Teflon rub strip smashed/torn aft leading edge quadrant |
| De-Ice boot             | NA                                                      |

**Photo #4 – Left propeller as-received**



**Photo #5 – Left spinner dome, internal counterweight contact mark**



Photo #6 – Left propeller mounting flange and spinner bulkhead prior to disassembly

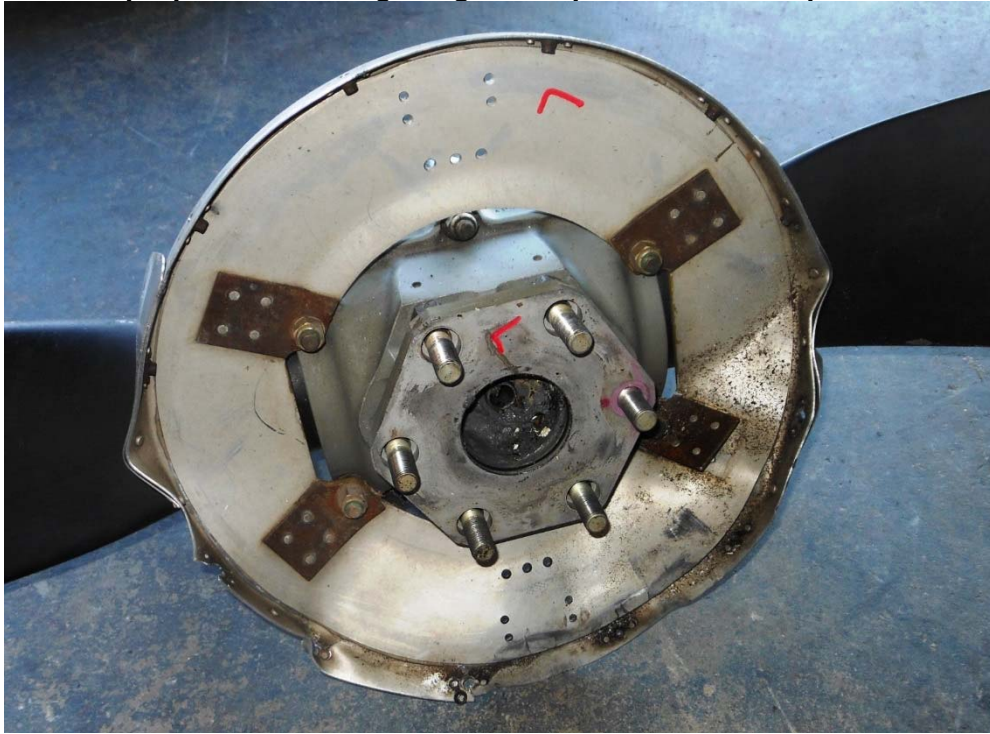


Photo #7 – Left propeller cylinder puncture by blade L1 counterweight



**Photo #8 – Left piston bottom and pitch change rod trapped in cylinder**



**Photo #9 – Left low pitch stop impact mark**



Photo #10 – Left aft hub half

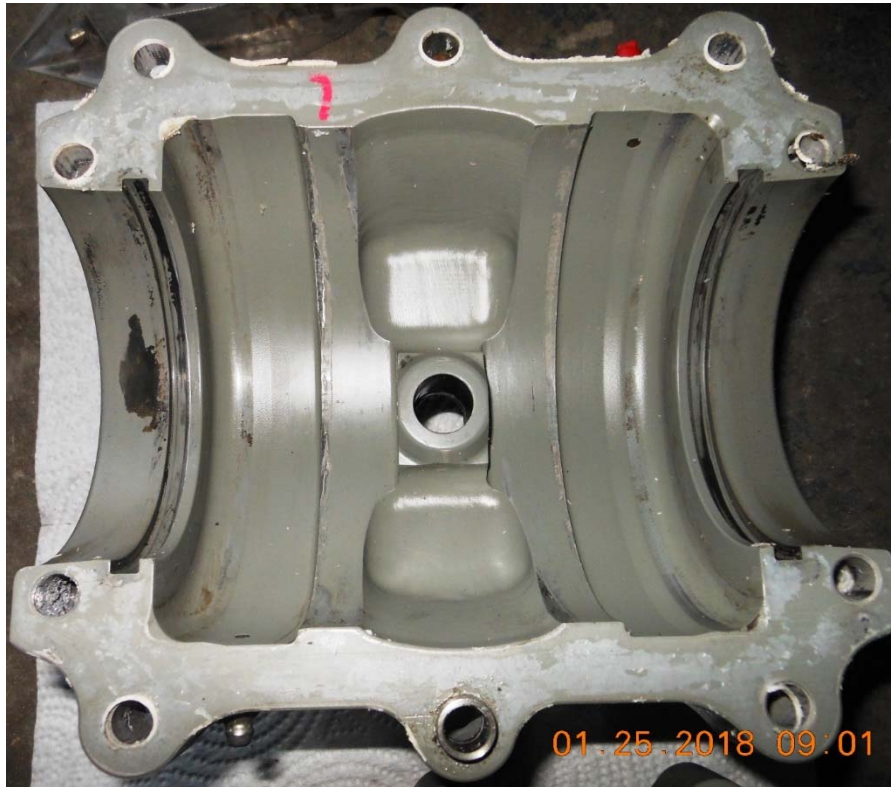


Photo #11 – Left preload plates and pitch change knobs/block



Photo #12 – Preload plate L2 impact mark measurement



Photo #13 – Blade L1 hub impact mark and seal rub strip damage



Photo #14 – Left blades; camber side



Photo #15 – Left blades; face side



**Position:** RIGHT

**Propeller Model:** HC-C2YR-2CLEUF with FJC7666A-2R blades

**Propeller Assembly Serial Number:** AU13654B

**Service History:** The logbooks were not presented at this examination so the propeller service history is unknown.

|             | <u>S/N</u> | <u>Date of Manufacture</u> | <u>TTSN</u> | <u>TSO</u> |
|-------------|------------|----------------------------|-------------|------------|
| Hub/Factory | A94700B    | 5/29/08                    | UNK         | UNK        |
| Blade R1    | H35268     | 3/20/91                    | UNK         | UNK        |
| Blade R2    | H35266     | 3/20/91                    | UNK         | UNK        |

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

**As Received Condition:** The propeller was recovered to Florida Air Recovery in Jacksonville, FL and presented for examination in the condition shown in Photo #16. The propeller fractured from the engine aft of the crankshaft propeller mounting flange. The starter ring gear and crankshaft flange were still attached (Photo #17). All six mounting studs were present with no apparent damage to the propeller mounting flange. Blade R1 was bent aft and twisted leading edge. Blade R2 bend and twist was unremarkable. The propeller pitch change mechanism appeared to be on the start lock. Blade R1 was rotated beyond the low pitch stop angle and the counterweight punctured the cylinder. The cylinder base appeared partially separated from the hub mounting area adjacent to blade R1. The air charge valve was fractured and all the air charge was released.

**Spinner Dome:** The spinner dome was crushed, punctured and torn. There was a counterweight puncture visible on the internal surface in the low pitch blade angle range (Photo #18).

**Spinner Bulkhead:** The spinner bulkhead was bent and the dome flange torn adjacent to blade R1. The bulkhead was cut to facilitate propeller disassembly.

**Propeller Cycling:** Propeller cycling via air pressure was not attempted.

**Cylinder:** The cylinder was partially separated from the hub. The cylinder was punctured by the blade R1 counterweight when the blade was forcefully rotated towards low pitch. The cylinder unthreaded from the hub boss but the pitch change rod could not be removed from the propeller assembly so it was cut by a saw as shown in Photo #19.

**Piston:** The piston appeared intact and undamaged but was trapped within the cylinder by the puncture/deformation caused by the R1 counterweight impact (Photo #20). No effort was made to remove the piston from the damaged cylinder.

**Pitch Change Rod:** The portion of the pitch change rod aft of the piston was cut to facilitate disassembly but otherwise appeared undamaged. There was no attempt to remove the piston and rod due to damage to the cylinder. The portion of the pitch change rod aft of the fork

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remained jammed in the aft hub half due to compression/swaging of the rod boss between the preload plates.

**Fork:** The fork was mostly undamaged; both plastic bumpers fragmented and debonded from their position on the fork.

**Spring/Spring Guides:** The spring, spring seats and spring guide remained trapped and compressed in the cylinder due to cylinder damage preventing piston removal. No effort was made to cut open the cylinder and remove the compressed spring due to safety concerns.

**Pitch Stops:**

**Low Pitch Stop:** The low pitch stop had an impact mark from the cap screw (Photo #21) suggesting forcible contact with propeller at/near low pitch.

**Feather Stop:** The feather stop washer was intact and undamaged.

**Start Lock:** The start lock assembly remained trapped between the piston and cylinder, no effort was made to remove it for inspection.

**Engine/Propeller Mounting:** The propeller mounting flange and hardware appeared intact and undamaged.

**Hub Assembly:** The hub unit appeared mostly intact. The hub cavity was mostly filled with black grease indicating it had been over-serviced. There was one visible crack in the R1 blade bearing pocket (Photo #22). There was visible preload plate shelf damage/deformation in the R1 and R2 blade pockets; predominantly in the aft/trailing edge quadrant on R1 and leading edge quadrant of R2 (Photos #23 and #24). There were discernable blade impact marks on the aft hub half blade apertures. The cylinder mounting boss was fractured adjacent to blade R1 as shown in Photo #25.

**Preload Plates:** Both preload plates exhibited knob block and/or block bumper contact marks in the low pitch range of normal operation (Photo #26).

**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 46° (knob 10° + 36° - 0° difference between blade Station 30 and the 30" reference radius = 46°).

| Preload Plate | Condition                                                                                                                                                                                 |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R1            | Lip deformed, sheared/fractured in aft/trailing edge quadrant, knob block bumper marring in the low pitch range, knob block bumper mark at 31.5° corresponding to a blade angle of 14.8°. |
| R2            | Lip deformed. Knob block impact mark at approximately 36.5° corresponding to a blade angle of 9.5°.                                                                                       |

**Propeller Blade Properties:** (Photos #27 through #29)

## Blade # R1

|                         |                                                                                                                                  |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Camber side             | Chordwise/rotational paint abrasion                                                                                              |
| Face side               | Paint abrasion near tip/trailing edge area.                                                                                      |
| Bend                    | Aft and opposite rotation                                                                                                        |
| Twist                   | Leading edge down                                                                                                                |
| Lead edge damage        | Not remarkable                                                                                                                   |
| Trail edge damage       | Not remarkable, paint transfer mark where contacted hub aperture near shank (Photo #27)                                          |
| Knob condition          | Fractured/sheared; fracture surface appeared to be overload                                                                      |
| Counterweight           | Intact, punctured cylinder and removed to facilitate disassembly                                                                 |
| Blade bearings          | Intact                                                                                                                           |
| Butt/shank impact marks | Contact mark with preload plate aft/trailing edge quadrant, the blade bearing lip sheared/fractured, smashed/torn seal rub strip |
| De-Ice boot             | NA                                                                                                                               |

## Blade # R2

|                         |                                             |
|-------------------------|---------------------------------------------|
| Camber side             | Chordwise/rotational abrasion               |
| Face side               | Paint abrasion near tip/trailing edge area. |
| Bend                    | Not remarkable                              |
| Twist                   | Not remarkable                              |
| Lead edge damage        | Not remarkable                              |
| Trail edge damage       | Not remarkable                              |
| Knob condition          | Not remarkable                              |
| Counterweight           | Intact, removed to facilitate disassembly   |
| Blade bearings          | Intact                                      |
| Butt/shank impact marks | Not remarkable                              |
| De-Ice boot             | NA                                          |

**Photo #16 – Right propeller as-received**



**Photo #17 – Right propeller fractured crankshaft and starter ring gear**



**Photo #18 – Right spinner dome counterweight impact mark**



**Photo #19 – Right propeller cylinder puncture by blade R1 counterweight**



Photo #20 – Right piston bottom and pitch change rod trapped in cylinder



Photo #21 – Right low pitch stop impact mark



**Photo #22 – Right aft hub half crack (highlighted with blue ink)**



**Photo #23 – Right aft hub half blade pocket R1**



**Photo #24 – Right aft hub half blade pocket R2**



**Photo #25 – Right hub cylinder mounting boss fractured**



Photo #26 – Right preload plates and pitch change knobs/block

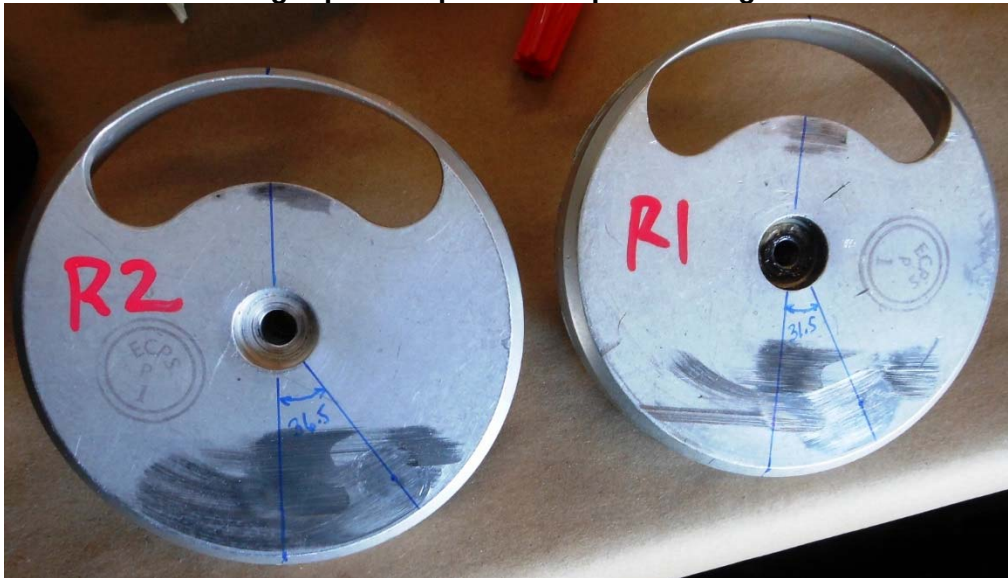


Photo #27 – Blade R1 hub impact mark and seal rub strip damage



Photo #28 – Right blades; camber side



Photo #29 – Right blades; face side



**LIST OF PHOTOGRAPHS**

**NOTE:** The following is a list of the original and unedited digital photographs. The photographs are available in digital format (CD, memory stick/card, FTP). The numbering sequence may not be chronological as some may have been deleted if out-of-focus, too dark, redundant, etc. Photos used in the text of this report are taken from photos on this list but may have been adjusted from the original. Modifications to images used in the report are limited to cropping, magnification, file compression, or enhancement of color, brightness, or contrast for the sole purpose to improve clarity of the report. No other alterations are permitted.

| <b><u>Picture File Name</u></b> | <b><u>Description</u></b>                                                |
|---------------------------------|--------------------------------------------------------------------------|
| DSCN6767.JPG                    | Right propeller as-received                                              |
| DSCN6768.JPG                    | Left propeller as-received A                                             |
| DSCN6769.JPG                    | Left propeller as-received B                                             |
| DSCN6770.JPG                    | Left propeller spinner bulkhead and mounting flange                      |
| DSCN6771.JPG                    | Right propeller mounting area, starter ring gear and spinner bulkhead    |
| DSCN6772.JPG                    | Left propeller with L1 counterweight removed showing cylinder puncture A |
| DSCN6773.JPG                    | Left propeller with L1 counterweight removed showing cylinder puncture B |
| DSCN6774.JPG                    | Left propeller cylinder puncture at L1                                   |
| DSCN6775.JPG                    | Left propeller start lock sleeve and feather stop hardware A             |
| DSCN6776.JPG                    | Left propeller start lock sleeve and feather stop hardware B             |
| DSCN6777.JPG                    | Left propeller hub after opening                                         |
| DSCN6778.JPG                    | Left aft hub half                                                        |
| DSCN6779.JPG                    | Left forward hub half                                                    |
| DSCN6780.JPG                    | Left cylinder mounting boss                                              |
| DSCN6781.JPG                    | Left mounting flange A                                                   |
| DSCN6782.JPG                    | Left propeller model and S/N                                             |
| DSCN6783.JPG                    | Right propeller prior to disassembly                                     |
| DSCN6784.JPG                    | R1 blade chordwise/rotational abrasion in mid-blade area                 |
| DSCN6785.JPG                    | R2 blade chordwise/rotational abrasion                                   |
| DSCN6786.JPG                    | Right low pitch stop impact mark                                         |
| DSCN6787.JPG                    | Right propeller start lock sleeve and feather stop hardware              |
| DSCN6788.JPG                    | Right propeller model and S/N                                            |
| DSCN6789.JPG                    | Right propeller, cutting pitch change rod                                |
| DSCN6790.JPG                    | Right propeller after cutting cylinder off                               |
| DSCN6791.JPG                    | Right propeller after opening hub, over-serviced with grease             |
| DSCN6792.JPG                    | Right aft hub half before cleaning                                       |
| DSCN6793.JPG                    | Left propeller components disassembled                                   |
| DSCN6794.JPG                    | Right propeller components disassembled                                  |
| DSCN6795.JPG                    | Left propeller shanks and pitch change components                        |
| DSCN6796.JPG                    | Right propeller blade shanks and pitch change hardware                   |
| DSCN6797.JPG                    | Left spinner dome and bulkhead                                           |
| DSCN6798.JPG                    | Left spinner dome                                                        |
| DSCN6799.JPG                    | Left spinner bulkhead                                                    |
| DSCN6800.JPG                    | Left spinner dome counterweight impression #1, external view             |
| DSCN6801.JPG                    | Left spinner dome counterweight impression #2 and #3, external view      |
| DSCN6802.JPG                    | Left spinner dome counterweight impression #2 and #3, internal view      |

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|              |                                                              |
|--------------|--------------------------------------------------------------|
| DSCN6803.JPG | Left spinner dome counterweight impression #1, internal view |
| DSCN6804.JPG | Left low pitch stop impact mark                              |
| DSCN6805.JPG | Left aft hub half - cleaned                                  |
| DSCN6806.JPG | Left forward hub half - cleaned                              |
| DSCN6807.JPG | Left mounting flange B                                       |
| DSCN6808.JPG | Left hardware bags                                           |
| DSCN6809.JPG | Left preload plates A                                        |
| DSCN6810.JPG | Left preload plates B                                        |
| DSCN6811.JPG | L1 pitch change knob fracture                                |
| DSCN6812.JPG | L1 blade butt                                                |
| DSCN6813.JPG | L2 blade butt                                                |
| DSCN6814.JPG | Left fork and low pitch stop                                 |
| DSCN6815.JPG | Left cylinder and pitch change rod                           |
| DSCN6816.JPG | Left cylinder puncture, piston and rod - internal view       |
| DSCN6817.JPG | L1 blade shank impact marks                                  |
| DSCN6818.JPG | L2 preload plate impact mark measurement A                   |
| DSCN6819.JPG | L2 preload plate impact mark measurement B                   |
| DSCN6820.JPG | Left blades camber side                                      |
| DSCN6821.JPG | Left blades face side                                        |
| DSCN6822.JPG | Right cylinder puncture                                      |
| DSCN6823.JPG | Right cylinder puncture, piston and rod - internal view      |
| DSCN6824.JPG | Right spinner dome - torsional/rotational deformation        |
| DSCN6825.JPG | Right spinner dome counterweight impact mark - internal view |
| DSCN6826.JPG | Right counterweight puncture - internal view                 |
| DSCN6827.JPG | Right spinner bulkhead                                       |
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| DSCN6829.JPG | Right forward hub half                                       |
| DSCN6830.JPG | Right aft hub half, fork and rod A                           |
| DSCN6831.JPG | Right aft hub half, fork and rod B                           |
| DSCN6832.JPG | R1 aft hub half blade pocket                                 |
| DSCN6833.JPG | R2 aft hub half blade pocket                                 |
| DSCN6834.JPG | Right cylinder mounting boss fracture A                      |
| DSCN6835.JPG | Right cylinder mounting boss fracture B                      |
| DSCN6836.JPG | Crack in R1 blade bearing pocket                             |
| DSCN6837.JPG | Right aft hub half, fork and rod C                           |
| DSCN6838.JPG | Right aft hub, pitch change rod boss crimp/swage             |
| DSCN6839.JPG | Right preload plates A                                       |
| DSCN6840.JPG | Right preload plates B                                       |
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| DSCN6842.JPG | Right preload plates impact marks measured A                 |
| DSCN6843.JPG | Right preload plates impact marks measured B                 |
| DSCN6844.JPG | R2 blade butt                                                |
| DSCN6845.JPG | R1 blade butt                                                |
| DSCN6846.JPG | R1 pitch change block                                        |
| DSCN6847.JPG | Right blades camber side A                                   |
| DSCN6848.JPG | Right blades camber side B                                   |

|              |                                            |
|--------------|--------------------------------------------|
| DSCN6849.JPG | Right blades camber side C                 |
| DSCN6850.JPG | Right blades face side                     |
| DSCN6851.JPG | R1 blade shank face side impact marks      |
| DSCN6852.JPG | Left and Right blades face side comparison |
| DSCN6853.JPG | L1 and R1 bend and twist comparison        |