



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

TURBOCHARGER AND PROPELLER SYSTEM EXAMINATION REPORT

WPR16FA178

This document contains 14 embedded photos.

A. ACCIDENT

Location: Reno, Nevada
Date: September 11, 2016
Aircraft: Piper PA28R-201T, Registration Number: N821ET, Serial #: 28P-7703147
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

Elliott Simpson
Senior Aviation Accident Investigator
National Transportation Safety Board

Les Doud
Air Safety Investigator
Hartzell Propeller / Hartzell Engine Technologies

C. SUMMARY

Examination of the turbocharger, propeller, and propeller governor components was conducted at the facilities of Hartzell Engine Technologies, Montgomery, Alabama, on February 28, 2018.

D. DETAILS OF THE INVESTIGATION

1.0 Examination

Turbocharger

Model Number: 3AT6EE10J2 (Kelly Aerospace)
PN: CF600573-9000
SN: TR0204148

The turbocharger assembly was largely intact, except for the outlet to the compressor housing assembly, which had broken away. The exhaust pipe had been crushed and remained attached, along with the Merlyn upper deck pressure control unit, to the turbine housing via the exhaust band clamp. The impeller wheel could not be rotated, and a radial score mark was observed next to the impeller wheel in the area adjacent to the inlet. (Photo 1) (During the initial engine examination, dated September 14, 15, 2016 – the impeller wheel could be rotated by hand). The impeller wheel was intact, and no blades were missing or exhibited obvious signs of damage. The impeller nut was in place, and the Vee clamp was intact and safety wired.

The exhaust pipe was removed, and a radial score mark was observed on the turbine housing next to the turbine wheel in the area adjacent to the inlet. (Photo 2). The housing was removed and score marks were observed to the outer blade surfaces of the outer turbine. All turbine wheel blades were intact and did not exhibit obvious indications of damage.

Utilizing a torque wrench, the impellor nut break-out torque was confirmed at 95 inch/pounds which, according to the HET representative, was appropriate for the type.

After the compressor wheel was removed, the turbine wheel could be rotated by hand. The turbine shaft was intact after the wheel was removed, and a light coating of oil was observed on the shaft bearing surface, which was free of scoring (Photo 3). Black coke deposits were observed on the center housing and spring ring, which according to the HET representative, was consistent with relatively low in-service life. The journal bearing was intact and wet with oil. The single feed bearing and bearing bore was coated in oil, and free of coke deposits (Photo 4). The oil feed and drain passages were clear.

Pressure Valve

AID PN: 481028-9001 (Garrett)
SN: PJR0106

The pressure valve was intact and exhibited no external damage beyond a scratch on the side of its housing. The unit was tested utilizing a pressure valve test bench, and was found to bypass appropriately, and maintain a pressure never exceeding 44 ¼ inches of mercury.

Propeller Assembly

SN: AM2559
Blade A SN: D54037
Blade B SN: D54049

The spinner had crushed around the propeller hub and was removed to facilitate examination. The hub remained attached to the crank flange, which had separated from the crankshaft. The shaft exhibited a conical 45° shear lip around its entire circumference, with serrated, ratchet-like tear features around most of the crown (Photo 5). Circumferential crack marks were present on the radial surface of the shaft adjacent to the ratchet marks.

Blade A exhibited leading edge gouging, chordwise scratches to its front and aft surfaces (Photo 7, 8, 9), and an S-bend along its entire length (Photo 6). The blade angle was in the high pitch position at the root. The outboard approximately 16-inch long section of the tip, had separated leaving a jagged tear pattern (Photo 7, 8, 9).

Blade B was intact and appeared to be in a position beyond the high pitch stops. The blade exhibited chordwise scoring on its forward side, and was bent about 15 degrees aft, about 12 inches from the root (Photo 6). A 1-inch section of the tip appeared to have torn away and was

not present for examination (Photo 10). The remaining tip section exhibited gouging and chordwise scoring at the area of separation.

Beyond a dent to the hub cylinder, no obvious external hub damage was observed, and the unit was disassembled. The cylinder was removed, and oil was present on the front side of the piston, with no signs of oil or leakage on the aft side of piston. A notch was observed in the end of the pitch change rod at the contact surface with the low pitch stop screw. The notch appeared to match the slots in the stop screw, and a sliver of metallic material was present in the stop screw adjustment slot.

The pitch change rod was then removed and appeared to be bent at the fork threads. The inner passage of the rod was clear. The pitch change fork was undamaged.

The hub through-bolts were removed, and the hub was disassembled. The blade- and hub-side races were free of damage.

The preload plate for blade A exhibited damage on its inner side, close to the high pitch end of the slot with a steel-like bur embedded in the damage area (Photo 11). On the aft hub, a black smear was present on the aft trailing edge quadrant of the A blade aperture, with corresponding damage to the shelf of the blade root pocket (Photo 12). No significant damage was observed to the forward side of the hub, except for light damage to preload plate shelf for the blade B side.

The pitch change knob of blade B had detached and exhibited shiny smear marks on its separation surface.

An imprint was present on the B preload plate, which corresponded to the bushing of the pitch change knob of blade A. The position of the imprint was at 27.5° forward of split line which corresponded to an A blade pitch angle of 17.5° (Photo 13). HET specifications call for a low pitch angle of 14.4 +/- 0.2°, and a high pitch angle of 29 +/- 1°. According to the HET representative, 17.5° pitch angle represents a position close to the maximum engine power at low airspeeds.

Governor

Part #PN: F5
SN: 615S

The governor case had been breached and was impinging the counter weights. As such, the input drive could not be rotated. The case was opened, and the counter weights, pilot valve, control arm, and bias spring were in place.

The pump gears were intact and coated with oil, and all bores were clear. Scalloping of the case was present adjacent to the fourth teeth of both gears consistent with rotation during impact (Photo 14).

2.0 Examination Photographs



Photo 1 – Impeller Wheel

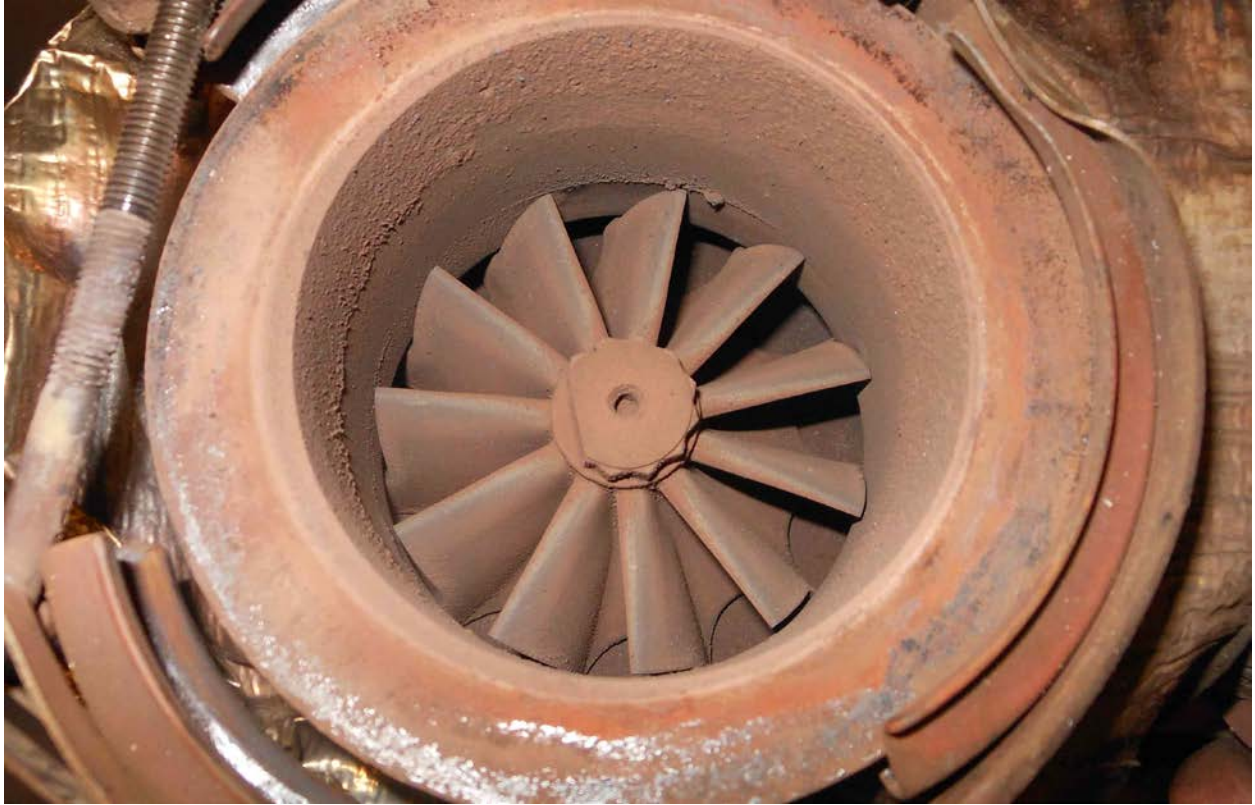


Photo 2 – Turbine Wheel



Photo 3 – Turbine Shaft

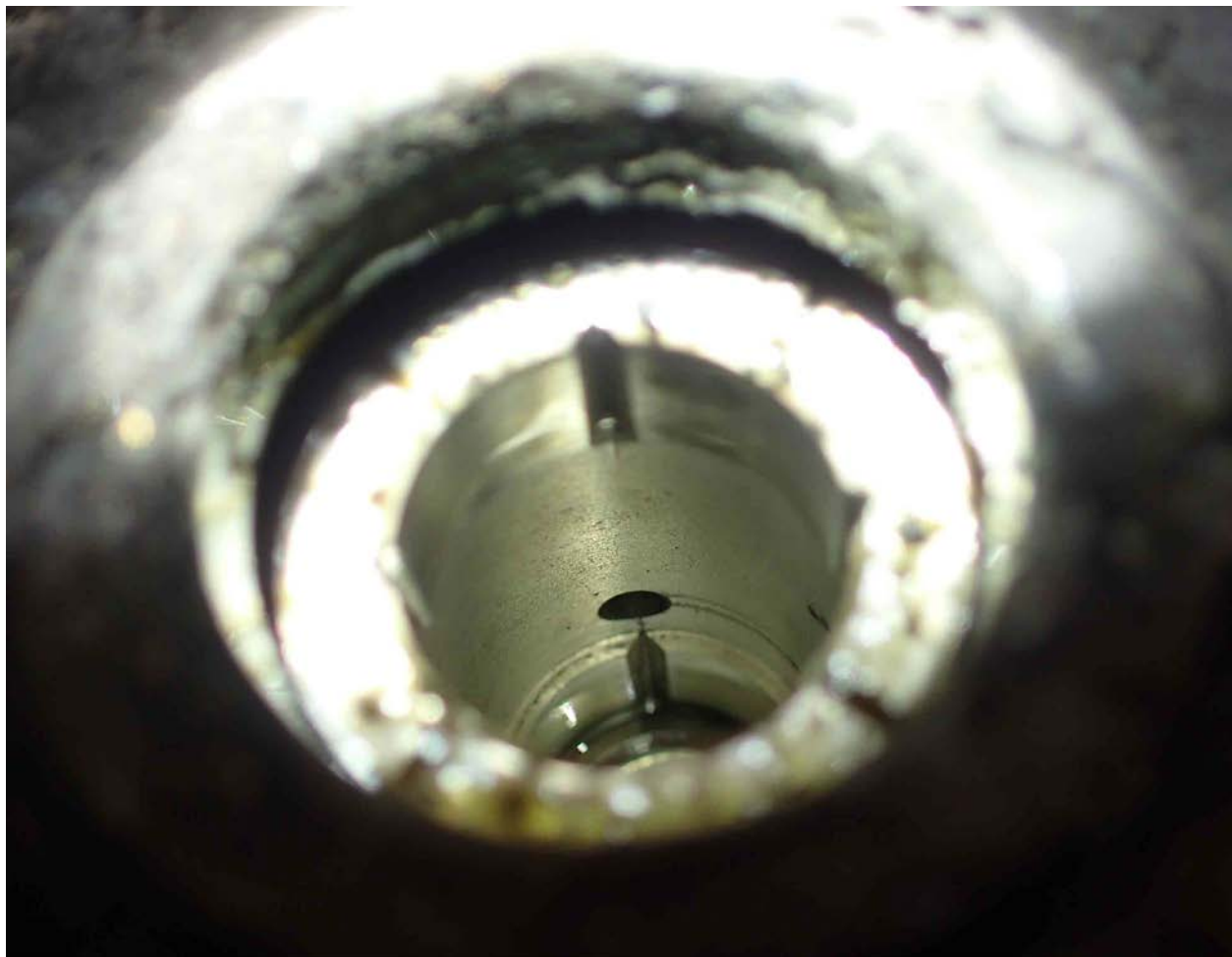


Photo 4 – Journal Bearing



Photo 5 – Crank Flange



Photo 6 - Propellers



Photo 7 – Blades A and B



Photo 8 - Blades A and B



Photo 9 – Blade A Tip



Photo 10 – Blade B Tip



Photo 11 – Blade A Preload Plate

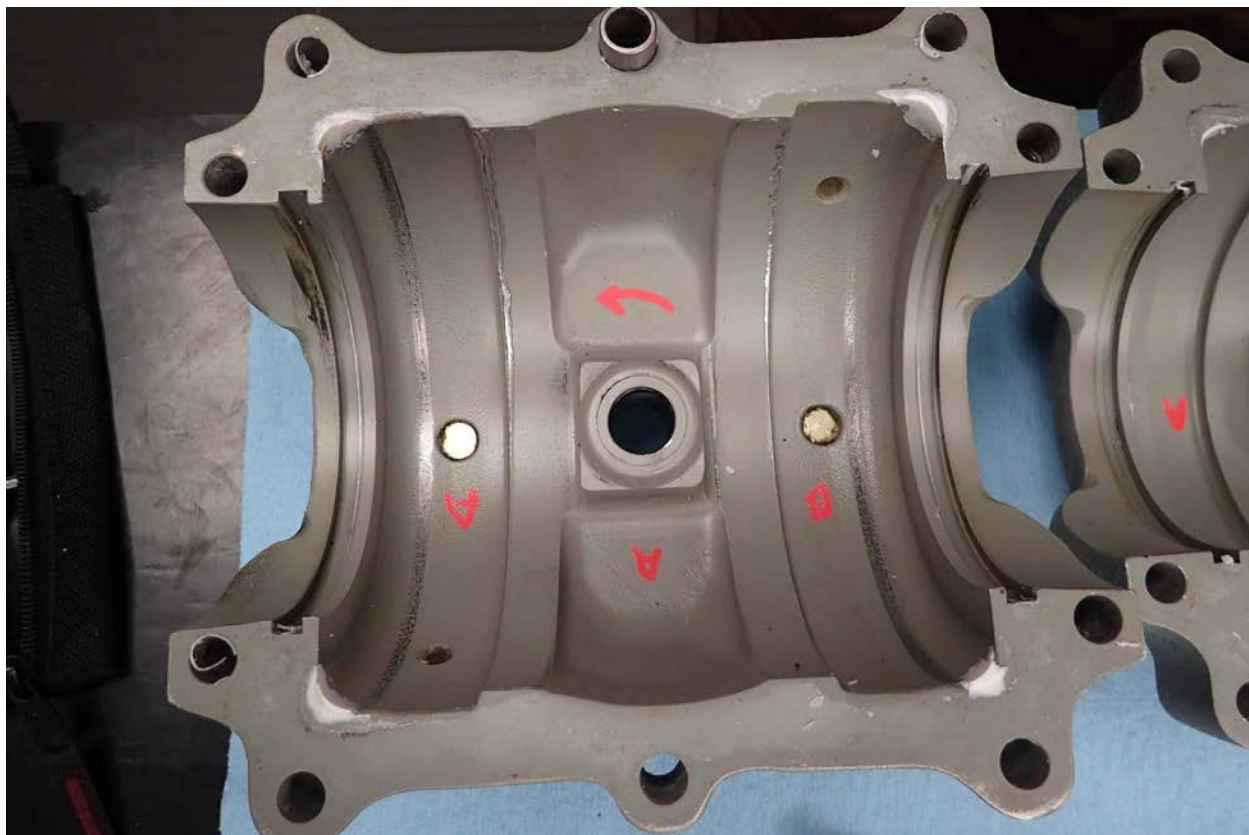


Photo 12 – Aft Hub

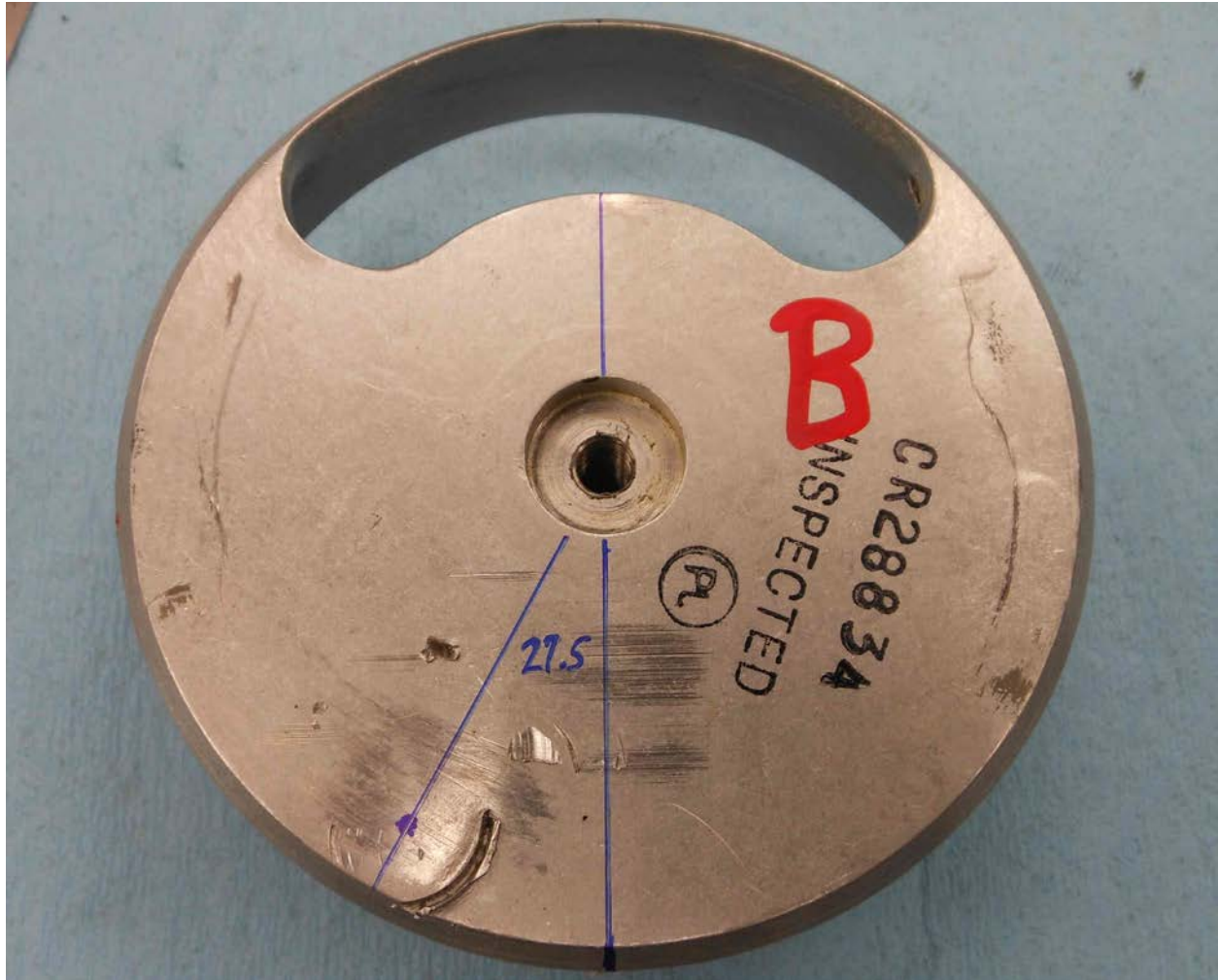


Photo 13 – Blade B Preload Plate



Photo 14 – Governor Pump Gears

Submitted by: Eliott Simpson