



ENGINE EXAMINATION REPORT

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

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WPR17LA042
Willows, California
December 27, 2016
1553 PST
Air Tractor AT-602; N602L

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HISTORY OF FLIGHT

On December 27, 2016, about 1553 Pacific standard time, an Air Tractor AT-602, N602L, was substantially damaged during a forced landing at Willows-Glenn County Airport (WLW), Willows, California. The commercial pilot was not injured. The airplane was owned and operated by the pilot under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the cross-country flight that departed Medlock Field Airport (69CL), Davis, California at approximately 1527. The personal flight was destined for WLW.

According to the pilot, he was returning the airplane to his home airport after a recent annual inspection. At the conclusion of the 25 minute flight, the pilot initiated a straight-in approach to runway 31 and slightly reduced the throttle. Immediately, he heard a “pop” noise, and observed a reduction in airspeed. When the pilot advanced the throttle to full power the engine power and airspeed did not change and the airplane began to sink rapidly. Further attempts to recycle the throttle were unsuccessful. As the airplane approached a canal on the south end of the airport, the pilot deployed the wing flaps and the main landing gear touched down on a gravel road beyond a ditch. The tailwheel impacted the ditch and the airplane flipped over and came to rest inverted.

Postaccident examination by a Federal Aviation Administration inspector revealed substantial damage to the rudder and left wing spar.



Photo 1: Airplane at Rest

ENGINE INFORMATION

Engine Manufacturer: Pratt & Whitney Canada

Engine Model Number: PT6A-65G

Engine Serial Number: PCE-PN0028

Recent Inspection: 100 Hour – 4,974.5 hours (hobbs)

Recent Inspection: Gas Generator TTSN – 6,537.0

Recent Inspection: Power Section TTSN – 6,469.8 (substituted power section during light overhaul)

Recent Recorded TSMOH: never overhauled; Last “hot section” service was on May 1, 2014 at a total time of 4,078 flight hours.

Time Since Inspection: 0.4 hours

INITIAL EXAMINATION AS RECEIVED

The engine was shipped from the recovery facility in Sacramento, California to Pratt and Whitney, Canada in Longueuil (Quebec), Canada via crate and bonded shipment. Upon receipt the engine was immediately logged and placed in bonded/secure storage and was not opened. The crate was viewed by the IIC as unopened and subsequently photographed and opened for examination. No external damage to the engine components were noted.



Photo 2: Engine as Received



Photo 3: Engine After Secure Crate Removed

DETAILED EXAMINATION

The engine accessories were removed and secured for further testing before the engine was disassembled. An examination of the propeller governor showed that the controller arm did not travel completely from stop to stop; however, the engine manufacturer stated that the controller linkage can be adjusted by the service facility to accommodate operational needs. This may prevent the control arm at the prop governor from traveling to the aft stop, but would not preclude the operator from making normal adjustments to propeller pitch. The engine case was then separated at the C flange to disassemble the power turbine section and remove the accessory gearbox case and inlet.

Compressor Section

The compressor was not displaced and displayed no evidence of impact damage. The impeller rotated freely through the N1 tach generator. During the subsequent examination, a small corner piece to one of the 2nd stage compressor blades was missing and several stage 3 and 4 compressor blades exhibited trailing edge damage.



Photo 2: Compressor Section

Bleed Valve

A slave seat was installed on the bleed valve and the unit was tested on a stand. About 55PSIA of pressurized air was pumped into the P3 inlet port of the bleed air valve and the unit's standing air pressure was measured. During the first test the standing air was measured at 54.5 PSIA using the accident O ring for the P3 inlet and 54.6 using a new O ring for the P3 inlet. Leaktec was distributed along the valve to locate the source of the leak. When the piston was moved, the leak was observed near the main body of the piston, but was negligible.

A representative of PWC showed the investigation team that overhauled or repaired unit is returned to the customer with a placard in lieu of the seat that states "Replace with BOV Seat." BOV is the abbreviation for Bleed Off Valve.

Once the piston moved beyond the carbon spacer, the piston exposed a P3 air leak, at which point P2.5 air would have prevailed and prevented the piston from moving any further.

The actual tested production ITT was 725C and the engine's max ITT is 810C. The bleed valve gap between the piston and the valve case was about one hundred and then thousandths. This particular valve was class six, (1 valve class will increase ITT from 8-14 degrees C), but without the valve seat would have placed the valve 15 classes above its production position and increased the ITT.

The pilot reported the airplane was more sluggish than normal during the takeoff attempt and the airplane was able to depart and enter cruise flight without any anomalies. Further, the pilot did not observe an ITT outside of the normal limitations during the flight.

Closing procedure – replace cabin bleed port. Install adapter with rubber hose that is run into a bucket of water. Run engine, when bleed valve is open the water will bubble and when it stops bubbling the bleed valve is closed. If they ran test, they would have still had bubbles because the valve would not have closed.

Bleed Valve and Placard



Photo 3: Bleed Valve and Placard

Accessory Gearbox Section

The accessory gearbox section gears and shafts rotated freely when actuated by hand.

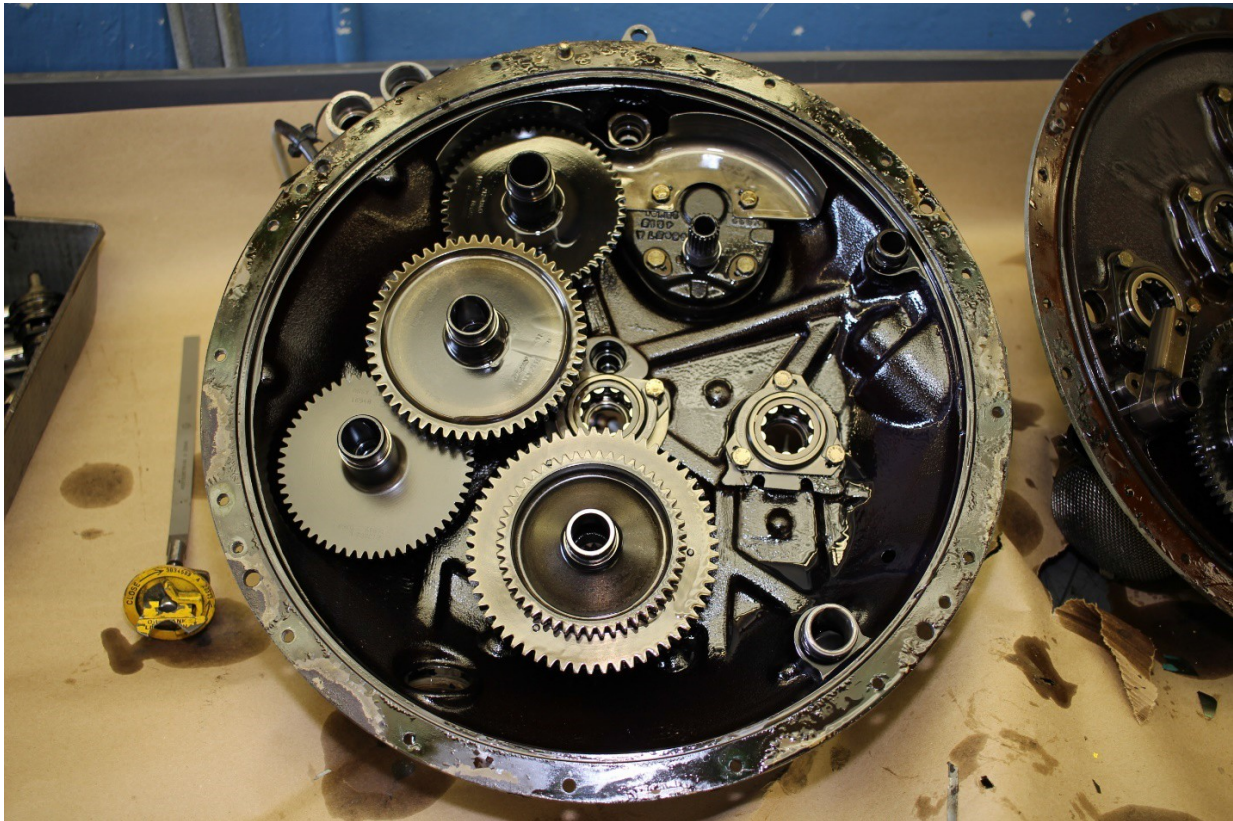


Photo 7: Accessory Gearbox Section

Combustion Section

Unremarkable

Fuel Nozzles

The fuel nozzles tested within normal limits with the exception of nozzle positions nos. 5, 9, 10, and 12. The spray angles produced by fuel nozzle nos. 5 was uneven. Further examination of the nozzles tips underneath a microscope revealed the presence of varnish along the circumference of each tip. Nozzle position no. 12 produced a flow rate of 19.3 pph, 0.1 pph below the minimum requirement and nozzle position no. 9 displayed a leak during the pressure test. Nozzle position nos. 2, 3 and 10 were comprised of tab washer tangs were wider than the manufacturer's production part.

Flow Divider

The flow divider tested normally and produced results within the manufacturer's limitations.



Photo 8: Fuel Nozzles & Flow Divider

Power Turbine Section

The prop flange, gearbox, and turbine fan blades rotated freely when actuated by hand at the main drive shaft. The fan blades and stator vanes did not display any abnormal wear. Some rotational scoring was observed along the turbine shroud, but the fan blades did not display any visible damage. The left side exhaust case was damaged.

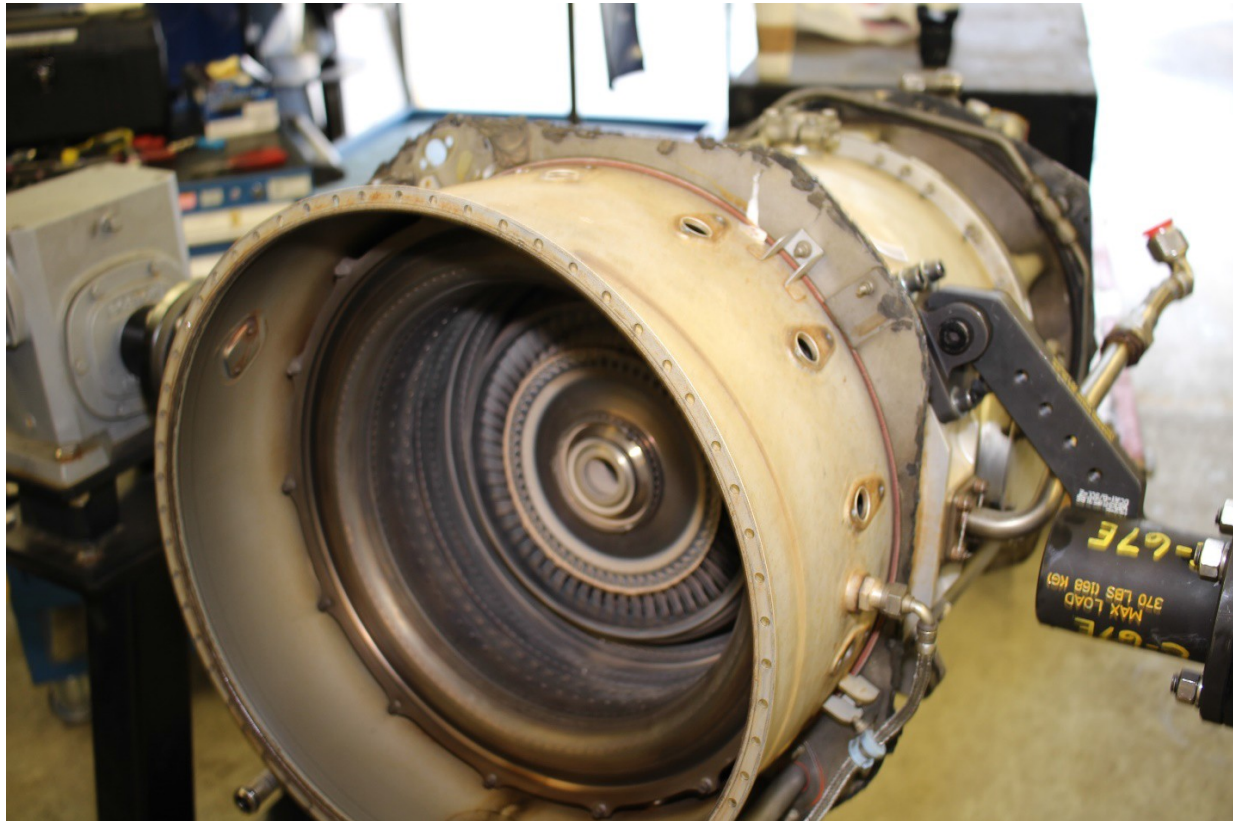


Photo 9: Power Turbine Section

Engine Accessories

Propeller Governor (CSU)

Woodward. The Py filter did not contain any debris or liquid contamination; however, some black fluid discharge was observed in the Py inlet port. A Woodward representative stated that oil is contained within the governor and can sometimes enter the Py line especially if the airplane has been inverted for some time.

The propeller governor reset arm could only be actuated about 50% aft; however, a subsequent test at the manufacturer's facility under the supervision of an FAA Aviation Safety Inspector revealed that the unit functioned normally.

Overspeed Governor

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Fuel Control Unit

Initial examination revealed a lockwire seal was incorrectly placed at the midpoint of the lockwire and not at the end as required by the component maintenance manual. A safety cable was used near the shutoff valve instead of lockwire as required by the component maintenance manual. Safety wire is used in this location to prevent interference with the valve.

The low and high idle weight flow were above the manufacturer limitations, which is only a factory requirement as the manufacturer assumes the operator will make some adjustments to FCU. Additionally, the power lever test results were higher than manufacturer limitations, which is also a factory requirement. This indicates that the operator adjusted the low idle, high idle, Max Ng reverse and Max Ng forward positions.

The FCU was run at simulated cruise setting, fixed speed, fixed P3, and power lever angle. The unit was allowed to run for 16 minutes, which did not yield any change in the fuel flow. This did not indicate any leak on the P3 bellows. The fuel control functioned normally without any adjustments, in its as received state. The weight flow values were normal when the unit was operated at lower RPM speeds, but exceeded the limits by a few pounds at simulated cruise speeds. The fuel control was then re-calibrated to meet production standards. A subsequent test revealed that the unit produced similar results to its pre-calibration settings.

Fuel Pump

The fuel pump was placed on a test stand where both a fuel pump calibration test and a filter bypass, valve, and pressure drop test were completed. The unit passed both tests.

Fuel Heater

The fuel heater was submerged in cold water and air was routed through the fuel inlet port, the fuel vaporized and oil was not observed, which indicated the fuel flow was not blocked and was not contaminated by oil. During the heat test, the sensor section was immersed in a 32 C hot water bath and the thermal element movement was measured. The thermal element moved 0.11 inches, below the specification, which is 0.160 inches. This indicates that the thermal element is exhibiting wear.

P3 Line

The nut tension was approximately 90 lbs when measured during the initial field examinations. Each nut was tight and could not be freely moved.