

## **Engine Wreckage Examination Notes June 25-26, 2015 Pleasant Grove, California**

NTSB Identification Number: WPR15FA195

Accident Date: June 22, 2015

Accident Location: Maricopa California

Accident Aircraft: Shorts Brothers Tucano S312 T Mk1

Accident Aircraft Registration: N206PZ

### **Background**

On June 22, 2015, at approximately 9:30 Pacific daylight time, a Shorts Brothers Tucano aircraft, registration 206PZ, impacted terrain near Maricopa, California. The pilot was fatally injured. The aircraft was destroyed. The aircraft was operated under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed at the time of the accident.

At the request of and under cognizance the National Transportation Safety Board (NTSB), representatives from the NTSB, Honeywell Aerospace, and Hartzell conducted an examination of the aircraft wreckage on June 25-26, 2015 at Plain Parts' facility in Pleasant Grove, California. The aircraft, engine, and propeller were left in the custody of Plain Parts.

### **Powerplant Description**

The Shorts Brother Tucano aircraft involved in the accident was powered by one Honeywell TPE331-12B-703A turboprop engine. TPE331 engines are a single spool engine with two centrifugal compressor stages and three axial turbine stages. The engine is rated at 1,100 shaft horsepower at a propeller speed of 2,000 rpm.

### **Engine Examination**

The engine dataplate was not identified in the aircraft wreckage. The serial number of the engine was determined by cross referencing engine component serial numbers with engine log book entries. The engine model is a TPE331-12B-703A, part number 3103400-3, serial number P-65617.

Three interconnected sections of the engine were recovered: (1) the bull gear, ring gear, engine prop shaft, and propeller fork (**Figure 1**). (2) The second-stage compressor housing and impeller, plenum, combustion liner, and the first- and second-stage turbine stator outer vane supports (**Figure 2 and Figure 3**). (3) The first-, second-, third-stage turbine rotors, and turbine bearing support housing (**Figure 4**). The remainder of the engine was recovered as individual loose items (**Figure 5**).

The first-stage compressor impeller was recovered as an individual loose item. All blades on the first-stage compressor impeller were folded (bent) opposite the direction of rotation (**Figure 6**). The curvic of the first-stage compressor was smeared (**Figure 7**). The mating forward curvic of the second-stage compressor impeller was also smeared (**Figure 8**). The shroud and compressor housing were crushed in and around the second-stage compressor impeller blades (**Figure 2**). Second-stage compressor impeller blades were bent both opposite and in the direction of rotation (**Figure 8**). The aft curvic of the second-stage compressor impeller was smeared (**Figure 9**).

The plenum had deformation damage (Figure 10), but there was no evidence of a high energy radially outward penetration. The turbine disks were intact and held together by a deformed segment of the main shaft (Figure 11).

The first-stage turbine stator vanes were separated from the outer diameter support (Figure 12). There was metal spray on the aft side of the first-stage turbine stator vanes (Figure 13). All first-stage turbine rotor blades were present. The first-stage turbine rotor blades were separated approximately 3/8" above the blade platforms (Figure 12).

The outer diameter support of the second-stage turbine stator remained in the turbine housing. The second-stage turbine stator vanes were missing. All second-stage turbine rotor blades were present. The second-stage turbine rotor blades were separated approximately 7/8" above the blade platform (Figure 14). Seven second-stage turbine rotor blades were moved aft approximately 3/8".

The outer diameter support of the third-stage turbine stator was out of the turbine housing. There was intermittent rotational scoring on the third-stage blade tip shroud (Figure 15). All third-stage turbine rotor blades were present. There was leading edge damage to the third-stage turbine rotor blades (Figure 16). There was metal spray on the pressure side of the third-stage turbine rotor blades (Figure 17).

Other engine control and accessory components recovered as individual loose items included:

- Engine Control, Part Number 897821-1, Series 1, Serial Number 108-1347, There was impact damage to the engine control (Figure 18). The electrical connector was attached with the blue strip indicated.
- Fuel Control, Part Number 897110-17, Series 4, Serial Number A1157C, There was impact damage to the fuel control (Figure 19).
- Fuel Flow Divider, Part Number 394408-8-1, Series 4, Serial Number 9590, The inlet fitting was removed during the June 25, 2015 examination to facilitate examination of the inlet fuel screen. There was no visible debris on the outside of the screen (Figure 20) or when viewed thru light to reveal the inside of the screen.
- Fuel Pump, A portion of the housing was recovered. The high pressure pump elements were intact (Figure 21). The low pressure element was not identified in the wreckage.
- Propeller Governor, Part Number 897711-4F (Woodward 8210-264C), Serial Number #2480802, the mounting flange was fractured and the drive shaft was missing (Figure 22).
- The oil pressure bypass was not extended (Figure 23).
- The gearbox oil scavenge pump.
- The oil filter housing cap was fractured, deformed and portions were missing exposing a deformed filter element.

## **Engine Maintenance Records**

- 20-October-2014 Engine Inspection in accordance with RSW-AIP-002, Revision 1: Engine Model TPE331-1B-703A, Part Number 3103400-3, TSN 2179.4 hrs CSN 2,198, Inspection conducted by RSW Group LLC

- 13-November-2013 Engine Inspection in accordance with RSW-AIP-002, Revision 1: Engine Model TPE331-1B-703A, Part Number 3103400-3, TSN 2124.0 hrs CSN 2,156, Inspection conducted by RSW Group LLC.
- 16-July-2003 Bird Ingestion Inspection: Engine Model TPE331-1B-703A, Part Number 3103400-3, TSN 1888:50 hrs CSN 1897, Inspection conducted by Industria de Turbo Propulsores (ITP) Madrid Spain.
- 13-May-2002 Overtemperature Inspection: Engine Model TPE331-12B-701A, Part Number 3103400-1, TSN 1794:40 hrs CSN 1827, Inspection conducted by Industria de Turbo Propulsores (ITP) Madrid Spain.
- 2-February-1989 Acceptance Tag & Traceability Input: Model TPE331-12B-701A, Part Number 3103400-1, TSN 0:00 hrs CSN 0, Garrett Turbine Engine Division.

### **Engine Cockpit Indications**

The engine TORQUE cockpit gauge dial had a witness mark just past 80% and a second witness mark just prior to 100% (Figure 24). The RPM cockpit gauge dial had a witness mark just past 100% (Figure 25).

### **Engine Disposition**

The engine was placed into to standard TPE331 shipping container and left in the custody of Plain Parts.

**Marlin Jay Kruse**  
**Air Safety Investigator**  
**Honeywell Aerospace, Product Integrity**



**Figure 1. Bull Gear, Ring Gear, Engine Propeller Shaft, and Propeller Fork.**



**Figure 2. Second-Stage Compressor Housing and Impeller, Plenum, Combustion Liner, First- and Second-Stage Turbine Stator Vane Outer Supports.**





**Figure 3. Second-Stage Compressor Housing and Impeller, Plenum, Combustion Liner, First- and Second-Stage Turbine Stator Vane Outer Supports.**



**Figure 4. First-, Second-, Third-Stage Turbine Rotors and Turbine Bearing Support Housing.**



**Figure 5. Recovered Engine Components.**



**Figure 6. First-Stage Compressor Impeller.**





**Figure 7. First-Stage Compressor Impeller, Aft Looking Forward.**



**Figure 8. Second-Stage Compressor Impeller.**



**Figure 9. Second-Stage Compressor Impeller, Aft Looking Forward.**



**Figure 10. Second-Stage Compressor Housing and Plenum.**





**Figure 11. First-, Second-, and Third-Stage Turbine Rotors.**



**Figure 12. First-Stage Turbine Stator Vanes and Rotor Blades.**



**Figure 13. First-Stage Turbine Stator Vanes.**



**Figure 14. Second-Stage Turbine Rotor.**





**Figure 15. Third-Stage Turbine Stator.**



**Figure 16. Third-Stage Turbine Rotor.**

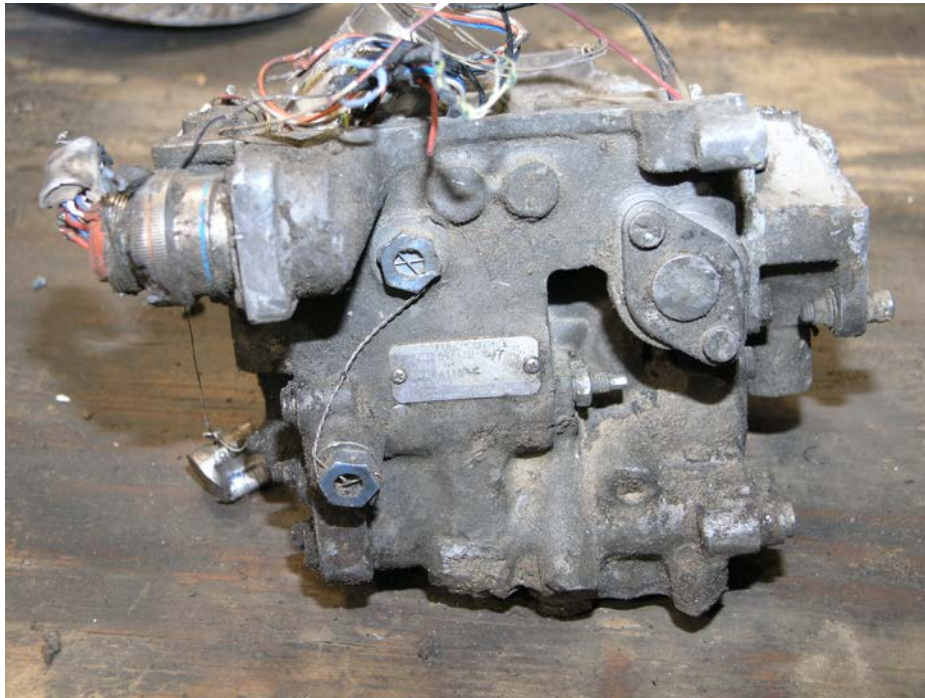




**Figure 17. Third-Stage Turbine Rotor Blades.**



**Figure 18. Engine Control.**



**Figure 19. Fuel Control.**



**Figure 20. Fuel Flow Divider Inlet Screen.**



**Figure 21. High Pressure Fuel Pump Elements.**



**Figure 22. Propeller Governor.**





**Figure 23. Oil Pressure Impending Bypass Indicator.**



**Figure 24. Engine Cockpit TORQUE Gauge Dial.**



**Figure 25. Engine Cockpit RPM Gauge Dial.**