



SUMMARY OF FINDINGS

Jason Aguilera
Air Safety Investigator
Central Region

An examination of a Honeywell LTS101-700D2 turbo shaft engine, s/n LE-46006C, was conducted at Honeywell's laboratories in Phoenix, Arizona under the auspices of the NTSB and the Federal Aviation Administration (FAA). The following findings were obtained during the examination.

Upon evaluation of the engine, the team agreed to proceed with attempting an engine operability test cell run. The engine was staged and installed in Honeywell's Propulsion Shaft Test Cell 903. A borescope examination of the turbine section of the engine did not reveal any discernible damage.

Four engine runs were accomplished on the engine

The engine was dry motored (fuel flow at cut-off) until a positive oil pressure indication was obtained. The roll downs did not disclose any anomalies.

The engine was tested for a total of 9 minutes during 4 separate runs. On the first start/run, the engine maintained idle for approximately 8 seconds before an uncommanded acceleration during the 2 minute run. The technician terminated the test by placing the power lever angle (PLA) into the cutoff position.

The Pg line from the FCU to the power turbine (PT) governor was removed to simulate the maximum input (fuel reduction) to the FCU governor reset assembly. During the second start/run, the engine achieved a sub-idle Ng speed with the PLA at the idle position. The throttle was advanced significantly to achieve an RPM of approximately 48% Ng (exact PLA not recorded). The engine was shut down after approximately 5 minutes of operation.

The Pg line from the FCU to the power turbine (PT) governor was reconnected. During the third start/run, the engine response was similar to the first run however the engine acceleration began almost as a continuation of the engine start acceleration process. The technician terminated the test by placing the power lever angle (PLA) into the cutoff position.

Both Pg and Pr pressures were removed from the control system to isolate/remove the PT governor influence by removing the Pc supply line to the PT governor and capping the Pc fitting at the temperature compensator. During the fourth start/run, the engine response was similar to the third run. The technician terminated the test by placing the power lever angle (PLA) into the cutoff position. The engine testing was terminated.

Prior to removal of the engine from the test cell, the PT rotor was photo documented due to the presence of oil in the tailpipe.

Following the engine test and removal from the test cell, the fuel control unit (FCU) was removed from the engine. The FCU drive bearing appeared to be degraded and no longer provided axial or radial positioning of the FCU drive shaft. Additionally, the splined fuel pump to FCU coupler spun freely on the FCU drive shaft.

A magnet was utilized to collect the bearing elements (3 were removed from the drain port). The black colored debris on the flange was collected and bagged along with the elements. The fuel pump was removed to inspect the FCU locating features.

The fuel pump was returned to the manufacturer Triumph for additional examination.

The fuel control unit (FCU) was returned to the Honeywell South Bend facility for additional examination. The FCU was disassembled. Drive bearing balls and debris were collected throughout the disassembly process. A metallurgy examination was conducted on the drive bearing balls and recovered debris. Testing found:

Particles rich in silicon and oxygen were found to be embedded in the ball contact surfaces of the drive bearing inner and outer races. Light scoring was associated with some of the particles. The races otherwise appeared to be relatively undamaged.

The bearing balls that were collected from the fuel control unit (FCU) had some embedded silicon/oxygen rich particles, but were otherwise undamaged. The balls that were recovered from the flow body exhibited some denting and were covered with aluminum rich material.

Evidence of polyimide material was found in a sample of debris particles that were collected during FCU removal. The polyimide material was believed to be from the bearing separators. The exact cause of the separator damage could not be determined.

No distinct material or assembly anomalies were observed.

The fuel pump was tested at Triumph Engine Control Systems in West Hartford, Connecticut, with over site provided by the FAA. The pump was installed on a test stand and successfully passed an Acceptance Test Procedure. All findings were normal and no leaks were noted.

---END---