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TFE731 Propulsion Systems Update
Agenda – TFE731 Propulsion Systems Update

- Global Customer Committee (GCC)
- TFE731 Fleet Statistics
- TFE731-60 Oil Line PN 3061253-4 Crack
- TFE731-20/40/50/60 Air Oil Cooler Supply Tube Chafing
- TFE731-20/40/50/60 Fan Bypass Stator Vane Repair
- TFE731-20/40 Fan Bypass Stator Vanes Redesign
- TFE731-20/40 Re-occurring Fan Vibration
- EEI Compatibility with Windows 7
Global Customer Committee Highlights

77 members worldwide
- 41 United States, 20 EMEAI, 16 APAC
- Operators, Pilots, Channel Partners

Drastically improved our Management Operating System
- Top 25 Rolling Action Item List
  - Balanced focus - mechanical/avionics/processes
  - Closed 49 actions YTD
- 8 meetings/year (2 Face to Face/region, 2 Global Telecoms)
- Customer Teams work with Honeywell on top actions
- OEM Liaisons communicate directly with OEM Advisory Boards

Committee Members
- Peter Zeeb
  - Chairman
  - 702.739.3742
- Dan Frisone
  - Pilot Vice Chair
  - (440) 523-4809
- Joe Bocsy
  - Electrical Vice Chair
  - 614-239-5443
- Dan Wieprecht
  - Mechanical Vice Chair
  - 214.353.2334

E-mail: GCC@Honeywell.com
Visit: http://committees.honeywell.com
TFE 731 Current Fleet Statistics

TFE731-2/3/4/5
• Engines in Service – 9,202
• Total Fleet Hours – 79,742,021
• 12 month cumulative average – 1,030,997

TFE731-20/40/50/60
• Engines in service – 3,340
• Total Fleet Hours – 12,206,103
• 12 Month cumulative average – 966,599

As of August 2014
TFE731-60 Oil Line PN 3061253-4 Crack

• Issue
  – Oil lines found cracked at AGB supply tube
  – Cracked oil tube can lead IFSD due to LOP
  – Weld joint at the AGB supply branch tube to the large tube body cracked due to fatigue

• Action
  – Re-design tube to improve robustness

• Status
  – Redesigned to eliminate weld joints
  – Incorporates IN625 casting
  – Honeywell SB 79-5124 released Feb. 6th, 2013
  – Sister engine program available
  – Commercially supported by Special Pricing Notice (SPN 36)
  – Recommended for incorporation at MPI
TFE731-20/40/50/60 Air Oil Cooler Supply Tube Chafing

• Issue
  – TFE731-20/40/50/60 Air Oil Cooler – Oil Supply Tube Chafing – Causing Oil Leaks
  – Effected Part Numbers: 3060997-1 (-20/40); 3061934-1 (-50) & 3061042-4 (-60)

• Action
  – Provide new tube design that solves the chafing issue on the TFE731-20/40/50/60 fleets

• Status
  – New tube design certification complete
  – Changing to a new 2-piece design to improve tube alignment
  – SB released March 2014 - TFE731-79-5127 (TFE731-20/40/50/60 Civil Fleet)
TFE731-20/40/50/60 Fan Bypass Stator Vane Repair

• Issue
  – Leading edge screen on bypass stator vane can delaminate from vane
  – Epoxy resin erosion can drive early vane replacement

• Action
  – Develop vane epoxy resin repair (complete)
  – Long term - Improve design - Foil leading edge vanes

• Status
  – Re-work service bulletin created to restore bypass stator vanes (TFE731-72-5232RWK released Feb 8, 2013)
  – Bypass Stator Vane re-design program moving forward
TFE731-20/-40 Bypass Stator Vane Re-Design

• Issue
  – TFE731-20/40 bypass stator vane leading edge screen erodes and delaminates prematurely.

• Action
  – A newly designed fan bypass stator vane with a foil leading edge that will increase vane life 4-6x.

• Status
  – Bypass Stator Vane re-design program moving forward
    • Straight vane – Foil leading edge
    • Expected Q4 2014 certification
    • Expected April 2015 Production Incorporation
    • Expected Field release via SB July 2015
TFE731-20/-40 Re-occurring Fan Vibration

- **Issue**
  - Operators report in-cabin noise leading to fan balance maintenance
    - Observed on 25% of the TFE731-20 fleet (Learjet 40/45)
- **Action**
  - Develop improvements to reduce the number of in-cabin noise and fan balance maintenance events
- **Status**
  - Internal on-wing troubleshooting procedure developed May 14, 2014
    - Will be undertaken on a case by case basis
    - Being used on bad actors to collect further data
    - Channel partners assisting
  - Continue to closely work with operators that experience fan vibration issues
  - Captured bad actor engine for further investigation in Phoenix
    - Fan module analysis in support of root cause investigation
      - Launched fan module investigation in August 2014
    - Update fan stack pilot analysis

*Root Cause Investigation Continuing in 2014*
EEI Compatibility With Windows 7

• Issue
  – Windows 7 is not FAA qualified as an operating system for Honeywell EEI software

• Action
  – Test and qualify Windows 7 as a valid operating system for EEI and then release the software to the field

• Status
  – Formal Qualification Testing Complete – October 2013
  – FAA/DER sign off (all above documents) – Complete March 2014
  – EEI Win 7(v 3) & FAQ document uploaded to My Aerospace portal – Complete
  – Issue SIL (Service Information Letter) – Complete
  – Windows 7 Compatibility – Complete
  – EEI Win 7 release article published in Business Aviation Newsletter – 6/30/2014
Questions?
Agenda – CFE738 Propulsion System Update

- CFE738-1-1B Operational Experience
- No. 3 Bearing Cage Cracking
- Compressor Impeller Splitter Vane Airfoils
- Compressor Rotor Misconfiguration
- Revised Preservation & Storage Procedures
- Shrouds – In Service Limits
CFE738-1-1B Operational Experience

- Aircraft Delivered: 231
- Engines In Service: 493
- Total Engine Hours: 3,199,958
- Total Engine Cycles: 2,098,132
- Engine Hours (Last 12 Mos): 217,904
- Fleet Utilization Rate (Hrs/Mo): 18,159
- Fleet Avg. Utilization (Hrs/Mo): 37
- Fleet Cycle-to-Hr Ratio (12 Mos): 0.67

Through July 31, 2014
No. 3 Bearing Cage Cracking

• Issue
  – Unscheduled engine removals and sump entries following oil chip indication (front sump/AGB)
    • 4340 Steel Platelets liberated from cracks formed on low time No. 3 bearing ball separators (cages)
    • Bearing inner race tilted on compressor shaft at install

• Action/Status
  – Improved bearing installation procedures in Light (LMM) and Heavy (HMM) Maintenance Manuals
  – Added new bearing drop checks and fixture, seating check fixture, through Temporary Revisions (TR)
    • LMM TR 72-229 released November 6, 2013
    • HMM TR 72-173 released November 6, 2013
  – Service Information Letter D201303000061, Rev 1
    • Released December 17, 2013
Compressor Impeller Splitter Vane Airfoils

• **Issue**
  - Compressor surge events primarily in Max Cruise
  - Borescope inspection findings of damaged compressor centrifugal impeller
  - Manufacturing change in 2010 to vane thickness within tolerances
    - Resulted in higher than expected stress
    - Impeller splitter vane distress/missing material

• **Action/Status**
  - Improved compressor impeller with thicker vanes
    - Service Bulletin CFE738-72-8076 released October 31, 2013
    - Introduces new impeller PN 6079T77P09
  - Recurring, 400-hour limited borescope inspections
    - Service Bulletin CFE738-72-8074 released November 7, 2013
    - Refer to Engine Logbooks to determine effectivity
  - Service Information Letter D201304000128, Rev 1
    - Released December 17, 2013

*Ensure Recurring Borescope Inspections are Performed*
Compressor Rotor Misconfiguration

• Issue
  – Unintentional High Pressure Compressor (HPC) rotor configurations discovered in service
    • Estimate up to sixty-nine (69) engines may be affected – refer to engine logbooks
    • Post-Service Bulletin CFE738-72-8057 Stage 2-3 Compressor Blisk used with pre-SB CFE738-72-8057 Tie Rod and Air Supply Tube
      – Configuration not approved for service

• Action/Status
  – SB CFE738-72-8057, Rev 3, released August 18, 2014 – clarifies configuration
  – SB CFE738-72-8077, Rev 0, released August 18, 2014
    • Replace Tie Rod and Air Transfer Tube at next CZI or access for cause
New Preservation & Storage Procedures

• Issue
  – Preservation instructions for installed engines too restrictive during major airframe inspections
    • Engine motoring was required every 4 weeks to ensure oil wetted areas coated to prevent corrosion

• Key changes implemented
  – CFE738 Light Maintenance Manual (72-06-03) Temporary Revision 72-232, released 06/18/14
  – Clarifications include return to service and corrective actions for procedure non-compliance
  – Three (3) preservation Methods for uninstalled engines
  – Two (2) Methods for installed engines
    • Method 4 – Changed motoring every 4 weeks to ground run after 60 days and then return to service
    • Method 5 – Up to 180 days – hand-rotate spools every 30 days and start engine at end of period

New Procedures Provide Increased Flexibility and Clarity
Shrouds – In Service Limits

• Issue:
  – Falcon 2000 CFE738, most replaced LRU is fan inlet housing due to fan abradable material on the shroud missing. You can do knock test with screwdriver, be proactive with the inspection for fan inlet to prevent AOG. Could also be related to Domestic Object Damage (DOD).

• Actions & Status:
  – Tap test inadequate to detect internal honeycomb disbond
    • X-Ray & Ultrasonic Test inspections developed to detect
  – Light Maintenance Manual (LMM) Temporary Revisions issued to reduce AOGs and rare DOD
    • 03/24/2011: TR72-211, 72-212 and 72-213 released
    • Added a 25-hour repair deferral; expanded missing material allowed (20 to 60 sq in); added Alodine treatment; added more readily available filler material (1.0 sq in areas, or less)
Discussion