Technologies to Improve C-130 Maintenance Efficiency: (C-130J DTADS and Maintenance Planning Strategies)

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Managing the Availability Margin

C-130 Availability margin ($A_m$)
difference between inherent and operational availability performance.

Inherent Availability ($A_i$) determined from failure rates and corrective maintenance times only.

Operational Availability ($A_o$) determined from time between maintenance actions, scheduled and corrective maintenance times and all associated logistics and administrative delays.

Increase fleet Availability ($A_o$) by improving design reliability, **maintenance efficiency** and logistic responsiveness.
C-130J Data Transfer And Diagnostic System (DTADS)

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C-130J Integrated Health Management System

- C-130J architecture is fully integrated through aircraft dual Mission Computers (MCs).
- Aircraft has Extensive Built In Test (BIT) capability.
• Maintenance Management System (MMS) takes advantage of integrated architecture.
  – Legacy MMS product is Ground Maintenance System (GMS) and Organizational Maintenance System (OMS) – Unix based.
  – Replacement MMS is Data Transfer And Diagnostic System (DTADS) – Windows based.
• DTADS seamlessly ties into integrated architecture to support maintenance:
  – Faults auto-detected and recorded real-time during flight.
  – Faults are auto-resolved to lowest failure mode on DTADS during post-flight debrief.
  – Data from aircraft and DTADS stored in a Data Access Point (DAP) to support fleet management.
  – DTADS supports onboard interactive maintenance.
C-130J DTADS Complete

DTADS Provides:
In-Flight Processing
Post-Flight Processing
Interactive Ground Maintenance
Structural Health Monitoring
Engine Health Monitoring
Data Viewing
RMM Management
Data Management

Abbreviations
DFDR – Digital Flight Data Recorder
MC-AMP – Mission Computer – Aircraft Maintenance Program
RMM – Removable Memory Module
OFP – Operational Flight Program
GFE – Government Furnished Equipment
DTADS Hardware

- Computer platforms are Government Furnished Equipment (GFE)
  - Laptops for on-aircraft use
  - Desktops for off-aircraft use
- DTADS Interface Unit (DIU) provides interface between aircraft and laptop via standard USB cables.
- Storage of laptop and DIU is in a hard case stored under crew bunk.
DTADS Interface Unit (DIU)

- DTADS Interface Unit Assembly includes:
  - DTADS Interface Unit
  - Aircraft Interface Cable
DTADS Storage

- DTADS laptop stored on-aircraft and includes:
  - Hard sided latching Pelican case.
  - Designed to accommodate DIU and aircraft interface cable in bottom compartment.
  - Designed to accommodate defined maximum laptop footprint dimensions in top tray.
DTADS Data Access Point (DAP)

- DAP is a user-defined directory for storage of aircraft and DTADS data.
- DAP data contains DTADS debrief reports, raw aircraft data, and XML conversions.
- DAP data can be used to build user-defined interface to support fleet management.
- Customizable Logistic Support System (LSS) available to manage aircraft fleet.
DTADS-to-LSS Interface Demonstrations Are Available in the Exhibitor Booth Area.
DTADS Fielding Status

• DTADS fielding status is as follows:
  – Current Production – 12 customers
  – New Production – DTADS is standard equipment
  – Retrofit – 9 customers
  – Future – 2 customers
Want to Learn More?

- DTADS-to-LSS Interface Demonstrations Are Available in the Exhibitor Booth Area.
- DTADS Side Session available – TBD (when and where)
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C-130/L382
Hercules Maintenance Planning

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Topics

• LM Aero Preventive Maintenance Program
• High Velocity Maintenance (HVM)
• Continued Airworthiness
  – FAA-Mandated Maintenance Plan Updates
• Service Center Programs
• Program Services Available
• Group Accomplishments
• Program Points of Contact (POC)
• Technical Inquiries
LM Aero C-130 Preventive Maintenance Program

• The maintenance engineering analysis is based on Reliability-Centered Maintenance Analysis (RCMA)

• The analysis process includes:
  – Failure Mode Effects and Criticality Analysis (FMECA)
    • Failure for Maintenance Significant Items (MSIs)
    • Damage for Structurally Significant Items (SSI)
  – LM Aero / Vendor / Historical data
• Program was developed for 120/240 week C Check intervals with flight hour backstops
  – A Check 30 Weeks
  – B Check 60 Weeks

• On going analysis concluded that program can be revised to fit 3 and 6 year intervals with the same flight hour backstops
  – A Check 38 Weeks
  – B Check 77 Weeks
LM Aero C-130 Preventive Maintenance Program

(Continued)

- Maintenance cycle increased from 4.5 years to 6.0 years
- LM Aero estimates Life Cycle Cost (LCC) savings and improvement in capability
  - Through a reduction in Non Mission Capable Maintenance (NMCM)
  - A reduction in Maintenance Man Hours (MMH)
  - An increase in fleet availability
Reduction in MMH by 23% and an increase in availability by 2.3% over a 30-year life
High Velocity Maintenance (HVM)

• Concept to refine production operations
  – Emulates industry’s high daily rate of touch-labor during scheduled maintenance events

• Objective
  – Lower Life Cycle Cost of the C-130
  – Increasing aircraft availability

• Examines processes which impact aircraft scheduled maintenance
  – Product flow - Infrastructure
  – Materiel support - Materiel support
  – Funding - Technology
• Key Processes for Successful Implementation
  – Known Aircraft/End Item Condition
    • Lead Time Ahead of Induction – Parts, Training, Infrastructure, Equipment, Data, etc.
  – Mechanic-Centric Focus
    • Parts, Tools, Data, Equipment Pre-Positioned at Point of Use
    • Maximum Use of Kitting
  – Expand Standard Work & Processes
  – Synchronize work and Repair Operations
  – Single Maintenance Concept
  – Integrated Planning, Decision Making and Data Collection
Continued Airworthiness

- **Aging Aircraft Rules**
  - FAA Mandated Updates
    - SFAR 88 (Fuel Tank Flammability) (2009)
    - Damage Tolerance (DT) Data for Repairs and Alterations (2009)
    - Electrical Wiring Interconnection System (EWIS) (2010)
    - Widespread Fatigue Damage (WFD) (2012)
• DT Data for Repairs and Alterations
  – FAA requires DAH (LM) to provide Damage Tolerance data for repairs and alterations to support operator compliance with the Aging Aircraft Rule (14 CFR Part 121.1109 and 129.109)
• DT Data for Repairs and Alterations
  – 14 CFR Part 121.1109 and Part 129.109 requires operators of large transport category airplanes to incorporate a means for addressing the adverse effects of repairs and alterations to fatigue critical structure in their maintenance program (December 2010)

• DT data provided by DAH used to support operator’s means for addressing repairs and alterations
• Limit of Validity (LOV) 14 CFR Part 26, Subpart C (Aging Aircraft Safety, Widespread Fatigue Damage)
  – LOV: Stated as number of total flight cycles or hours or both, during which it is demonstrated that WFD will not occur in airplane
  – Rule (§26.21) requires DAH to evaluate airplanes to establish an LOV of the engineering data that supports the structural maintenance program
Continued Airworthiness
(Continued)

- Electrical Wiring Interconnection System (EWIS)
  - FAR 26.11 states that holders of type certificates for applicable aircraft must develop instructions for continued airworthiness (ICA) for a representative aircraft's EWIS using the guidelines specified in Federal Aviation Regulations (FAR) 25, Appendix H
  - EWIS analysis and inspection intervals were developed in response to FAR 25 and FAR 26 using the guidelines and direction provided by the Federal Aviation Administration AC 25-27
• EWIS Continued
  – After March 10, 2011, FAR Parts 121 and 129 require operators to incorporate FAA-approved EWIS ICA into their maintenance program
  – Update of SMP 515-C is a combination of specific detailed and general visual inspections
• Electrical Wiring Interconnection System (EWIS) Training
Service Center Programs

• LM Aero Certified Service Centers
• SMP 515-C-SC
  – Complete aircraft and systems
  – All configurations (Except customer MODs)
• SMP 515-C-QEC
  – QEC / Engine / Propeller
• Both programs delivered October 2012
Program Services Available

• Customize Maintenance Plans
  – All Type Model Series (TMS)
  – Convert USAF TO 1C-130-6 (Legacy & C-130J) to an OEM approved program
  – Progressive (PMP) or Isochronal (ISO)

• Aircraft/Site Surveys
  – Determine scheduled maintenance compliance
  – Support Avionic Modification Programs
  – Meet key personnel and discuss options to meet customer requirements

• Support and Analysis of Customer Developed Programs
Group Accomplishments

• Delivered 18 Maintenance Programs
• Analyzed C-130J customers maintenance plans
  – Provided recommendations for improvement and implemented LM Aero scheduled maintenance changes
• Developed a C-130J 540 day Isochronal (ISO) Inspection Program
• Implemented C-130B-H extended inspection intervals for 4 SMP 515-C programs
Group Accomplishments (Continued)

- Tailored C-130J inspection program for small fleet operators by developing packaged based inspections
- Performed Site Surveys
  - Supporting F-16 Off-Set program
  - USAF TCG Customer
  - Optimization support of a C-130J Customer’s Initial C Check
- Responded to 80 + Customer technical inquiries
Program Points of Contact

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