C-130 Block Upgrade Programs

Lockheed C-130 Block Upgrade Program Approach

Jim Porter/Ron Sikes/Steve Traub
Lockheed Martin / Fleet Support

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Block Upgrade Topics

• Defining Requirements
  – Phase 0 programs
  – COSSURM

• Upgrade Programs
  – Block 5.4
  – Block 6.0
  – Block 6.1
  – Block 7.0
  – Block 8.1
  – Capability Management Update #1

• Collaboration Efforts
Phase 0 Programs

- LM works closely with customer to develop requirements for an upgrade / capability
- Define Program Structure
- Develop Technical Solution(s)
- Develop Program Execution Schedule
- Assess Risks
- Determine Complexity
- Provide ROM
COSSURM Program

• COSSURM is an integral part of overall LM Aero C-130J sustainment strategy

• COSSURM program will include:
  – Software Upgrades
    • Mission Computer OFP
    • Bus Interface Unit OFP
    • Ground Based Support products / DTADS
    • Supplier OFPs
COSSURM Program

– Hardware / wiring updates to aircraft
– Documentation
– CNS/ATM updates
– Parts Obsolescence / DMS issues
– Updates to spares, documentation, training devices only to reflect the contracted COSSURM configuration
COSSURM Key Concepts

- Customers select capabilities they desire
- Customers share in requirements development
- Customers share in procurement of Common Core Aircraft Items
- Continual Requirements Management Cycle
- Cyclical Requirements Releases
  - Common Core Items
  - Customer Unique Items

Phase 1
(COSSURM) Collaborative Requirements Management
Requirements Management For Common Core

Phase 2
C-130J Block Upgrades (Block 6.0, 6.1 7.0, 8.1)
Product Development and Delivery For Each Customer
### COSSURM Benefits

<table>
<thead>
<tr>
<th>Customer Benefits</th>
<th>LM Aero Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Customer gets Value-for-Money</td>
<td>• Discrete Work Packages</td>
</tr>
<tr>
<td>• Acceptance Criteria Defined</td>
<td>• More Accurate Estimations</td>
</tr>
<tr>
<td>• Get “What They Want”</td>
<td>• Remove “Long Pole” Scheduling</td>
</tr>
<tr>
<td>• Involvement With the Process</td>
<td>• Promotes Disciplined Processes</td>
</tr>
<tr>
<td>• More Accurately Plan Funding</td>
<td>• Predictable Staffing Levels</td>
</tr>
<tr>
<td>• Ability to Upgrade Weapon System</td>
<td>• Satisfied Customers</td>
</tr>
<tr>
<td>• Updated Support Elements</td>
<td></td>
</tr>
</tbody>
</table>

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Block 5.4 Program

• Initial C-130J Spec Compliant Release
• Software Update (MC/BIU/Ground Based SW)
  – Database Improvements, Nuisance Faults Removal
• Communications Enhancements
  – VHF Radio, Intercom, IFF
  – Satellite Communications
Block 5.4 Program

• Structural Enhancements
  – Operators Light, Book Shelf, IR Strobe Light
  – Life Support Equipment Storage

• Loading System Enhancements
  – Winch Modifications, Station Markings/Static line

• Non 5.4 Upgrades
  – 14 + TCTO Incorporations (ACE Mod)
Block 6.0 Program

• Navigation Safety - TAWS
  – TAWS Special Alerts
  – Normal Modes
  – Tactical Modes
• GATM – IFF Mode S Enhanced Surveillance – Upgraded APX-119
• Common CNI
Block 6.0 Program

- Takeoff and Landing Data (TOLD) Embedded in MC OFP
- Analytical Expansion Weight Limitation Chart (WLC)
- Utilizing Existing Structural Limit for Improved Assault Landing Weight for Stretch C-130J
## Block 6.1 Content

<table>
<thead>
<tr>
<th>Block 6.1 Capabilities</th>
<th>Block 5.4</th>
<th>Block 6.0</th>
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<tbody>
<tr>
<td>Optimum Cruise Page</td>
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<tr>
<td>DZ Elevation Advisory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provisions for CNI Bus / RT Monitor</td>
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<tr>
<td>Fuel Reserves</td>
<td></td>
<td></td>
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<tr>
<td>CNIMU performance figures</td>
<td></td>
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<tr>
<td>PERF MASS changes</td>
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</tr>
<tr>
<td>Takeoff and Landing Data (TOLD) Level A Software</td>
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<tr>
<td>CNI TOLD not computed completely for certain temperatures</td>
<td></td>
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</tr>
<tr>
<td>Updated CNI Chute list and ballistic data suite</td>
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<tr>
<td>GATM Phase I – Terrain Awareness and Warning System (TAWS)</td>
<td></td>
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<tr>
<td>CNI Track Offset</td>
<td></td>
<td></td>
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<tr>
<td>Mode S Enhanced Implementation</td>
<td></td>
<td></td>
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<tr>
<td>CNI Zeroize function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio Selection via ASD Table</td>
<td></td>
<td></td>
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<tr>
<td>Waypoint Transition</td>
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<tr>
<td>GCAS Mode 6 (Tactical and Normal Modes)</td>
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<tr>
<td>High Altitude Ramp and Cargo Door Operation</td>
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<tr>
<td>Propeller Dynamic Balance Requirements</td>
<td></td>
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<tr>
<td>DTADS</td>
<td></td>
<td></td>
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<tr>
<td>Expanded autopilot operation limit to maximum TOGW</td>
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<td></td>
</tr>
<tr>
<td>Vmu3</td>
<td></td>
<td></td>
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<tr>
<td>Gun Box + Classified Storage</td>
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</table>
Block 6.1 Program

- Address CNS/ATM Requirements
- Combined Block 5.4 / 6.0 Content
- Unique Block 6.1 Capabilities
  - Initial Multi-National Block Upgrade Program (COSSURM)
  - Content Provided to USAF in subsequent Block Upgrade Program
Block 7.0 Program Overview
Hercules Operators Council
October 2013

Ron Sikes
Block 7.0 Content

**Integrating Software Impacted**
- Flight Management System (FMS) Software
- Mission Computer (MC) Software
- Special Mission Display (SMDP) Software
- Maintenance Management System (DTADS)

**Vertical Navigation**
- Reduced Crew Work Load
- Coupled Autopilot
- Improved Time Navigation
- Improved Fuel Predictions

**CNS/ATM**
- RNP/RNAV Compliance

**Tactical Data Link**
- Link 16

**New FMS**

**New Control Wheel**
- Maintainability

**SMDP**

**Civil GPS**

**Hot Weather Ground Power Modes**
- Maintainability / Reliability

**New FMS**

**Hot Weather Ground Power Modes**
- Civil GPS
- SMDP
- Tactical Data Link (Link 16)
## Block 7.0 Program

<table>
<thead>
<tr>
<th>COSSURM ID NO.</th>
<th>TITLE</th>
<th>SYSTEM</th>
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<tbody>
<tr>
<td>COS-05-0013</td>
<td>DMS, CNI-SP</td>
<td>CNIS</td>
</tr>
<tr>
<td>COS-04-0163</td>
<td>Civil IFR GPS Navigation</td>
<td>CNS-ATM</td>
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<tr>
<td>COS-04-0225</td>
<td>IFF Baro Altitude Source Selection for Full RVSM Compliance</td>
<td>MCSW</td>
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<tr>
<td>COS-04-0025</td>
<td>Insufficient Brightness of the HUD During NVG Operations</td>
<td>DISP</td>
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<td>COS-04-0072</td>
<td>Hot Weather Ground Operations Modes</td>
<td>MCSW</td>
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<td>COS-04-0185</td>
<td>C-130J Special Mission Processor – Interface (SMP-I)</td>
<td>MCSW</td>
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<td>COS-05-0033</td>
<td>Real-Time Operating System (RTOS)</td>
<td>MCSW</td>
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<td>COS-05-0058</td>
<td>Selectable Altitude Readout (Meter/Feet)</td>
<td>MCSW</td>
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<tr>
<td>COS-03-0402</td>
<td>Tactical Data Link (Link 16)</td>
<td>CMNV</td>
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<tr>
<td>COS-03-0130</td>
<td>Check Baro Command</td>
<td>CNIS</td>
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<tr>
<td>COS-04-0414</td>
<td>Altitude/Reference Auto Selection</td>
<td>MCSW</td>
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<td>COS-04-0169</td>
<td>Reset Device without Power Cycling Mission Computer (MC)</td>
<td>MCSW</td>
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<tr>
<td>COS-03-0160</td>
<td>TNAV Inaccuracies during Climb/Descent</td>
<td>CNIS</td>
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<tr>
<td>COS-03-0330</td>
<td>CNI Upgrade of STARs Function</td>
<td>CNIS</td>
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<tr>
<td>COS-03-0261</td>
<td>Enhanced Fault Isolation (FI) Set (Volume 2 and/or 3)</td>
<td>GMSS</td>
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<tr>
<td>COS-04-0078</td>
<td>Reduced Short Field Landing Approach Speed/Ground Roll – Reduced Over the Fence Speed</td>
<td>ANLY</td>
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<tr>
<td>COS-04-0024</td>
<td>Increased Covert/Normal Exterior Aircraft Lighting Control</td>
<td>MCSW</td>
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<tr>
<td>COS-03-0187</td>
<td>CNI Waypoint Operations</td>
<td>CNIS</td>
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<tr>
<td>COS-04-0125</td>
<td>Block 7.0 Nuisance Fault Reduction</td>
<td>MCSW</td>
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<tr>
<td>COS-03-0100</td>
<td>Poor LZ Slowdown Cueing</td>
<td>CNIS</td>
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<td>COS-03-0103</td>
<td>Unstable CARP Solution</td>
<td>CNIS</td>
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<td>COS-03-0188</td>
<td>OAT Data Entry</td>
<td>CNIS</td>
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<td>COS-04-0155</td>
<td>Auxiliary Feather Pump Mod Requirements</td>
<td>MCSW</td>
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<td>COS-03-0132</td>
<td>Scratchpad Management</td>
<td>MCSW</td>
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<tr>
<td>COS-03-0325</td>
<td>Yoke Switch Repair</td>
<td>AFRM</td>
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<tr>
<td>N/A</td>
<td>DTADS Update</td>
<td>GMSS</td>
</tr>
</tbody>
</table>
Block 7.0

Summary of Improvements

- **Operational & Mission Performance Enhancements**
  - New FMS Necessary to Meet Plan for Worldwide Civil Airspace Operation
  - CNS ATM - Civil GPS with RNP and RNAV approaches
  - Enhanced Search and Rescue patterns
  - Automated/optimized Computer Air Release Point (CARP) Construction
  - One Civil-Certifiable (IFR) Worldwide Navigation Database
  - Link 16 - Battlefield Situational Awareness / Improved Survivability
  - SMPI - Supports Roll on Roll off Equipment
  - MC Reset - Allows Crew to Re-establish Communication to Selected Devices

- **Operational & Maintainability Savings**
  - Fully Automatic Fuel Planning – Carry Less Fuel
  - Optimal Altitude, Trip Altitude, and Maximum Altitude – Carry Less Fuel
  - New Quick Release Control Wheel – Reduces Remove & Replace Time
  - Enhance Fault Isolation - Improves Maintenance Troubleshooting
  - New Ground Power Modes – Powers Selected Systems / Reduces Wear
Block 8.1 Program Overview
Hercules Operators Council
October 2013

Jim Porter
Block 8.1 Program

- Flight Management System (FMS) Software
- Mission Computer (MC) Software
- Bus Interface Unit (BIU) Software
- Maintenance Management System

Integrating Software Impacted
- Flight Management System (FMS) Software
- Mission Computer (MC) Software
- Bus Interface Unit (BIU) Software
- Maintenance Management System

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# Ten Capability Requirements Identified for Block Incorporation

<table>
<thead>
<tr>
<th>Capability</th>
<th>Supplier</th>
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<tbody>
<tr>
<td>COS-07-0009 - Block 8.1 TEMPEST Compliance</td>
<td>LM</td>
</tr>
<tr>
<td>COS-06-0009 - IFF Transponder Mode 5</td>
<td>Raytheon</td>
</tr>
<tr>
<td>COS-06-0022 - ADS-B (Out)</td>
<td>Raytheon</td>
</tr>
<tr>
<td>COS-06-0036 - Enhanced Intercommunication System (ICS)</td>
<td>Palomar</td>
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<tr>
<td>COS-06-0021 - ATS and AOC Data Link for LOS and BLOS Comm</td>
<td>GE / LM, Honeywell, Thrane &amp; Thrane, Ball Aerospace</td>
</tr>
<tr>
<td>COS-03-0102 - Vertical Profile Cueing</td>
<td>LM / GE, Rockwell Collins, L3 Comm</td>
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<tr>
<td>COS-06-0010 - Improved PA system</td>
<td>LM, Palomar</td>
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<tr>
<td>COS-08-0015 - APV/LPV Approach Capability</td>
<td>GE / LM</td>
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<tr>
<td>COS-04-0012 - Failure Detection of the Triaxis Accelerometer</td>
<td>LM</td>
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<tr>
<td>COS-06-0074 – Covert Lighting Aft of the Ramp</td>
<td>Soderberg</td>
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</table>

Gen Raymond Johns (AMC/CC): “Block 8.1 will be the baseline for the AMC’s C-130J fleet”

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• IFF transponder
  – Mode 5 level 2 per U.S. DoD AIMS 03-1000A
  – Automatic dependent surveillance broadcast (ADS-B) class B1 (ADS-B out) per RTCA DO-260B

• CNS/ATM Data Link
  – Future aircraft navigation system (FANS 1/A)
    • Controller-pilot data link communications (CPDLC)
    • Automatic dependent surveillance-contract (ADS-C)
  – Aeronautical operations center (AOC) messages
  – Inmarsat SATCOM (BLOS) & VHF (LOS)

• Enhanced ICS
  – 14 input/output and 20 receive only
  – Implement a 2nd link 16 LVT voice channel
  – Implement integrated SATCOM voice
Block 8.1
Summary of Improvements

- Improved PA System
  - Reallocation and distribution of new speakers

- Vertical Profile Cueing
  - Additional Symbology on HUD and CMDU PFD
  - New vertical profile flight plan display on NAV/RADAR display

- APV/LPV Approach Guidance
  - Implement approach guidance provided by the CMA-5024 GPS/WAAS receiver (block 7.0 capability)

- Failure Detection Of Tri-axis Accelerometer
  - Detect when any of the three (3) Triaxis accelerometer channels fail

- Covert Lighting Aft Of The Ramp
  - Install three (3) infrared (I/R) loading lights aft of the ramp

- Tempest
CMU #1 Program

- Software Only Build
- Address Block 7.0 Enhancements
- To be combined with Block 8.1 Program
- Capabilities selected by 7-nation team
- 48 Capabilities
  - FMS Related
  - MC Related
  - Link 16 Related
  - DTADS Related
Potential Collaboration Efforts

• Existing Capabilities on C-130
• Defensive Systems
  – IRCM
  – RWR
  – MWS
  – CMDS
• High Altitude Ramp & Door
• New Requirements
Questions?