Automation Concepts for Army Aviation

Providing an integrated solution to future Army aviation automated logistics, operations, training, mission planning, safety and risk reduction/management requirements
Army Aviation Unit Logistics Automation

• TODAY
  – Networks are moving data through the theater to enterprise. Bandwidth
  – Data is being collected for current analysis and stored for future analytic requirements. CBM
  – Automation is used throughout the Enterprise. Multiple Systems
  – Maintenance management information system (MMIS) continues to improve. All Levels
  – Some critical components are analyzed with Condition Based Maintenance tools. Evolving

• TOMORROW
  – Networks that fully support Enterprise, CBM, MFOQA requirements. Volume / Storage Restrictions
  – Data to support mission readiness and engineering purposes. How Much Of What
  – Automation Integration. Independent Solutions, Some Proprietary
  – Robust aircraft diagnostic/prognostic (CBM) capabilities. IETM, GSS, Communications
  – Military Flight Operations Quality Assurance (MFOQA) program implementation. Blending Of Systems
OBJECTIVE SYSTEM

- AIRCRAFT EMBEDDED SENSORS
  - Digital Source Collectors (DSC)

- ACN (Aircraft Notebook)
  - Mechanics Tool Box of Software

- CBM (Condition Based Maintenance)
  - Top Tier Collection and Analysis

- MFOQA (Military Flight Operations Quality Assurance)
  - MOST (Maintenance Operations Safety and Training)

- SUPPORT LOGISTICS ENTERPRISE
  - Tactical and National Levels
    - GCSS-A (F/T) Global Combat Support System – Army – Field Tactical
    - LMP (Logistics Modernization Program)

- COMMUNICATIONS
  - Hardware and Software
Communications
- JTDI – Transmits data to external systems
- ELUMS – Parses A/C Data for use by ACN and transfer via JTDI
- Portal (MFOQA) – Provides access to MFOQA programs for enhancing “MOST” Maintenance–Operations-Safety-Training

Maintenance Processes
- IETM – Interacts with GSS, MIS, & JTDI (Display & Updates)
- GSS – Analytic tool, interprets A/C Data for IETM and MIS
- Reference Docs – ARs, SOPs, FMs, etc.
- A/C Unique SW – For specific tasks by airframe (Ex: Maintenance Test Flight Calculator)
Aircraft Data
Downloaded data from A/C monitoring devices to support:
- Fault Detection
- Troubleshooting
- CBM Analysis
- MFOQA Initiatives via "MOST"

Forms & Records
MIS (Maintenance Information System)
- Records TAMMS-A Data & Forms
- Interacts with Communications for Notifications /Updates /Sends Data
- Interacts with MAINT Processes to Expedite MAINT Actions

Maintenance Processes
IETM
GSS
TMDE Software
Reference Docs
A/C Unique SW

Communications
JTDI
ELUMS
Portal (MFOQA)

ACN Software Sections - 2 of 2
**CBM (Condition Based Maintenance)**

- **Maintenance to Improve Operational Availability and Reduce Maintenance Burden on Soldier by:**
  - Enhancing Diagnostics
  - Evolving to Predicting Remaining Component Life
  - Then Evolving to Proactive Supply Transactions

- **Derived From Near Real-time Assessment & Analysis of Data From:**
  - Embedded Sensors
  - Platform Maintenance Environments (DSCs and ACN)
  - Aircraft and Supply Historical Data

**Key CBM Enablers**
- Embedded Sensors
- Plane Side Diagnostics
- Data Fusion
MFOQA (Military Flight Operations Quality Assurance)

- Military Flight Operations Quality Assurance (MFOQA)
  - Is a Knowledge management process
  - Will employ a web based knowledge-driven decision support system (DSS)
  - Provides actionable information to decision makers for improvements in maintenance, operations, safety, and training (MOST).
  - Uses aircraft flight data downloaded after every flight.
  - Leverages: Aircraft, Ground Station, Communications, Safety, Personnel and Enterprise Systems

- Derived from the civilian version, FOQA, an accepted commercial standard operating procedure endorsed by the FAA.

- MFOQA goes beyond traditional Quality Assurance by providing:
  - Situational awareness and understanding.
  - Pre/Post mission debrief.
  - Aircraft maintenance and troubleshooting.
  - Flight data analysis.
  - Mishap investigation.

Class A Human Error Cost
Sep 01 – Jul 07
$2.55B & 386 Fatalities
BASIC COMMUNICATIONS STRUCTURE (Current)

- **DSC Data**
  - CVR/FDR
  - HUMS
  - Data Transfer Devices
    - 1553 Cable
    - USB Stick
    - PCMCIA Card

- **VSAT**
  - Aircraft Notebook (ACN)

- **CAISI**
  - Production Control
  - Quality Control

- **ENTERPRISE**
  - Government Ground Station

- **THEATER**
  - Back Shops
  - Flight Ops

- **CONUS**
  - CBM Warehouse
  - Fleet Mgr
  - LOGSA
  - AED
  - MFOQA Data Base
BASIC COMMUNICATIONS STRUCTURE (Future)

CONUS

Enterprise

MFOQA Server

Maintenance & Logistics Satellite

Company (Detached & Connected)

Company (Detached & Connected)

Company (Detached & Connected)

SFAE-AV-S-ACIB

Battalion Network

HHC

Alpha Company

Bravo Company

Charlie Company

(Synchronized) Deployable Company Server

Wireless Connection

Delta Company

All companies can operate connected or disconnected.
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- MFOQA (Military Flight Operations Quality Assurance)
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- SUPPORT LOGISTICS ENTERPRISE
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- COMMUNICATIONS
  - Hardware and Software
? QUESTIONS ?
BACK UP
Digital Sensors AH-64 APACHE

AH-64 A/D - 53 Parts Monitored

Main rotor head
M/R Hub
Trunion damper
Upper bearing
Lower bearing
M/R Swashplate
M/R Swashplate Bearing
PC link
PC link rod ends
Air Data Processor
bearing (A-model)
Derotation Unit
(D-model)
Straps
Pitch housing
Lead-lag link
Feathering bearing
Lead-lag damper
Rod end (damper)
Main rotor blade
Tip cap
M/R blade attach pin

Drive Shafts (#1 - #7)
Hanger Brngs (Fwd & Aft)
Intermediate GB**
Drive Flange

Main Transmission
Clutch (left/right)
Sprag clutch (primary/secondary)
M/R drive plate
M/R drive shaft (Gearshaft-spur)

APU
APU clutch**
APU shaft

Hydraulic Pump
(Primary & Utility)
Lube Pumps
Generator
Shaft Driven Compressor
(A-model only)

Engine (No. 1 & 2)
Nose GB (No. 1 & 2)
Quill Shaft
Engine Starter

Currently lists -2410 tracked parts
And additional life limited parts
---mainly rotating components

Currently Monitored by Vibration
Structural Part, Possible addition for Monitoring in FY08
**Digital Sensors CH-47 CHINOOK**

**CH-47D - 88 Parts Monitored**

- FWD Tie Bar
- Pitch housing
- Pitch Bearing (2)
- Pitch Shaft
- Vertical Pin Bearing
- Horizontal Hinge Pin
- Horiz. Pin Bearing (2)
- Damper

- AFT Tie Bar
- Pitch housing
- Pitch Bearing (2)
- Pitch Shaft
- Vertical Pin Bearing
- Horizontal Hinge Pin
- Horiz. Pin Bearing (2)
- Damper

- Synch Shaft (7)
- Hanger Bearings (7)
- Synch Shaft Mounts (7)

- FWD Rotor Blade
- Vibration Absorbers (3)

- FWD Transmission
  - FWD Rotor Shaft
  - Hydraulic Pump
  - Lube Pumps (2)

- APU
  - AFT Transmission
    - Rotor Shaft
    - Transmission Fan
    - Generators (3)
    - Hydraulic Pumps (2)
    - Lube Pump

- AFT Rotor Blade
- AFT Transmission
  - Rotor Shaft
  - Transmission Fan
  - Generators (3)
  - Hydraulic Pumps (2)
  - Lube Pump

**Currently lists -2410 tracked parts**
**And additional life limited parts---mainly rotating components**

- AFT Rotor Head
- AFT Rotor Hub
- AFT Swashplate
- Swashplate Bearing
- Pitch Link
- Pitch Link Bolts (2)

- AFT Rotor Blade
- AFT Transmission
  - Rotor Shaft
  - Transmission Fan
  - Generators (3)
  - Hydraulic Pumps (2)
  - Lube Pump

**Currently Monitored by Vibration**
**Structural Part, Possible addition for Monitoring in FY08**

- Engine (No. 1 & 2)
- Eng. Transmission (2)
- Clutch (2)
- Engine Driven Shaft (2)
- Cross Shaft (2)
Digital Sensors UH-60 BLACKHAWK

UH-60A/L - 56 Parts Monitored

Currently lists -2410 tracked parts
And additional life limited parts
And additional rotating components

Main Rotor Hub
Main Rotor Shaft
Bifilars
Swashplate ASSY
Swashplate Guide
Swashplate Bearing
PC Links
M/R Spindle
Spherical Bearing
M/R Spindle Tie Rod
Control Horn
M/R Shaft Extender
M/R Damper
M/R Blade
M/R Blade Tip Cap
M/R Blade Expandable Pin
M/R Blade Cuff

T/R Blade
T/R Pitch Change Horn
PC Links
T/R Pitch Change Shaft
T/R Pitch Change Bearing
Tail Rotor GB
Retention Plates (2)
Gearshaft
Viscous Bearings (4)**
T/R Driveshafts (7)
Intermediate GB

Currently Monitored by Vibration
Structural Part, Possible addition for Monitoring in FY08

Main Transmission Module
Accessory Module
Generators (2)
Hydraulic Pumps (2)
Planetary Carrier
Engine (No. 1 & 2)
Driveshafts (2)
Input Modules (2)
Oil Cooler Axial Fan
Oil Cooler Fan Bearing
APU

Vibration Absorbers (2)