



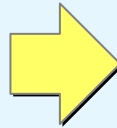
# RAM Engineering Trends/Challenges in Army Aviation

2005 DoD Maintenance  
Symposium



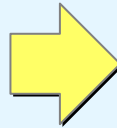
# RAM Engineering Trends in Army Aviation

**Inspection & Failure Based Maintenance**



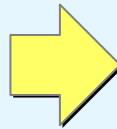
**Condition Based Maintenance**

**Repair to Acceptable Standard**



**Recapitalization**

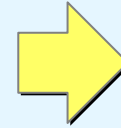
**Reliability Hardware Improvement by Engineering Design Change**



**Reliability System Improvement by Soldier/Engineer System Change**



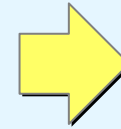
## **Inspection & Failure Based Maintenance**



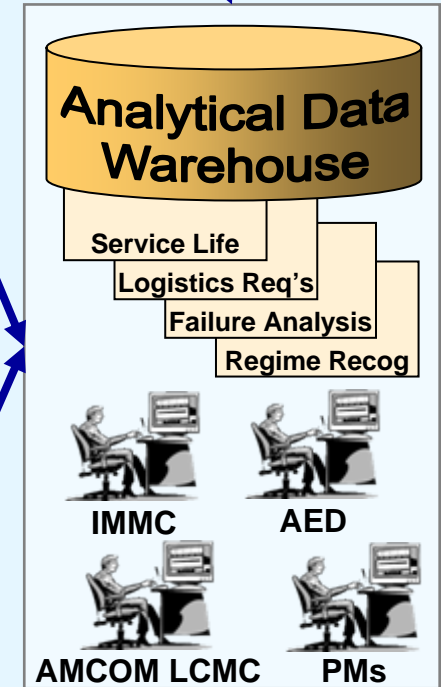
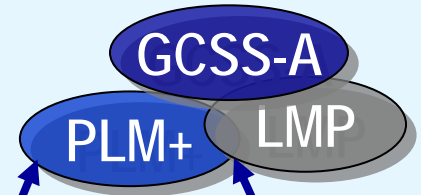
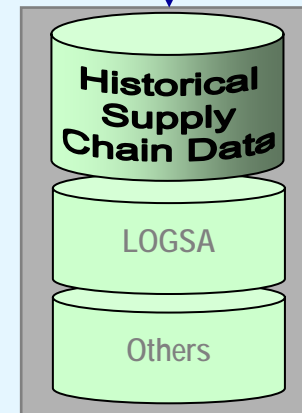
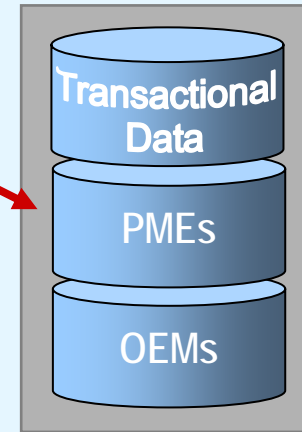
## **Condition Based Maintenance**

- **A Set Of Maintenance Processes and Capabilities that Improve Operational Availability and Reduce the Maintenance Burden On the Soldier by:**
  - **Enhancing Diagnostics**
  - **Evolving to Predicting Remaining Component Life**
  - **Then to Proactive Supply Transactions**
  
- **Derived from Near Real-Time Assessment & Analysis of Data from:**
  - **Embedded Sensors**
  - **Platform Maintenance Environments**
  - **Aircraft and Supply Historical Data**

# Inspection & Failure Based Maintenance



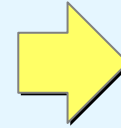
# Condition Based Maintenance



*Redstone Arsenal*



**Inspection & Failure  
Based Maintenance**



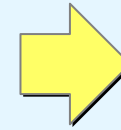
**Condition Based  
Maintenance**

## ■ Challenges

- **Signal to Noise Ratio**
- **Keep up with sensing technology and the technology of the equipment being sensed**



**Repair to Acceptable Standard**

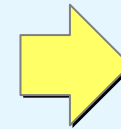


**Recapitalization**

- Maintenance burdens and O&S costs are rising due to the aging fleet flying.
- Aviation Program Management Offices are executing Recapitalization Programs to address these increasing failure rates and maintenance repair times.
- The Recapitalization Programs involve a disassemble, fix, replace, and reassemble process. *TIME=Zero*
- The mandatory parts that are replaced typically include structural upgrades, new overhaul standards, and new parts.



# Repair to Acceptable Standard



# Recapitalization

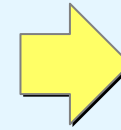
Recap has proven to be a success for Army Aviation. Improvement in overhaul procedures is working.

	Unscheduled Maintenance Man-Hours	Total Flight Hours	Unscheduled Maintenance Ratio
Non-Recap	1732.9	1654.5	1.1
Recap	1805.2	2365.0	0.76
Percent Reduction			<b>30.9%</b>

Recap Part	% Improvement
Longitudinal. Servo	14.46%
LH Nose Gearbox	590.64%
Hydraulic Manifold	11.83%
DIR T/R Servo	137.96%
Main Transmission	123.09%
T/R Swashplate	35.58%
RH Nose Gearbox	236.69%
TADS Turret	52.22%
Tail Rotor Gearbox	-0.54%
Intermediate Gearbox	-5.65%



**Repair to Acceptable  
Standard**

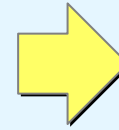


**Recapitalization**

## ■ Challenges

- Design for reliability after overhaul
- Pay attention to life requirements

## Reliability Hardware Improvement by Engineering Design Change



## Reliability System Improvement by Soldier/Eng Sys Change

# Soldier Focused Logistics CH-47 Horizontal Hinge Pin & Cartridge Solenoid Valve

### Horizontal Hinge Pin

#### Problem:

- High demand rate.
- Premature Removals.
- Expensive to refurbish.

#### Solution (Short Term):

- Revise the inspection criteria and produce a DVD showing proper inspection method.



### Cartridge Solenoid Valve

#### Problem:

- High Demand Rate
- Premature Removals

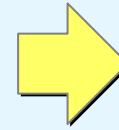
#### Solution:

- Add troubleshooting guide to procedures and design go/no-go test set.





**Reliability Hardware  
Improvement by  
Engineering Design Change**



**Reliability System  
Improvement by  
Soldier/Eng Sys Change**

## **Mylar Laminate Tear-off Project**

### **Problem:**

Iraqi campaign data showed a significant increase in windshield demand, outpacing supply.

- Sand Erosion
- Rock Damage
- Crack Propagation
- 8-Hr Replacement Time

### **Solution:**

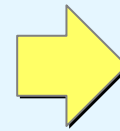
The Mylar sacrificial windshield tear-off similar to the tear-offs used in professional auto racing. Additional NRE work to meet aviation specific needs (ie. adhesive, ESD). The Black Hawk was selected as the initial aviation platform due to the inability of the windshield manufacturer to keep pace with demand during OIF/OEF deployment.







**Reliability Hardware  
Improvement by  
Engineering Design Change**



**Reliability System  
Improvement by  
Soldier/Eng Sys Change**

## ■ Challenges

- Go to the field
- Take care of the soldier and he will take care of you