



Presented to
DoD Maintenance Conference

RCM Field Implementation

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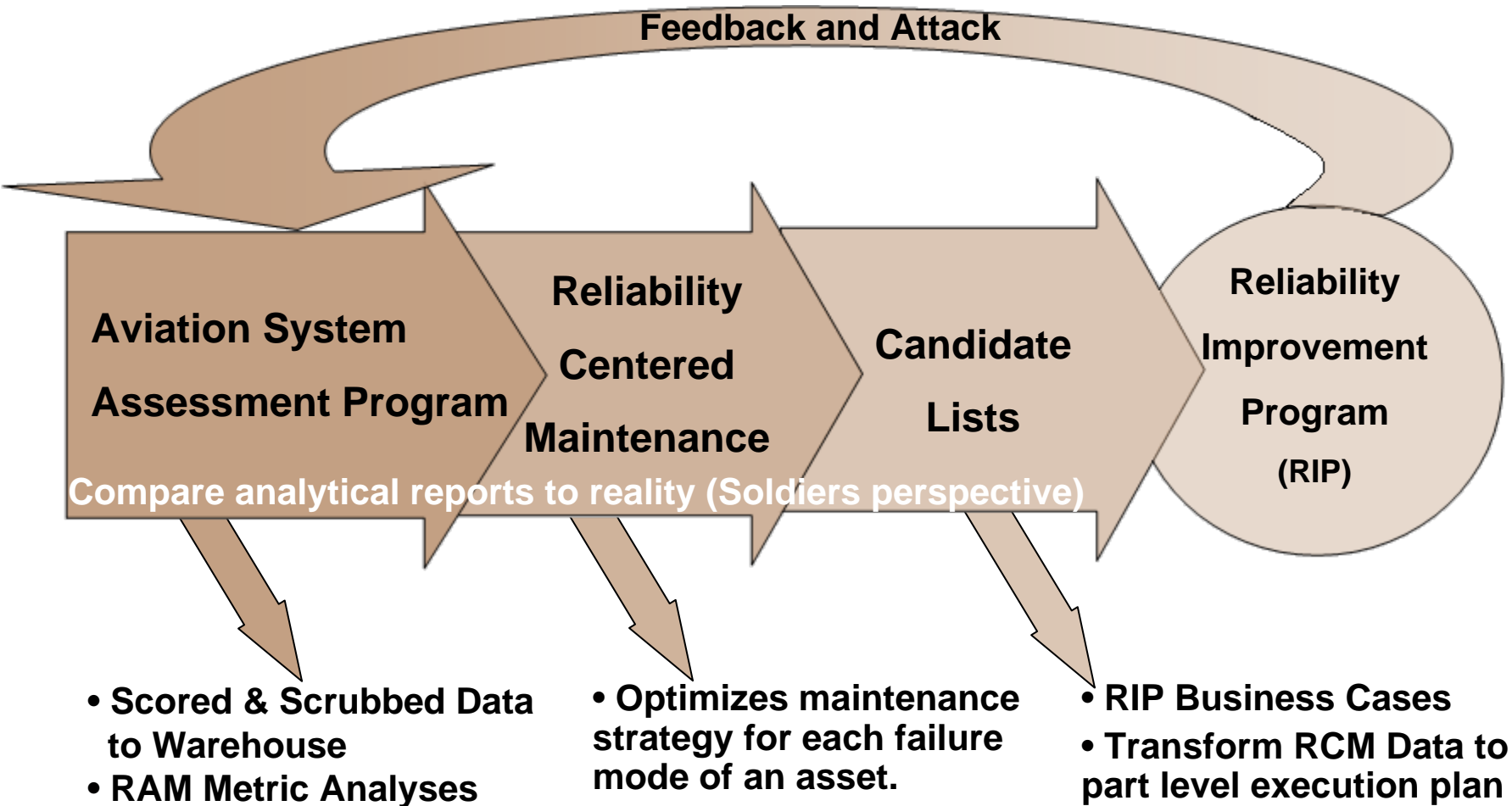
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Date: 10/27/08

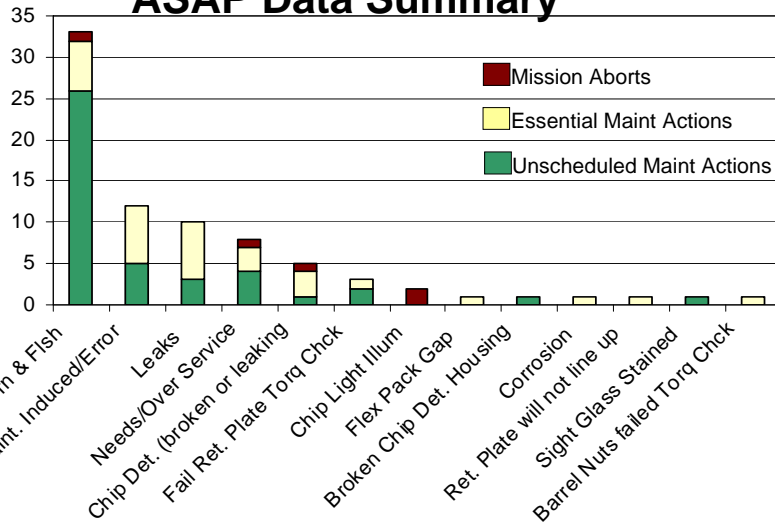
Presented by:

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Aviation and Missile Research,
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ASAP Data Summary



ASAP Maintenance Actions

Events	Events	Events / 1,000 Flt hrs	Rank
Mission Abort	5	##	##
Essential Maint Actions	31	##	
Unscheduled Maint Actions	81	##	##
MMHs	828.4	##	##

MISSION ABORTS

- Chip light (2)
- Leak (1)
- Maintenance Error (1)
- AOAP (crew notified during run up (1))

Scheduled Maintenance Tasks

Task	Details	MMHs / 1K Flt Hrs
Preflight	Fluid level, condition	##
Daily	Leaks, security, cracks, corrosion, damage	##
Periodic	AOAP	##
Periodic	Balance Check, (Special Chip Det. & Temp. Sensor Insp)	##
Periodic	Cracks, damage, security, shims of ret. plates. Torque Check in I/B ret. Plate botls	##
Periodic	Pylon for cracks, dents, nicks, corrosion, security. PMI 1, Tail Rotor servo and input bevel pinion	##
Periodic	inspection of trans, mounts, hardware	##
Life Limit		##

Maintenance Impact

1. Reduce mission aborts and in flight emergencies due to unusual vibrations and associated caution/warning lights (CHIP DET).
2. Eliminate requirement to install / remove AVA and perform ground run when an unusual vibration is detected.
3. Provides capability to trend fault progression and allows maintenance to be scheduled prior to vibrations being detected by the crew or the illumination of chip lights.
4. Earlier detection of fault conditions reduces collateral damage and cost associated with transmission rebuild at depot.
5. May reduce/remove AOAP requirements via vibration monitoring.

Army Oil Analysis Program (AOAP) – Establishing appropriate inspection frequencies.

Status Quo

- Utility Inspection Intervals
 - Main Trans – 720 hr
 - Intermediate Gearbox – 40 hr
 - Tail Rotor Gearbox – 40 hr
- Cargo Inspection Intervals
 - FWD Trans – 50 hr
 - AFT Trans – 50 hr
 - Combing Trans – 50 hr
 - Engine Trans – 50 hr
 - Engine – 50 hr
- Attack Inspection Intervals
 - Main Trans – 50 hr
 - Nose Gearbox – 50 hr



Proposed RCM Improvement

- Utility Inspection Intervals
 - Main Trans – 720 hr
 - Intermediate Gearbox – 720 hr
 - Tail Rotor Gearbox – 720 hr
- Cargo Inspection Intervals
 - FWD Trans – 200 hr
 - AFT Trans – 200 hr
 - Combing Trans – 200 hr
 - Engine Trans – 200 hr
 - Engine – 200 hr
- Attack Inspection Intervals
 - Main Trans – 250 hr
 - Nose Gearbox – 250 hr

Proposed Savings per 100,000 flight hours:
Maintenance hours (MH): 3736.1
New Oil Cost: 26277.3
Downtime: 319 days

Vibration Absorbers – Change scheduled maintenance to condition based maintenance.

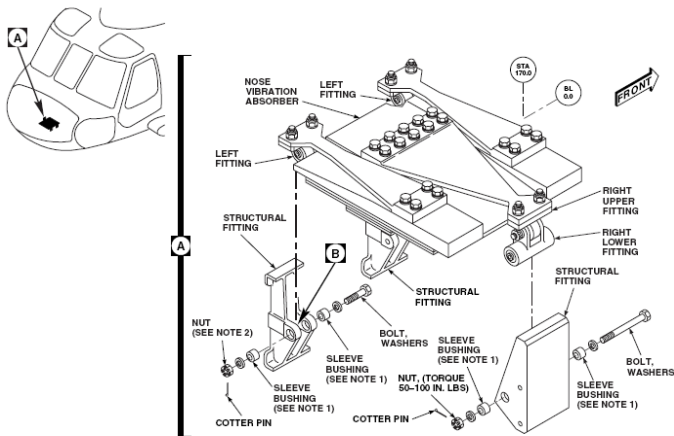
Status Quo

- The TM 1-1520-237-23PMI outlines that the inspection has to be done. Reference the verbiage in the INSPECTION REQUIREMENTS “INSPECT NOSE VIBRATION FOR WEAR AND SECURITY”.
- The inspection and procedure is outlined in TM1-1520-237-23-5 W.P 0219, PAGE 00-4, under INSPECT/REPAIR.
- The first inspection is to “**CHECK FITTING BEARINGS FOR WEAR**”.

TM 1-1520-237-23

0219 00

REPLACE NOSE VIBRATION ABSORBER (SPRING TYPE) - Continued



Proposed RCM Improvement

- The TM 1-1520-237-23PMI outlines that the inspection has to be done. Reference the verbiage in the INSPECTION REQUIREMENTS “INSPECT NOSE VIBRATION FOR WEAR AND SECURITY”.
- The inspection and procedure is outlined in TM1-1520-237-23-5 W.P 0219, PAGE 00-4, under INSPECT/REPAIR.
- The first inspection is to AIRCRAFT WITH IVHMS/HUMS INSTALLED VERIFY TUNING OF THE ABSORBERS, IF NO ADJUSTEMENTS ARE REQUIRED INSPECTION IS COMPLETE.

Proposed Savings:

- MH: 8 per phase
- Incidental Damage from removing and replacing (R&R)
- Downtime: 1 day per phase

Exhaust Mounting Brackets – Remove Redundant Non Destructive Inspections identified for A-Kit brackets.

Status Quo

TM 1-1520-237-PMH

PHASE INSP NO.		PERIODIC INSPECTION CHECKLIST			
Area Name and No.		Aircraft Serial No.			
6. Main Rotor Pylon					
PHASE NO.	Inspection Requirements	MH	MOS	Status	Faults and/or Remarks
2	6.50 HIRRS Inspect as follows: Remove modules. Disassemble cores from modules and remove baffles from cores. Inspect rear fairing and panel for cracks, dents, and security of attachment hardware. Inspect nacelle for cracks, dents, and security of attachment hardware. Inspect suppressor and nacelle support mounts for cracks or damaged bearings (TM 1-1520-237-23). Inspect module bulkhead for cracks. Inspect titanium/steel structure for cracks, and broken spot welds and rivets.	3.2	15T		

TM 1-1520-237-23 0489 00

Found during normal inspection intervals and once again during R&R.

INSPECT SUPPRESSOR AND NACELLE FAIRING SUPPORT MOUNTS - Continued

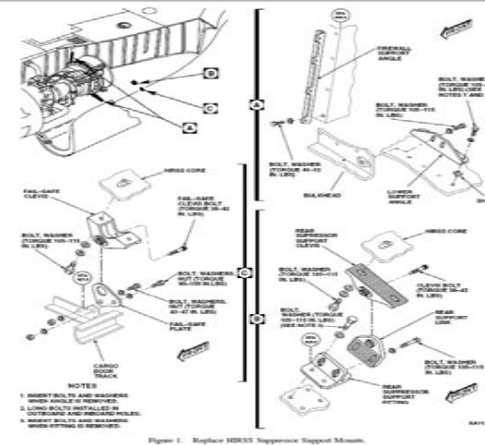
- a. Visually check spherical bearing in rear support link for looseness or damage. **NO LOOSENESS OR DAMAGE ALLOWED.** Replace parts that have loose or damaged bearings.
 - b. Visually inspect rear suppressor support fitting, rear support link, and rear suppressor support clevis for flats or damage to adjustment ridges. **NO DAMAGE ALLOWED.** Replace rear suppressor support clevis if adjustment ridges are damaged.
 - c. **Inspect fail-safe plate, fail-safe plate, rear suppressor support clevis, rear suppressor support fitting and link using fluorescent penetrant inspection method (TM 1-1520-265-23). NO CRACKS ALLOWED.** Replace cracked parts.
 - d. Check fail-safe and rear suppressor support clevis bolts for wear. **DIAMETER OF CLEVIS BOLT SHANK IN CONTACT AREA MUST NOT BE LESS THAN 0.281-INCH.** Replace worn bolt.
2. Inspect nacelle fairing support mount as follows:
 - a. Visually check spherical bearings in upper nacelle support fitting and lower nacelle support link for looseness or damage. **NO LOOSENESS OR DAMAGE ALLOWED.** Replace parts that have loose or damaged bearings.
 - b. Check upper support clevis for flats or damage to adjustment ridges. **NO DAMAGE ALLOWED.** Replace upper support clevis if adjustment ridges are damaged.
 - c. **Inspect lower nacelle support fitting and link using fluorescent penetrant inspection method (TM 1-1520-265-23). NO CRACKS ALLOWED.** Replace lower nacelle support fitting and link if cracks are found.
 - d. Inspect upper nacelle support fitting and clevis using fluorescent penetrant inspection method (TM 1-1520-265-23). **NO CRACKS ALLOWED.** Replace upper nacelle support fitting and clevis if cracks are found.
 - e. Check upper and lower clevis bolts for wear. **DIAMETER OF CLEVIS BOLT SHANK IN CONTACT AREA MUST NOT BE LESS THAN 0.281-INCH.** Replace worn bolt.

INSTALL

Proposed RCM Improvement

Remove Non Destructive Inspection requirement based on HIRRS installation to reduce excess maintenance when HIRRS is removed to facilitate other maintenance.

Location of the Mounting Brackets



Proposed Savings:

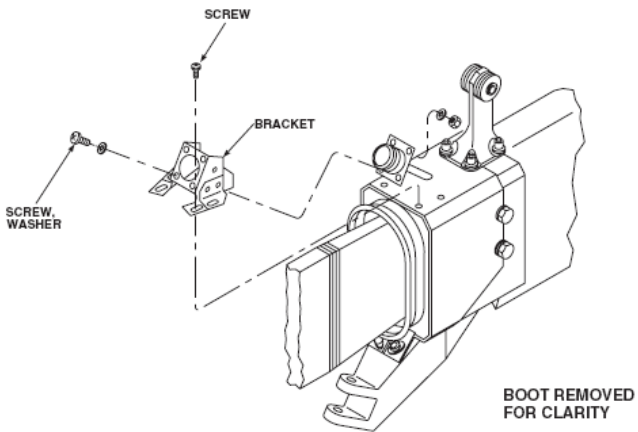
- MH: 13 (5 per R&R + 8 for ALDT)
- Incidental Damage from R&R
- Downtime: 1 day per R&R

De Ice Bracket – Changing verification/validation maintenance to take advantage of on board monitoring systems.

Status Quo

As a part of replacing the Tail Rotor De-Ice bracket a maintenance operational check (MOC) is required to verify the tail rotor is still within balance.

This requires a dedicated run-up of the aircraft.



Proposed RCM Improvement

Aircraft with the IVHMS/HUMS make an entry in the aircraft logbook stating “UPON COMPLETION OF FIRST FLIGHT, VERIFY TAIL ROTOR BALANCE UTILIZING THE IVHMS/HUMS GROUND STATION”

Proposed Savings:

- MH: 0.8
- Incidental Damage from R&R
- Downtime: 2 hours per R&R

Tail Rotor Boot Replacement – Changing verification/validation maintenance to take advantage of on board monitoring systems.

Status Quo

As a part of replacing the Tail Rotor Boot a maintenance operational check (MOC) is required to verify the tail rotor is still within balance.

This requires a dedicated run-up of the aircraft.

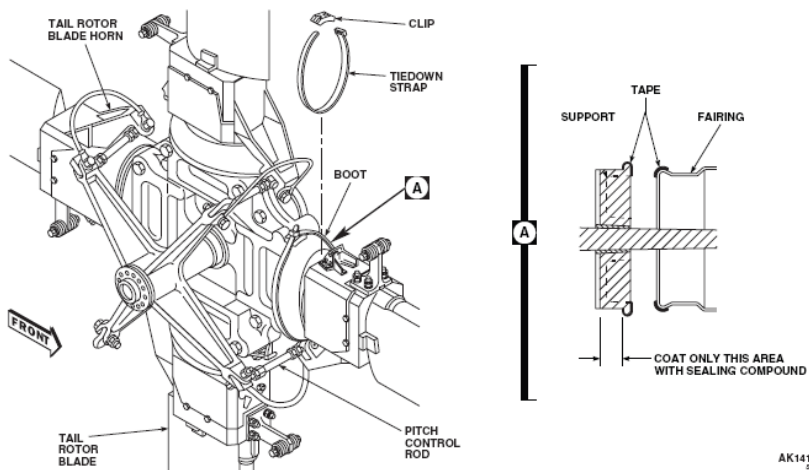


Figure 1. Replace Tail Rotor Boot.

Proposed RCM Improvement

Aircraft with the IVHMS/HUMS make an entry in the aircraft logbook stating “UPON COMPLETION OF FIRST FLIGHT, VERIFY TAIL ROTOR BALANCE UTILIZING THE IVHMS/HUMS GROUND STATION”

Proposed Savings:

- MH: 0.8
- Incidental Damage from R&R
- Downtime: 2 hours per R&R

EPUSHA Pump – Providing better equipment for better maintenance.

Status Quo

- Hand pump requires 15 minutes to charge the accumulator.
- Physically strenuous on soldiers to pump.
- Manually recharging accumulator causes significant increases in downtime while diagnosing the APU.

**EPUSHA
Pump in
Field-
101st 7th BAT
9/27/07**



RCM Improvement

Integrate an electronic hydraulic pump to recharge the accumulator to start the APU.

Savings:

- **Reduced 39 maintenance tasks by at least 0.67 MH per task.**
- **Reduced physical stress on soldiers**
- **Reduced Crew exposure to hostile fire**

Soldier Feedback

“(We’ve) been waiting on this for 10 years.”

“Wonderful...Great time saver...especially in hot weather when required to wear body armor” **SFC Lance Classen**

“Time saved...far less physically demanding” **SGT Lindsey Dalbani**

“Several times in Viet Nam this pump would have lessened the amount of time I was exposed to enemy fire while performing ground maintenance.” **MSG Ret. Ken Bowie**

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Main Rotor Blade Wedges – Changing Hardware to increase part life and ease maintenance.

Status Quo

In order to track main rotor blades the trim tabs on the trailing edge of the blade are bent. This method of tracking blades induces fatigue on the tabs and causes them to become less rigid as more bends are performed to keep track.



Proposed RCM Improvement

Change the maintenance from bending trim tabs to installing elastomeric wedges that create the same tracking adjustments as bending trim tabs.

Proposed Savings:

- Eliminates Trim tab failure mode
- Reduces Rotor Track and Balance (RTB) time by 2:1
- Estimated Annual savings of \$2,000,000

Input Module – Adapting proactive maintenance to prevent secondary damage.

Status Quo

A failure mode identified within the drive system is causing vibrations to be transferred back into the engines and causing accelerated wear and premature removal of the engine.

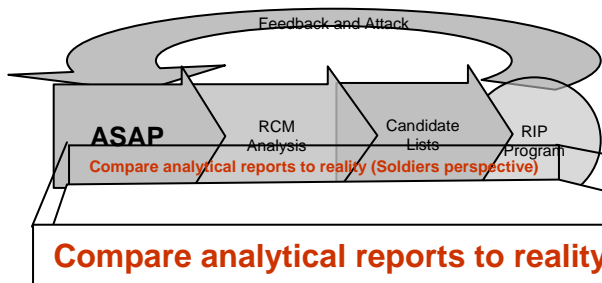


Proposed RCM Improvement

Active monitoring of the input module and parametric data from the engines are able to identify this phenomenon, and allows the input module to be replaced before engine damage occurs

Proposed Savings:

- Reduce Engine removals by 1.5%
- Reduces Rotor Track and Balance (RTB) time by 2:1
- Estimated Annual savings of \$2,261,056



Provides insight into current challenges and solutions and offers user feedback on program effectiveness.

Field Partnership

- Veteran presence on staff ensures field perspective and experience is an integral part of business cycle
- Unit site visits
 - Provides real time feedback on projects
 - Matches quantitative and qualitative data
 - Unfiltered input
- Engineer on the Flight Line
 - Embed engineers in field units
 - Provides hands on experience in aircraft maintenance



Industry Partnership

- Performance Racing Industry
 - Isotropic Super Finishing of drive train
 - Sacrificial Windshield Laminates
 - Collaboration with NASCAR
- Smart bolts
- Diamond Coating of TADS/PNVS Window
- Rub-N-Repair Kits
- Composite repair kits
- Columbia Helicopters



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