

Implementation of Inaccessible Corrosion Sensors on Military Aircraft

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OSD Project

Background

- Battelle Corrosion Sensors Flying on Military Aircraft Since 2003 (>1500 at present)
 - All In Accessible Locations; e.g. MLG
 - Multiple Short Term Objectives Including CPC; Wash Interval Evaluations; rebasing effects; sheltering; paint evaluations
 - Begin to put “hard” metrics on cause and effects
- New OSD Program Started CY2008 To Evaluate Use In Hard-To-Access Areas
 - C5, C130, H60, F16 Aircraft

Implementation

- Implementation Plan -- General
 - Nothing Totally New
 - Same Sensor For Inaccessible Locations
 - Cable Run From Sensor To Accessible Locations
 - Evaluate Any Implementation/Procedural Problems



C5 Application

Implementation Studies

Implementation C5

- Implementation Plan – C5 Specific
 - Bases (as of 2/08)
 - WPAFB/Westover (68-0222)
 - Martinsburg (69-0013)
 - Stewart
 - Locations on Aircraft
 - Vertical Stab By ELT
 - FWD MLG Pod
 - Top Hayloft At FS 2101
 - Above CWB
 - Crown Skin Below ADF; FS 1774
 - Hayloft Skin Above HF Antenna
 - FS1844 Below Overhead Trim
 - Flight Station Crown Skin
 - Bilge Below Crew Latrine Service Pan

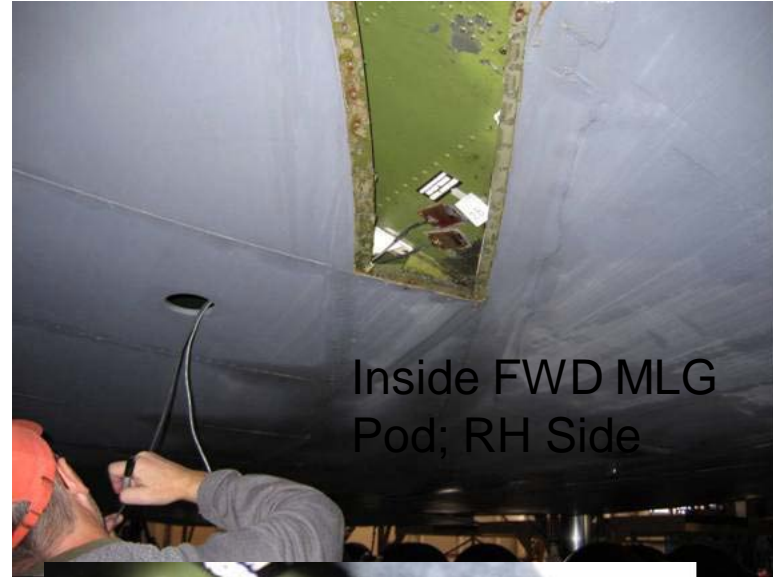
Implementation C5

- Implementation Plan – C5 Specific
 - Sensor Condition
 - 2 Sensors Each Location
 - 1 Bare Metal; 1 Treated With CPC (CB35)
 - Install At ISO; Read Periodically/Anytime
 - Data
 - Tentative 3 month readings Starting Feb 2008
 - Read New Sensors; Read Old (2005) Sensors Still Flying With and Without CPCs (no reapplication) From Earlier LM Program

Examples 69-0013



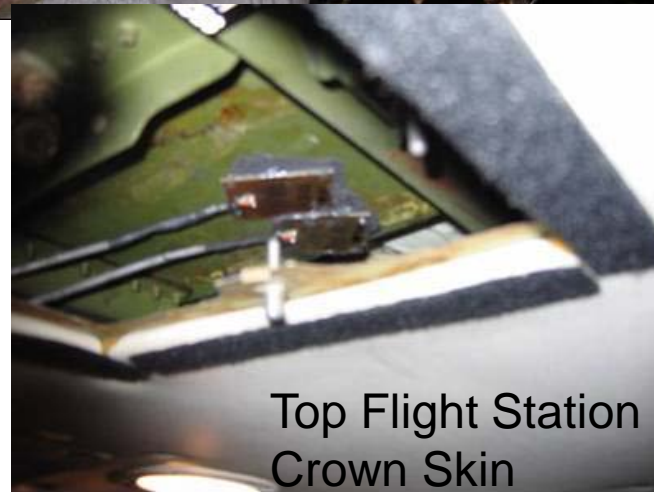
Vertical Stab by ELT



Inside FWD MLG Pod; RH Side



Hayloft Skin By HF



Top Flight Station Crown Skin

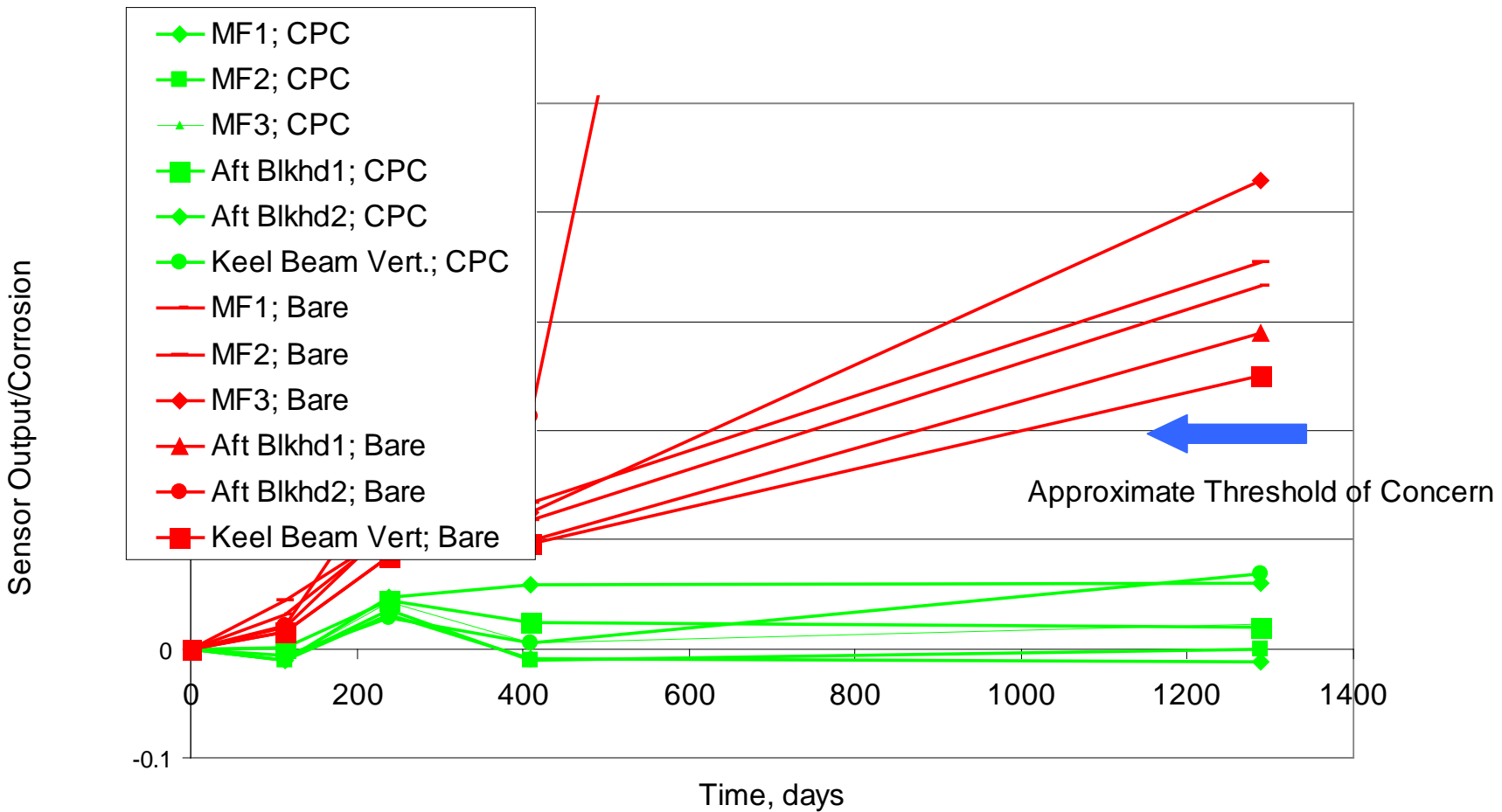
Data

- Limited Data From New C5 Installs (Just starting)
 - 90013 Just Measured WPAFB @ 4 months
 - Large/unexpected “hit” @ Top of T Tail By ELT (Bare sensor only)
 - Skin Corrosion and Paint Loss Evident Visually
- Data Available From 2005 Installs
 - Accessible Sensors
 - With and Without CPCs
- Data Available From F16D Inaccessible Installs (flying since 2003)
- No Data Yet On C130 or H60

Sensor Kinetics and CPC Benefits On Accessible Sensors

From 2005 Installs; C5 690027

Red= Bare; Green= CB35



C130 Application

Implementation Studies

Implementation C130 Specific

- 1 Bare Sensor Each Location
- 3 Aircraft; Savannah ANG; 4th planned
- Locations
 - Left Horizontal Stab
 - Right Horizontal Stab
 - Rear Cargo Ramp; Center Fuselage
 - Left Wing to Fuselage Fairing
 - Under floorboards; 2 locations

C130 Examples



H60 Application

Implementation Studies

H60 Implementation

- Areas of Interest
- First Installations
 - Patrick; Feb 2009; Phase
 - Under Floorboards (2); Tail Boom (1); Fwd Avionics (2)
 - Probably Fogged With CX
- Planned Installations
 - Phase; E City & CCAD
 - Possible Other Bases CONUS and OCONUS @ Phase
 - Timing Critical To Coordinate With Floorboard and INU Removal

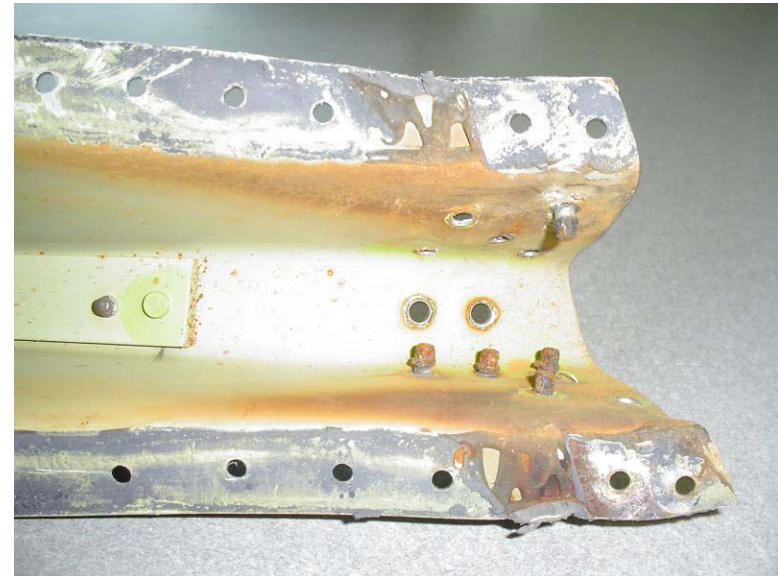
H60 Examples ; Patrick



F16 Application

Corrosion Under Rear Seat Of D's

Corrosion Examples A/C 382; Under Rear Seat

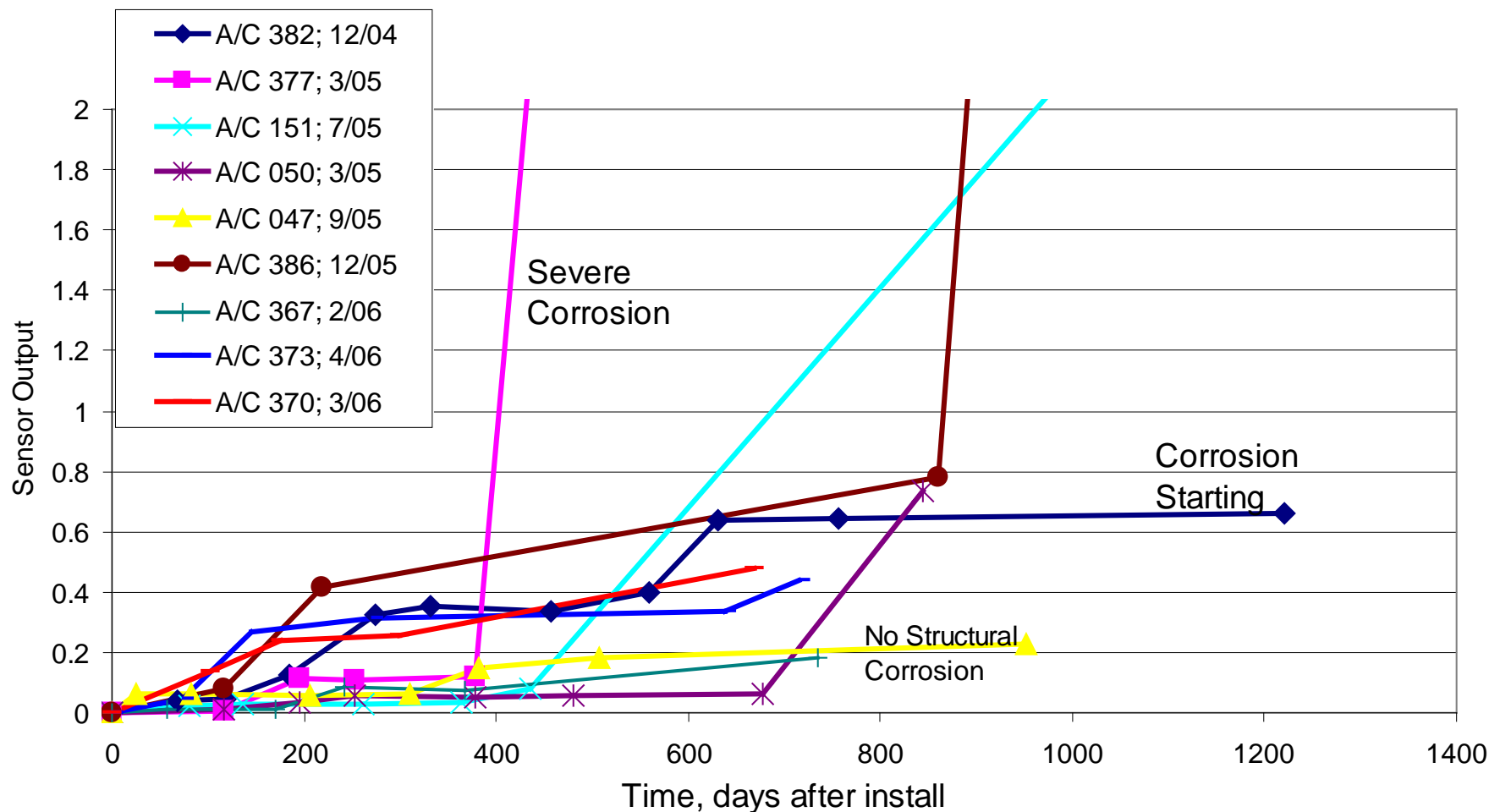


Results From F16D Sensors Under Rear Seat

- Serious Long Term Corrosion/Safety of Flight Problem
- Source(s) of Problem and “Fix” Uncertain
 - ECS Malfunction ?
 - Other Water Intrusion
 - Microbial ?
 - Wet Insulation (Similar to C5 Chain Box ?)
 - **Unpredictable By T/N**
 - **Possibly >25% of D’s**
- Sensors Being Used For
 - Early Warning
 - Inspection Tool
 - Targeted Seat Removal
 - Hard Metrics For Possible Mitigation
 - Insulation Removal
 - CPC Use
 - Springfield, Lackland, Homestead, McEntire, Edwards



Typical Sensor Output Data By T/N; F16 D; WAAR



Conclusions

- Feasibility of accessible and inaccessible sensor installations demonstrated on operational aircraft
- Sensor usefulness as early warning device demonstrated (short term)
- Effectiveness of CPCs demonstrated (>5:1) corrosive severity attenuation; life > 2-3 years
- Need Still Exists to Relate Readings To Actual Effects On Structure and Time Effects
- Sensors should be considered for long term CBM use