



Demonstration/Validation of High Performance Corrosion Preventive Compound For Interior Aircraft Applications

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What is it?



Problem

Existing CPC products require reapplication every 6 - 9 months, which results in an increase in the cost due to air pollution, maintenance, labor, down time, and the number of inspections.



Objectives



- **Demonstrate/validate a newly developed high performance corrosion preventive compound (Navguard) on fleet aircraft and weapon systems.**
- **Demonstrate long-term protection to reduce environmental pollution caused by HAPs and VOCs and corrosion maintenance.**



Why are we doing it?



- **Reduce environmental pollution caused by HAPs (Hazardous Air Pollutants) and VOCs (Volatile Organic Compounds)**
- **Improve the fleet readiness through the following:**
 - **Extend maintenance inspection intervals**
 - **Reduce the number of CPC applications**
- **Reduce waste and disposal costs**



Regulatory Impact to the Navy

<u>Requirements</u>	<u>Priority</u>	<u>Requirement Title</u>
2.I.01.q	High	Control of VOC and HAP Emissions
3.II.03.a	High	Non-VOC/ODS Solvents and Cleaning Systems for Aircraft/Weapon systems
2.1.01.g	High	Control/Reduce Emissions from Cleaning, Stripping, and Cleaning Operations.



Deliverables



- **New high-performance, long-lasting (two years) CPC product (Navguard) for internal airframe applications**
- **Complete field test evaluation on several Army, Navy, and Marine Corps aircraft in various operational environments**
- **A new qualified product to MIL-PRF-81309 F specification for internal aircraft applications**
- **Recommend changes to aircraft Maintenance Manuals and Maintenance Requirement Cards (MRC)**
- **Final report**



Who is Involved?

- **Testing Sites**

- NAVAIR, PAX River, MD
- FRC, Cherry Point, NC (H-46)
- FRC, North Island, CA (F-18)
- NAS, Oceana, VA (F-18)
- NAS, Whidbey Island, WA (EA-6B)
- US Marine, Camp Pendleton, CA (EFV)
- Army Aviation, Ft. Rucker, AL (H-60)

- **Funding Agents**

- ESTCP , OSD Corrosion IPT, AERMIP (Aircraft Reliability and Maintainability Improvement Program)



Properties of Navguard Product

- **Foggable (by aerosolizing nozzle)**
- **Low VOC content**
- **Compatible with metal and non-metallic components**
- **Water displacing agent**
- **Corrosion inhibition of aluminum and steel alloys**
- **Reapplication does not add significant weight to aircraft**
- **Exhibits significant improvement upon corrosion inspections**



CPC Formulation



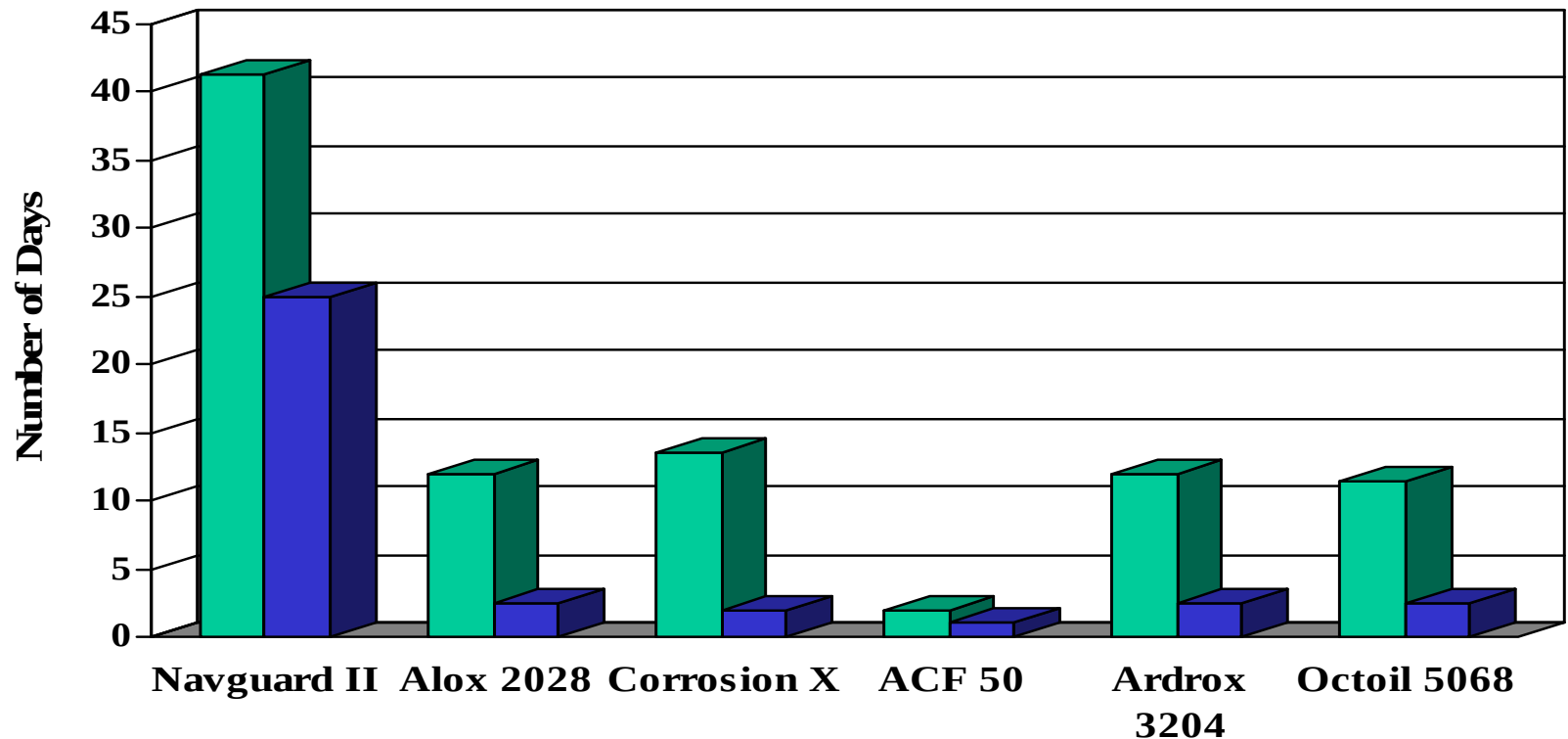
Navguard Formulation

(Patent Pending, Navy Case 95904)

- ▶ Corrosion Inhibitors
- ▶ Oil (Paraffinic or Naphthenic)
- ▶ Solvents
- ▶ Water Displacing Agent
- ▶ Metal Deactivator Agent
- ▶ Antioxidant



Neutral Salt Spray Test Results for Navguard compared to Commercial CPC Products



New CPC Formulations and Control

■ Aluminum ■ Steel



Navguard Type II and Type III (Armick Chemical)





Field Test for Navguard on Expeditionary Fighting Vehicle (EFV), Camp Pendleton, CA





Expeditionary Fighting Vehicle (EFV-E4), Camp Pendleton, CA (U.S. Marine – General Dynamics)





E-7 Port For EFV Without Parker Seal and Cover

NAV  AIR





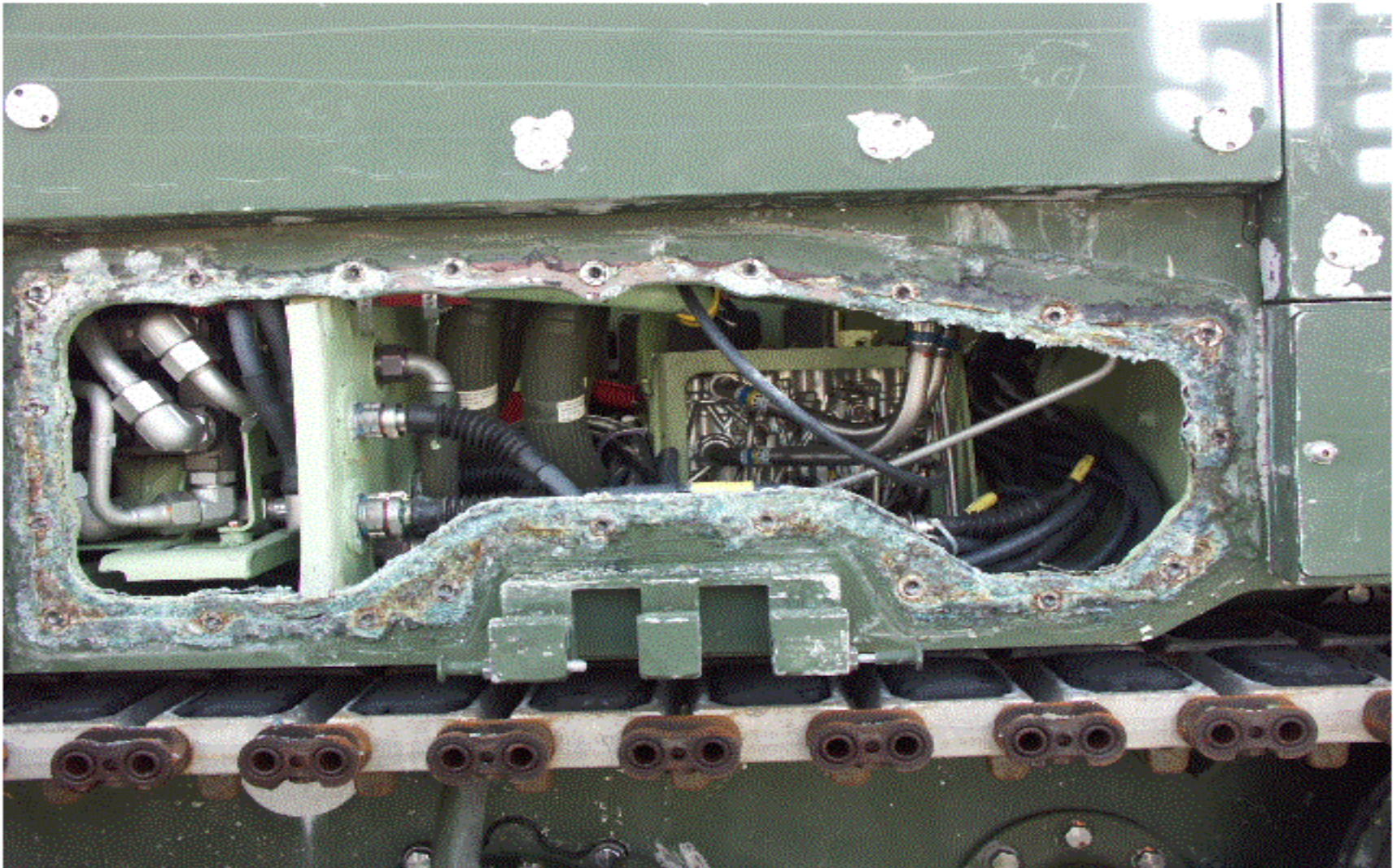
New Parker Seal with Navguard Installed in EFV





Corroded Port Panel Frame with Defected Seal, EFV E-7

NAV  AIR





Panel Frame After Six Months With and Without Navguard CPC, EFV E-7



Without Navguard



With Navguard





Field Test for Navguard on F-18/B, NAS Oceana, Norfolk, VA

NAV  AIR





Door #3, Field Test on F-18/B Aircraft (Twenty-Four Months Exposure)





Navguard Application on F-18/B Compartment After Twenty-Four Months



After 24 Months



Initial Application





Summary of the Dem/Val of Navguard CPC on Different Platforms



Location	# Aircraft	Type of Aircraft	Schedule
FRC, North Island, CA	5	F-18	Started June 2007
NAS Oceana, VA	12	F- 18	Started May 2007
FRC, Cherry Point, NC	4	H-46	Started January 2007
NAS Whidbey Island, WA	5	EA-6B	Started May 2007
AMCOM, Red Stone, AL	1	H-60	Started September 2007
US Marine Corps, Camp Pendleton, CA	8 Units	EFV	Started November 2006



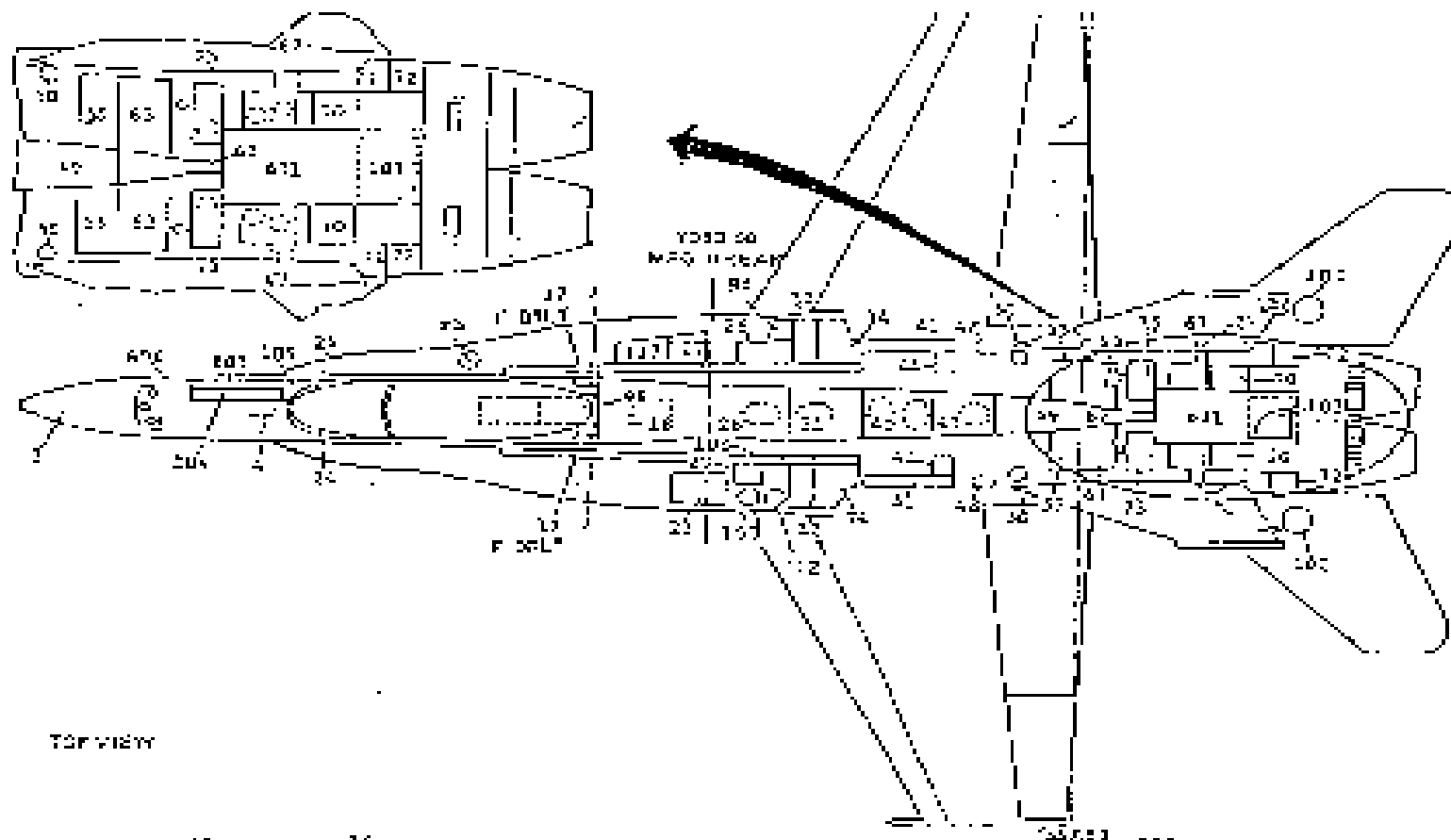
Demonstration Design



All Panels/Compartments will be the same per TMS	Aircraft #1 TMS BUNO	Aircraft #2 TMS BUNO	Aircraft #3 TMS BUNO
General Access Panel #1 Panel ID TBD	Control 81309 Type II	NAVGUARD Type III	NAVGUARD Type II
General Access Panel #2 Panel ID TBD	NAVGUARD Type II	Control 81309 Type II	NAVGUARD Type III
General Access Panel #3 Panel ID TBD	NAVGUARD Type III	NAVGUARD Type II	Control 81309 Type II
Avionics Compartment #1 Panel ID TBD	Control 81309 Type III	NAVGUARD Type III	Control 81309 Type III
Avionics Compartment #2 Panel ID TBD	NAVGUARD Type III	Control 81309 Type III	NAVGUARD Type III



Application of Navguard on F-18 Platform, NI, CA





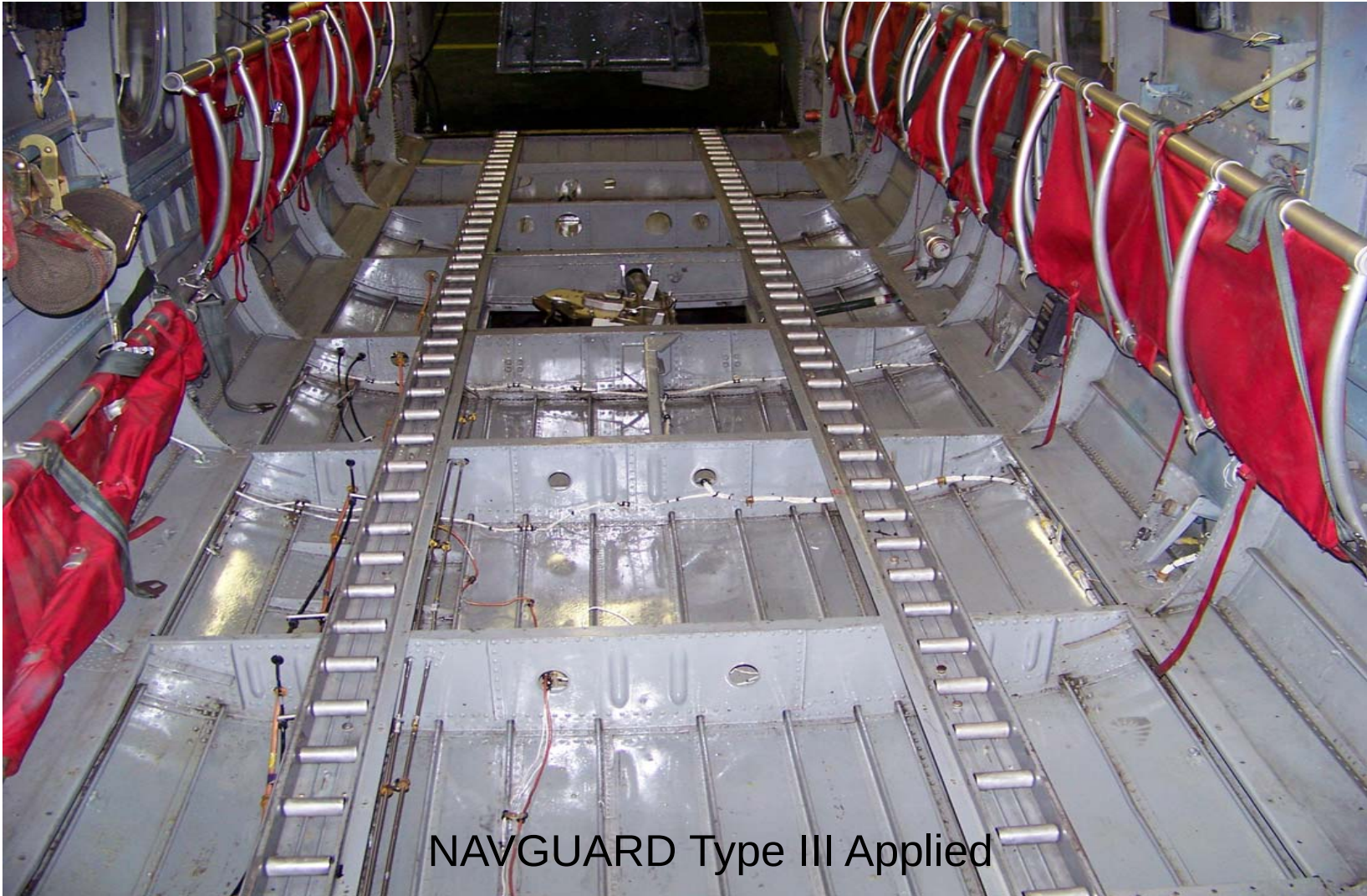
Application of Navguard CPC on H-46, FRC, Cherry Point, NC, January, 2007



H-46



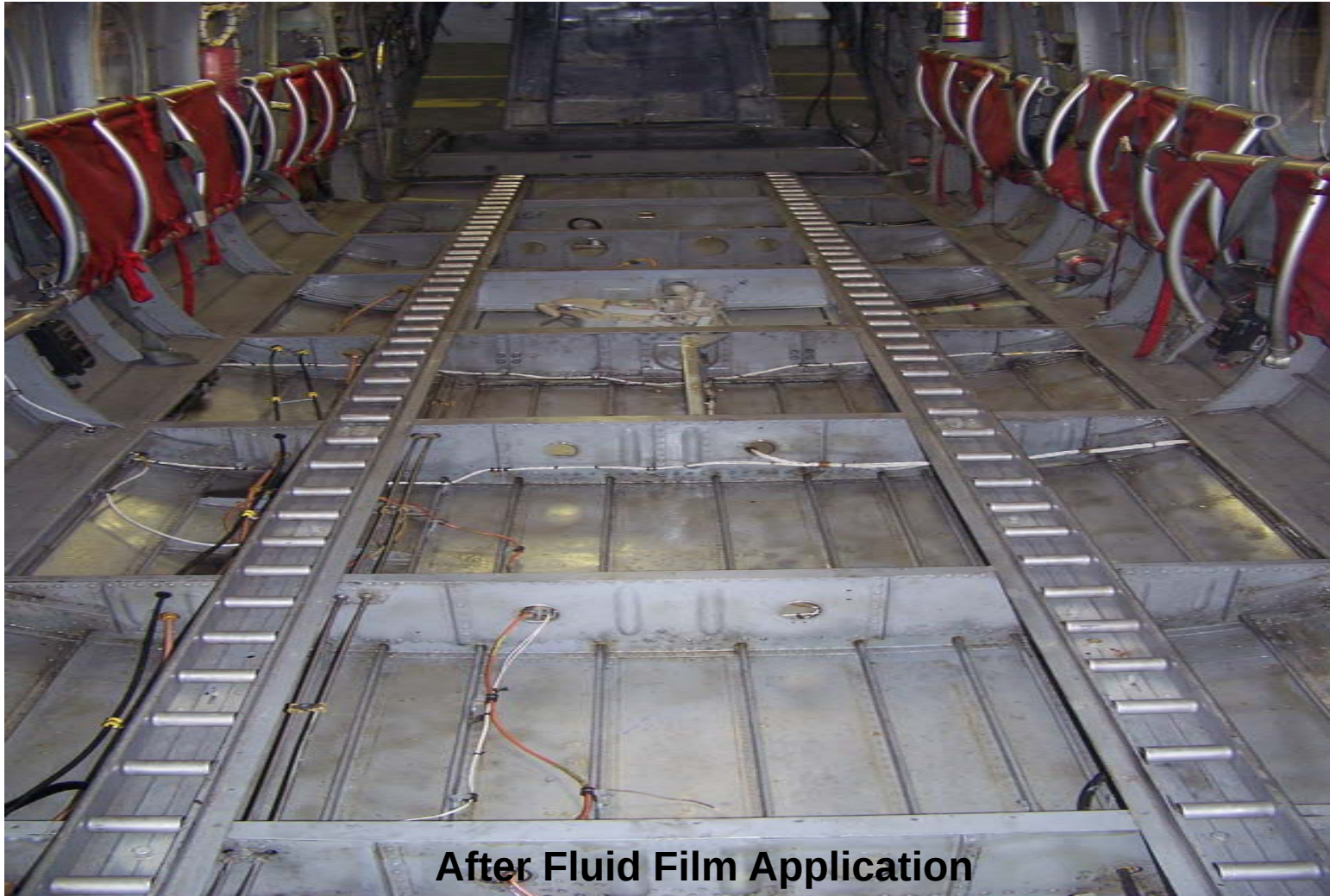
Navguard Type III Applied on the Bilge Areas, H-46, FRC, Cherry Point, NC



NAVGUARD Type III Applied



Fluid Film (Control) Applied as Control on H-46, FRC, Cherry Point, NC



After Fluid Film Application



Navguard CPC with Mildew Inhibitor Additives

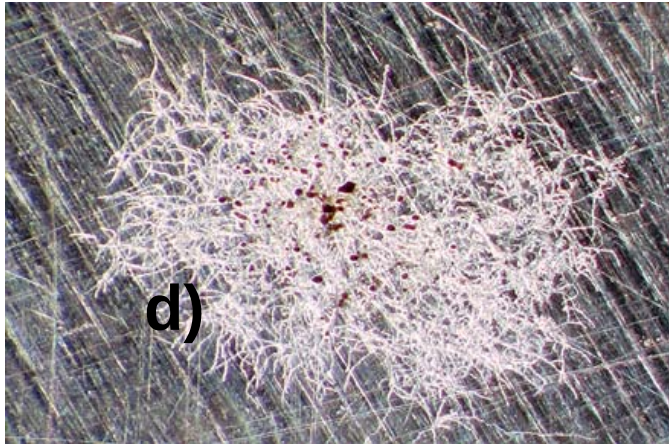


A Laboratory Evaluation of Corrosion Preventive Compounds and Mildew Inhibitors in the Presence of Fungi

Richard I. Ray and Brenda J. Little
Naval Research Laboratory
Stennis Space Center, MS 39529



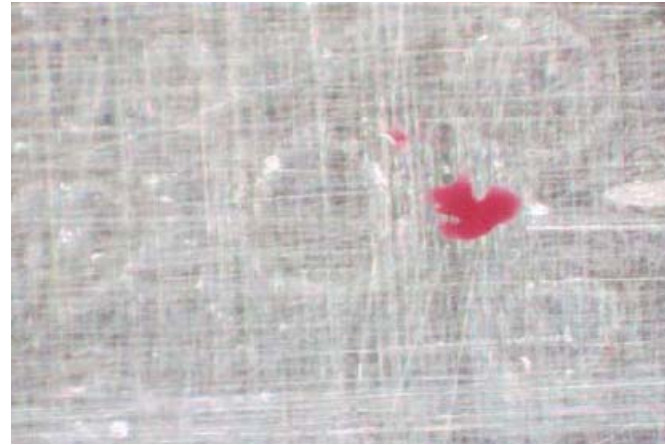
Navguard CPC with Mildew Inhibitor Additives



**AI Panel/hydraulic Fluid
Only/Fungi**

50X

(35 Days)



**AI Panel/Navguard with
Mildew Inhibitor/Fungi**

50X

(100 Days)

[illegible]



Transition Plan

- **Stakeholders approval of the new technology**
- **Evaluate the scaled-up product (Navguard) to MIL-PRF-81309F Specification requirements to be included in the QPL**
- **Dem/Val of the new technology on different platforms at several testing sites**
- **Assign a National Stock Number (NSN) to be listed with the DLA**
- **Issue NAVAIR (AF/AMCOM/ other) authorization letter to implement changes to the Cleaning and Corrosion Control Manual (NAVAIR 01-1A-509) and other applicable documents**



Accomplishments



- 1- Licensing Navguard to Commercial Vendors**
- 2- Navguard Patent Application to US Patent Office**
- 3- Lead-the-fleet demonstrations for Navguard on F-18 and EFV**
- 4- Applying Navguard on Weapon systems (H-46, F-18, EA-6B, H-60, and EFV)**
- 5- Stakeholders Approval of Navguard for Dem/Val Plan**
- 6- Qualification of Navguard to MIL-PRF-81309F Specification**



Expected DoD Benefits

- 1. Corrosion preventive compound CPC with potentially 2 to 3 times greater corrosion resistance**
- 2. Reduce maintenance and corrosion repair cost**
- 3. Decrease aircraft and other weapon systems down time due to fewer scheduled maintenance and inspection**
- 4. Reduce environmental pollution caused by HAPs and VOCs**
- 5. Reduce waste and disposal costs**
- 6. Increase aircraft/vehicle availability**



Project Performers

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