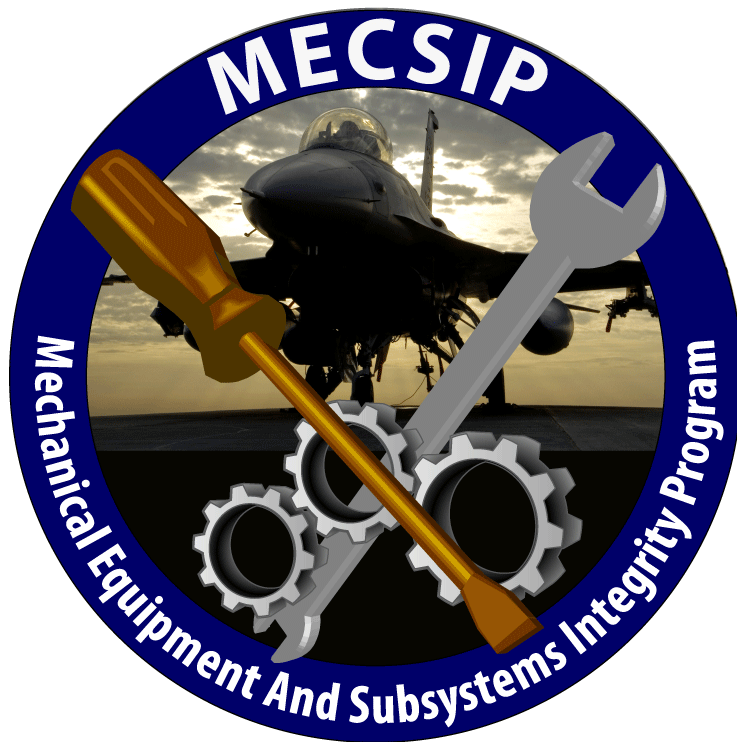


# AF Life Cycle Management Center

*Birthplace, Home & Future of Aerospace*



## **Mechanical Systems Integrity Program (MECSIP) Corrosion Overview**

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# MECSIP Direction



- **AFPD 63-1, Integrated Life Cycle Management; “The Air Force shall apply integrity programs to weapon systems.”**
- **Required by AFI 63-101/20-101, Integrated Life Cycle Management, Chg 2, 23 Feb 15**
  - “For all new or modified systems, the PM shall plan and implement effective integrity programs.”
  - PMs shall establish Aircraft Structural Integrity Program, MIL-STD-1530
  - PMs shall integrate development, documentation, and implementation of other integrity efforts applicable to systems by applying and tailoring:
    - MIL-STD-3024, Propulsion System Integrity Program
    - MIL-STD-1798, Mechanical Equipment and Subsystem Integrity Program
    - MIL-STD-1796, Avionics Integrity Program
    - MIL-HDBK-513, Low Observable Integrity Program
    - MIL-HDBK-515, Weapon System Integrity Guide
    - MIL-HDBK-525, Electrical Wiring Interconnect System Integrity Program
    - MIL-HDBK-1783, Engine Structural Integrity Program

# MECSIP Tasks

## TASK I

PRELIMINARY  
PLANNING

## TASK II

DESIGN  
INFORMATION

## TASK III

DESIGN  
ANALYSIS &  
DEVELOPMENT  
TESTS

## TASK IV

COMPONENT  
DEVELOPMENT  
& SYSTEMS  
FUNCTIONAL  
TESTS

## TASK V

FORCE  
MANAGEMENT

- Understand the environment/use
- Classify parts and design to prevent failure of safety-critical parts
  - Damage Tolerance approach
  - Risk based approach
- Perform appropriate analysis and tests to qualify system



### Component Classification:

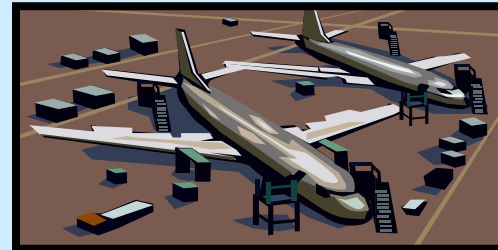
- Safety Critical
- Mission Critical
- Durability Critical
- Durability Non-Critical
- Other/Expendable

### Monitoring of Repairs/Overhaul



Reliability  
Analysis  
Team (RAT)

### Preventative Maintenance



Reliability  
Centered  
MX  
(RCM)

# What is MECSIP?

## Applicability (WUC Titles):

- 12 Cockpit and Fuselage
- 13 Landing Gear
- 14 Flight Control
- 15 Helicopter Rotor System
- 16 Escape Capsule
- 17 Aerial Recover System
- 18 Vertical Or Short Takeoff and Landing Power and Control Transmission System
- 24 Auxiliary Power Plant
- 39 Ice and Rain Protection
- 41 Air Conditioning, Pressurization, and Surface Ice Control
- 42 Electrical Power Supply
- 43 Electrical Multiplex
- 44 Lighting System
- 45 Hydraulic and Pneumatic Power Supply
- 46 Fuel System
- 47 Oxygen System
- 48 Indicating/Recording
- 49 Miscellaneous Utilities
- 91 Emergency Equipment
- 96 Personnel and Miscellaneous Equipment
- 97 Explosive Devices and Components
- MIL-HDBK-525, Electrical Wiring Interconnect System (EWIS) Integrity Program



# MECSIP Summary



- **MECSIP is an ongoing program based on MIL-STD-1798 requiring dedicated manpower throughout the entire system lifecycle**
- **Simplistically, MECSIP can be reduced to the following**
  - Understanding of the validated capabilities of each mechanical system and component relative to the design service life, failure modes, safety of flight/mission criticality, usage, and environments
  - Monitoring of each mechanical system/component performance during sustainment and the implementation of corrective action when appropriate
  - Implementation of a Preventative Maintenance Program, particularly for safety critical items (RCM/MSG-3)
- **Essentially all other tasks/subtasks support these three elements**



# MIL-STD-1798C

## Corrosion Guidance



### 5.2.1 Corrosion prevention and control.

The contractor shall define the approach to the development, evaluation, and incorporation of corrosion-resistant materials, protective treatments, finishes, etc. The selection of materials, finishes, and protection schemes shall consider the service-life requirements, environmental impacts, and sustainment costs. Effects of corrosion on the mechanical and electrical properties of the materials shall be established, as well as the suitability of dissimilar materials not to induce damage (galvanic effects). The plan to accomplish these tasks shall be incorporated in the MECSIP Master Plan. Implementation of this plan shall be in accordance with the Product Integrity Control Plan (reference 5.2.9). A MECSIP representative shall be included as a member of the Corrosion Prevention Advisory Board (CPAB). The Corrosion Prevention Control Plan (published by the CPAB) shall include MECSIP equipment.

### Other paragraphs with corrosion guidance throughout the MIL-STD

- 5.2.12 Design Criteria. ...Criteria shall be established to ensure that safety critical components can safety withstand...corrosion, ...
- 5.2.16 Product Integrity Control Plan. ...Specialized controls may be required for ...corrosion prevention...
- 5.2.18 Update the MECSIP Master Plan ...The Corrosion Prevention & Control Plan...
- ...



# 2017 MECSIP Review Corrosion Findings



- Corrosion addressed directly in annual evaluation criteria
- MECSIP Process Tab (organic MECSIP programs only)

MIL-STD-1798C Reference	MECSIP Process Element	Criteria for Metric	Grading Scale Complete: 85+% Partial: 50+% Not Complete: <50%
5.2.1 (Also See 3.8, 3.13, 3.34, 5.2.12, 5.2.16, 5.2.18, 5.3.2.2, 5.3.2.4, 5.3.3.1, 5.5.2.15, 5.5.3.2.5.2, 5.5.3.6.3, 5.5.3.10.4, 5.5.3.11.1, 5.5.5.1.3.1, Table A-II)	9 Corrosion prevention and control is part of the MECSIP execution	1. Corrosion prevention and control requirements are included in the MECSIP master plan. 2. Included corrosion prevention and control requirements include all applicable paragraphs from MIL-STD-1798C (8 August 2013).	G = Both criteria Y = 1 of 2 criteria or Partial on both criteria R = 0 of 2 criteria

## • Corrosion Tab:

MDS	A/C Qty	IOC Year	# of A/C based or deployed in a severe environment in 2014	For A/C in Column D, what was the average # of days spent in the severe environment	Has a Corrosion Prevention Advisory Board (CPAB) been established?	If a CPAB has been established, is a MECSIP representative a member?	Has a Corrosion Prevention and Control Plan (CPCP) been written?	If a CPCP exists, does it include MECSIP equipment?	If a CPCP exists, is it being executed as written?	Have Corrosion Assessments (CA) been performed?	What is the name and phone # of your corrosion manager and MECSIP CPAB representative?	What are the major Standards & Specs related to CPC that the Program adheres to?
EXAMPLE BELOW												
	60	YYYY	10	90	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Name, Phone Number Name, Phone Number	MIL-HDBK-1568 LM Spec ?



# 2017 MECSIP Review Corrosion Findings



- **2017 MECSIP Reviews with program offices did not identify any common corrosion related high drivers**
  - Exception is landing gear – common across many, primarily ASIP
  - B-1, B-2, & C-130 identified issues with leaky toilets
  - Other components (not common across platforms) – pressurized air starting system, leading edge actuators, external antennae, LOX warming coil, ECS ducts, and magnesium flight control components
- **Program offices frequently lack insight into what drove failures and what findings were made during overhaul**
  - Common belief is corrosion occurs, but isn't driving failures
- **Other findings**
  - CP&C in MECSIP Master Plan





# 2017 MECSIP Review Corrosion Findings (continued)



- **CP&C in MECSIP Master Plans**

- Fully incorporated - 13 of 23
- CP&C not in MECSIP Master Plan, but intent met - 9 of 23

<b>Yes</b>	<b>7</b>
<b>Partial – in MMP, MMP needs updated</b>	<b>6</b>
<b>Partial – Not in MMP, meets intent</b>	<b>9</b>
<b>No</b>	<b>1</b>
<b>N/A (Not asked - CDA or Developmental)</b>	<b>22</b>

- **CPAB, CPCP, and Corrosion Assessments**

- CPAB 27 of 37 programs, MECSIP included in CPAB 60%
- CPCP 27 of 28 programs, MECSIP included in CPCP 41%
- Corrosion Assessments 25 of 31, Unclear MECSIP %

	<b>Yes</b>	<b>No</b>	<b>No response</b>
<b>CPAB Established</b>	<b>27</b>	<b>10</b>	<b>8</b>
<b>CPAB incl/ MECSIP Member</b>	<b>16</b>	<b>14</b>	<b>15</b>
<b>CPCP Written</b>	<b>27</b>	<b>1</b>	<b>17</b>
<b>CPCP include MECSIP</b>	<b>11</b>	<b>7</b>	<b>27</b>
<b>CPCP Active/Executed as Written</b>	<b>18</b>	<b>5</b>	<b>22</b>
<b>Corrosion Assessments Performed</b>	<b>25</b>	<b>6</b>	<b>14</b>



# Corrosion Initiative



- **Established working group with AFLCMC/EZP and AFCPO – Feb 2017**
    - Goal: Identify if corrosion is an issue driving NMC for MECSIP components
    - Determine if qualification test modifications or other corrective actions are warranted
  - **Phase 1 - EZFA tasked 16 program offices to identify top 10 MECSIP high drivers (platform list) in terms of NMC time**
    - Assumption: If corrosion is a major contributor to NMC time, then it may be present AND causal in the top 10
  - **Phase 2 - Initiated on-site depot reviews @ OO-ALC, OK-ALC, and WR-ALC from 22-26 May on to gain insight/scope the issue**
    - Reviewed most common commodity parts identified
      - Hydraulic/Mechanical Power (pumps, actuators, valves, etc)
      - Landing Gear
      - Generators
- **General Findings to date: None of the parts on the list have corrosion as a driver for removal or condemnation**



# Summary



- **Corrosion remains a topic of emphasis in MECSIP annual reviews**
  - No common high drivers identified
  - Program offices frequently lack insight into what drove failures and what findings were made during overhaul
  - Common belief is corrosion occurs, but isn't driving failures
- **CP&C in MECSIP Master Plans (2017 Review)**
  - Fully incorporated - 13 of 23 programs
  - CP&C not in MECSIP Master Plan, but intent met - 9 of 23 programs
- **CPAB, CPCP, and Corrosion Assessments**
  - CPAB 27 of 37 programs, MECSIP included in CPAB 60%
  - CPCP 27 of 28 programs, MECSIP included in CPCP 41%
  - Corrosion Assessments 25 of 31, Unclear MECSIP %
- **MECSIP Corrosion Initiative Investigation ongoing**
  - General Findings to date: None of the parts on the list have corrosion as a driver for removal or condemnation