



# U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND AVIATION & MISSILE CENTER

An Overview of the Electrical Wiring Interconnect System (EWIS) and  
EWIS Data Analysis

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# AGENDA



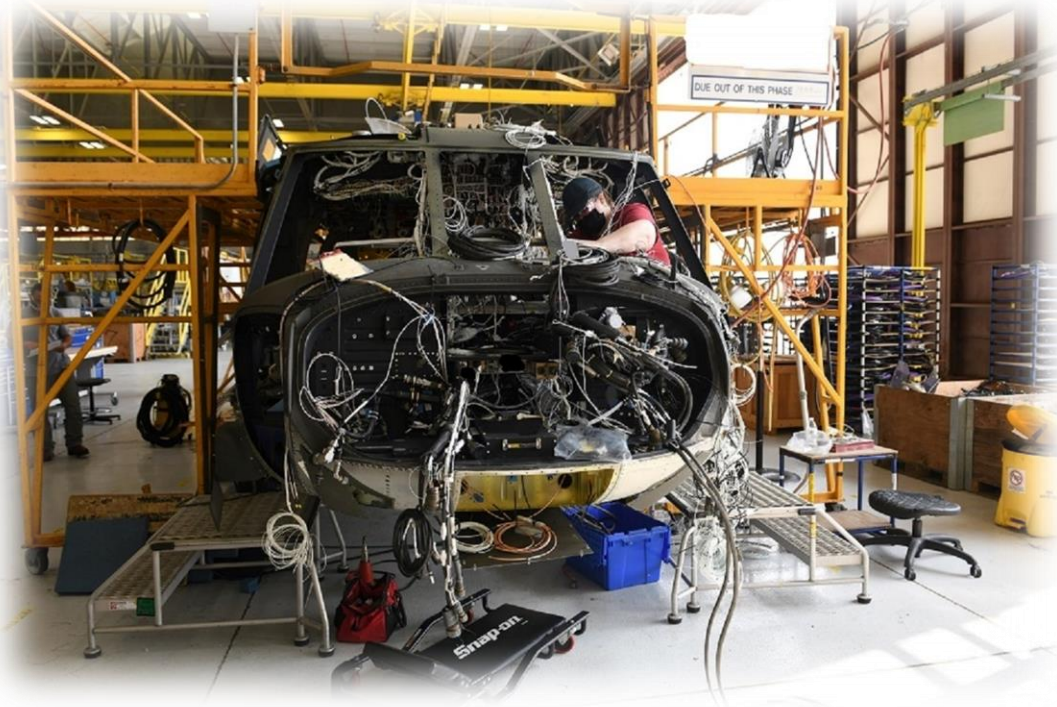
- What is EWIS
- EWIS History
- EWIS Standards
- Implementation of EWIS Integrity Program
- RAM Engineering
- Work Unit Codes
- Challenges of EWIS Data Analysis
- EWIS Improvement Efforts

# WHAT IS EWIS?



- *“Electrical Wiring Interconnect System: EWIS, also known as aircraft wiring, is defined as any wire, fiber optic link, wiring or fiber device, or a combination of these items (including terminations) installed in any area of the aircraft for the purpose of transmitting electrical energy, signals, or data between - two or more electrical end points.”*

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CHG 2 12Sept2023



# EWIS HISTORY



- FAA initiated programs to address EWIS integrity concerns in 1999 in response to high-profile aircraft accidents.
  - **TWA Flight 800**
    - July 17, 1996
    - Boeing 747-100 exploded 12 minutes after takeoff.
    - Probable cause from NTSB report explosion of fuel vapors in center fuel tank likely caused by a short circuit.
  - **Swiss Air Flight 111**
    - September 2, 1998
    - McDonnell Douglas MD-11
    - Crashed due to in-flight fire, arcing in the wiring system for the in-flight entertainment system was found to be a contributing factor.
- Aging Transport Systems Rulemaking Advisory Committee ATSRAC tasked to characterize commercial EWIS integrity and recommend actions for improvement.
  - Found evidence of aging wiring, material degradation, and inadequate installation and maintenance practices
- Enhanced Airworthiness for Airplane Systems (EAPAS), FAA AC25-27A, was developed to communicate strategies for improve aircraft safety.
  - Integrity of the EWIS system is emphasized in EAPAS.

# EWIS STANDARDS



- ***Common standard for installing, inspecting, and maintaining aircraft wiring throughout industry.***
  
- MIL-STD-1798D Mechanical Equipment and Subsystems Integrity Program
  - Standard established in 1988
  - Adapted from the highly successful Aircraft Structural Integrity Program (ASIP) first employed in the 1950's
  - Program reinstated in 2008 and has been continually updated.
  - Encompasses all aircraft mechanical systems and subsystems.
    - ***EWIS considered to be an aircraft system.***
  
- MIL-HDB-525 Electrical Wiring Interconnect System (EWIS) Integrity Program
  - Introduced in 2013
  - Based on lessons learned from FAA Advisory Circulars (AC's)
  - Provides framework to establish a successful EWIS integrity program using principles and processes developed by the FAA
  - Establishes seven core process tasks to implement EWIS integrity program.
  
- SAE AS50881 Wiring, Aerospace Vehicle
  - Established as an industry replacement for MIL-W-5088.
  - Covers all aspects of the EWIS system.
  
- TM 1-1500-323-24-1 Aircraft Electric and Electronic Wiring
  - Joint services manual with Navy and Air Force
    - NAVAIR 01-1A-505-1
    - TO 1-1A-14

# IMPLEMENTATION OF EWIS INTEGRITY PROGRAM



- How do we perform data analysis on components?
  - MIL-STD-1798D
    - Establishes tracking components by Work Unit Code (WUC) and using component WUC to;
      - Determine Mean Time Between Faults (MTBF)
      - Monitor failure trends
      - Identify ‘Bad Actors’
      - Monitor system aborts.
  
- How do we implement EWIS Program?
  - MIL-HDBK-525 Defines Implementation through Core Process Tasks
    - Task 1 – Overall EWIS Documentation
    - **Task 2 – Data Analysis**
    - Task 3 – Physical Aircraft Inspection
    - Task 4 – Component Assessment
    - Task 5 – Risk Assessment
    - Task 6 – Action Plan
    - Task 7 – Iterative EWIS Assessment



# RAM ENGINEERING & SYSTEM ASSESSMENT DIVISION: WHAT WE DO



## Aviation Systems

- Supports All PEO Aviation PMOs
- Aviation RAM Support
  - Analyses / Assessments
  - Models
  - Design for Reliability & Maintainability (R&M)
- Aviation System Assessment Program (ASAP) Analyses / Assessments
- Reliability Centered Maintenance (RCM)
- Reliability Improvement Projects (RIP)
- Foreign Military Sales (FMS) RAM Analyses

## Missile Systems

- All PEO M&S PMOs and MDA
- Materiel Release RAM Certification
- Missile and Ground Support Equipment RAM Support
- Stockpile Reliability Programs (Army & FMS)
- Sustainability Support for Missile Operations
- Missile Health Monitoring
- Supportability Analysis
- Logistics Assessments

## RAM Technology

- AvMC Energy Lab (AEL) and
- Reliability, Availability, Maintainability Analysis
- Failure Reporting and Corrective Action System (FRACAS)
- Science & Technology (S&T) Development & Support
- Data Driven Analytics/Machine Learning/Artificial Intelligence
- Policies and Procedures



**Improved Reliability, Availability, and Maintainability**

**Ensuring System Readiness**

# AVIATION SYSTEM ASSESSMENT PROGRAM (ASAP)



**RAM ASAP**  
Aviation System Assessment Program



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## WHAT IS ASAP?

- The Aviation System Assessment Program (ASAP) is a U.S. Government organically developed software tool used by the Reliability, Availability, and Maintainability (RAM) Aviation Branches to quickly analyze and display a host of reliability/maintainability metrics.
- The U.S. Army ASAP tool contains scored data for rotary wing platforms and was developed over 20 years with millions of records scored.
- Permissions/Access are vetted by the customer/platform PMO.

## WHAT DOES RAM ASAP DO?

- RAM ASAP is the recognized source for U.S. Army Aviation systems data, analysis, and interpretation throughout their life cycle.
- The ASAP RAM team scores a sample of each army aircraft platform's maintenance records (DA FORM 2408-13-1) and uploads data for analysis and presentation via the ASAP Tool.



# WORK UNIT CODES



- WUC's grouped by function at the two-digit level.
- All Army aircraft have the same functional group codes
- WUC's are used as 'buckets' for sorting data for Army Reliability and Maintainability Metrics
  - ASAP top drivers sorted by WUC
- All Army rotary wing aircraft have same basic WUC structure for similar systems.
  - IE 07A is same for H-60, CH-47, and AH-64 as primary hydraulic system.



## FUNCTIONAL GROUP CODE

- 02 AIRFRAME
- 03 LANDING GEAR
- 04 POWER PLANT
- 05 ROTOR SYSTEM
- 06 DRIVE TRAIN
- 07 HYDRAULICS / PNEUDRAULICS
- 08 INSTRUMENTS SYSTEMS
- 09 ELECTRICAL SYSTEMS
- 10 FUEL SYSTEMS
- 11 FLT CONTROLS (MECH)
- 12 UTILITIES SYSTEMS
- 13 ENVIRONMENTAL CONTROLS
- 14 HOISTS & WINCHES
- 15 APU (AUXILLARY POWER PLANT)
- 16 MISSION EQUIPMENT
- 17 EMERGENCY EQUIPMENT
- 19 AVIONICS (COMM/NAV/IFF)
- 30 ARMAMENT SUB SYSTEM
- 31 FIRE CONTROL SUB SYSTEM
- 32 HELLFIRE
- 33 TARGET ACQUISITION & DESIGNATION SYSTEM (TADS)
- 34 NIGHT VISION SIGHT (PNVS)
- 35 AREA WEAPONS SYSTEM
- 36 MILES INSTALLATION (OTHER WEAPONS)
- 37 FIRE CONTROL / RADAR (FCR/RFI)
- 38 SYMBOL GEN (DISP PROC)
- 39 IHADSS
- 52 AUTO PILOT (DAFCS)
- 76 ELECTRONIC COUNTER MEASURES (ECM)
- 80 SPECIAL TOOLS (ACTUATOR BLOCKS)
- 82 FLYAWAY ITEMS
- 83 GRD SUPPORT ITEMS



# SO HOW DO WE SCORE EWIS FAULTS?



# CHALLENGES OF EWIS DATA ANALYSIS



- EWIS is a system hidden within systems
  - Data analysis efforts effectively ‘hid’ EWIS faults by scoring them to the parent system
    - IE, Intercom System wiring issues would be scored to the Intercom System
    - This ultimately led to ‘Bad Actor’ systems with EWIS faults scored as failures against these systems because there was no other WUC to charge these faults against
  - Data fidelity from maintenance records
  
- Other DoD services have selected FG/WUC for EWIS
  - US Airforce selected WUC 35 or WUC 42 as required by airframe
  - US Navy and US Marine Corps selected WUC 42.
  - This implementation completed in 2019
  
- US Army unable to implement WUC 35 or 42 across all aircraft platforms
  
- In January 2024 WUC 59 selected as the US Army EWIS WUC for all US Army Aviation platforms.
  - Leaves the platforms the same at the functional group WUC level
  - Allows for comparative data analysis between aircraft platforms

# WHAT DOES A EWIS WUC ALLOW?



- Common functional group structure across Army aircraft
- All aircraft are built and maintained to the same EWIS standard.
  - Avionics and aircraft electrical repairers are assigned to repair all models of Army aircraft
- ***Data Analysis: We don't know what we don't know***
  - Allows for tracking maintenance trends across aircraft models related to EWIS faults
    - EWIS 'Bad Actors' to be identified
      - Accurate MTBF for EWIS failures
      - Implement EWIS failure mitigations
- MIL-HDBK-525 EWIS Integrity Program core process tasks implemented



# EWIS IMPROVEMENT EFFORTS



- Joint Services Wiring Action Group (JSWAG)/Joint Services Fiber Optics Working Group(JFOWG)
  - Established in 1984 as Naval Aerospace Vehicle Wiring Action Group
  - Became JSWAG in 2005, continuing to expand in participation with representatives from each branch of the Armed services
  - JFOWG established 2005
  - Made up of representatives from all Armed Services
  - 2024 JSWAG associated meeting will be held during the DoD Maintenance Symposium in Salt Lake City, Utah
  - *“The joint service forum provides advancement in safety, reliability, maintainability and readiness of all DoD aircraft by improving their Electrical Wire Interconnect Systems (EWIS)”*
  
- Automatic Detection and Determination of the Electrical Wiring Interconnected System (ADDEWIS)
  - Automatic Wire Test Set (AWTS) that tests the physical uniformity of the aircraft wiring
  - Detection of wiring anomalies prior to loss of function
  - Provides accurate condition assessment of EWIS
  - Validates circuit breaker condition
  - Reduces LRU replacements
  - Tracks aircraft wiring health over time
  - Limited fielding in 2023



# QUESTIONS?



# THANK YOU.



## Points of Contact

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