

SLIDES ONLY

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Weapon System Wiring and Product Support

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Air Force Photo by Staff Sgt. Todd Pouliot
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Purpose of Today's Session

- Identify **product support** considerations for effective long-term sustainment of weapon system wiring.



U.S. Army photo by Sgt. Daniel Schroeder

Product Support is the “package of support functions required to field and maintain the readiness and operational capability of covered systems, subsystems, and components, including all functions related to covered system readiness.” (10 U.S.C. 4324)

Outline

- Integrated Product Support Elements
- Wiring Requirements: PSM's Perspective
- Product Support Analysis
- Design Interface
- Parts Selection
- Logistics Test & Evaluation
- Technical Data
- Configuration Management
- Modifications
- Parting Thoughts

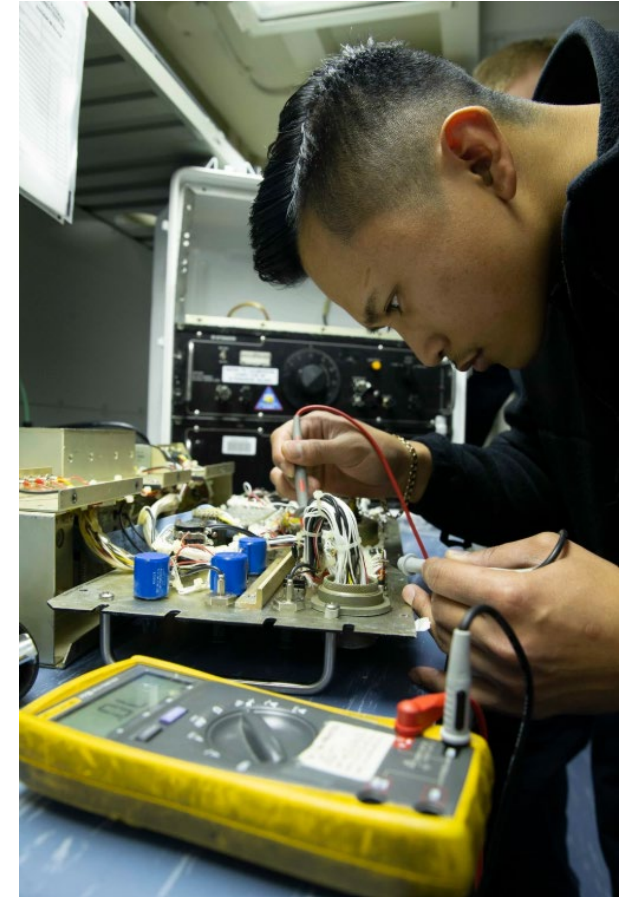
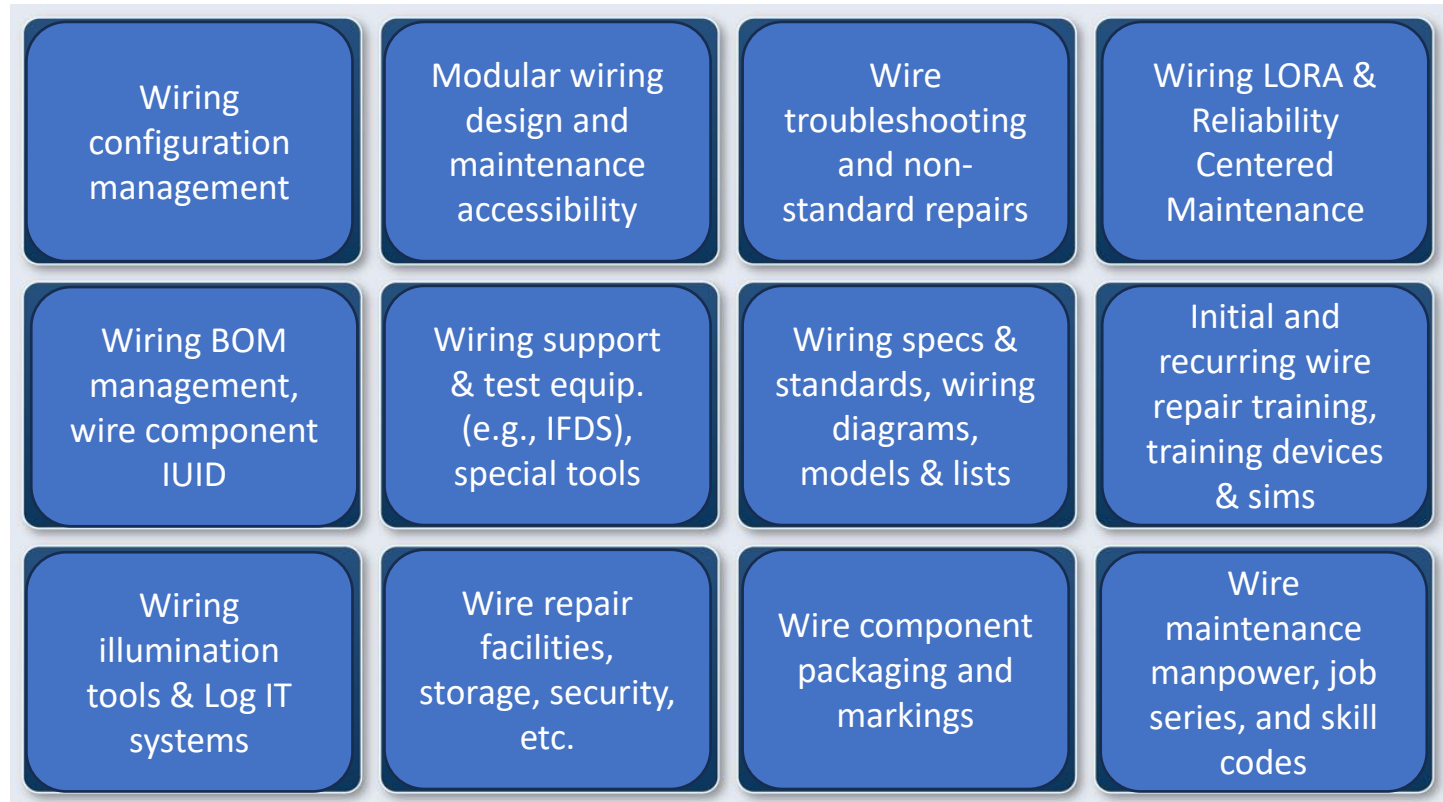


Photo by Seaman Apprentice Zachary Guth

Integrated Product Support (IPS) Elements

- The **IPS Elements** provide a structured and integrated framework for managing product support.
- The **Product Support Manager (PSM)** addresses the IPS Elements in the system's Product Support Strategy and continuously assessed throughout the life cycle.
- **Every element** applies to wiring!



Select “next” to reveal examples.

Wiring Requirements: PSM's Perspective

- Requirements *specific to* system wiring are generally NOT found in higher-level requirements documents unless related to a key performance parameter such as survivability (e.g., redundant wiring for critical subsystems)
- System requirements are generally expressed in:
 - Initial Capabilities Document (ICD)
 - Capability Development Document (CDD)
 - System Requirements Document (SRD)
 - System/Subsystem Specifications (S/SS)
 - Service-specified requirements document (e.g., for a Middle Tier program)
- More often, wiring requirements are ***derived from*** the above based on their contribution to system reliability, maintainability, availability ... as determined by Product Support Analysis

Product Support Analysis (PSA)

- PSA (a.k.a. Supportability Analysis), “the analysis required to create the product support package,” is:
 - Multidisciplinary (requires experts in engineering, product support, maintenance, etc.)
 - Iterative (updated as the design matures and when modified)
- PSA includes activities such as:
 - Failure Modes Effects & Criticality Analysis (FMECA)
 - Fault Tree Analysis (FTA)
 - Reliability Centered Maintenance (RCM) Analysis
 - Level of Repair Analysis (LORA)
 - Maintenance Task Analysis (MTA)
- PSA evaluates tradeoffs and alternatives

ANSWERS QUESTIONS SUCH AS:

- *Which wiring system components will fail?*
- *When/how will they fail?*
- *What is our repair strategy?*
- *Which activity (field/depot) should repair them?*
- *What is needed to make repairs?*

Design Interface

- Wiring SMEs should be involved in Systems Engineering Technical Reviews (SETRs)
 - System Functional Review
 - Preliminary Design Review
 - Critical Design Review
 - System Verification Review
 - Physical Configuration Audit
- SETRs are key opportunities to evaluate wiring maintainability and long-term sustainment by examining:
 - System models
 - Model-based Human Engineering Design Approach Document-Maintainer
 - Digital mockups or simulations
 - Early Prototypes
 - Test articles
 - Production/production-representative articles

Early in development, ~70% of Operating & Support (O&S) costs are “locked in” by the design.

By the start of production, ~90% of O&S costs are determined.

... SMEs play a critical role up front in the development phase!

Parts Selection

- Standard Parts (SD-19)
 - Emphasizes use of common parts to the maximum extent
 - Select parts that minimize the risk of long lead times, poor reliability, and sole sources
- Modular Open Systems Approach (MOSA)
 - Promotes use of common, non-proprietary interfaces

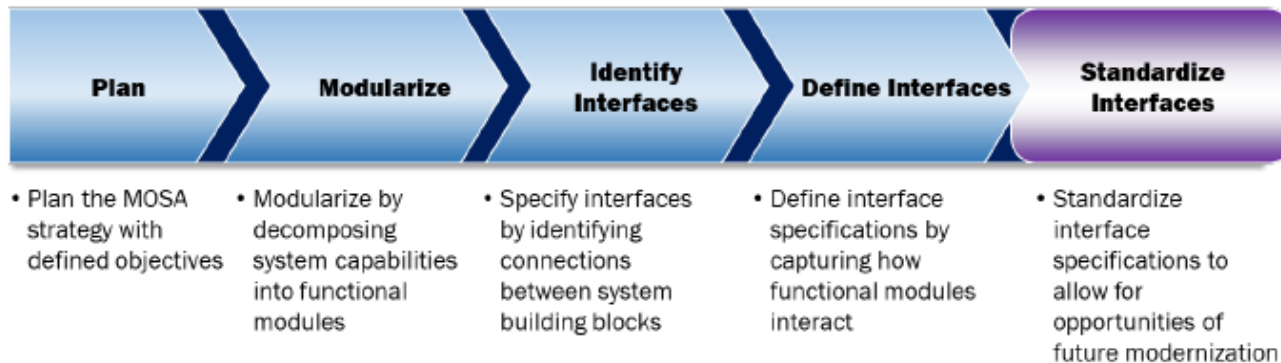
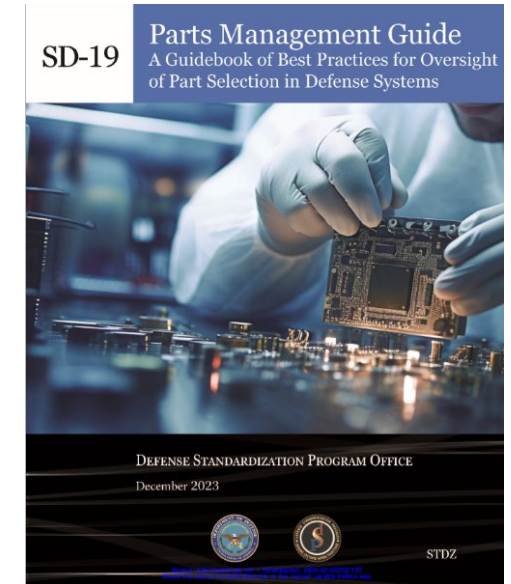


Figure 3-1. MOSA Planning Framework

Source: Implementing a Modular Open Systems Approach in Department of Defense Programs (Feb 2025)



Logistics Test & Evaluation (T&E)

- Wiring SMEs should participate in:
 - Verification activities (inspection, analysis, test, demonstration)
- Maintenance demonstration (M-demo)
 - Evaluating production or production-representative systems
 - Using maintenance manuals, support equipment, test equipment, and special tools that will be used by field maintenance



Photo by Staff Sgt. Nathanael Callon

Technical Data

- Contract deliverables should include all technical data needed to maintain wiring, including:
- Technical Data Package (TDP)
 - Models, drawings, lists, etc.
 - Managed in a Product Lifecycle Management (PLM) or equivalent capability
- Technical Manuals
 - e.g., S1000D Interactive Electronic Technical Manuals (IETMs), depot maintenance manuals, etc.
 - Wiring diagrams
- Model-Based Instructions (MBI)
 - Models and simulations to assist with troubleshooting

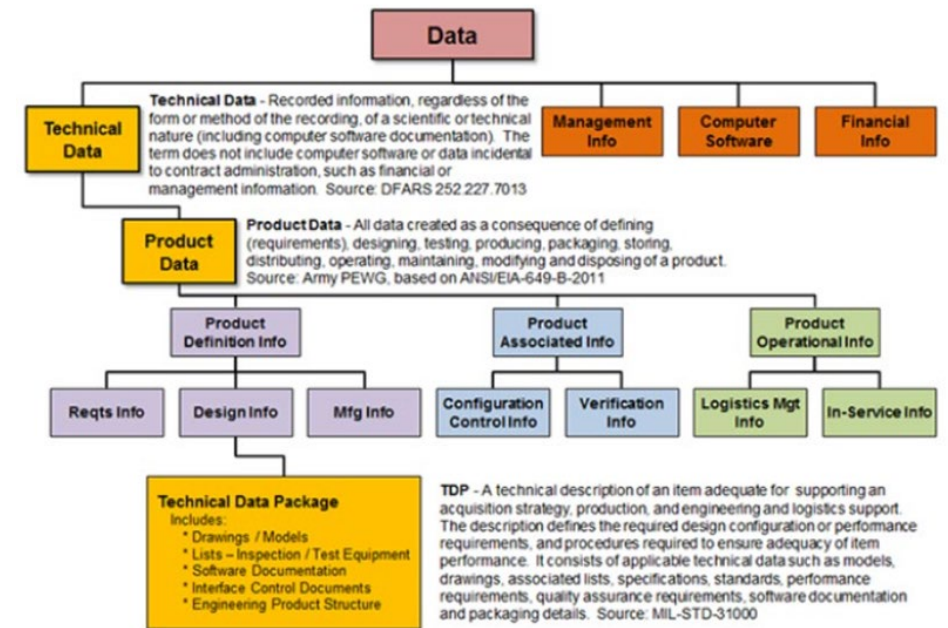


Figure 7-1 How data is organizationally structured.

Configuration Management (CM)

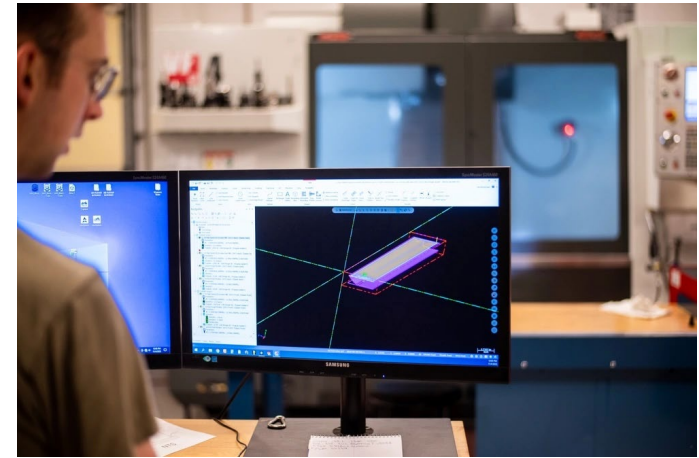
- Programs must maintain the “Authoritative Source of Truth” (ASoT) for wiring across the life cycle
 - Logistics Product Data
 - Technical Data Package
- CM activities
 - Baseline management (functional, allocated, product)
 - Configuration Control
 - Configuration Status Accounting
 - Auditing
- An effective CM program will prevent “technical surprises” during maintenance and modifications



Air Force Photo by Addie Peterson

Modifications

- When modifying systems, particularly if multiple entities are involved, it is critical to maintain the ASoT for wiring
 - Update authoritative system models and LPD
 - For multiple configurations, document Useable on Codes



Model-Based (Local) Manufacturing: F-15C tail cone stringer (USAF Photo by SSgt Sean Campbell)

Parting Thoughts

- Two imperatives will pay dividends for maximizing reliability, availability, and maintainability:
 - Invest in supportable wiring system design **up front** before life cycle costs are “locked in”
 - Maintain the ASoT **throughout the life cycle**
- Anticipated benefits include:
 - More accessible wiring
 - More sustainable wiring
 - Elimination of “technical surprise”



Q & A

Resources

- DAU Courses (<https://icatalog.dau.edu>)
 - LOG 0290, Condition Based Maintenance Plus (CBM+)
 - LOG 0300, Reliability Centered Maintenance (RCM)
 - LOG 0610, Digital Twins for Predictive Maintenance
 - LOG 0630, Introduction to Parts Management*
- Articles & Papers for further research
 - [*Aging Aircraft Wiring: A Proactive Management Methodology*](#), V. Tambouratzis, NPS thesis, June 2001.
 - [*Prognostics for Wiring: Managing the Health of Aging Wiring Systems*](#), G. Smith et al., AFRL, 1999.
 - [*Nondestructive Evaluation of Aircraft and Spacecraft Wiring*](#), J. White et al., Johns Hopkins, undated.

*This course will be revised in FY26.