Cybersecurity

S&MA Trilateral Meeting

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Topics

- Cybersecurity for Missions
- Policy and Requirements: NIST Cybersecurity Framework
- Communications: CCSDS Security Protocols
- Software: Common Weakness Enumerations

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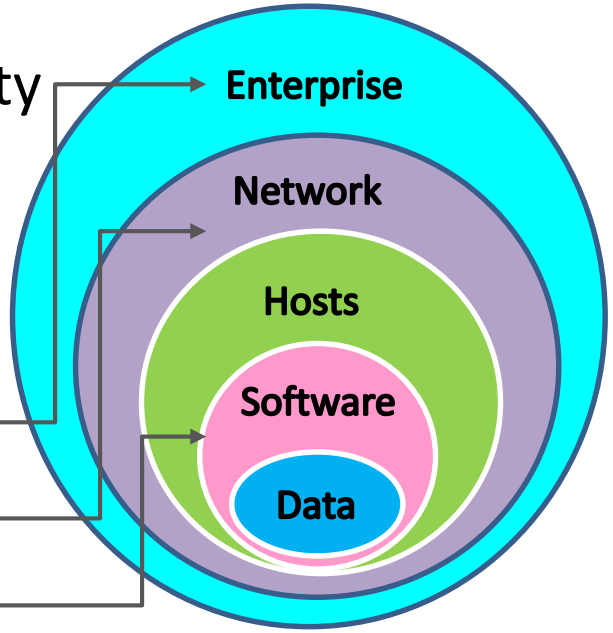
Cybersecurity for Missions

- Cybersecurity needs to address the end-to-end mission system
  - Meeting the cybersecurity challenge requires joint efforts across Project Management, Engineering, Development, V&V, S&MA, Operations & Maintenance, and CIO groups
- Mission cybersecurity assurance needs to leverage existing S&MA processes for safety and reliability
- There are multiple layers to be addressed for mission cybersecurity assurance
  - Agency Policy Layer
  - Communications Layer
  - Software Layer



Mission Systems cannot be safe or reliable if they are not secure

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NIST Cybersecurity Framework

- The National Institute of Standards and Technology (NIST) has developed a Cybersecurity Framework (CSF)
- Provides a comprehensive structure for making informed, risk-based decisions and managing cybersecurity risks

IDENTIFY	PROTECT	DETECT	RESPOND	RECOVER
• Develop organizational understanding to manage cyber risk to systems, assets, data, and capabilities	• Develop and implement appropriate safeguards to ensure delivery of critical services	• Develop and implement appropriate activities to identify the occurrence of a cyber event	• Develop and implement appropriate activities to take action regarding a detected cybersecurity event	• Develop and implement appropriate activities to maintain resilience and restore any services impaired due to a cyber event

https://www.nist.gov/cyberframework

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Policy Resources are Readily Available

- NIST CSF includes a structured decomposition.
- Categories/Subcategories
- Numerous document references

- Need an entity responsible for cyber policy implementation at the Agency level.
- Every Agency organization has cybersecurity responsibilities.
- Need teams dedicated to independent vulnerability assessments.

https://www.nist.gov/cyberframework

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Consultative Committee on Space Data Systems (CCSDS)

- Communications and data systems standards since 1982.
- Includes architecture, archive, security, XML exchange formats.
- End to end data/communications architecture for any mission.

https://public.ccsds.org

- CCSDC has published numerous guidebooks including standards, protocols, reference architecture
- Security Resources
  - CCSDS 350.1-G-2 Security Threats Against Space Missions
  - CCSDS 350.7-G-1 Security Guide for Mission Planners
  - CCSDS 352.0-B-1 CCSDS Cryptographic Algorithms
  - CCSDS 355.0-R-3 Space Data Link Security Protocol

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Secure Coding
Common Weakness Enumerations

- The majority of cyber vulnerabilities are found in software.
- Common Weakness Enumeration (CWE) documents code patterns that can result in cyber vulnerabilities.
- The CWE list was complied by a consortium of government and commercial entities, maintained by MITRE Corporation.

- Software Quality Assurance should adopt practices that target CWE prevention and removal
  - Coding standards, software inspections, and testing
  - Commercial and Open Source Static Code Analysis tools are available to help with CWE identification

https://cwe.mitre.org

Common Types of Software Weaknesses:

Buffer Overflows, Format Strings, Etc.
Structure and Validity Problems
Common Special Element Manipulations
Channel and Path Errors
Handler Errors
User Interface Errors
Pathname Traversal and Equivalence Errors
Authentication Errors
Resource Management Errors
Insufficient Verification of Data
Code Evaluation and Injection
Randomness and Predictability

Summary

- Cybersecurity is a growing risk to space missions.
- S&MA has an important role to play in cybersecurity assurance.
  - S&MA needs to develop cybersecurity expertise to hold mission projects accountable.
  - There are many resources available online to help.
- Cybersecurity assurance requires a multi-disciplinary approach.