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A WORLD OF INNOVATION

Retrofitting Ground Systems to improve Cyber Security

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Overview

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- Satellite System Cyber Security is particularly challenging
  - Satellite Mission Management networks have unique designs and challenging mission constraints
  - Security Solutions/Security COTS are not designed with Satellite Operations in mind
- Retrofitting legacy satellite mission management systems is particularly difficult
  - Operations budgets are extremely limited
  - Maintenance windows are generally short
- Reuse has been a common method to reduce deployment Costs
  - Security reuse represents a way to reduce Cyber Security costs

Security Patterns enable Reuse of Proven Security Solutions

Satellite System Commonalities

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Merges sophisticated cutting-edge mission planning software

To specialized, long-life (and often ancient) command hardware

Requires 7x24 uptime, stable technologies & stable environment (no experimenting & no beta software!)

Are high-value and mission-critical assets

Satellite Systems have Specialized Security Requirements

Security Challenges

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- **Escalating Focus on Cyber Security**
  - Government concern over Cyber Security has resulted in ever-increasing numbers of security requirements
    - **Federal Government - NIST SP 800-53**
      - Over 800 Controls, describing baseline technical and procedural security
    - **DoD – DoDI 8500.2/DoD 8581.01**
      - 110+ Procedural and Controls, depending on classification level
    - **ISO/IEC 27002**
      - 12 Sections 114 controls, providing goals, but little implementation guidance
- **Measuring Cost/Benefit**
  - Cyber Risk is difficult to quantify
  - Every dollar spent on security is not spent on expanding mission capability
  - Retrofitting legacy systems can be costly with only nominal security benefit

Applying Security to Ground Systems Can be Costly & Difficult

Security Pattern Reuse

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- Reuse software Design Pattern methodology to
  - Create reusable “Security Patterns”
  - Apply Security Patterns to High Value Mission Management Systems
- Reuse of proven Mission Management policies including:
  - Access Control
  - Network
  - Anti-Virus
  - User Roles
  - Systems Hardening
  - Configuration Management
  - Secure Communications
  - Software Assurance
  - Product Selection Criteria
- Reuse of proven technology solutions, including:
  - Reference Security Architecture
  - Hardened OS/COTs images
  - Security Assessments
  - Encryption
  - Log Reduction/SEIM
  - Network Defense Product
  - Approved Products
  - Public Key Infrastructure

Lower Deployment Costs and Security Risk through Reuse

Scenario 1: Systems Hardening

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- Reuse of Policy Templates, Automation Scripts and Assessment tools for hardening Windows/Linux Systems
  - Templates mined from a large-scale multi-platform Command/Control system
  - Templates were already tailored to unique CPU/Disk/performance requirements of a C2 System

- Benefits included:
  - Speeds time to upgrade core Infrastructure
  - Provides standards-compliant, tested base OS templates for application, database and web servers
  - Includes hooks for “modern” security protocols, including IPSec, PKI, TLS and SSL
  - Reduces labor and schedule time associated with COTS configuration and maximizes integration/test time
  - Provides a higher confidence development schedule, based on schedule/cost actuals from previous deployments

Cost-effective Satellite Security by Reusing Proven Cyber Solutions

Scenario 2: Access Policy

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- Reuse of Access Policy templates for Satellite C2 System
  - Includes common satellite mission C2 roles, including Shift Commander, Satellite Vehicle Operator, and Payload operator
  - Identifies roles, permissions, and constraints necessary to support Satellite Operations
  - Validated as meeting compliance requirements
- Benefits:
  - Minimizes policy development time
  - Provides an example of an approved, accredited policy
  - Tailored to security and mission requirements unique to satellite operations (e.g. separation of duties, shift changes, 2-man controls)

Cost-effective Security by Reusing Proven Satellite C2 Solutions

Conclusion

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- Cost-effective security upgrades of legacy systems are possible
  - Best value is in upgrades to core Security Enabled COTS
  - Lowest risk is in reuse of Satellite Mission expertise

- Security Patterns approach allows for a “buffet-style” approach to improving security
  - Not as robust as a “built-in” security approach, but
  - Provides significant, measurable improvements in cyber-resiliency for legacy systems