Collins Aerospace
An RTX Business

Securing With Constraints: Working With Embedded Systems

Chitra Amzarewale

17/05/2025

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Agenda

- Introduction
- Aerospace as a Domain
- Expanding Attack Surfaces in Avionics
- Threats & Risks of Concern
- Security Architectures & Mitigation Strategies
- Zero Trust & Resilient Architectures
- Securing by Processes

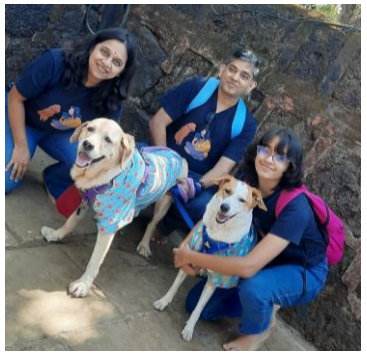
Introduction

Born and Brought up in Gujarat

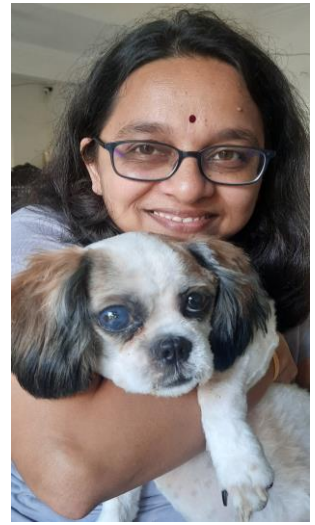
B.Sc (Mathematics)
B.E. (Electronics)
M.E(Control& Robotics)

Giving Back To Society

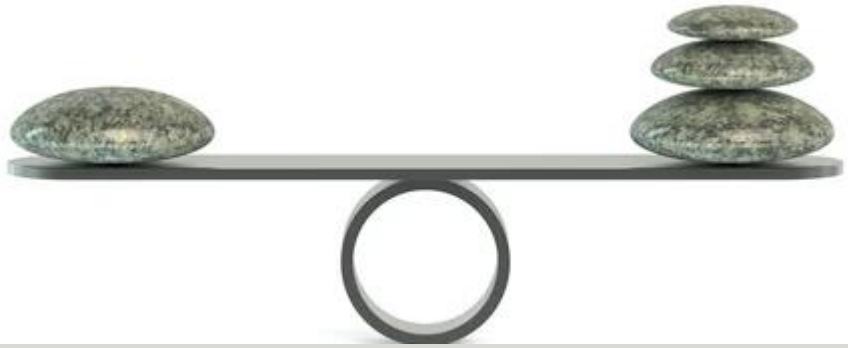
Fascinating world of Aerospace



Our Small World

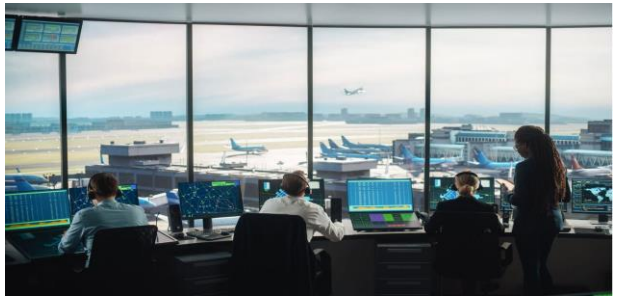


Rescue & Rehab
Founder @TheWagSocial



Work Life Balance is a Myth

Get to Know Collins Aerospace



Air Traffic Management

Military & Defense

Commercial Aviation

Airports

Helicopters

Business Aviation

Space

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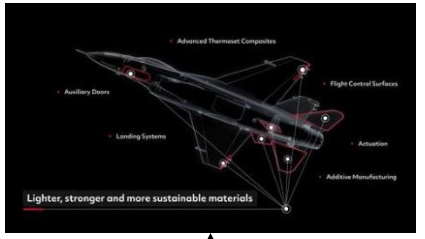
Collins Aerospace Initiatives

Autonomous Operations

Electrified Aircraft

Integrated Solutions



Advanced Structures

Connected Ecosystem

Cabin Experience

Connected Battlespace

Redefining Aerospace

Aerospace Domain: Background Concept & Design

Conceptualizing the product

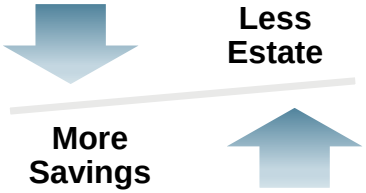
Life Span of the Product

Development Cycle

Obsolescence Management

?

Serviceability of the Product



Cost and Real Estate

Emerging Technological Trends

Design that Sustains Generations

Increased Attack Surfaces

- Rapid growth of IoT
- Extensive usage of Cloud
- Reliance on Digital Systems
- Digital transformation
- Sophistication of Threat Actors
- Increase in WFH or more connectivity facilities
- Aging technology and outdated hardware/software/firmware
- Insider Threats

One's loss
Other's gain:

Is Avionics Remains Secure?

Growing Threats & Risks: Embedded Systems

- Targeted Ransom Attacks
- Phishing Attacks
- Fileless Attacks
- Malware
- DDOs Attack
- Insider Threats
- Crypto Jacking
- Supply Chain Attacks

- Intellectual Property Compromise
- Code Integrity
- Data Confidentiality & Integrity
- Communication Channel Authentication & Authorization

Steady Growth in Attacks on Engineering

Generic Security Measures

- Robust Security Controls

  Patch Management, Multi-Factor Authentication (MFA), Firewalls and Intrusion Detection Systems (IDS), Encryption, Antivirus and Anti-Malware Software, Network Segmentation, Zero – Trust Architecture
- Regular Risk Assessments and Audits
- Awareness and Training

  Every person in organization must speak security
- Incident Response

  Plan, Monitor and Respond
- Compliance to Standards and Guidelines
- Technology Based Measures

  Monitor network traffic using edge technologies, Physical Measures and access control, BioMetrics, Encryption
- Collaborate

  Join other organization to defend the cyber threats, the rate at which cyber is growing, collaboration is the key

We Are Stronger Together

What do you all think?

- Do you think aviation is not secure anymore?

  Yes/No
- Are the listed measures enough?

  Yes/No
- Can all commercial electronics products be secured with these measures?

  Yes/No
- Can all avionics products be secured with all these measures?

  Yes/No
- Do you think any different measure/approach is needed?

  Yes/No

One Solution For All?

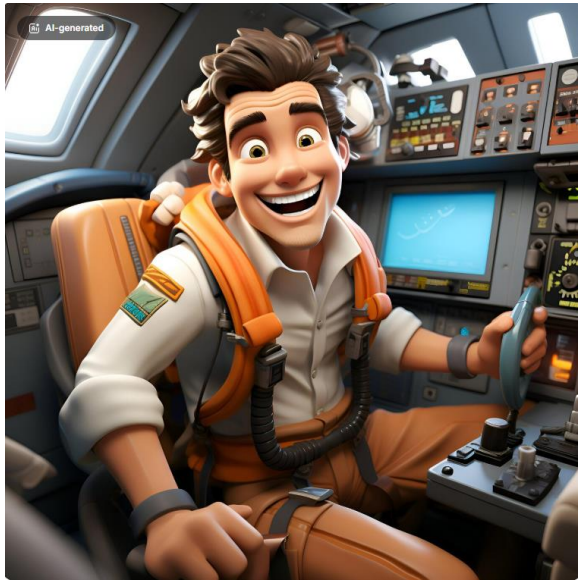
Approach: Securing Embedded Systems

- Legacy, Modified, New
- Airborne, On – Ground
- Embedded, Web Application, Mobile Application
- Connected, Not – Connected, Partially – Connected
- SDLC Phases: Development, Production, Maintenance, Operation, Disposal

Embedded System Is Not A Commercial Electronics

Security Measures: Web or Mobile

- Access Controls
- Bio Metrics
- MFA Authentication
- Real Time OTP/notifications
- End to End Encryption
- On Device Authentication
- AI/ML implementation for analysis
- PCIDSS Compliance for in air payment

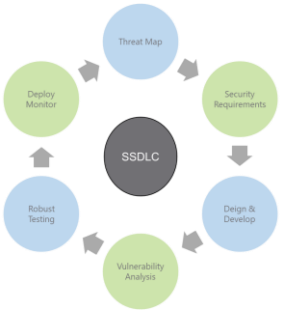


Security Measures: Product Evolution

Solution Fit for all? Products are diverse in terms hardware, software capabilities which prohibits us from arriving at a common solution however it could still enable us to propose a common solution for a subset of the products.

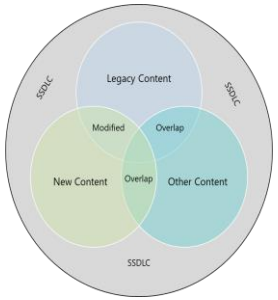
New Products

- Recommend Trusted Hardware Package based architecture
- Governed by Secure Software Development Process (SSDLC)
- Threat model guiding security requirements and robust testing
- Vulnerability Analysis at appropriate stage
- Secure Infrastructure etc.



Modified Products

- Governed by Secure Software Development Process (SSDLC) for the modified portion
- Most process for “Modified Portion” remains same as “New Products”
- Code reuse is enabled based on Threat Map & vulnerabilities
- Vulnerabilities are categorized based on risk & need mitigation



Legacy Products

- Perform product assessment for threat and vulnerability analysis
- Document risks based on inputs
- Product team to provide mitigation based on risk score or justification
- Prioritize fixes based on the modification plan

Security Measures: Bare Minimum

- ✓ Secure Development Lifecycle
- ✓ Risk Assessments
- ✓ Impact Analysis for the vulnerabilities
- ✓ Static Code Analysis or Dynamic in certain cases
- ✓ Digital Signature authentication
- ✓ Pen Testing and Vulnerability Identification
- ✓ Software Bill of Materials with patch update agreement
- ✓ Compliance and Cert

Protect any or all systems

Security Measures: Product Evolution

Enable Systems to Protect Itself

Securing Perimeter

- Inbuilt Crypto
- Secure Ground Support Equipment
- Secure Debug/Test Interface
- Secure Inputs
- Boot Securely

Tampering

- Secure Loading
- Encrypted Loads
- Encrypted Storage
- Secure Architecture
- Privileged Maintenance Access

Field Threats

- Encrypted Logs
- Secure Communications
- Secure Identify
- Reporting
- AI Solutions for faults/reports

Aim is Zero Trust

Zero Trust Architecture → Resilient Architecture

Verify Everything Every time

- Based on continuous validation and monitoring
- Strict controlled access privileges
- Assume compromise is reality
- Identify each user and access levels
- Compliance to Connected devices
- Clear distinction between assets

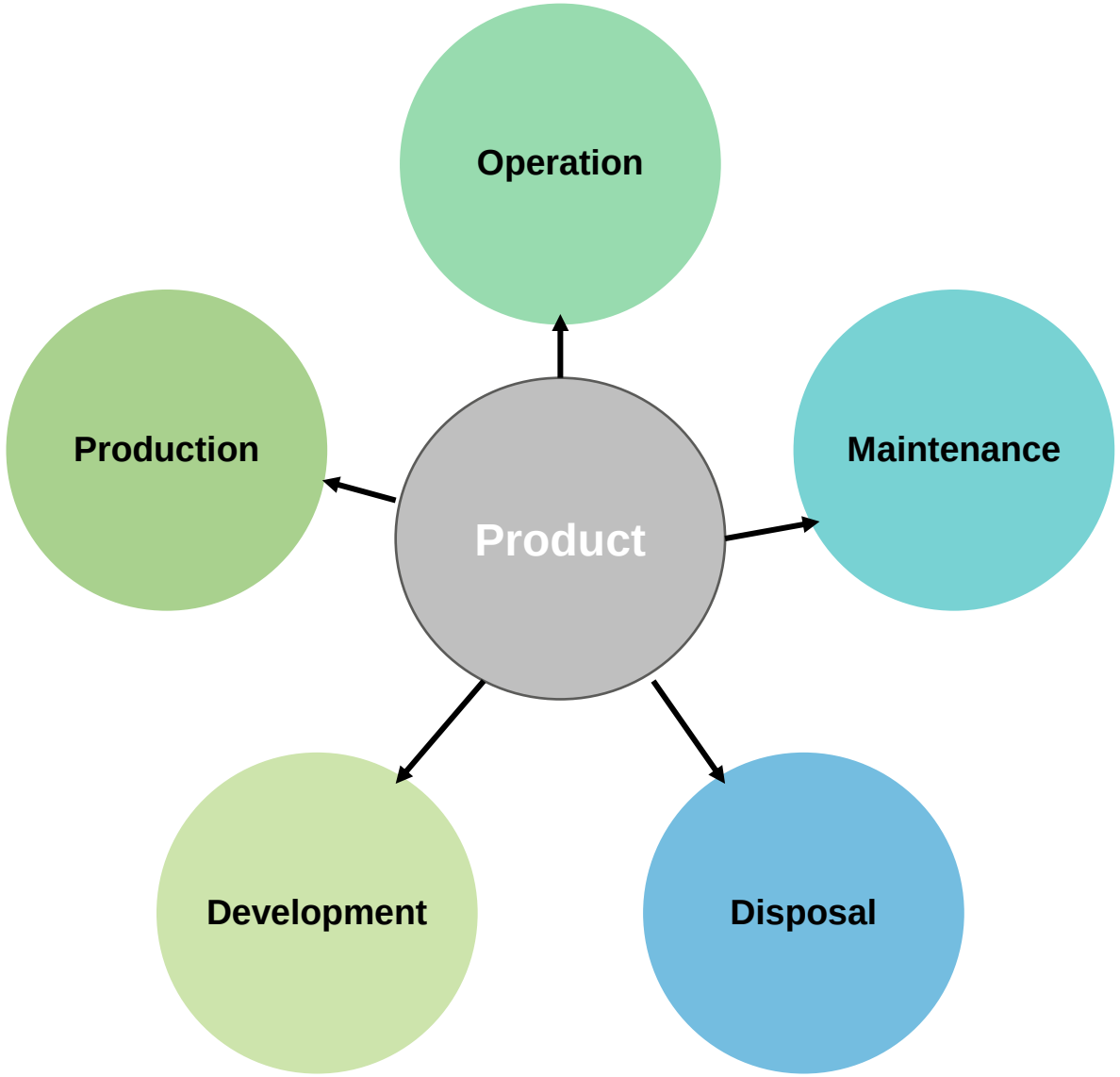
Ability to withstand Failures and Interruptions

- Failure is reality but the essence is recovery
- Monitoring and Adapting
- Uninterrupted Operation
- Proactive Anomaly Detection
- Dissimilar Redundant Backup
- Scalable

No fixed requirement for Zero Trust based Resilient Architecture, it depends what needs to be secured or resilient and from which threat?

Zero Trust & Resilient Architecture Is The Future

Security Measures: Secure By Process



- Maintenance at Airports and at Airlines owned facilities
- To tackle and protect IP there needs to be clear agreement between supplier and customer
- Access privileges help but the strategic agreements like field loading, repairs in own facilities are key
- Disposal of the retired unit is another challenge if not done appropriately
- The cases in which aircraft is not in service but not yet dismantled are tricky

Thank You

Q & A

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