



# SECURITY & QUALITY IN MISSION-CRITICAL AEROSPACE SYSTEMS

Tom Smelker, SVP, Processing Technologies  
Mercury Systems



# MERCURY SYSTEMS

INNOVATION THAT MATTERS®

---

## Trusted Mission-Critical Technology

Mercury is a global technology company that delivers mission-critical processing to the edge, enabling 300+ defense programs in 35 countries

## Commercial Innovation, Defense Grade

We bridge the gap between Silicon Valley innovation and defense requirements, delivering software-defined, purpose-built solutions that are secure from chip to system



# The Mercury Processing Platform is a flexible combination of innovative technologies supports mission-critical decision-making

## Signal

Analog and digital pre-processing of RF and microwave signals

## Compute

Real-time edge processing of signals to extract valuable, actionable data

## Data Mgmt

Recording, storing, protecting, and exchanging data and communications

## Display

Visualization of analyzed data for situational awareness and mission execution

## Secure

Engineering to ensure systemwide integrity and protect Critical Program Information, IP, and sensitive data



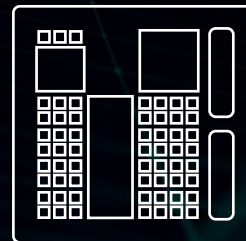
SILICON TO SYSTEMS

- Components
- Modules
- Subsystems
- Integrated Solutions

## Components



## Modules

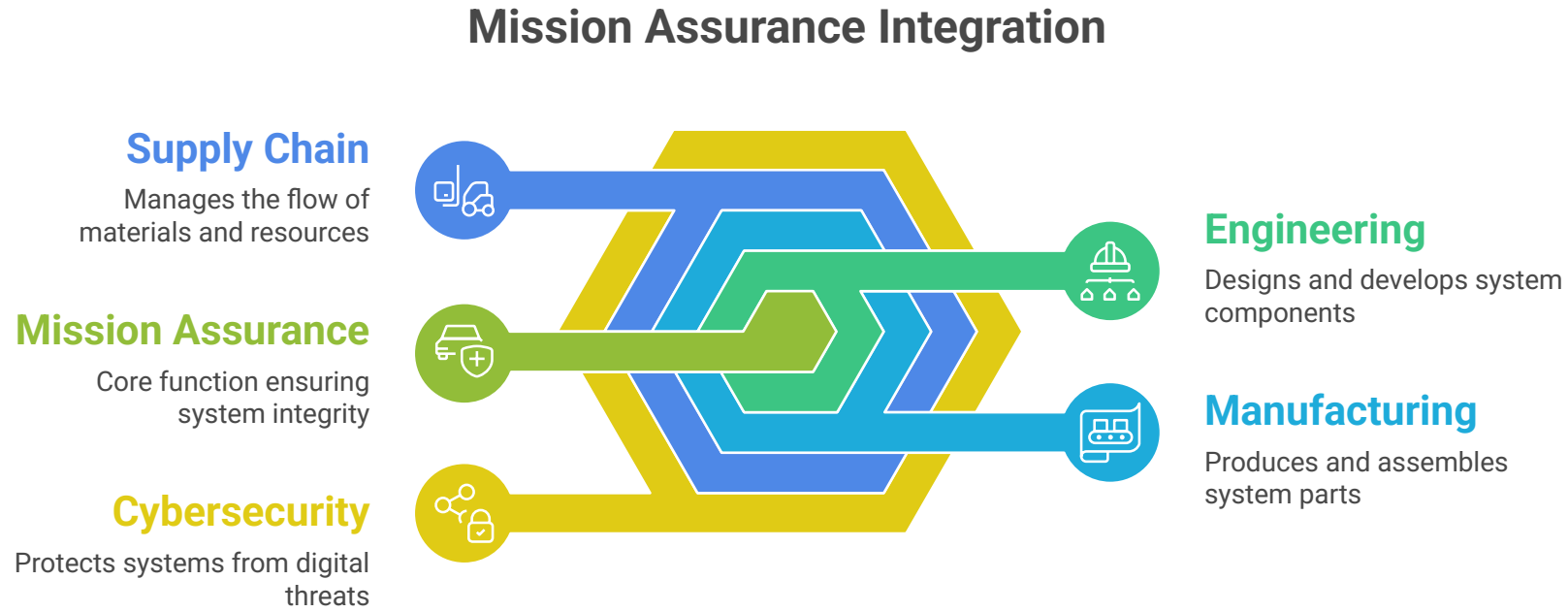


## Subsystems



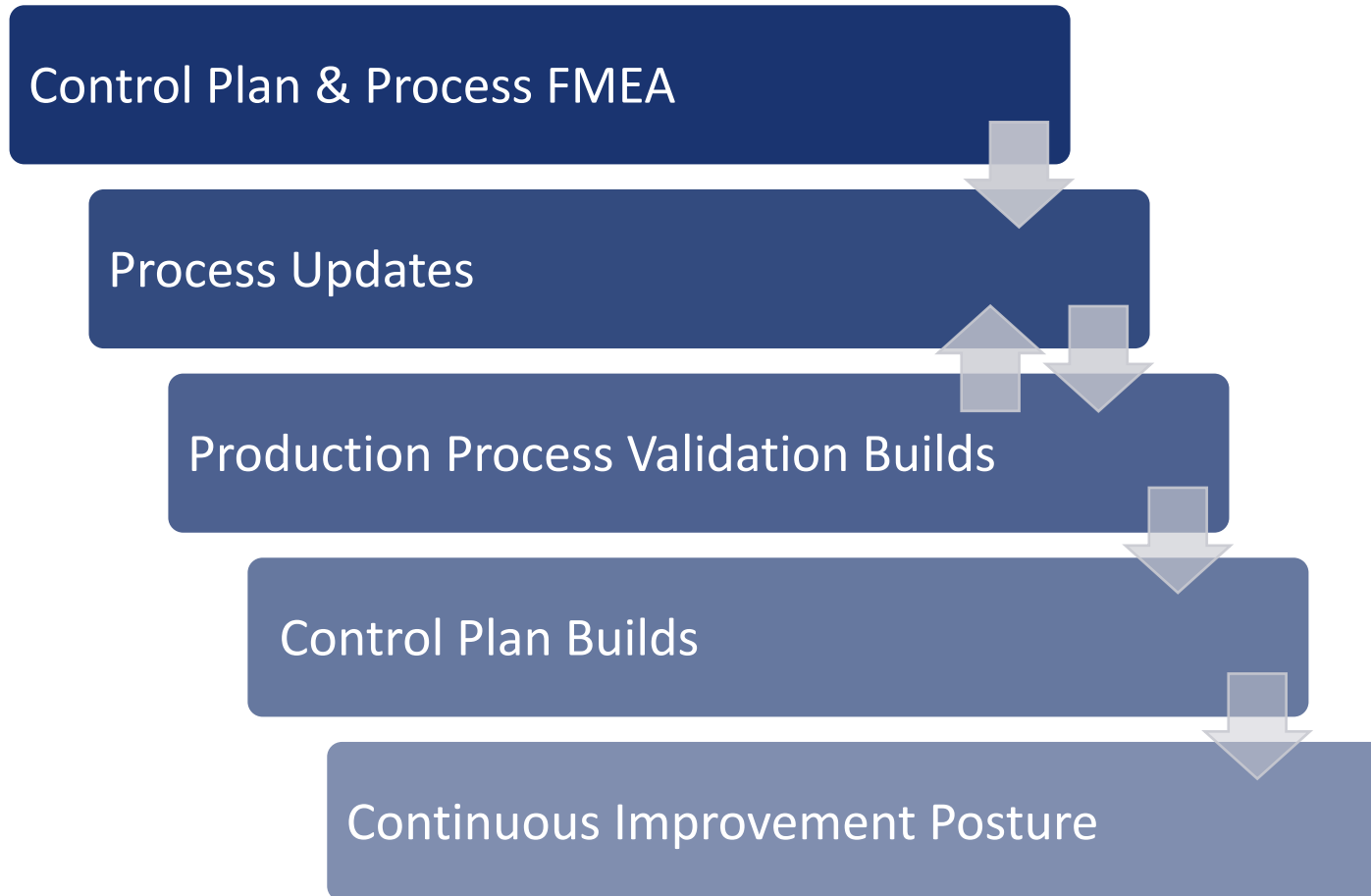
# The Convergence of Security & Quality in Modern Aerospace Systems

*“You cannot have Quality without Security — and you cannot have Security without Quality.”*



- Secure by Design + Quality by Design = **trusted mission outcomes**
- Security as a measurable quality attribute (integrity, availability, and confidentiality)
- Our Quality enables resilience, ensuring the system detects, prevents, and recovers from threats

# Mercury's Production Process Validation Initiative



## Purpose

*ensure design and process stability, improve yield, eliminate waste, and achieve predictable performance*

# Case Study | HDS9665 Motherboard PCB Production Process Review

## Process Failure Modes & Effects Analysis (PFMEA) Findings

	Process Step	RPN
1	Bench Test	288
2	X-Ray	245
3	Xray after Post Solder	245
4	Flying Probe	112
5	Bench Test After Conformal Coating	108
6	Component Vent Seal	105
7	Manufacturing Inspection	96
8	Verify Documentation is up to date.	84
9	Pick and Place	84
10	AOI	84
11	Pick and Place	84
12	AOI	84
13	Selective Solder	84
14	QA AOI Before Conformal Coating	84
15	QA Inspection Before Conformal Coat	84
16	Picking parts from stock locations.	80
17	Pre-SMT Pad Tinning for Searay connector	72
18	Solder Paste Handling.	72
19	Solder Paste Handling.	72
20	Mask/Part Placement Selective Solder	72

- ✓ 68 Process steps reviewed and ranked by Risk Prioritization Number (RPN)
  - 3 **High Risk** Operations Identified
  - 10 **Improvement Opportunity** Operations Identified
- ✓ 25 PFMEA Process Improvements Identified

## Improvements Implemented

- ✓ Extensive routing optimizations
- ✓ Build process clarifications
- ✓ ESS Memory tests before underfill
- ✓ Flying probe procedure overhaul
- ✓ X-Ray program enhancements
- ✓ Selective solder process improvements
- ✓ Improved AOI inspection fixturing
- ✓ CPU Solder Mask Optimization
- ✓ Automated Optical X-Ray Inspection

## Production Impacts

Control Plan Builds	Before Q2 FY25	After Q1 FY26	Delta
Assembly Starts	82	30	-
Total Yield	80%	100%	+25%
Rolled Throughput Yield	23.6%	39.5%	+67%
Average Defect Count	6.78	3.15	-53%
Cycle Time (Days)	136.7 Days	49.5 Days	-64%

# Why Security and Quality Define Space Mission Success

---

## THE UNFORGIVING REALITY

- Space systems operate 3-7 years—software can be patched, hardware cannot be repaired
- Extreme environment: 100x Earth radiation, -150°C to +150°C thermal cycles
- Component degradation and physical failures are permanent

---

## THE ADVERSARY THREAT

- Space enables GPS, secure comms, missile warning, ISR—our military advantage
- Active threats: Supply chain infiltration, counterfeit components, cyber attacks
- Compromise = operational denial when capabilities are needed most

---

## THE NEW REQUIREMENT: SPEED + TRUST

- Defense demands rapid deployment (spiral development model)
- But speed without security/quality = vulnerability
- The challenge: Commercial tech pace with defense-grade assurance

# Principles for Security and Quality in Modern Space Systems

## Supply Chain Integrity

- Trusted manufacturing with full provenance—from component sourcing through final integration

## Minimized Attack Surface

- Hardware-first architectures that fundamentally reduce cyber vulnerability versus software-heavy systems

## Design for Extreme Environments

- Components engineered and proven for accumulated radiation dose over full mission life

## Verification Without Shortcuts

- Test regimes that find hardware failures before launch—because physical repairs aren't an option



# Case Study | SDA Proliferated Warfighter Space Architecture

---

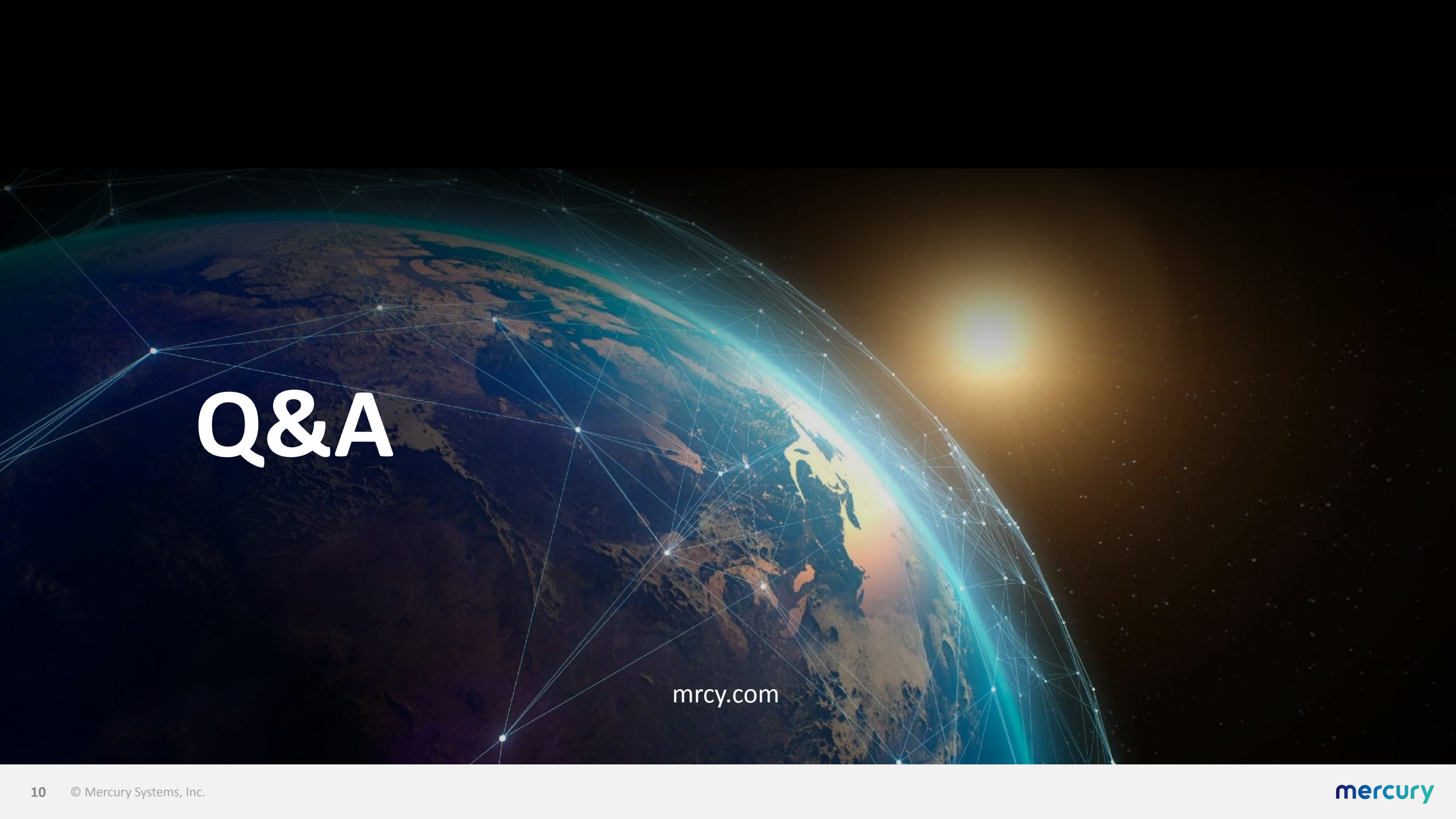
## WHY SECURITY AND QUALITY ARE NON-NEGOTIABLE

- Threat speed: Mach 20+ weapons = minutes to respond
- Data volume: Terabytes of IR sensor data processed on-orbit in real-time
- Mission duration: 5-7 years in radiation environment—hardware failures are permanent
- National security stakes: Defending homeland against most challenging threats

---

## WHAT SUCCESS REQUIRES

- Trusted manufacturing for rapid spiral deployment
- Hardware-based security for mission-critical data
- Radiation-tolerant components proven to survive mission life
- On-orbit AI/ML processing (SCFE6933) for real-time threat detection



# Q&A

[mrcy.com](http://mrcy.com)