



C-17 Software Development Process

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The logo for the C-17 Globemaster III, featuring a stylized red and blue '17' with a red swoosh above it, set against a background of the American flag.

Introduction

- The C-17 airlifter is a software intensive system with an ongoing avionics upgrade program
- Software process is inseparable from Systems engineering process
 - Robust avionics systems and software engineering processes are critical to success
 - Process improvement is an essential component of performance improvement



Topics

- C-17 Program
- Avionics Systems and Software Engineering Process
- Challenges, Lessons Learned and Improvement Strategies
- Summary



C-17: A High Performance Program

MEETING OUR COMMITMENTS

- Excellent Quality
- Ahead of Schedule
- On Price
- 180 Aircraft Program

MEETING OUR COMMITMENTS

- 141 USAF Aircraft - 6 Bases
- Worldwide Operations
- Best Fleet Reliability
- 4 UK C-17s Delivered



Over 898,750 Flight Hours!
USAF Fleet – 872,885 UK Fleet – 23,085



Unique C-17 Capability

Delivers Heavy and Outsize Cargo into Short Runways

and/or

Semi-prepared Runways

through

Small Ramps or Narrow Body Slots



Direct Deliveries Over Intercontinental Distances into Small Austere Airfields

Carries Airborne Troops Anywhere: Reduces Manpower: 3-Person Aircrew; Breaks Less and is Easier to Fix



C-17 Bed Down Locations

145 of 184 Delivered



Elmendorf AB
Alaska
8 A/C
2007

McChord AFB
44 A/C
2004

Travis AFB
13 A/C
2007

March ARB
8 A/C
2006

Hickam AB
8 A/C
2006

Altus/Training
15 A/C
2007

Jackson ANG
8 A/C
2004

C-17 SG

Charleston AFB
50 A/C
2003

Dover AFB
13 A/C
2008

Brize Norton
4 A/C
2001

McGuire AFB
13 A/C
2005

-  C-17 Bases
-  Next Base
-  Future Bases



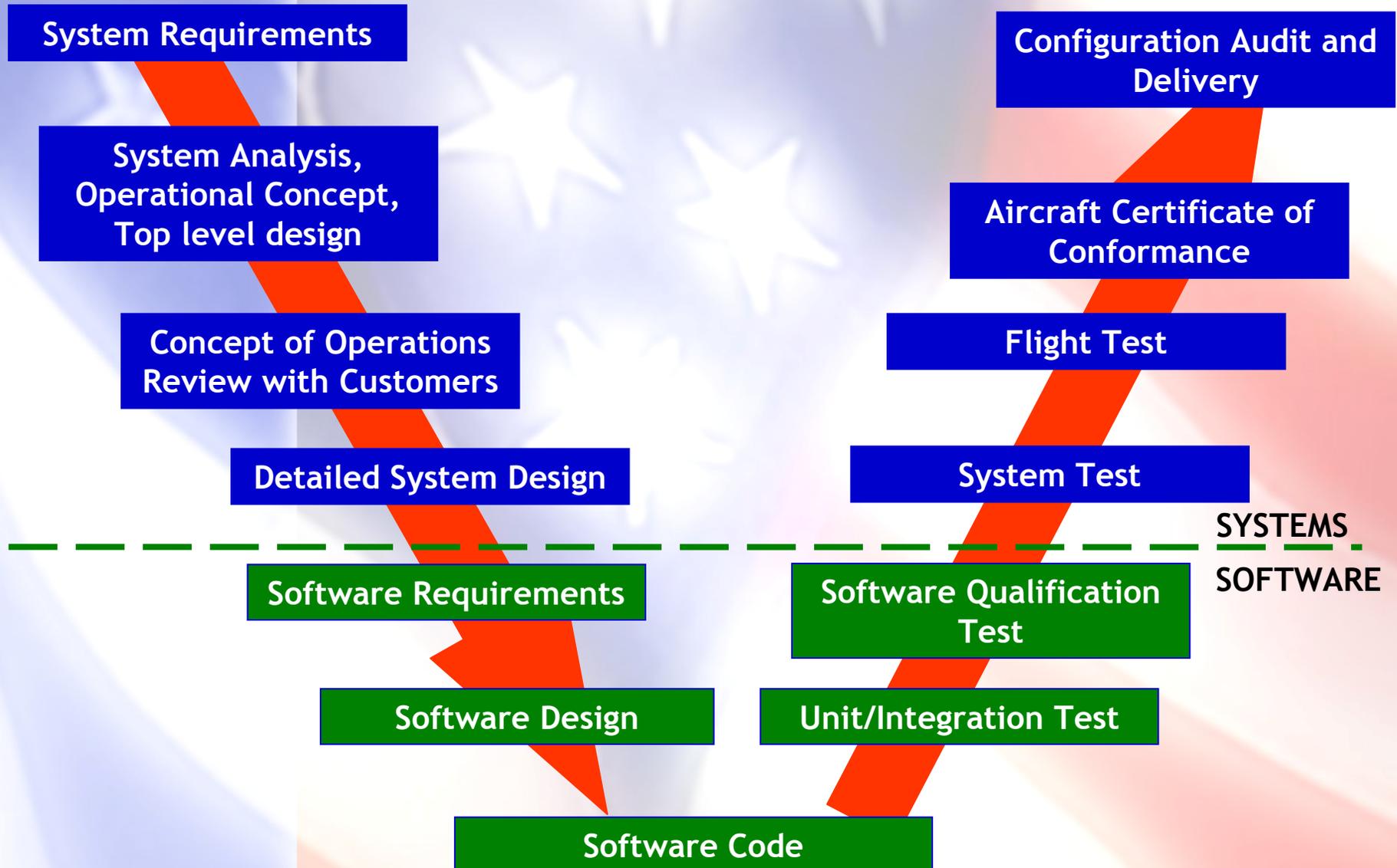
C-17 Flight Software Summary

- Over 2 million source lines of code
- Mix of military and commercial software
- Software development/maintenance
 - Approximately 50%-50% Boeing/Supplier split
 - Over 20 suppliers
- Many software languages
 - Migrating to Ada 95 and C/C+ as equipment is modernized

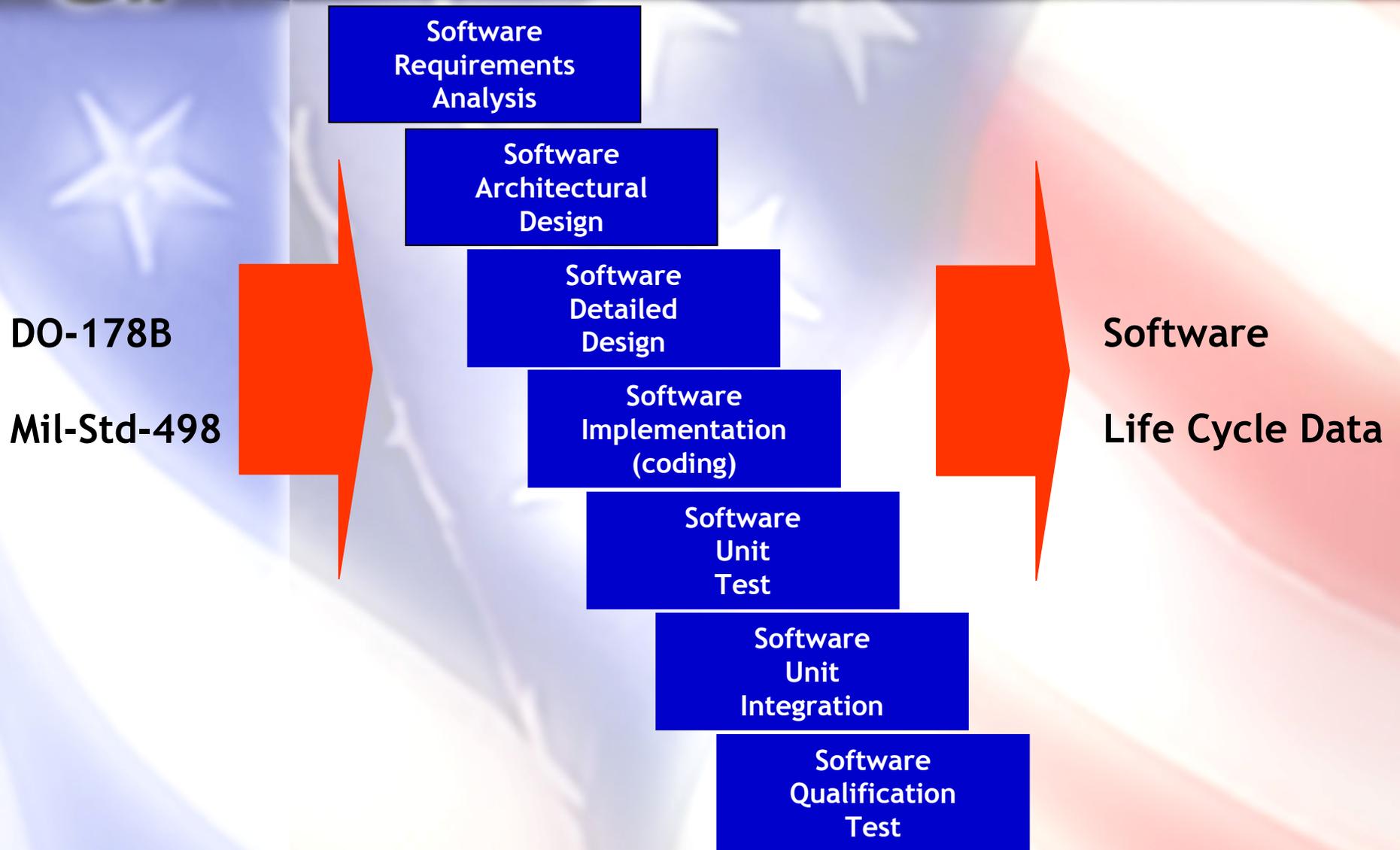


Avionics Systems and Software Engineering Process

Systems and Software Engineering Process

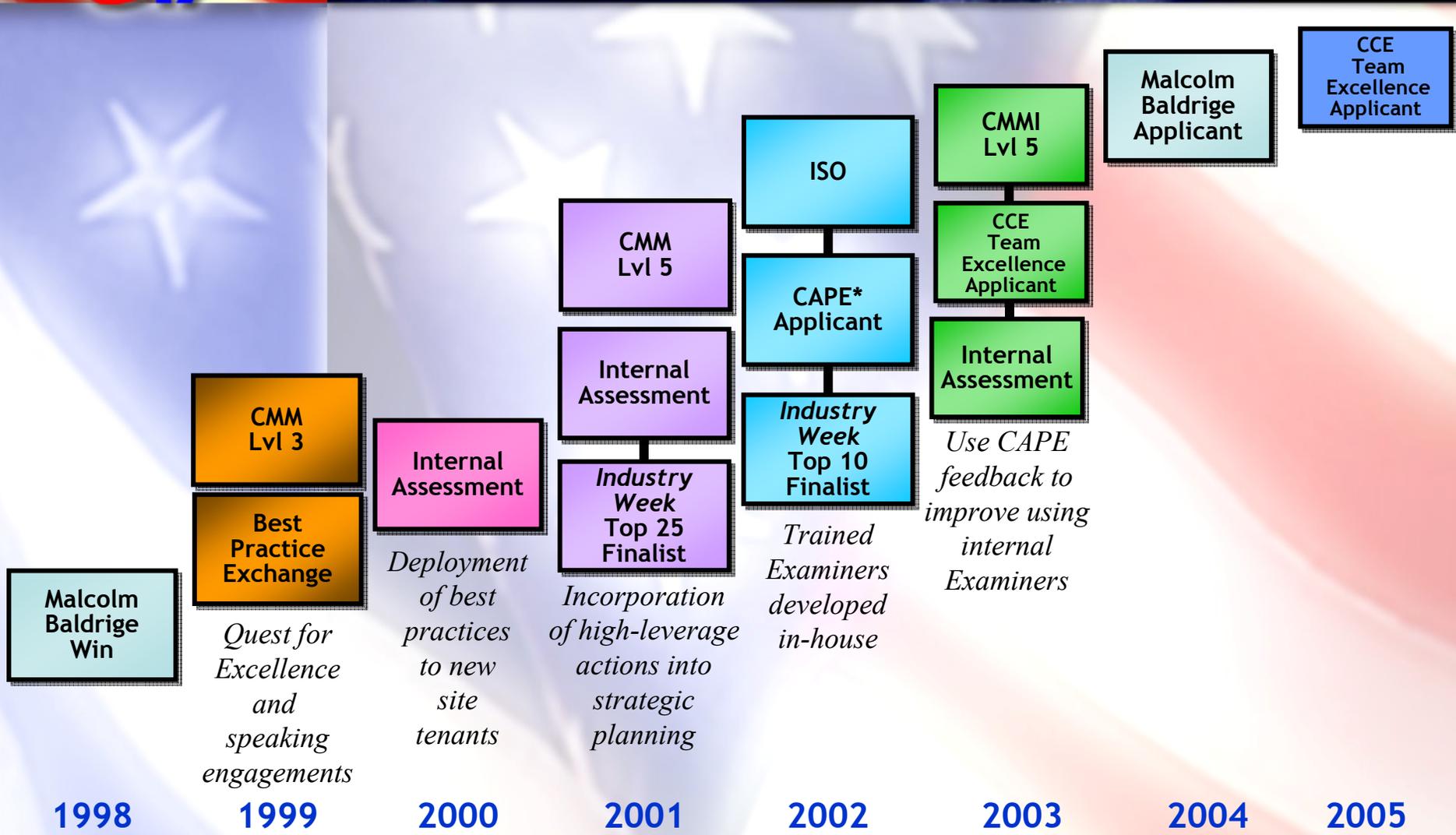


Software Development Process



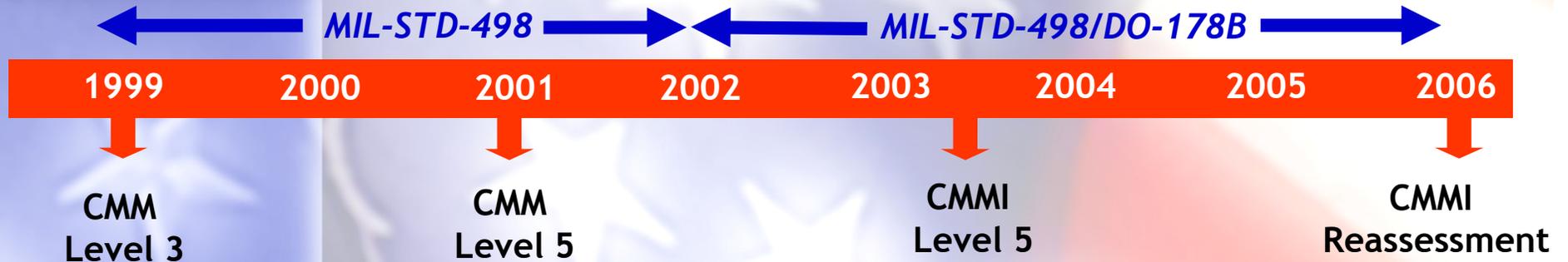
Contractual process documented in C-17 Software Development Plan

Quality Journey

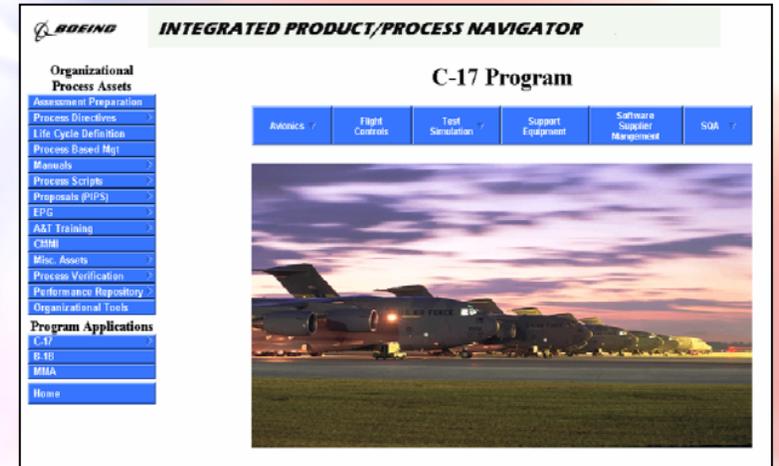


Software process improvement is a key component in the quality journey

C-17 Software Process Evolution



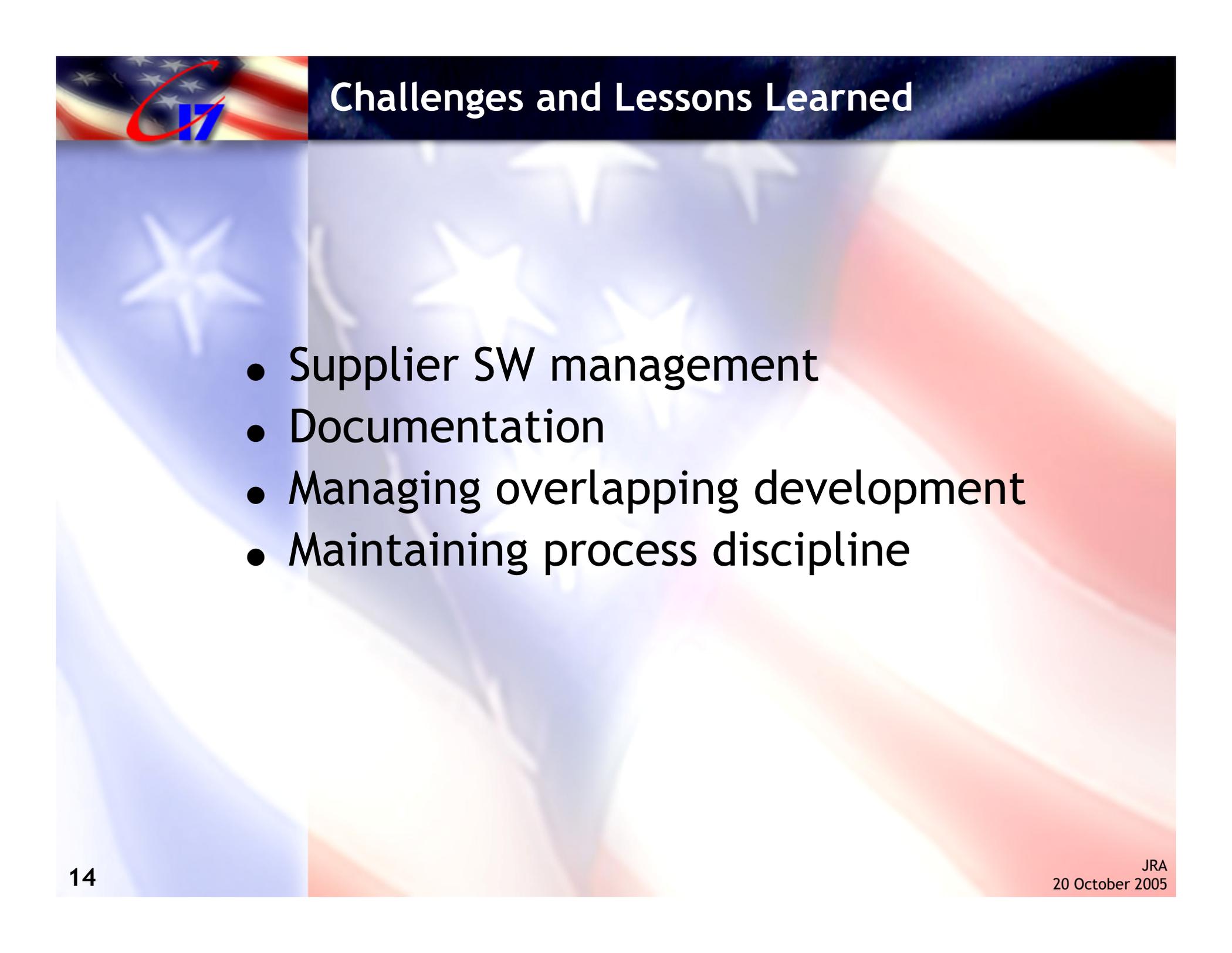
CMM to CMMI Transition



**Airlift and Tankers Organizational Process
C-17 Tailored Process
Process Compliance Artifacts**



Challenges, Lessons Learned and Improvement Strategies



Challenges and Lessons Learned

- Supplier SW management
- Documentation
- Managing overlapping development
- Maintaining process discipline

Supplier Software Management

- Approximately half of C-17 software is developed and maintained by suppliers
- Boeing-Supplier teamwork is essential for success
- Supplier Software Management Team
 - Software engineering experience
 - Software acquisition experience

SPN Page y-326001 - Microsoft Internet Explorer
Address: https://sedev.hb.ca.boeing.com/pls/son/spn_main.plg.ShowMain

BOEING **INTEGRATED PRODUCT/PROCESS NAVIGATOR**

Software Supplier Management

Organizational Process Assets

- Assessment Preparation
- Process Directives
- Life Cycle Definition
- Process Based Mgt
- Manuals
- Process Scripts
- Proposals (PIPS)
- EPG
- A&T Training
- CMMI
- Misc. Assets
- Process Verification
- Performance Repository
- Organizational Tools

Program Applications

- C-17
- B-1B
- HIMA
- Home

Documents | Document Reviews | Compliance Matrix | SSM Checklists | Templates

SSM Scripts -- P-121 & Beyond

Select Supplier | Monitor Supplier

Software Quality Engineering Scripts

Quality Planning | Process Audits | Quality Management | SW Test Evaluations | SW Development Design/Phase Reviews | Product Evaluations | Quality Records | Quality Reporting | Supplier Management | Software Delivery

SSM Scripts -- Pre P-121

Select Supplier | Monitor Supplier

Repository for review artifacts

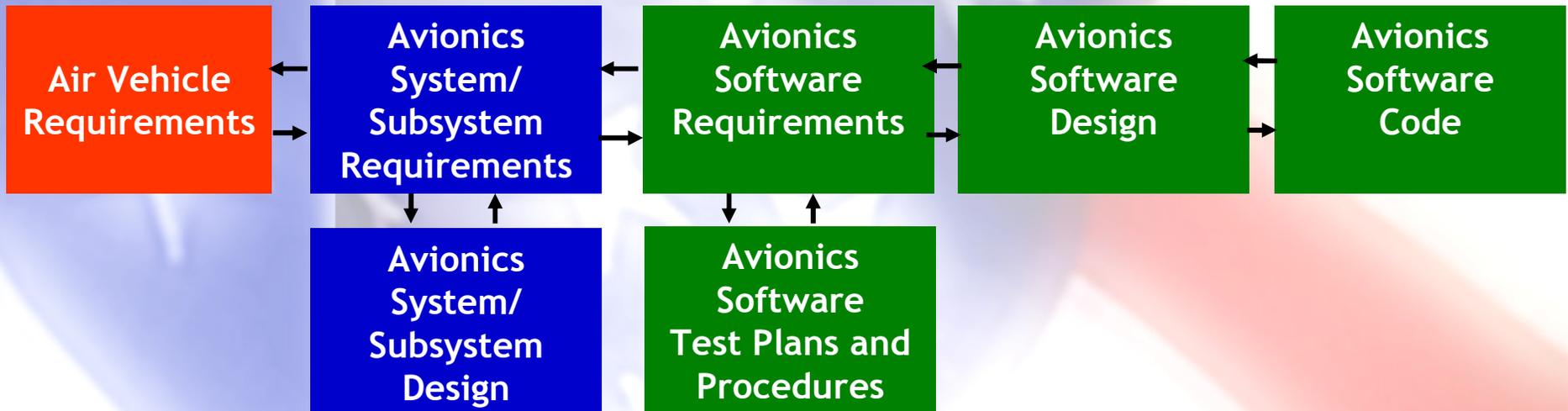
Software acquisition tools

- Lifecycle data/product review checklists
- Template Statement of Work

Supplier Selection and Monitoring Processes

Supplier Software Metrics

Documentation



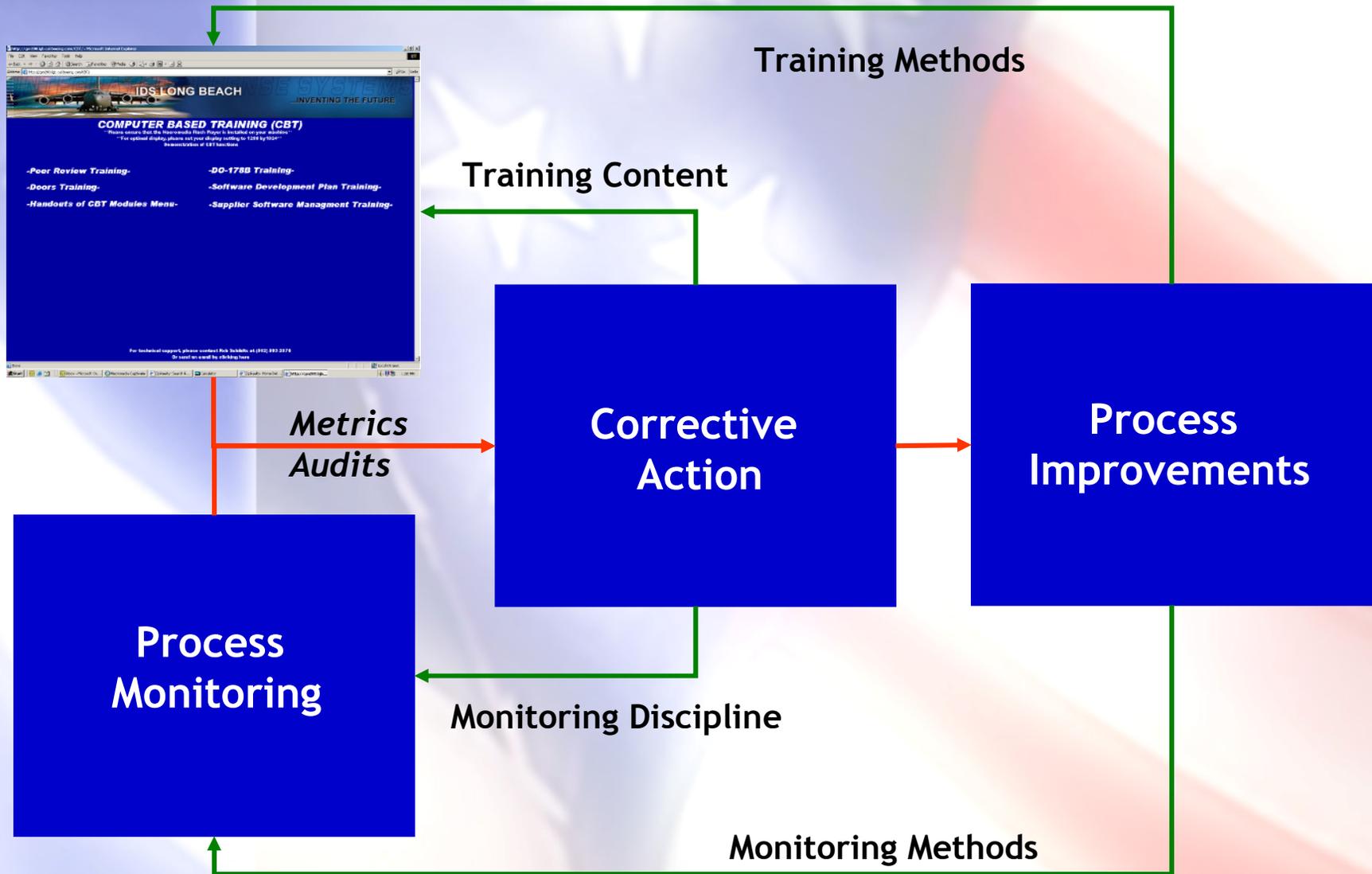
- Capturing and verifying airborne software life cycle data is a complex task
 - Thousands of requirements
 - Thousands of pages
 - Traceability
 - Milestone review entry criteria
- Solutions
 - Implemented DOORS
 - Improved product evaluations



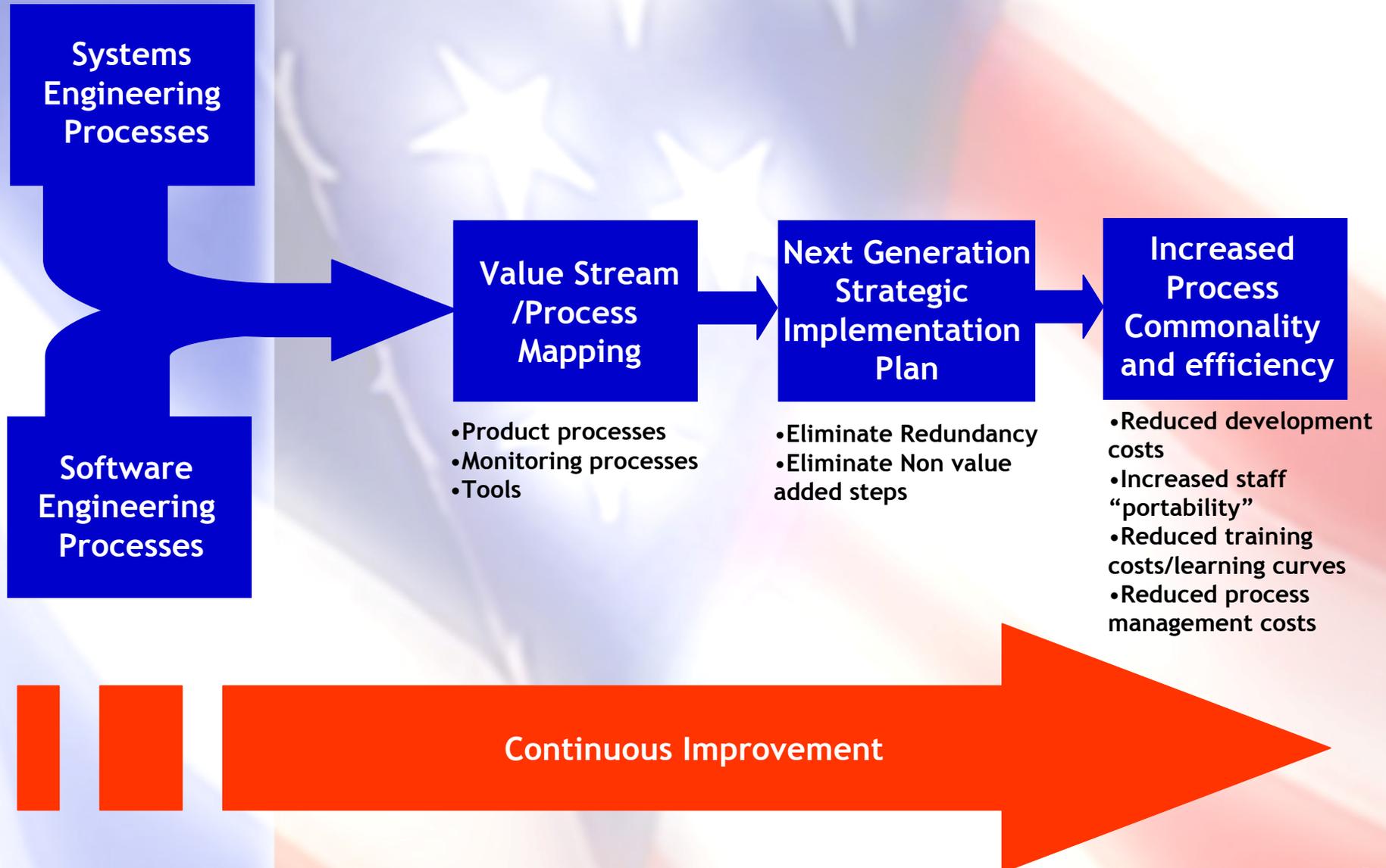
Overlapping Development

- Multiple Software block upgrades occur simultaneously with different effectivity
- Challenges
 - Laboratory Capacity
 - Flight Test Capacity
 - Manpower availability
- Solutions
 - Integrated block planning
 - Block Integration
 - Alternate test resources
 - Staff versatility
 - Earlier error detection *-reducing late phase rework*

Maintaining Process Discipline

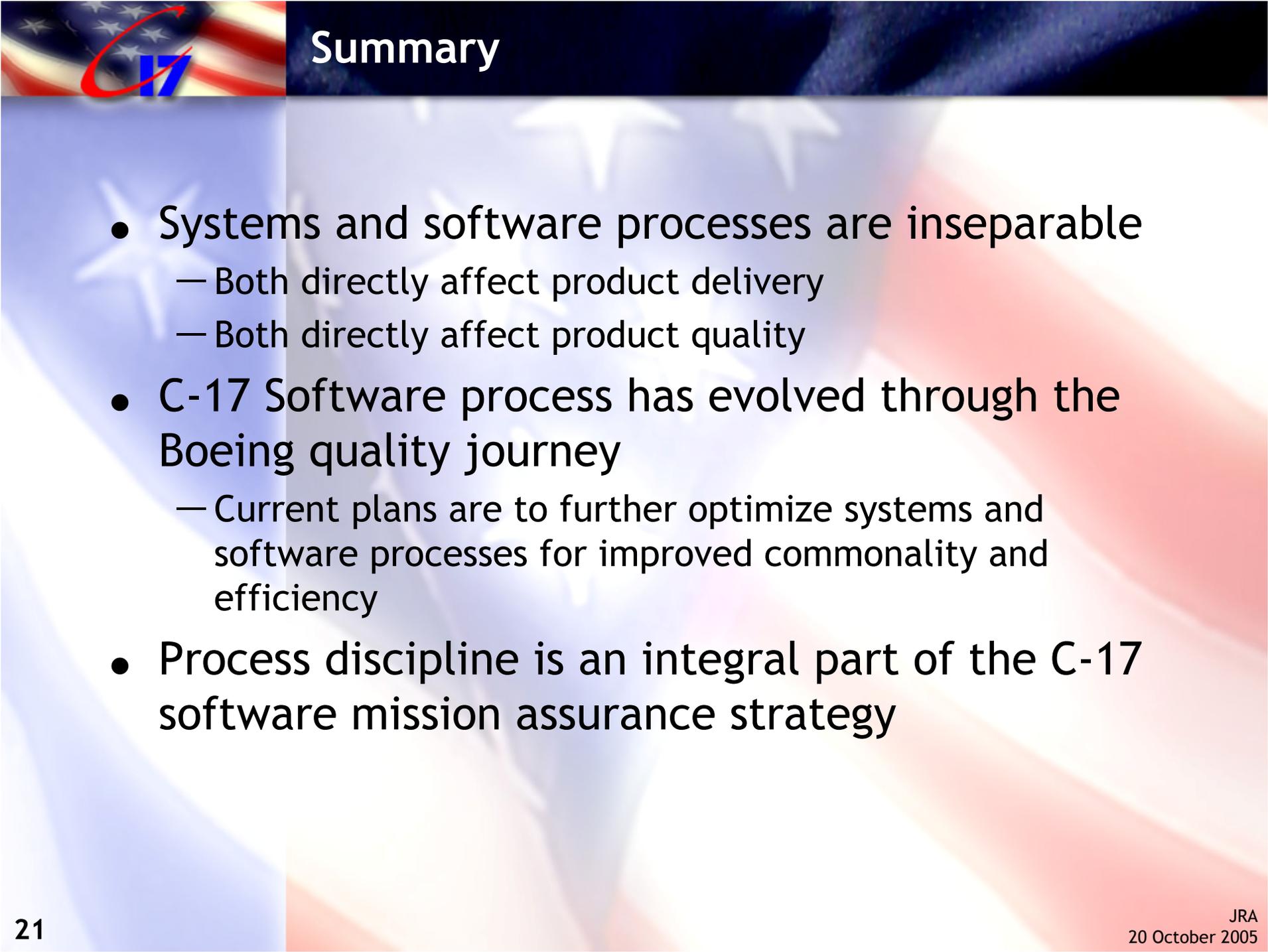


Strategic Process Improvement





Summary



Summary

- Systems and software processes are inseparable
 - Both directly affect product delivery
 - Both directly affect product quality
- C-17 Software process has evolved through the Boeing quality journey
 - Current plans are to further optimize systems and software processes for improved commonality and efficiency
- Process discipline is an integral part of the C-17 software mission assurance strategy