

Commitment: Strategy for Delivering Capabilities

Perspective

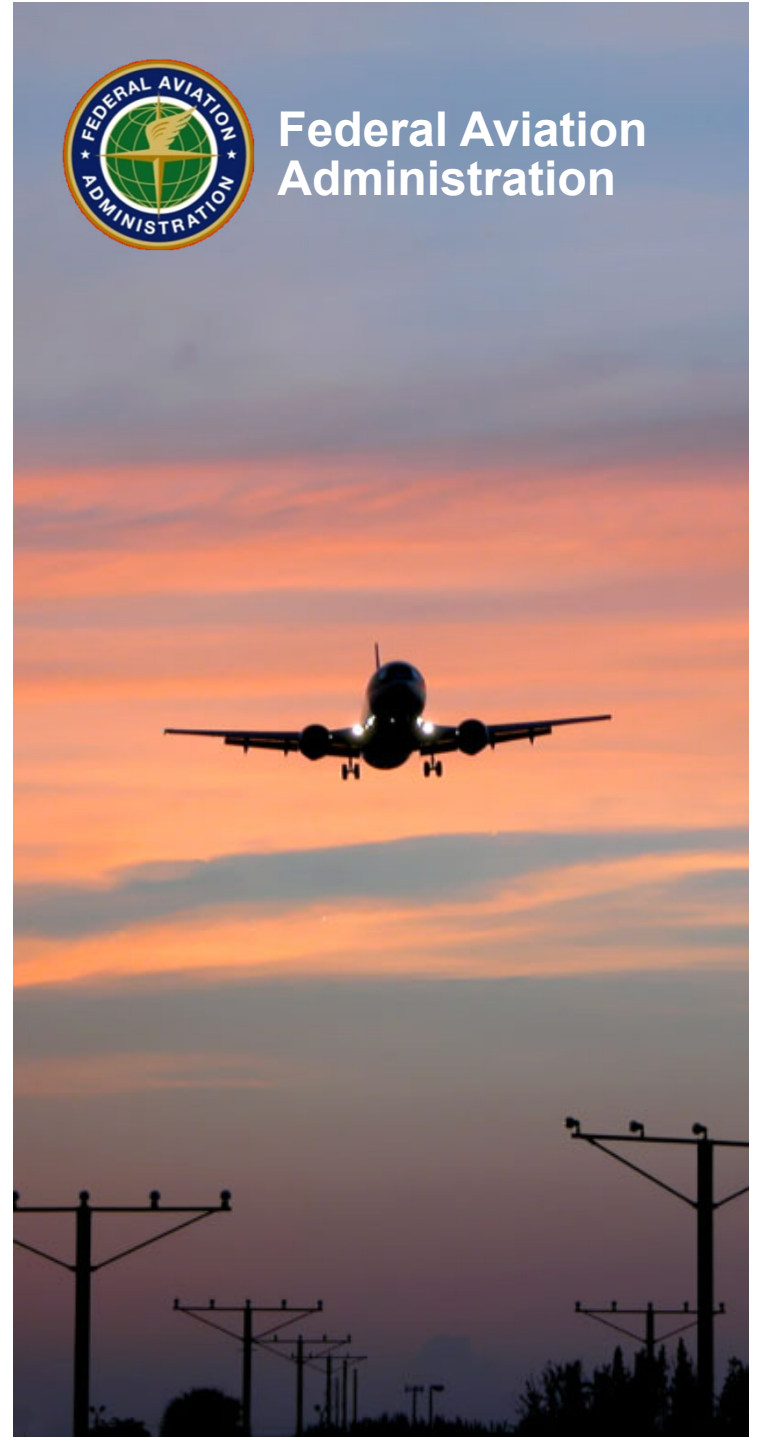
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Federal Aviation
Administration



TOPICS

- **Background**
- **Approach**
- **Understanding the Problem**
- **Solutions: People, Process, and Tools**
- **Implementation**



Approach

- 1. Problem analyze**
 - Understand problem
 - Ishikawa Cause and Effect Problem Analysis
- 2. Leverage improvement initiatives that have already been initiated**
- 3. Define solutions based on the “Golden Triangle” of change**
 - People
 - Processes
 - Tools
- 4. Initiate, manage and track initiatives for each solution area**



Problems and Challenges

1. Technical Complexity

- System-of-systems architecture
- New Operational Concepts
- More stakeholders engaged with the NAS

2. Organizational structures

- Need to be structured to support NextGen advancement and integration
- Need to support crosscutting capability implementation

3. Standards and Practices

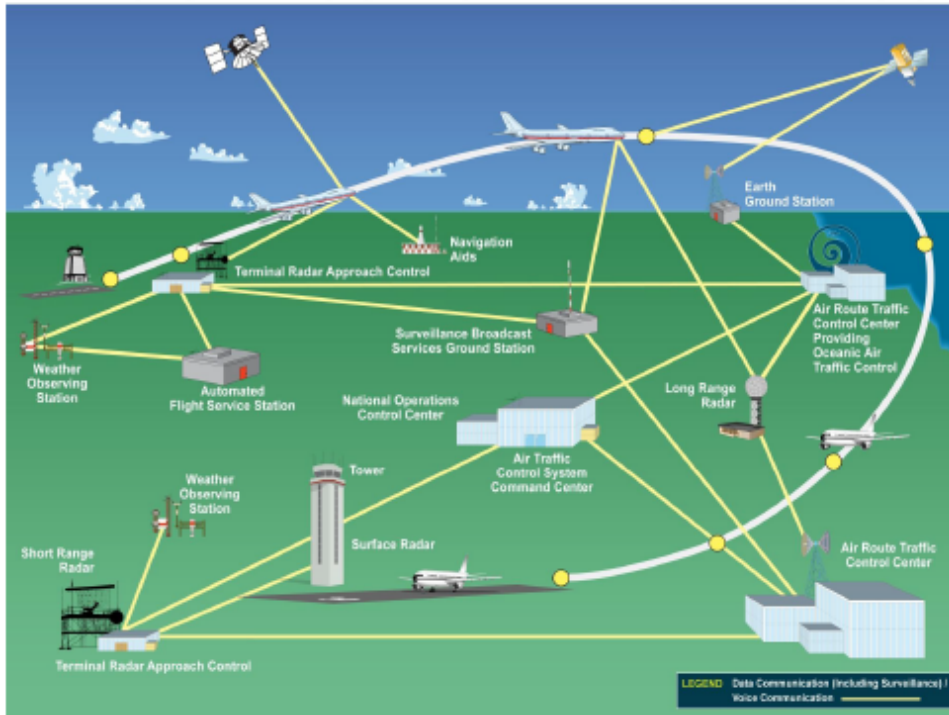
- Segmented practices
- Oriented to the development of individual systems

4. Test capabilities and infrastructures have evolved to support legacy systems and programs

- Independent systems providing FAA services
- Labs, simulators and models focused on independent systems



National Airspace System Near-Term (2011) As-Is Enterprise-Level Architecture High Level Concept Graphic (OV-1)



Current NAS

Future NAS

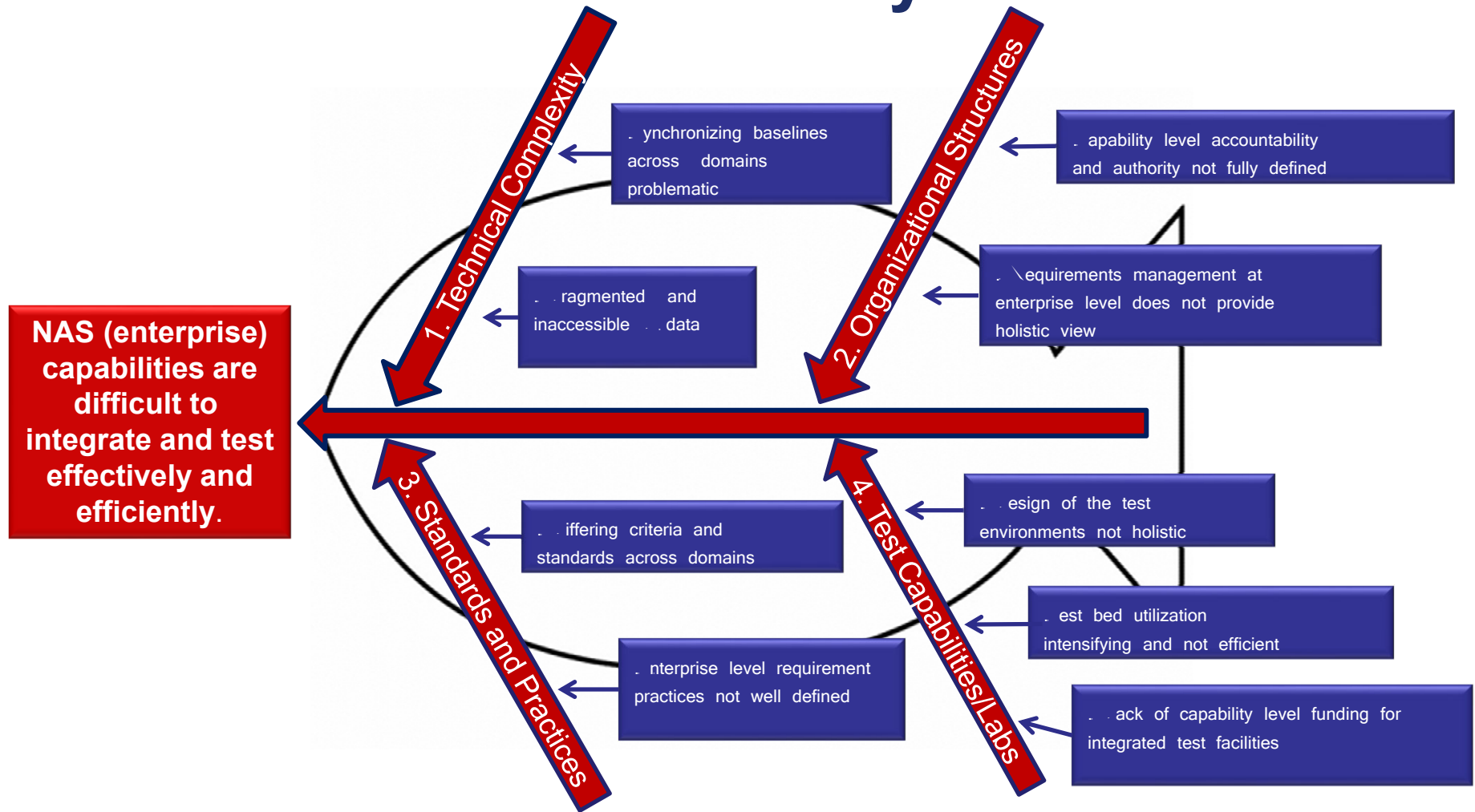


strategy for delivering capabilities

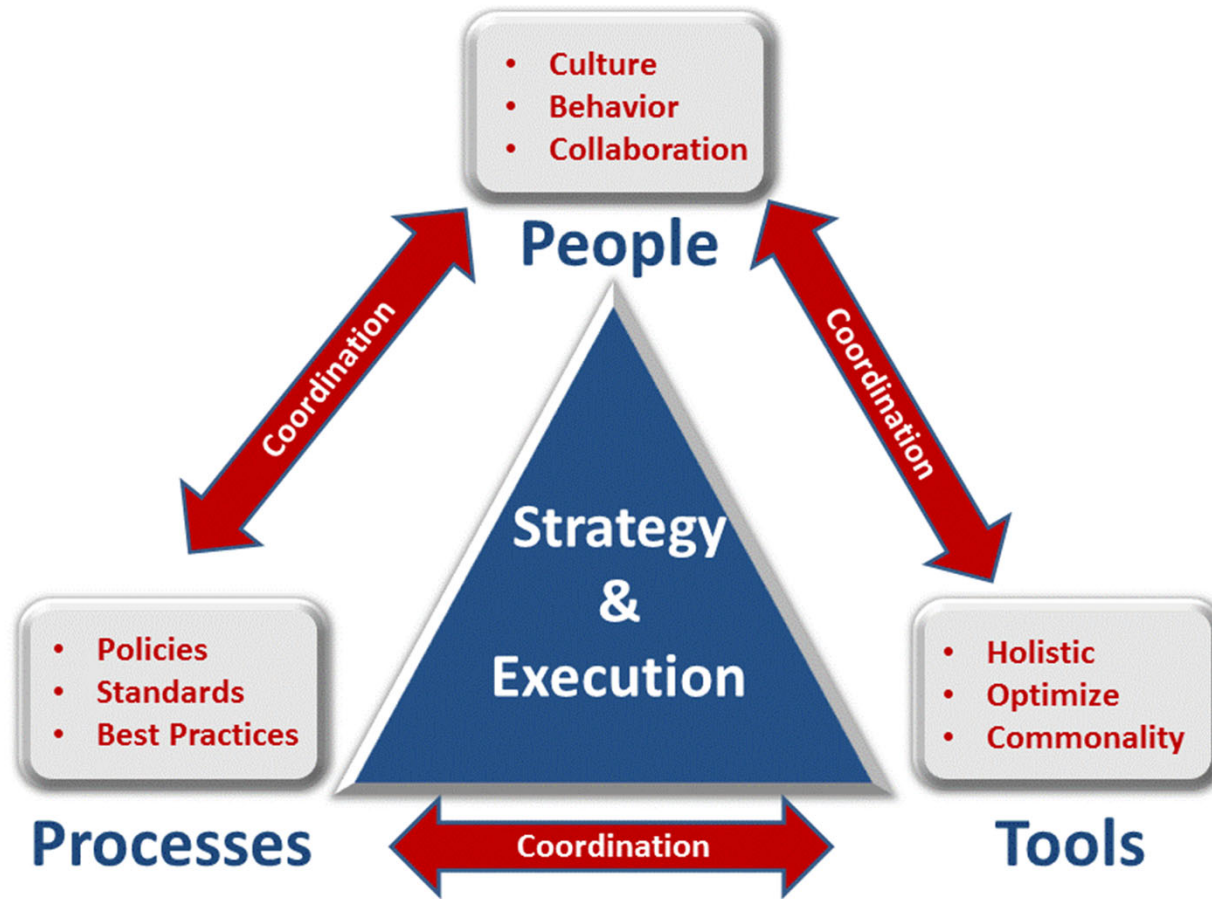


Federal Aviation Administration

Ishikawa Cause and Effect Diagram for Problem Analysis

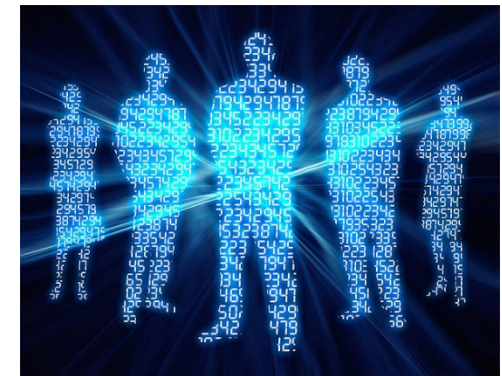


Golden Triangle: Solution Approach

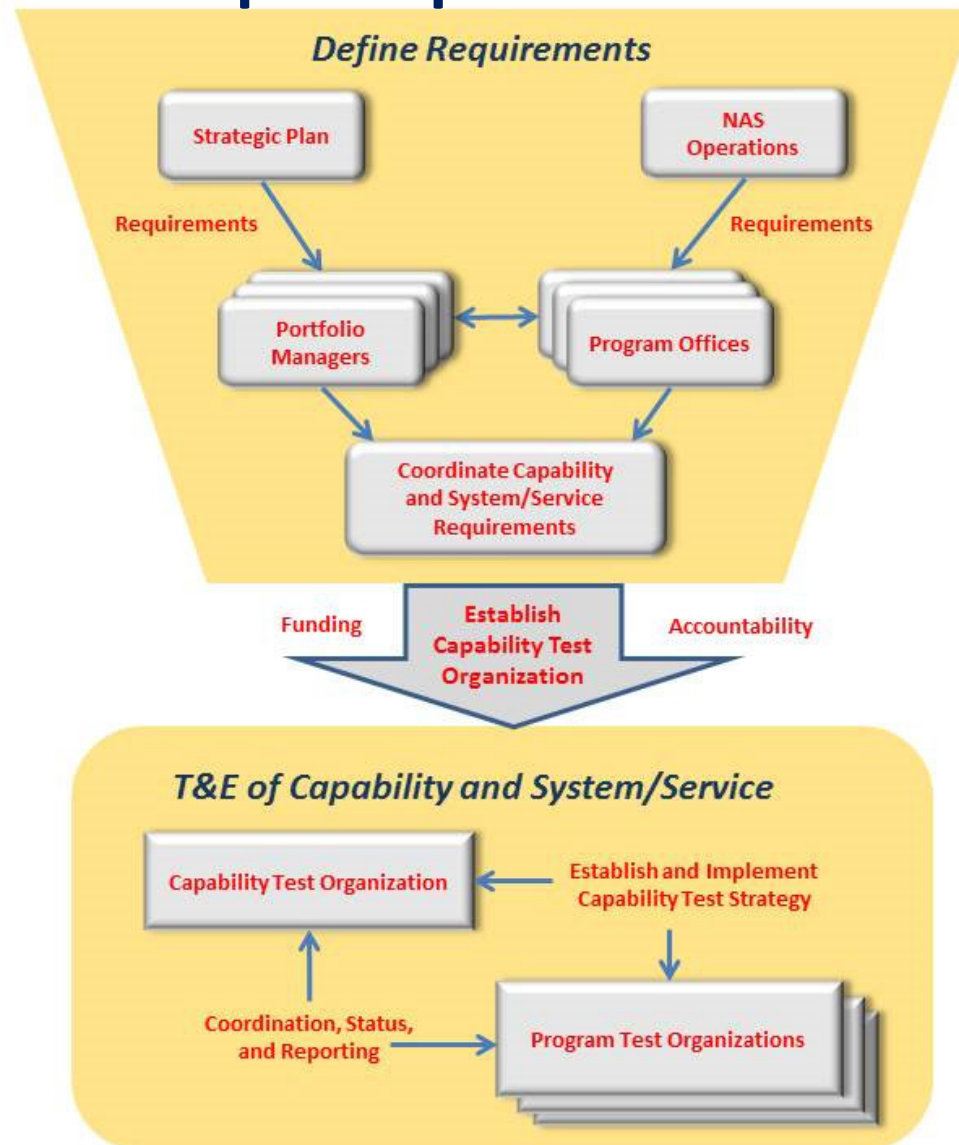


People: Solution Approach

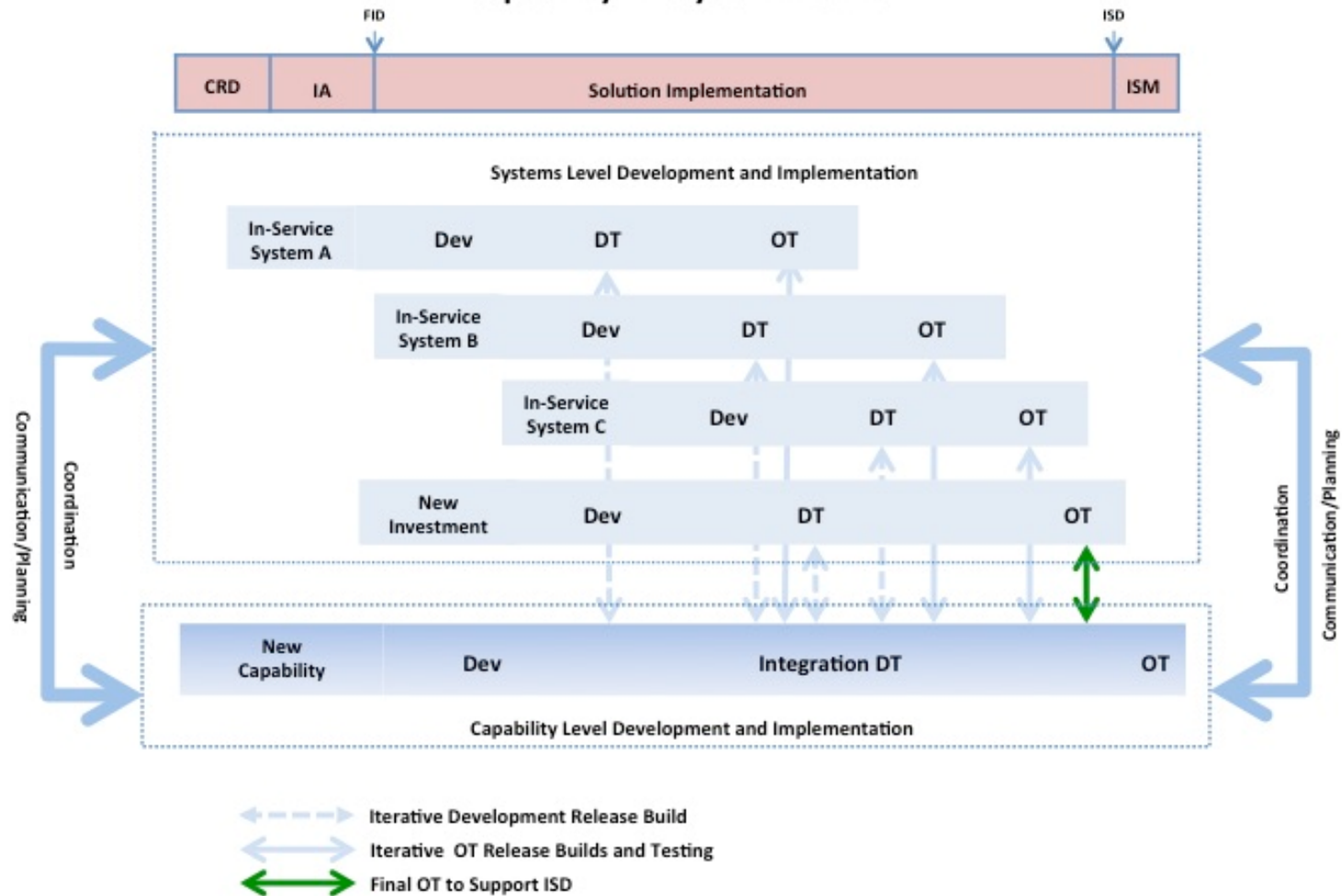
- **Define and establish enterprise integration and test roles for:**
 - **Organizational responsibilities to support capability implementation**
 - **Establish accountability for capability testing in the AMS lifecycle**
 - **Capability level reporting and system independent evaluations**
- **Promote holistic and consistent integration and test approach across the FAA through:**
 - **Accountability and roles**
 - **Organizational missions and management practices**
 - **Communications and interchange**
 - **Training and credentialing**



People Implementation



Capability Lifecycle Timeline



As development completes, iterative testing is conducted and coordinated to ensure system/capability requirements have been properly verified and validated.

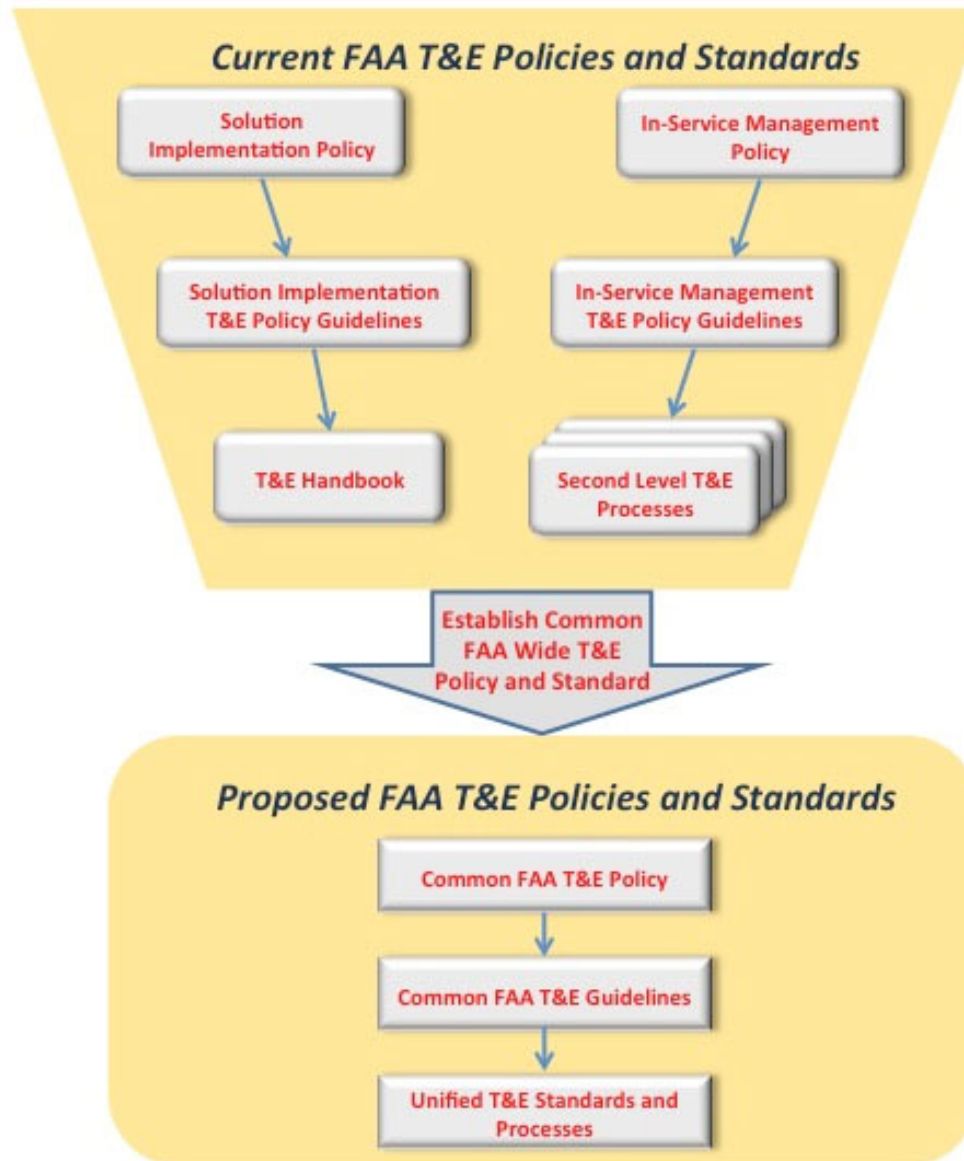


Process: Solution Approach

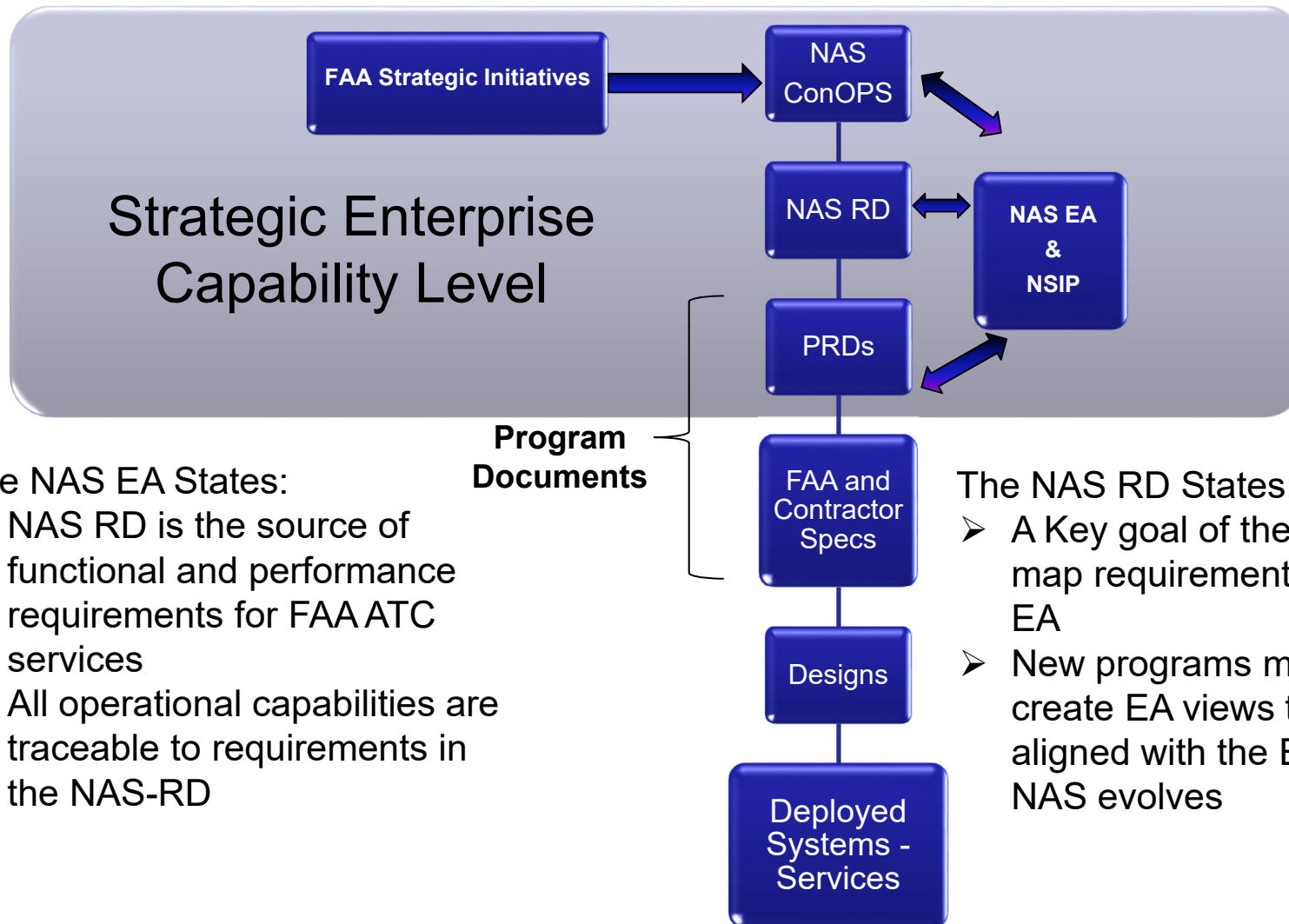
- Establish common FAA wide T&E policies and processes for NAS sustainment and implementation of NextGen capabilities
- Ensure FAA processes link capability and programmatic requirements
- Ensure all requirements trace from the NAS ConOps and Requirements Document through the FAA and contractor specifications
- Define checks and balances that ensure processes are consistently followed
- Ensure the structured V&V of enterprise requirements



Process Implementation



High Level NAS Requirements Flow



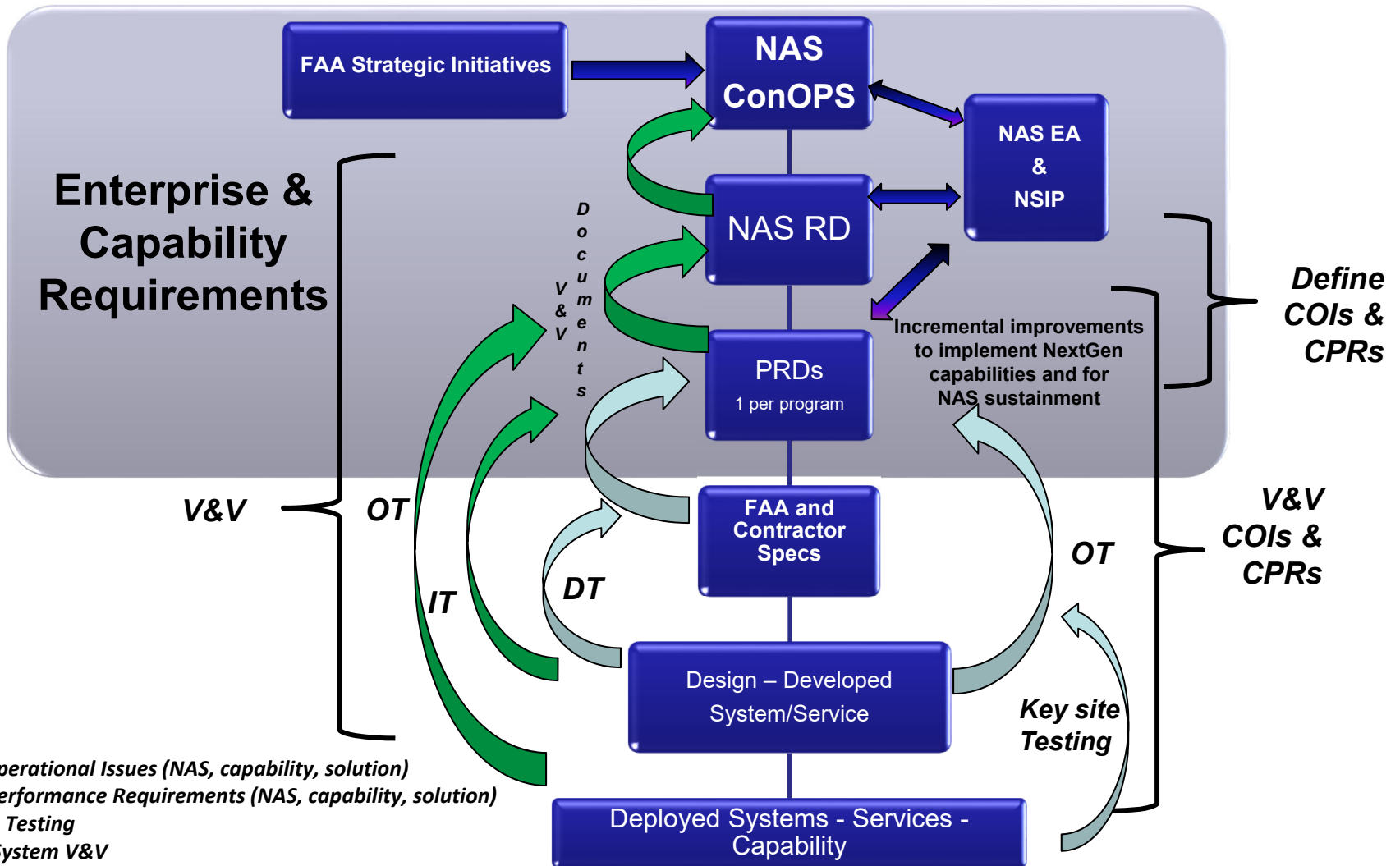
The NAS EA States:

- NAS RD is the source of functional and performance requirements for FAA ATC services
- All operational capabilities are traceable to requirements in the NAS-RD

The NAS RD States:

- A Key goal of the RD is to map requirements to the EA
- New programs must create EA views to stay aligned with the EA as the NAS evolves

V&V of Requirements



COI - Critical Operational Issues (NAS, capability, solution)
 CPR - Critical Performance Requirements (NAS, capability, solution)
 IT - Integration Testing
 Blue Arrows - System V&V
 Green Arrows - Capability V&V



Tools: Solution Approach

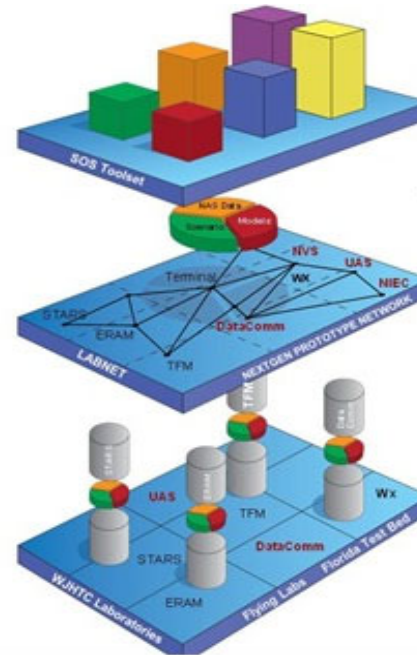
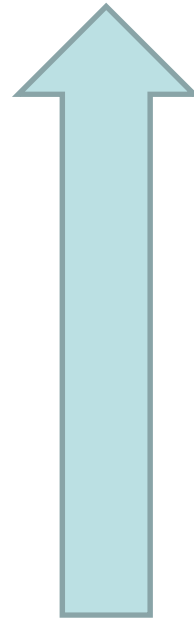
- **Establish a unified laboratory and simulation architecture as part of the NAS**
- **Develop holistic test environment**
- **Use intelligent agent technology to model air traffic controllers, pilots, and command center decisions**
- **Use model based evaluation to supplement lab resources**
- **Establish a funding source to address the unique T&E requirements associated with the introduction of new capabilities**
- **Assess and optimize lab utilization strategy**



Tools Implementation

Enterprise

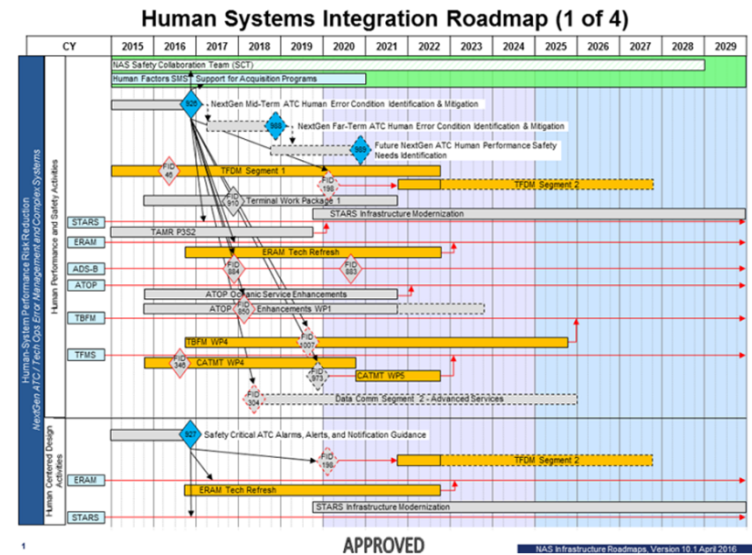
System/Service



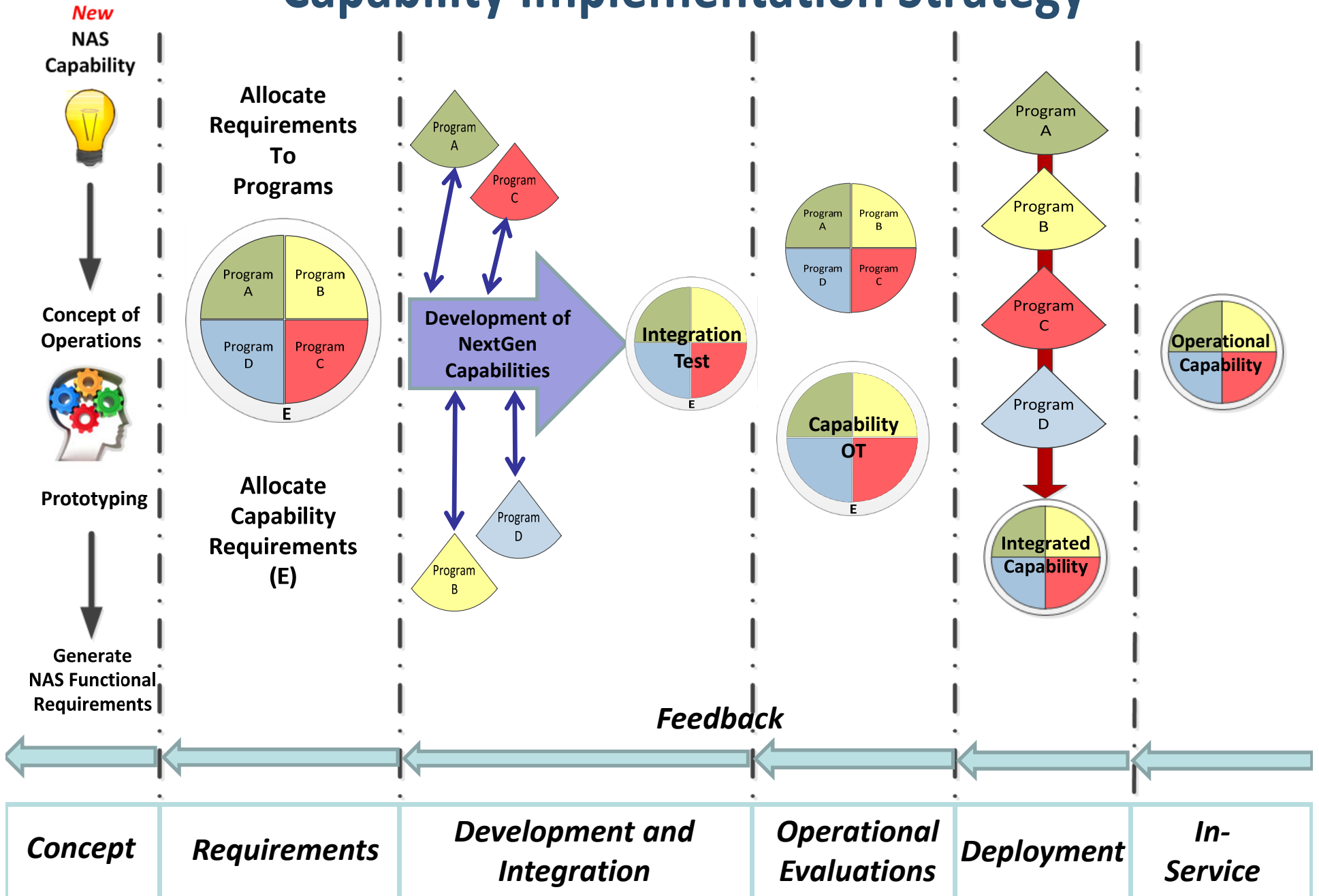
***Integrated NAS Environment Delivering
NextGen Capabilities***

NAS Unified Laboratory and Simulation Architecture (ULSA)


- Integrate the NAS ULSA roadmap into the EA
- Strategically ensure the NAS ULSA supports:
 - ✓ The implementation of future operational improvements across programs
 - ✓ The sustainment of fielded capabilities across systems
- CM the NAS ULSA as an essential element of the operational NAS



Capability Implementation Strategy



Implementation Underway

- 
- **Established an Enterprise Capability Test Team for the Terminal Sequencing and Spacing program**
 - **Integrate Solution Implementation and In-Service Management teams and practices**

- 
- **MOA established with System Engineering to improve requirements**
 - **Manage and plan requirements traceability from investment planning through test reporting**

- 
- **Establishing common policies, framework, and processes**
 - **Facilitate planning and conduct of V&V of capabilities at the system and enterprise levels for new investments and NAS maintenance**

- 
- **Established TEMP requirements for the Initial and Final investment Decisions**
 - **Involve test services early in the program during requirements development and investments planning**

- 
- **Task Order to enhance existing Target Generation Facility simulation capabilities with agent base technology (with current Agentfly software)**
 - **Models air traffic controllers and pilots**

Summary



- **Common organizational view and philosophy are the first hurdles in overcoming these enterprise problems**
- **Standardized best practices and continuous improvement is the road map for quality T&E in the FAA**
- **Quality practices can efficiently move capabilities through the lifecycle**
- **Test beds and tools that can address the enterprise level challenges holistically need to be planned for and instituted**

***Seamless T&E is our goal –
Complex/net centric systems are our challenge***

Back-Up Slides



NextGen 2025 OV-1

INTERNATIONAL HARMONIZATION

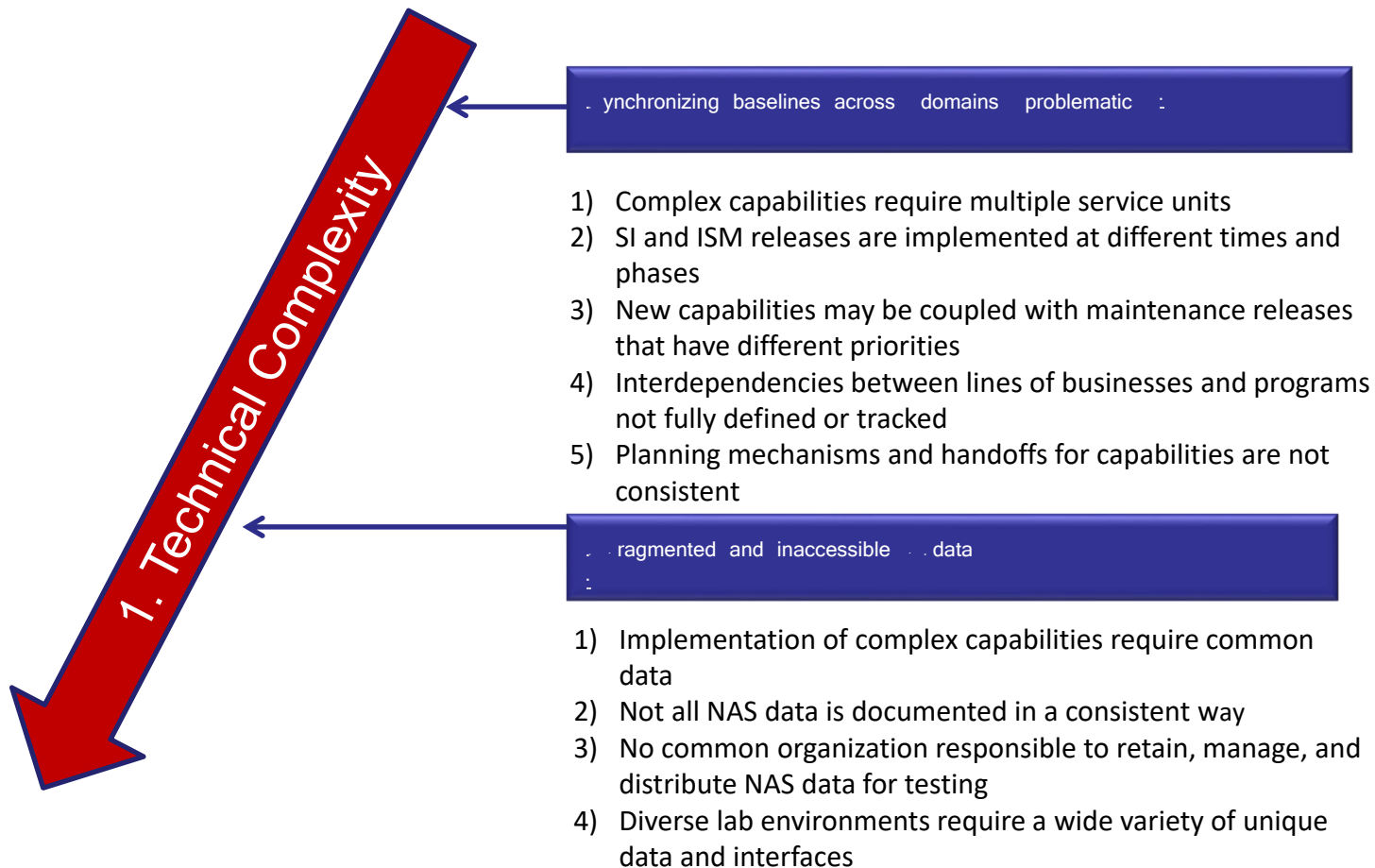


Net Centric Operations

SOA CORE SERVICES				SUPPORT SERVICES		ENTERPRISE GOVERNANCE		ADMINISTRATIVE SERVICES			
Messaging Services	Interface Management	Security Service	Enterprise Services Mgt	Collaboration Services	Data Flow Management	Data Access	Strategic Governance	Run-time Management	Data/Network Support Services	Services Provisioning	Training Support
ENTERPRISE WIDE OPERATIONS (NATIONAL)											
System & Services Analysis	System & Services Management	Safety Management Service	Trajectory Management	Flow Contingency Management	Capacity Management	Flight & State Data Management	Weather Information Management	Aeronautical Information Management	Surveillance Information Management		



Problems Contributing to Root Causes



Problems Contributing to Root Causes

2. Organizational Structures

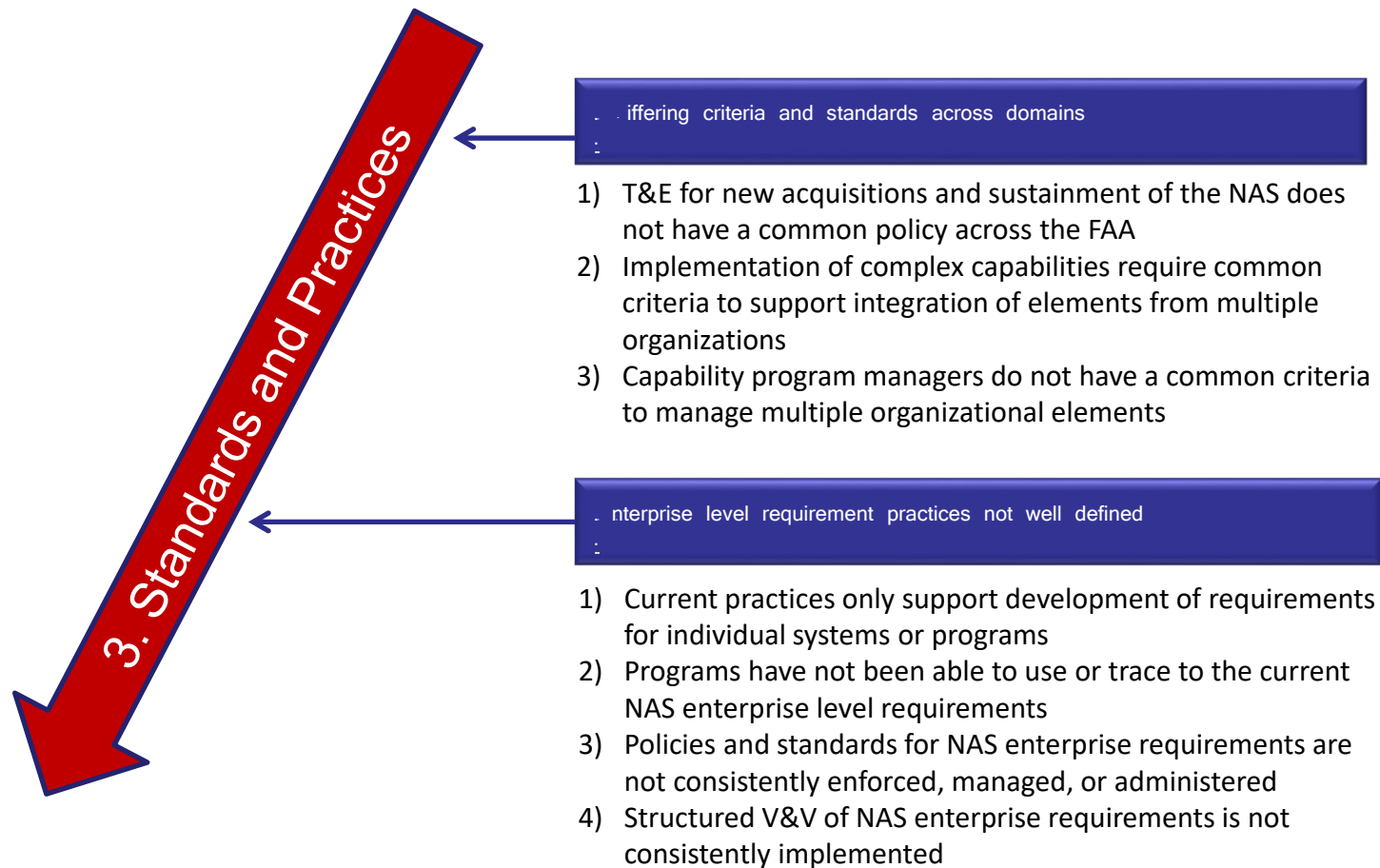
Capability level accountability and authority not fully defined

- 1) Implementation of complex capabilities require well defined roles and authority to manage and test
- 2) Acquisition policies and processes are not fully defined to support capability level roles and accountabilities
- 3) T&E organizational roles and funding are not established for capability implementation
- 4) Responsibilities for independent checks and balances are not established for capability implementation

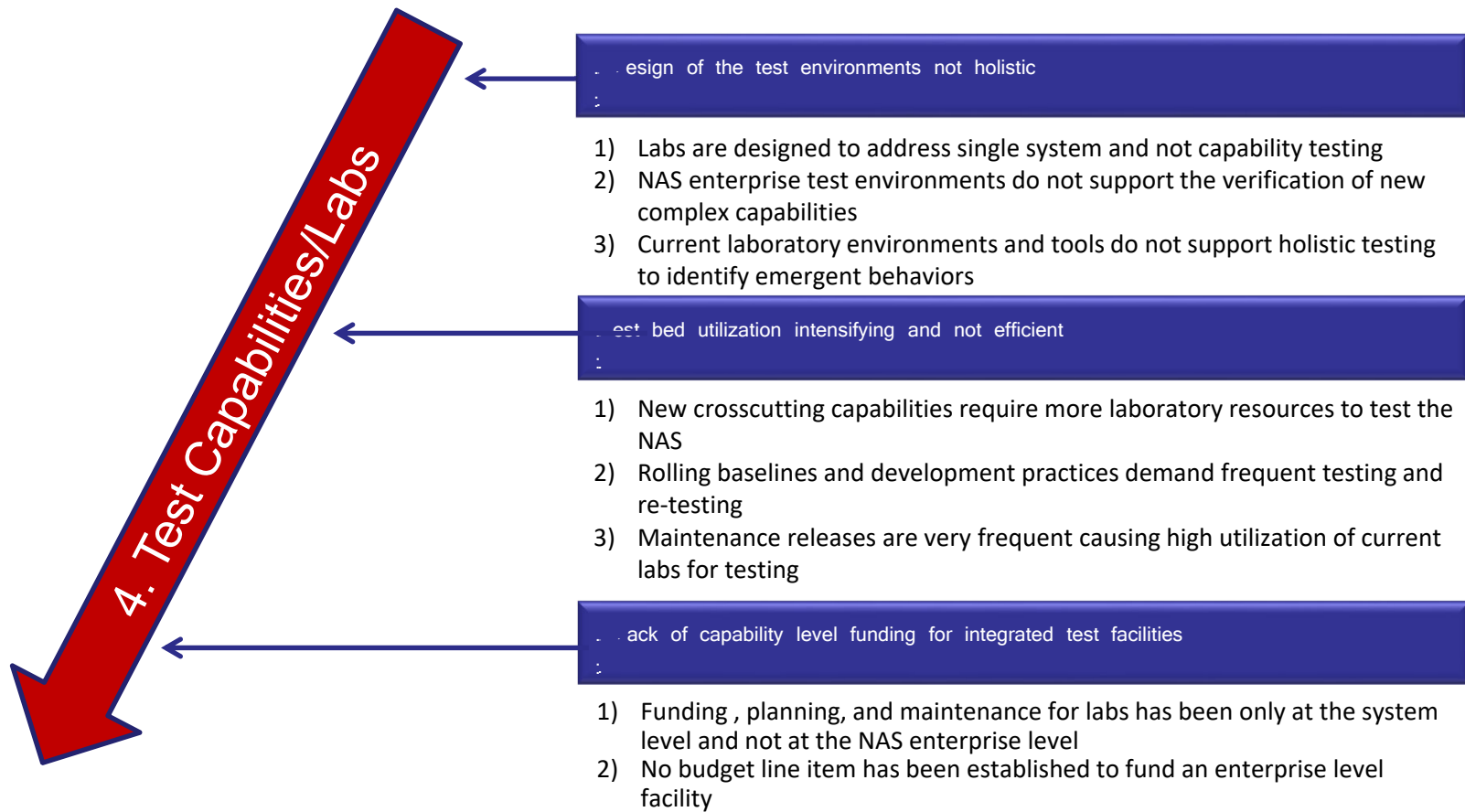
Requirements management at enterprise level does not provide holistic view

- 1) Current lab environments are not managed to support enterprise level requirements
- 2) Current NAS requirements are primarily defined at the system level and do not address the complex NextGen capabilities
- 3) Currently programs do not trace to the NAS level requirements

Problems Contributing to Root Causes



Problems Contributing to Root Causes



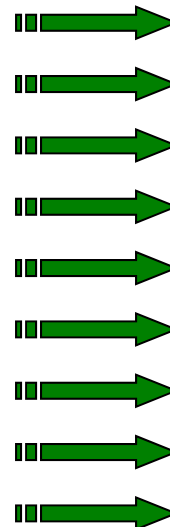
NextGen: Improving Efficiency & Capacity

Today's NAS

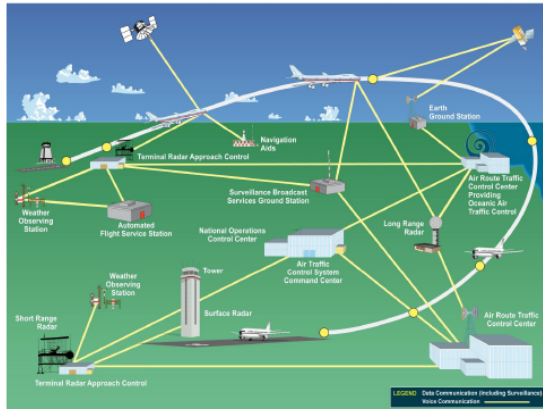
- Ground-based Navigation and Surveillance
- Air Traffic Control Communications By Voice
- Disconnected Information Systems
- Air Traffic "Control"
- Fragmented Weather Forecasting
- Airport Operations Limited By Visibility Conditions
- Forensic Safety Systems
- Inefficient Security Screening
- Current Aircraft Environmental Footprint

NextGen

- Satellite-based Navigation and Surveillance
- Routine Information Sent Digitally
- Information More Readily Accessible
- Air Traffic "Management"
- Forecasts Embedded into Decisions
- Operations Continue Into Lower Visibility Conditions
- Prognostic Safety Systems
- Integrated security Risk Management
- Reduced Aircraft Environmental Footprint



National Airspace System Near-Term (2011) As-Is Enterprise-Level Architecture High Level Concept Graphic (OV-1)



The transition to NextGen has already begun.



Improving the Quality of Test



- **Verification and Validation (V&V) approach with a focus on quality Test and Evaluation (T&E)**
- **Adopted V&V goals defined in CMMI**

Verification: ***Build the system right***

- Ensures work products and products meet specified requirements

Validation: ***Build the right system***

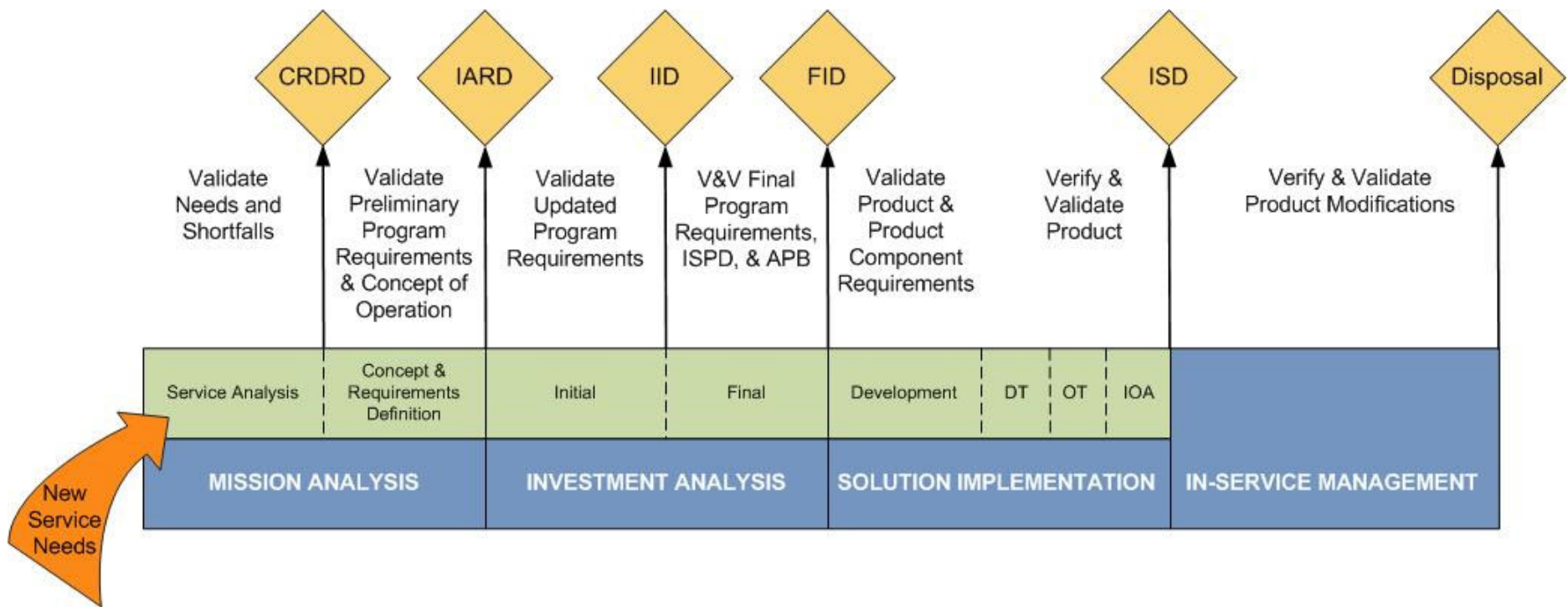
- Demonstrates that products and product components will fulfill their intended purpose when placed in the intended environment

V&V: ***Build an effective system efficiently***

- Focuses on problem prevention, detection, and resolution as early in the lifecycle as possible
- Provide basis for T&E quality standard practices

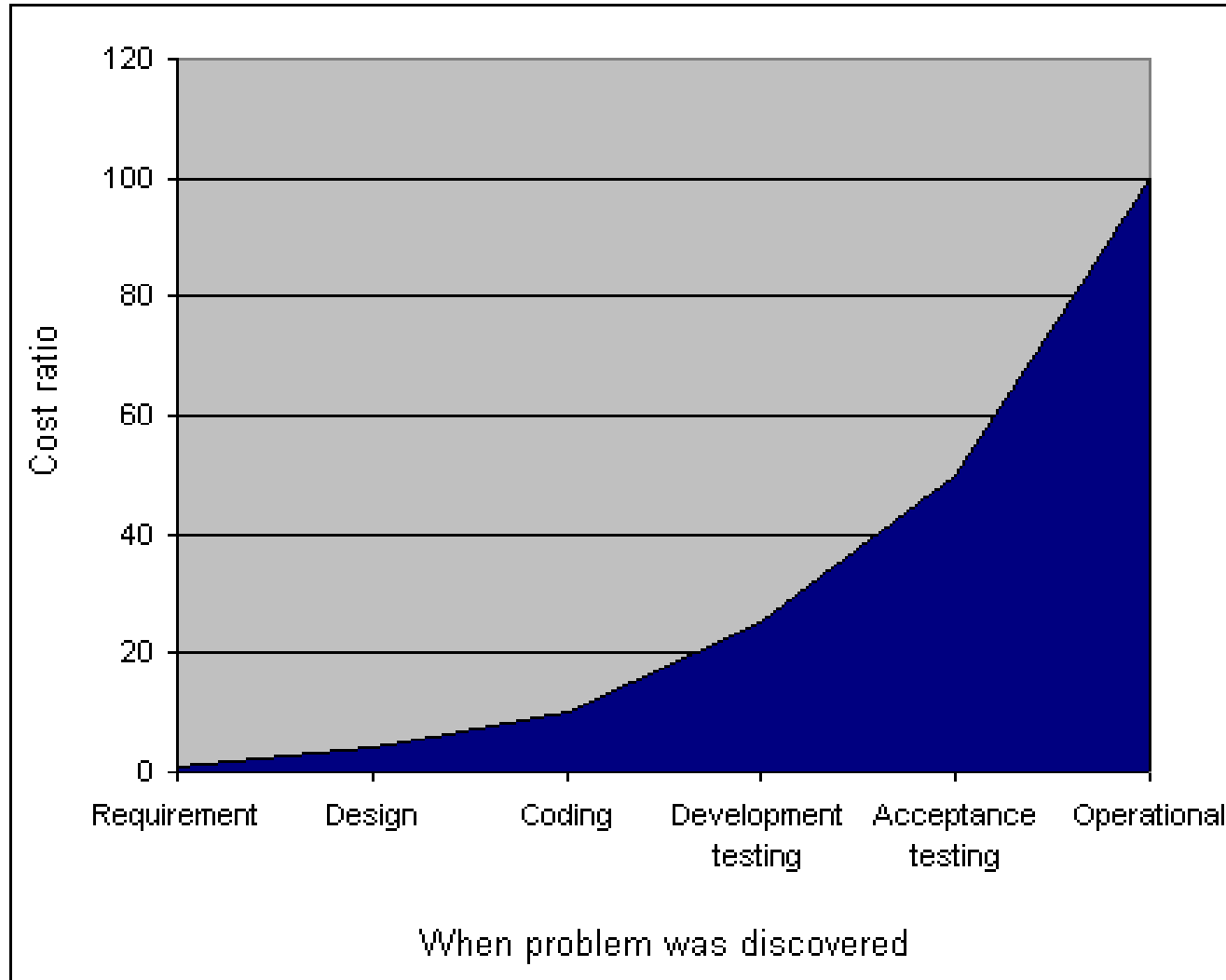
Based on the same CMMI® model used for GAO audits

V&V Across the FAA Acquisition Lifecycle

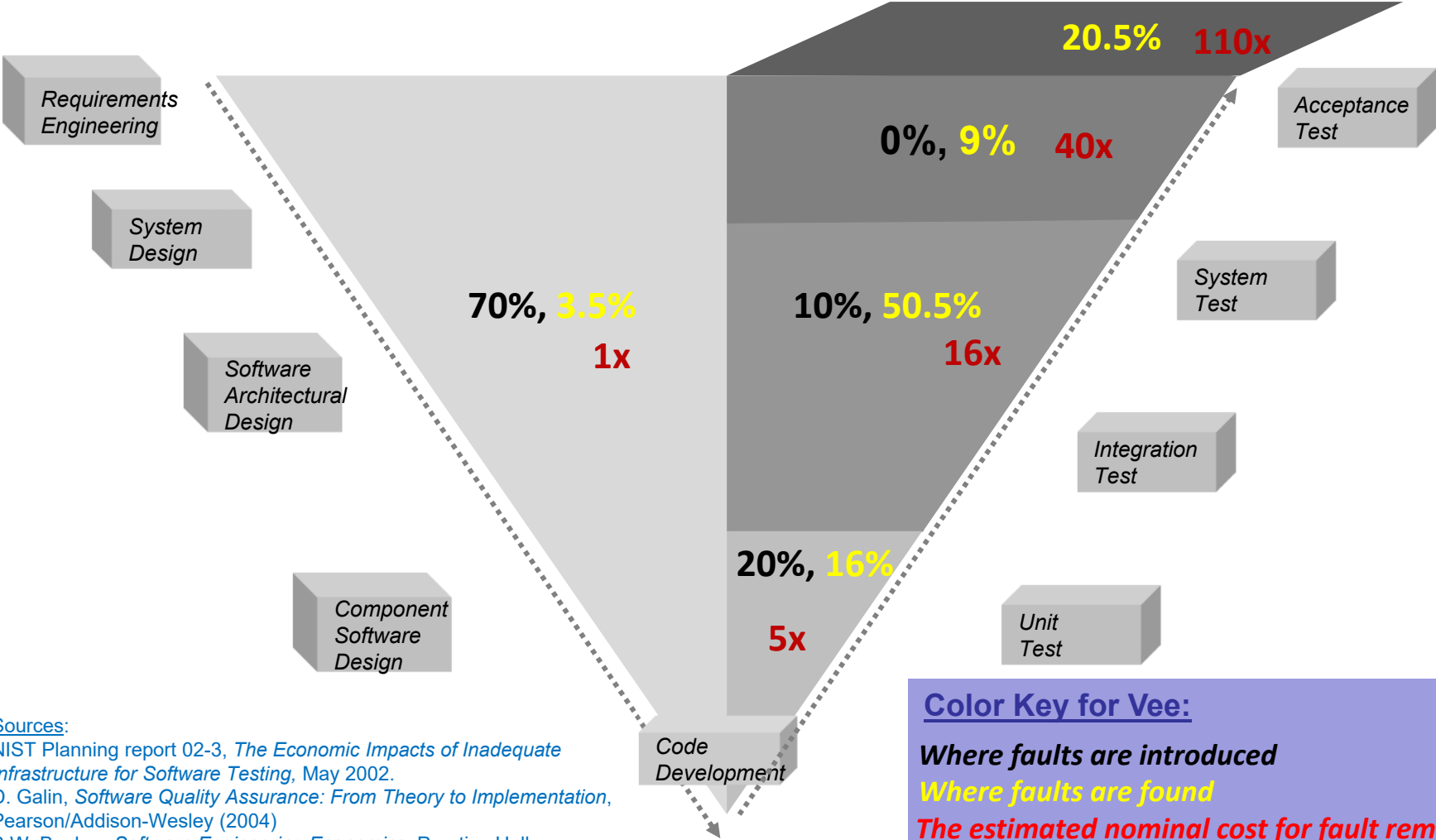


CRDRD - Concept and Requirements Definition Readiness Decision
 IARD - Investment Analysis Readiness Decision
 IID - Initial Investment Decision
 FID - Final Investment Decision
 ISD - In-Service Decision

Relative Cost to Fix



Cost Avoidance Data for V&V



Sources:
 NIST Planning report 02-3, *The Economic Impacts of Inadequate Infrastructure for Software Testing*, May 2002.
 D. Galin, *Software Quality Assurance: From Theory to Implementation*, Pearson/Addison-Wesley (2004)
 B.W. Boehm, *Software Engineering Economics*, Prentice Hall

