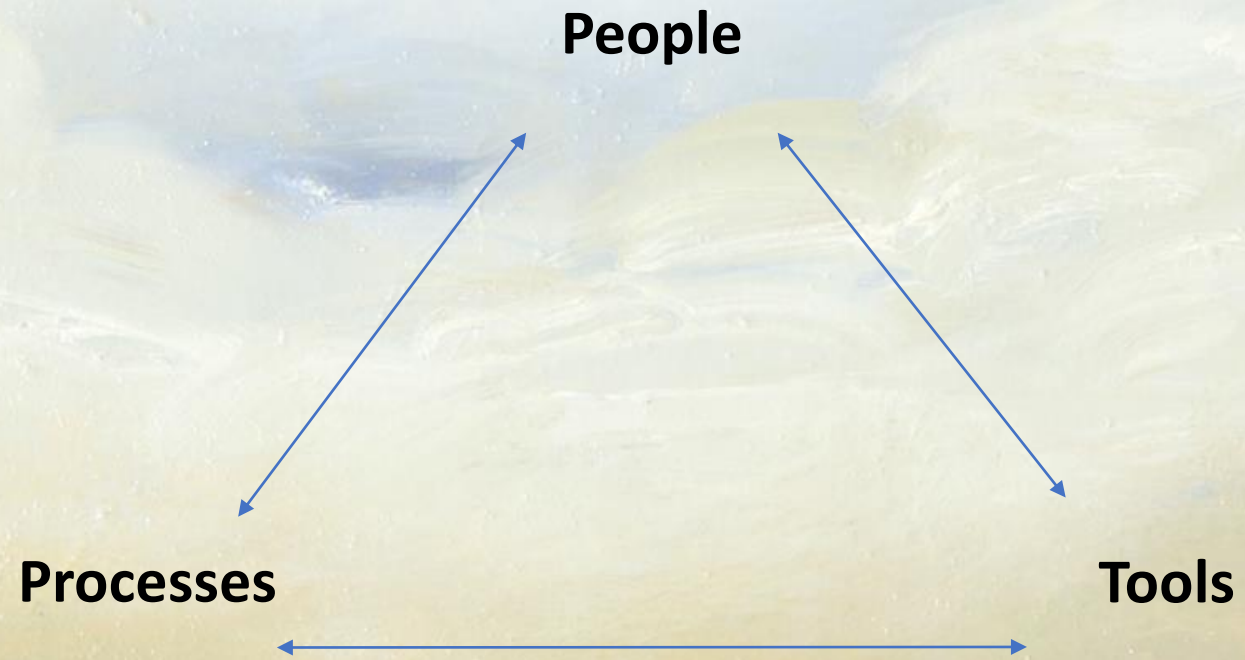National Aeronautics
and Space Administration

Operational Concepts, Architecture, and Requirements Integration
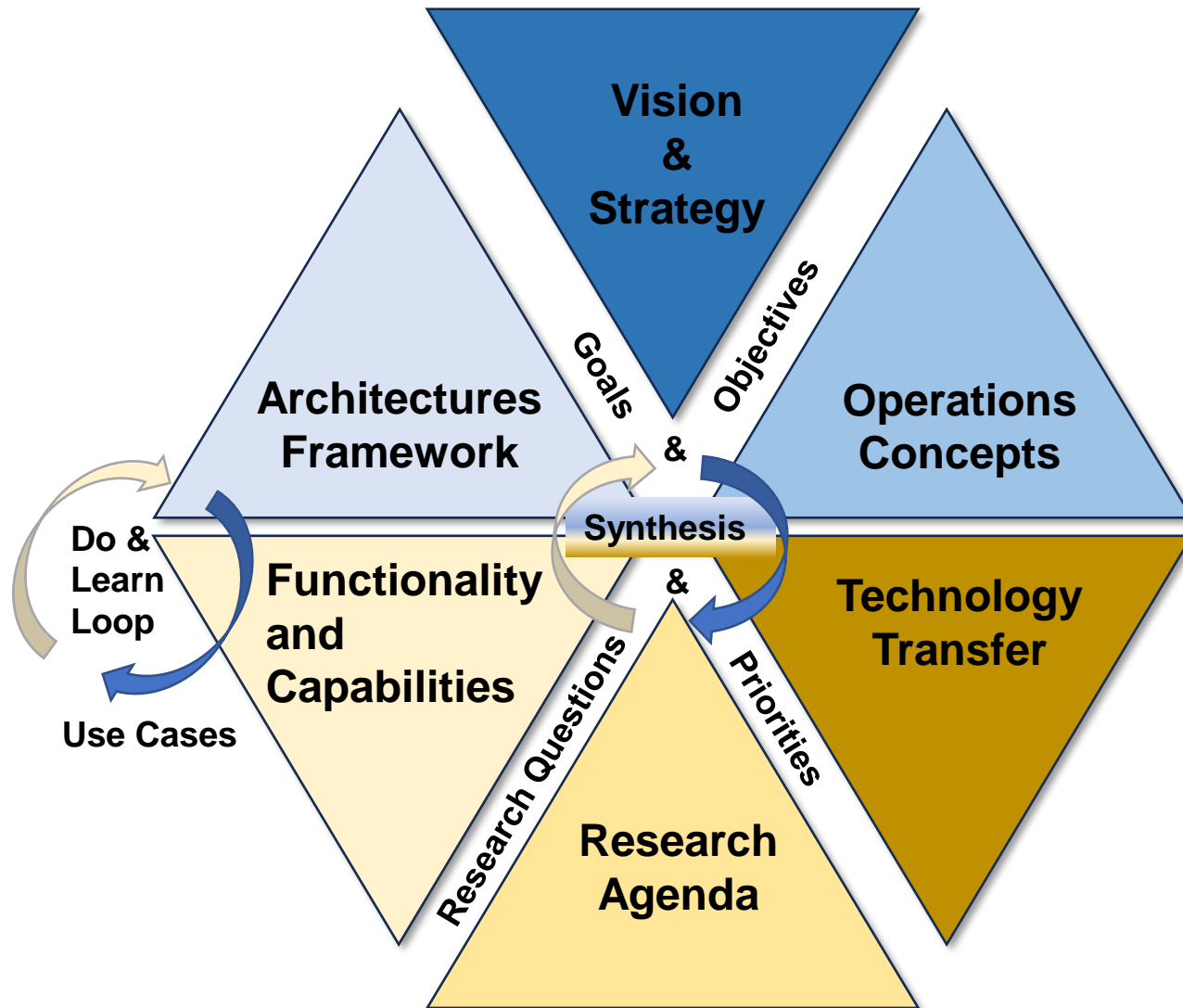
Ian Levitt
19th Annual V&V Summit

May 8, 2024

Integration Principle

People

Processes

Tools

ARMD Advanced Air Mobility Mission Integration Office Strategy

Vision & Strategy:
Enable a safe, air transportation system for emerging aviation markets and innovation to achieve sustainability, greater mobility, and economic growth on path to NAS 2040 and Sky for All

Operations Concepts*:
Co-develop, model, and evolve Operations Concepts with the FAA and stakeholders

Architectures Framework:
Develop high-level unifying structure, MBSE-based process for integration, interoperability and traceability of AAM ecosystem(s) reference data

Functionality & Capabilities:
Derive and define structures and behaviors needed for system feasibility, readiness and interoperability

Research Agenda:
Develop R&D portfolio view, research goals and objectives, priorities, identify gaps, duplication and synergy. Propose validation tech accelerators – simulation models, ground and flight operations demonstrators
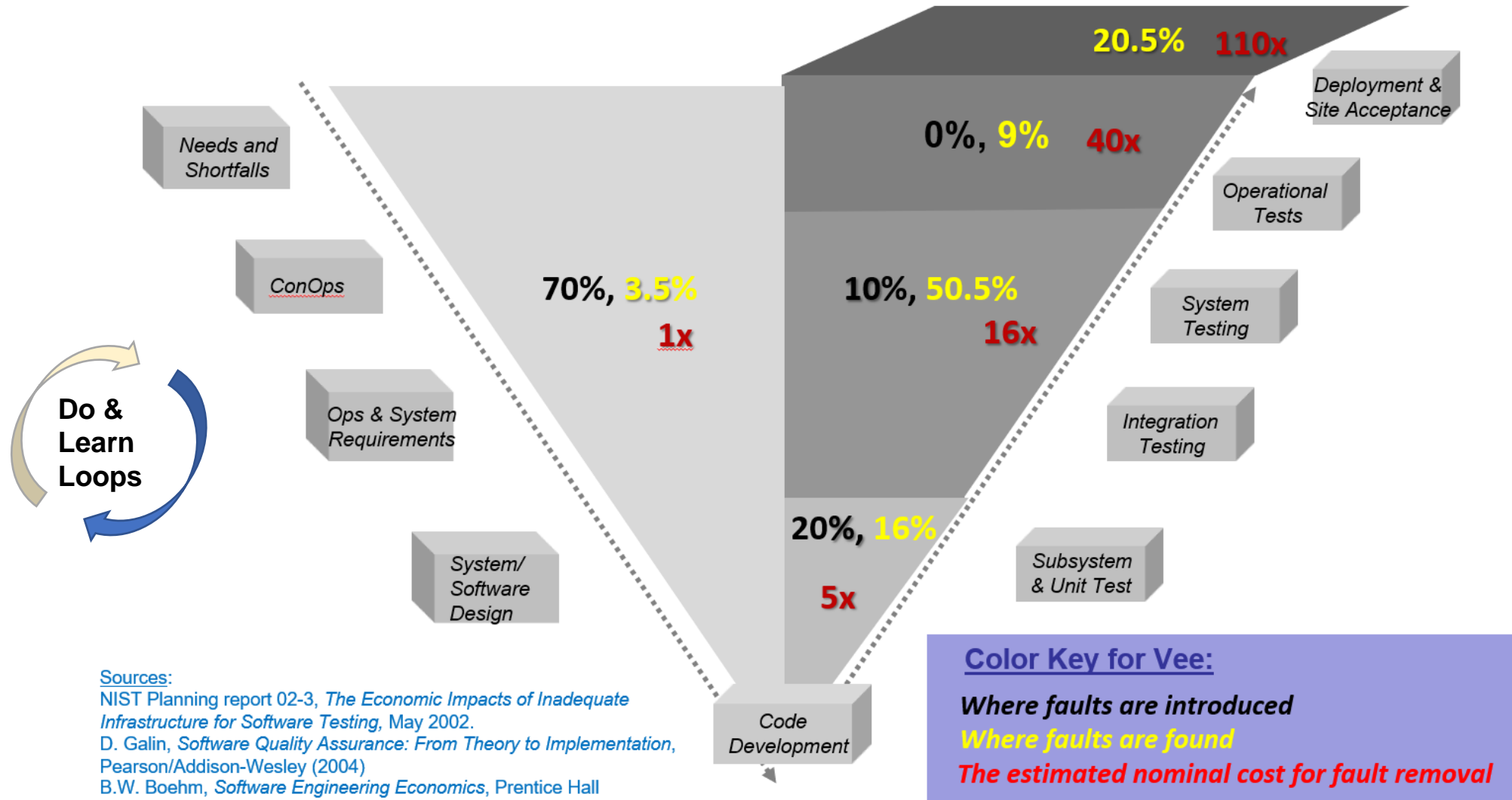
Technology Transfer:
Collaborate on technology transfer/partnering strategy to integrate research outcomes, monitor progress and risk management, including global standards

* System-centric descriptions of the intended users, uses, how the system is intended to be used, and the external conditions expected during use of the system.
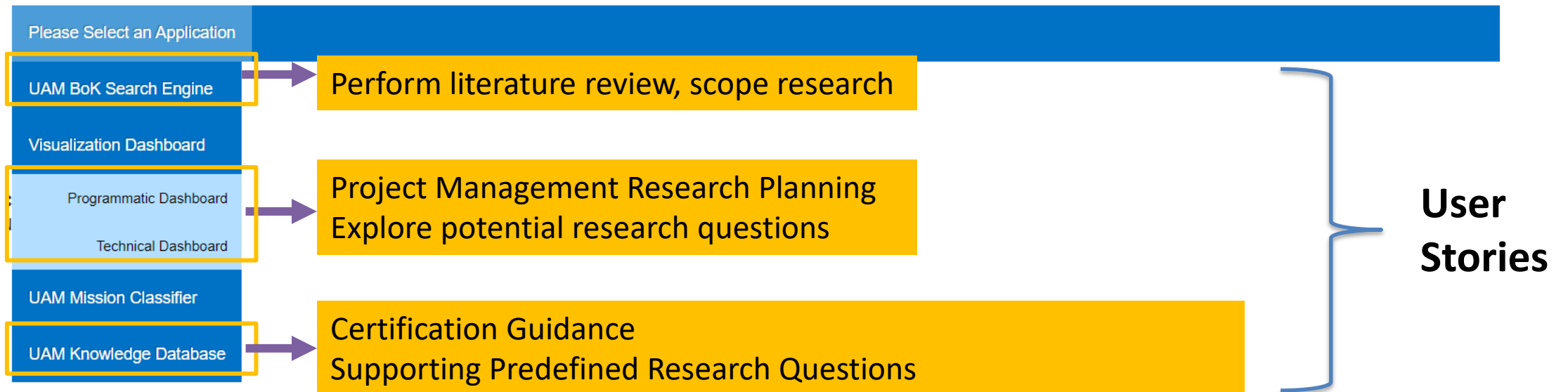
Why

Early Prototype Web-service

Prototype web-service: UAM Knowledge Database (nasa.gov)

Knowledge Database for UAM Research

Please Select an Application

| UAM BoK Search Engine → | Perform literature review, scope research |

| Programmatic Dashboard | |
| Technical Dashboard → | Project Management Research Planning
Explore potential research questions |

| UAM Knowledge Database → | Certification Guidance
Supporting Predefined Research Questions |

User Stories

Digital Engineering and Innovation

The roadmap model captures a highly complex interdependencies among individual elements far beyond the subject-matter-expert's ability to extract insights for project's portfolio assessment.
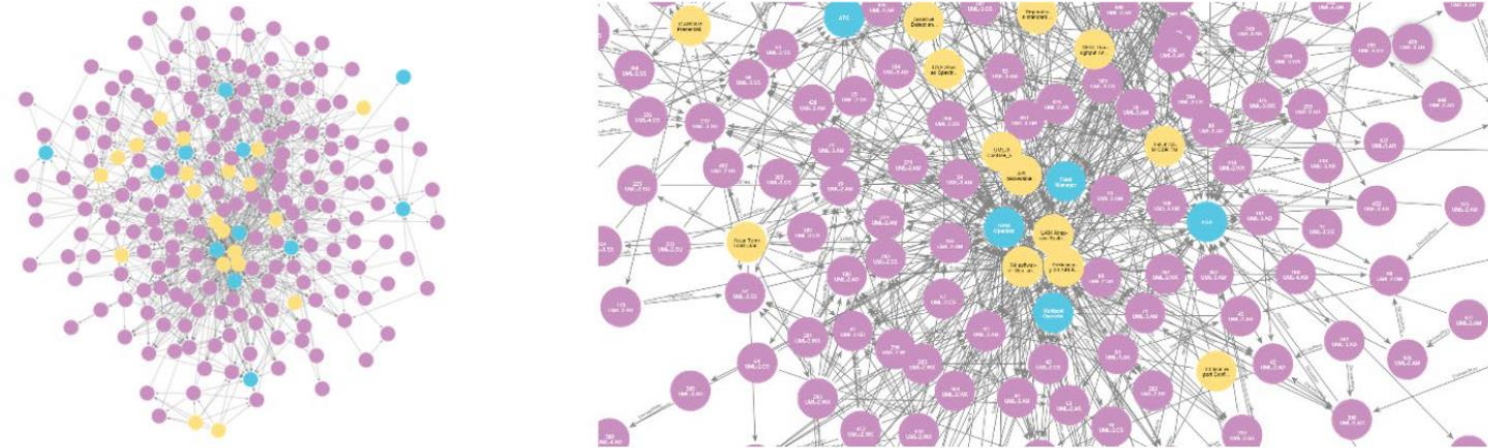

Fig. 1 Partial UAM Knowledge Graph Structure relevant to this study where purple nodes are requirements, blue nodes are system actors, and yellow nodes are project's deliverables (the left figure for the bird-eye view and the right for the zoom-in view)
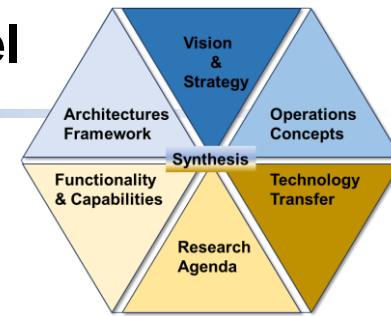
https://www.youtube.com/watch?v=FeyRp8rW4F0

BACKUP

# AAM Architecture Systems of Systems Engineering approach: Mental Model

Reference Architectures
Source of Authority– architecture evolves with approved validated revisions.
Allocation of functionality is minimal to promote future cooperative operations.
• Behaviors (Functionality, Functional Requirements, Use Cases)
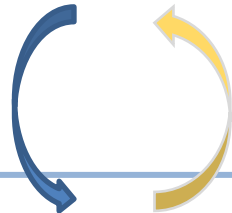• Non-Functional Requirements

Barriers, Needs
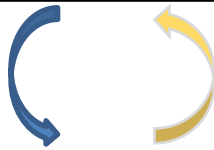
Architecture proposed evolution for trade study / analysis

Candidate Solutions Architectures
(under defined characteristics/dimensions, an instantiation of reference)
• Capabilities
• Behavior realization

Capability Needs, Validation Needs

*Validated Capabilities solutions
Validated Requirements
Validation of architecture
Recommended Standards*

Project Organizational Traceability (Development "Business" Flow)
• Deliverables and Process for delivering for ARMD mission
• Model Based System Eng Process to engineer MBSE project – project management
• Captures how supporting project activities mature the architecture
• Defines how the project is meeting ALL the integrated deliverables
• Defines how test data will be used
• Provides Progress indicators
• Manages Risk

Test architecture (in relevant environment)
• Defines physical architecture under test
• Achieves Test Goals and Objectives (including Architecture Needs)
• Test can also identify new unknown Needs
• Delivers Test deliverables and data
• Demonstrates possible capability/solutions - Technology, Innovation