# Achieving MOSA Benefits
# A Decision Framework For Choosing MOSA Metrics

## What Questions Should We Be Asking?

**"Change begins with inquiry, and Leading with Questions jump-starts the process with its practical approach for leaders who want to develop and ask questions that provoke reflection, get meaningful information, and initiate action."**

Leading with Questions: How Leaders Find the Right Solutions By Knowing What To Ask, Michael Marquardt


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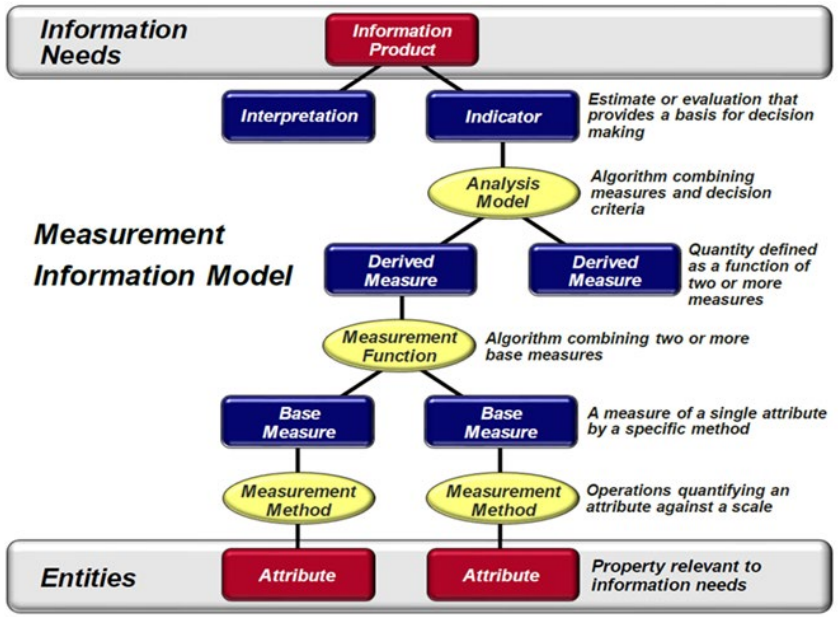
Version 25, 23 Oct 22

# How Can We Define MOSA Success?

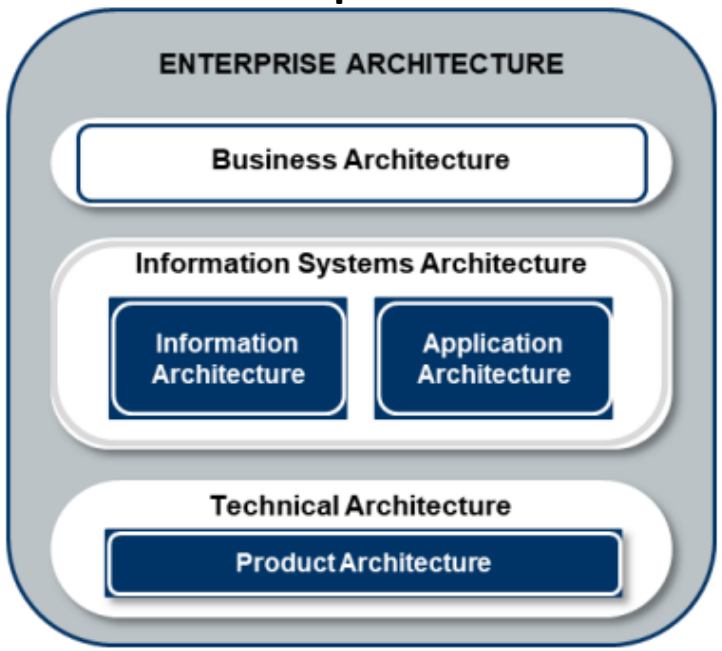
Practical Software and Systems Measurement Continuous Iterative Development Measurement Framework, V 2.1

## MOSA Metrics




MOSA Reference Frameworks in Defense Acquisition Programs, May 2020

## MOSA Implementation




Decision/ Knowledge Management

Project Assessment and Control

Measurement

Project Planning

## MOSA Objectives and Enablers

Continuous Competition
Reference Architectures
Mission Integration
Interoperability
Cost Savings
Product Life cycle
Operational Flexibility
Commonality
Rapid Tech Refresh
CM
Profit
ROI
Open Standards
Interfaces
Integration
Enabling Environment
Revenue Growth
Standards Conformance
Modular Design
Affordability
Reuse
Supply Chain

# DoD Modular Open System Approach Ecosystem

## What are the Different Stakeholders Views of MOSA Success?

Policy and Guidance Effectiveness and Achievement of MOSA Benefits

MOSA Strategy to Achieve Desired Benefits - Cost, Schedule, Performance, Speed of Change and MOSA Enabling Environment Process Controls

Availability of Staffing Resources and Skills to Support Effective Requirements Development and Planning


Modular Design - MBSE, Resilient Architecture, Open Standards, Design Interfaces, Modularity, Integration, Verification, Product Line Engineering and Interoperability

Statutory, Policy, Standards Conformance, High Quality, and Configuration Management

Continuous Competition, Contract Performance, and MOSA Enabled Supply Chain

DoD and Commercial Contract Opportunities, Revenue Growth, Profit, and Return on Investments

Adapted: Under Secretary of Defense for Research and Engineering, Modular Open System Approach

# How Do We Achieve MOSA Success?

## MOSA Enablers

**Mature Systems Engineering**

- Acquisition and Supply Processes
- Organizational Project Enabling Processes
- Technical Management Processes
- Technical Processes

Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition

**Digital Engineering Environment**
**"Authoritative Source of Truth"**

Establish Enabling Environment

Employ Modular Designs

Designate Key Interfaces
Use Open Standards
Certify Conformance

**Mission Integration Management**

## DoD MOSA Benefits

**Enhance competition** open architecture with severable modules, allowing components to be openly competed

**Enable cost savings/cost avoidance reuse of technology**, modules, and/or components from any supplier across the acquisition life cycle

**Facilitate technology refresh** delivery of new capabilities or replacement technology without changing all components in the entire system

**Incorporate innovation operational flexibility** to configure and reconfigure available assets to meet rapidly changing operational requirements.

**Improve interoperability** allow severable software and hardware modules to be changed independently

Adapted: Under Secretary of Defense for Research and Engineering, Modular Open System Approach

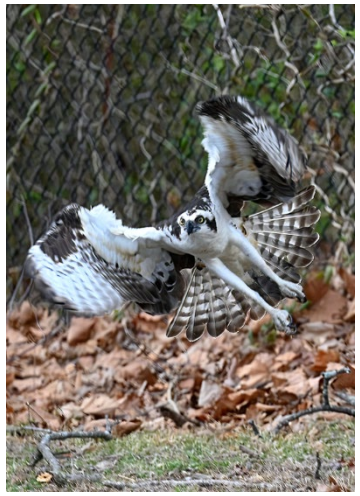
# Measurement Selection/Tailoring Lessons Learned

## "What Gets Measured Get Done"

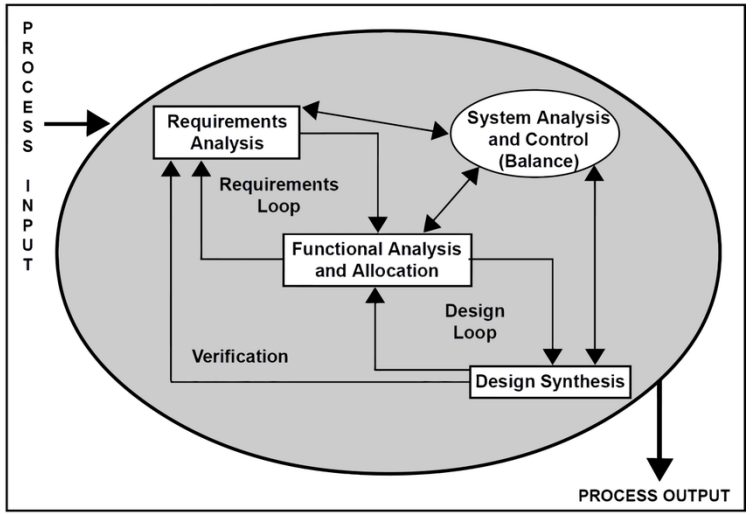
- Develop and track metrics to control processes, measure against goals and objectives, and make decisions
  - **How do we know we will succeed?**
  - **If a metric won't help make a decision, you don't need it**
- There will be fact of life metric "taxes" from external sources
  - **How does your customer user the information and metrics?**
- Metrics tracked and owned at Program, Functional, and IPT levels
  - **What information is needed to do the job at all levels of the organization?**
- Define a minimum core set -- teams may want/need more
- Goal:
  - **Focus on Your Goal and Desired Benefit**
  - **Obtain Delivery Velocity/Meet Commitments**
  - **Ensure Quality**
  - **Enable Insight**

Metric Selection Philosophy is a Forcing Function

# Sample MOSA Benefit Measurement Use Cases

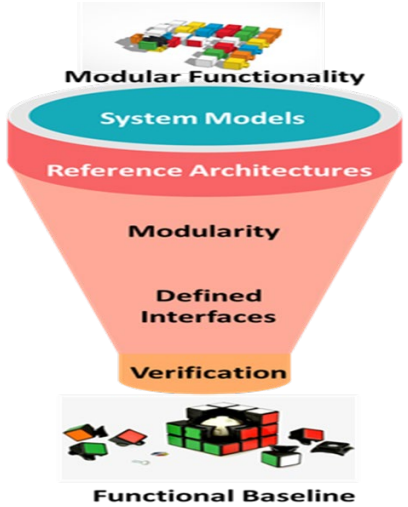


**MOSA in Nature**



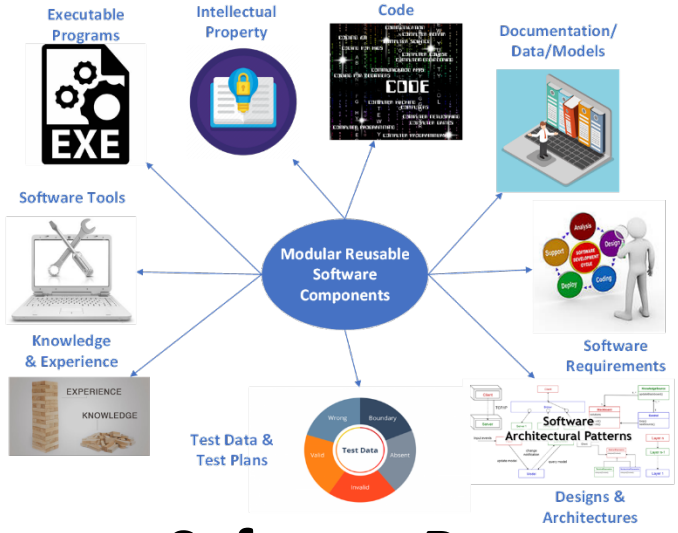

**Systems Engineering Life Cycle MOSA Implementation**

GATM Business Case – Collins KC-135




Interoperability

**What other Use Cases do we need?**




**Software Reuse**

# Osprey Nest MOSA

**Modular Component Integration**

## What's Important to the Osprey?

Loosely Couple Nest Architecture

**Conformance With Accepted Open Standards and Key Interfaces**

**Lifecycle Modular Part Supply Chain**

**Rapid Technical Refresh**

**Abundant Food**

**Multi-level Security**

**Operational Flexibility**

**Osprey MOSA Enabling Environment**

**MOSA Benefit**

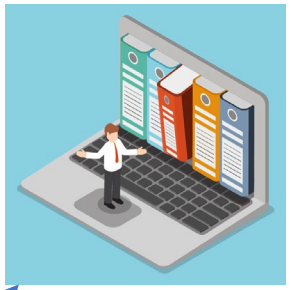
# How do We Measure the Benefits of SW Reuse?

Executable Programs


Intellectual Property

Code


Documentation/ Data/Models

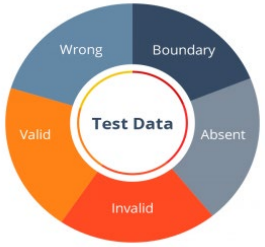


Software Tools

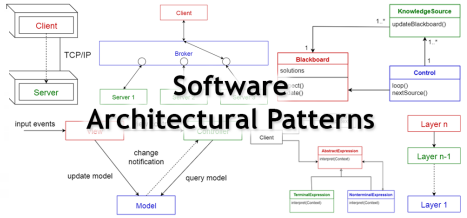
Modular Reusable Software Components


Knowledge & Experience


Test Data & Test Plans




Software Requirements




Designs & Architectures

## Potential MOSA Reuse Benefit Metrics

- Release Frequency
- Cycle Time Reductions
- Schedule Reductions
- Cost Avoidance
- Team Velocity
- Technical Refresh Innovation Adoption Frequency
- Mean Time to Repair/Replace
- Return on Investment

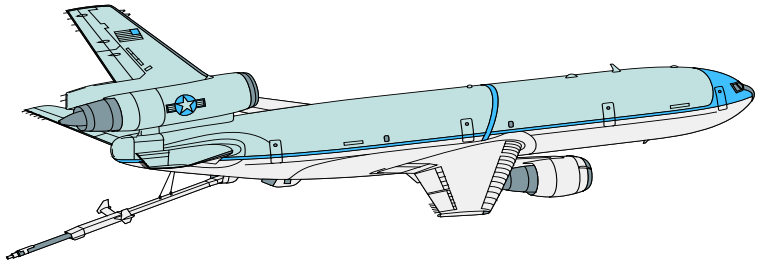
# Global Air Traffic Management (GATM) Mission Needs and MOSA Business Case

**Communication**
Digital Radios to Handle Reduced Channel Spacing and Datalink

**Navigation**
Better Horizontal and Vertical Position Accuracy to Meet Required Navigation Performance in Reduced Separation Environment

**Surveillance**
Enhanced Situational Awareness, Collision Avoidance and Automatic Position Reporting Via Datalink

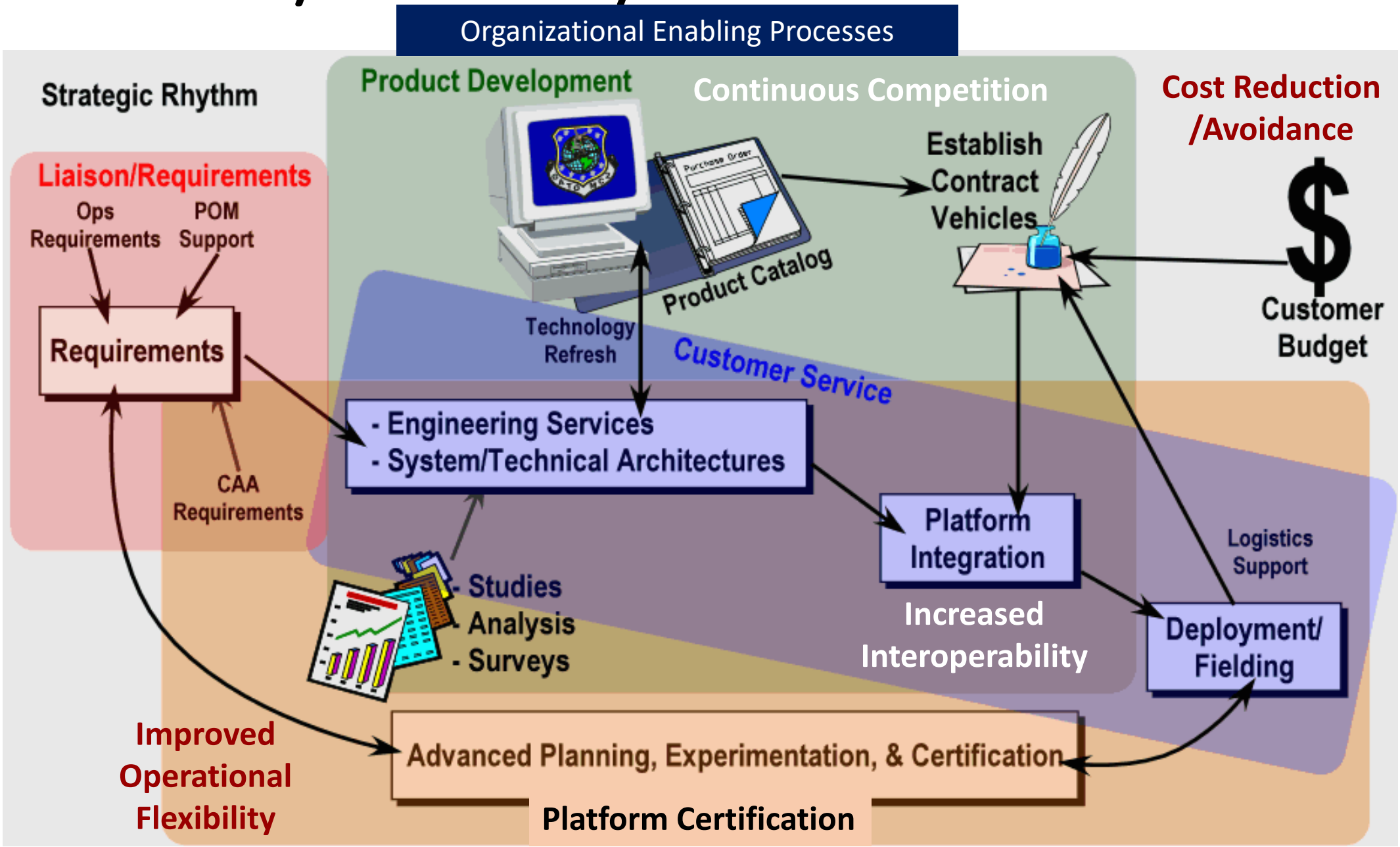
**Air Traffic Management**
Transition From Air Traffic Control to Management Using New Procedures and Automation



- **$2.5 B Program**
- **28 Aircraft Programs**
- **20+ Modular Components**
- **Published International/ FAA Standards**
- **Immediate Operational Impacts**
- **Short Implementation Schedule**

**Failure to comply with international aviation flight standards and equipage will result in restrictions in worldwide airspace and decreased combat capabilities**

# GATM System Of Systems SPO CONOPS

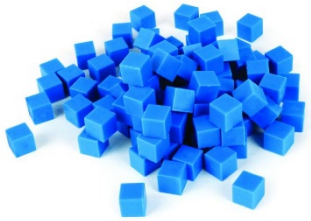


# What Were the GATM Stakeholder MOSA Success Metrics?

| GATM Program Office | Aircraft Program Office | Major Command |
|---|---|---|
| **GATM Acquisition Capability Time Lines**<br>• Cycle Time (Time from RFP Release to Contract Award) – component availability<br>• Competition Frequency Planned vs Actual | **Aircraft GATM Integration/ Deployment Timelines**<br>• On time GATM Component Delivery vs need<br>• Aircraft GATM Integration Cycle Times | **Aircraft GATM Deployment Timelines**<br>• GATM Equipage % by Fleet Burndown<br>• Denied Airspace Access Backlog |
| **Competition Cost Savings**<br>• Component Unit Pricing Catalog versus IDIQ Bid Prices<br>• Component Unit Pricing Trends over time<br>• Component Repair Cost<br>• Quantity Buy Savings<br>• Integration Competition Cost Savings | **Aircraft GATM equipage cost**<br>• Aircraft Integration Cost Funding Shortfalls<br>  • Integration Competition Cost Savings<br>  • Integration Cost Avoidance<br>• GATM Component Unit Pricing Trends over time<br>• GATM Component Repair Cost | **Total GATM Program Cost**<br>• Aircraft Integration Cost vs Committed<br>• Sustainment Cost Reductions<br>  • Mean Time Between Failures<br>  • Mean Time to Repair<br>• GATM Competition Cost Savings<br>• Commonality Across Platforms<br>• Lifecycle Cost |
| **Speed of Delivery**<br>• Delivery Time vs Contract<br>• Mean Time to Repair and Return<br>• Surge Repair Delivery Times | **Speed of Delivery**<br>• Average GATM Component Delivery time from time of order<br>• Aircraft GATM Modification Cycle Time Trends | **Speed of Delivery**<br>• Aircraft GATM Equipage vs Need Timelines<br>• Mean Time to Repair and Return |
| **Aircraft Conformance to GATM Standards**<br>• USAF GATM Conformance Requirements<br>• Component Standards Conformance<br>• Aircraft GATM Conformance burn down | **Aircraft Conformance to GATM Standards**<br>• Aircraft GATM Conformance burn down<br>• Aircraft Safety Standards Conformance<br>• System Suitability and Effectiveness Measures | **Aircraft Conformance to GATM Standards**<br>• Airspace Access Standards Conformance<br>• Mission Limitations Burndown<br>• Operations That Can Be Executed vs Committed |

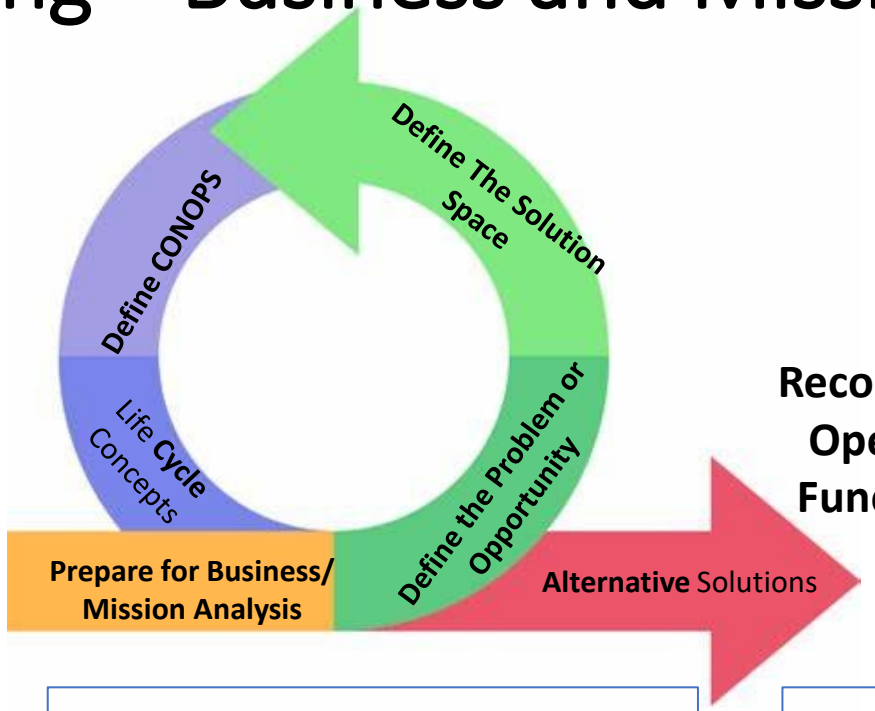
# Systems Engineering Life Cycle MOSA Implementation
# Systems Engineering – Business and Mission Analysis

**Modular Parts**



**Modular Functionality**

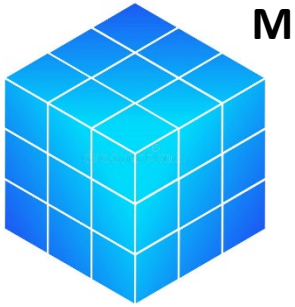
**It starts with Mission Engineering**




**Alternative Solutions**

**Reconfigurable Operational Functionality**

**Multi-Function**



**Scaled Single Function**

## MOSA Information Needs

- Organization Strategic Plan
- Program/Mission Constraints
- Mission characterization
- MOSA Candidate solutions
- Reuse Opportunities
- MOSA Benefits opportunities
- Solution Modularity to support CONOPS, Technical Refresh and Competition
- Mandatory Standards and Reference Architectures

## Process MOSA Outputs

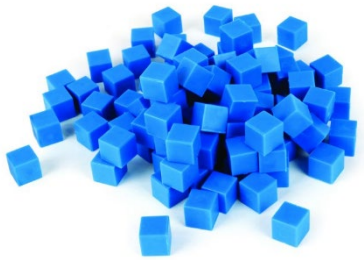
- Stakeholder identification
- Preliminary Life Cycle Concepts
- Problem & MOSA Opportunity Statement
- MOSA Business/IP Requirements
- Preliminary MOSA Benefit evaluation criteria
- MOSA Requirements Traceability
- MOSA Implementation Plan

Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition

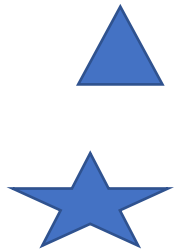
## Preliminary MOSA Measurements/Metrics

- **Burndown**
  - MOSA Enabling Environment Backlog
  - Interoperability Gaps Backlog Solution Interfaces
  - Data Standard Compliance Backlog
  - Technical Debt
  - Intellectual Property
- **Committed vs Delivered**
  - Solution Reuse Cost Avoidance
  - Competition Savings Committed vs Achieved
- **Cumulative Flow**

# Stakeholder Needs and Requirements



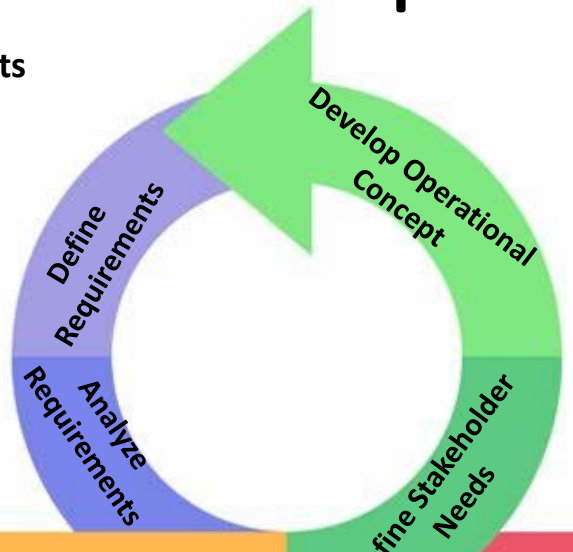
Modular Parts



Modular Concepts

Modular Functionality

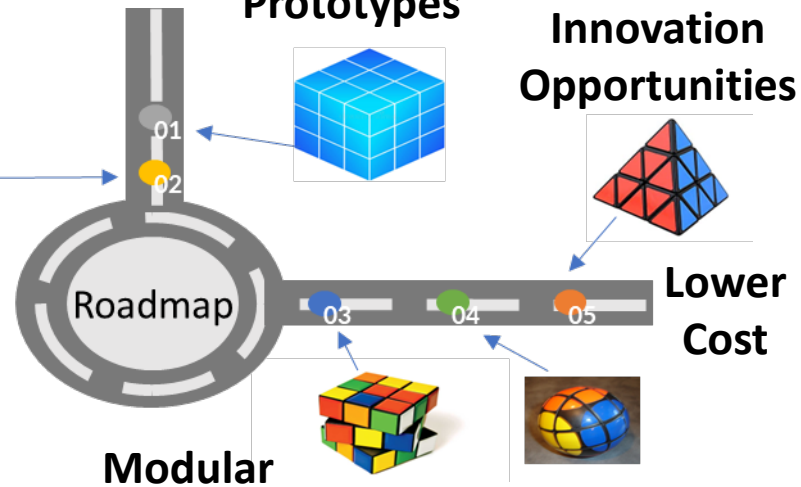
Interfaces




Initial MVP

Rapid Prototypes

Continuous Innovation Opportunities




Frequent Releases

Lower Cost

Modular Operational Agility

Technical Refresh Competition

**MOSA Information Needs**

- Identify and define constraints on a system
- Identify the MOSA tenets that address the stakeholder needs and the MOSA benefits that will be achieved

**Process MOSA Outputs**

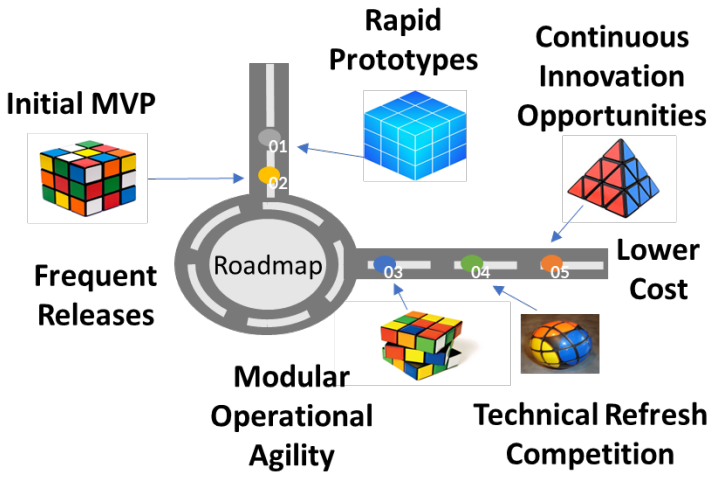
- Stakeholder agreement that their needs, expectations, and interoperability are reflected adequately in the requirements
- Define a representative set of scenarios to identify all required capabilities and MOSA needs that correspond to anticipated operational and other life-cycle concepts.
- Test methodologies to verify MOSA compliance
- Approved Information Support Plan (ISP)

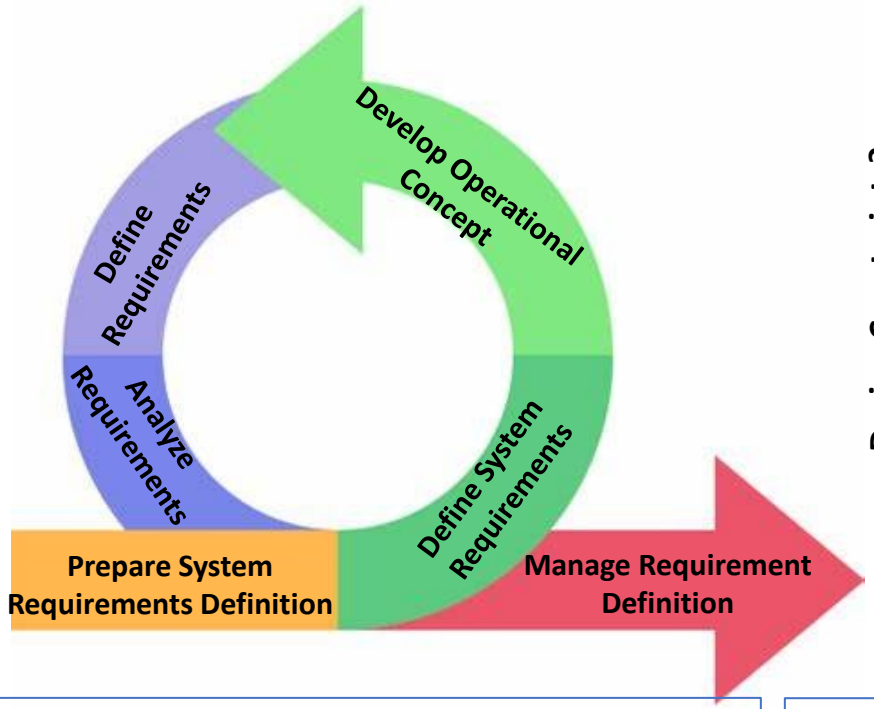
**MOSA Measurements/Metrics**

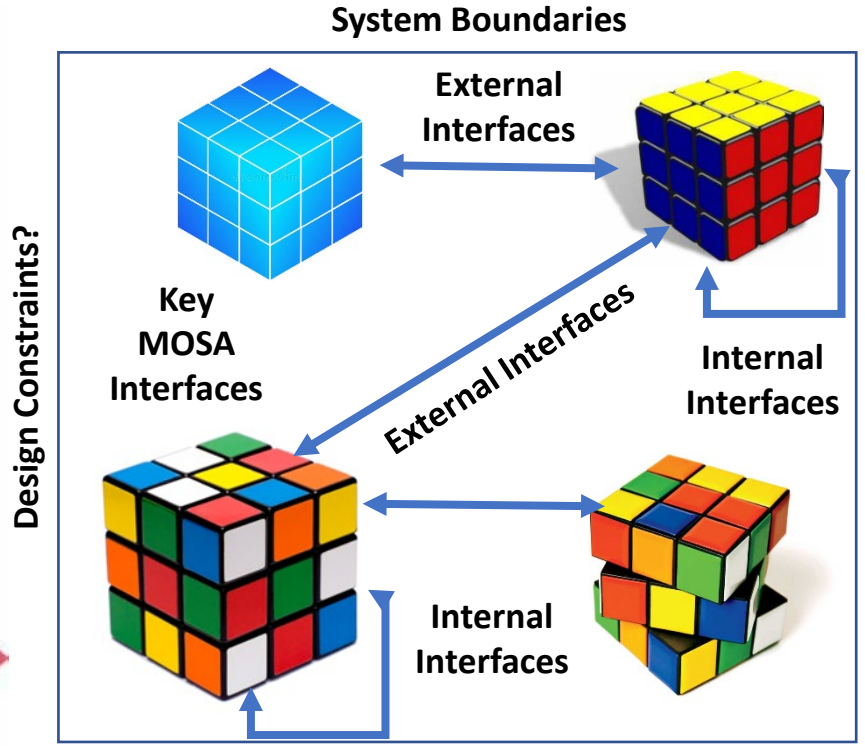
- **Burndown**
  - Conditions Which Operations Can Be Executed Burndown or **Committed vs Delivered**
  - Interoperability Gap Backlog
  - Desired system or system of systems operational configurations backlog
- ***Committed vs Delivered*** *or* ***Cumulative Flow***
  - MOSA Interfaces Standards Identification
  - Requirements Verification Traceability Matrix (RVTM)

Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition & AIR FORCE MATERIEL COMMAND (AFMC) GUIDEBOOK FOR IMPLEMENTING MODULAR OPEN SYSTEMS APPROACHES IN WEAPON SYSTEMS

# Systems Requirements Definition




## MOSA Information Needs

- Document system description, including system interfaces, functions and boundaries, for a system solution
- Define system requirements (functional, performance, process, non-functional, and interface) and design constraints

## Process MOSA Outputs

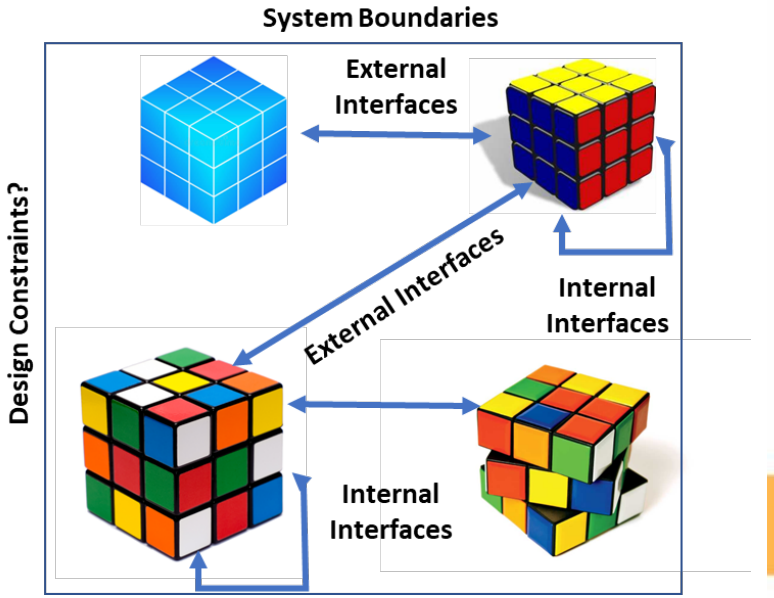
- System functional definition
- Approved System/MOSA Requirements
- System functional interface identification
- System of System interface definition(s)
- MOSA requirements verification criteria
- Updated RVTM

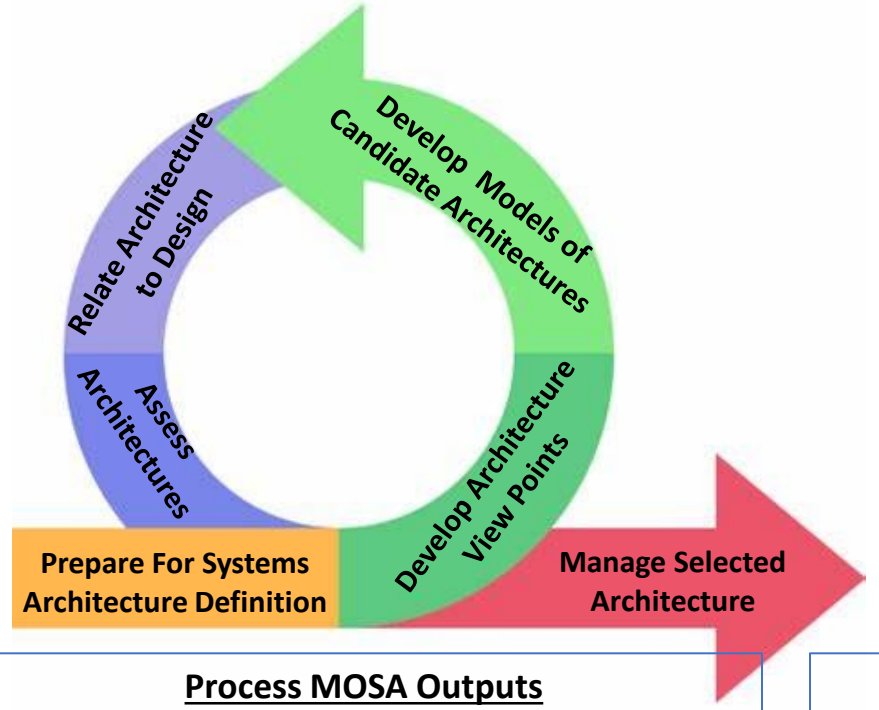
## MOSA Measurements/Metrics

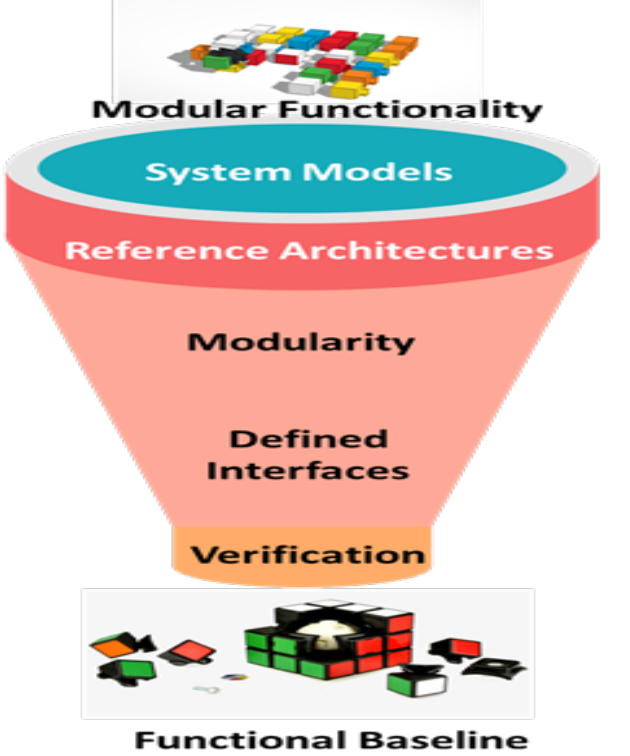
- **Definition Cumulative Flow**
  - Systems Requirement System Interface Identification - Internal and external; Artificial Intelligence; Machine to Machine…
  - Update MOSA Verification Criteria/RVTM
- **Burndown**
  - Status MOSA functional requirements definition
- **Committed vs Delivered**
  - Interoperability Performance Measures
  - MOSA Benefit Performance Measures

Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition & AIR FORCE MATERIEL COMMAND (AFMC) GUIDEBOOK FOR IMPLEMENTING MODULAR OPEN SYSTEMS APPROACHES IN WEAPON SYSTEMS

# Architecture Definition




## MOSA Information Needs

- Define context, boundaries, and external interfaces of the system
- Develop/reuse architecture views and models of the system(s)
- Identify system elements and their interfaces
- Alignment of the architecture with requirements and design MOSA characteristics to be achieved.

## Process MOSA Outputs

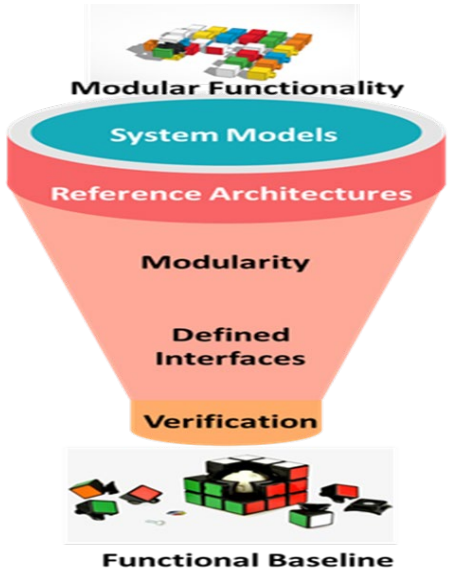
- System functional definition
- System Requirements
- System functional interface identification
- System of System interface definition(s)
- Standard/Reference Architecture Selection
- MOSA requirements verification criteria
- Updated RVTM
- Modular Open System Architecture Selection
- Rational for MOSA design choices
- Functional Baseline

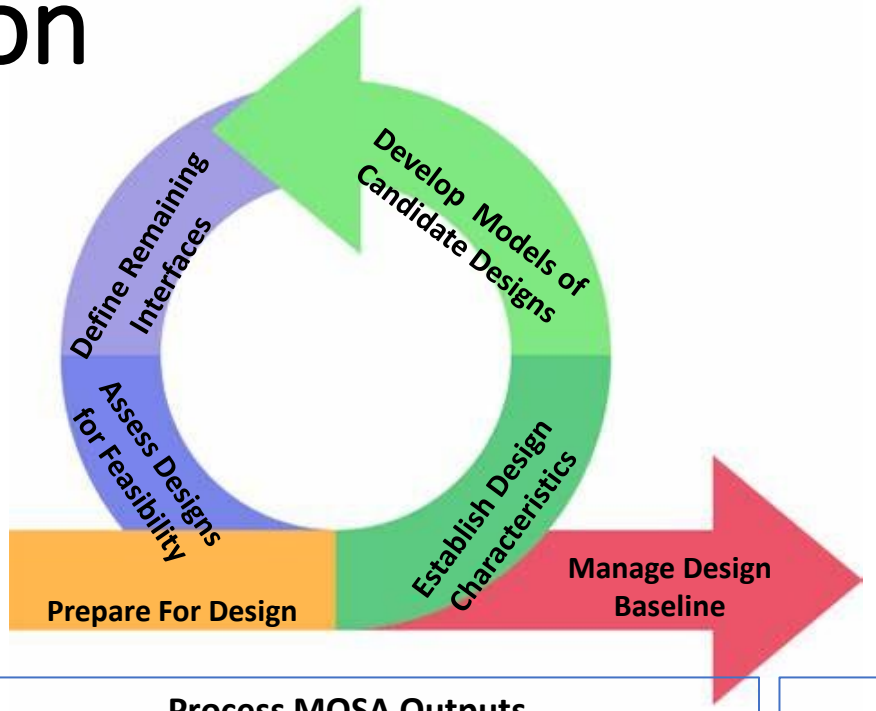
## MOSA Measurements/Metrics

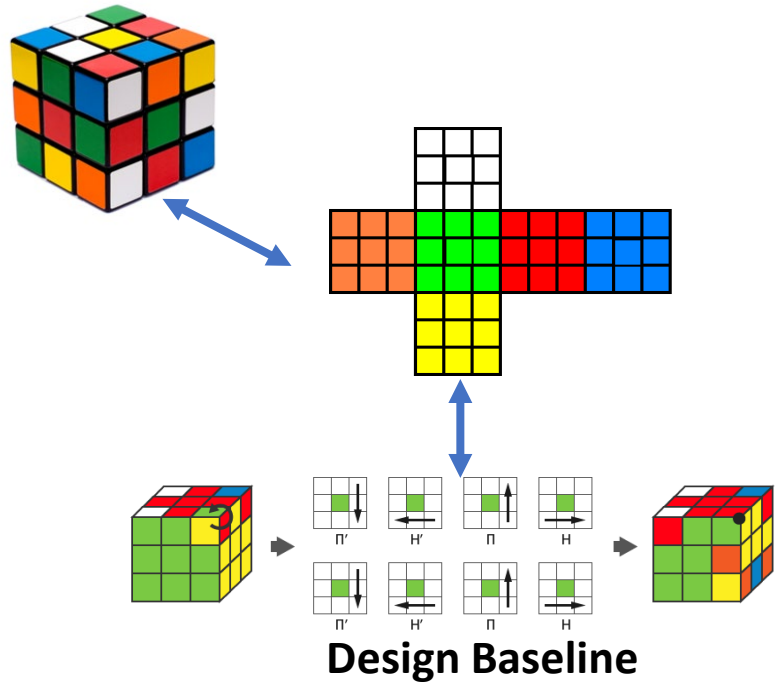
- **Cumulative flow**
  - Functional allocation and analysis
  - System Model completion
- **Burndown**
  - Selected Reference Architecture and Standards conformance
  - System interfaces definition backlog
- **Committed vs delivered**
  - Modularity
  - Cohesion and Coupling
  - Cyclomatic Complexity
  - Change and Propagation

Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition & AIR FORCE MATERIEL COMMAND (AFMC) GUIDEBOOK FOR IMPLEMENTING MODULAR OPEN SYSTEMS APPROACHES IN WEAPON SYSTEMS

# Design Definition




**MOSA Information Needs**

- System models Maturity
- MOSA Design documentation
- Design rational
- MOSA and Digital Engineering enabling environment
- MOSA Requirements Traceability
- Design Baseline(s)

**Process MOSA Outputs**

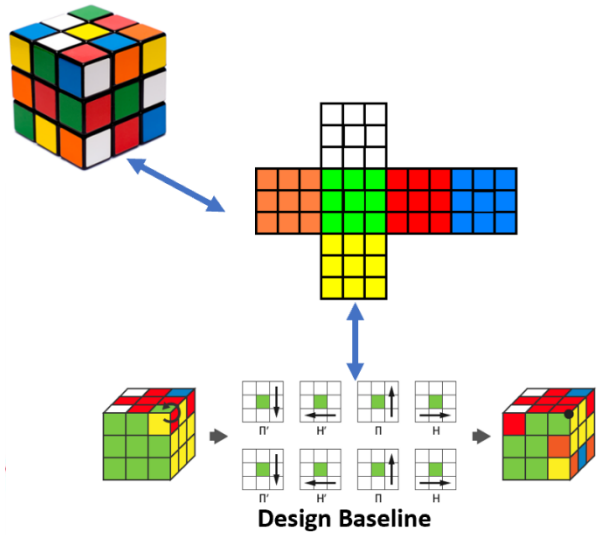
- Defined modular design characteristics of each system element
- Defined and standardize Interfaces (ICD/API) between system elements composing the system to allow for opportunities of future modernization
- Digital modular design artifacts
- MOSA enabling environment necessary for design definition and implementation
- Demonstrated modularity/standards to support desired competition and technical refresh

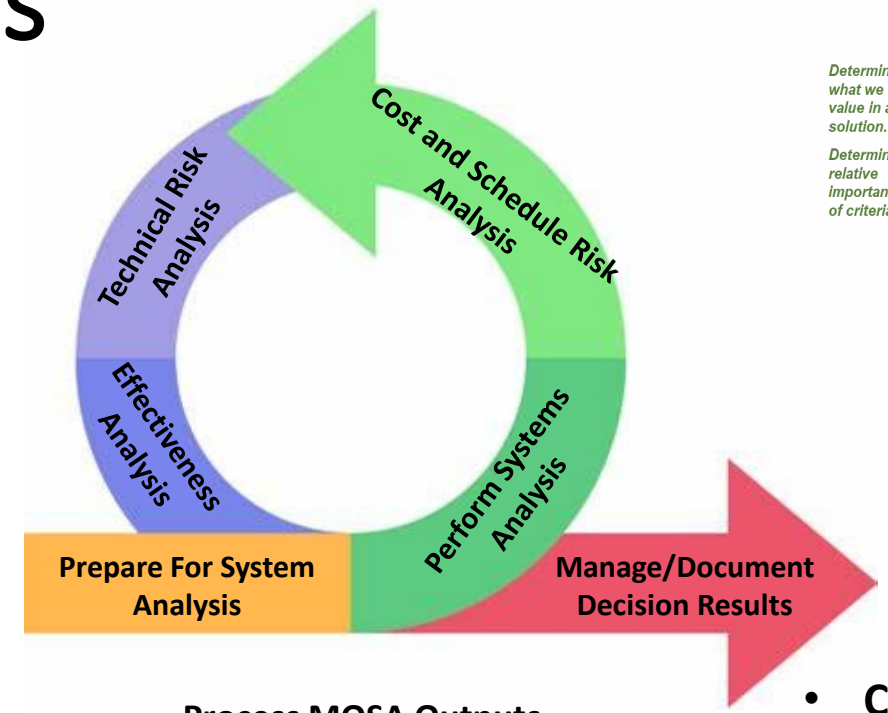
**MOSA Measurements/Metrics**

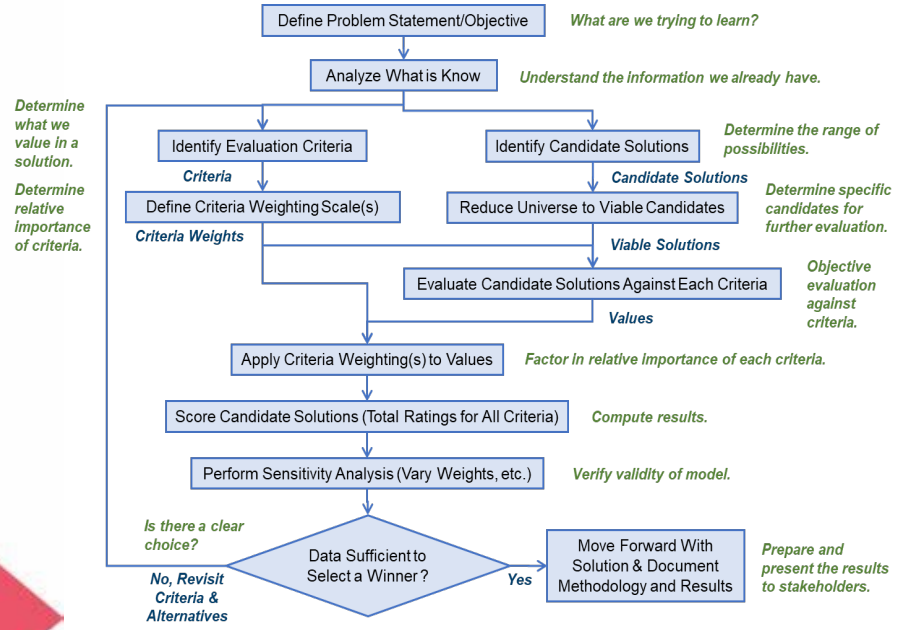
- **Committed vs Delivered**
  - MOSA/Digital Engineering enabling environment
  - Modularity
  - Competition Effectiveness
  - Conditions Which Operations Can Be Executed
- **Burndown or Cumulative Flow**
  - Design Baseline Documentation Backlog
  - Standards Compliance backlog Burndown external/internal interface definitions
- **MOSA Design Performance Metrics**
  - Life Cycle Cost Trends
  - Mean Time to Repair/Recover
  - Integration/Reuse Readiness Levels

Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition & AIR FORCE MATERIEL COMMAND (AFMC) GUIDEBOOK FOR IMPLEMENTING MODULAR OPEN SYSTEMS APPROACHES IN WEAPON SYSTEMS

# System Analysis




## MOSA Information Needs

- MOSA Decisions requiring alternative analysis are identified.
- Alternative courses of to achieve MOSA benefit goals.
- Preferred MOSA course of action
- The resolution, decision rationale and assumptions for MOSA are recorded
- Modular Open Systems Approach into program protection review and analysis

## Process MOSA Outputs

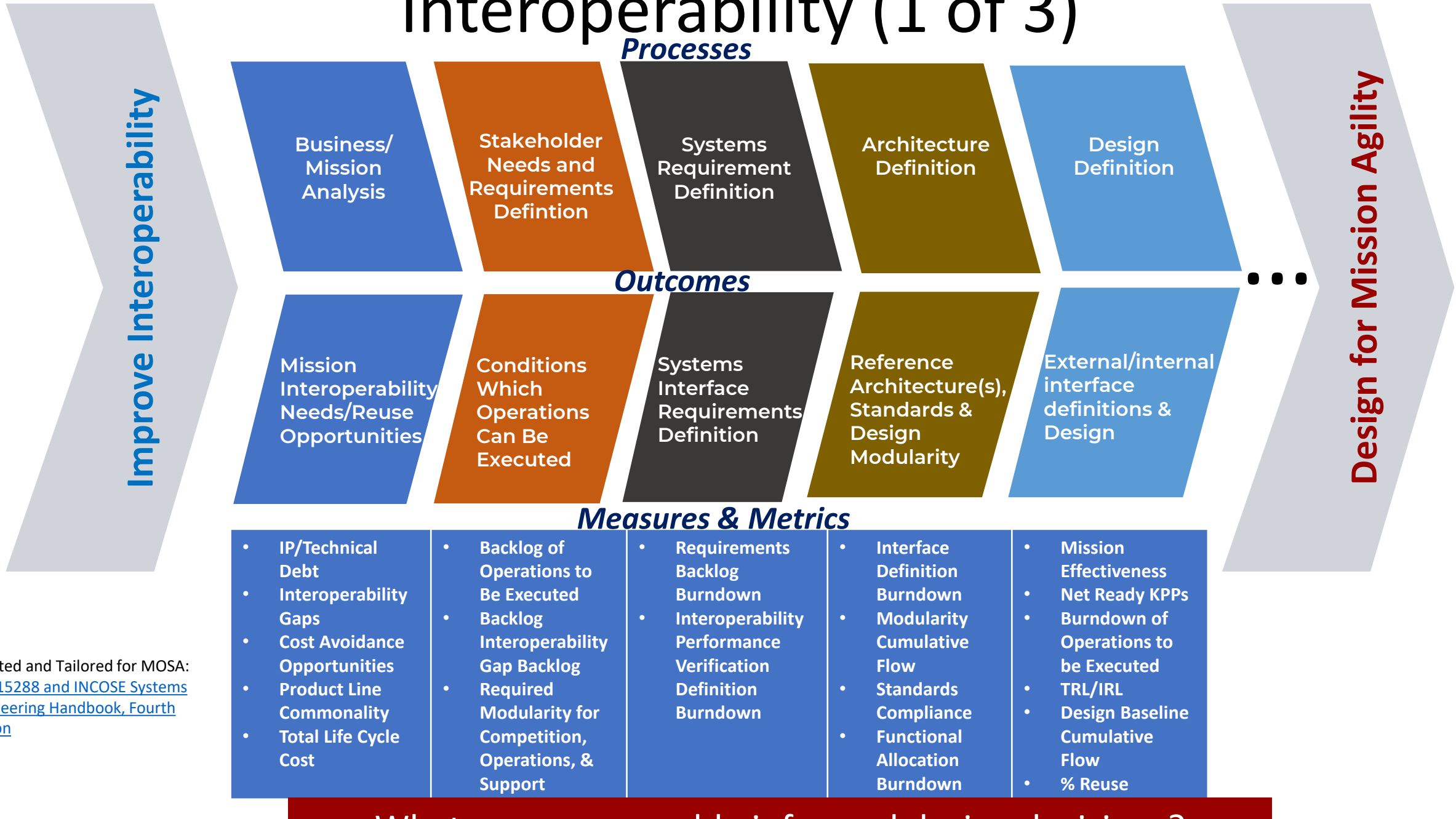
- MOSA competition strategy
- MOSA Technical Refresh Strategy
- Updated MOSA Implementation Plan & SEP/SEMP
- MOSA success measures
- Listing of selected standards and rationale for why they were chosen
- Listing of considered standards that were not selected and why they were not chosen

## MOSA Measurements/Metrics

- **Committed vs Delivered**
  - Technology, Integration, and Reuse Readiness Levels
  - Conditions Which Operations Can Be Executed Cost Risk/Affordability Assessments
  - Lifecycle Cost Target Commitments
  - Reuse Cost Savings
- **Schedule/Cost Risks Assessment Trends**
- **Competition Effectiveness**
  - % of BOM Value Competed
  - % of BOM Components with Adequate Competition for Technical Refresh
  - Competition Frequency Planed vs Actual
  - Competitive Cost Savings Committed vs Achieved

Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition & AIR FORCE MATERIEL COMMAND (AFMC) GUIDEBOOK FOR IMPLEMENTING MODULAR OPEN SYSTEMS APPROACHES IN WEAPON SYSTEMS

# Interoperability (1 of 3)

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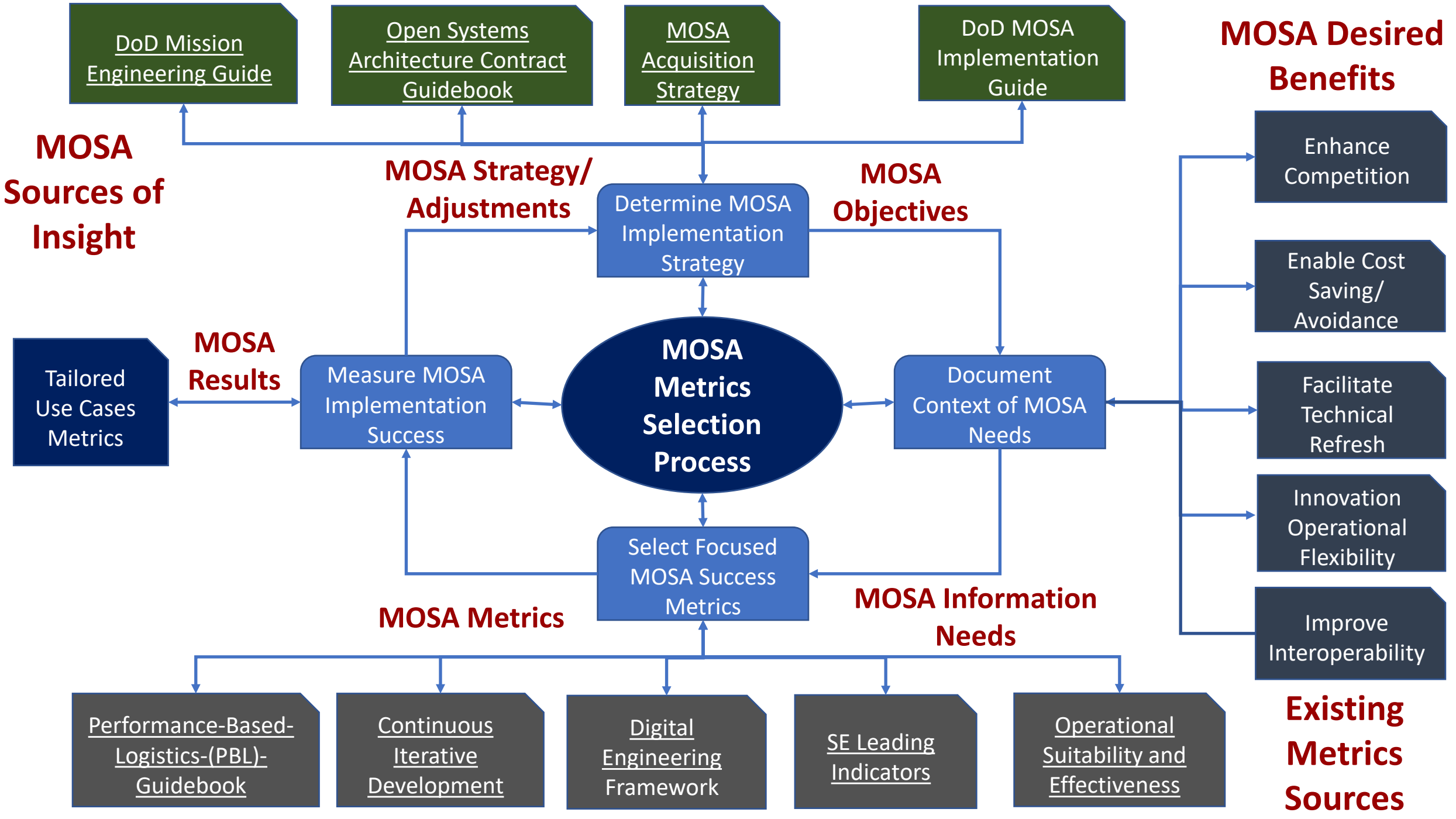
**What measures enable informed design decisions?**


DoD Mission Engineering Guide
Open Systems Architecture Contract Guidebook
MOSA Acquisition Strategy
DoD MOSA Implementation Guide
MOSA Sources of Insight
MOSA Strategy/ Adjustments
Determine MOSA Implementation Strategy
MOSA Objectives
MOSA Desired Benefits
Enhance Competition
Enable Cost Saving/ Avoidance
Facilitate Technical Refresh
Innovation Operational Flexibility
Improve Interoperability
Tailored Use Cases Metrics
MOSA Results
Measure MOSA Implementation Success
MOSA Metrics Selection Process
Document Context of MOSA Needs
Select Focused MOSA Success Metrics
MOSA Metrics
MOSA Information Needs
Performance-Based-Logistics-(PBL)-Guidebook
Continuous Iterative Development
Digital Engineering Framework
SE Leading Indicators
Operational Suitability and Effectiveness
Existing Metrics Sources

# MOSA Metrics Selection Framework Guide Status / Help Needed

- ✓ Identified Most Likely MOSA Use Cases
  - Primarily Acquirer-Centric
  - Some Supplier-Centric
  - More Use Cases Possible Over Time
- ✓ Identified MOSA Sources Selection Process
- Determining MOSA Metric Candidates Superset (Currently 100's) – In Progress
  - Extracted from Leaves in the Mind Mapping of the MOSA Info Sources/Benefits
  - Significant Commonality Emerging in Metrics Types (Similar to Distribution Function)
- Distilling Superset to Most Common Metrics – Initiating
  - Expect a Limited Number of Common Metric Types (Likely a Few Dozen)
  - Unique, Individual Metrics for MOSA to be Developed, as Needed
  - Similar to Digital Engineering Metrics
- Drafting MOSA Metrics Implementation Guide – In Progress
  - Similar to Digital Engineering Metrics Implementation Guide

**Help Needed for Validating MOSA Metrics Most Viable Product (i.e., the Most Common MOSA Metrics and Plan for Implementation)**

International Council on Systems Engineering

SE Handbook

National Defense Industrial Association

NDIA MOSA White Paper Final Release NDIA Architecture Committee 2020

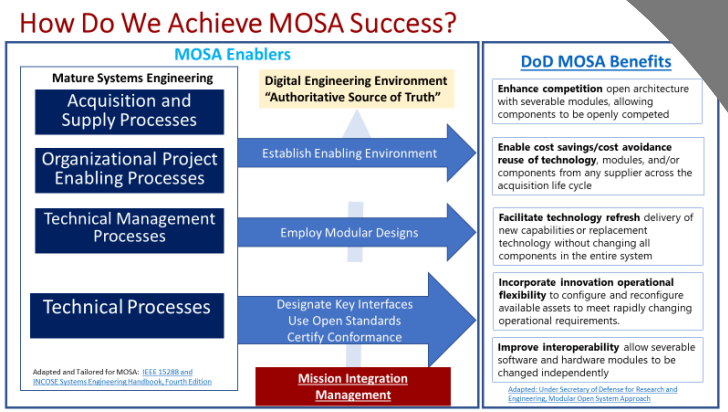
Practical Software & Systems Measurement

Practical Software and Systems Measurement Continuous Iterative Development Measurement Framework

DI-MGMT-82099, Open System Management Plan

## Determine MOSA Implementation Strategy


- **Enhance competition**
  - GATM Business Case
  - CANES Business Case
  - MOSA in Source Selection
  - Architecture Modularity
- **Enable Cost Savings/Avoidance**
  - Software Reuse
  - Reuse Readiness Levels
- **Facilitate Technical Refresh**
- **Incorporate innovation operational flexibility**
- **Improve Interoperability**
- **SE Life Cycle MOSA Implementation**




**Selection Framework**

## Document Context of Modularity/Openness Needs

## Select Focused MOSA Value Success Metrics

## Measure MOSA Implementation Success

# Any Questions?

## NDIA MOSA Metrics Selection Framework Guide

# Backup

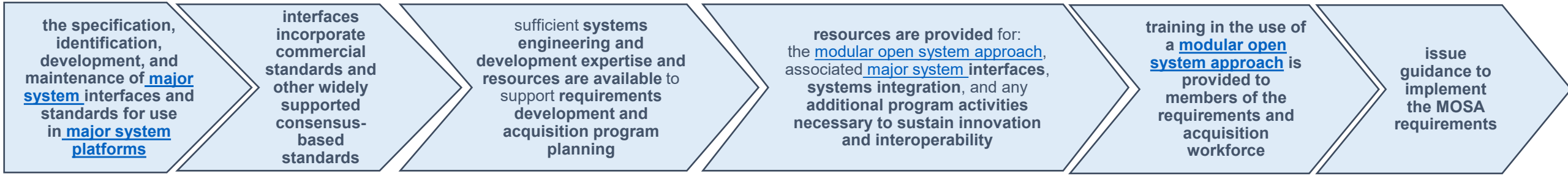
# What are Your Program MOSA Requirements?

## DoD Modular Open Systems Approach (MOSA) Statutory Requirements

- 10 USC 3771: Rights in technical data: regulations
- 10 USC 3772: Rights in technical data: provisions required in contracts
- 10 USC 3773: Domestic business concerns: programs for replenishment parts
- 10 USC 3774: Major weapon systems and subsystems: long-term technical data needs
- 10 USC 3775: Definitions

- 10 USC 4401: Requirement for **modular open system approach** in major defense acquisition programs
- 10 USC 4402: Requirement to address modular open system approach in **program capabilities development and acquisition weapon system design**;
- 10 USC 4403: Requirements relating to **availability of major system interfaces and support** for modular open system approach definitions

### DoD MOSA Requirement Cliff Notes



# MOSA Enhance Interoperability Overview

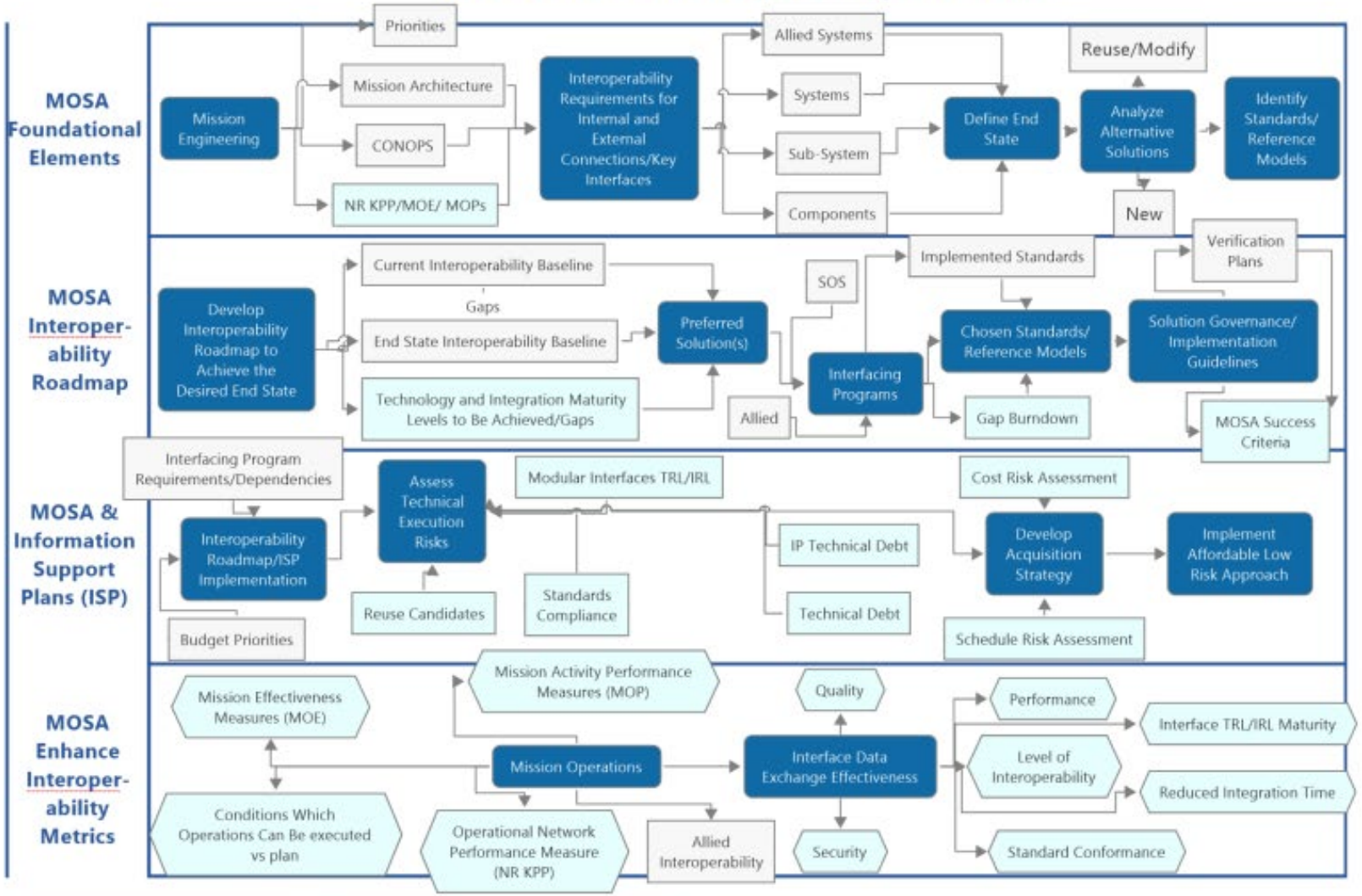
## Information Needs

**What are our Interoperability Needs**

**What is required to provide the needed interoperability?**

**How do we provide the needed interoperability?**

**How can MOSA's contribution to interoperability mission and interface's success be measured?**




## Information Needs

**What Standards and Reference Models Do We use?**

**What are the system data exchanges and associated measures and metrics?**

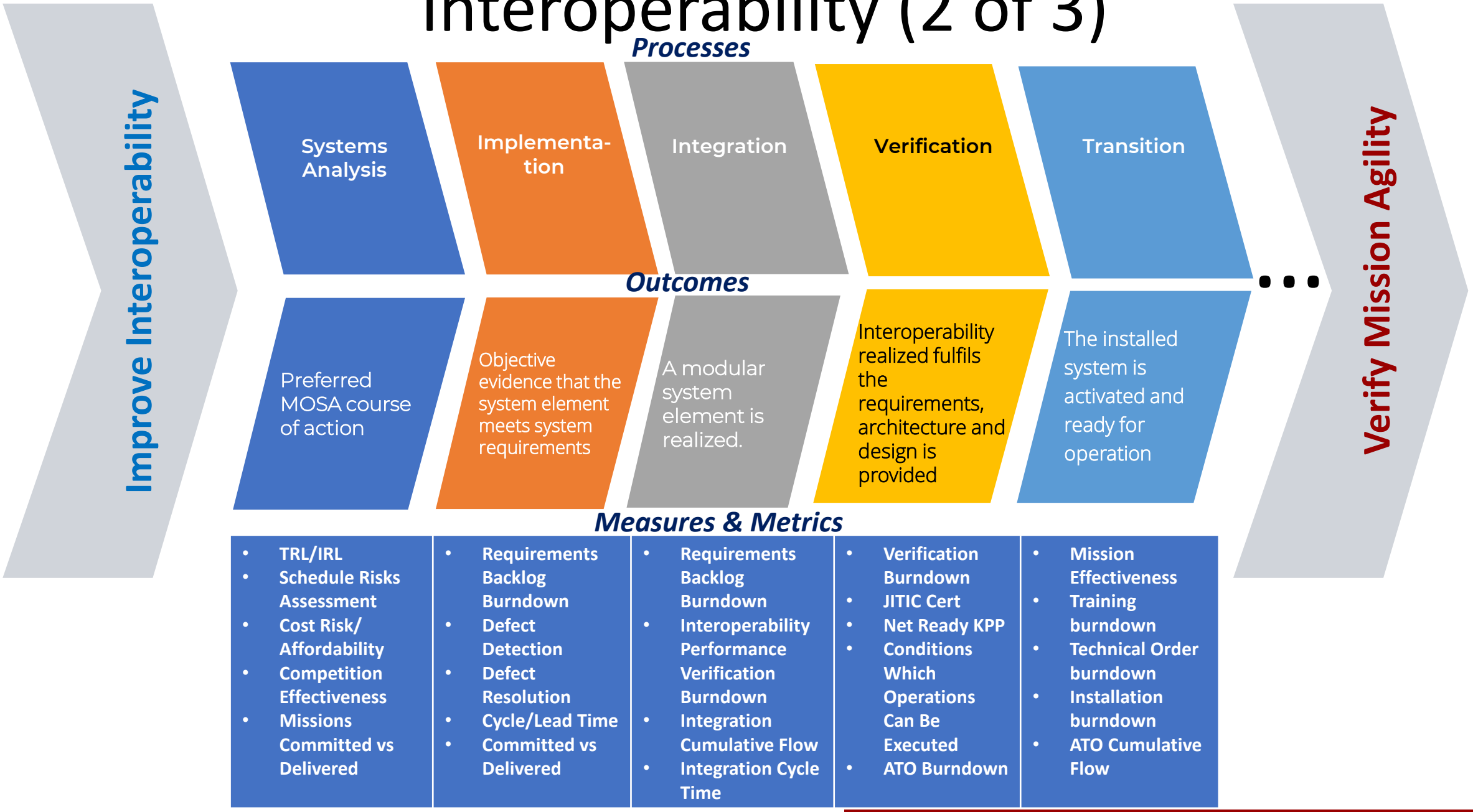
**How will we achieve and maintain the Joint interoperability certification?**

**Which of these metrics apply to you and your current program?**


**Steve Henry**
**TAMU1971@msn.com**


MOSA Interoperability Metrics | MOSA Interoperability Readiness Metrics | MOSA Interoperability Focus | MOSA Interoperability Information Needs

# Interoperability (2 of 3)

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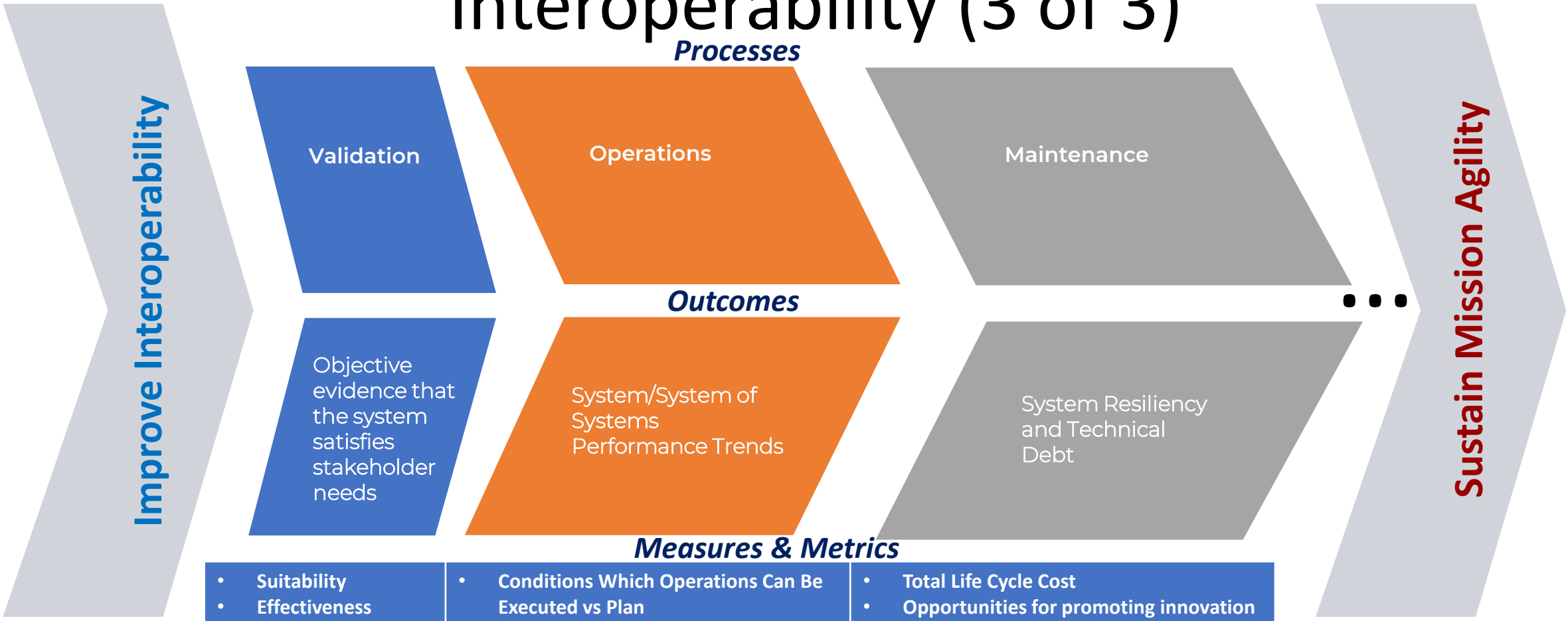
What measures tell us we are ready to deploy?

# Interoperability (3 of 3)




## Measures & Metrics

| | | |
|---|---|---|
| • Suitability<br>• Effectiveness<br>• Operational Configuration Flexibility<br>• Conditions Which Operations Can Be Executed<br>• Change Effectiveness | • Conditions Which Operations Can Be Executed vs Plan<br>• Speed of Change for new interoperability or capability<br>• Release Frequency<br>• Lead/Cycle Times<br>• # of Mission Configurations<br>• Systems Resiliency (Interoperability (Backlog/Burndown) or Committed vs Planned<br>• Lifecycle Cost Trends | • Total Life Cycle Cost<br>• Opportunities for promoting innovation<br>• Reliability/Availability<br>• System Resiliency<br>• Technology refresh strategy<br>• Continuous completion strategy<br>• Technical debt<br>• Obsolescence Risks<br>• Mean time to repair<br>• Mean time to recover/restore |

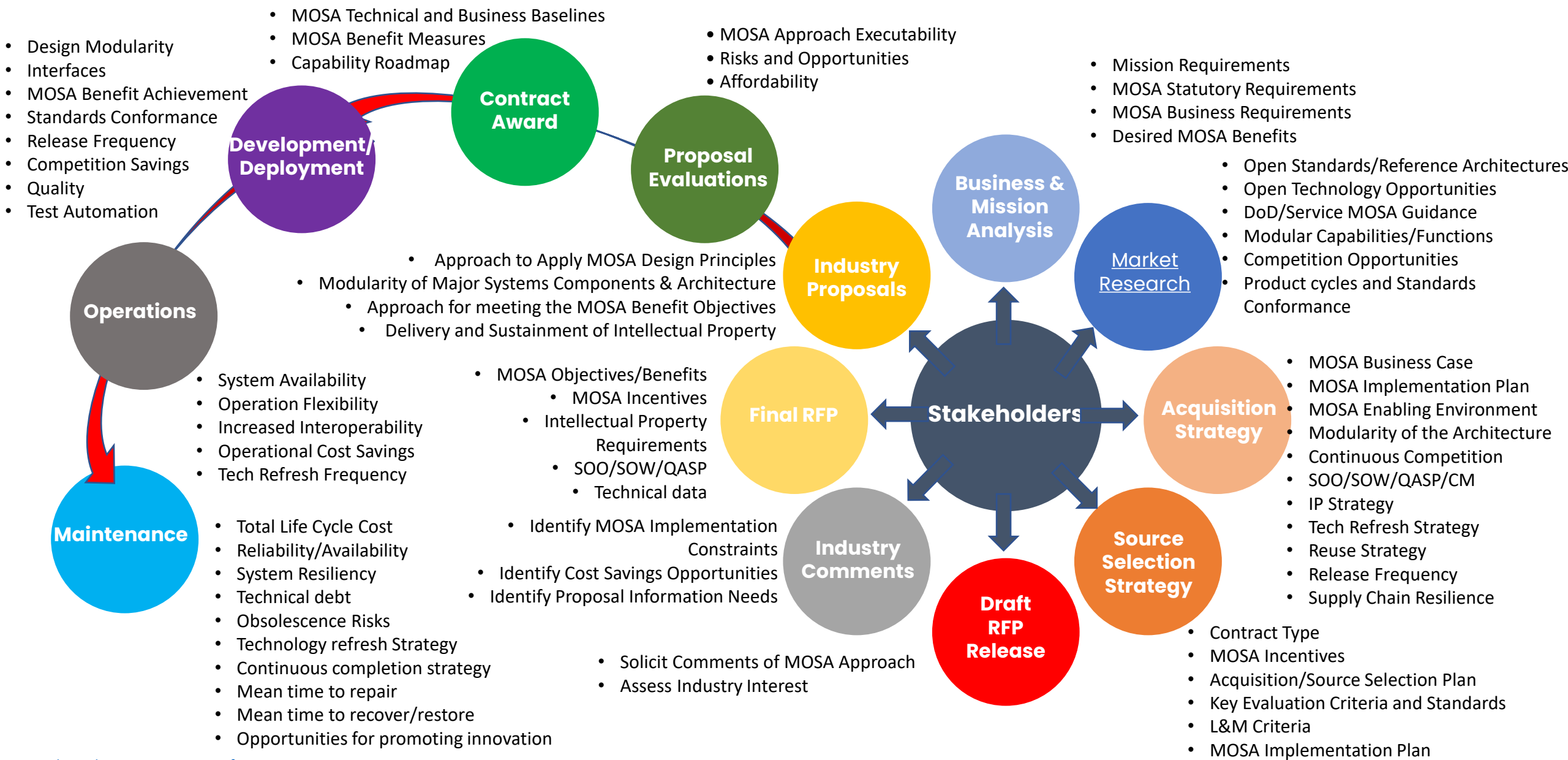
Adapted and Tailored for MOSA: IEEE 15288 and INCOSE Systems Engineering Handbook, Fourth Edition

What measures tell us we are still meeting requirements and achieving the benefits?

# How Did GATM Implement its MOSA Approach?

| MOSA Implementation Actions | Outcome |
|---|---|
| **1. Standardize interface specifications to allow of opportunities for future modernization** | Use Open Standards: Open standards allows developers to leverage commercially developed technologies, increasing competition. Additionally, they offer faster upgrades at reduced cost and complexity. Fielded systems are more affordable and maintainable.<br>**GATM adopted open AEEC, RTCA/ARINC Standards for all GATM components Add action**<br>**The GATM components are the foundation for growth to the ADS-B capabilities** |
| **2. Maintain a digital engineering MOSA authoritative source of truth** | Combine model based techniques, digital practices, and computing infrastructure to enable delivery of high pay off solutions to the warfighter at the speed of relevance. Improves technical, contract, and business practices through an authoritative source of truth and digital artifacts. **GATM Configuration baselined for all components on vendor web site. GATM Program Office maintained specifications/requirements by country, one stop ordering, and engineering support on-line.** |
| **3. Specify all interfaces by identifying connections between the systems and systems of systems building blocks** | Decouple the interface and Service implementation so that they can maintain separate life cycles. In order for components to decouple their inner workings from each other but be able to leverage the capability provided by each highly cohesive service, developers expose openly available key interfaces to other components. **The GATM MOSA approach followed the ICAO CNS/ATM architecture and modernization roadmap.** |
| **4. Plan Program to Achieve the MOSA Objectives** | Describes the developer's approach for using modular design, standards-based interfaces, and widely-supported, consensus-based standards to achieve defined MOSA and Mission objectives. **The CNS/ATM Vendors are authorized by the FAA to produce TSO certified components have a modular card that provides the open interface between the component and the aircraft.** |
| **5. Modularize by decomposing system Capabilities into functional modules** | Accurately isolate functionality during the design process to simplify development, maintenance, changes and upgrades.<br>**Each GATM component and its associated functions are modular, built to the standards, and certified** |
| **6. Define Interface specifications by capturing how functional modules work** | Decouple the interface and Service implementation so that they can maintain separate life cycles. In order for components to decouple their inner workings from each other but be able to leverage the capability provided by each highly cohesive service, developers expose openly available key interfaces to other components. **The GATM IDIQ contract allows the addition of upgraded products and capabilities as long as the original interface and capabilities are retained.** |
| **7. Verify conformance to selected MOSA standards** | Certify Conformance: Developers need to verify and validate their MOSA strategy and requirements, ensuring conformance to selected internal and external open interface standards. **The GATM aircraft integration contracts required procurement of compliant components from the GATM IDIQ contract and GATM accreditation GATM standards conformance by the GATM Program Office. Conformance certification enabled access to airspace worldwide.** |

# MOSA Business Strategy Implementation

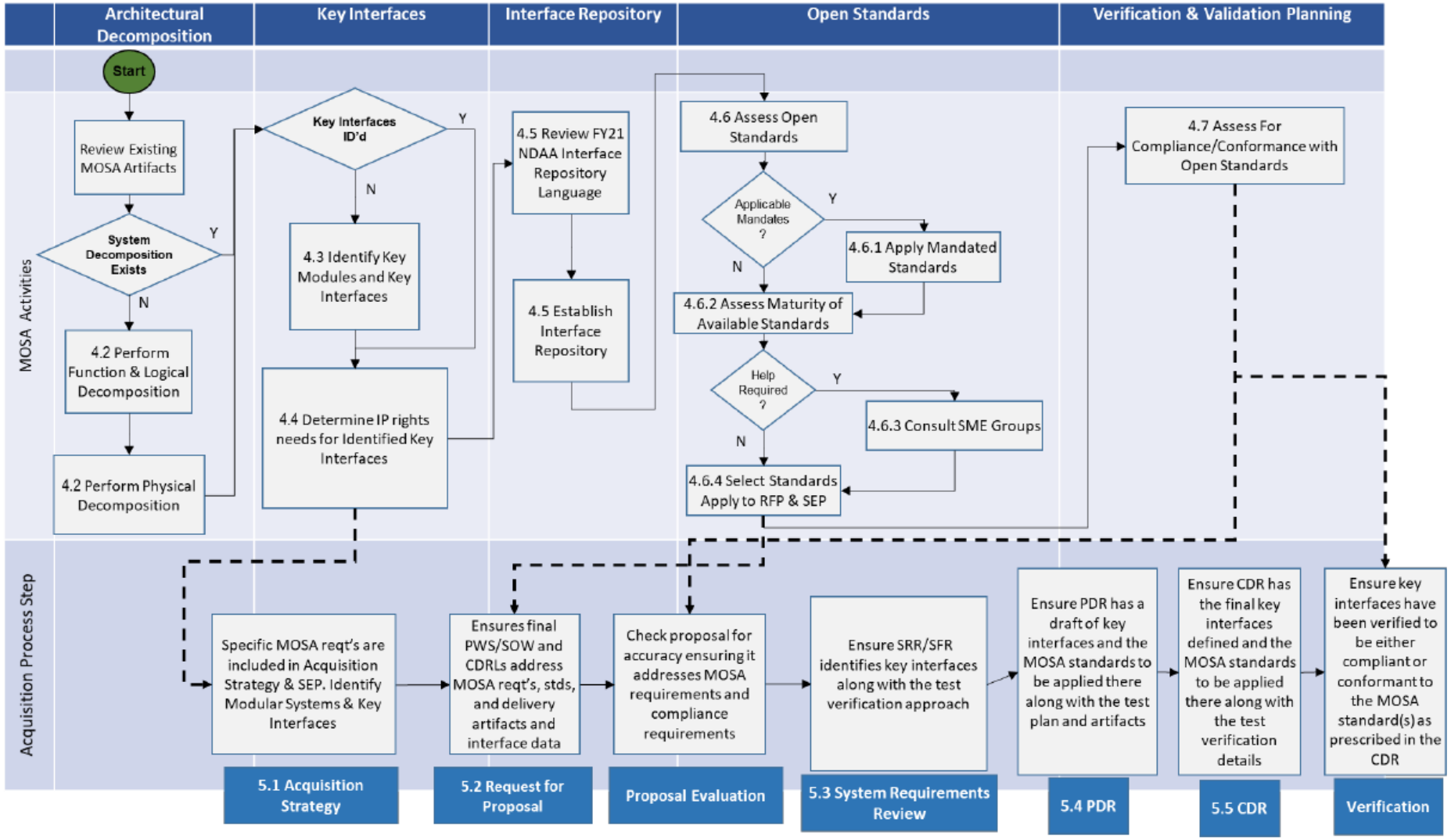



Adapted: DAU Acquisition of Services

# MOSA Technical Implementation Flow


[Adapted Best Practices for Using Systems Engineering Standards (ISO/IEC/IEEE 15288, IEEE 15288.1, and IEEE 15288.2) on Contracts for Department of Defense Acquisition Programs]

# USAF MOSA Starting Point for New Programs




AIR FORCE MATERIEL COMMAND (AFMC) GUIDEBOOK FOR IMPLEMENTING MODULAR OPEN SYSTEMS APPROACHES IN WEAPON SYSTEMS

# USAF MOSA Starting Point for Legacy Programs

## Key Questions

- What is the Expected Service Life of the system?
- Is the modification replacing obsolete components?
- Can the modification be executed in such a way as to open a portion of the overall architecture?
- What future modifications are projected for the weapon system?
- What is the threat environment for the weapon system?

**Tailor the MOSA Approach and Measurements to Address the MOSA Benefit Objectives**

## Legacy MOSA Approach

- Apply MOSA principles to their development and modification efforts
- Connect MOSA techniques to Digital Transformation and Model Based Acquisition objectives.
- Align with DoD, Department of the Service, and Major Command MOSA policy requirements
- Decompose MOSA concepts into actionable steps that can be tailored to fit program needs and constraints
- Align with traditional Acquisition schedule milestones and Adaptive Acquisition Framework alternatives including Agile Acquisition approaches

# Metrics Selection Example
# Enhance Competition – MOSA Approach

- **Source Selection Evaluation Criteria – Selected MOSA Objective**
  - **Architecture Completeness:** The extent to which the offeror's MOSA systems engineering and business approach and schedule demonstrate an appropriate balance of cost, schedule, and performance risk to implement and sustain the proposed MOSA approach throughout the lifecycle.
  - **Digital Engineering and Modeling:** The extent offerors Open System Management Plan and System Engineering Master Plan addresses the program MOSA requirements, identifies relevant modular systems/components and intellectual property required to meet MOSA objectives throughout the lifecycle
  - **Past Performance -** The Offeror shall provide details of your company's experience with implementing MOSA and achieving the benefits of MOSA on similar efforts
- **MOSA Information Needs/Measures**
  - Source Selection
    - Functional Architecture Completeness and Volatility
    - Committed vs Completed
    - Model Traceability
  - Execution
    - Functional Architecture Completeness and Volatility
    - Model Traceability
    - Architecture MOSA Requirements Implementation – Burndown, Cumulative Flow, Committed vs Delivered
    - Intellectual Property Committed Vs Completed
    - Technical Debt Burndown
  - Sustainment
    - Functional Architecture Completeness and Volatility
    - Technical/IP Debt – Committed vs Delivered, Burndown