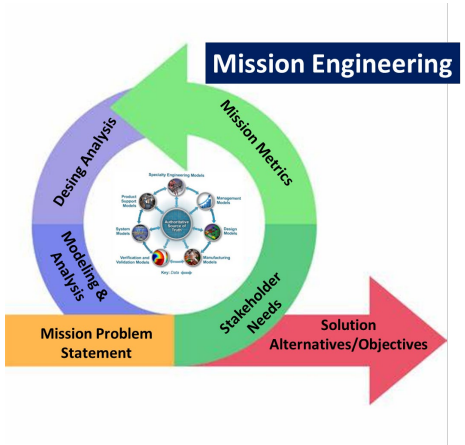
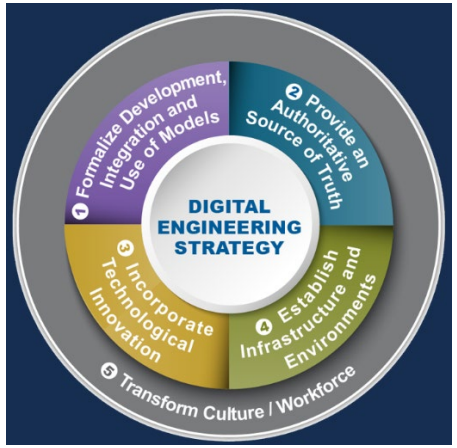
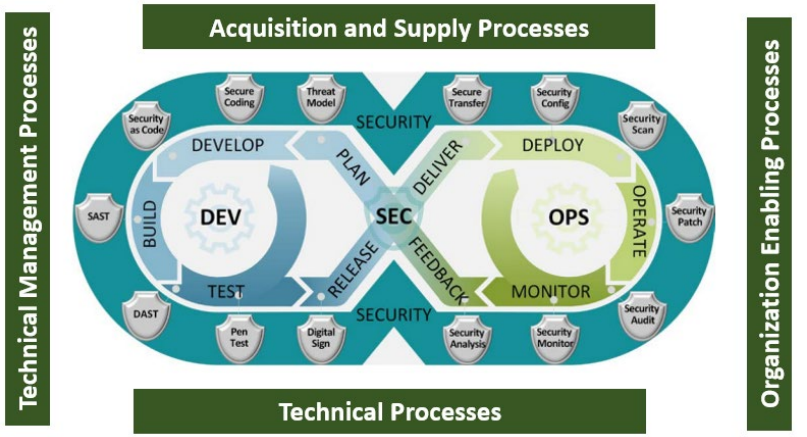




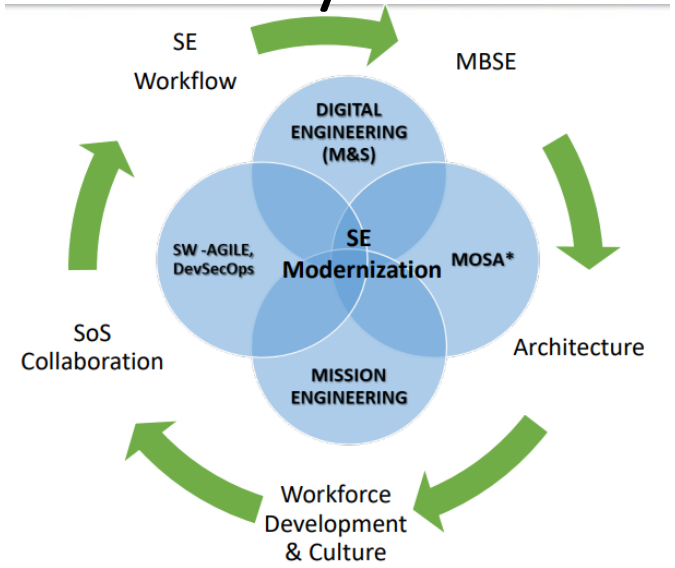


Program MOSA Transformation

Information Needs and Metrics

Measuring MOSA Implementation and MOSA Product Value/Success

Policy to Practice



NDIA Systems and Mission Engineering Conference

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Version 8

NDIA SE Division
Architecture Committee
MOSA Metrics Working Group

DoD Modular Open System Approach Ecosystem

What are Key Stakeholder MOSA Information Needs?

Policy Effectiveness and Guidance for Achievement of MOSA Benefits

MOSA Strategy, Cost, Schedule, Performance, Speed of Change and MOSA Enabling Environment Process Controls

Staffing Resources and Skills to Support Requirements Development and Planning

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

Continuous Competition and Contract Performance, MOSA Enabled Supply Chain

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

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

MOSA Implementation Iceberg Challenge

Business Approach

usiness
bjective

Reduced Time to Field Capability and Lifecycle Cost

Build for Change: Secure, Responsive, Scalable, Modular, Available, and Affordable Functionality.

Cost and Schedule Baseline

Optimized Modular Design/ Verified Interfaces

Identify Enabling Interfaces, Reference Architectures and Open Standards and **Acquire Appropriate Data Rights**

Develop Functional Architecture/**Model Traceability & Document Authoritative Source of Truth**

Technical Approach

Rapid Deployment of Suitable and Effective Mission Capability

Mission Objective

Product Baseline - Supporting Operational Flexibility and Reduced Support and Sustainment Cost

Digital Twin/MOSA Enabling Environment - Supporting Continuous Competition, Innovation, and Increase Interoperability

Allocated Baseline - Supporting Enhanced Incremental Technology Change and Reuse Using Rapid, and Agile Development

Functional Baseline – Establishes Initial system performance specification and external interface specifications

Progress

Measure MOSA Implementation Progress and Objective Achievement Measures

BLUF – Measure Progress of the System's MOSA Implementation and MOSA Objective Success

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27 Sep 23

Step 1: Begin with The End MOSA Objective in Mind

- **Success is defined in the context of enterprise and program business and mission objectives**

Step 2: Apply MOSA Tenants to Define the Required Standards, Interfaces, and Modularity

- **Acquirers should identify the standards, interfaces, and modularity needed to meet objectives**

Step 3: Identify Derived MOSA Implementation Requirements

- **MOSA attributes needed to meet objectives are requirements and implemented as part of the mission capability solution**

Step 4: Conduct Program Planning/ Contracting – MOSA Information Needs and Metrics

- **Program planning requires robust systems engineering and program management to produce and coordinate and effective and workable implementation and lifecycle achievement of MOSA objectives**

Step 5: How to Status MOSA Implementation (MOSA Metrics)

- **Program assessment and control processes and measures provide the information needed to support program decisions and effectively execute the program plan and MOSA implementation**

Step 6: Managing MOSA In Technical Baselines – Information Needs and Metrics

- **The technical baseline provides an accurate and controlled basis for managing change, cost estimates/budgets, technical plans and schedules, and contracting activity.**

Step 7: Measuring Lifecyle MOSA Benefit Achievement (MOSA Metrics)

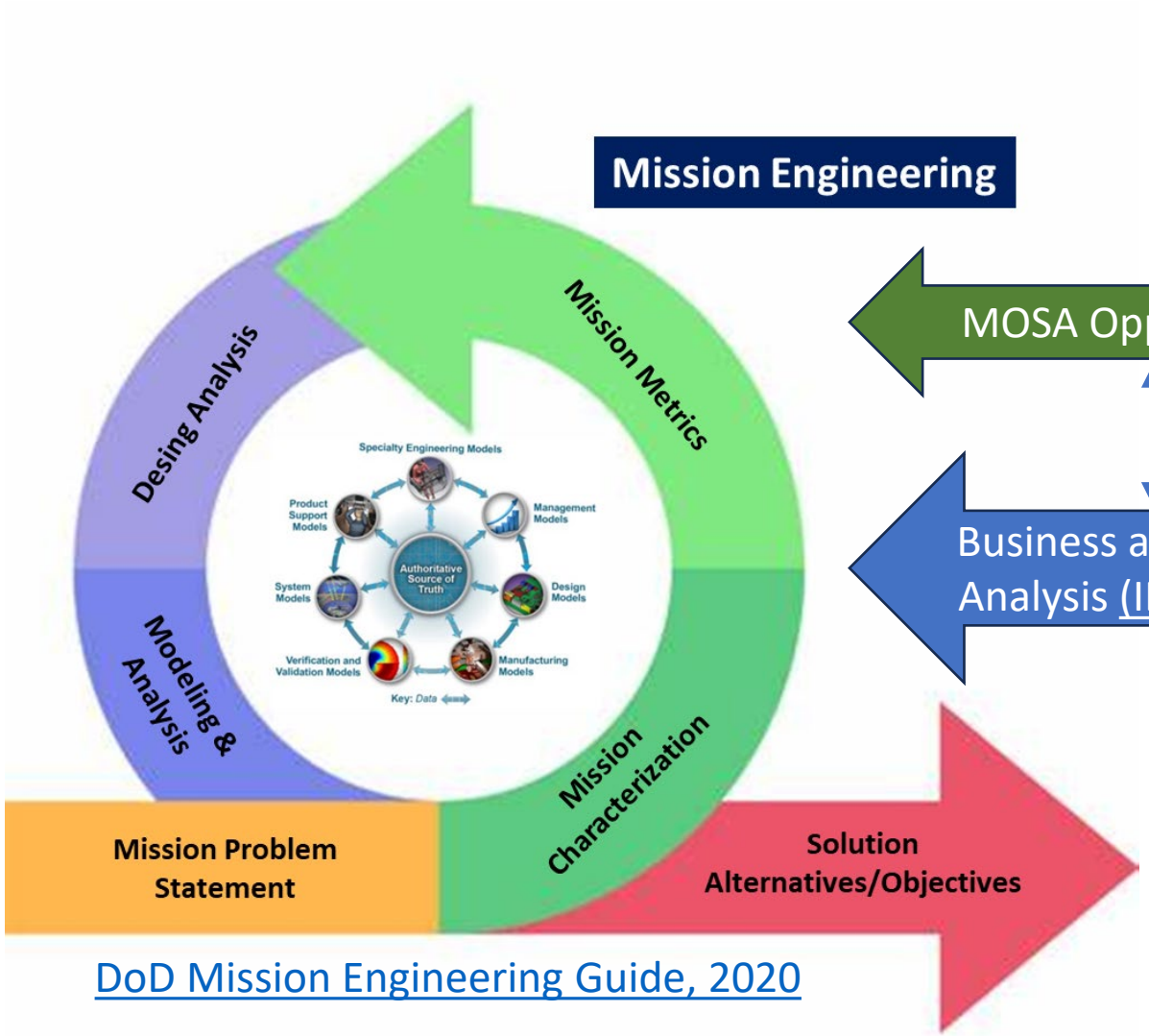
- **Are we achieving our MOSA business/technical objectives and MOSA Product Value identified in Step 1?**

10 U.S. Code § 4401 - Requirement for modular open system approach in major defense acquisition programs; definitions

10 U.S. Code § 4402 - Requirement to address modular open system approach in program capabilities development and acquisition weapon system design

10 U.S. Code § 4403 - Requirements relating to availability of major system interfaces and support for modular open system approach

Step 1 – Begin with the End in Mind



[DoD Mission Engineering Guide, 2020]

MOSA Opportunities

Business and Mission Analysis (IEEE 15288)

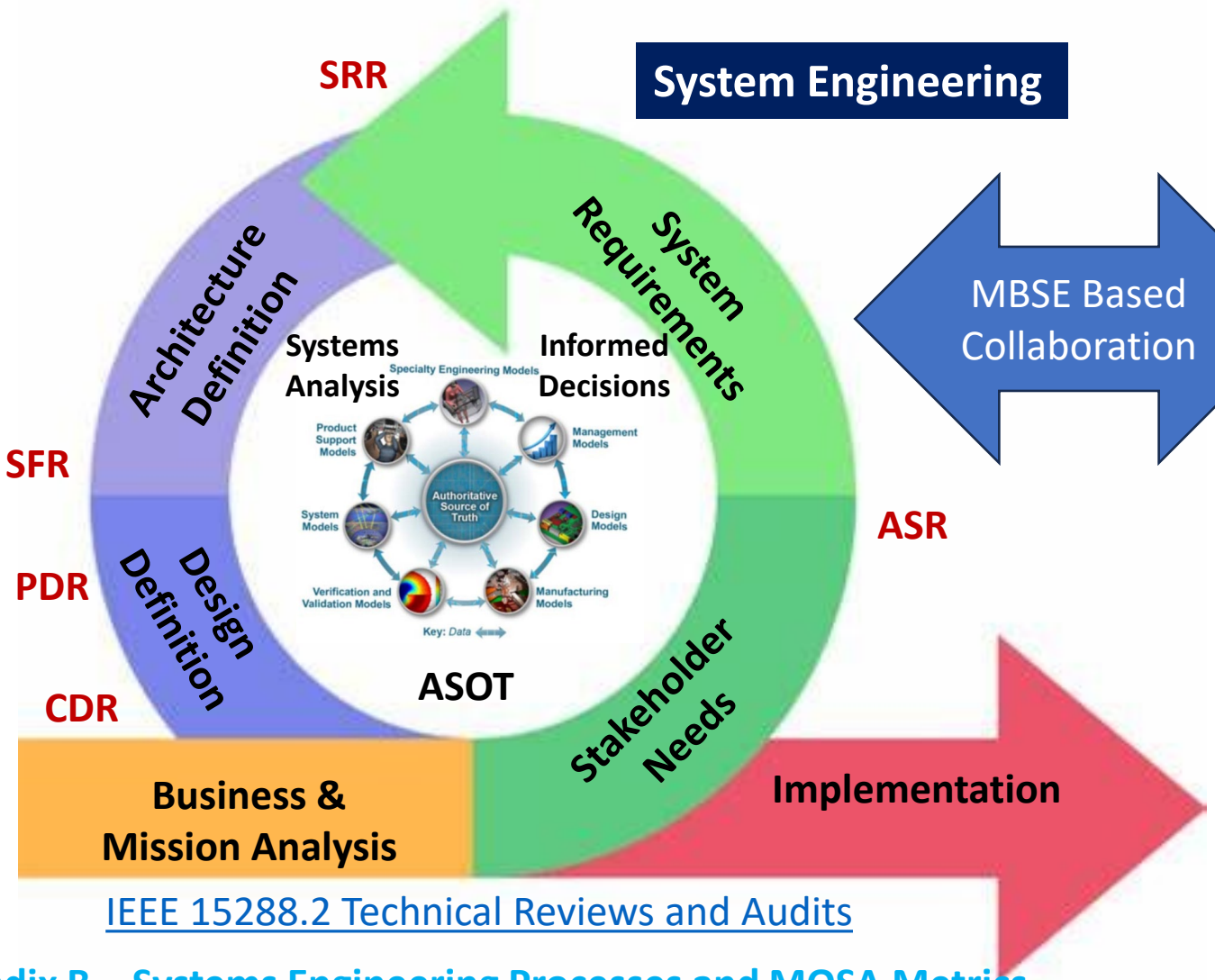
MOSA Objectives

[DoD MOSA Reference Frameworks in Defense Acquisition Programs, 2020]

What Mission Capabilities and MOSA Benefits do we wish to achieve?

→ [Army PEO Aviation MOSA Objectives Exemplar Example]

Step 2 - Apply MOSA Tenets to Define the Required Standards, Interfaces, and Modularity



MBSE Based Collaboration

Enduring Authoritative Source of Truth (ASOT)

Collaborate Knowledge Transfer

IEEE 15288.2 Technical Reviews and Audits

Appendix B – Systems Engineering Processes and MOSA Metrics

Appendix H – Systems Engineering Technical Review Questions

Step 3 Identify Derived MOSA Implementation Requirements Open Architecture Technical Approach and Processes

- **Adopt an Open Architecture Approach**
  - **Incorporate appropriate considerations for:** reconfigurability, portability, maintainability, technology insertion, vendor independence, reusability, scalability, interoperability, upgradeability, and life cycle supportability
  - **Document the intended implementation** of identified open standards, interfaces and/or Technical Reference Frameworks in the system models and acquisition strategy
  - **Address the means for ensuring adherence or conformance** to open standards and open architectural principles throughout the development process and lifecycle.
- **Optimize Architecture Modularity to Support Competition and Change**
  - **Describe in detail proposed system architecture** and how it is robust, layered, modular, adaptable and makes maximum use of existing Government-Off-the-Shelf (GOTS) hardware and software, Commercial CSCIs including Commercial-Off-the-Shelf (COTS) software, COTS hardware, operating systems, and middleware
  - **Reduce module coupling and increase module cohesion**
  - **Describe how the level of modularity supports MOSA and Mission Objectives**

Incorporate the MOSA implementation Attributes in technical baselines and models

Can Capture the MOSA Statutory Requirements from 10 U.S. Code § 4402 in the Open System Management Plan, DI-MGMT-82099

Appendix A Master MOSA Metrics List, Appendix H, Technical Review Questions Appendix D – Modular Open System Approach (MOSA) Reuse of SW and HW Use Case

Step 4 – MOSA Business Strategy Implementation

Adapted: DAU Acquisition of Services

Program Status
- Design Modularity
- Interfaces
- MOSA Benefit Achievement
- Standards Conformance
- Release Frequency
- Competition Savings
- Quality
- Test Automation

MOSA Technical and Business Baselines
- MOSA Benefit Measures
- Capability Roadmap
- Contracted MOSA Baseline

Best Value
- MOSA Approach Executability
- Risks and Opportunities
- Affordability
- MOSA Product Value

Solution Alternatives/Objectives
- Mission Requirements
- MOSA Statutory Requirements
- MOSA Business Requirements
- Desired MOSA Benefits

Range of Options/Opportunities
- Open Standards/Reference Architectures
- Open Technology Opportunities
- DoD/Service MOSA Guidance
- Modular Capabilities/Functions
- Competition Opportunities
- Product cycles and Standards Conformance

Development/ Deployment

Contract Award

Proposal Evaluations

Operations

Maintenance

Business & Mission Analysis

Market Research

Industry Proposals

Final RFP

Stakeholders

Acquisition Strategy

Industry Comments

Draft RFP Release

Source Selection Strategy

- **Approach for meeting the MOSA Benefit Objectives**
  - Approach to Achieve and Sustain MOSA Objectives
  - Modularity of Major Systems Components & Architecture
  - Delivery and Sustainment of Intellectual Property

Operational Effectiveness
- System Availability
- Operation Flexibility
- Increased Interoperability
- Operational Cost Savings
- Tech Refresh Frequency

Operational Suitability
- Total Life Cycle Cost
- Reliability/Availability
- System Resiliency
- Technical debt
- Obsolescence Risks
- Technology refresh Strategy
- Continuous completion strategy
- Mean time to repair
- Mean time to recover/restore
- Opportunities for promoting innovation

MOSA Objectives/Benefits/ Product Value
- Required Interfaces and Standards
- MOSA Incentives
- Intellectual Property/Data/ Model Requirements - SOO/SOW/QASP
- System Architecture/Models

Identify MOSA Implementation Constraints
- Identify Cost Savings Opportunities
- Identify Proposal Information Needs

Gather Feedback
- Solicit Comments on MOSA Approach
- Assess Industry Interest
- Understand Risks and Opportunities

MOSA Business Case
- MOSA Implementation Plan
- MOSA Enabling Environment
- Modularity of the Architecture
- Continuous Competition
- SOO/SOW/QASP/CM
- IP Strategy
- Tech Refresh Strategy
- Reuse Strategy
- Release Frequency
- Supply Chain Resilience
- Available Budget

Acquisition/Source Selection Plan
- Contract Type(s)
- MOSA Incentives
- Key Evaluation Criteria and Standards
- MOSA Product Value L&M Value Criteria
- MOSA Implementation Plan

10 U.S. Code § 4402 - Requirement to address modular open system approach in program capabilities development and acquisition weapon system design

Appendix J - Methods and Assessment Criteria to Quantitatively Evaluate MOSA

Appendix K MOSA Enhance Competition Strategy and Metrics

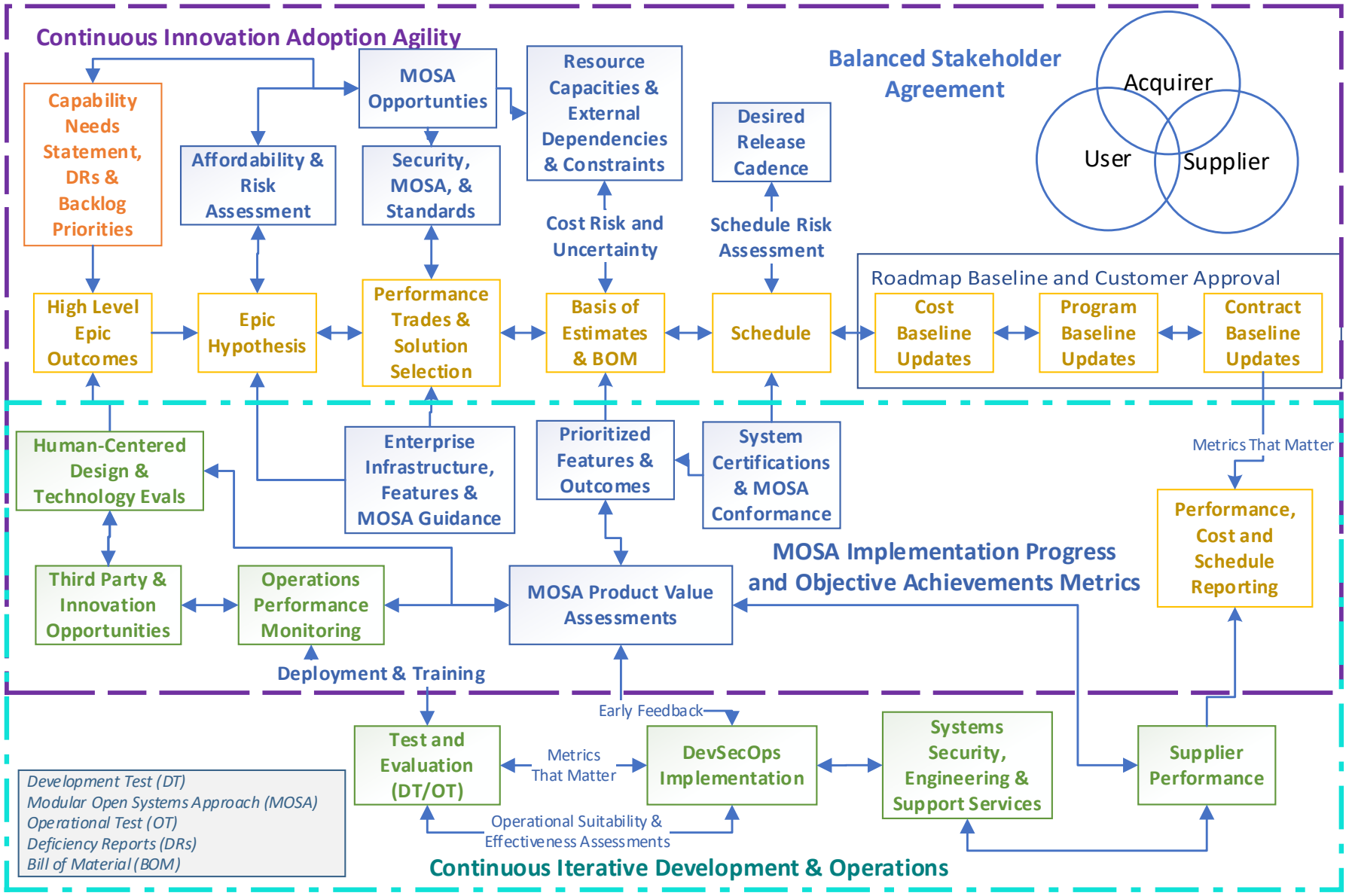
Step 4 Program Planning

MOSA Product Value

- **Optimized Modularity**
- **Functionality/ Performance**
- **Dependability**
- **Security**
- **Business Value**

KEY MOSA Planning Considerations

Product Acquisition Planning – MOSA Integrated Business and Technical Strategy



Appendix J - Methods and Assessment Criteria to Quantitatively Evaluate MOSA

Appendix K - MOSA Enhance Competition Strategy and Metrics

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27 Sep 23

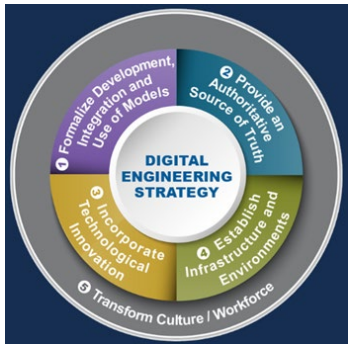
Step 5 – Tailor Your Measurement of MOSA Implementation

Appendix A - Master MOSA Metrics List

PSM Continuous Iterative Development	PSM Digital Engineering	Technical Risk Assessments	Business and Financial	Operations and Support
MOSA Product Value (Secure, Responsive, Scalable, Modular, Available, and Affordable)				
Automated Test Coverage	Functional Architecture Completeness and Volatility (8.1)	Technology Readiness Levels	Trend Line Chart	Reliability and Maintainability
Burndown	Model Traceability (8.2)	Integration Readiness Levels	Cost Risk Assessments	Mean time Between Failures
Committed vs Delivered/ Completed	Product Size (8.3)	Reuse Readiness Levels (NASA)	Schedule Risk Assessments	Operational Availability
Cumulative Flow	Digital Engineering (DE) Anomalies (8.4)	Manufacturing Readiness Levels	Market Share/Revenue Growth	Corrective Maintenance Time (CMT)
Cycle Time/Lead Time	Adaptability and Rework (8.5)	System Complexity Levels	Return on Investment (ROI)	Key Performance Parameters (KPP)
Defect Detection	Product Automation (8.6)	Change Failure Rates	Profit Margin	Change Failure Rates
Defect Resolution		Reliability and Maintainability	Probability of Competition (Pgo)	Lifecycle Cost Trends
Mean Time to Detect (MTTD) and Mean Time to Restore (MTTR)		Technical Performance Measures	Probability of Win (Pwin)	MOE/MOPS
Release or Deployment Frequency			Competition Effectiveness	
Team Velocity			Change Failure Rates	
Technical Debt			Lifecycle Cost Trends	

These Recommended Metrics are not prescriptive, but they represent best practices

Step 6 – Manage Technical Baselines
Align MOSA Implementation With SE Process



Technical Baselines Key Information

- **Functional**
  - System Performance Specification
  - **External Interfaces Specifications/Standards**
  - **Functional Architecture**
- **Allocated**
  - Item Performance Specifications
  - **Internal Interfaces Specifications/ Standards**
  - Physical Architecture
- **Production**
  - **Item Details Specifications**
  - **Physical Architecture**
  - **Technical Architecture**

MOSA features are implemented and verified in the design and implementation?

Technical Baseline Purpose

- The **functional baseline** is the required system functionality describing functional and interface characteristics of the overall system, and the verification required to demonstrate the achievement of those specified functional characteristics.
- The **allocated baseline** is the configuration items making up a system, and then how system function and performance requirements are allocated across lower-level configuration items (hence the term allocated baseline).
- The **product baseline** is the documentation describing all of the necessary functional and physical characteristics of a configuration item; the selected functional and physical characteristics designated for production acceptance testing; and tests necessary for deployment/installation, operation, support, training, and disposal of the configuration item.

DAU Technical Baselines

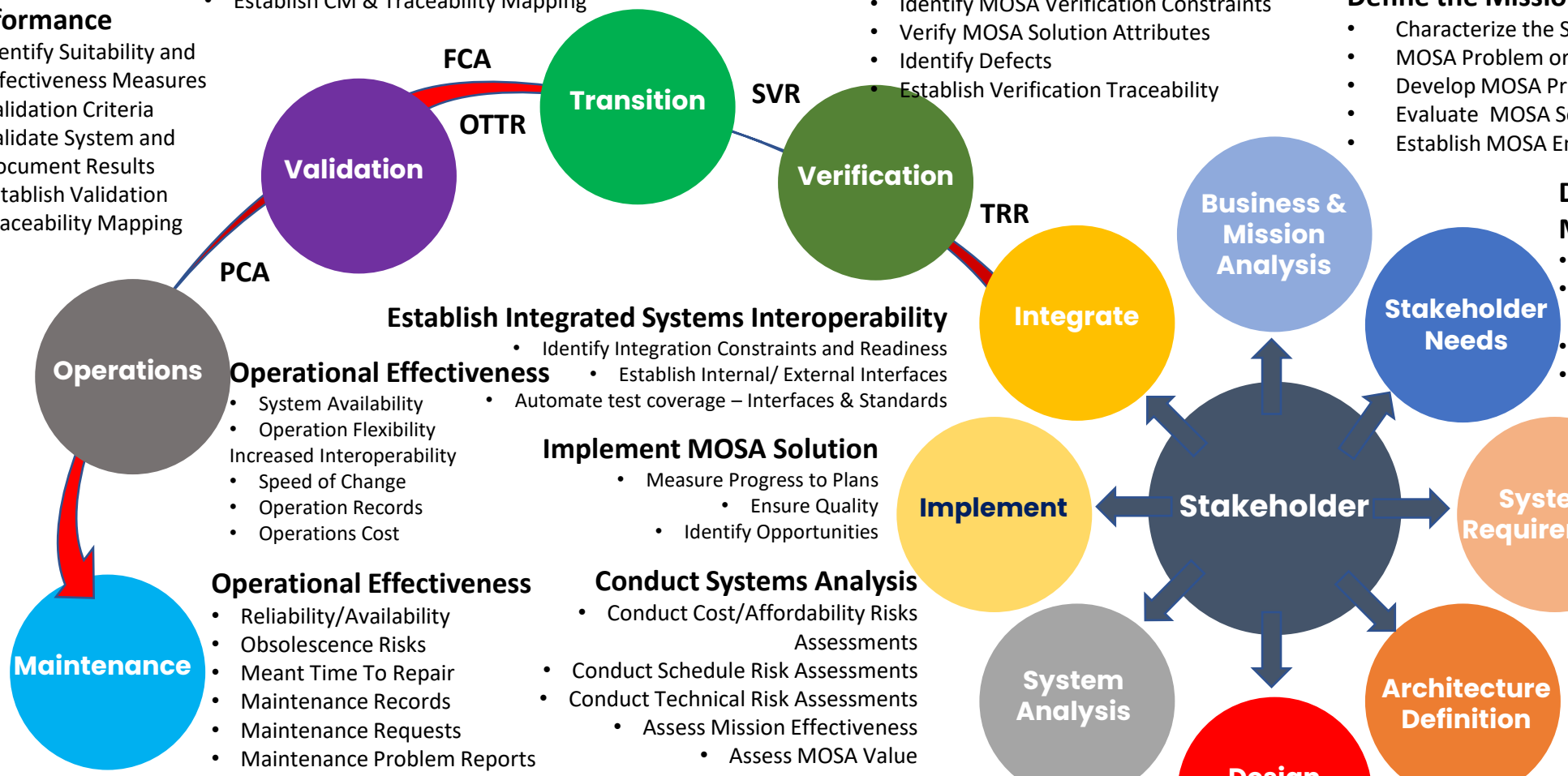
Step 6- MOSA Systems Engineering Processes and Solution Implementation Metrics

Transition to Operations
- Site MOSA technical debt burndown
- Training burndown
- Technical Order burndown
- Installation burndown
- Establish CM & Traceability Mapping

Validate System Performance
- Identify Suitability and Effectiveness Measures Validation Criteria
- Validate System and Document Results
- Establish Validation Traceability Mapping

Establish Verified Product Baseline
- Identify MOSA Verification Constraints
- Verify MOSA Solution Attributes
- Identify Defects
- Establish Verification Traceability

Define the Mission and MOSA Opportunity Space
- Characterize the Solution Space
- MOSA Problem or Opportunity Statement
- Develop MOSA Problem or Opportunity Statement
- Evaluate MOSA Solution Alternatives
- Establish MOSA Enabling Environment



Define Stakeholder MOSA and Mission Needs and Requirements
- Characterize Life Cycle Concepts
- Identify Critical Performance and MOSA Success Measures
- Prioritize Mission and MOSA Requirements
- Establish Requirements Traceability

Establish Integrated Systems Interoperability
- Identify Integration Constraints and Readiness
- Establish Internal/ External Interfaces
- Automate test coverage – Interfaces & Standards

Operational Effectiveness
- System Availability
- Operation Flexibility

Increased Interoperability
- Speed of Change
- Operation Records
- Operations Cost

Implement MOSA Solution
- Measure Progress to Plans
- Ensure Quality
- Identify Opportunities

Develop System Description
- Define System interfaces, functions and boundaries
- Define MOSA System Requirements
- Define Design Constraints
- Define Critical Performance Measures

SRR
- Establish Configuration Controls and Traceability Mapping

Operational Effectiveness
- Reliability/Availability
- Obsolescence Risks
- Meant Time To Repair
- Maintenance Records
- Maintenance Requests
- Maintenance Problem Reports
- Logistics Actions & Report
- Maintenance Report

Conduct Systems Analysis
- Conduct Cost/Affordability Risks Assessments
- Conduct Schedule Risk Assessments
- Conduct Technical Risk Assessments
- Assess Mission Effectiveness
- Assess MOSA Value
- Validate MOSA Assumptions and Results

Establish Allocated and Initial Product Baseline
- Assess Design Alternatives
- Define MOSA Design Modularity
- Assess and Chose Reuse Opportunities
- Produce Modular Design Artifacts
- Document Design and Reuse Rational
- Define MOSA External/Internal Interfaces

CDR PDR SFR

Establish Functional Baseline
- Align Architecture with MOSA Policy & Program Cost and Schedule Constraints
- Develop and Update System Models
- Allocate MOSA Concepts, Characteristics, Functions, Interfaces, and Constraints to Architecture
- Define Interfaces and System Elements
- Develop Architecture View
- Document Verification Requirements

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[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]

Step 6 – Manage the Technical Baselines

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Technical Processes

- System requirements definition process
- Architecture definition process
- Design definition process
- System analysis process

- Business or mission analysis
- Stakeholder needs and requirements definition process

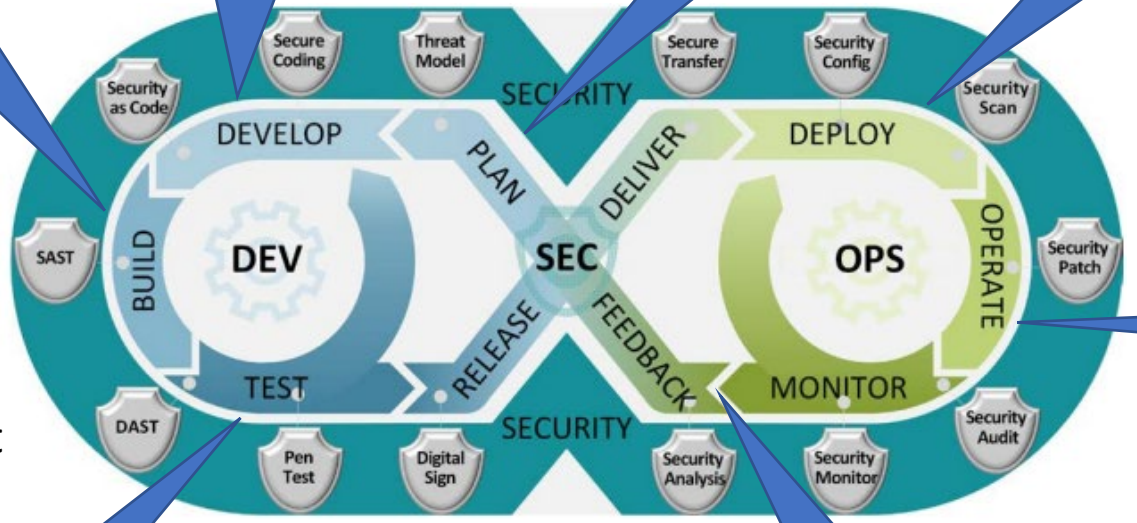
- Implementation process
- Integration process

- Transition process
- Validation process

Lifecycle Model, Infrastructure, Portfolio, Human Resources, Quality, and Knowlegege Management Processes

Potential Measures

- CID
- Digital Engineering
- Technical Risks
- Business/Financial
- Operations/Support



Technical Management Processes

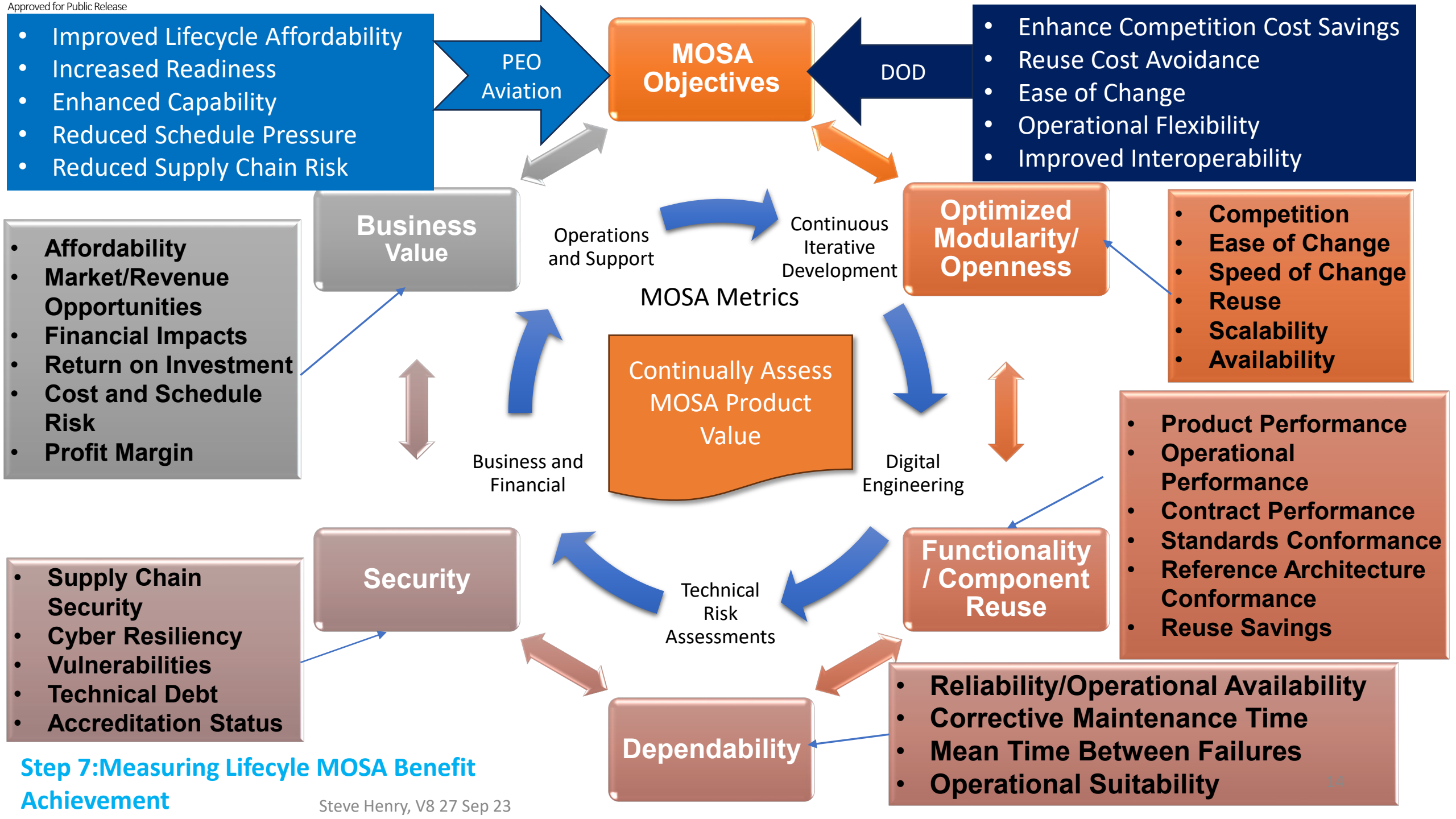
- Operation process
- Maintenance process

- Verification process

- Disposal Process

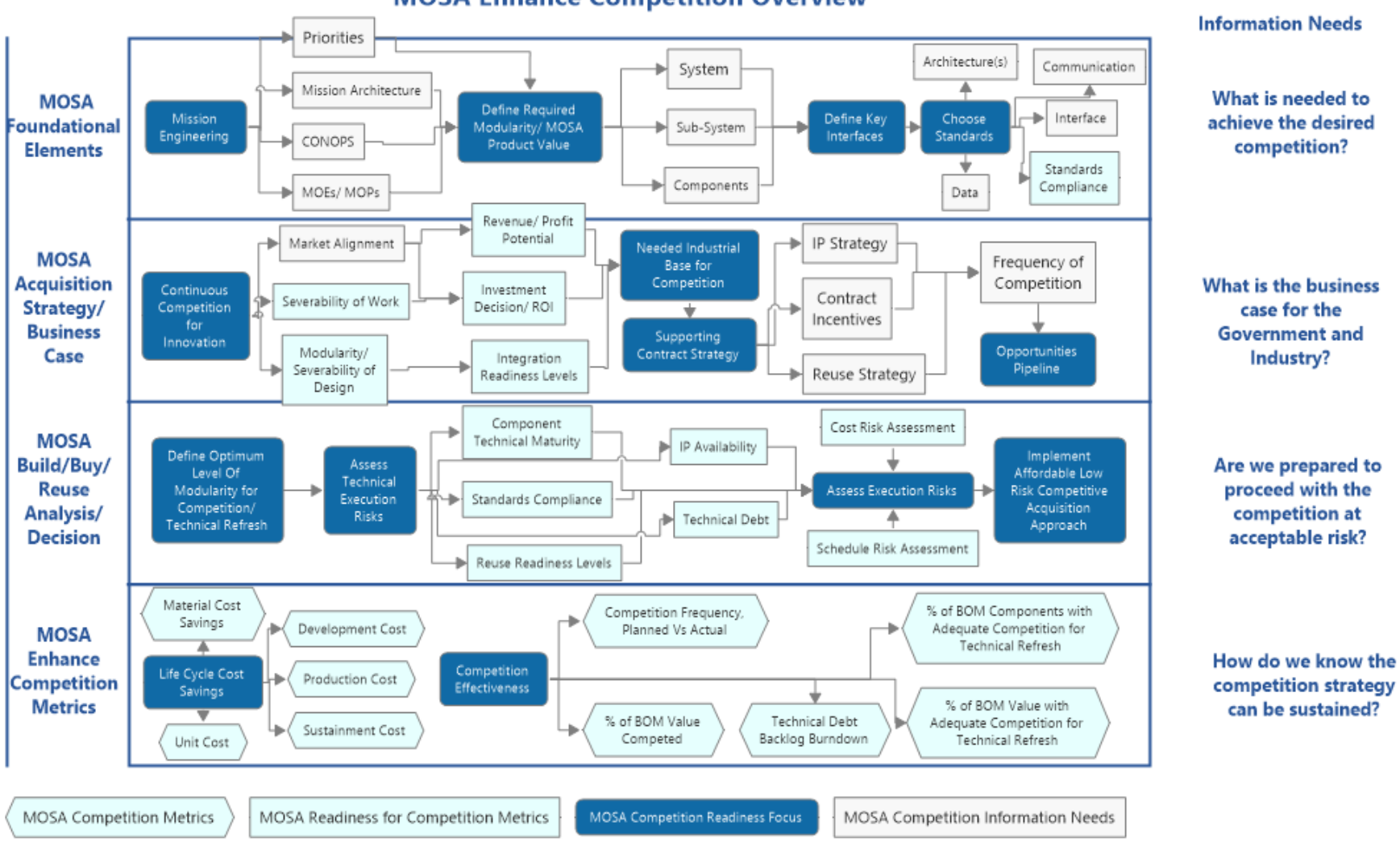
Acquisition and Supply Processes

Project Planning; Project Assessment and Control; Decision, Risk, Configuration, Information Management; and Measurement and Quality Assurance Processes



Step 7:Measuring Lifecyle MOSA Benefit Achievement

Step 7 Measure Lifecycle Benefit Achievements Enhance Competition Use Case



Appendix K - MOSA Enhance Competition Strategy and Metrics

Step 7 Measure Lifecycle Benefit Achievements

(Measure MOSA Success Against the Objectives Chosen in Step 1)

NDIA Example (Not PEO Aviation) Mapping of Candidate Metrics to Army PEO Aviation MOSA Objectives				
Improved Live Cycle Affordability	**Increased Readiness**	**Enhanced Capabilities**	**Reduced Schedule Pressure**	**Reduced Supply Chain Risk**
MOSA Product Value	**MOSA Product Value**	**(Secure, Responsive, Scalable, Modular, Available, and Affordable)**		
Life Cycle Cost Trends	Reliability & Maintainability	Competition Frequency	Lead Time	Functional Architecture Completeness and Volatility (8.1)
Material Cost Trends	Operational Availability	Opportunity Pipeline	Cycle Time	Model Traceability (8.2)
Unit Cost Trends	Change Rate Failure	Investment Trends	Release Frequency	Committed vs Delivered
Touch Labor Trends	MOEs/MOPs	Return on Investment	Team Velocity	Release Frequency
Competition Effectiveness	Defect Detection	Budget Trends	Automated test Coverage	TRL/IRL/MRL
Cost Risk Assessments	Defect Resolution	Key Performance Parameters)KPPS)	Defect Detection	Reuse Readiness Levels
Reliability & Maintainability		MOEs/MOPs	Defect Resolution	System Complexity Levels
Cost Risk Assessments		Reuse Readiness Levels	Schedule Risk Assessments	Change Failure Rate
Reuse Readiness Level		Technical Debt	Mean Time to Detect/ Restore	Automated test Coverage

NDIA MOSA Implementation Considerations, Information Needs and Metrics Use Case Appendices Content

MOSA Implementation Considerations, Information Needs and Metrics White Paper

- Planned Release Oct 2023
  - NDIA Connect Systems Engineering - National Defense Industrial Association (ndia.org) (Membership Required)
  - NDIA System Engineering Division Studies and Publications (Public Access)
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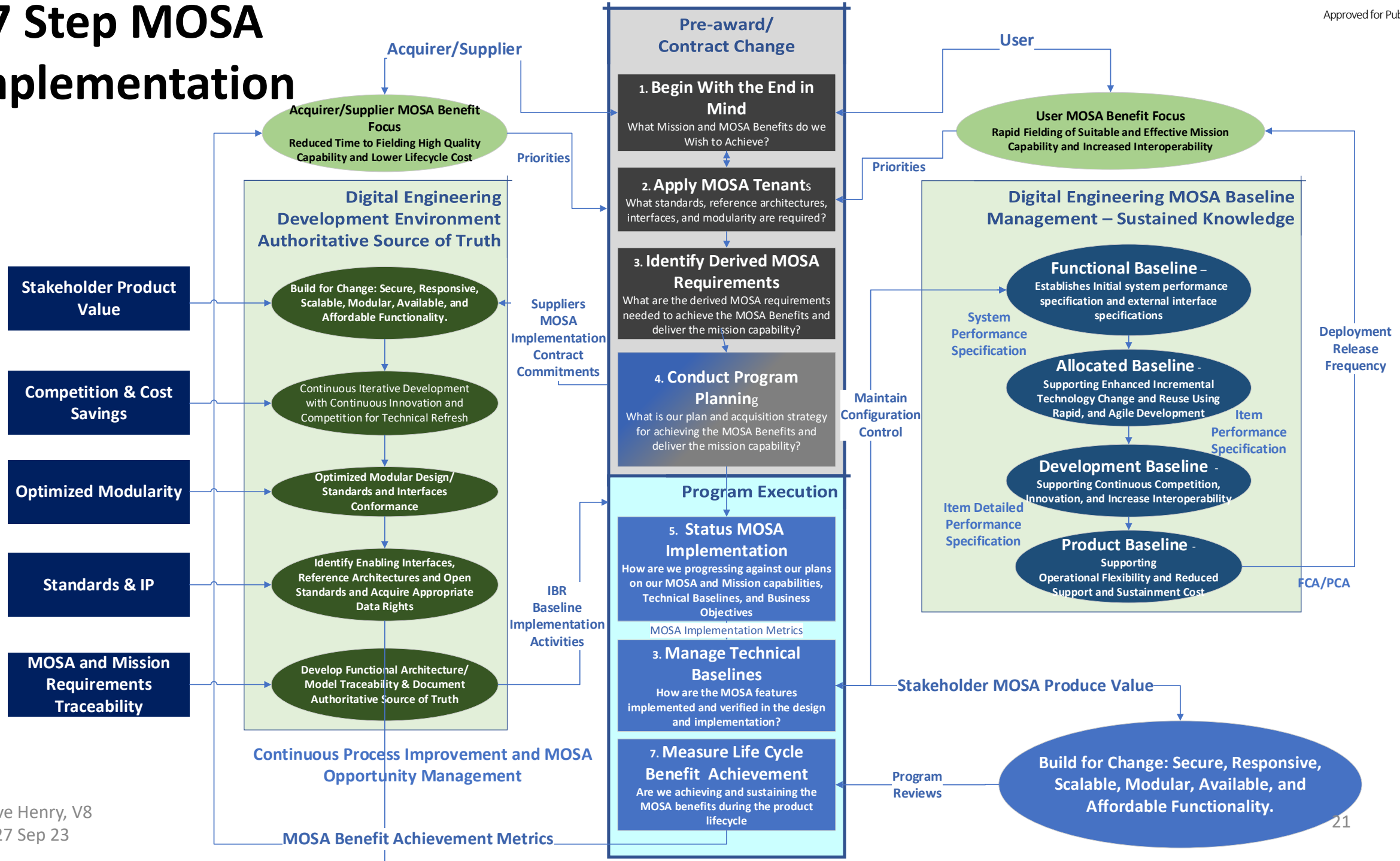
BACKUP

7 Step MOSA Implementation



Appendix A – Master MOSA Metrics List

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Metric	Information Need	Examples MOSA Application of Measures

MOSA Product Value – Optimized Product Modularity CID 9A	What value is MOSA providing the program, product, capability, or system?	**Optimized Modularity:** Modularity provides significant opportunities for continuous life cycle competition innovation for both the acquirer and supplier supply chain. Modularity and data and intellectual property fully support the product roadmap evolution path, technical refresh plans, and operational reconfiguration flexibility and achieves desired MOSA benefits:
		• → Significant cost savings or avoidance
		  ○ → Life Cycle Cost Reductions
		  ○ → Reuse cost saving/avoidance
		  ○ → Reduced Production Cost
		  ○ → Reduced Maintenance Costs
		• → Schedule reductions
		  ○ → Reduced lead and cycle times
		  ○ → Faster release frequency
		• → Opportunities for technical upgrades
		  ○ → Reduced obsolescence
		  ○ → Technical performance measures
		• → Increased interoperability, including system of systems interoperability and mission integration; or other benefits during the sustainment phase of a major weapon system

MOSA Product Value – User **Stakeholder Value** CID 9B1	What is the Value of MOSA to the stakeholders?	**User:** • → Rapid on demand deployment frequency • → Combat operational configuration flexibility • → Increased interoperability • → High system availability • → Increase readiness with increased cyber resiliency • → Lower operations and support cost
MOSA Product Value – **Acquirer Stakeholder Value** CID 9B2		**Acquirer:** • → Increased affordability: Avoid vendor lock, increase competition, and enable reuse (develop & certify once, deploy many) and reduce lifecycle costs. • → Reduce supply chain risk: Competitive options, obsolescence mitigations, and simplified logistics tail

Appendix B

MOSA Systems Engineering Processes and Solution Implementation Metrics

Portfolio Management Process

The portfolio management process commits the investment of adequate organization funding and resources, and sanctions the authorities needed to establish selected projects. It performs continued qualification of projects to confirm they justify, or can be redirected to justify, continued investment. (IEEE 15288)

MOSA Information Need	Sample Application of Metrics for MOSA

• What are the supportive requirements; business practices; and technology development, acquisition, T&E, and product support strategies for effective development of open systems in the portfolio?
• Are the portfolio MOSA projects being implemented in accordance with established MOSA policies and contract requirements?
• What investment(s) are required to effectively implement the MOSA strategy?
• What is the cost and schedule of realizing the MOSA investment(s)
• What is the new MOSA opportunity backlog?
  ○ Commonality
  ○ Reuse
  ○ Other…
• What is the current mission and MOSA requirement priorities?
• What is the return on investment for MOSA opportunities?
• What is the status of implementing MOSA interfaces, components, and required portfolio reference architectures and standards?
	• Committed vs Delivered/Completed
	• Cumulative Flow
	• Burndown
	• Cost Risk Assessment
	• Schedule Risk Assessment
	• Return on Investment (ROI)
	• Burndown

Realizing MOSA Product Value

MOSA Product Value Affordability Assessment Criteria Example

1.0 Affordability: Will the system, product, or capability, improve mission needs and achieve MOSA benefits while meeting or exceeding project budget constraints? – Degree by which the system, product, or capability will improve the mission capability and yet stay within budget constraints using a MOSA approach. Set the value 0-100. Recommended as part of a minimal set of attributes.
Recommended Stakeholders: Acquirer; and Supplier.

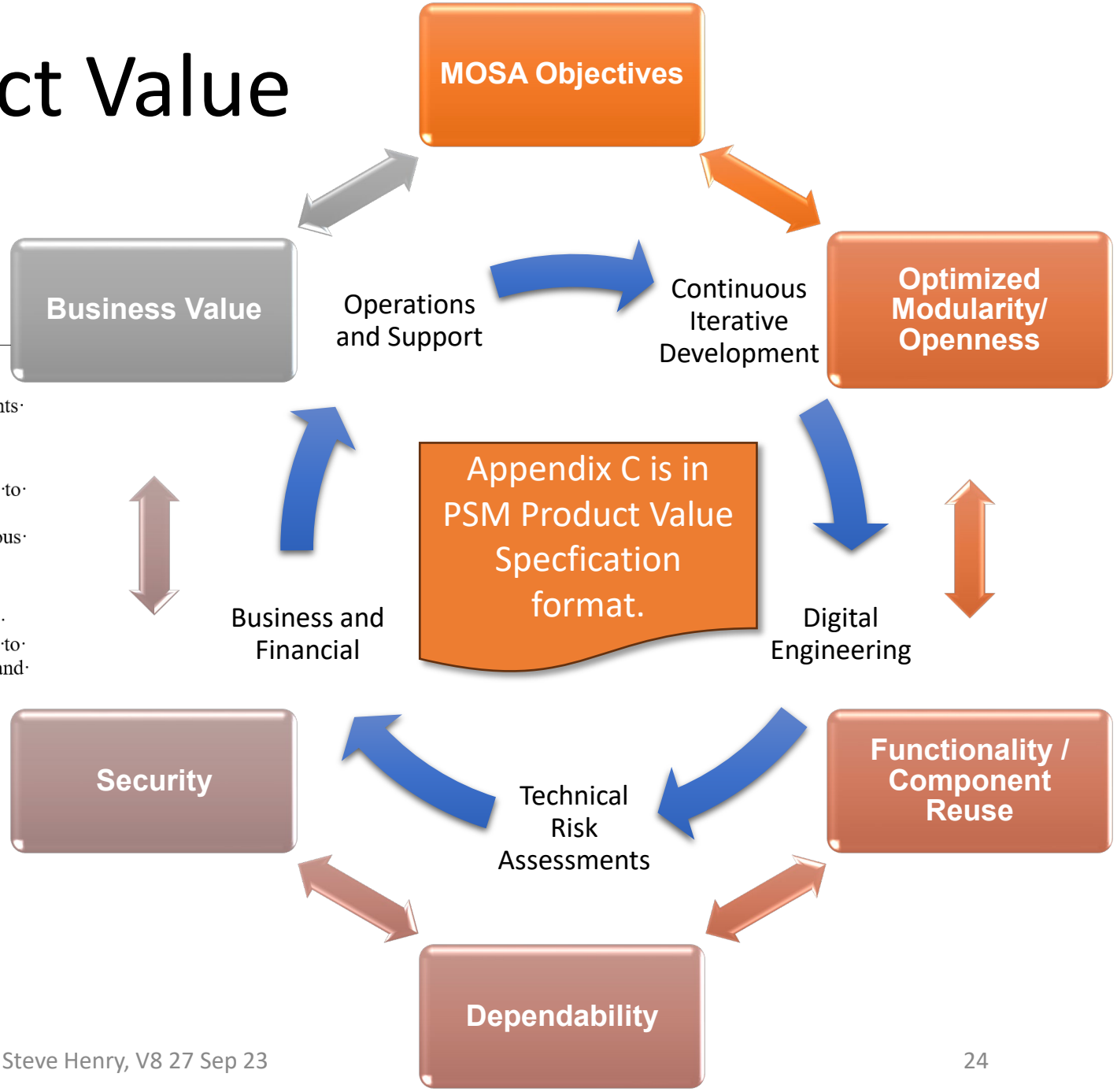
0 = The system, product, or capability does not improve mission needs and is not expected to perform to budget constraints. Competition does not exist or minimal competition cost saving can be achieved. In planning or execution, the program has no cost or schedule margin and has numerous risks. Reuse options are limited. Support cost/repair costs exceed available budget and desired cycle repair time.

50 = The system, product, or capability may improve mission needs but not perform to budget or may perform to budget but not improve mission needs. Competition opportunities exist that can lead to cost savings. Implementation of MOSA attributes and automation can provide integration cost and schedule savings. Reuse opportunities are available.

100 = The system, product, or capability will improve mission needs and is expected to perform well within budget constraints. MOSA enables continuous competition for technology refresh numerous standards-based reuse opportunities

Information Needs and Measures:

- → Technical Performance Measures
- → Performance/MOSA Benefits Committed vs Delivered
- → Schedule Risks Assessment



Appendix C – MOSA Product Value Specification

Appendix D – Software Reuse Readiness Levels Assessment Criteria (What are the Program risks?)

Reuse Readiness Level Attributes	RRL Attribute Focus
Documentation	**Information that describes the software asset and how to use it.**
Extensibility	**The ability of the asset to be grown beyond its current context.**
Intellectual Property	**The legal rights for obtaining, using, modifying and distributing the asset.**
Modularity	**The degree of segregation and containment of an asset or components of an asset.**
Packaging	**The methodology and technology for assembling and encapsulating the components of a software asset.**
Portability	**The independence of an asset from platform-specific technologies**
Standards Compliance	**The adherence of an asset to accepted technology definitions.**
Support	**The amount and type of assistance available to users of the asset.**
Verification and Validation	**The degree to which the functionality and applicability of the asset has been demonstrated.**

Adapted: (NASA Reuse Readiness Levels)

Appendix D - Reuse Readiness Level Score Card Detailed Scoring Example

Reuse Readiness Attribute Defintions				
Reuse Readiness Attribute	**Resue Readiness Atttribute Defnition**	**RRL 1**	**RRL 2**	**RRL 3**
Documentation	**Information that describes the software asset and how to use it.** **MOSA Benefit:** Documentation enables potential adopters to determine whether the software addresses the need and informs adopters how to utilize the software and reduce the risks and costs of reuse. Documentation includes descriptions of interfaces and capabilities, information about the execution environment, and instructions for the consumer on the purpose of the asset and on ways in can be reused. Documentation also describes plans for subsequent releases and future development.	Little or no internal or external documentation available	Partially to fully commented source code available	Basic external documentation for sophisticated users available
		Source code is available, with little or no useful internal or external documentation	Source code is available and fully commented, but no other documentation is provided	For example, a README file, a "man" page, or command line usage examples
			It may be challenging for a good programmer to determine how to reuse the software	This type of documentation would be sufficient for a sophisticated user to figure out how to use the software, but probably not a general user.

Appendix E
Navy CANES MOSA Acquisition Strategy 2007

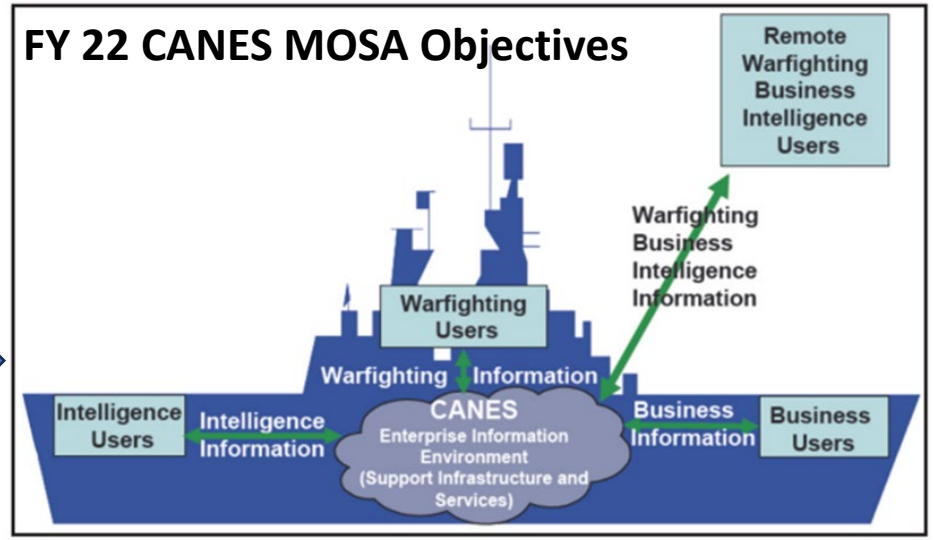
- **Adapt to evolving requirements and threats** as identified by the Government
- **Enhance interoperability and the ability to integrate new capabilities** without redesign of entire systems or large portions
- **Accelerate transition from science and technology** into acquisition and deployment;
- **Facilitate systems reconfiguration and integration**
- **Reduce the development cycle time and total life-cycle cost**
- Plans for **integrating the systems** both internally and with external systems (System of Systems)
- Provide a means for **ensuring conformance to open standards and profiles**
- Develop a technical approach that ensures having access to **mature as well as the latest technologies** by establishing **a robust, modular, and evolving architecture based on open standards**.
- Develop a **strategy for maintaining the currency of technology** (e.g., through COTS or reusable NDI insertion, technology refresh strategies
- Maintain continued **access to cutting edge technologies and products from multiple suppliers**; and
- **Mitigate the risks associated with reliance on a single source of supply over the life of the system**, to include, but be not limited to, technology obsolescence and dependence on proprietary or vendor-unique technology.

Appendix E Navy CANE MOSA Benefit Evolution

CANES 2012 MOSA Baseline

- **Maximize Competition: CANES** strategy maximizes competition throughout program's lifecycle
- **Open Standards**: CANES specifications promote further competition
- **CANES MOSA Strategy:** CANES Life-Cycle Support Approach
  - **Modular Open System Approach (MOSA) Open Systems Architecture Requirements**
  - **Reference Architecture:** The CANES system developed in accordance with the NESI Implementation Framework
  - **Standards Conformance:** Validated development the program in compliance with NESI standards and mission capabilities
  - **Intellectual Property:** Secured full data rights.

Continued MOSA Benefits



- Provide a **secure afloat network** required for Naval and Joint Operations
- Consolidate and **reduce the number of afloat networks** through the use of **Common Computing Environment** and mature cross domain Technologies
- **Reduce the infrastructure footprint and associated Logistics, Sustainment, and Training Costs**
- **Increase reliability, security, interoperability and application hosting** to meet current and projected Warfighter requirements

CANES Application Integration effort provides common software governance, testing, processes, and tools to application developers.

GATM Use Case Enterprise Architecture and Objectives

Mission Engineering

Communications
- **More direct and efficient air -ground linkages**
- Improved data handling
- Reduced channel congestion
- Reduced communications errors
- **Interoperability across applications**
- Reduced workload

Navigation
- High-integrity, high-reliability, all-weather navigation services worldwide
- Improved four-dimensional navigation accuracy
- **Cost savings from reduction or non -implementation of ground based navigation aids**
- Better airport and runway utilization
- Provision of non -precision approach/precision approach (NPA/PA) capabilities at presently non -equipped airports
- Reduced pilot workload

Surveillance
- Reduced error in position reports
- Surveillance in non -radar airspace
- **Cost savings**
- Higher degree of controller responsiveness to flight profile changes
- Conformance monitoring
- Improved emergency assistance

* MOSA Benefits

Determine MOSA Based Implementation Strategy

Governance Standards & Reference Architectures

MOSA Based Acquisition Strategy

- **Integrated Technical and Business Lifecyle Strategy to Rapidly Deliver/Sustain Mission and MOSA Benefits**
  - Program Office managed integration
  - **Single focal point for procurement of GATM Group B and sustainment**
  - **Quantity buys and discounts**
  - **Single supply chain with multiple vendors**
  - **Single USAF accreditation organization**
  - Consolidated GATM expertise
  - **Enable commonality across platforms**
  - Available to all DoD
  - **Increase Interoperability**
- **MOSA GATM ID/IQ Contracts**
  - **Multiple Selections/ Increased Competition to lower cost**
  - **Enable Rapid Replacement (24 hour turn)**
  - **Extended Warranty Lower Support Cost**
  - **Facilitate Tech Refresh and Product Evolution**
  - **Conformance to Open Standards Conformance**
- **Provide Governance**
  - **Enterprise level configuration control visibility**
  - **GATM IDE/Web Digital Environment for ordering and exchange of technical information**
  - Free Technical Support
  - **Published GATM Accreditation Process**
  - **Integrated Enterprise level POM Support**
  - Integration Source Selection Support
- **Key Objectives**
  - Meet CNS/ATM Requirements
  - **Rapid delivery and Refresh timelines**
  - **Competition and Lifecycle cost savings**
  - **Improved Interoperability and commonality**
  - County Acceptance of GATM Certification

Appendix F

Steve Henry, V8
27 Sep 23

Global Air Traffic Management (GATM) MOSA Strategy Implementation and Evolution

USAF Scientific Advisory Board Findings, Report on Global Air Navigations, Volume 2, Detailed Findings, SAB-TR97-02, Sep 1998

0305099F Global Air Traffic Management (GATM), RD2 – February 2000

0305099F Global Air Traffic Management (GATM), RD-2, Feb 2015

0305099F Global Air Traffic Management (GATM), RD-2, May 2021

Appendix F GATM Acquisition Strategy

Steve Henry,
V8 27 Sep 23

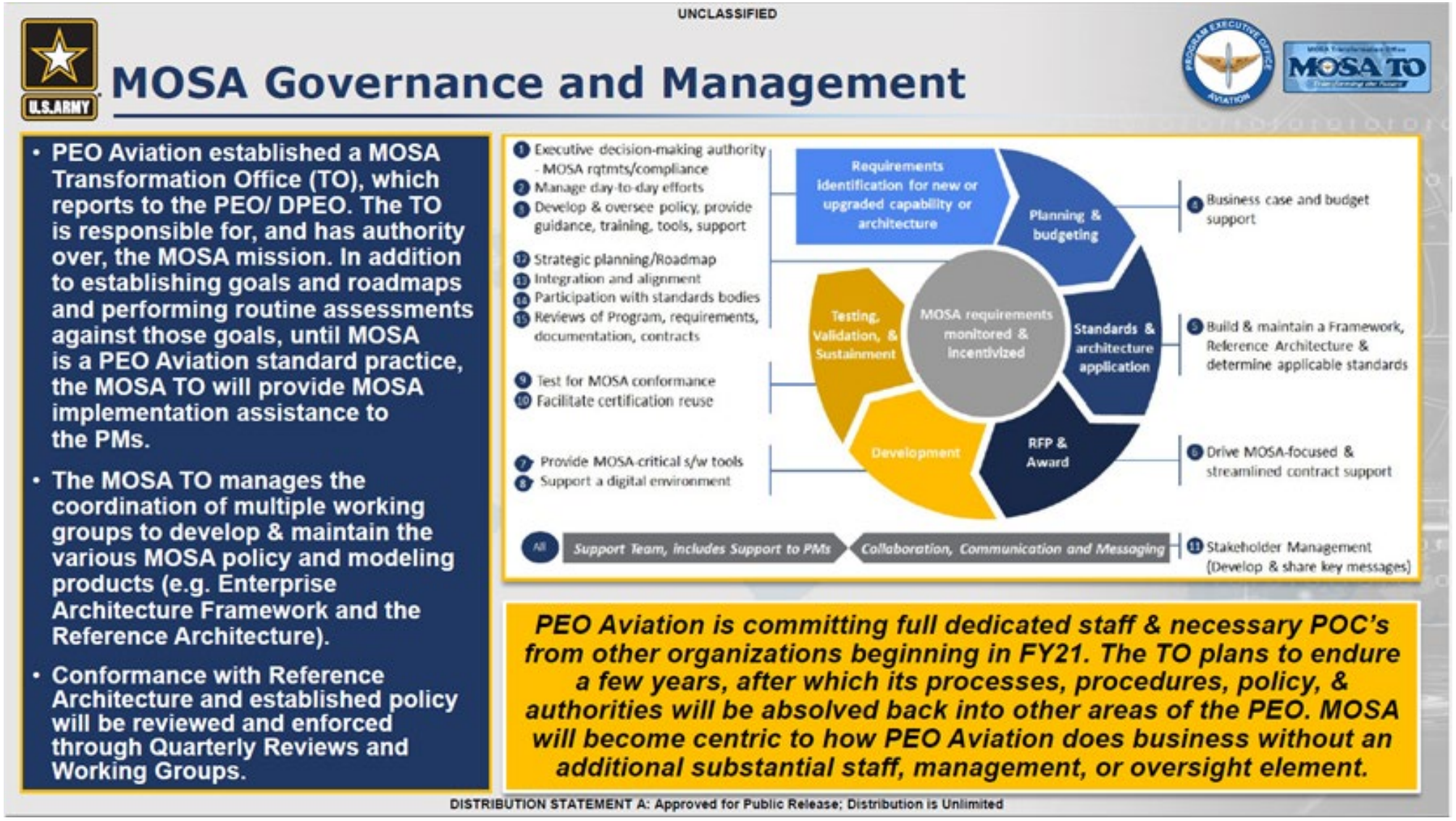
GATM Stakeholder MOSA Success Metrics

GATM Program Office	Aircraft Program Office	Major Command
GATM Acquisition Capability Time Lines • Cycle Time (Time from RFP Release to Contract Award) – component availability • Competition Frequency Planned vs Actual	**Aircraft GATM Integration/ Deployment Timelines** • On time GATM Component Delivery vs need • Aircraft GATM Integration Cycle Times	**Aircraft GATM Deployment Timelines** • GATM Equipage % by Fleet Burndown • Denied Airspace Access Backlog

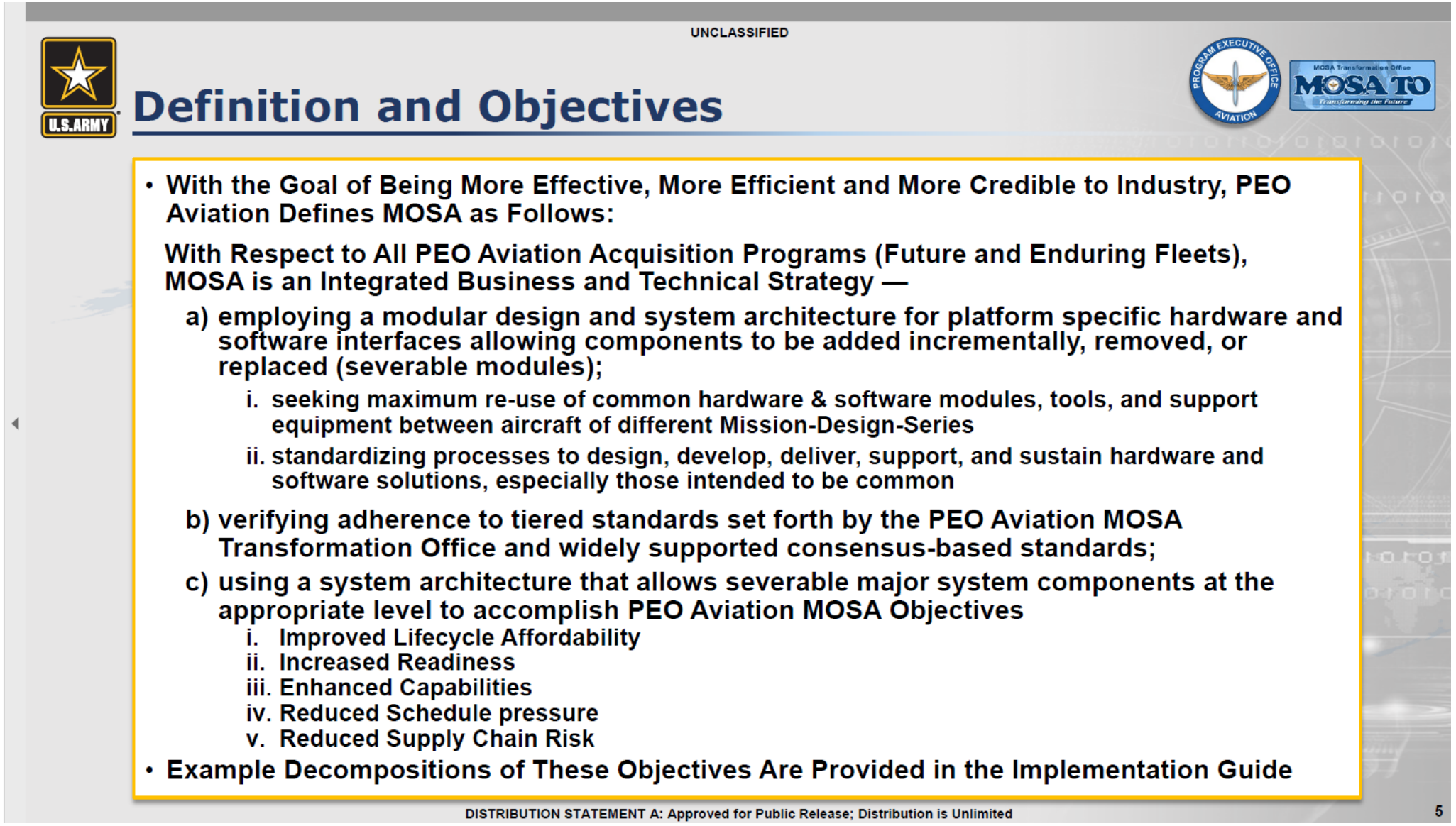
Competition Cost Savings
• Component Unit Pricing Catalog versus IDIQ Bid Prices
• Component Unit Pricing Trends over time
• Component Repair Cost
• Quantity Buy Savings
• Integration Competition Cost Savings
	Aircraft GATM equipage cost
	• Aircraft Integration Cost Funding Shortfalls
	  • Integration Competition Cost Savings
	  • Integration Cost Avoidance
	• GATM Component Unit Pricing Trends over time
	• GATM Component Repair Cost
		Total GATM Program Cost
		• Aircraft Integration Cost vs Committed
		• Sustainment Cost Reductions
		  • Mean Time Between Failures
		  • Mean Time to Repair
		• GATM Competition Cost Savings
		• Commonality Across Platforms
		• Lifecycle Cost

Speed of Delivery • Delivery Time vs Contract • Mean Time to Repair and Return • Surge Repair Delivery Times	**Speed of Delivery** • Average GATM Component Delivery time from time of order • Aircraft GATM Modification Cycle Time Trends	**Speed of Delivery** • Aircraft GATM Equipage vs Need Timelines • Mean Time to Repair and Return
Aircraft Conformance to GATM Standards • USAF GATM Conformance Requirements • Component Standards Conformance • Aircraft GATM Conformance burn down	**Aircraft Conformance to GATM Standards** • Aircraft GATM Conformance burn down • Aircraft Safety Standards Conformance • System Suitability and Effectiveness Measures	**Aircraft Conformance to GATM Standards** • Airspace Access Standards Conformance • Mission Limitations Burndown • Operations That Can Be Executed vs Committed

Appendix G PEO Aviation Governance and Management



PEO Aviation MOSA Definitions and Benefit Objectives

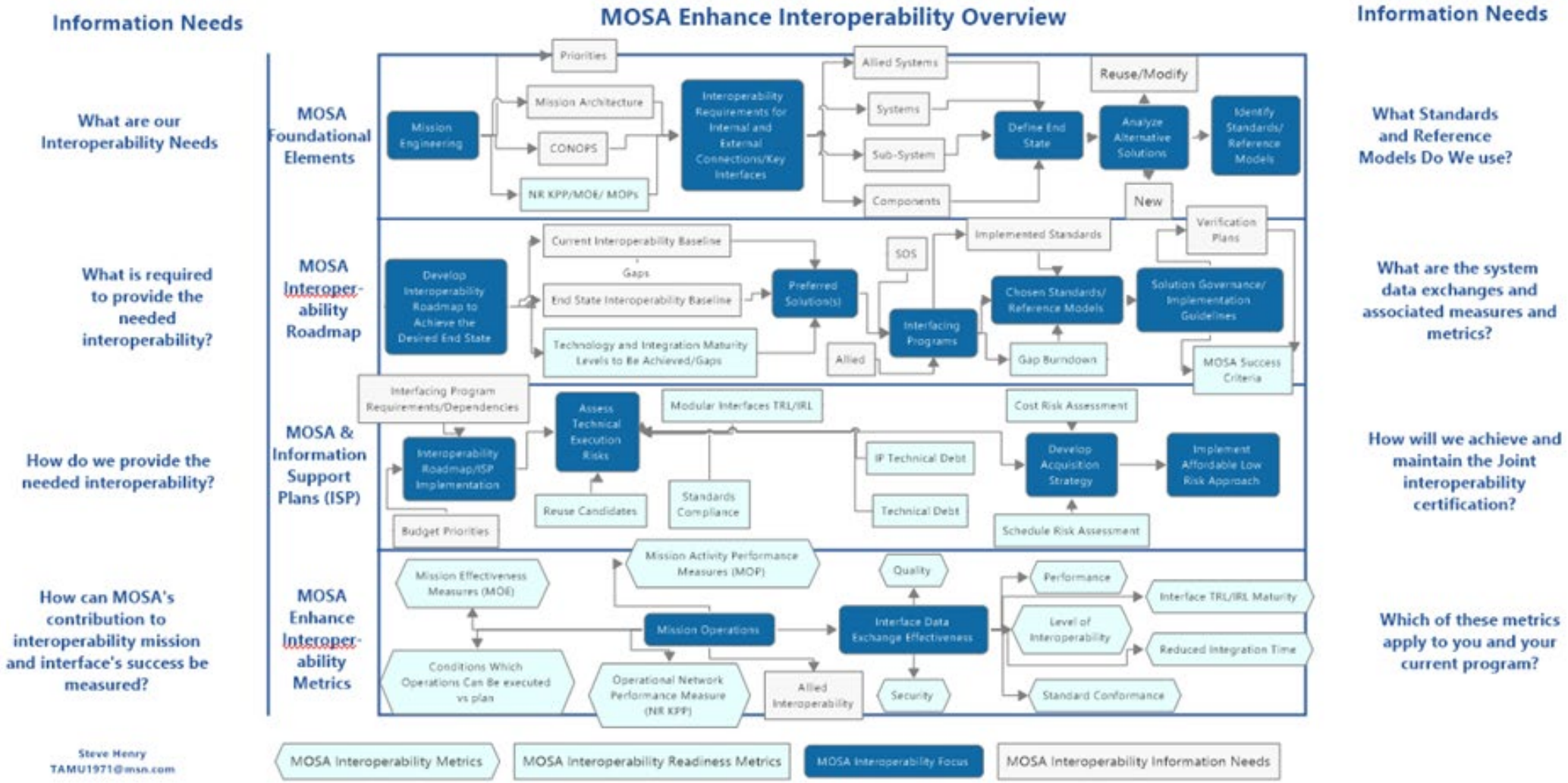


Appendix H Technical Review Questions Alternative Solution Review Example

3. How will we ensure the preferred materiel has the best potential to be cost effective, affordable, operationally effective and suitable, and can be developed to provide a timely solution to the need at an acceptable level of risk given the program constraints?

- What is our Modular Open Systems Approach?
- What are the MOSA benefit objectives?
- What is the system sustainment strategy?
- At what level of indenture of the major system platform's Work Breakdown Structure (WBS) that feature what functionality will be added, removed, or replaced in future increments consistent with that major system platform's sustainment strategy and MOSA.
- What are our internal and external program interfaces and dependencies?

Appendix I System of Systems Interoperability and Mission Integration



Appendix J Methods and Assessment Criteria to Quantitatively Evaluate MOSA Approach Examples

MOSA Approach

- Technical Planning and Management
- Lower Cost and Rapid Refresh:
- Lower Cost and Supply Chain Innovation:
- Design Optimization:
- Standards and Reference Architecture Conformance:

Evaluation Criteria

- Balanced Execution Approach:
- Competition and Refresh Effectiveness:
- Supply Chain Innovation and Cost Savings:
- Optimizing for speed of change:
- MOSA Planning:
- Architecture Implementation/Lifecycle Effectiveness: