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hybrid event

Dublin, Ireland
July 2 - 6, 2024

Start with the End in Mind: Envisioning the Strategic Role of MOSA in Defense Systems

Nadine Geier – OUSD(R&E) Director, Systems Engineering

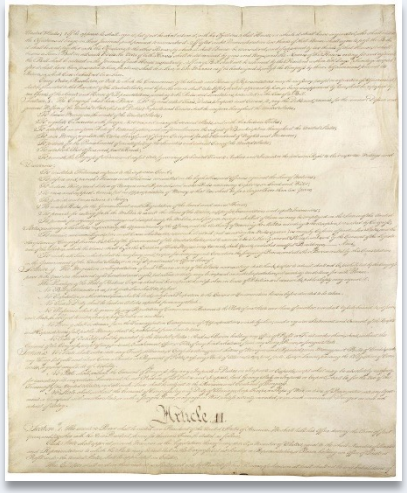
Executive Branch of the United States of America

Leaders

Joe Biden
President

Kamala Harris
Vice President

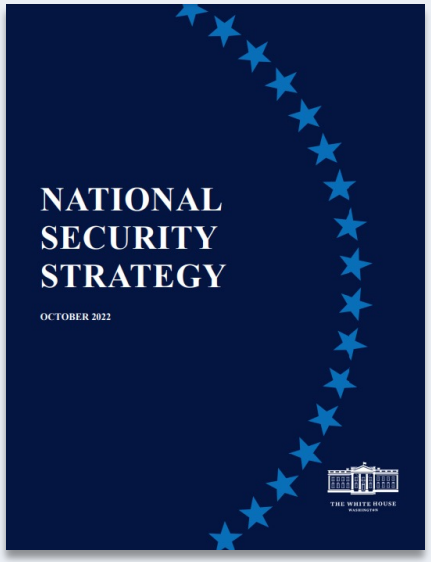
Authority From The Constitution



https://www.archives.gov/founding-docs/constitution-transcript

"The President shall be **Commander in Chief** of the Army and Navy of the United States, and of the Militia of the several States, when called into the actual Service of the United States," –Article II, Sec. 2

Priorities



The war in Ukraine highlights the criticality of a vibrant Defense Industrial Base for the United States and its allies and partners. It must not only be capable of rapidly manufacturing proven capabilities needed to defend against adversary aggression, but also **empowered to innovate and creatively design solutions** as battlefield conditions evolve.

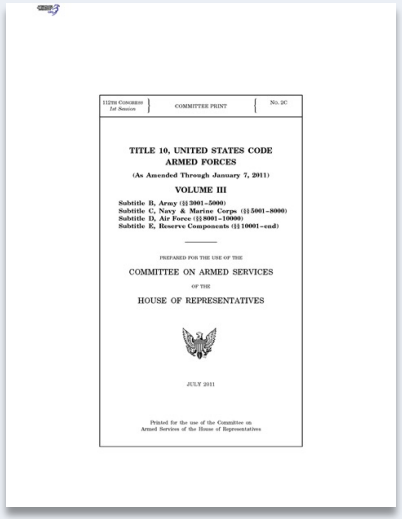
Department of Defense

Leaders

Lloyd J. Austin III
Secretary of Defense

Dr. Kathleen H. Hicks
Deputy Secretary of Defense

Authority From Title 10: U.U.S. Code



TITLE 10, UNITED STATES CODE
ARMED FORCES
(As Amended Through January 7, 2011)
VOLUME III
Subtitle B, Army (§§ 2001–5000)
Subtitle C, Navy & Marine Corps (§§ 5001–8000)
Subtitle D, Air Force (§§ 8001–10000)
Subtitle E, Reserve Components (§§ 10001–end)
PREPARED FOR THE USE OF THE
COMMITTEE ON ARMED SERVICES
OF THE
HOUSE OF REPRESENTATIVES
JULY 2011

https://uscode.house.gov/browse/prelim@title10&edition=prelim

"(a)(1) There is a Secretary of Defense, who is the **head of the Department of Defense**, appointed from civilian life by the President, by and with the advice and consent of the Senate."

Priorities

To succeed….the Department will **reduce institutional barriers**,….that inhibit….**interoperability,** intelligence and **information sharing**,…We will work across the U.S. government to **upgrade technology**….facilitate **information exchange for mutual benefit**.

Background – Warfighter Imperative
National Defense Strategy (NDS)

Gen Lloyd Austin
SECDEF

"Our current system is too slow and too focused on acquiring systems not designed to address the most critical challenges we now face.

This orientation leaves little incentive to design open systems that can rapidly incorporate cutting-edge technologies, creating long-term challenges with obsolescence, interoperability and cost effectiveness."

2022 NDS, pg. 27

"The nuclear enterprise will increase focus on research, development, test and evaluation efforts; government purpose data rights; and faster development of technologies and ***system concepts through digital engineering*** *and open architecture designs…"*

2022 NDS, pg. 58

Prioritize speed of delivery, continuous adaptation, and frequent modular upgrades

https://www.defense.gov/Spotlights/National-Defense-Strategy/

Background – MOSA Contributions to National Defense Authorization Act

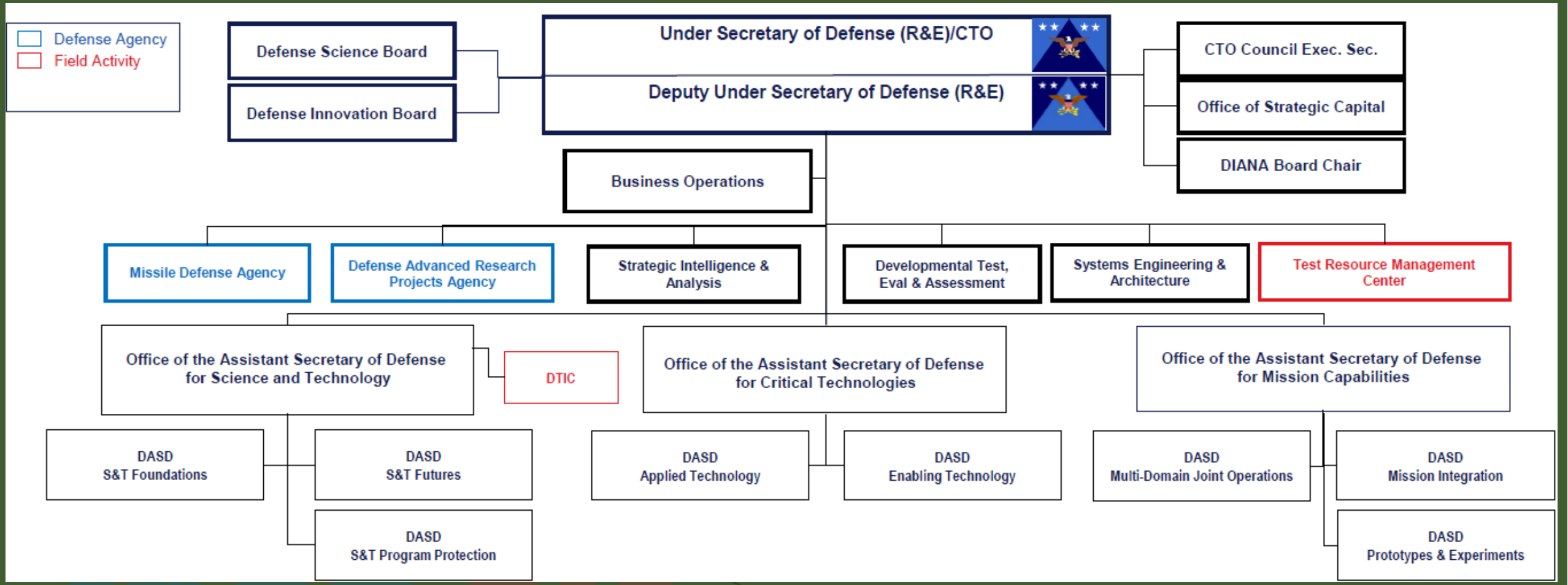
FY20 National Defense Authorization Act

All major acquisition defense programs must be designed and developed with a modular open system approach to enable incremental development and enhance competition, innovation, and interoperability.

FY22 National Defense Authorization Act
Title 10, United States Code, Section 4401-4403

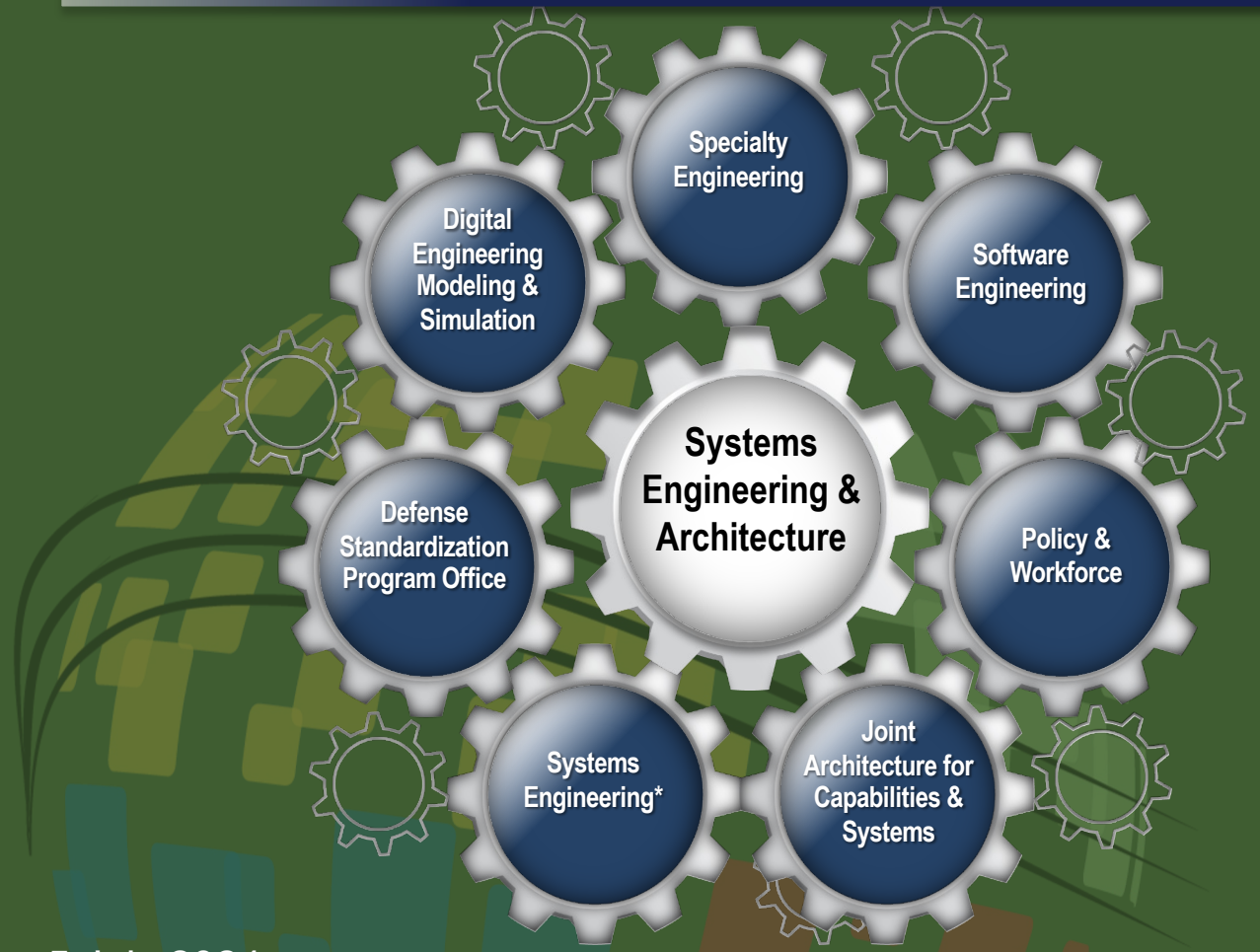
- 4401. Requirement for modular open system approach in major defense acquisition programs; definitions.
- 4402. Requirement to address modular open system approach in program capabilities development and acquisition weapon system design.
- 4403. Requirements relating to availability of major system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

OUSD(R&E) - Engineering Activities



Overview Systems Engineering & Architecture (SE&A)

SE&A promotes innovative engineering principles and techniques to advance DoD engineering practice



Lines of Effort

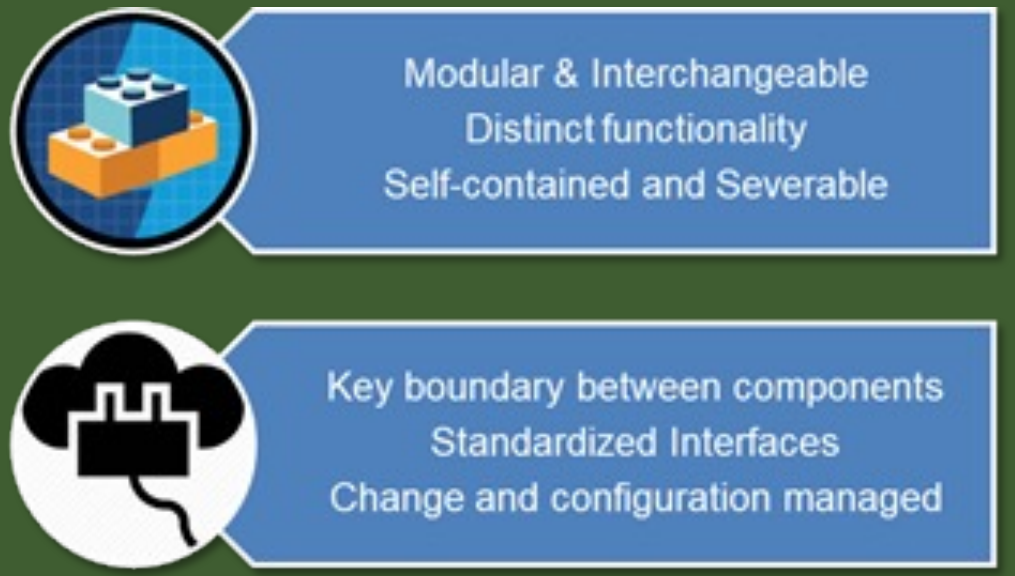
1. Advance the Engineering Practice
2. Connect and Strengthen the Technical Community
3. Develop the Workforce
4. Advance and Manage Standards
5. Provide Technical Expertise for Independent Engineering Assessments
6. Provide System of Systems (SoS) Architecture Guidance

***Includes Modular Open Systems Approach (MOSA)**

What is MOSA?

A **MOSA**, formerly known as Open Systems Architecture or Open Systems Approach, can be defined as a technical and business strategy for designing an affordable and adaptable system. A MOSA is the DoD preferred method for implementation of open systems, and it is required by US law. Title 10 USC §4401., states all Major Defense Acquisition Programs (MDAP) are to be designed and developed using a MOSA that -

- Employs a modular design that uses major system interfaces…
- Is subjected to verification to ensure major system interfaces comply…
- Uses a system architecture that allows severable major system components at the
- Complies with the technical data…



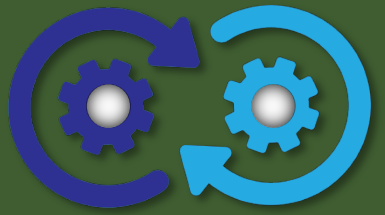
OUSD R&E MOSA Perspectives

- OUSD Research & Engineering (R&E) is leading the development of MOSA implementation guidance for DoD
- Resources and guidance to support successful MOSA implementation
  - DoD MOSA Working Group (MOSWG)
  - DoD MOSA Implementation Guidebook
  - Joint Services MOSA Memo
  - Joint Requirements Oversight Council (JROC) MOSA memo
  - Defense Acquisition University (DAU) learning content
  - Systems Engineering Research Center (SERC)
  - MOSA contracting guidance (with OUSD Acquisition & Sustainment)
  - MOSA Acquisition Tiger Team (with OUSD A&S)
  - MOSA Verification (Government Accountability Office action)

MOSA Principles

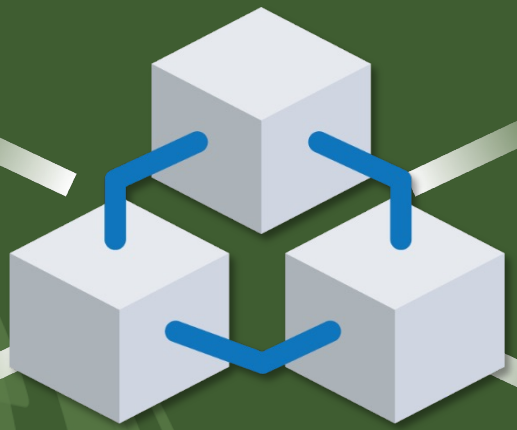
Scalable

Adjustability



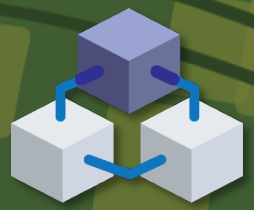
Consensus-based
Open Standards

Interoperability



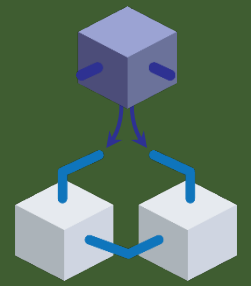
Modularity

Common Components



Reusability

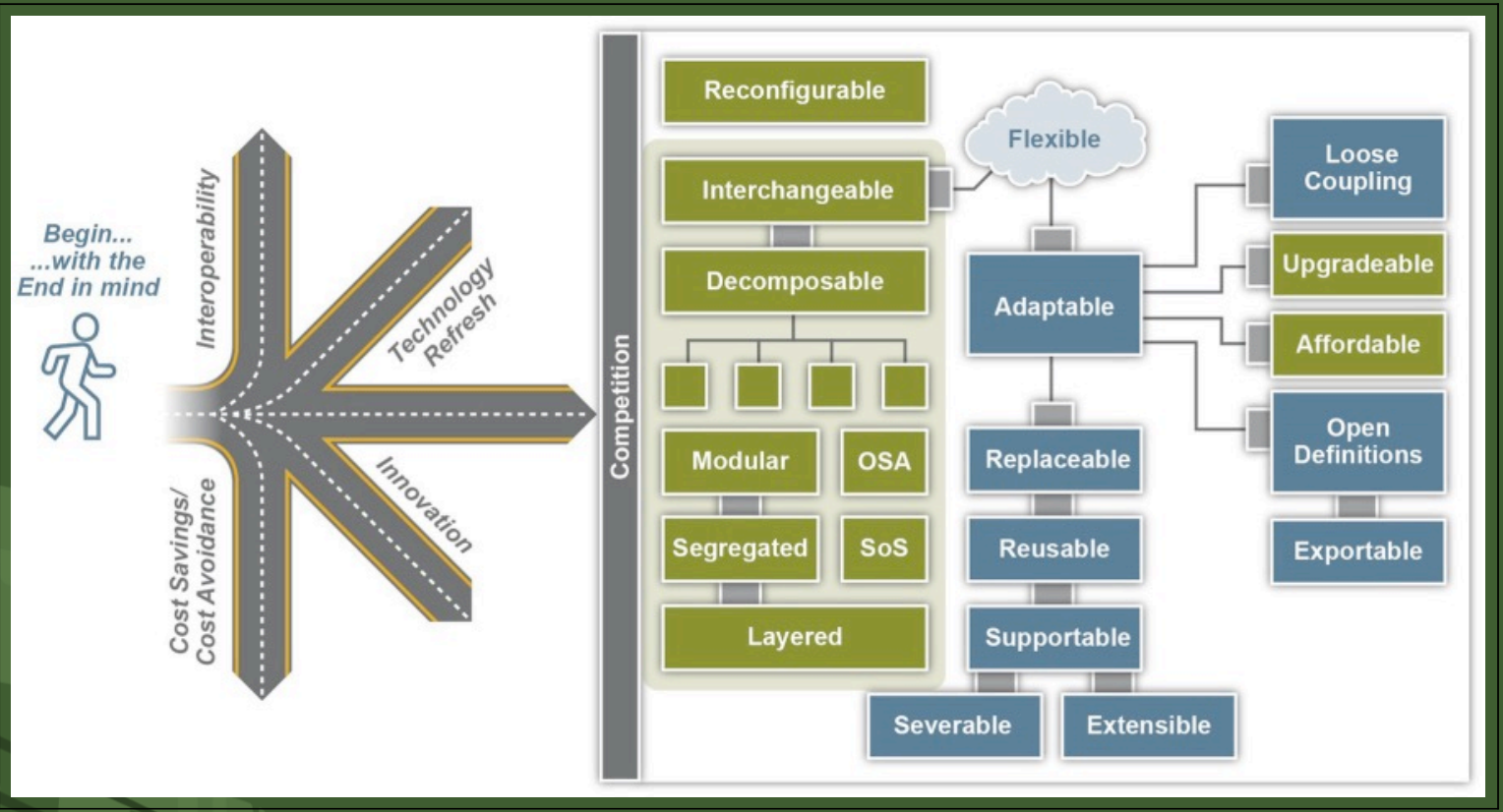
New Capability
Tech Insertion



Flexibility/Adaptability

Apply MOSA in Architecture and Designs
MOSA Drives Innovation & Reuse

- **Standards** – Identify standards and specifications which facilitate modularity and openness
- **Architecture** – Rely on architectures accessed from authoritative sources of truth
- **Interfaces** – Acquire systems with modular system interfaces
- **Data Rights** – Use relevant technology forecasts to identify and appropriate technical data rights



By using modular design techniques, open standards, and architectures that enable open systems, programs can achieve MOSA benefits

Start with the End in Mind

- Address MOSA in all aspects of acquisition
- Establish a strong relationship between the technical and business communities
- Governance and leadership is needed across and within programs
- Manage intellectual property/technical data rights in design documentation and architecture

WHY	HOW	WHAT
Interoperability	Modular Design	**Utilize Technical Design Approaches** ▪ Design severable modules ▪ Define interfaces between modules ▪ Recommend published consensus-based standards ▪ Define, standardize & describe data models
Tech Refresh	Defined Interface	
Competition	Standards Process	
Innovation	Accessible Data	▪ **Employ Open System Business Approaches** ▪ Use standards & specs for interfaces ▪ Recognize the relevant technical community ▪ Acquire necessary data & IP rights
Cost Savings	Open Interfaces	
	IP Rights	

What are your End Goals?

- Eliminate Vendor Lock
- Reuse of Designs/Parts
- Common Architectures
- Changing technology
- Reduce the Logistics chain
- Interface with Legacy systems
- Flexibility in dealing with obsolesce issues
- Scalability
- Shipping Size

Measure Progress of the System's MOSA Implementation & MOSA Objective Success – *NDIA MOSA Implementation Considerations, Information Needs and Metrics 16 Oct 2023*

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/Suppliers 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 enterprise architectures, mission capability solution, and product baseline

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?

Navy CANES Example

The Navy Consolidates Afloat Navy Enterprise System (CANES) was an early adopter of MOSA. Their approach stressed a strategy that maximizes the following:

- Competition throughout program's lifecycle
- Competitive procurement for Engineering & Manufacturing Development (EMD)
- Down-select for Limited Deployment (LD)
- Separate Full & Open competition for Full Deployment (FD) Production Units

Navy CANES Example

The winning Northrop Grumman approach was solution was based on continuous competition throughout the CANES life cycle. Key elements in the winning bid and execution where as follows:

- Vendor neutral open, modular and scalable design
  - Used consensus open IT standards
  - Design to cost and Cost as an Independent Variable Trades
- Built Operational Prototype prior to CDR
  - All potential supplier products integrated in prototype – enabled selectable configurations
  - Demonstrated system performance with different product configurations
- Enabled continuous competition of component products for each buy
  - 80% of the Bill of material cost was in 20 products
  - Obtained up to 83% cost discounts
- Automated production loads to reduce cost and speed delivery

Virginia Class Submarine Example

Traditionally shipbuilding design was custom, with significant associated costs. The new design took advantage of:

- Integrated Product & Process Development
- Modular Construction
- Parts Reduction
- COTS Components

Virginia Class Submarine Example

Result

- 1st submarine was delivered on time
- Parts library was 80% less than the previous submarine produced
- Electronic Technical Manual, Reliability & Maintainability calculations, and Obsolescence planning simplification
- Reduced engineering change orders during construction
- Use of standard test equipment resulted in 32% reduction
- $789 million cost avoidance over program life
  - Obsolescence simplification saved $96 million

Contact

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https://www.cto.mil

SE&A – https://www.cto.mil/sea/

MOSA CoP – https://www.dau.edu/cop/mosa/

DEBOK – https://de-bok.org/

SERC – https://sercuarc.org/

NDIA - https://ndia.org/

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www.incose.org/symp2024

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