MOSA White Paper

NDIA SE Division - Architecture Committee Summary Recommendations

Rev. D, October 10, 2019

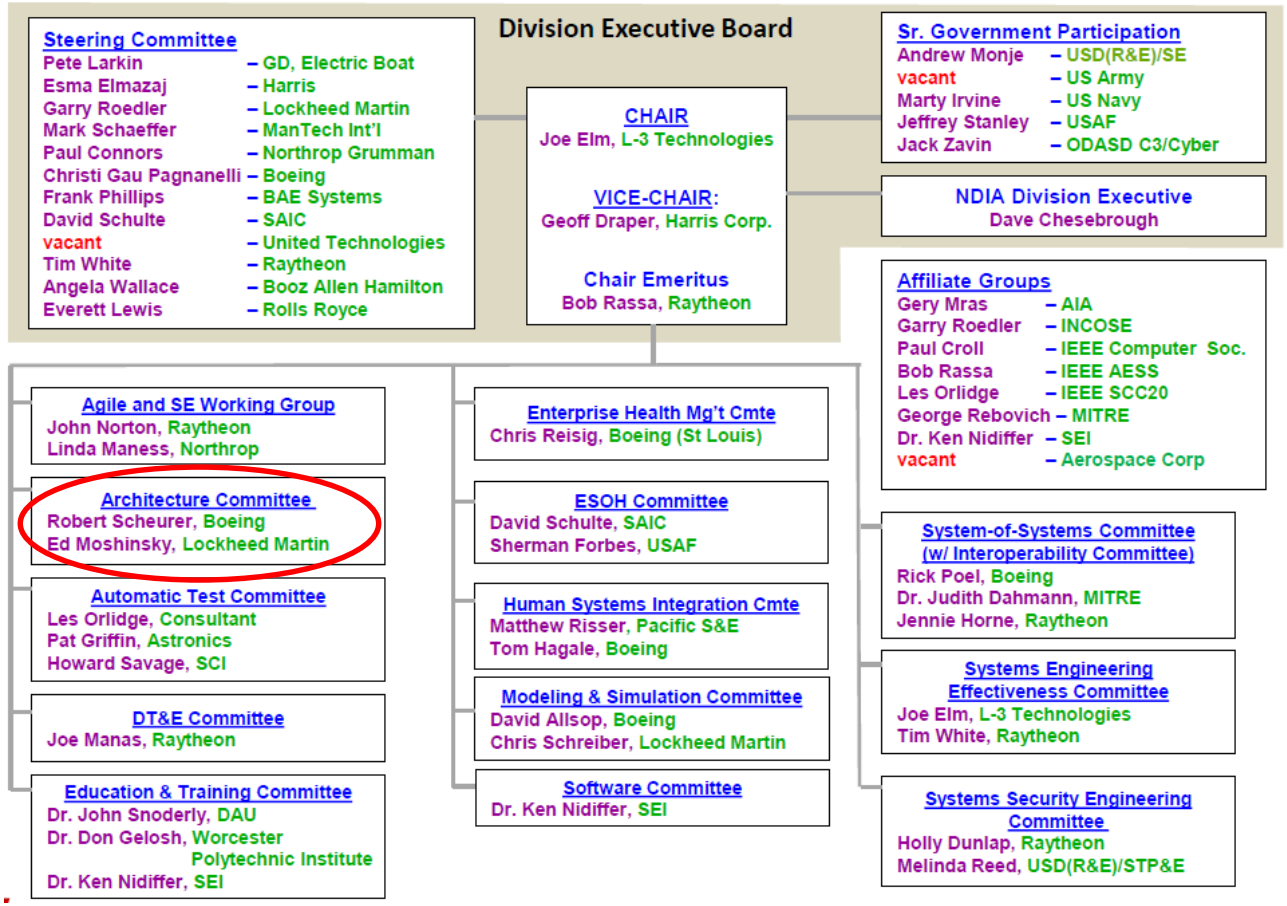
Steve Thelin

Topics

- **NDIA Architecture Committee Overview**
- **MOSA White Paper Intended Audience**
- **Top 10 Committee Recommendations on MOSA**

NDIA Architecture Committee Overview

- **National Defense Industrial Association (NDIA)**
  "Promotes the best policies, practices, products and technology to build a more responsive and collaborative community in support of defense and national security"
- **NDIA SE Division - org chart**
- **Architecture Committee**
  - Membership: 38 Industry; 14 Gov't; 5 Academia
  - Key focus on MOSA since 2017
  - MOSA white paper being developed
  - This presentation captures key recommendations from the Committee's work



Overview

- **Government and industry need to work together to define a MOSA implementation that can yield significant benefits**
- **We need a structured approach to respond to congressional language mandating the use of MOSA**
- **Properly implemented MOSA can provide increased competition, reduce costs and create new synergistic capabilities and missions across multiple product lines**
- **MOSA is the foundation that Mission Engineering, Digital Engineering and System Security Engineering can build on**
- **Understanding how to apply open interfaces is critical in fostering competition and in defining how and where IP will be protected.**

MOSA White Paper Intended Audience

- **Government – Who have to figure out the guidance for executing Contracts and producing SoS Architectures supported by those contracts and our industrial base.**
- **Prime Contractors – Who have to execute the contracts**
  - Investment Strategy Considerations
  - Subcontractor Impacts
  - Intellectual Property Ramifications
- **Systems Engineers in Govt. who have to write the RFP's for acquisitions**
  - MOSA requirements
  - RFP Guidance
  - Evaluation criteria
- **NDIA Architecture Team**
  - Planning tool to help with developing the recommendations and changes needed in current policies and guidance
  - Standards development

Conclusions and Recommendations

1) Develop MOSA strategy and objectives early in the acquisition process

- Understand reason and objectives for MOSA and its application on an acquisition
- Define supplier success and how MOSA will be evaluated
- Define MOSA partitioning at a level above the planned procurement system
  - How does the planned acquisition fit into adjacent systems or other platforms?
  - What interfaces are needed for adequate Mission Engineering?
  - Which standards need to be used for interfaces to other systems?
  - What standards are missing or need development?
- Demonstrate understand of financial and performance justification for planned partitioning
- Explicitly state MOSA objectives and desired outcomes and the strategy/plan to get there at all appropriate levels
- Provide MOSA strategy early in acquisition cycle to allow contractors to plan technology investments

Conclusions and Recommendations

2) Define MOSA implementation approach (Acquirer and supplier roles)

- Define level of MOSA addressed, planned partitioning, functional analysis, interfaces to be controlled/open and the domain in which commonality is desired, as well as the objective for MOSA implementation (adaptability, sustainability, upgradeability, competition, etc) – for each level of design
- Consider incentives for implementing MOSA in order to facilitate acceptance by acquirers and suppliers
- Define OSD policy and regulations for implementing Technical Data Rights and Intellectual Property (those impacted by MOSA)
- Develop MOSA architecture at level being procured along with governance of planned open interfaces
- Plan for design disclosure of common modules adequate to enable second sourcing and competition
- Identify common standards or release of ICDs and other documents that define open interfaces
- Define methods for sharing of program information and interfaces across services, programs and security levels

Conclusions and Recommendations

3) Define Interfaces in Terms of MIL-STD-881D Taxonomy Levels of Detail

- MIL-STD-881D is important for establishing a common language
  - Provides consistent approach to defining hierarchy within a system or System of Systems
  - Needs to be employed consistently
- Define levels of taxonomy/modularity to eliminate ambiguous terms such as ”major component” and “platform level”
- Consider System Taxonomy breakdown of the Nomenclature system Mil-STD-196F/G (System, Subsystems, Centers, Centrals, Sets, Group, Units) for related taxonomic conventions
- Define level of integration (Manual, type of automation, etc.) expected between platforms, systems, subsystems, and components at all applicable levels in the SoSs Taxonomy

Conclusions and Recommendations

4) Apply MOSA in software architectures at appropriate levels of abstraction and complexity

- Apply MOSA requirements appropriate to software architecture levels of abstraction / reification, including the SoS level
- Develop a software taxonomy similar to MIL-STD-881D (other than current CPCI treatment) to guide development of software MOSA. Especially focus on modularity in software and standard interfaces
- Define a Framework/Lexicon to enable discussion of the design level with appropriate partitioning at various levels and stages of design and associated logical interfaces.
- Develop a common reference architecture for data model identification at varying levels of fidelity, including applicability of various partitions in the various DoD Domains
- Define modular software data rights at appropriate levels of modular abstraction/reification (OS vs. micro-services)

Conclusions and Recommendations

5) Implement MOSA as part of a larger and more robust Digital Engineering strategy

- Models can be used to define and communicate MOSA architectures and partitioning
- Development of a common MOSA framework/lexicon needs to be tasked to define System Functions at multiple levels of an architecture (Instance data at the next levels below the DoDAF Meta Data of “Performer and System).
- System and SoS Architecture definition and management responsibility need to be articulated at the government and mission level, with flow-down to contractors and procurement items.
- Standards, common modules and interfaces should be categorized as to their level in the SoS taxonomy and technology state (old, latest implemented, emerging, etc.), then placed in a reference architecture

Conclusions and Recommendations

6) Incorporate cybersecurity strategy in a MOSA application at the time of initial design, not as a later addition

- System Security Engineering needs to be performed up-front as part of the development process (when identifying CONOPS and declaring security requirements)
- Understand effects of modularity and open interfaces on cybersecurity and system security
- Understand possible MOSA-induced threat vectors and associated risks
- Develop security architecture early in the program and define risk mitigation approaches

Conclusions and Recommendations

7) DOD and industry work together to define how to evaluate MOSA and certify as MOSA compliant

- Define MOSA metrics for various domains and SOS levels
- Establish MOSA evaluation process and evaluation criteria for proposals
- Define what it means to be MOSA compliant and develop standard certification objectives and criteria
- Emphasize measurement methodology over structure (One set of metrics for one domain, e.g. ship building, may not be appropriate for a different domain, e.g. aerospace)

Conclusions and Recommendations

8) Develop and implement enablers with appropriate investment to effect culture change required for successful widespread adoption of MOSA: Includes OSMP, MOSA in Technical Reviews, and MOSA Strategy Defined at all levels of the system

- Make MOSA a requirement -- not an option -- for all procurements
- Open Systems Management Plan as common as a SEMP
- MOSA incorporated into technical/management reviews
- A common approach to functional analysis is needed to define partitioning
- MOSA strategy defined at all levels of the system of systems
- Include explicit MOSA principles in all architectures
- Include MOSA as a primary consideration in “Value Engineering”
- Government needs to coordinate across services and weapon systems as to specifications, standards, and mission engineering
- Provide a means for sharing interfaces and data between programs
- Embed MOSA in System/Mission/Digital Engineering and SoS processes
- Build MOSA incentives into contracts and award fee structures
- Services and DoD should ensure effective management and coordination of the various MOSA-enabling standardization efforts

Conclusions and Recommendations

- **9) Create library of MOSA certified systems and interfaces**
  - Maintain re-useable archive of systems that are certified MOSA systems and interface types identified as certified MOSA interfaces
    - MOSA-compliant systems are made available for reference and follow-on improvement
  - Includes the system partitioning architecture as well as the ICDs and standards for the “open “interfaces defined in the system, providing traceability to the driving requirements and processes in the Operational Architectures.
  - Include the modularity objectives, how those objectives were achieved, and why they are important
  - Facilitate development of common, open architectures, providing access to critical information that will 1) help accelerate MOSA adoption, 2) speed a system’s development, and 3) increase competition across industry

Conclusions and Recommendations

10) Define a means for comparing and specifying standards and interfaces for a MOSA-enabled environment

- Develop method to talk about and compare standards
- Critical for gap analysis
- Develop a common method of assigning interfaces or types of interfaces to an architecture
- Identify tool that can be used by program managers and other stakeholders to determine appropriate standards to use
- Map standards interfaces to MIL-STD-881D

Summary

- **Key benefits from a MOSA implementation**
  - Weapon system interoperability and scalability
  - Technology refresh and new technology insertion
  - Reduced cost
  - Reduced development cycle for new capabilities
  - Increased competition
  - Improved sustainment and life cycle costs
- **Key MOSA enablers**
  - Development of key standards and interfaces
  - Detailed Service implementation plans and consistent application
  - Formal and standard way of assessing MOSA implementations
  - Transition to a MOSA culture and environment