Modular Open Systems Architecture in DoD Acquisition

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Resilient Design

• The only constant for DoD systems is change:
  – Evolving threats
  – Strategic and Tactical Innovation
  – Rapid technological change
  – Increased Defense leverage of commercial systems
  – Resource and demand uncertainty

• These factors all demand increased resilience – the ability to explicitly design military systems to have capacity to adapt and adjust to maintain relevance and operational advantage in an environment of change

Modular Open System Architecture is a key contributor to Resilient Design
Defining Modular Open Systems Architecture

**What:** A technical architecture that leverages technical standards to support a modular, loosely coupled and highly cohesive system structure

**How:** Customer definition and ownership of product architecture; publication of key interfaces within the system

**Why:** Enables Open, Competitive Business Model – allowing components to be added, modified, replaced, removed or supported by different vendors throughout the life cycle – driving opportunities to enhance competition and innovation
DoD Interest in Modular Open Systems Architecture

- Drives risk-prudent competition
- Enables Business Architectures that mirror Technical Architectures
- Provides a constant battle rhythm of competition
- Levels playing field; reduces barriers to market entry
- Addresses obsolescence risk
- Promises wider access to innovation
Modular Open Systems: Enabling New Business Models

Objective: Competition at the sub-system level

• **Government must be able to share:**
  – Design documentation, specifications, interfaces, tools, etc.
  – Architecture definition
  – Established sub-systems boundaries that are defined, coherent and loosely coupled

• **Focus on what is needed for competition:**
  – Scale sufficient to attract competitors
  – Scoped to accept innovative offerings
  – Support for innovation through appropriate licensing of IP

• **Government must be a smarter buyer.**
  – Creates significant new demands on government in-house engineering capabilities and capacity
Modular Open Systems
Considerations in Development

Establish an Environment for Change
- Be clear about intent to compete/recompete
- Establish a flexible contracting approach
- Incentivize good behavior among contributing contractors

Focus Systems Engineering for Openness
- Develop common architectures across a product line or across related product families
- Functionally decompose legacy capabilities

Leverage and Exercise Data Rights
- Assess current and needed data rights
- Be a better customer: confirm that data rights restrictions are correct and assert data rights
- Use government purpose rights (GPR) for next competition

Explore Business Architectures and Sound Competition Approaches
- Create alternatives
- Inject MOSA through technical insertions
- Consider alternative integrations concepts
- Ensure incentives align with desired behaviors
- Reward reuse
Balancing Potentially Conflicting Goals

Customer
- Cost of Data Rights
- Typical Engineering Deliverables

Vendor
- Competitive Advantage
- Financial Return on Research Investment

Use of Modular Open Systems must be driven by a value-focused business case.
Technical Data, Computer Software, and Intellectual Property Rights

- Data rights are considered up-front when developing an acquisition strategy; if critical data and software are not be specified for delivery, they may be unavailable (or unaffordable) years later for use on a program during its sustainment phase.

- **Some Technical Data Rights Strategy considerations:**
  - Data deliverables included in the RFPs and subsequent contracts
  - Data rights, including the responses to the contractor’s data assertion lists
  - Data management approach including how the data will be delivered, accessed, maintained, and protected
Diminishing Manufacturing Sources and Material Shortages (DMSMS): An Emerging Crisis

• **Likely impact of current fiscal environment:**
  - Fewer new-start development programs
  - More Service Life Extension Programs (SLEP)

• **Accelerating technology life cycles means fewer sources for “pin-compatible” replacement parts**

• **Driving SLEP cost and risk:**
  - Loss of OEM sources
  - Obsolete parts
  - Loss of component pedigree
  - Loss of key manufacturing expertise

**Modular open systems principles mitigate much of DMSMS risk**
Some MOSA Challenges

- Lack of key technical insight by government customers
- Risk of Government acting as integrator
- Inability to project long-term DoD plans = uncertain business cases
Key MOSA Implementation Gap: Lack of Domain-Specific Common Standards

- Standards critical to allow comparisons across vendors/systems
- Standards create shared competitive ecosystem
- Standards ensure adequacy of technical interface definitions

**Strong Service support for MOSA standards provides opportunity to converge on common approaches**
Navy Open Systems Effort: Future Airborne Capability Environment (FACE)

- The FACE technical standard is a standard of standards with a business strategy that is set to completely re-architect the acquisition of aircraft software systems
- FACE Conformance Program provides testable requirements to MOSA principles
- FACE aligns with and supports other Open Architecture initiatives
- FACE addressing business and technical requirements in developing the ecosystem

FACE is a bold new step in establishing greater Open System Architecture benefits in Defense Acquisition
Air Force Open Systems Effort: Open Mission Systems (OMS) Project

- Develop industry consensus, non-proprietary mission system architectural standard
  - Enable affordable capability evolution
  - Sustained competition across the life cycle
  - Simplify mission system integration
  - Isolate the effects of change
  - Do not stifle innovation
  - Options for legacy aircraft and NDI items

- Build an OMS ecosystem to enable Family-of-Systems enterprise-level acquisition strategies

Service Oriented Mission System Architecture

Key-interface definition + common composition rules = “acquisition efficiency”
Army Open Systems Effort: C4ISR/EW Integration in Ground Platforms

Traditional Approach

VICTORY Approach

"Bolt On" Mission Equipment Integration

VICTORY Data Bus enables interoperability across C4ISR/EW and platform systems

Soldier Benefits

- Less Crowded Crew Area
- Enabled New Capabilities
  1) Single Sign-On
  2) Access to shared info at all Crew Stations w/in security boundary
  3) Remote Configuration
- Potential for Mission Flexibility

Enterprise Benefits

- Commonality
- Third Tier Vendor Competition
- Reduced Acquisition Cycle Times
- Reduced Logistics Burden
- Reduced Integration Costs
- Reduced Life-cycle Costs

VICTORY Standards

Benefits Both Platform and Mission Equipment Design Implementation

We can’t afford not to do VICTORY
Opportunity for the Community:
Convergence

Traditional Approach

VICTORY Approach

“Bolt On” Mission Equipment Integration

VICTORY Data Bus enables interoperability across C4ISR/EW and platform systems
Opportunities and Challenges

- DoD is looking to innovative acquisition models to achieve increased efficiency and effectiveness

- Open Systems Architectures offer great opportunities to leverage sub-system-level competition to future-proof systems, provide a pathway for innovation and drive down cost over time

- Open Systems business models are dependent on detailed engineering designs that incorporate and define open systems architectures, standards and interfaces

- These designs will increase demand on DoD engineering competence, capability and capacity

- Adoption of open systems approaches should only be made where a well defined business case and acquisition strategy support this approach
Better Buying Power 3.0 (Draft)
Achieving Dominant Capabilities Through Technical Excellence and Innovation

Achieve Affordable Programs
• Continue to set and enforce affordability caps

Achieve Dominant Capabilities While Controlling Lifecycle Costs
• Strengthen and expand “should cost” based cost management
• Build stronger partnerships between the acquisition, requirements, and intelligence communities
• Anticipate and plan for responsive and emerging threats
• Institutionalize stronger DoD level Long Range R&D Planning

Incentivize Productivity in Industry and Government
• Align profitability more tightly with Department goals
• Employ appropriate contract types, but increase the use of incentive type contracts
• Expand the superior supplier incentive program across DoD
• Increase effective use of Performance-Based Logistics
• Remove barriers to commercial technology utilization
• Improve the return on investment in DoD laboratories
• Increase the productivity of IR&D and CR&D

Incentivize Innovation in Industry and Government
• Increase the use of prototyping and experimentation
• Emphasize technology insertion and refresh in program planning
• Use Modular Open Systems Architecture to stimulate innovation
• Increase the return on Small Business Innovation Research (SBIR)
• Provide draft technical requirements to industry early and engage industry in funded concept definition to support requirements definition
• Provide clear “best value” definitions so industry can propose and DoD can choose wisely

Eliminate Unproductive Processes and Bureaucracy
• Emphasize Acquisition Executive, Program Executive Office and Program Manager responsibility, authority, and accountability
• Reduce cycle times while ensuring sound investments
• Streamline documentation requirements and staff reviews

Promote Effective Competition
• Create and maintain competitive environments
• Improve technology search and outreach in global markets

Improve Tradecraft in Acquisition of Services
• Increase small business participation, including more effective use of market research
• Strengthen contract management outside the normal acquisition chain
• Improve requirements definition
• Improve the effectiveness and productivity of contracted engineering and technical services

Improve the Professionalism of the Total Acquisition Workforce
• Establish higher standards for key leadership positions
• Establish stronger professional qualification requirements for all acquisition specialties
• Strengthen organic engineering capabilities
• Ensure the DoD leadership for development programs is technically qualified to manage R&D activities
• Improve our leaders’ ability to understand and mitigate technical risk
• Increase DoD support for Science, Technology, Engineering and Mathematics (STEM) education

Continue Strengthening Our Culture of Cost Consciousness, Professionalism, and Technical Excellence
**Better Buying Power 3.0 (Draft)**

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*Highlighted items are key opportunities for engineering community engagement*
Use Modular Open Systems Architecture to Stimulate Innovation

• **Challenges**
  
  – DoD is challenged to affordably address emerging threats, component obsolescence, and loss of critical suppliers, and to conduct planned technology insertion/upgrades into tightly coupled, highly integrated systems
  
  – DoD seeks to drive innovative technology into platforms at the subsystem level through competition – enabling affordable capability refresh and engaging the largest possible competitive base
  
  – Standardized, documented modular interfaces enable “plug-and-play” insertion of new/upgraded capabilities on existing platforms – but current standards are of limited utility in supporting definition of modular interfaces in complex military systems

• **BBP 3.0 Opportunity**
  
  – Support incorporation of modular design features in new DoD designs
  
  – Develop common technical standards to support specification and interface control of modular interfaces
Systems Engineering: Critical to Defense Acquisition

Defense Innovation Marketplace
http://www.defenseinnovationmarketplace.mil

DASD, Systems Engineering
http://www.acq.osd.mil/se