



Naval Open Architecture

NDIA 11th Annual

Systems Engineering Conference

AIR



C4I



SPACE



SUBS



SURFACE



MARINES



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Agenda

- The Open Architecture Imperative
- Open Architecture Policy and Requirements
- Benefits of Open Architecture
- Open Architecture Business and Technical Practices
- Examples of Open Architecture Implementation across the Navy
- Importance of Acquiring and Exercising Intellectual Property Rights
- Conclusion



The Navy must build a fleet where our systems ...



... are modular, interoperable, and affordable to upgrade



To accomplish this, ASN (RD&A) in 2003 commissioned a Red Team to assess the Navy's plan to adopt Open Architecture

The Red Team Made 13 Recommendations to leadership:

1. Develop and promulgate a clear Navy policy
2. Develop a Navy-wide business strategy to support OA goals
3. Redirect the OA implementation by defining architectures for domains based on their unique needs
4. Assign one PEO to be accountable for managing OA in each domain
5. Investigate alternate strategies for budgeting and contracting for ships and their combat systems to maximize benefits of open architectures
6. Evaluate DDX, AEGIS, LCS, and CVN/large deck L-ships combat system requirements and analyze architecture/cost trades to exploit a common architecture for surface ship command and decision systems
7. Review all applicable programs to determine how OA is actually being implemented and what changes in the program of record are required



Red Team Recommendations (continued)

8. Reaffirm the role of PEO IWS in the Navy-wide OA Initiative
9. Modify and enforce the OA architecture definition and standards selection processes within and across communities
10. Implement and sustain a proactive education and information exchange program across the Industrial and Government communities
11. Modify testing and certification processes to exploit OA
12. Regarding JTM and its development by JSSEO:
 - Determine whether the technical approach and the transition strategy to Navy programs is appropriately risked
 - Determine whether the Navy programs have sufficient, coordinated off-ramps
13. Consider using the basic framework of these recommendations for Navy OA to address Joint interoperability and network centric warfare requirements

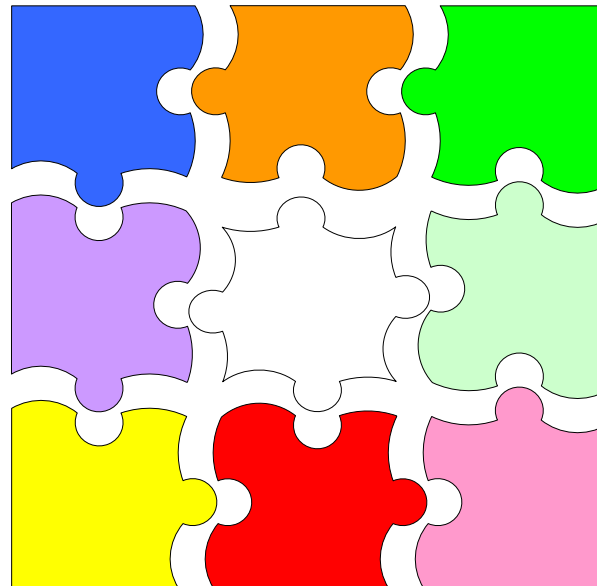
The Red Team included several technical recommendations



These recommendations acknowledge that many pieces of the acquisition puzzle are required to become “truly open”

Open Architecture

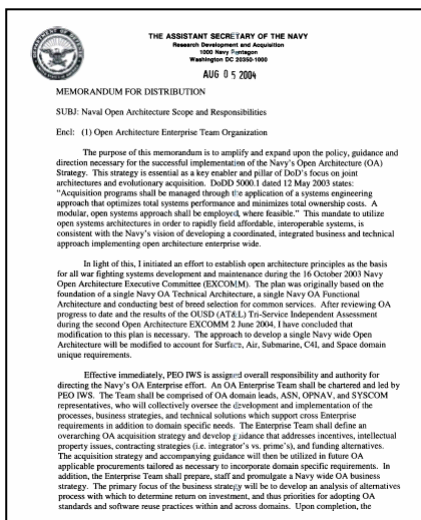
The confluence of business and technical practices yielding modular, interoperable systems that adhere to open standards with published interfaces.





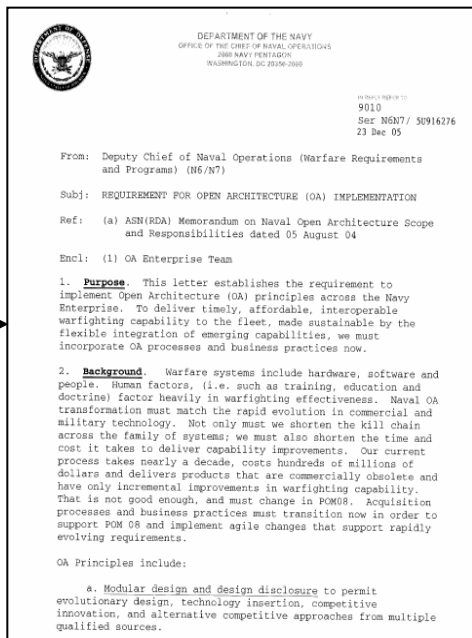
So, leadership mandated *Open Architecture* implementation across the Naval Enterprise and provided some guidance

1 Aug 2004 ASN RDA mandates open architecture



Naval OA Policy

2 Dec 2005 OPNAV issues OA Requirements letter



Naval OA Requirements

OA CORE PRINCIPLES

Modular design and design disclosure

Reusable application software

Interoperable joint warfighting applications and secure information exchange

Life cycle affordability

Encouraging competition and collaboration



From this guidance, the OA Enterprise Team (OAET) developed a Naval OA Strategy that includes goals, objectives, practices, and tools ...

OA STRATEGY

OA GOALS

OA PRACTICES

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Naval OA Strategy

"Probably the biggest challenge I have is to get the ship building key right, to get the future capabilities right. We are at 281 ships today. We have come down, and I believe are projected to go up -- and we need to sustain that projection to a positive direction."
- ADM Muller, Chief of Naval Operations, 26 Oct 2005

Navy leadership is faced with building future combat systems and a fleet capable of meeting emerging threats and evolving national security requirements while at the same time controlling the rising costs of our weapon systems and aging platforms. In order to build combat systems capable of countering emerging threats in sufficient numbers needed to support our warfighters, we must be able to quickly introduce new or upgraded technologies into the Fleet. Changing the way we do business today is imperative if we are to gain the added flexibility required to capitalize on these technologies and deliver the right capabilities.

Naval Open Architecture (OA) is an enterprise-wide, multifaceted business and technical strategy for acquiring and maintaining National Security Systems and interoperable systems that adopt and exploit open system design principles and architectures. This initiative is a key enabler and pillar of the Department of Defense's (DoD) focus on joint architectures and evolutionary acquisition. DoD Directive 5000.1 dated 12 May 2003 states: "Acquisition programs shall be managed through the application of a systems engineering approach that optimizes total system performance and minimizes total ownership costs. A modular, open systems approach shall be employed, where feasible."

By adopting OA principles throughout the naval enterprise today, we can build modular, affordable, future combat systems designed to meet the future needs of our Sailors. These systems will also be able to readily incorporate insertion of new technologies from a broad range of industry partners. However, as the CNO states, we must become leaders of innovation and change to make this happen. We must identify our path forward. This strategy lays out the Navy's vision, goal, and objectives for institutionalizing OA across the enterprise.

Naval OA Vision

To meet the CNO's priorities to sustain combat readiness, build a fleet for the future, and develop 21st century leaders, the Naval OA vision is to:

Transform our organization and culture and align our resources to adopt and institutionalize open architecture principles and processes throughout the naval community in order to deliver more warfighting capabilities to counter current and future threats.

Institutionalizing Naval OA throughout the Naval community will require that the enterprise:

Align	Share	Collaborate
<ul style="list-style-type: none"> Align Requirements & Acquisition commitments Align Domains across the Enterprise and with Joint Services Align Industry and Academic Partners 	<ul style="list-style-type: none"> Share Products and assets across the enterprise Share access to products and assets through government intellectual property rights Share knowledge and ideas through communities of interest 	<ul style="list-style-type: none"> Collaborate thru end-to-end experiments to reduce risk Collaborate to harmonize standards and guidance Collaborate to reduce T&E expenses through common modular designs and standard interfaces.

1. Change the Naval processes and **business** practices to "utilize open systems architectures in order to rapidly field affordable, interoperable systems."
2. Provide **OA Systems Engineering** leadership to field common, interoperable capabilities more rapidly at reduced costs
3. Change the Naval and Marine Corps **Cultures** to Institutionalize OA Principles

- Disclose design artifacts
- Negotiate appropriate data rights
- Foster enterprise collaboration
- Reuse GOTS products
- Institute Peer Reviews
- Develop new business models
- Incorporate OA in contracts

- Publish interfaces
- Isolate proprietary components
- Use widely adopted standards
- Modularize systems

- DAU OA Training Outreach
- Government Symposia & Industry Days
- NPS Research

TOOLS TO ASSIST

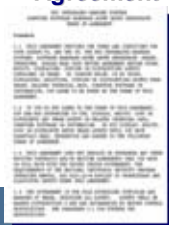
OA Contract Guidebook



OA Assessment Tool



Reuse Licensing Agreement



OA/FORCENet Experiment



SHARE Repository



OA Training Module



Industry Days



OA Website





... and found that implementing OA yields many benefits

Reduction in Time to Field

- Decreased development and acquisition cycle times to field new warfighting capabilities
- Faster integration of open standards based systems

Increased Performance

- Improved operator performance thru delivery of cutting edge technologies and increased bandwidth capabilities from spiral developments and technology insertions

Improved Interoperability

- Use of common services (e.g. common time reference)
- Use of common warfighting applications (e.g. track mgr)
- Use of published interfaces to standardize collaboration

More Competition

- Modular architectures enable competition at the component level
- Sharing data rights allows third parties to compete

Cost Avoidance

- Cost avoidance from software reuse and use of commodity COTS products at optimum prices
- Reduced training and streamlined lifecycle support



Therefore, the Navy is changing its business and technical practices to take advantage of OA's benefits

Business Practices

- Disclose design artifacts
- Negotiate appropriate data rights
- Increase enterprise collaboration
- Institute reviews of solutions
- Develop new business models
- Change contracts
- Increase competition
- Design for lifecycle affordability

Technical Practices

- Modularize systems
- Publish interfaces
- Isolate proprietary components
- Use widely adopted standards
- Re-use software components
- Build interoperable applications
- Ensure secure data exchange
- Implement common solutions

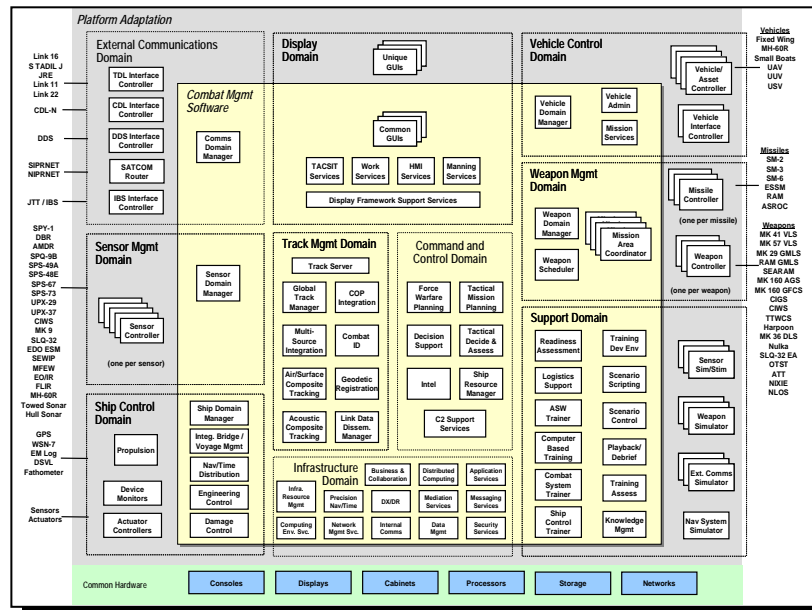


For example, PEO IWS is building a modular, common combat system architecture ...

Aligning platform combat systems ...



... to one open, objective architecture ...



"I expect us to compete whenever possible. Competition provides us with options to seek the best solution for the fleet and the taxpayer. ... I also expect us to foster an environment in which competition can be sustained over time. Competition once does not serve our interests."

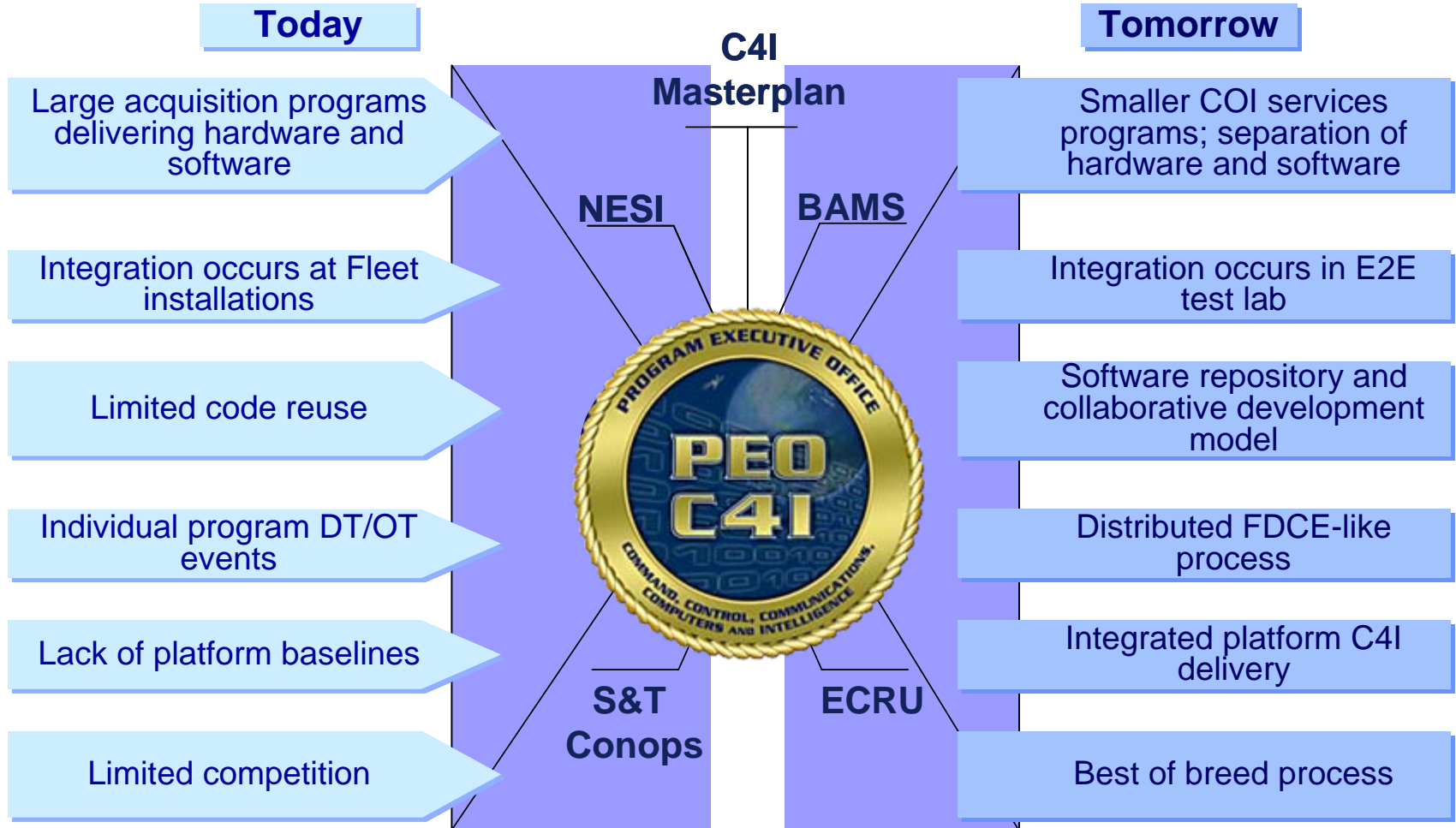
—VADM Paul E. Sullivan

... to achieve commonality across multiple ship classes where the business case supports it

... to help increase competition



PEO C4I is developing new business models ...



... to neck down and move towards common services



Another significant cultural change is that the Navy now understands the importance of exercising its intellectual property rights

- A key aspect to implementing OA is for the Government to **exercise** the intellectual property (IP) rights it acquires
- Under the Federal Acquisition Regulations (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS):
 - The Government gets **Unlimited Rights** in both Technical Data (TD) and Computer Software (CS) for noncommercial items **developed exclusively at the Government's expense**.
 - For noncommercial items developed with **mixed funding**, the Government gets **Government Purpose Rights (GPR)** in TD and CS.
- If a contractor asserts more restrictive rights over a system/component's IP and the Government fails to challenge such an assertion by exercising its rights, the contractor obtains the asserted rights
- It is imperative that the Government assert and exercise the IP rights it acquires because it may lose those rights after a period of time





For example, acquiring, asserting, and exercising IP rights enables Naval programs to disclose designs to foster collaboration ...

- Design artifacts from AEGIS, LCS, DDG 1000, SSDS, SIAP, IABM are available to qualified vendors in IWS's SHARE repository



IWS SHARE REPOSITORY



- Project artifacts from CLIP, XCOP, and NITES-Next are available to qualified vendors in the C4I NESI collaboration site



C4I NESI COLLABORATION SITE



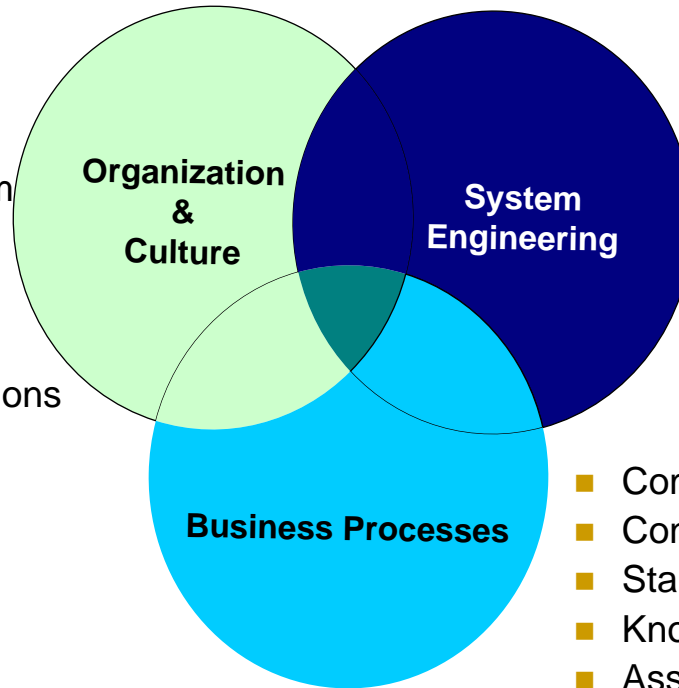
... and improve interoperability



In conclusion, over the four year span of this enterprise transformation, lessons learned have emerged

OA Enterprise Transformation Requires...

- Clear vision and strategy
- Top leadership support & commitment
- Quick wins to get momentum
- Enterprise governance & ownership
- Identified Change Agents
- Consistent OA Communications
- Accountability at all levels
- Performance metrics
- Fleet driven requirements
- Industry / Academia Involvement
- Training / Research



- Operational Capability Roadmap
- Open / Scalable architectures
- Aligned architectures
- Access to design artifacts
- Published interfaces
- Enterprise collaboration
- Threat / data driven performance evaluation
- Tech refresh process

- Compliance checkpoints – six gate
- Consistent assessment approach
- Standardized contract language
- Knowledge of upcoming contracts
- Asset user licensing agreements
- Software asset repositories
- Changed acquisition bus model
- Viable sourcing alternatives
- Transparency -Third Party Reviews
- Streamlined acquisition processes