Naval Open Architecture

NDIA 11th Annual
Systems Engineering Conference

AIR | C4I | SPACE | SUBS | SURFACE | MARINES

October 23, 2008

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PEO C4I

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)

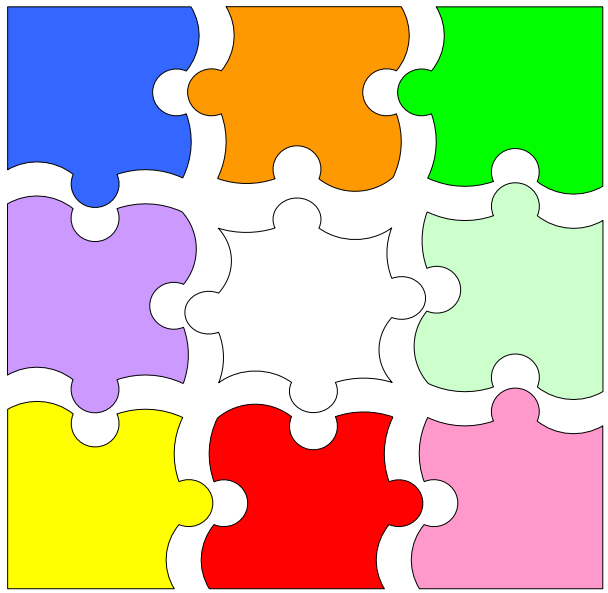
8. Reaffirm the role of PEO IWS in the Navy-wide OA Initiative
9. Modify and enforce the OA architecture definition and standards selection processes within and across communities
10. Implement and sustain a proactive education and information exchange program across the Industrial and Government communities
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"

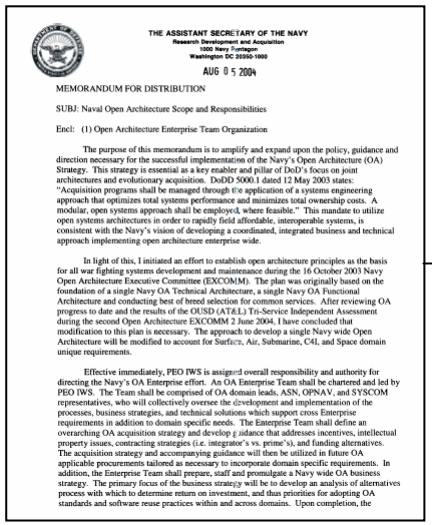
Open Architecture

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**



THE ASSISTANT SECRETARY OF THE NAVY
Research Development and Acquisition
1000 Navy Pentagon
Washington DC 20350-1000

AUG 0 5 2004

MEMORANDUM FOR DISTRIBUTION

SUBJ: Naval Open Architecture Scope and Responsibilities

Encl: (1) Open Architecture Enterprise Team Organization

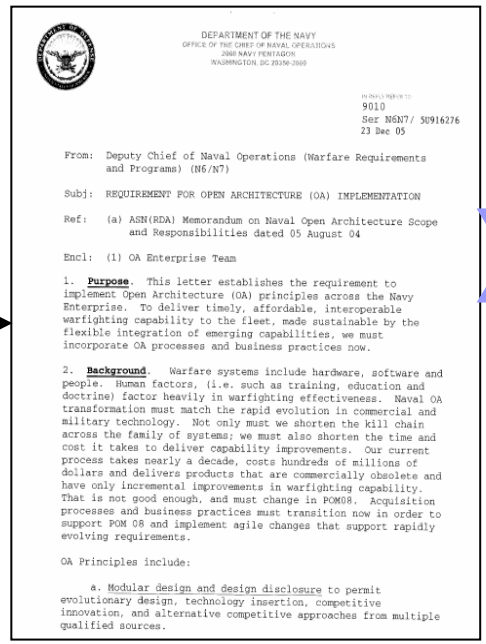
The purpose of this memorandum is to amplify and expand upon the policy, guidance and direction necessary for the successful implementation of the Navy's Open Architecture (OA) Strategy. This strategy is essential as a key enabler and pillar of DoD's focus on joint architectures and evolutionary acquisition. DoDD 5000.1 dated 12 May 2003 states: "Acquisition programs shall be managed through the application of a systems engineering approach that optimizes total systems performance and minimizes total ownership costs. A modular, open systems approach shall be employed, where feasible." This mandate to utilize open systems architectures in order to rapidly field affordable, interoperable systems, is consistent with the Navy's vision of developing a coordinated, integrated business and technical approach implementing open architecture enterprise wide.

In light of this, I initiated an effort to establish open architecture principles as the basis for all war fighting systems development and maintenance during the 16 October 2003 Navy Open Architecture Executive Committee (EXCOMM). The plan was originally based on the foundation of a single Navy OA Technical Architecture, a single Navy OA Functional Architecture and conducting best of breed selection for common services. After reviewing OA progress to date and the results of the OUSD (AT&L) Tri-Service Independent Assessment during the second Open Architecture EXCOMM 2 June 2004, I have concluded that modification to this plan is necessary. The approach to develop a single Navy wide Open Architecture will be modified to account for Surface, Air, Submarine, C4I, and Space domain unique requirements.

Effective immediately, PEO IWS is assigned overall responsibility and authority for directing the Navy's OA Enterprise effort. An OA Enterprise Team shall be chartered and led by PEO IWS. The Team shall be comprised of OA domain leads, ASN, OPNAV, and SYSCOM representatives, who will collectively oversee the development and implementation of the processes, business strategies, and technical solutions which support cross Enterprise requirements in addition to domain specific needs. The Enterprise Team shall define an overarching OA acquisition strategy and develop guidance that addresses incentives, intellectual property issues, contracting strategies (i.e. integrator's vs. prime's), and funding alternatives. The acquisition strategy and accompanying guidance will then be utilized in future OA applicable procurements tailored as necessary to incorporate domain specific requirements. In addition, the Enterprise Team shall prepare, staff and promulgate a Navy wide OA business strategy. The primary focus of the business strategy will be to develop an analysis of alternatives process with which to determine return on investment, and thus priorities for adopting OA standards and software reuse practices within and across domains. Upon completion, the

Naval OA Policy

2 **Dec 2005 OPNAV issues OA Requirements letter**



DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO
9010
Ser N6N7/ 5U916276
23 Dec 05

From: Deputy Chief of Naval Operations (Warfare Requirements and Programs) (N6/N7)

Subj: REQUIREMENT FOR OPEN ARCHITECTURE (OA) IMPLEMENTATION

Ref: (a) ASN(RDA) Memorandum on Naval Open Architecture Scope and Responsibilities dated 05 August 04

Encl: (1) OA Enterprise Team

1. **Purpose**. This letter establishes the requirement to implement Open Architecture (OA) principles across the Navy Enterprise. To deliver timely, affordable, interoperable warfighting capability to the fleet, made sustainable by the flexible integration of emerging capabilities, we must incorporate OA processes and business practices now.

2. **Background**. Warfare systems include hardware, software and people. Human factors, (i.e. such as training, education and doctrine) factor heavily in warfighting effectiveness. Naval OA transformation must match the rapid evolution in commercial and military technology. Not only must we shorten the kill chain across the family of systems; we must also shorten the time and cost it takes to deliver capability improvements. Our current process takes nearly a decade, costs hundreds of millions of dollars and delivers products that are commercially obsolete and have only incremental improvements in warfighting capability. That is not good enough, and must change in POM08. Acquisition processes and business practices must transition now in order to support POM 08 and implement agile changes that support rapidly evolving requirements.

OA Principles include:

a. Modular design and design disclosure to permit evolutionary design, technology insertion, competitive innovation, and alternative competitive approaches from multiple qualified sources.

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

Statement A: Approved for Public Release; distribution is unlimited.

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 Mullen, 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 as 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 minimized 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
• Align Requirements & Acquisition communities • Align Domains across the Enterprise and with Joint Services • Align Industry and Academia Partners	• 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	• Collaborate thru end-to-end experimentations to reduce risk • Collaborate to harmonize standards and guidance • Collaborate to reduce T&E expenses through common modular designs and standard interfaces

OA GOALS

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

OA PRACTICES

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

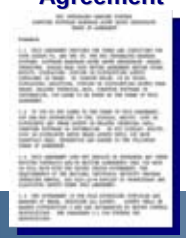
DAU OA Training
Outreach
Government Symposia & Industry Days
NPS Research

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

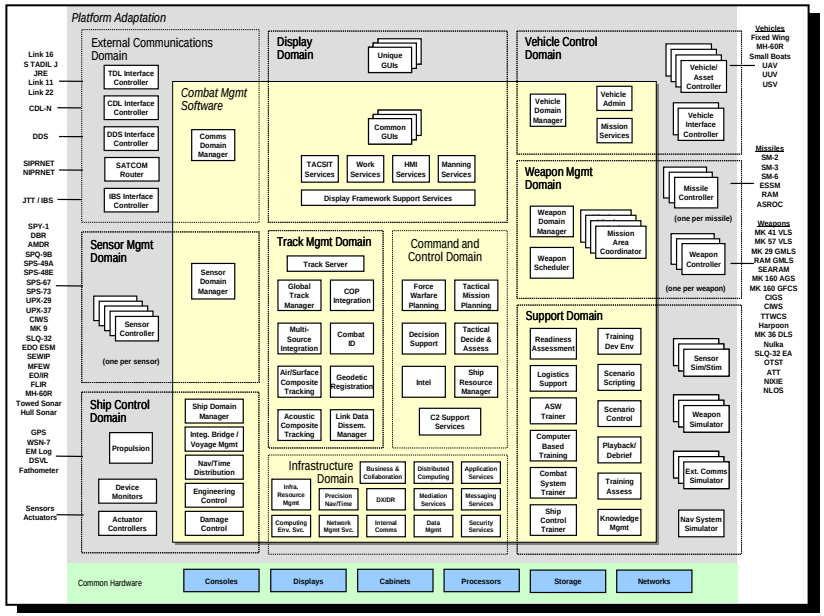
Therefore, the Navy is changing its business and technical practices to take advantage of OA's benefits

Business Practices	Technical Practices
❑ Disclose design artifacts	❑ Modularize systems
❑ Negotiate appropriate data rights	❑ Publish interfaces
❑ Increase enterprise collaboration	❑ Isolate proprietary components
❑ Institute reviews of solutions	❑ Use widely adopted standards
❑ Develop new business models	❑ Re-use software components
❑ Change contracts	❑ Build interoperable applications
❑ Increase competition	❑ Ensure secure data exchange
❑ Design for lifecycle affordability	❑ Implement common solutions

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

Aligning platform combat systems …

… to one open, objective architecture …



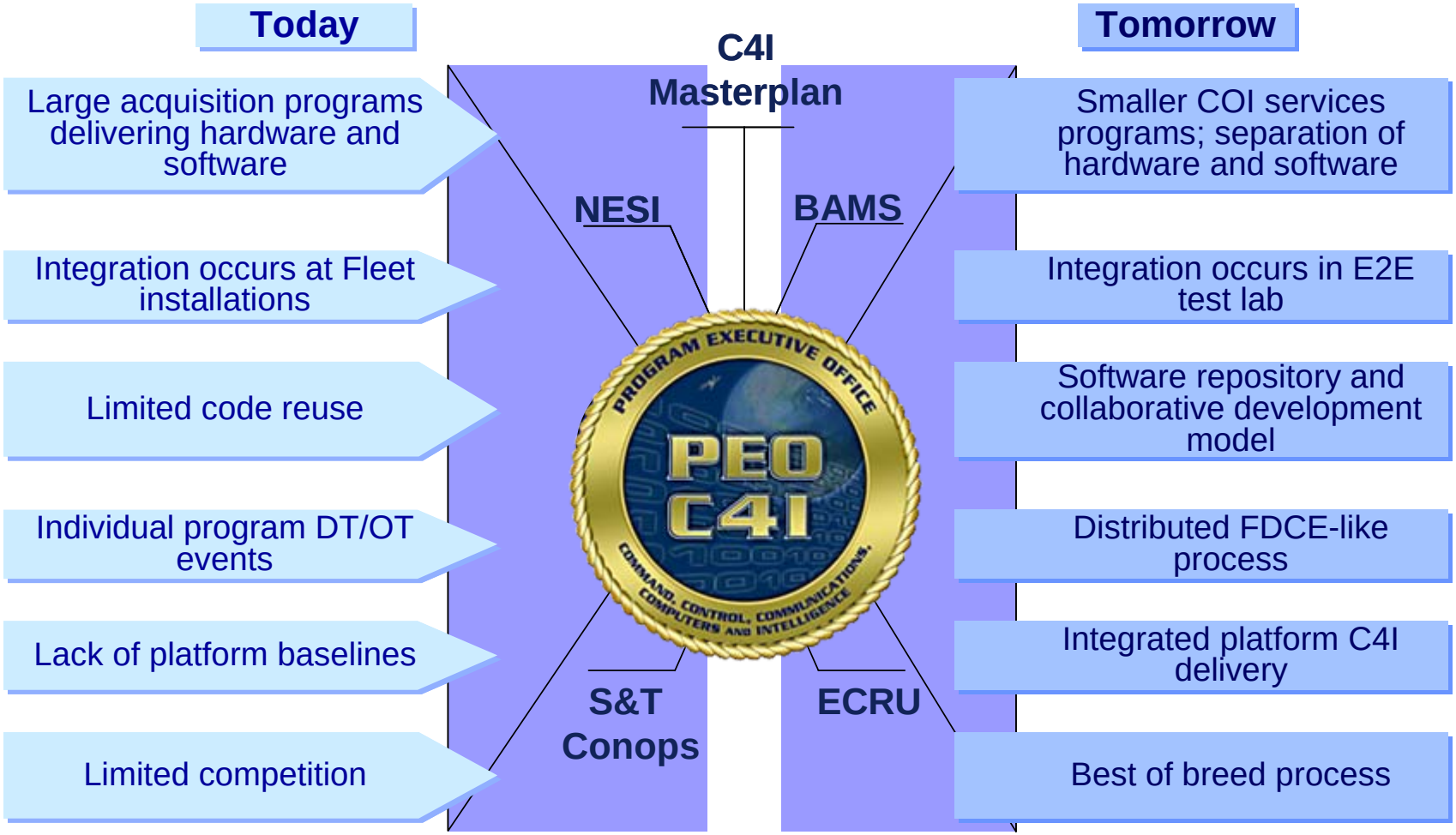
… to achieve commonality across multiple ship classes where the business case supports it

"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 help increase competition

PEO C4I is developing new business models …



… to neck down and move towards common services

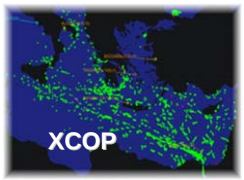
Another significant ***cultural*** change is that the Navy now understands the importance of exercising its intellectual property rights

- 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 ...

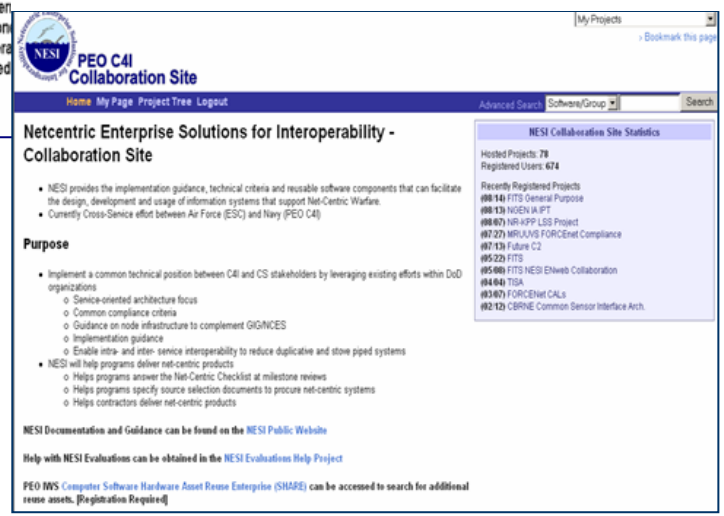
- Design artifacts from AEGIS, LCS, DDG 1000, SSDS, SIAP, IABM are available to qualified vendors in IWS's SHARE repository

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



IWS SHARE REPOSITORY

C4I NESI COLLABORATION SITE

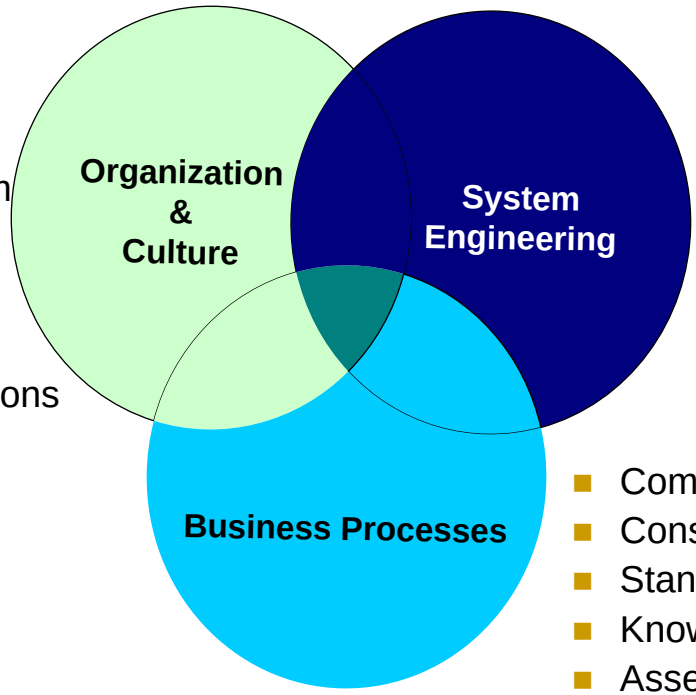


... and improve interoperability

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