Naval Open Architecture

8 August 2007

Distribution Statement A: Approved for Public Release

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Open Architecture
PEO IWS 7.0

The adoption of *Open Architecture (OA)* has been mandated for three years now

Naval Open Architecture (OA) is the confluence of <u>business and technical practices</u> yielding modular, interoperable systems that adhere to open standards with published interfaces.

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 05 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. <u>Modular design and design disclosure</u> to permit evolutionary design, technology insertion, competitive innovation, and alternative competitive approaches from multiple qualified sources.

Naval OA Requirements

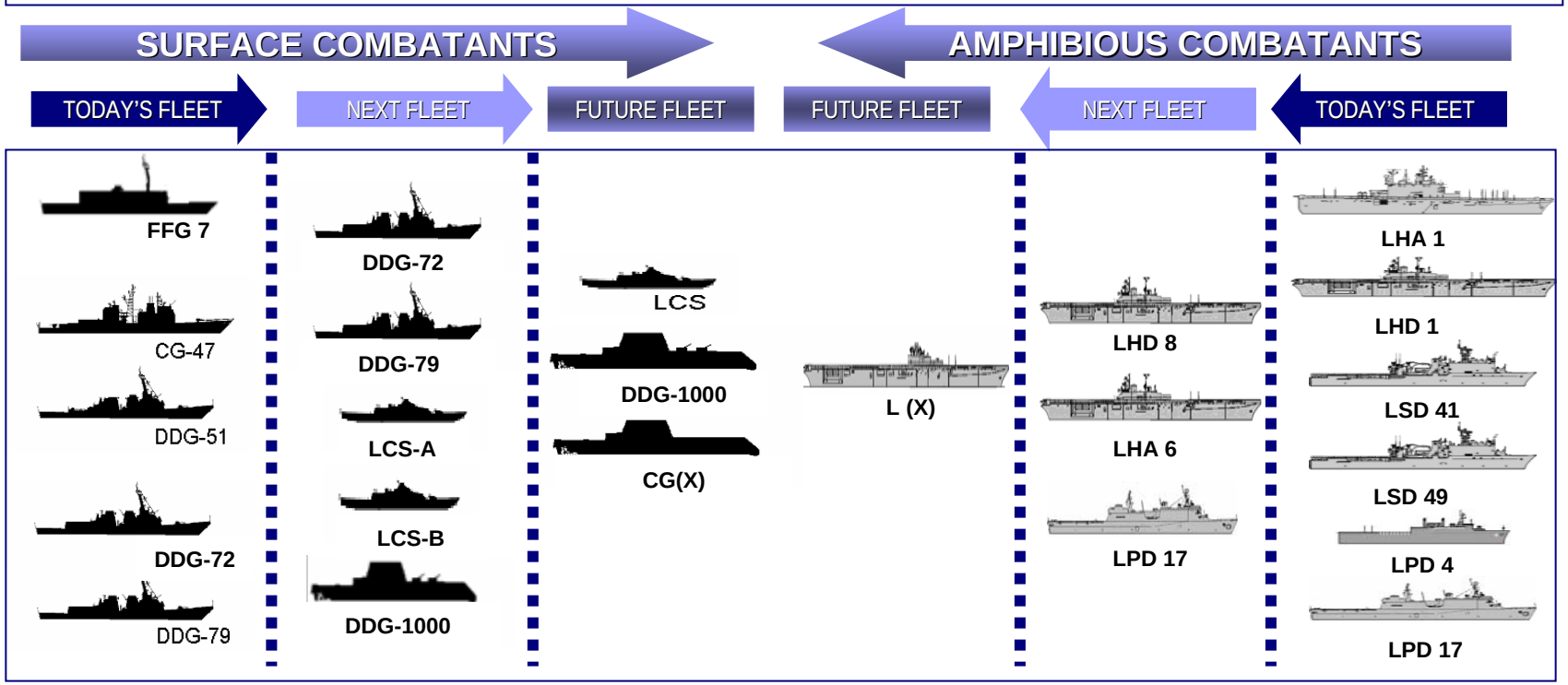
OA CORE PRINCIPLES

- ***Modular design and design disclosure***
- ***Reusable application software***
- ***Interoperable joint warfighting applications and secure information exchange***
- ***Life cycle affordability***
- ***Encouraging competition and collaboration***

OA is a critical piece to our national shipbuilding plan

Necking Down

"The Navy's 30 year shipbuilding plan call for 19 ship types and 27 models in 2020. But a team at NAVSEA says the types of ships could be whittled down to 6 with 10 models, by using OA and common hull designs. Only 1 aircraft carrier and 2 submarine types would be built. Here is what the surface fleet would look like:"

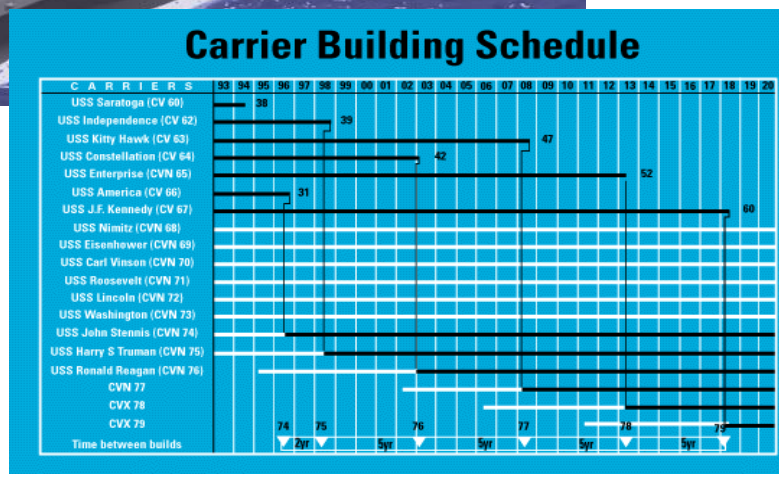


"In addition to reducing ship types & models, we must implement OA, reduce system baselines and enforce more commonality and standardization in our components"

Source: A Question of Cost by RADM Goddard, Howard Fireman, Chris Deegan, Armed Forces Journal, June 2007

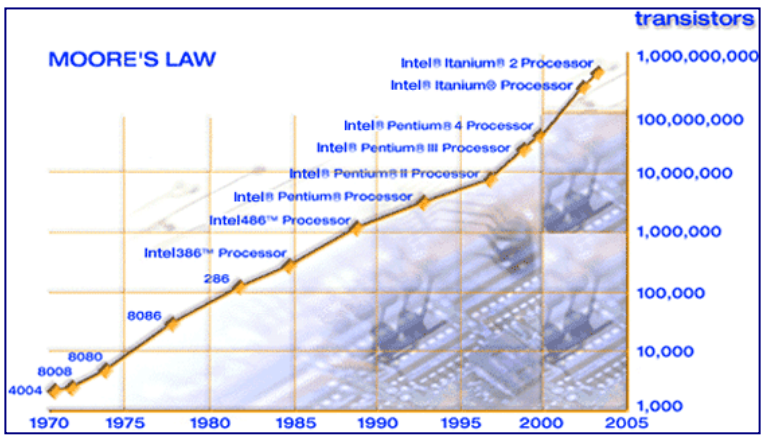
As we build our future fleet, we must make changes today to fulfill the projected life span of platforms

…the " CVX class is being designed for a 55-year life span, during which it could see as many as 4 generations of <u>combat systems</u>, 5 generations of <u>aircraft</u> and 10 generations of <u>computers</u>" [1]



Num	Ordered	Comm	Decomm [2]
CVN 78	2007	2014	2064
CVN 79	2011	2019	2069
CVN 80	2017	2024	**2074**

Moore's Law - the # of transistors in an integrated circuit will double every year; adjusting the rate to every two years. Moore also predicted that the "manufacturing costs of ICs would dramatically drop as the technology advanced." Each time the transistor size shrinks, integrated circuits become faster, consume less power, and its manufacturing costs decrease.



[1] *Sources: http://www.popularmechanics.com/technology/military_law/1281161.html?page=2*

[2] *http://www.globalsecurity.org/military/systems/ship/cvx-unit.htm*

Although OA is often in the news, there is still a learning curve on some key principles of OA

Why do we need to open and modularize our systems?

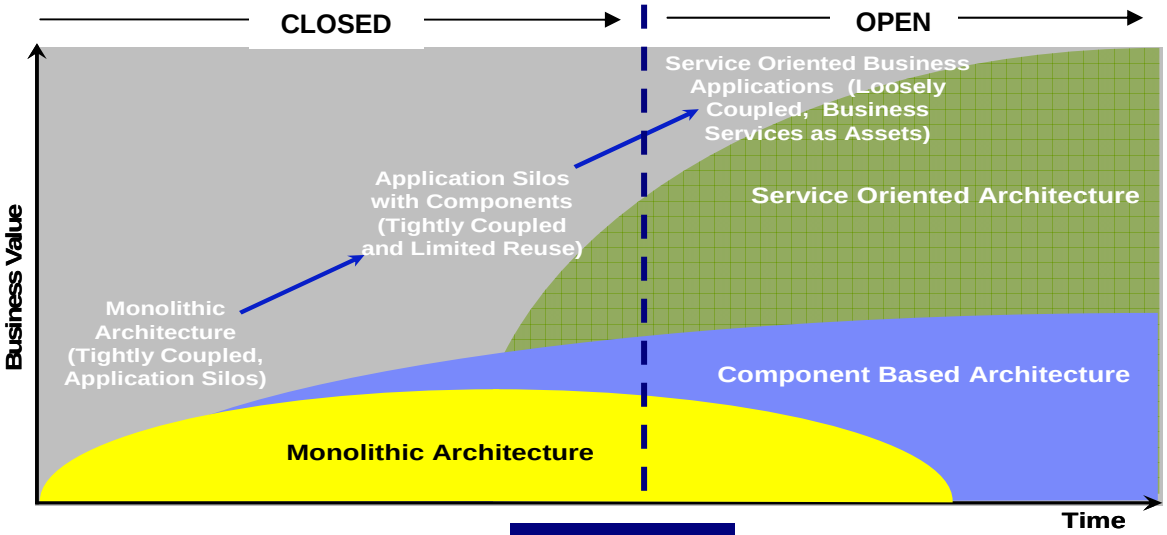
Why do we need the intellectual property rights to products?

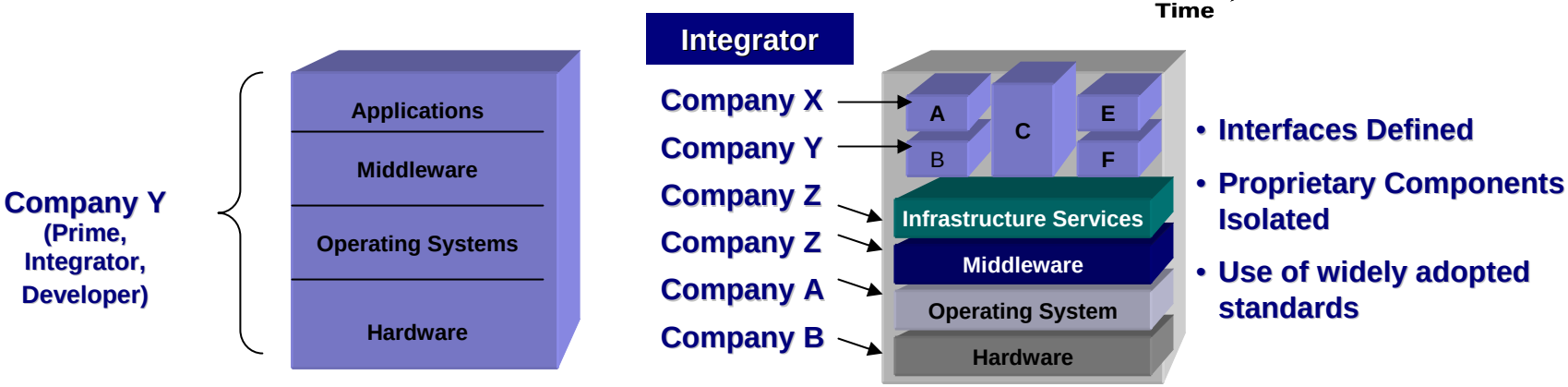
Why do we need to disclose design artifacts early & often?

Why do we need to increase competition?

Why do we need more collaboration?

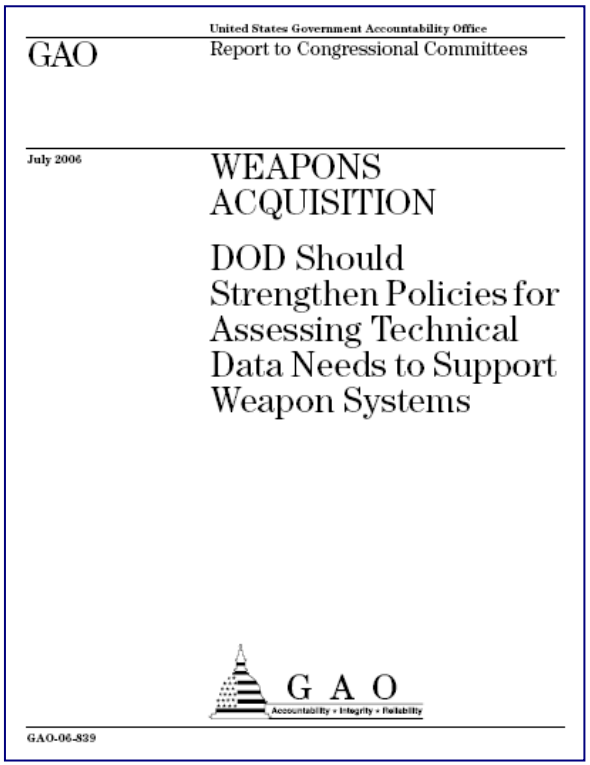
Why do we need open, modular systems?





We must be able to quickly upgrade components as new technologies mature, field capabilities faster, reuse components, improve interoperability, and get the best value for the Navy.

Why do we need the appropriate intellectual property rights?


United States Government Accountability Office

GAO

Report to Congressional Committees

July 2006

WEAPONS ACQUISITION

DOD Should Strengthen Policies for Assessing Technical Data Needs to Support Weapon Systems

GAO

Accountability • Integrity • Reliability

GAO-06-839

- The Services' have encountered limitations in sustainment plans for some fielded weapon systems because we lack needed technical data rights.
- The lack of technical data rights limits the services' flexibility to:
  - Make changes to sustainment plans that are aimed at achieving cost savings
  - Reuse software among Programs and Family of Systems
- The full impact of data rights issues often does not manifest itself until the program office attempts to perform system upgrades, at which point the PM learns how data rights (or lack of) restricts the available upgrade options

We must strive for government purpose rights to use, modify, reproduce….or disclose intellectual and technical data within the government without restriction. Obtaining these rights is critical for systems of systems and family of systems engineering!

Why do we need to disclose design artifacts?

PEO-IWS Software Hardware Asset Reuse Enterprise Repository

https://viewnet.nswc.navy.mil

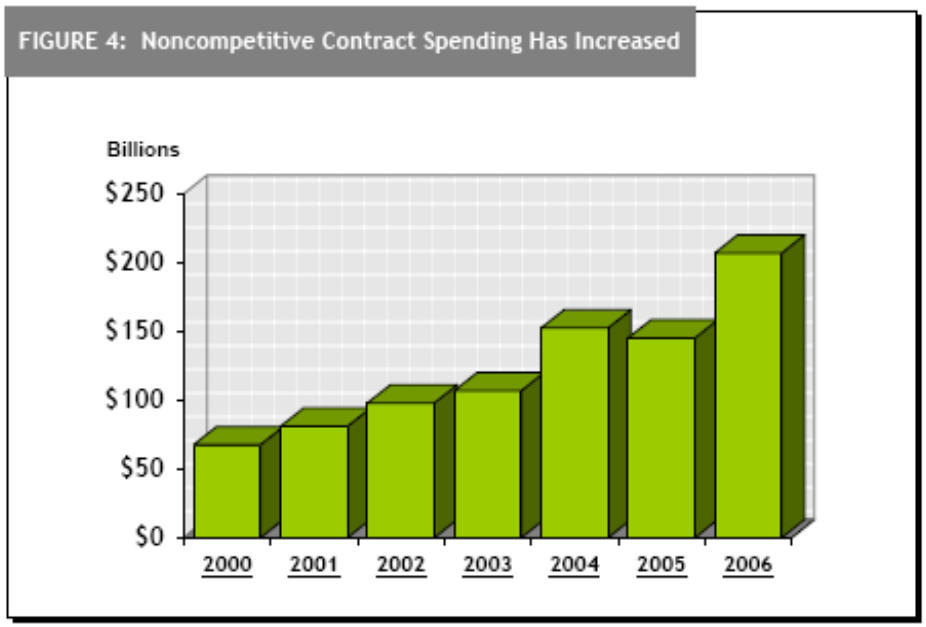
PEO-C4I & Space Collaboration Site

https://nesi.spawar.navy.mil

We must facilitate the sharing of government off the shelf products between programs, better understand the interfaces of systems to improve interoperability, and create opportunities for new products.

Why do we need competition?

Competition in federal contracting protects the interests of taxpayers by ensuring that the government gets the best value for the goods and services it buys. Competition also discourages favoritism by leveling the playing field for contractors while preventing waste, fraud, and abuse.



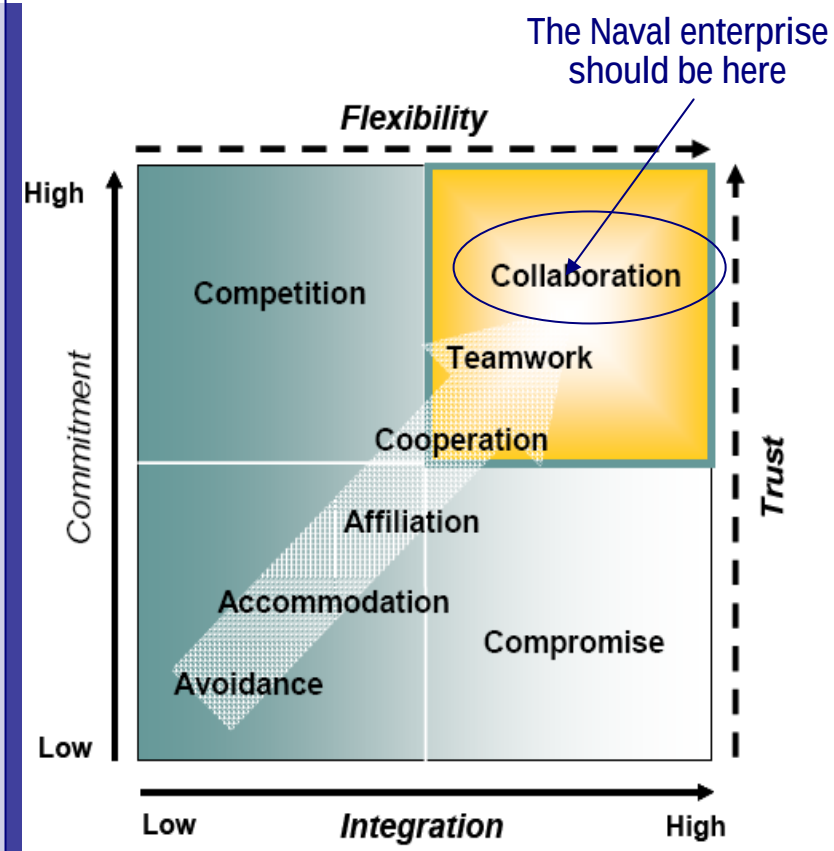
- In 2006, 6 companies received 24% of all federal procurement spending
- In 2006, 50.2% of federal procurement spending was awarded **without full and open competition**
- Federal spending on no-bid and limited competition contracts grew to $206.9 billion in 2006– an increase of 206% from 2000[1]

We must avoid long-term vendor lock-in to proprietary solutions. We must drive innovation and ensure the Navy gets the best value.

[1] *Source: US House of Representatives Committee on Oversight and Government Reform, June 2007*

Why do we need more collaboration?

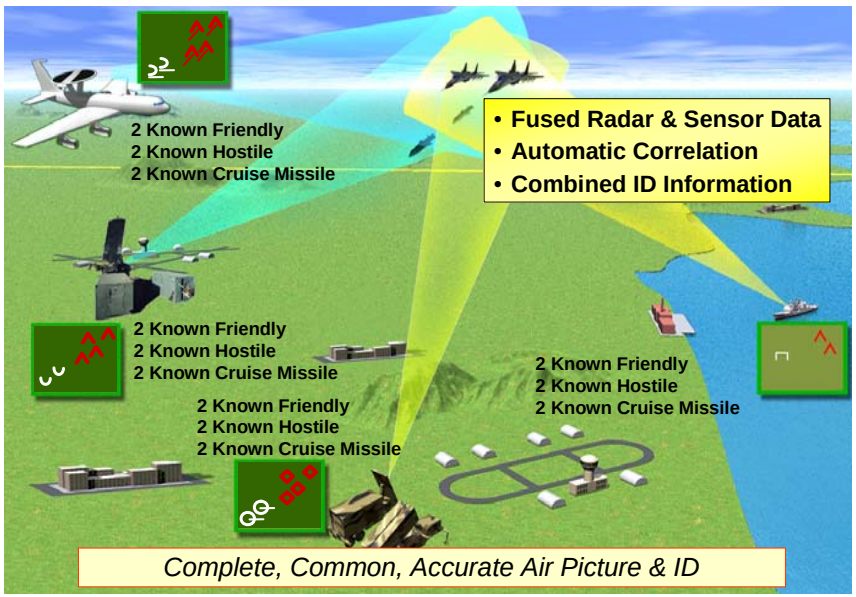
- Competition has losers and winners by its design, but it also yields greater innovation at whatever cost the market will bear. Closed competition breeds more losers than winners.
- Compromise rarely breeds best-in-class results but is based instead on the lowest common denominators among the parties. Naval Open Architecture is often mistakenly viewed as an example of compromise.
- Collaboration is the cultural characteristic that embraces commitment, integration, trust and flexibility. Collaboration leads to:
  - Improved decision making
  - Quicker access to subject experts and core knowledge
  - Improved productivity
  - Avoidance of redundancies and reinvention

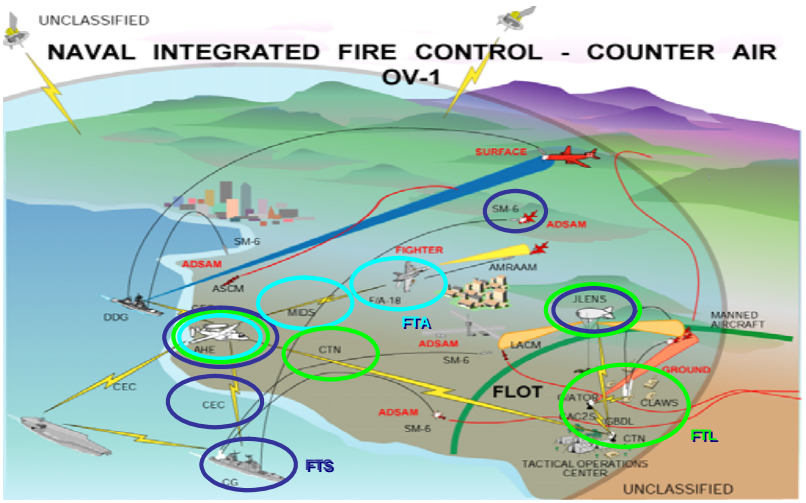


We must identify the best of breed solution for the Navy, break down stovepipes and share information. How do we do it? Through Peer Reviews, Communities of Practice, & Collaboration Sites.

Adopting OA today enables us to develop new capabilities from families of systems…

Naval Integrated Fire Control-Counter Air *capability integrates technologies across multiple platforms from cooperative engagement, AEGIS, SM-6 and E-2D to expand the battle space to maximum kinematic range of the SM-6 missile.*





The Single Integrated Air Picture *capability will unite the military services in applying joint systems engineering to enhance air surveillance interoperability.*

…and across the Services…

…to better counter new threats…

drones

anti-ship missiles

improvised explosive devices

small arms fire

rocket propelled grenades

explosively formed projectiles

…and more

Flood of intelligent weapons

- Some 32 nations are developing or manufacturing more than 250 models of drones, according to the DOD's UAV Roadmap

Easy access to technologies and weapons

- High-precision, low cost manufacturing machines, that can make sophisticated parts for ships, planes and weapons, can now be located nearly anywhere and owned by anyone. This raises the specter in which rogue nations could sell weapons of mass destruction or missiles as digital files to anyone with a portable Computer Numerically Controlled factory to build their own weapons.

Asymmetric – unconventional warfare

- In Operations Iraqi Freedom and Enduring Freedom, rocket propelled grenades, mines, improvised explosive devices, and small arms fire have been responsible for a significant number of casualties.

…new net-enabled technologies…

High Performance Computing

Multiple CPU cores into a single module

- Tightly coupling it with high speed cache memory

IPv6

Enhanced Proliferation of IP-addressed applications/devices, and "comm on the move"

VOIP

Increased flexibility/capacity through broadband Internet connection

- Allows for converged voice and data on the same network

Mobile / Satellite Communications

Real time connectivity, high data rate, ISR ex-filtration, and communication on the move

IA / Security

Secured DoD information, systems, and information infrastructure

...and more

…and new approaches to solution design

Service Oriented Architecture

Easy-to-use services to access, share, reuse, and collaborate

Model-Driven Architecture ™

Separated designs from architecture

- Design addresses the functional requirements
- Architecture provides the infrastructure through which non-functional requirements like scalability, reliability and performance are realized

Open Standards

Open Source

Advancements toward commonality

- Enable interoperability of technologies
- Encourage innovativeness and healthy competition
- Increases consumer choice and opens entirely new markets

Virtualization

Platform and Resource Virtualization

- Enables dynamically reconfigurable grid computing
- A single physical resource appear to function as multiple logical resources
- Multiple physical resources appear as a single logical resource

...and more

Fundamental shift from “walls and patches” to “secure from the start”

The bottom line…Our world is rapidly changing and if we don't adopt OA now, we won't be ready

The Navy currently is transitioning to a state of "continuous readiness." Instead of cyclical preparations before deployments, the Global War on Terrorism requires constant operational capability. "Whether it's a warfight or a natural disaster—and they seem to be coming more ***frequently—we must be much more ready for responding to this very uncertain world than the regimented fashion in the past."***

~ Remarks by Adm. Mullen, December 2006