Naval Enterprise Open Architecture
What Program Managers Need to Know

January 2006

Captain Jim Shannon, USN
Naval Open Architecture Program Manager
PEO IWS 7.0

The purpose of this presentation is to provide Navy program personnel with information on the history of Naval Open Architecture (OA) and why it is important.

- Naval Enterprise Open Architecture policy
- The Open Architecture Assessment Model (OAAM)
- The Open Architecture Assessment Tool (OAAT)

Naval Enterprise Open Architecture policy is set forth in several Department of Defense and Navy policy documents:

- 12 MAY 2003 Department of Defense Directive (DoDD) 5000.1, “The Defense Acquisition System”
- 5 APR 2004 Under Secretary of Defense (Acquisition, Technology & Logistics) Memorandum “Amplifying DoDD 5000.1 Guidance Regarding Modular Open Systems Approach (MOSA) Implementation”*
- 5 AUG 2004 Assistant Secretary of the Navy (Research, Development & Acquisition) Policy Statement, “Naval Open Architecture Scope and Responsibilities”
- 3 DEC 2004 Memorandum of Understanding among PEO IWS, PEO SUBS, PEO (T), PEO C4I, and PEO Space Systems supporting establishment of the Open Architecture Enterprise Team (OAET)
- 15 MAY 2005 ASN(RD&A) Memorandum summarizing OA EXCOMM III of 22 FEB 2005
- 23 DEC 2005 Deputy Chief of Naval Operations (Warfare Requirements and Program) (N6/N7) Requirement for Open Architecture (OA) Implementation*

***Links to these policy documents are available at the Naval OA Special Interest Area (SIA) https://acc.dau.mil/oa**

DoDD 5000.1 tells acquisition programs a "modular, open systems approach shall be employed, where feasible."

Department of Defense

DIRECTIVE

NUMBER 5000.1

May 12, 2003

Certified Current as of November 24, 2003

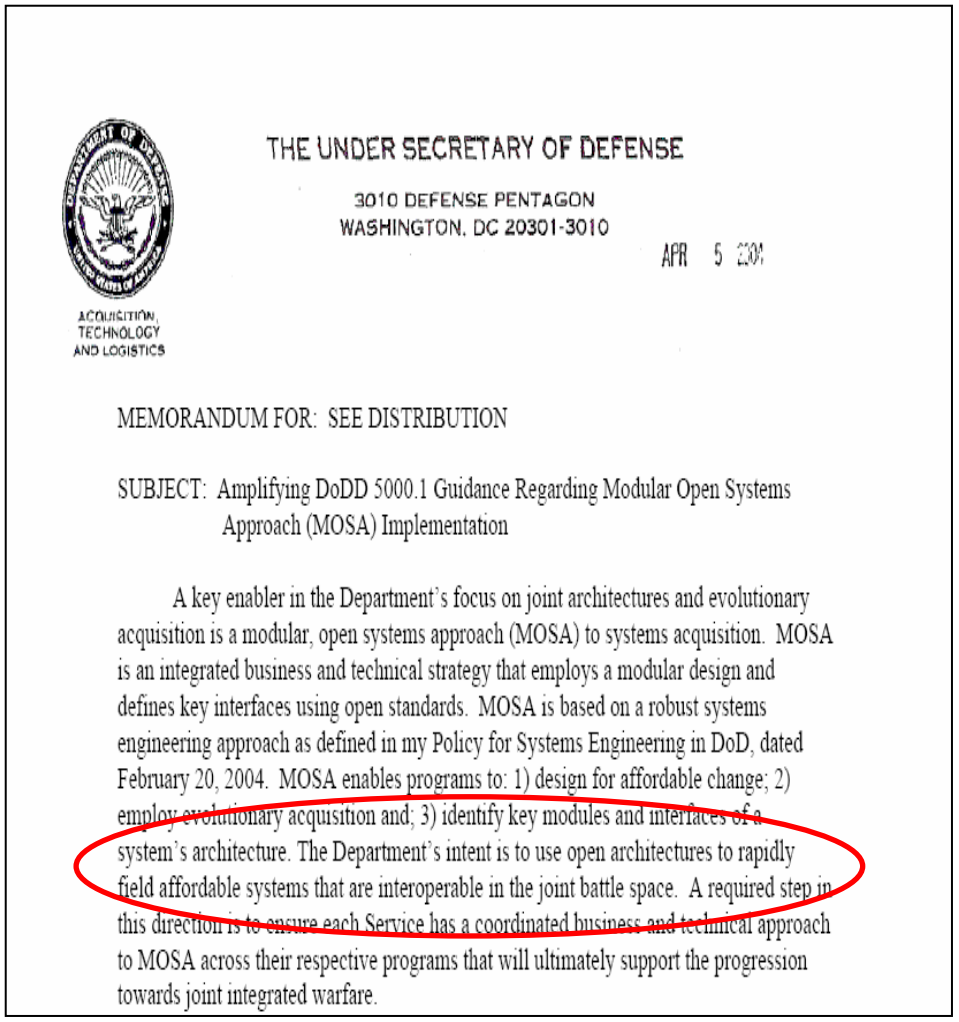
USD(AT&L)

SUBJECT: The Defense Acquisition System

E1.1.27. Systems Engineering. 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.

5 APR 2004 USD(AT&L) Memo amplifies DoD Directive 5000.1, stating that the DoD's intent is to use OA to rapidly field affordable systems that interoperate

- All programs subject to milestone review must brief their Modular Open Systems Approach (MOSA) implementation to the Milestone Decision Authority
- The Open Systems Joint Task Force (OSJTF) was designated the lead for the MOSA effort
- OSJTF developed a Program Manager's Guide for implementing MOSA and adapted the Office of Management and Budget's Program Assessment and Rating Tool (PART) for assessing MOSA implementation



THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

APR 5 2004

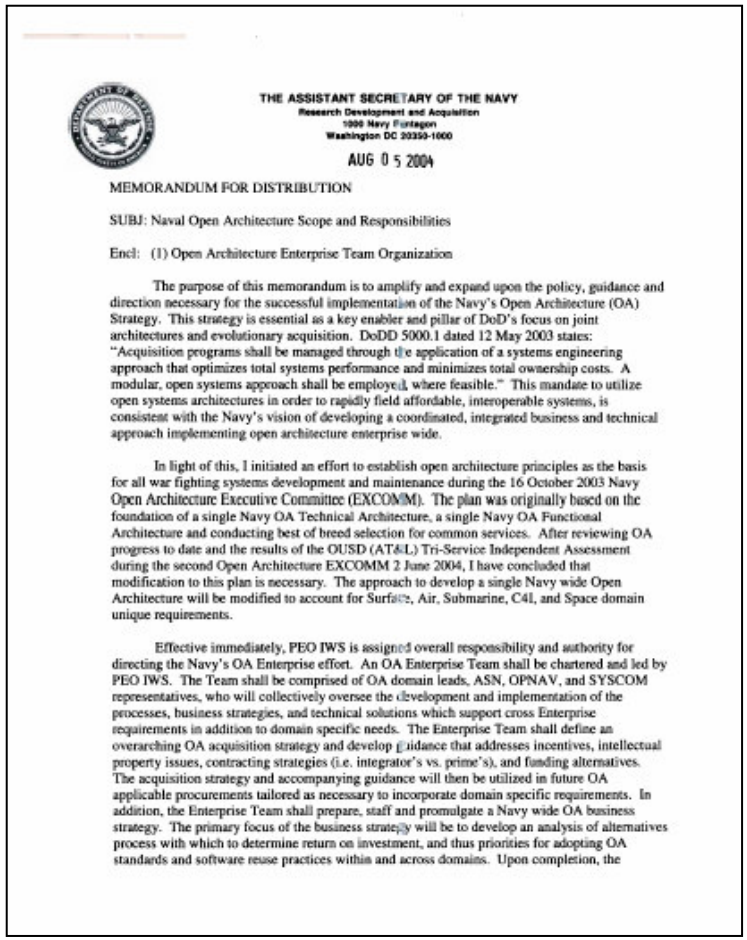
ACQUISITION, TECHNOLOGY AND LOGISTICS

MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Amplifying DoDD 5000.1 Guidance Regarding Modular Open Systems Approach (MOSA) Implementation

A key enabler in the Department's focus on joint architectures and evolutionary acquisition is a modular, open systems approach (MOSA) to systems acquisition. MOSA is an integrated business and technical strategy that employs a modular design and defines key interfaces using open standards. MOSA is based on a robust systems engineering approach as defined in my Policy for Systems Engineering in DoD, dated February 20, 2004. MOSA enables programs to: 1) design for affordable change; 2) employ evolutionary acquisition and; 3) identify key modules and interfaces of a system's architecture. The Department's intent is to use open architectures to rapidly field affordable systems that are interoperable in the joint battle space. A required step in this direction is to ensure each Service has a coordinated business and technical approach to MOSA across their respective programs that will ultimately support the progression towards joint integrated warfare.

ASN(RD&A)'s 5 AUG 2004 Memo chartered the OAET



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

- OA Enterprise Team (OAET) is chartered and led by PEO Integrated Warfare Systems (IWS)
- The OAET shall define an overarching OA acquisition strategy and develop guidance addressing incentives, intellectual property issues, contracting strategies, and funding alternatives
- The OAET shall prepare, staff, and promulgate a Navy-wide OA business strategy
- All ACAT I and II programs shall provide BCAs to the OAET using this process

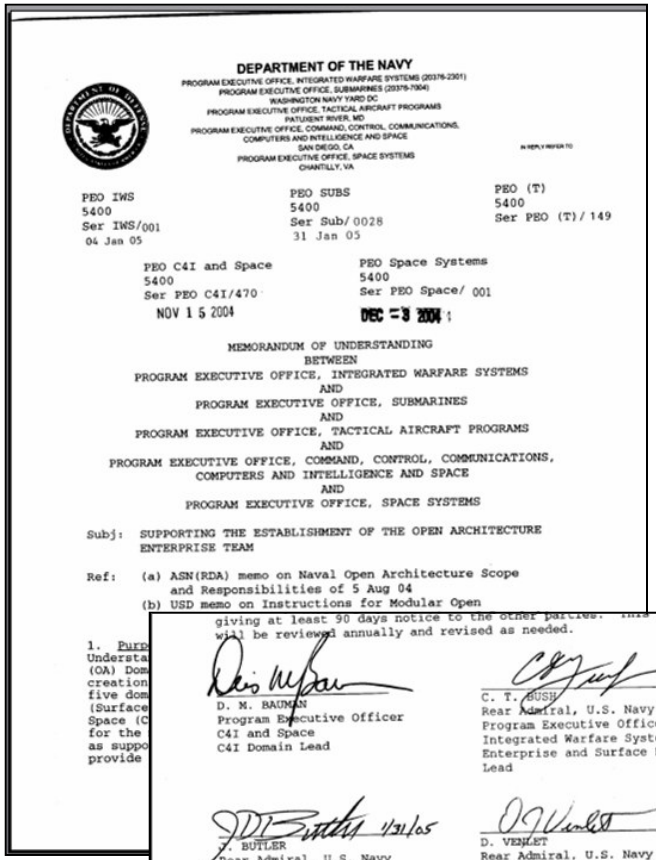
Additional OAET Roles & Responsibilities outlined in ASN(RD&A)'s Memo:

- Lead the Navy Enterprise to OA implementation → *Leadership*
- Provide OA Systems Engineering leadership to PEOs, industry partners, Joint Organizations, Navy Warfare Centers and other participating organizations → *Partnership*
- Provide the forum and process by which cross domain OA proposals and solutions are reviewed and approved → *Coordination*
- Oversee OA implementation efforts ensuring standardized and disciplined processes are utilized across domains → *Technical*
- Identify cross-domain components and opportunities for cost reduction and reuse → *Business*
- Leverage technical, business, and organizational solutions from all participating communities → *Organization*
- Establish an advisory team, comprised of industry and academia, to interpret and advise the team on an as periodic basis → *Communication*

"PEO IWS is assigned overall responsibility and authority for directing the Navy's OA Enterprise effort"

Reference: ASN RD&A Memorandum dated Aug 05, 2004

3 DEC 2004 MOU Among the 5 Navy Domain Leads makes the OAET responsible for the OA effort across the Naval Enterprise, including ensuring implementation conforms to MOSA policy and requirements



DEPARTMENT OF THE NAVY

PROGRAM EXECUTIVE OFFICE, INTEGRATED WARFARE SYSTEMS (20376-2301)
PROGRAM EXECUTIVE OFFICE, SUBMARINES (20375-7904)
WASHINGTON NAVY YARD DC
PROGRAM EXECUTIVE OFFICE, TACTICAL AIRCRAFT PROGRAMS
PATUXENT RIVER, MD
PROGRAM EXECUTIVE OFFICE, COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS AND INTELLIGENCE AND SPACE
SAN DIEGO, CA
PROGRAM EXECUTIVE OFFICE, SPACE SYSTEMS
CHANTILLY, VA

PEO IWS
5400
Ser IWS/001
04 Jan 05

PEO SUBS
5400
Ser Sub/0028
31 Jan 05

PEO (T)
5400
Ser PEO (T)/149

PEO C4I and Space
5400
Ser PEO C4I/470
NOV 1 5 2004

PEO Space Systems
5400
Ser PEO Space/001
DEC 13 2004

MEMORANDUM OF UNDERSTANDING
BETWEEN
PROGRAM EXECUTIVE OFFICE, INTEGRATED WARFARE SYSTEMS
AND
PROGRAM EXECUTIVE OFFICE, SUBMARINES
AND
PROGRAM EXECUTIVE OFFICE, TACTICAL AIRCRAFT PROGRAMS
AND
PROGRAM EXECUTIVE OFFICE, COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS AND INTELLIGENCE AND SPACE
AND
PROGRAM EXECUTIVE OFFICE, SPACE SYSTEMS

Subj: SUPPORTING THE ESTABLISHMENT OF THE OPEN ARCHITECTURE ENTERPRISE TEAM

Ref: (a) ASN(RDA) memo on Naval Open Architecture Scope and Responsibilities of 5 Aug 04
(b) USD memo on Instructions for Modular Open

giving at least 90 days notice to the other parties. This MOU will be reviewed annually and revised as needed.

D. M. BAUMAN
Program Executive Officer
C4I and Space
C4I Domain Lead

C. T. BUSH
Rear Admiral, U.S. Navy
Program Executive Officer
Integrated Warfare Systems
Enterprise and Surface Domain Lead

J. BUTLER 12/1/05
Rear Admiral, U.S. Navy
Program Executive Officer
Submarines
Submarine Domain Lead

D. VENLET
Rear Admiral, U.S. Navy
Program Executive Officer
Tactical Aircraft Programs
Air Domain Lead

DR. J. BREEDLOVE
Program Executive Officer (Acting)
Space Systems
Space Domain Lead

Per ASN(RD&A)'s Memo, the OAET is responsible for coordination, liaison and participation with the Office of the Secretary of Defense (OSD) Open System Joint Task Force, to include:

- Ensuring that Naval OA Enterprise implementation conforms to applicable MOSA policy and acquisition requirements
- Ensuring that OA progress assessments comply with the Program Assessment Review Tool (PART)
- Promoting Naval OA Enterprise products to OSD, DoD Agencies and other Service components

The outcome of EXCOMM II (Aug '04) required PEO-IWS and the OA Enterprise Team to provide programs with analysis tools

Decision 3: OA efforts need to be guided by a well-defined business strategy.

Action: Prepare, staff and promulgate a Navy-wide business strategy to support OA goals.

Business Strategy shall:

- Define an acquisition strategy addressing incentives, intellectual property issues, contracting (integrators vs. primes), and funding alternatives.
- Incorporate inputs from each lead PEO on current application of OA within its programs and identify if any OA redirection is needed or desired with associated costs. This includes a business case analysis for OA implementation across the Enterprise that is based on established criteria.
- Provide a prescribed format to be used by PEOs for OA compliancy waivers.
- Determine total cost estimate of projected OA effort for input to PR-07. Industry and academia participation is required.
- Provide programs with analysis tools needed to make OA tradeoffs.

Lead: PEO IWS
Follow: Enterprise Team
Due Date: 31 August 2004

See August 5, 2004 ASN (RD&A) Memorandum

In March 2005, an OA Assessment Model was approved as a tool to help managers assess a current program's openness

Business and Acquisition Characteristics

0 – Isolated
- Exclusive use of closed sole source contracts
- Proprietary interface, no access to systems

1 – Connected
- Initial OA language in contracting and acq docs
- Program (gov't/industry) educated on FORCEnet/OA
- Initial use of commercial standards and best practices
- Program has achieve "Marginal" level for MOSA business indicators

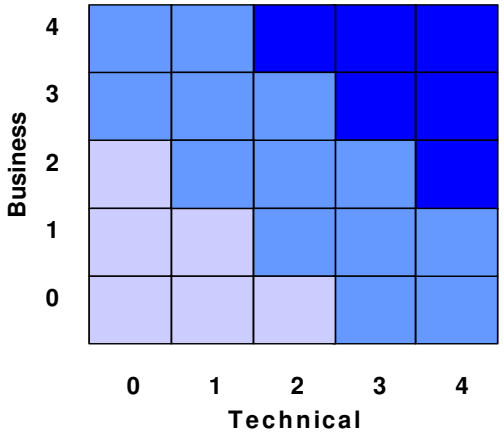
2 – Migrating to Openness
- Program has validated NR-KPP
- Transitioning to JCIDS capability needs documents
- Contracting approach maximizes cost competitiveness and innovation
- Use of commercial standards based COTS products
- Some market research employed to leverage commercial investment
- Completed FIBL Survey and verified information
- Program has achieve "Satisfactory" level for MOSA business indicators

3 – Common
- Spiral development/evolutionary acquisition employed to facilitate rapid technology insertion
- Applicable program acquisition and engineering documentation (AS, SEP, ISP, etc) includes OA language
- Integrated team approach to development involving requirements, resource, testing, user community members
- "Community of Interest" teams employed to develop system
- Program has robust FORCENet/OA implementation roadmap

4 – Open and Net-Centric
- OA compliance metrics part of PM processes and program reviews
- Extensive use of commercial standards and best practices across Enterprise
- Program conducts continuous market research
- Continuous process for FORCENet/OA improvement
- Program has achieve "Exemplary" level for MOSA business indicators

OA Assessment Model

Version 1.0 (8 March 2005)



Business and Acquisition Strategy Characteristics refer to the processes & documentation programs employ to acquire and manage systems;

Architecture and Technical characteristics are the technical features of computing environments and application software

Openness Characterization
- Low
- Moderate
- High

Architecture and Technical Characteristics

0 – Closed
- Proprietary Hardware or API (O/S or middleware)
- Predominant number of point to point legacy interfaces
- Highly integrated applications with integral middleware

1 – Layered
- Standards-based COTs Hardware & O/S
- Specialized middleware
- Highly integrated monolithic applications isolated from Computing environment
- Standard communications between layers
- Program has achieve "Marginal" level for MOSA technical indicators

2 – Layered & Open
- Computing Environment / App. S/W independence
- Open published APIs
- Modular application components
- Facilitates technology insertion/replacement
- Standard communications between layers
- Exposes data to network via I/Fs to legacy system/subsystems
- Separates operator, application, and data
- Program has achieve "Satisfactory" level for MOSA technical indicators

3 – Common
- Discovers/publishes capability using standards (where applicable)
- Adheres to a common architecture across multiple programs
- Uses common services (such as security)
- Common semantics and data model
- Ability to Interact with GIG/FORCENet

4 – Enterprise
- Adheres to a common architecture across multiple domains
- Data exchange between domains via std interface
- Commercially accepted services or data model
- Uses core services (e.g., NCES, DIB)
- Exposes services and data to GIG/FORCENet
- Program has achieve "Exemplary" level for MOSA technical indicators

See May 15, 2005 Summary of OA EXCOMM III

EXCOMM III (Feb '05) required ACAT I programs to use the model to determine the "as-is" level of openness and desired "to-be" state

Text from the May 15, 2005 Summary of OA EXCOMM III

- All Domains and Executive Committee members have agreed to the OA Assessment Model. The model shall be used to demonstrate programs' positional relationship to the desired levels of openness. All ACAT I programs will commence this process, while all others will do so as coordinated by PEO IWS through the Open Architecture Enterprise Team (OAET). This model shall be used to determine the "as-is" level of openness and the desired or "to-be" level of openness and shall be coordinated with program sponsors. For those programs not on a plan to achieve a desired level of openness, program managers shall conduct business case analyses (BCAs) to determine the cost and benefits of achieving the desired state. BCAs shall be sent to the OAET for assessment following program sponsor and PEO concurrence. If the OAET, Program Sponsors, and PEO concur, the BCA becomes the approved waiver.

Action Item 3 in the attached action items to May 15, 2005 Summary of OA EXCOMM III

3) Produce metrics for all ACAT I programs and conduct business cases analyses (BCAs) if necessary. Produce metrics for ACAT II, III, and IV programs and conduct BCAs as coordinated by the OAET.

Lead: PEO IWS, PEO T, PEO C4I & Space, PEO Subs, PEO Space Systems
Follow: PEO LMW, PEO Carriers, PEO Ships, PEO A, PEO W, PEO Strike, DRPM JSF, OPNAV N6/7
Due Date: Aug 05 and report progress at the next EXCOMM or earlier.

Each domain was required to produce metrics and conduct BCAs if necessary

The OA Assessment Tool was developed to link Naval OA with MOSA principles, use the OA Assessment Model Structure, and add greater detail for National Security Systems

OA ASSESSMENT MODEL (OAAM)

- Developed late 2004
- Approved Feb 05 OA EXCOMM
- Structure- Business / Technical Axes
  - Axis Range - Closed to Open
  - Questions Sample Range for Each Axis
- Characteristics
  - 23 Business, 27 Technical
- Implementation
  - PowerPoint Slide
  - Not Interactive Scoring Tool

OA ASSESSMENT TOOL (OAAT)

- Interactive scoring EXCEL tool
- OAAT is based on the OAAM
  - Uses the OAAM Structure with clarifications
  - Addresses OAAM Content Points with Questions
  - Adds Questions for additional OA Issue Coverage
- Structure- Business / Technical Axes
  - **Business and Technical Questions**
  - Axis Range - Closed to Open
  - Questions Sample Range for Each Axis

At EXCOMM IV (Oct '05), ASN(RD&A) reinforced the need to report on programs' OA progress by assigning additional Action Items

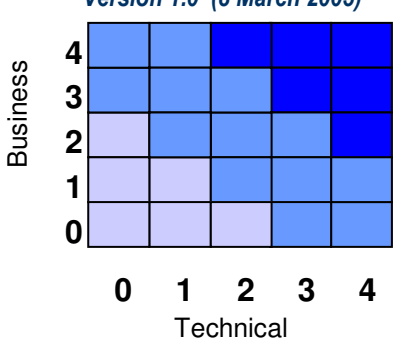
- In an effort to determine how much progress has been made on Open Architecture to date, ACAT I and II Program Managers were required to report out on:
  - The functionality their programs provide
  - The prime integrator
  - The number of companies currently involved with that prime integrator
  - The size of those companies
  - The detailed approach being taken to move toward OA
- All Program Managers were directed to assess and provide written reports on their programs' compliance with the mandate to move toward OA using the OAAM as measured with the OAAT. OAET Domain Leads were directed to ensure assessments are completed and reported to PEO IWS 7.0.

ASN(RD&A) reiterated that OA EXCOMM Action Items are effective the date of the meeting, the minutes are a mere formality

Together, the OAAM and OAAT help produce the required metrics and support the analysis in determining if a Business Case Analysis (BCA) is required

OA Assessment Model

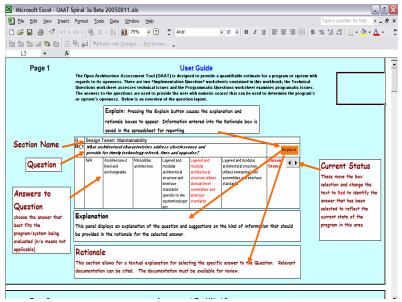
Version 1.0 (8 March 2005)



- Graphical depiction of the current OA maturity state
- Identifies progression towards openness

… as implemented through the …

OA Assessment Tool



- Set of business and technical questions to help PMs understand how to become more open
- Official Version 1.0 released December 8, 2005

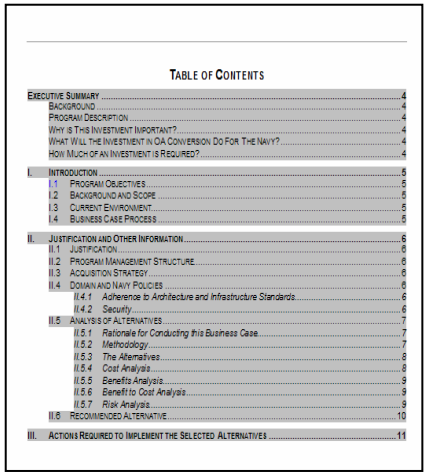
… produces support to determine …

Where is my program today?

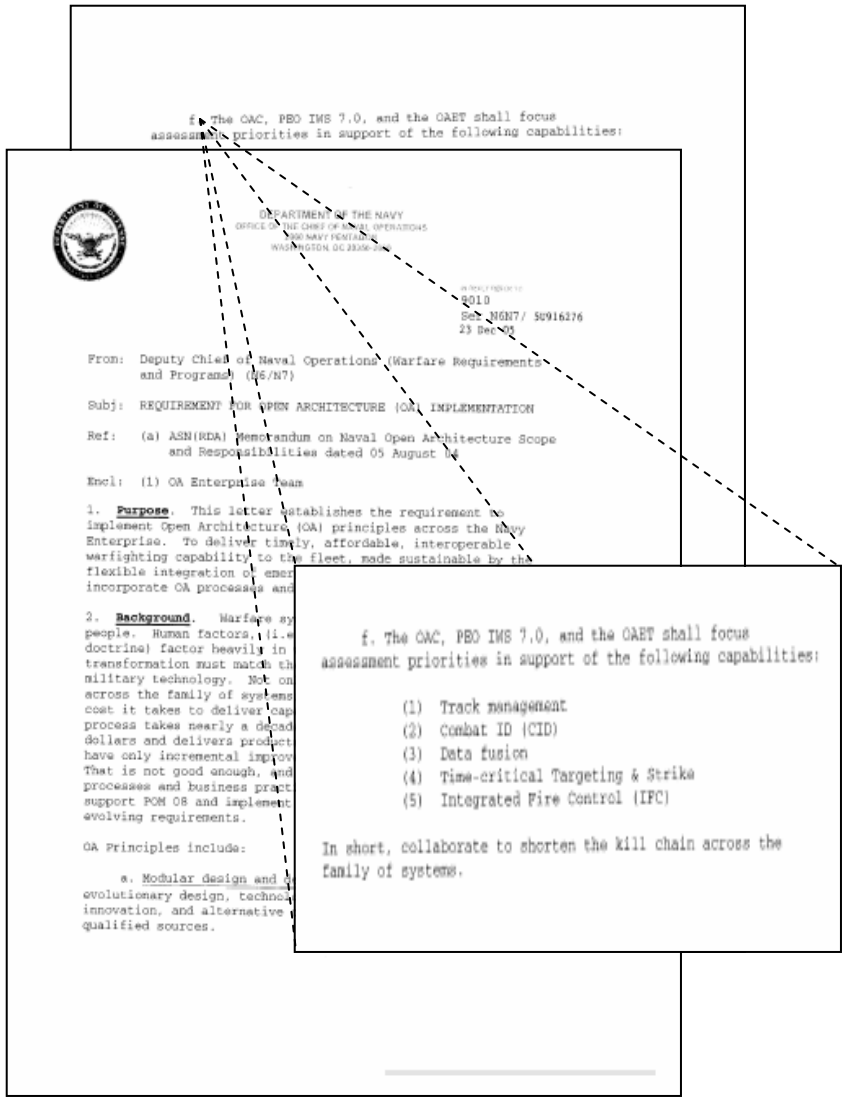
What are the alternatives for advancing towards OA?

Is a business case needed?

BCA Template



In its 23 DEC 2005 letter, OPNAV (N6/N7) established the Navy-wide requirement for OA and laid out the priorities on which it wants Naval OA to focus



f. The OAC, PEO IWS 7.0, and the OAET shall focus assessment priorities in support of the following capabilities:

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

5010
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 emer... incorporate OA processes and...

2. **Background**. Warfare sy... people. Human factors, (i.e... doctrine) factor heavily in ... transformation must match th... military technology. Not on... across the family of systems... cost it takes to deliver cap... process takes nearly a decad... dollars and delivers product... have only incremental improv... That is not good enough, and... processes and business pract... support POM 08 and implement... evolving requirements.

OA Principles include:

a. Modular design and ... evolutionary design, techno... innovation, and alternative ... qualified sources.

f. The OAC, PEO IWS 7.0, and the OAET shall focus assessment priorities in support of the following capabilities:

(1) Track management
(2) Combat ID (CID)
(3) Data fusion
(4) Time-critical Targeting & Strike
(5) Integrated Fire Control (IFC)

In short, collaborate to shorten the kill chain across the family of systems.

- The letter "establishes the requirement to implement Open Architecture (OA) principles across the Navy Enterprise"
- It establishes the OA Council (OAC) of representatives of N6/N7 Division Directors to work with the OAET on the requirements
- The letter directs the OAC, PEO IWS 7.0, and the OAET to focus assessment priorities in support of the following capabilities:
  - Track management
  - Combat ID (CID)
  - Data fusion
  - Time-critical Targeting & Strike
  - Integrated Fire Control (IFC)

Therefore, the OAET has distributed version 1.0 of the OAAT to all Major Program Managers

- Distribute the OAAT among your program staff so that they become familiar with it
- Share the OAAT with your industry contractors so they understand what OA implementation entails and can help with your assessments
- Use the OAAT to conduct an OA assessment of your program as soon as possible