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**Analysis of Modular Open Systems Approach (MOSA)
Implementation in Navy Acquisition Programs**

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by

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The following article is taken as an excerpt from the proceedings of the annual Acquisition Research Program. This annual event showcases the research projects funded through the Acquisition Research Program at the Graduate School of Business and Public Policy at the Naval Postgraduate School. Featuring keynote speakers, plenary panels, multiple panel sessions, a student research poster show and social events, the Annual Acquisition Research Symposium offers a candid environment where high-ranking Department of Defense (DoD) officials, industry officials, accomplished faculty and military students are encouraged to collaborate on finding applicable solutions to the challenges facing acquisition policies and processes within the DoD today. By jointly and publicly questioning the norms of industry and academia, the resulting research benefits from myriad perspectives and collaborations which can identify better solutions and practices in acquisition, contract, financial, logistics and program management.

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Analysis of Modular Open Systems Approach (MOSA) Implementation in Navy Acquisition Programs

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Introduction

This research continues the exploration of the use of the modular open systems approach (MOSA) as a method for implementing an evolutionary acquisition strategy in Department of Defense (DoD) programs. The background on the initial DoD and Navy policy on using a MOSA approach in defense acquisition is presented, followed by a review of the initial research findings. A discussion is then provided on the Navy's method for assessing its implementation of a MOSA approach in its acquisition programs. This discussion will focus on the use of the Naval Enterprise Open Architecture Assessment Tool (OAAT). The primary purpose of this continuing research is to provide an analysis of the results of the OAAT assessment of Navy acquisition programs.

Background on MOSA Policy

DoD 5000.1 states that, "a modular open systems approach shall be employed where feasible" (Under Secretary of Defense (AT&L), 2003, May 12a; 2003, May 12b). Furthermore, in April 2004, the USD (AT&L) issued a memorandum stating, "all programs subject to milestone review shall brief their program's MOSA implementation status to the Milestone Decision Authority (MDA) to determine compliance" (Under Secretary of Defense (AT&L), 2004, April 5).

Later that year, the Office of the USD(AT&L), Director of Defense Systems, issued instructions for MOSA implementation and identified the Open System Joint Task Force (OSJTF) as the DoD lead for MOSA. This memo also identified MOSA as, "an integral part of the toolset that will help DoD achieve its goal of providing the joint combat capabilities required



in the 21st century, including supporting and evolving these capabilities over their total life-cycle” (Under Secretary of Defense (AT&L), 2004, July 7).

In addition, in August 2004, Assistant Secretary of the Navy (Research, Development & Acquisition) (ASN (RDA)) issued a policy statement that developed a single Navy-wide Open Architecture to account for Surface, Air, Submarine, C4I, and Space domain unique requirements. That memo also assigned PEO IWS overall responsibility and authority for directing the Navy's OA Enterprise effort. An OA Enterprise Team comprised of OA domain leads, ASN, OPNAV, and SYSCOM representatives was chartered and led by PEO IWS. The Team collectively oversees 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 will also 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 (ASN (RD&A), 2004).

Finally, in a 23 December 2005 letter, Deputy Chief of Naval Operations (Warfare Requirements and Program) established the Navy-wide requirement for OA and laid out the priorities on which it wants Naval OA to focus. 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, and Integrated Fire Control (IFC).

Initial Research Findings

The purpose of the initial MOSA research was to explore both the use of the modular open systems approach (MOSA) as a method for implementing an evolutionary acquisition strategy, as well as the implications of using such an approach on the contracting process.

Although the phases of the contracting process are the same for MOSA-based programs as they are for non-MOSA-based programs, this research found that the specific activities conducted and documents developed during the execution of these contracting phases have a direct influence on the success of a MOSA-based program. For example, the various options for allocating roles and responsibilities between the government and the contractor for the various steps in the acquisition process will influence the amount of “openness” in the program and the contractor's motivation for meeting the desired level of openness.

This research indicated that the greater degree of jointness in acquisition roles and responsibilities, as well as the greater degree of contractor-developed acquisition documents, will lead to a higher level of openness.

This initial research also identified early involvement and participation by industry in developing requirements and acquisition strategy as a key factor in successful MOSA-based programs. Program offices managing a MOSA-based program should conduct extensive market research and industry conferences to achieve this contractor involvement. A best-value contract strategy that is tailored to emphasize technical performance in open-based systems and COTS systems is also a critical factor in meeting higher levels of openness in MOSA-based



programs. A contract strategy which involves developing source-selection evaluation factors specifically weighted to emphasize an open systems approach will be critical for MOSA-based programs.

As important as the acquisition strategy is the structure of the contract of a MOSA-based program.

This research identified the use of incentive-fees, award-fees, and award-term contract incentives as integral to the success of MOSA-based programs. These incentives, if structured appropriately, are effective tools for motivating and incentivizing contractors to achieve higher levels of openness in the design and development of systems.

Finally, the consistent and aggressive use of the contractor past-performance information system, as well as the development and establishment of lessons-learned programs and best practices will be essential as more and more MOSA-based programs are initiated. As contractors performing work on MOSA-based programs begin to realize that the DoD is insistent on using open systems in developing its major weapon systems, they should begin to dedicate the required resources to this method of developing weapon systems.

Internal Assessment of MOSA Implementation

The focus of this follow-on research is to analyze the effectiveness of the implementation of MOSA in Navy acquisition programs by investigating the results of MOSA-internal assessments, specifically the results of the Open Architecture Assessment Tool (OAAT). The results of this research will prove beneficial to senior Navy officials by providing data points on MOSA implementation by analyzing the consistency of MOSA compliance status and internal assessments for specific Navy acquisition programs.

The OAAT is a tool designed to assist Navy program managers in assessing the "openness" of their programs. It aligns to the Open Architecture Assessment Model (OAAM) as approved by ASN(RDA) and provides a reproducible and objective method of conducting program assessments. Specifically, the OAAT is an analytic tool that evaluates responses to a set of interrelated questions to provide program officers with an objective and evidence-based assessment of the degree that a program exhibits openness along two axes: business and technical. The degree that openness is implemented is presented in terms of business/programmatic and technical criteria. The business/programmatic dimension criteria include questions that address: Open Architecture, Modular Open Design, Interface Design and Management, Treatment of Proprietary Elements, Open Business Practices, Peer Review Rights, and Technology Insertion. The technical dimension criteria cover essential OA design tenets of Interoperability, Composability, Reusability, Maintainability and Extensibility.

The OAAT assessment score summary provides a summary of the ratings for each of the evaluated areas (See Figure 1).



Business Areas

Open Systems Approach
Open Architecture
Open Modular Design
Interface Design and Management
Treatment of Proprietary Elements
Open Business Practices
Peer Review Rights
Technical Insertion
Commercial Standards
Compliance

Technical Areas

Design Tenet: Interoperability
Design Tenet: Maintainability
Design Tenet: Extensibility
Design Tenet: Composability
Design Tenet: Reusability
General Design Tenet

Figure 1. Ratings of Evaluated Areas

In addition, an OA assessment matrix that displays the program current state with respect to business and technical openness is also provided in the assessment summary. Each of these areas (business and technical) is rated on a scale of 0 to 4. (See Figure 2.) The results of the OAAT assessment could then be used by the program manager to help improve the program with respect to Naval Open Architecture.

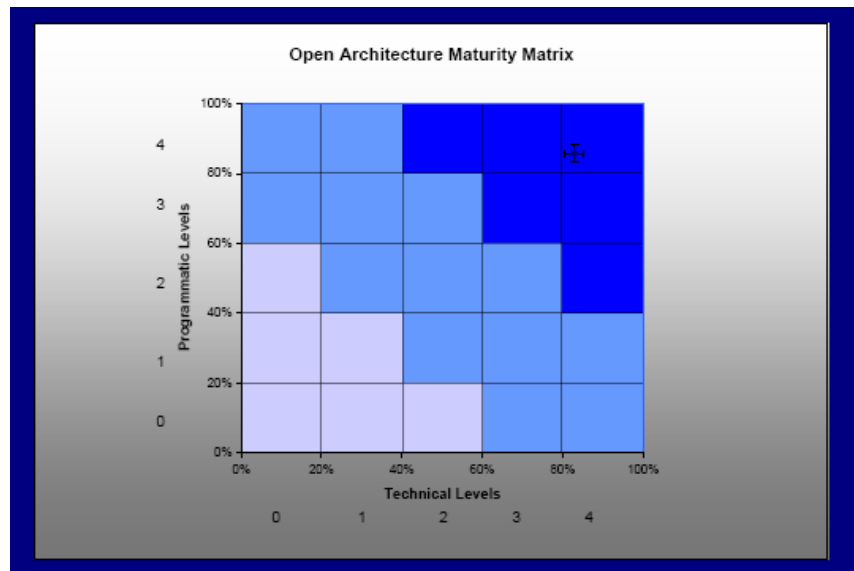


Figure 2. Open Architecture Maturity Matrix

This is an executive summary of the complete research report. The complete research report may be accessed from the Naval Postgraduate School website www.nps.navy.mil/gsbpp/acqn/publications.

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2003 - 2006 Sponsored Acquisition Research Topics

Acquisition Management

- Software Requirements for OA
- Managing Services Supply Chain
- Acquiring Combat Capability via Public-Private Partnerships (PPPs)
- Knowledge Value Added (KVA) + Real Options (RO) Applied to Shipyard Planning Processes
- Portfolio Optimization via KVA + RO
- MOSA Contracting Implications
- Strategy for Defense Acquisition Research
- Spiral Development
- BCA: Contractor vs. Organic Growth

Contract Management

- USAF IT Commodity Council
- Contractors in 21st Century Combat Zone
- Joint Contingency Contracting
- Navy Contract Writing Guide
- Commodity Sourcing Strategies
- Past Performance in Source Selection
- USMC Contingency Contracting
- Transforming DoD Contract Closeout
- Model for Optimizing Contingency Contracting Planning and Execution

Financial Management

- PPPs and Government Financing
- Energy Saving Contracts/DoD Mobile Assets
- Capital Budgeting for DoD
- Financing DoD Budget via PPPs
- ROI of Information Warfare Systems
- Acquisitions via leasing: MPS case
- Special Termination Liability in MDAPs

Logistics Management

- R-TOC Aegis Microwave Power Tubes
- Privatization-NOSL/NAWCI
- Army LOG MOD
- PBL (4)



- Contractors Supporting Military Operations
- RFID (4)
- Strategic Sourcing
- ASDS Product Support Analysis
- Analysis of LAV Depot Maintenance
- Diffusion/Variability on Vendor Performance Evaluation
- Optimizing CIWS Lifecycle Support (LCS)

Program Management

- Building Collaborative Capacity
- Knowledge, Responsibilities and Decision Rights in MDAPs
- KVA Applied to Aegis and SSDS
- Business Process Reengineering (BPR) for LCS Mission Module Acquisition
- Terminating Your Own Program
- Collaborative IT Tools Leveraging Competence

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Acquisition Research Program:
Creating Synergy for Informed Change

Analysis of MOSA Implementation in Navy Acquisition Programs

Rene G. Rendon

Overview

- Background
- Policy
- Current Research
- Initial Findings
- Preliminary Conclusions



Background

- Modular Open Systems Approach (MOSA)
 - An integrated business and technical strategy that employs a modular design.... (OSJTF)
- MOSA Principles
 - Enabling Environment
 - Modular Design
 - Key Interfaces
 - Open Standards
 - Conformance



Background

- Open Architecture (OA)
 - A Navy initiative for a multi-faceted strategy providing a framework for developing joint interoperable systems that adapt and exploit open-system design principles and architectures.... (Naval OA website)



MOSA Policy

- “A modular open systems approach shall be employed where feasible...” (*DoD Directive 5000.1, May 2003*)
- “All programs...shall brief their MOSA implementation status to the Milestone Decision Authority to determine compliance...” (*USD (AT&L) Memo, April 2004*)



OA Policy

- “...Enterprise team shall prepare, staff, and promulgate a Navy wide OA business strategy...” (*ASN (RD&A), 5 Aug 2004*)
- “...establishes the requirement to implement Open Architecture (OA) principles across the Navy enterprise...” (*Deputy Chief of Naval Operations (Warfare Requirements and Programs), 23 Dec 2005*)



Current Research

Analyze how the Navy is monitoring the implementation of MOSA in its defense acquisition programs.



Assessing MOSA Implementation

- Assessment of acquisition program's level of “openness” conducted using Open Architecture Assessment Tool (OAAT)
- Assessment results reflected in the Open Architecture Assessment Model (OAAM)



Open Architecture Assessment Tool (OAAT)

- Excel-based tool designed to provide a quantifiable estimate for a program or system with regard to its level of “openness”



Open Architecture Assessment Tool

- “Openness” refers to both programmatic and technical characteristics of a program that support
 - Modular design
 - Easy interoperability with other systems
 - Extensive employment of commercial standards
 - Enhanced competition for development and support
 - Facilitates rapid technology insertion



Open Architecture Assessment Tool

- The OAAT provides an assessment of the user's responses to questions about the programmatic and technical practices of the program and plots its "as-is" state on the Open Architecture Assessment Model (OAAM)
- OAAT, version 1.1 includes OSJTF's MOSA PART questionnaire, which the Department of Defense requires all Acquisition Category (ACAT) programs to complete



OAAT Assessment Areas

(Version 1.1)

Technical Areas

- Design Tenet: Interoperability
- Design Tenet: Maintainability
- Design Tenet: Extensibility
- Design Tenet: Composability
- Design Tenet: Reusability
- Design Tenet: MOSA

30 Questions

(Includes 13 MOSA PART questions)

OAAT Assessment Areas

(Version 1.1)

Programmatic Areas

- Open Systems Approach
- Open Architecture
- Open Modular Design
- Interface Design and Management
- Treatment of Proprietary Elements
- Open Business Practices
- Peer Review Rights
- Technical Insertion
- Commercial Standards
- Compliance

29 Questions

(Includes 10 MOSA PART questions)

Area or
Section

Section

Total Questions Applicable	Total Questions Not Applicable	Max Score	Achieved	Normalized
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A	Open Systems Approach	2	0	8	2	25.0%
B	Open Architecture	2	0	8	2	25.0%
C	Open Modular Design	3	0	12	3	25.0%
D	Interface Design and Management	4	0	16	4	25.0%
E	Treatment of Proprietary Elements	4	0	16	4	25.0%
F	Open Business Practices	4	0	16	4	25.0%
G	Peer Review Rights	3	0	12	3	25.0%
H	Technical Insertion	4	0	16	4	25.0%
I	Commercial Standards	1	0	4	1	25.0%
J	Compliance	19	0	76	19	25.0%
Combined Programmatic Rating		40	0	136	34	25.0%
K	Design Tenet: Interoperability	6	0	24	0	0.0%
L	Design Tenet: Maintainability	2	0	8	0	0.0%
M	Design Tenet: Extensibility	3	0	12	0	0.0%
N	Design Tenet: Composability	2	0	8	0	0.0%
O	Design Tenet: Reusability	4	0	16	0	0.0%
P	General Design Tenets	13	0	52	0	0.0%
Combined Technical Rating		30	0	120	0	0.0%

Open Architecture Maturity Matrix

Programmatic Levels

4: Open and Net-Centric

3: Common

2: Migrating to Openness

1: Connected

0: Isolated

Technical Levels

4: Enterprise

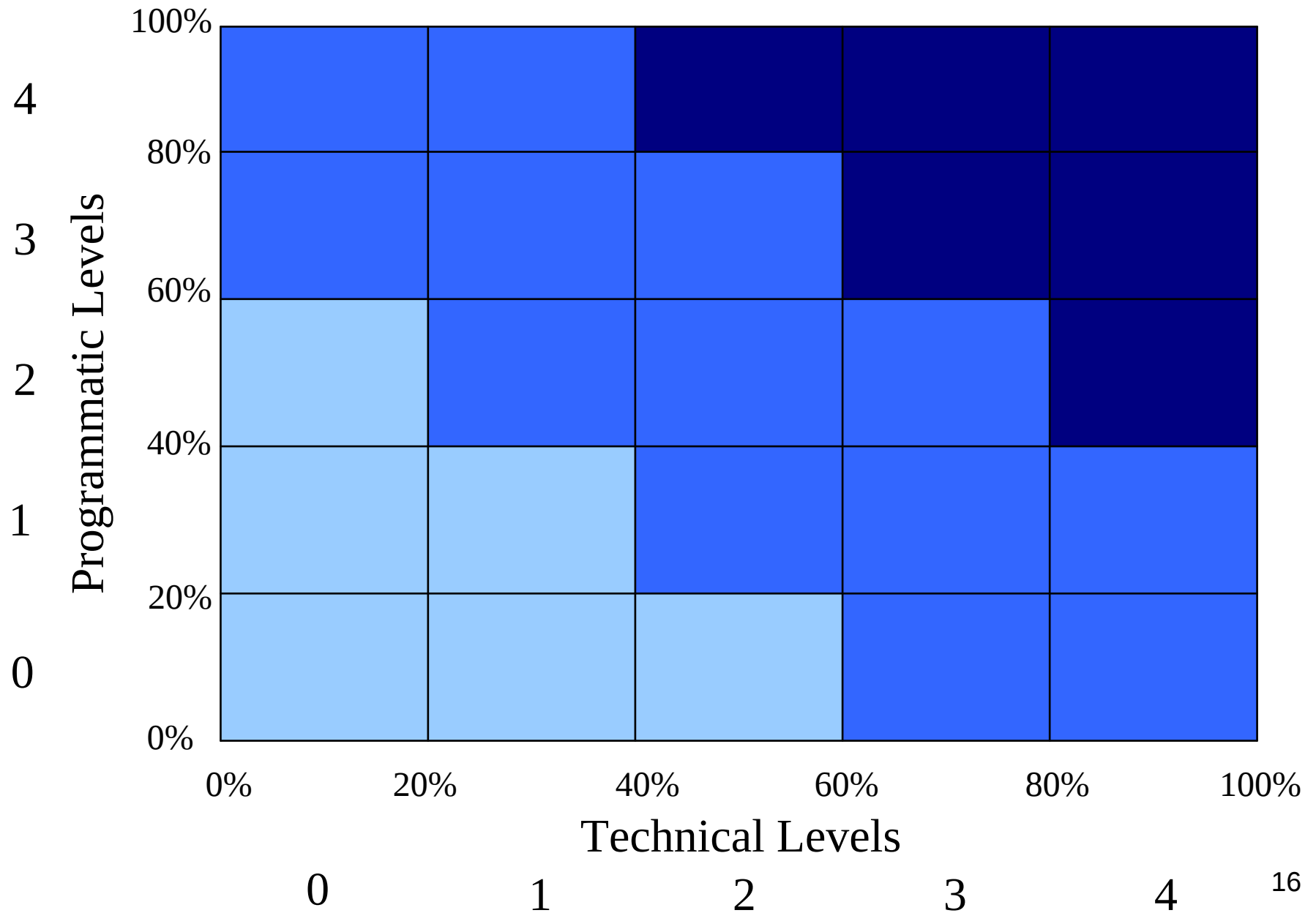
3: Common

2: Layered & Open

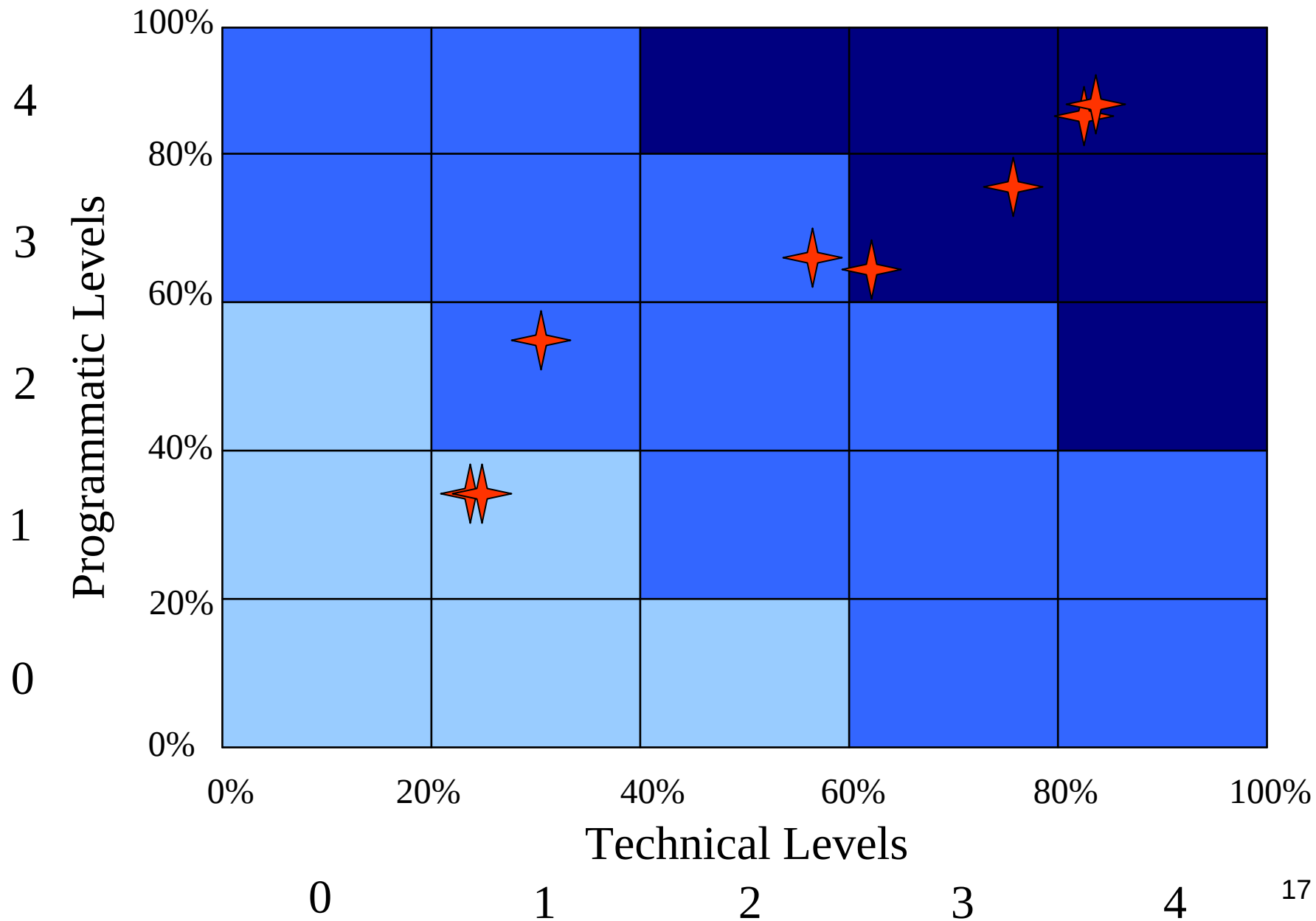
1: Layered

0: Closed

OAAT Assessment Matrix

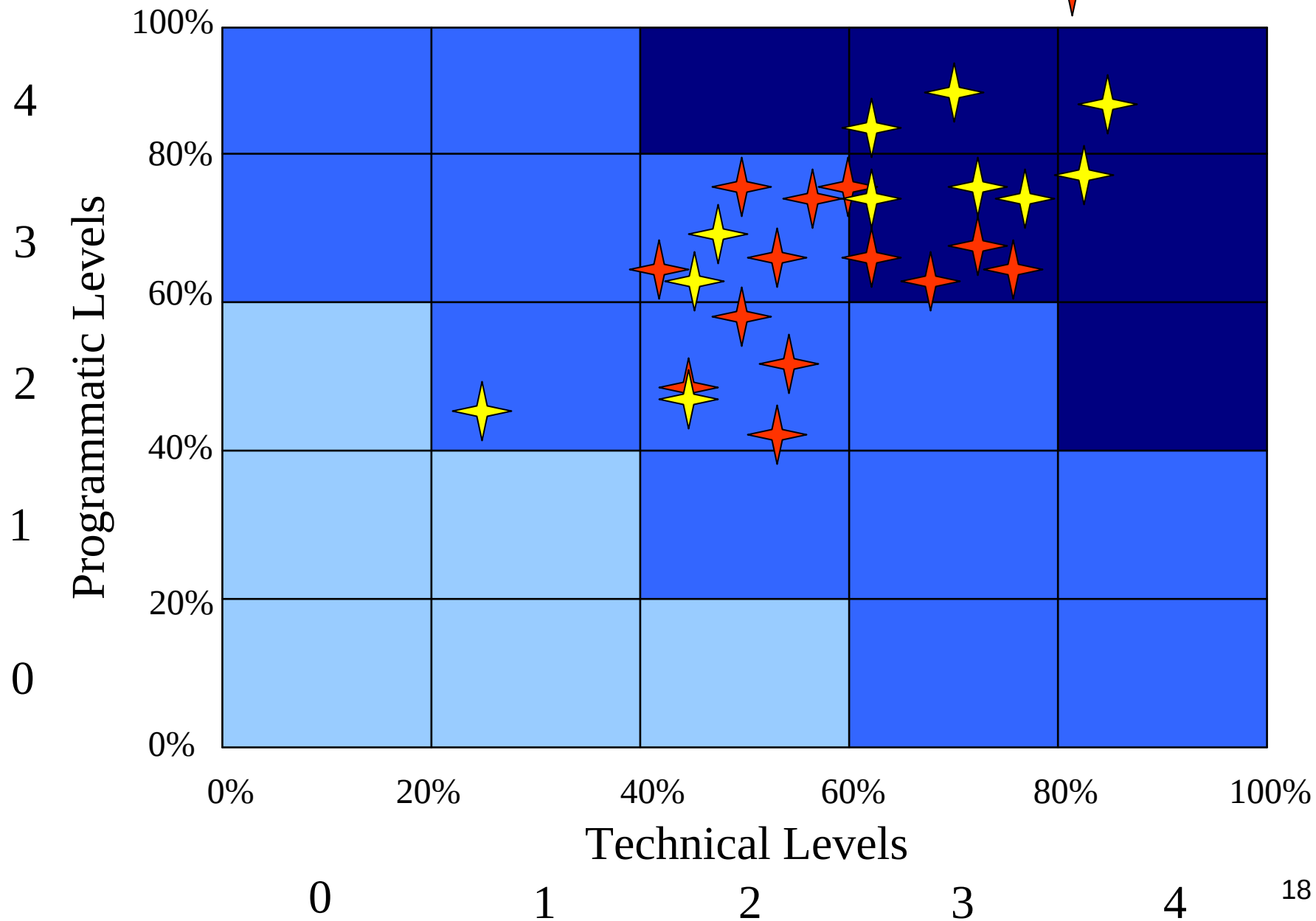


Sub Domain OAAT Assessments



Air Domain OAAT Assessments

- ★ Systems
- ★ Aircraft



Reporting Assessment Results

- PMs are directed to assess and provide written reports on compliance with OA policy using the OAAM
 - “As-is” level of openness
 - “To-be” level of openness



Reporting Assessment Results

- PMs conduct a BCA to determine the cost and benefits of appropriate level of openness
- Domains report assessment results to PEO IWS 7.0



Conclusion

- Compliance with MOSA policy is reflected in Navy's OA initiative
- Navy's OA requirement is assessed using the OAAT and reflected in OAAM
- OAAM score summaries reflect the various levels of openness for Naval programs and systems



Back-Up Slides



Previous Research Findings

- MOSA strategy has specific implications to the contracting process
 - Industry involvement
 - Shared roles between government and industry
 - Best value acquisition strategy
 - Contract incentive structure
 - Emphasis on contractor past performance



Characteristics of MOSA Based Contracts

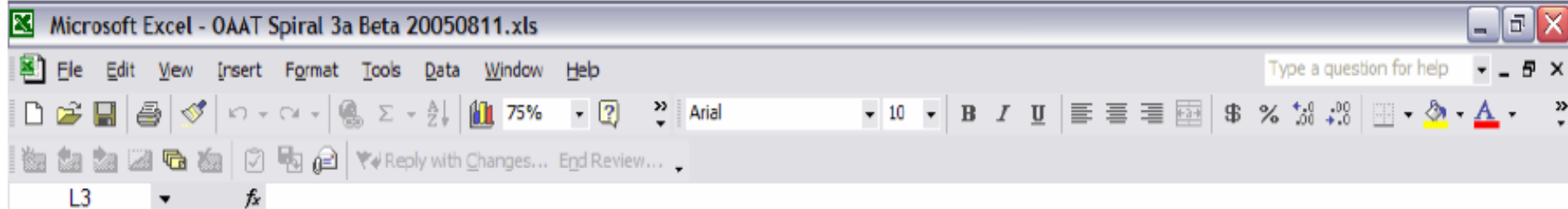
- Early involvement and participation of industry in developing requirements and acquisition strategy
- Shared roles between government and contractors in development of system specification and statement of work (SOW)
- Best value source selection strategy, with higher weights given to non-cost evaluation factors such as technical performance and past performance



Characteristics of MOSA Based Contracts

- Contract structure that includes incentives for meeting higher levels of openness (Incentive fees, Award fees, Award term)
- Documentation of contractor's performance in meeting openness requirements (Past performance evaluation)





Page 1

User Guide

The Open Architecture Assessment Tool (OAAT) is designed to provide a quantifiable estimate for a program or system with regards to its openness. There are two "Implementation Question" worksheets contained in this workbook; the Technical Questions worksheet assesses technical issues and the Programmatic Questions worksheet examines programmatic issues. The answers to the questions are used to provide the user with numeric scores that can be used to determine the program's or system's openness. Below is an overview of the question layout.

Explain: Pressing the Explain button causes the explanation and rationale boxes to appear. Information entered into the Rationale box is saved in the spreadsheet for reporting.

Section Name

Question

Answers to Question

choose the answer that best fits the program/system being evaluated (n/a means not applicable)

Design Tenet: Maintainability						
B1_1	What architectural characteristics address obsolescence and provide for timely technology refresh, fixes and upgrades?					Explain
	N/A	Architecture is fixed and unchangeable.	Monolithic architecture	Layered and modular architectural structure and interface standards specific to the system/subsystem	Layered and modular architectural structure utilizes enterprise level assemblies and interface standards	Current Status

Explanation

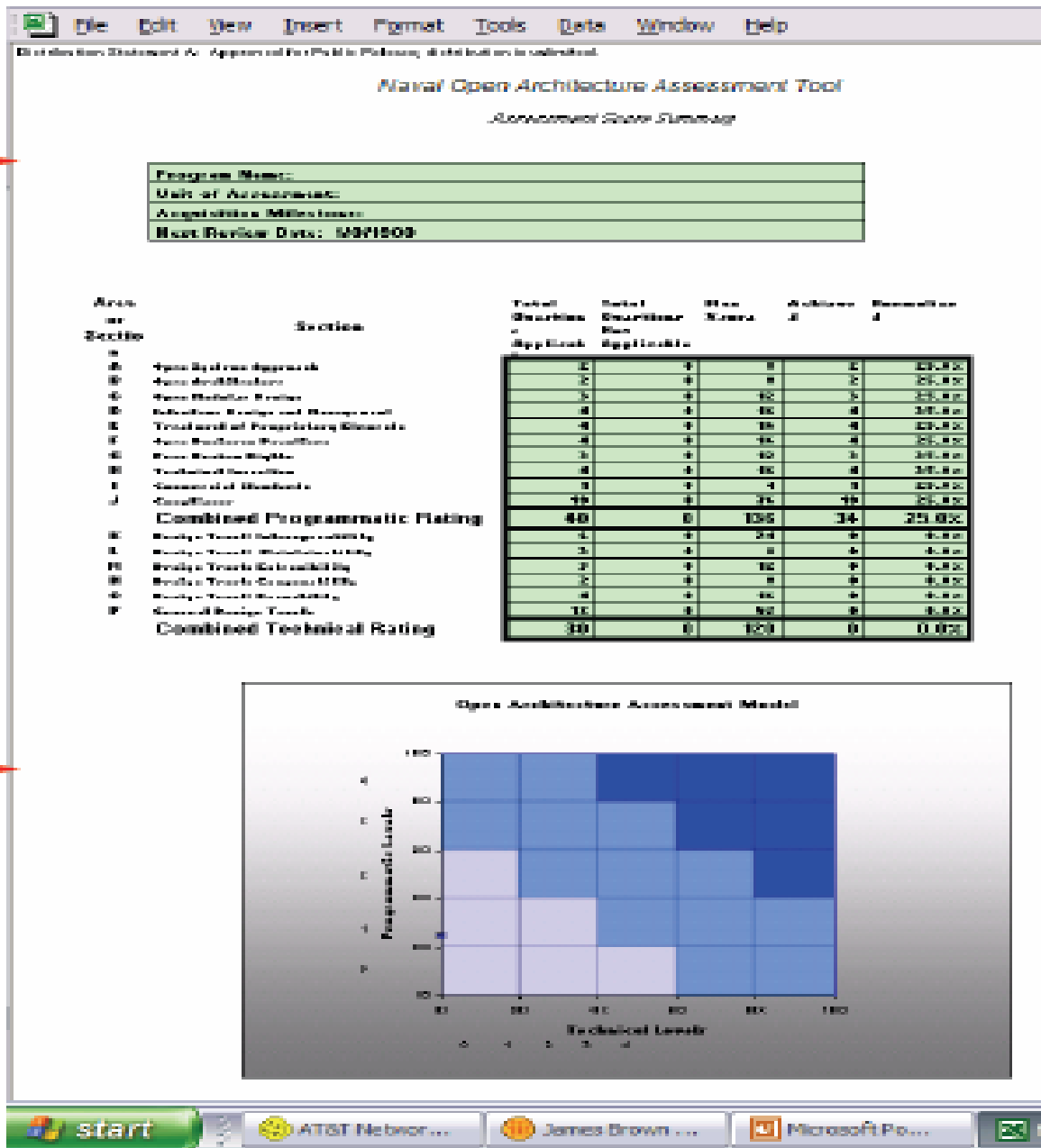
This panel displays an explanation of the question and suggestions on the kind of information that should be provided in the rationale for the selected answer.

Rationale

This section allows for a textual explanation for selecting the specific answer to the Question. Relevant documentation can be cited. The documentation must be available for review.

Current Status

These move the box selection and change the text to Red to identify the answer that has been selected to reflect the current state of the program in this area.



- An **Assessment Score Summary**, which shows data such as the program name, milestones, a breakdown of the Programmatic Rating and the Combined Technical Rating

- A plot on the **Open Architecture Assessment Model** (referred to as the **Open Architecture Maturity Matrix** in the OAAT), the 5x5 matrix that displays the program's "as-is" state with respect to Programmatic (or business) openness and Technical openness, each on a scale of 0 to 4

