



# EXCERPT FROM THE PROCEEDINGS

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OF THE  
TENTH ANNUAL ACQUISITION  
RESEARCH SYMPOSIUM  
SYSTEM OF SYSTEMS MANAGEMENT

## **Innovating Naval Business Using a War Game**

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## Preface & Acknowledgements

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Welcome to our Tenth Annual Acquisition Research Symposium! We regret that this year it will be a “paper only” event. The double whammy of sequestration and a continuing resolution, with the attendant restrictions on travel and conferences, created too much uncertainty to properly stage the event. We will miss the dialogue with our acquisition colleagues and the opportunity for all our researchers to present their work. However, we intend to simulate the symposium as best we can, and these *Proceedings* present an opportunity for the papers to be published just as if they had been delivered. In any case, we will have a rich store of papers to draw from for next year’s event scheduled for May 14–15, 2014!

Despite these temporary setbacks, our Acquisition Research Program (ARP) here at the Naval Postgraduate School (NPS) continues at a normal pace. Since the ARP’s founding in 2003, over 1,200 original research reports have been added to the acquisition body of knowledge. We continue to add to that library, located online at [www.acquisitionresearch.net](http://www.acquisitionresearch.net), at a rate of roughly 140 reports per year. This activity has engaged researchers at over 70 universities and other institutions, greatly enhancing the diversity of thought brought to bear on the business activities of the DoD.

We generate this level of activity in three ways. First, we solicit research topics from academia and other institutions through an annual Broad Agency Announcement, sponsored by the USD(AT&L). Second, we issue an annual internal call for proposals to seek NPS faculty research supporting the interests of our program sponsors. Finally, we serve as a “broker” to market specific research topics identified by our sponsors to NPS graduate students. This three-pronged approach provides for a rich and broad diversity of scholarly rigor mixed with a good blend of practitioner experience in the field of acquisition. We are grateful to those of you who have contributed to our research program in the past and encourage your future participation.

Unfortunately, what will be missing this year is the active participation and networking that has been the hallmark of previous symposia. By purposely limiting attendance to 350 people, we encourage just that. This forum remains unique in its effort to bring scholars and practitioners together around acquisition research that is both relevant in application and rigorous in method. It provides the opportunity to interact with many top DoD acquisition officials and acquisition researchers. We encourage dialogue both in the formal panel sessions and in the many opportunities we make available at meals, breaks, and the day-ending socials. Many of our researchers use these occasions to establish new teaming arrangements for future research work. Despite the fact that we will not be gathered together to reap the above-listed benefits, the ARP will endeavor to stimulate this dialogue through various means throughout the year as we interact with our researchers and DoD officials.

Affordability remains a major focus in the DoD acquisition world and will no doubt get even more attention as the sequestration outcomes unfold. It is a central tenet of the DoD’s Better Buying Power initiatives, which continue to evolve as the DoD finds which of them work and which do not. This suggests that research with a focus on affordability will be of great interest to the DoD leadership in the year to come. Whether you’re a practitioner or scholar, we invite you to participate in that research.

We gratefully acknowledge the ongoing support and leadership of our sponsors, whose foresight and vision have assured the continuing success of the ARP:



- Office of the Under Secretary of Defense (Acquisition, Technology, & Logistics)
- Director, Acquisition Career Management, ASN (RD&A)
- Program Executive Officer, SHIPS
- Commander, Naval Sea Systems Command
- Program Executive Officer, Integrated Warfare Systems
- Army Contracting Command, U.S. Army Materiel Command
- Office of the Assistant Secretary of the Air Force (Acquisition)
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- Program Executive Officer, Littoral Combat Ships

James B. Greene Jr.  
Rear Admiral, U.S. Navy (Ret.)

Keith F. Snider, PhD  
Associate Professor



# System of Systems Management

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## **Acquisition Management for System of Systems: Affordability Through Effective Portfolio Management**

Navindran Davendralingam and Daniel DeLaurentis  
*Purdue University*

## **Identifying Governance Best Practices in Systems-of-Systems Acquisition**

David J. Berteau, Guy Ben-Ari, Joshua Archer, and Sneha Raghavan  
*Center for Strategic and International Studies*

## **The Making of a DoD Acquisition Lead System Integrator (LSI)**

Paul Montgomery, Ron Carlson, and John Quartuccio  
*Naval Postgraduate School*

## **Innovating Naval Business Using a War Game**

Nickolas Guertin and Brian Womble, *United States Navy*  
Paul Bruhns, *ManTech International Corporation*

## **Computer-Aided Process and Tools for Mobile Software Acquisition**

Christopher Bonine, Man-Tak Shing, and Thomas W. Otani  
*Naval Postgraduate School*



# Innovating Naval Business Using a War Game

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**Brian Womble**—Womble is the deputy for open architecture in the Office of the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation. He spent the first half of his career working as a system developer in the telecommunications industry in Dallas, TX. In 2001, Womble joined Lockheed Martin in Manassas, VA, on open architecture efforts within the U.S. Navy Submarine ARCI program. He joined the Navy civilian workforce in 2009 and is now leading efforts to transition the Naval Enterprise to Open Systems Architecture through an open business model. [brian.womble@navy.mil]

**Paul Bruhns**—Bruhns provides direct support to the Office of the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation for the Business Innovation Initiative and for open systems architecture. He has extensive experience in the development and fielding of U.S. Navy submarine acoustic and tactical information systems. Bruhns served as an original team leader for the Acoustics Rapid Cots Insertion (ARCI) program office with an emphasis on translating fleet requirements to specifications, implemented using commercial off-the-shelf (COTS) hardware and open software standards. He recently led a successful pilot project to demonstrate cross-program reuse of tactical software products using the SHARE repository as part of a fielded maintenance free operating period (MFOP) demonstration for surface ships.

## Abstract

The Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation (DASN RDT&E) created a Business Innovation Initiative (BII) to identify and overcome challenges presented by the updated Naval Open Systems Architecture (OSA) strategy. The BII seeks to find innovative ways to incentivize Naval program management staff and their industry partners to implement aggressive change measures that improve cost, performance, and time to field for national security systems. The BII conducts workshops and crowd-sourcing activities that focus on specific business impediments to OSA. The Massive Multiplayer Operational War Game Leveraging the Internet (MMOWGLI) game was used as a crowd-sourcing tool to elicit the collective intelligence of acquisition practitioners, students of business, and industry stakeholders to identify and overcome challenges presented by the updated OSA strategy. The MMOWGLI platform provides an efficient mechanism that crosses functional and geographical workspace boundaries for exchanging ideas and forming community in addressing the OSA business problem. The results of the first BII crowd-sourcing event using the MMOWGLI platform are presented in this report.

## Introduction

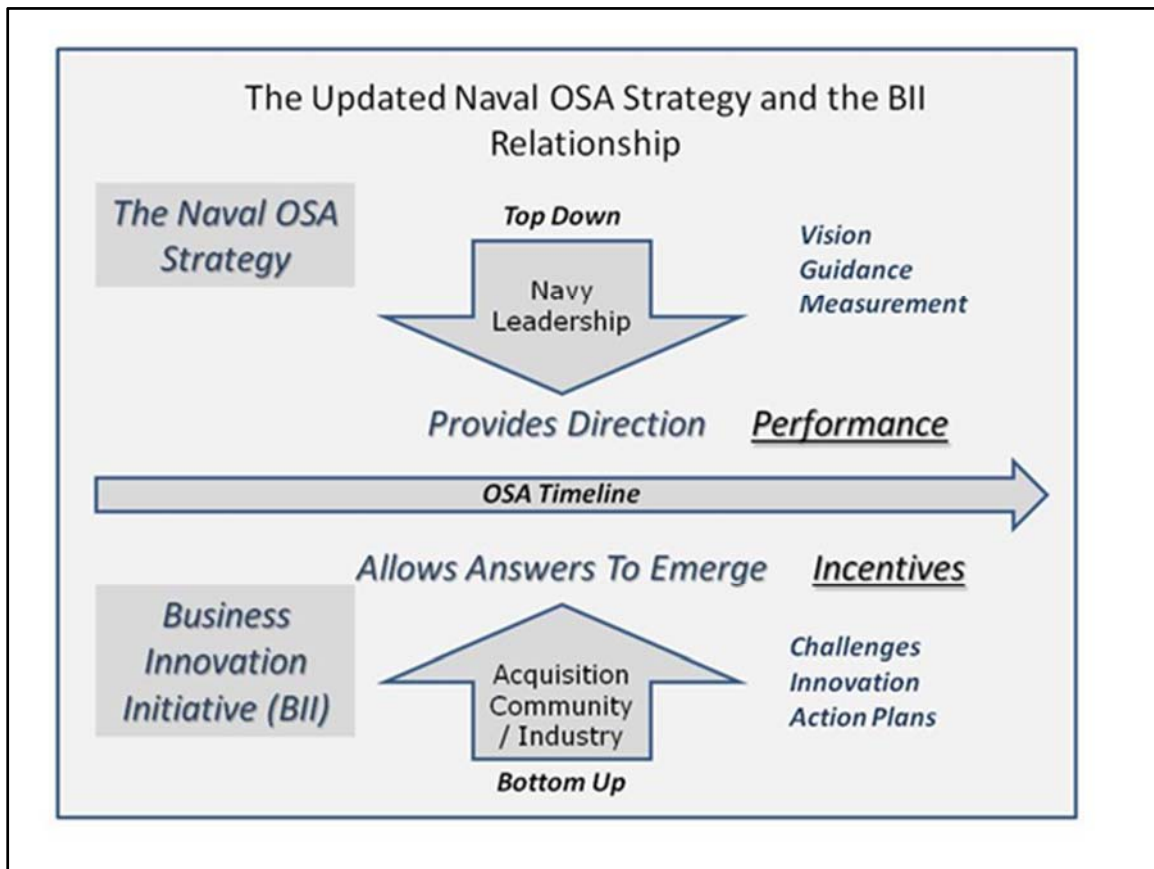
The Assistant Secretary for Research Development and Acquisition (ASN[RDA]) authorized a new Naval Open Systems Architecture (OSA) strategy in November 2012 (see Appendix A) to reduce the total ownership cost of systems, encourage innovation, and more rapidly deliver needed capabilities to the warfighter. This strategy specifically challenges the Naval acquisition workforce to institute measures to improve competition, eliminate redundant developments, and coordinate program activities that promote the reuse of tactical products across sea and air platforms. The acquisition organization is tasked to



implement the strategy, and success will require substantial changes in the Navy’s business practices, organizational structures, and resource planning.

In concert with the updated strategy, the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation (DASN RDT&E) created a BII to search for ways to better incentivize OSA business practices across our current programs of record. Mr. Sean Stackley, ASN(RDA), said in a recent article,

The value of an innovation initiative is to explore what business relationship changes are needed to open up competition; incentivize better contractor performance; increase access to innovative products and services from a wider array of sources; decrease time to field new capabilities; and achieve lower acquisition and life-cycle costs while sustaining fair industry profitability. (Hudson, 2012)



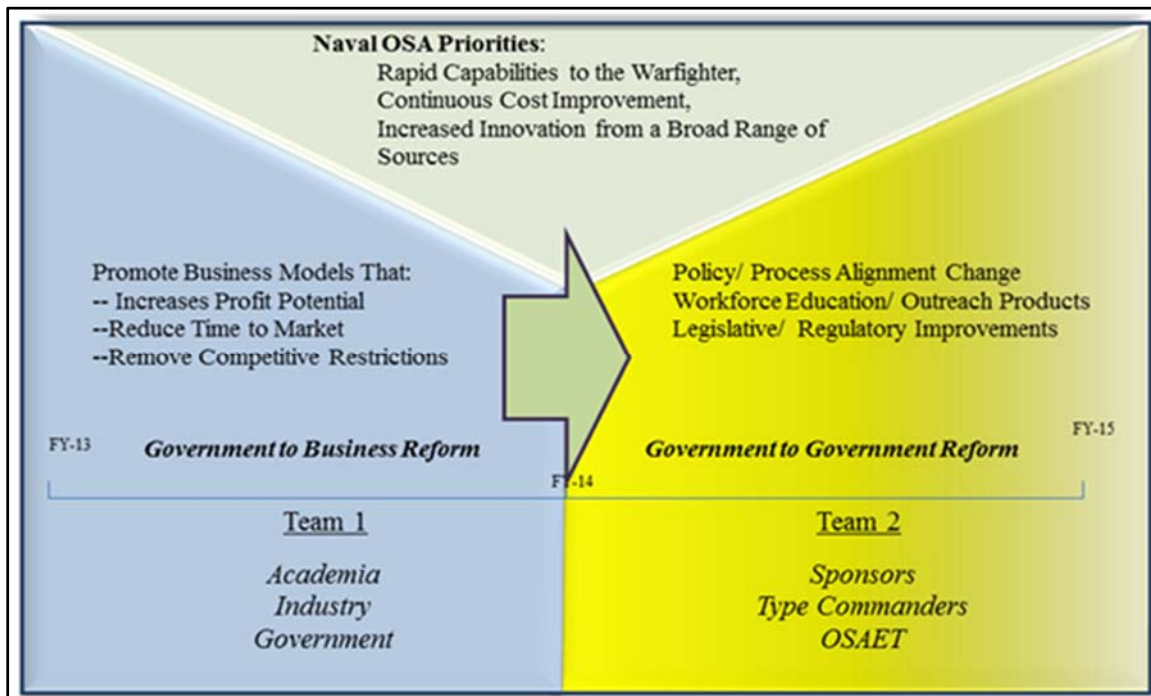
**Figure 1. Updated Naval Open Systems Architecture Strategy and Business Innovation Initiative Relationship**

As a companion of the updated Naval OSA strategy, the BII examines business operations, processes, and incentives associated with delivering national security systems. DASN RDT&E recognized that using the crowd-sourcing war game facility developed by the Naval Postgraduate School (NPS) presented an opportunity to examine both the OSA strategy and the BII in tandem. Both share activities that could be explored and melded together into a comprehensive set of recommendations on how to advance technical and business changes needed in Naval acquisition.



The BII addresses a two-year plan that will codify methods to rapidly bring innovative capabilities to the warfighter and find a process that seeks continuous cost improvements for initial acquisition, production, and sustainment, while fostering innovation from a broad range of sources.

In the first year, the Naval OSA Enterprise Team (ET) is promoting business models that lower overall cost and ensure a reasonable profit potential, reduce time to market, and remove competitive restrictions. This innovation initiative is looking for reforms that create effective business relationships between government and industry (government-to-business) and between government organizations (government-to-government).



**Figure 2. Naval Open Systems Architecture Business Innovation Initiative**

**Government to Business:** In the first year, the government-to-business team is acting to create an open business model framework that recognizes that the defense market is changing and seeks to find opportunities to improve and normalize business relationships. Team 1 consists of academia (top-tier business schools and NPS), industry representatives (strategically formed to have a balanced representation with participation from large and small businesses), and key Department of the Navy (DoN) acquisition staff. The team is scheduled to complete its objectives within 12 months and publish its findings and recommendations to the ASN(RDA).

**Government to Government:** The second team will complement the work of the first team and will focus on changes that affect the government acquisition community. Team 2 will consist of key representatives from the resource community, the fleet, and the acquisition force (PEOs, SYSCOMs, and laboratories). The team will deliver actionable supporting policies, new procedures, workforce education /outreach tools, and candidate legislative changes.

**BII War Games**

The term “war game” is used to describe the crowd-sourcing concept exploration events of the BII. The war game is a social networking construct to explore and solve

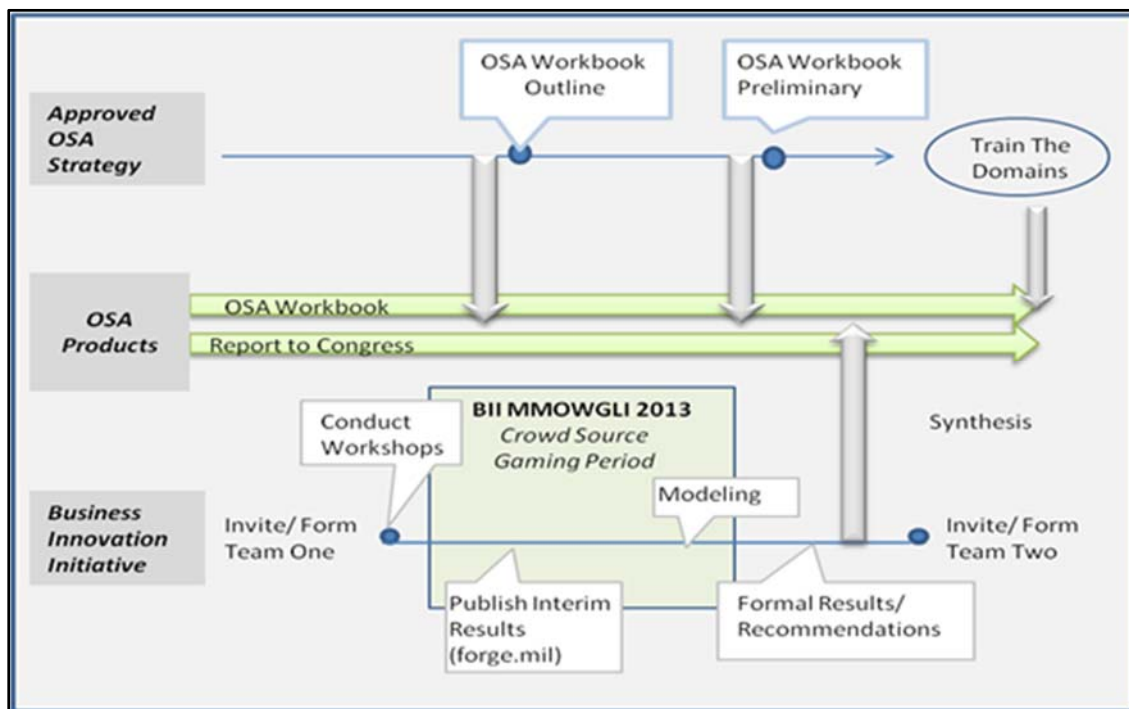




“wicked problems” (Conklin, 2005) in a large and diverse forum. Wicked problems are those with complex interdependencies where the effort to solve the stated problem may reveal or create other problems. In Naval OSA, for example, a recognized problem is “vendor lock.” Vendor lock is the business principle associated with limited acquisition choice and sole-source contracting and may further be an indication of an unrecognized strategic problem.

The DASN RDT&E selected the Massive Multiplayer Operational War Game Leveraging the Internet (MMOWGLI) as the mechanism to bring innovative concepts from a diverse group together rapidly and effectively. MMOWGLI is an open-source software platform sponsored by the Office of Naval Research (ONR), developed by NPS, and originally designed by Institute For The Future (ITFF). MMOWGLI provides a text-based social networking platform that allows many users to interact directly with one another using web browsers in real time.

The first BII MMOWGLI game was intended to serve as a trial run for understanding whether a crowd-sourcing method for exploring innovations for implementation of the Naval OSA strategy might be valuable and robust. Round One of the BII MMOWGLI game is described in detail in Section 2.



**Figure 3. Relative Timeline for Open Systems Architecture/Business Innovation Initiative Interactivities**

### **BII MMOWGLI Game**

#### **What Is MMOWGLI?**

MMOWGLI is an online game platform designed to elicit collective intelligence from an engaged pool of players to solve real-world problems. MMOWGLI was developed at the NPS’s MOVES Institute under the sponsorship of the ONR. It was launched in 2011. MMOWGLI games have been conducted to look for innovative ideas in a variety of complex problems, including countering international maritime piracy, improving energy efficiency on Navy ships, and several others. Games have also been conducted at a variety of scales (50 to 550 players) and with different audiences (public, industry, Navy, and others).



## ***BII MMOWGLI Round One***

War-game design is an important part of the process. The MMOWGLI platform is designed to spur innovation and is highly configurable, but players will not visit or engage unless a clear purpose is evident. Several months of effort went into defining and refining the game themes and prospective audience that might provide the greatest possible impact supporting the overall project goals. A preliminary workshop and a trial mini-game provided excellent feedback regarding what themes were most interesting. Extensive details and the game itself are available online (see BII MMOWGLI Game Portal, n.d.; BII MMOWGLI Game Blog, n.d.; BII MMOWGLI Game Play, n.d.; BII MMOWGLI Game Reports, n.d.).

The DASN RDT&E conducted the first of two planned BII MMOWGLI games for fiscal year (FY) 2013 during the period of January 14 through 28. The purpose of the first round was to test and validate the use of the MMOWGLI crowd-sourcing tool for finding innovation in Naval acquisition and to identify how to use it to find challenges of implementing the updated Naval OSA strategy. Over 100 professionals from government, academia, and industry participated, generating over 890 idea cards and 11 action plans. The first week was dedicated to card play, followed by a second week used for detailed action-plan development.

### ***The Call to Action Statement***

Establishing group motivation and common goals is a fundamental prerequisite for an effective war game. The BII MMOWGLI game was introduced to players with this invitation:

The **BII MMOWGLI game** is for professionals exploring how best to achieve the business goals of the Navy's new "Open Systems Architecture (OSA) Strategy." Your feedback on this plan is welcome.

Round One explores the challenges and opportunities in developing a "Payloads over Platforms" business model driven by the OSA strategy. We are here to discover ways to incentivize acquisition programs and our industry partners to help craft a new business relationship that eliminates redundant development, ensures sustainability of war-fighting capabilities, and positively rewards good industry performance.

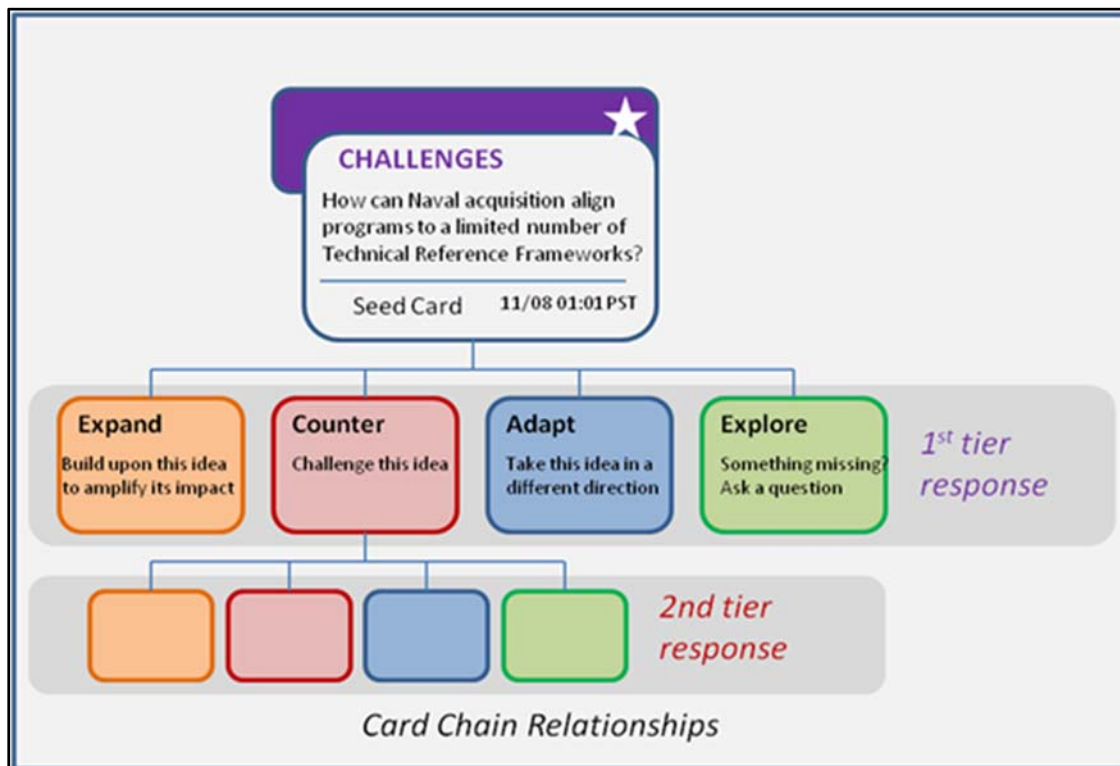
Your contributions are essential. Please join in. The BII portal is a great information resource for game play. Check the BII blog for game news. Thanks for your ideas. Play the game, change the game.

### ***Card Play***

All MMOWGLI games begin with a set of thought-provoking seed cards to initiate discussion. In the BII game Round One, the seed cards were labeled as "challenges." Each challenge card was configured to provide four responses: expand, counter, adapt, or explore. Players would select a response category and type their thoughts in 140 characters maximum, which forced them to be clear and concise with their message. Other players could immediately see that card as part of the discussion chain and be able to select it and respond in kind: expand, counter, adapt, or explore. These linked cards created a chain (or



discussion) where any number of players could contribute. Rules on how to play a particular response card were left to the player's intuition. See Figure 4.



**Figure 4. BII MMOWGLI Card Chain Exemplar**

**Challenge Cards.** In our BII MMOWGLI game, seven general questions about the strategy were cast as challenge cards, intended to help players begin conversations of interest. They were as follows:

Challenge Cards:

1. What are the primary challenges of the CNO's "payloads over platforms" strategy?
2. How to incentivize programs and industry to deliver reusable component solutions as an acquisition model?
3. How can we align across programs to eliminate redundant development?
4. How can Naval acquisition align programs to a limited number of technical reference frameworks (TRFs)?
5. Technology conditions change over long service lives of ships and aircraft.
6. Has open architecture (OA) succeeded from a micro perspective and failed in the macro perspective?
7. What do you see as the greatest challenge moving into Phase 1 of the OSA strategy?

An additional set of seven seed cards were also formed under the heading Future Goals. They were "what do you think?" topics intended to stimulate discussion on system acquisition. They were as follows:



### Future Goals Cards:

1. How might the acquisition process change to enable more competition by industry: large companies, small companies, and system integrators?
2. How can life cycle management (LCM) improve to avoid “lock in” and enable competition through the long term program?
3. What ships and aircraft are the best exemplar platforms to consider?
4. What Navy programs are the best exemplar payloads to consider?
5. Unmanned systems have much shorter lifecycles, enabling rapid change. How might that improve the acquisition process?
6. How do we define payloads? One person’s payload is another person’s truck...
7. What topic do you want to see addressed in round 2 of the Game next summer? Our theme: *Future Paths Forward For Improved Business Practices.*

### Game Play Results

Figures 5 and 6 show the number of player responses for each of the seed cards. Expand and explore cards were most often chosen by the players to amplify on a previous card. Counter and adapt card responses were given much less frequently.

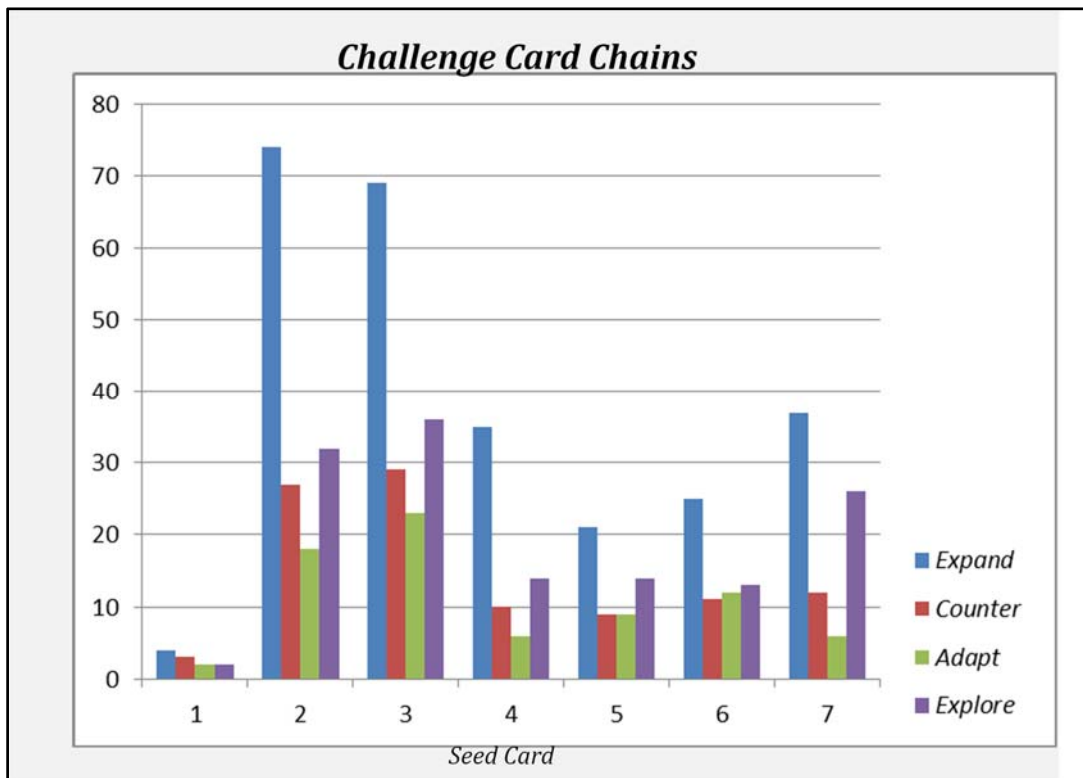
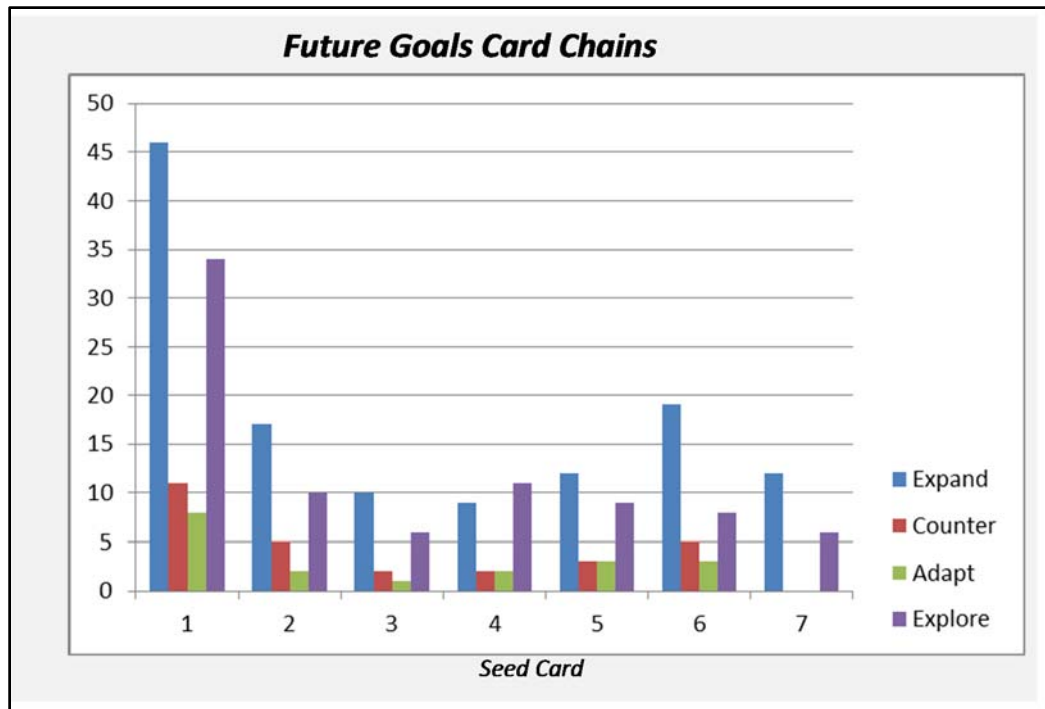


Figure 5. Challenge Card Chains





**Figure 6. Future Goals Card Chain**

Four seed cards generated the most response. It is noted that these cards focused more on Phases 2 and 3 of the OSA strategy.

**Challenge Seed Card #2:** How to incentivize programs and industry to deliver reusable component solutions as an acquisition model?

Finding ways to incentivize programs and industry to deliver reusable component solutions as an acquisition model generated the second highest interest in the game with 151 total exploration cards played. Today, acquisition programs most often employ effort-based development contracts for a single end user without considering how it might be reused in other programs. A new concept of a “first user–subsequent user” model was offered as a means to include the subsequent user in the acquisition model where vendor savings naturally occur, indicating how the Navy and industry might share benefits of reuse. Conversations focused on data rights, intellectual property, licensing, royalties, and RFP process areas. Industry has the incentive of an expanded market, and government has the incentive of reduced schedule and cost profiles.

**Challenge Seed Card #3:** How can we align across programs to eliminate redundant development?

This topic drew the highest response in the game with 157 exploration cards played. Program objectives memoranda (POM) roadmaps are a resource management tool that align program funding to the corresponding Future Years Defense Program (FYDP). Financial plans for product line acquisitions were offered as a way to show sponsors that collaboration equals value. These would include first user–future user program budget/schedules as a way to help PEOs and resource sponsors connect the dots.

**Challenge Seed Card #7:** What do you see as the greatest challenge in executing Phase 1 of the OSA strategy?



One player cited Dr. Gansler's "The Changing Face of Competition," noting that one third of the acquisition workforce has less than five years of experience and does not understand industry operations and incentives. As a result, government relies on a contracting style based more on precedence (i.e., how we do things today rather than how we might do things better). Players focused on the need for specific workforce training for OSA as the greatest challenge to the strategy.

**Challenge Seed Card #4:** How can Naval acquisition align programs to a limited number of technical reference frameworks (TRFs)?

Citing declining budgets as a motivator, it was noted that some PEOs are starting to coordinate technical frameworks into their plans and programs. Even though PEOs collaborate, there is no technical chain of command, so aligning frameworks becomes a coalition of the willing. Players suggested having the government own their TRFs, so product developers have a stable base to enable broader competition. A counterargument stated that "a limited number should not be the goal since different programs have different needs." This was quickly challenged by another player: "A different need is code for not invented here." The message from this discussion thread is that coordinated TRF design and governance will form a key role in the OSA strategy.

### ***Action Plan Products***

Idea card chains quickly illustrate the pros, cons, and alternatives associated with an issue. More is needed when moving beyond improved understanding towards charting possible paths forward and analyzing alternative courses of action.

In MMOWGLI, an action plan is an expansion of an idea formed in game play. It is authored by a small group of players, usually three or four, who collaborate to describe how an idea might work, what the benefits are, and the scope of effort necessary. There are five parts to an action plan (essentially, who, what, where, when, why and how). Below, the "how will it work" section is included as a summary of the plan.

The following five action plans were significant in that they achieved a greater than 66% (two of three possible thumbs-up) voter rating. Players that vote one thumb-up think that the plan is not ready to proceed. Players that give two thumbs-up consider an action plan worthwhile, while players awarding three thumbs-up mean that they think that a plan is especially promising and worthy of further exploration. Here are the top five plans, based on averaged player ratings, from highest to lowest:

**Action Plan #10:** *How can the Navy use data and software rights to achieve the OSA strategy, ensuring long-term stability and growth?*

How will it work?: Conduct a series of workshops and discussion groups to focus on different perspectives, including how we best leverage the commercial market (while addressing issues and challenges unique to DoD systems) and how we establish a marketplace for reusable applications to reduce cost and increase innovation and interoperability. Result is a spectrum of strategies from which programs can select depending on the reuse potential of specific products in identified markets. Then train the workforce.

**Action Plan #3:** *Define community of interest (COI) activities and external relationships in the context of the OSA strategy.*

How will it work?: The main catalyst for COIs today is interoperability for mission performance, rather than reuse. The mission area interoperability and integration (I&I) effort should help define systems of systems (SoS) capability gaps. Once people start thinking in



SoS terms, they can start looking at reuse across platforms. That often leads to a homegrown approach and a PARM relationship between programs. PEOs submit capability-based coordinated POM inputs for whole capabilities. The OPNAV coordinates funding decisions so that holistic upgrades are funded.

**Action Plan #11:** *Streamline OSA contracting to make the process more agile, rewarding innovation.*

How will it work?: Unlike the SBIR program, all efforts would be fully funded, but they would be similar to SBIRs in that they are incrementally funded. Initial awards based on start year (e.g., 2014 base year, with option years 1 ... 5). Base-year candidates would be minimally funded with data rights and royalties for reuse, while more mature option year awards would benefit from increased funding. This would push competition for best solutions to win the options as well as the additional royalties.

**Action Plan #8:** *Outline ROI steps to justify reusing components across participating COI programs.*

How will it work?: An ROI metric would quantify the different ways we save via reuse, including requirements specification, integration, test, training, maintenance, sparing (for H/W), IAVM, and technology refresh. COPLIMO has a COCOMO-based cost model that can look at SW product lines and show where costs are reduced with subsequent reuse by leveraging existing requirements. Also, we need a way to quantify operational benefits from consistency of performance, user interfaces, and more widespread fielding.

**Action Plan #6:** *How do programs that group together get rewarded for increasing enterprise value?*

How will it work?: In this budget climate, PMs will seek protection, even at the cost of increased program risk, by coupling budget and schedules together. Top leadership direction will be needed to ensure that the reward mechanisms are impactful and consistently applied. Enterprise value must be held to a very high and consistent standard. Accolades must be peer-reviewed. This would have two benefits: the attention to award criteria will rise, and consistency of awards will increase.

### **Lexical Link Analysis**

Results were analyzed independently at NPS using the lexical link analysis (LLA) software-based text comparison tool. LLA compared BII game data to the OSA strategy document and separately to the *Department of Defense (DoD) Open System Architecture Contract Guidebook for Program Managers* (Defense Acquisition University [DAU], n.d.). LLA metrics indicate that the OSA strategy is not considered risky and not particularly controversial, nor is it considered impossible to implement.



## What does LLA indicate about BII MMOWGLI Round 1?

- LLA analysis of MMOWGLI data indicates
  - Ideas and draft Action Plans expressed in BII game, by anonymous players, showed strong consistency with the concepts in Program Manager's Contract Guidebook
  - Metrics indicate draft OSA strategy triggered new and innovative ideas
  - Metrics did not indicate that OSA strategy was risky, controversial, or impossible to implement etc.
- Next-round game efforts:
  - Focus on LLA-discovered themes of particular interest
  - Encourage even more player input

3

**Figure 7. LLA Conclusions, BII MMOWGLI Analysis Report, February 6, 2013**

LLA is a form of text-based data mining in which word meanings represented in coupled lexical terms (e.g., word pairs) can be represented as if they are in a community of a word *network*. LLA discovers and displays these networks of word pairs from large-scale, unstructured data. LLA can also be used as a search and knowledge management tool for scoring and ranking interesting information and for visualizing and reporting correlations among categories and layers of information including lexical, semantic, and social links.

This effort then presents the decision-maker with results that were previously unavailable regarding emerging patterns and themes, as well as unprecedented levels of analysis, thus reducing the workload and overcoming the blind spots of human analysts by leveraging automation. For example, for the recent MMOWGLI games used to develop and identify new ideas about a specific subject, LLA was engaged to identify potentially interesting information from idea cards, link them, and then reveal them to domain experts. The methodology of LLA is discussed in more detail in the article in these same conference proceedings (Zhao, Brutzman, & MacKinnon, 2013).

For the BII MMOWGLI project, we performed two separate post-game data analyses.

1. Idea cards (892) and action plans (11) were compared to the proposed OSA strategy (four pages) considered by players.
2. Idea cards (892) and action plans (11) were compared to the *Department of Defense (DoD) Open System Architecture Contract Guidebook for Program Managers* (158 pages) already familiar to most players.

What did LLA indicate about BII MMOWGLI Round One? LLA data analysis indicates the following:





- Ideas and draft action plans expressed in the BII game by anonymous players showed strong consistency with the concepts in *Department of Defense (DoD) Open System Architecture Contract Guidebook for Program Managers*.
- Metrics indicate that draft OSA strategy triggered new and innovative ideas.
- Metrics did not indicate that OSA strategy was risky, controversial, nor impossible to implement.

LLA also discovered eight main or popular themes listed, reflecting common interest of the players, using the following keywords:

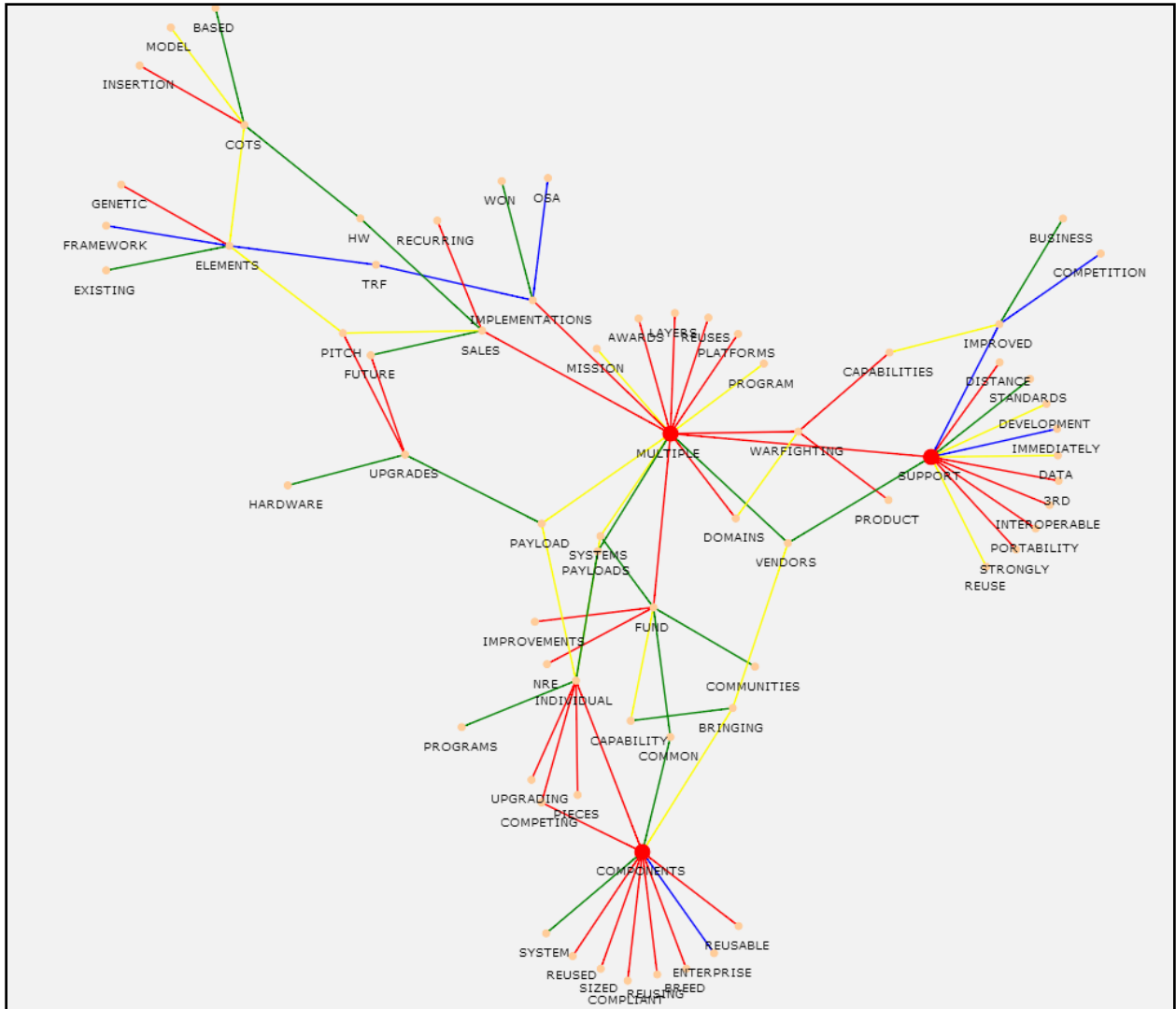
- multiple support and components
- common data, data model
- component reuse, OSA
- open system and business
- systems architecture, current systems
- specific price and fee
- existing reusable programs
- engineering, government, and community

We also found innovative ideas (i.e., gaps between the game data and the OSA strategy document) in the following areas (themes):

- small and shared based
- developed and built faster
- critical definition
- specific price and fee
- sponsors change and risk
- changing requirements
- interoperability and interfaces

Figure 8 shows one example theme detailed from the comparison of game data with the OSA strategy document. Red nodes show the top three word hubs with most links (most “central”). Yellow word pairs are unique to the action plans, green word pairs are unique to the ideas cards, and blue word pairs are unique to the OSA strategy document. Red word pairs are found in more than two sources.





**Figure 8. One Theme Detailed From the Comparison of the Game Data With the OSA Strategy Document**

*Note.* Red nodes show the top three word hubs with most links (most “central”). Yellow word pairs are unique to the action plans, green word pairs are unique to the ideas cards, and blue word pairs are unique to the OSA strategy document. Red word pairs are found in more than two sources.

Subject-matter expertise is necessary to determine whether statistically generated concepts have real relevance and interest. Based on the concepts, themes, and gaps discovered in BII Round One, analysts compiled and distilled a list of 20 candidate topics for possible seed card exploration in BII Round Two. One example is shown as follows, using the theme illustrated in the preceding figure and centered around the keywords *multiple-support* and *components*.

- How will the concept of TRF addressed in the strategy document be enhanced from the ideas surrounding “multiple support and components,” a COTS-based model?
- Relevant concepts from Round One: Network-based COTS (Idea Card Chain 850), COTS hardware (Idea Card Chains 138, 89), COTS insertion (Idea



Card Chain 770), COTS model (Action Plan 4), and COTS elements (Action Plan 10)

The reason emerging concepts such as this can be generated is that salient ideas emerge from commonality and differences between data corpus comparisons, allowing expert analysts to discern which topics might hold the greatest interest.

A number of reports and analytic products are generated by the game. To reap the maximum benefits from the contribution of so many focused ideas and plans, post-game analysis is an important activity that helps find the most valuable conclusions and also results in products of greatest value to past (and future) participants.

### **Lessons Learned**

**Round One Results Exceeded Expectations.** The DASN RDT&E expected that BII MMOWGLI Game Round One would generate a list of challenges for the updated OSA strategy. Players instead concentrated their activities on identifying ways to make the strategy successful. It was clear that they viewed their role as problem solvers rather than problem identifiers. This is a valuable lesson for planning Round Two of the BII MMOWGLI game. Understanding a player's natural motivation to create ideas on challenges gives the planning team a better understanding of how to select and "seed" the topics for consideration in the next round of play.

**Crowd Sourcing Builds Community.** An unexpected benefit from using this tool was the aspect of community building. Those who played BII MMOWGLI Game Round One formed a diverse team with different points of view. Game players were anonymous and used a made-up player name to engage in discussions. The anonymity provided a shield from intimidation or prejudice, in that all seemed open to the ideas and comments of others and willing to engage in debate on the pure basis of the issues, rather than taking an industry or government positional argument. Players expanded their ideas using a game feature called action plans, inviting other players to help them author potential solutions ... and it worked. The lesson learned here is to open the problem set to the widest audience possible. Opinions and interactions ultimately come together to build the views of a larger community.

**Enlisting a Broad Audience Requires Promotion and Advertising.** BII MMOWGLI Game Round One was as much about testing the tool as it was about getting direct, actionable results. As such, marketing was minimal. E-mail invitations shortly ahead of the event and a few public announcements formed the ad campaign. Current members of the OSA ET, BII academic partners, and selected industry partners who volunteered to participate at the Defense Daily Open Architecture Summit of October 2012 formed the main body of invitees. In response to approximately 900 e-mail invitations, just over 100 people played.

### **Conclusions**

The success of the new Naval OSA strategy relies on the Navy acquisition community's ability to cross program boundaries and work together toward common goals. We can take full advantage of the power of community by using focused information technology. MMOWGLI has proved to be an effective mechanism to improve communication and coordination among the various program offices, program executive offices, and systems commands. The DASN RDT&E considers the BII MMOWGLI Game Round One a success for the following reasons:



1. The use of MMOWGLI to explore Naval OSA challenges exceeded expectations. The players of the BII war game identified several innovations on how to implement the Naval OSA.
2. Game play supported the intent of the BII to explore the business relationships changes to (a) open up competition, (b) incentivize better contractor performance, (c) increase access to innovative products and services from a wider array of sources, (d) decrease time to field new capabilities, and (e) achieve lower acquisition and life-cycle costs while sustaining fair industry profitability.
3. Those who played BII MMOWGLI Game Round One formed an enthusiastic group with different points of view, highlighting the power of crowd sourcing to build a diverse community around topics of mutual interest.

Multiple recommendations for future work are now being pursued as the team prepares for BII MMOWGLI Round Two. Our motto remains: Play the game, change the game!

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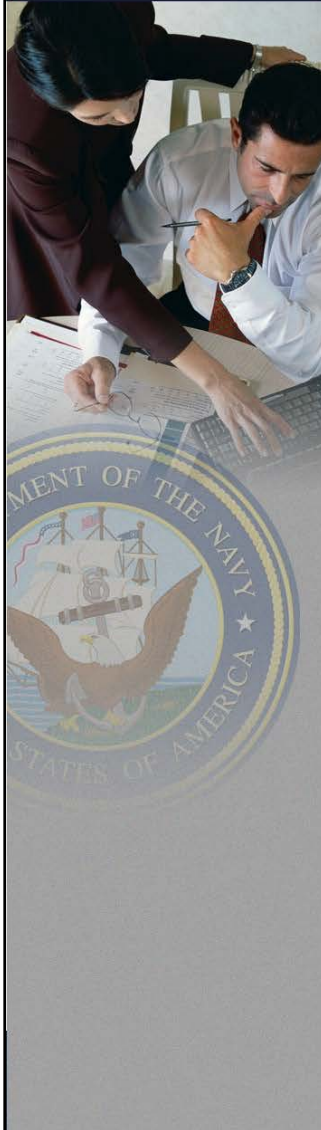
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Appendix A



**Introduction**

The current Naval Enterprise acquisition model is centered on highly integrated platforms with systems that are largely vendor locked, and expensive to acquire and upgrade. This model is especially problematic in the current economic environment.

The Naval Open Systems Architecture (OSA) strategy will decompose monolithic business and technical designs into manageable product lines composed of competition-driven modular Enterprise components. This will yield innovation, reduced cycle time, and lower total ownership costs.

**The New Naval Enterprise OSA Strategy:**

The Naval OSA Strategy is an iterative set of business and technical changes that points to an end state where affordable, open platforms easily accommodate open modules. As the Navy moves toward this future, the Enterprise must first align itself to become open, modular, common, competitive, and ultimately, affordable. It will begin by implementing change in a coordinated fashion across all programs.

The Naval OSA Enterprise Team will lead the execution of this strategy with the participation of stakeholders (e.g., Resource Sponsors, PECs, TWAs, etc.) as follows:

- Implement the coordinated set of business changes that improve competition, incentivize better performance, and deliver capability more rapidly;
- Construct a limited number of technical reference frameworks to immediately support improved competition and ultimately enable enterprise re-use;
- Develop an Execution Guidebook for this strategy; and
- Lead and guide training the workforce on OSA implementation.

Once these changes have been adopted at the program level, a second iteration (Figure 1) will prepare the Enterprise to eliminate redundancy and deliver open systems with reusable modules.

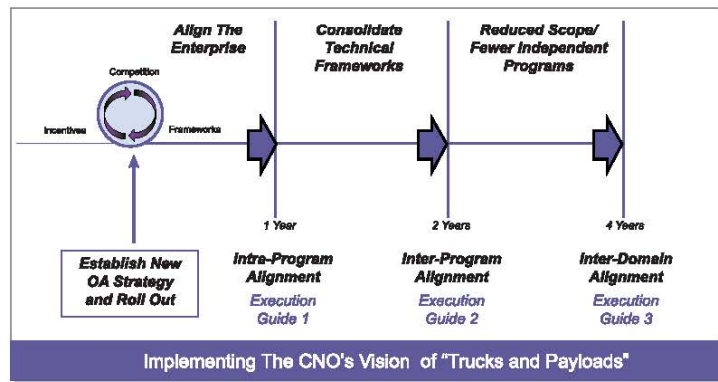


Figure 1. Iterative Naval OSA Strategy





An Open Systems Architecture (OSA) approach integrates business and technical practices that yield systems with severable and compete-able modules. A system constructed in this way allows vendor-independent acquisition of warfighting capabilities, including the intentional creation of inter-operable Enterprise-wide reusable components. Successful OSA acquisitions result in reduced total ownership cost and can be quickly customized, modified, and extended throughout the product life cycle in response to changing user requirements.

**Naval OSA Strategy Actions**

Unless otherwise stated, the principal lead for the following actions is the Open Systems Architecture Enterprise Team (OSAET), led by Deputy Assistant Secretary of the Navy (Research, Development, Test and Engineering) (DASN RDT&E), with participation from Systems Commands (NAVSEA, NAVAIR, SPAWAR, and MARCORSYSCOM), program Executive Offices (PEO), the Office of Naval Research, and designated Communities of Interest (COIs).

**Phase 1:** *Align current programs to execute the OSA strategy and report progress.*

**Phase 2:** *Consolidate technical frameworks across programs; eliminate redundant stovepipes.*

**Phase 3:** *Implement Enterprise architecture of modular development and maximum reuse.*

**Phase 1 Tasks**

- Establish a limited number of OSA Technical Reference Frameworks (TRFs);
- Change acquisition processes to adopt these coordinated and common OSA TRFs;
- Require and incentivize competition throughout program life cycles;
- Establish meaningful metrics to assess OSA progress;
- Develop the OSA Strategy Execution Guidebook;
- Educate the Naval Engineering, Logistics, and Acquisition Workforce; and
- Codify knowledge, skills and processes in the “OSA Program Managers Guidebook, rev 1.0”

**Phase 2 Tasks**

*Tasks for phase 2 are TBD; here are a few categories:*

- Communications processes to provide transparency across PEOs and SYSCOMS about existing programs
- Incentives for collaboration and cooperation
- Funding techniques for cross-Enterprise co-development
- Update the “OSA Program Managers Guidebook”
- Build on education efforts through DAU and integrate the new Guidebook with standing courses

**Phase 3 Tasks**

*Tasks for phase 3 are TBD; here are categories:*

- Fine tune communications processes to provide transparency across PEOs and SYSCOMS about existing programs, as needed
- Adjust incentives for collaboration and cooperation as needed
- Add courses to fill needed knowledge gaps
- Adjust funding techniques for cross-Enterprise co-development



#### Establish a Limited Number of Technical Reference Frameworks (TRFs)

A Technical Reference Framework (TRF) is an integrated set of components that provide a reusable architecture for a family of related applications. TRFs should be capability-based to maximize employment and capability insertion on multiple platforms. Limiting the number of TRFs will increase interoperability and reuse opportunities, leading to life cycle cost savings.

Maintaining non-duplicative TRFs will require cooperative interaction and create interdependencies across program boundaries. TRFs are dynamic so will continue to evolve as technology dictates. Configuration management and attribute/characteristic alignment processes will be crucial TRF enablers. To develop and maintain TRFs, the Naval Enterprise shall take the following steps:

1. Analyze existing system TRFs and develop a detailed set of proven Enterprise attributes, including standardized specifications, architectures, data models, interoperability protocols, and software development tools;
2. Catalog features and suitability for a variety of platform types;
3. Promote tailor-able open standards relative to TRF attributes;
4. Coordinate cross-program TRF implementations to reduce duplication through transparency;
5. Identify, publish, and manage TRF elements necessary to move programs to coordinated product lines and S&T investments using enterprise-level TRF attributes; and
6. Require PEOs and Systems Commands to use TRFs for all development unless explicitly waived by ASN (RD&A).

#### Change Acquisition Processes to Adopt OSA TRFs

Changes must be made to current Naval acquisition processes to allow Enterprise adoption of OSA TRFs. The Naval Enterprise shall take the following steps:

1. Charter cross PEO groups and Communities of Interest (COIs) through Program Management Offices (PMOs) to steer the development of common TRFs, applications, and testing strategies;
2. Identify best practices and collaborative forums to increase the likelihood of transitioning maturing technology into programs of record;
3. Change guidance, procedures, and instructions to require preference for OSA implementation and systematic reuse for cost savings across system life cycles; and
4. Insert OSA into the System Engineering Technical Review (SETR) and acquisition program Gate Review processes.

#### Require and Incentivize Competition throughout Program Life Cycles

The Navy values innovation and lower costs at all acquisition phases (i.e., concept development, design, build, maintenance and upgrade) and system levels (i.e., component, system, platform, and system of systems). The Naval Enterprise shall take the following competition-focused steps:

1. Create contract language templates for use in contract solicitations at the platform, integrator, system, and component levels;
2. Develop tools and methods to promote competition at the component level and to objectively measure the openness of development environments;
3. Require Program Managers to evaluate movement away from monolithic acquisitions to multiple, modular acquisitions enabled by OSA;
4. Require Program Managers to secure and exercise data rights needed to ensure future competition for sustainment, maintenance, and capability insertion; and
5. Establish reward mechanisms for programs and personnel successful in achieving OSA implementations that rapidly integrate innovation and lower total ownership costs.



#### Establish Meaningful Metrics to Assess Progress

Development and adoption of metrics that are objective, readily obtained (ideally from existing sources), easy to interpret, and actionable to enforce desired behaviors (i.e., increased competition, component reuse and reduced costs) are vital to the OSA strategy. The Naval Enterprise shall take the following steps to implement an OSA metrics program:

1. Establish a set of metrics for use in assessing the Enterprise value of new capabilities;
2. Pilot these metrics to selected COIs/Programs of Record (PORs) from each domain;
3. Update metrics based on these pilots for application across the Naval Enterprise;
4. Implement an Enterprise metrics program and conduct periodic peer review assessments on a sampling of PORs from across the Enterprise; and
5. Identify patterns of strengths and weaknesses in Enterprise OSA implementation and apply remediation throughout program life cycles.

#### Develop the OSA Strategy Execution Guidebook

The Execution Guidebook will contain actionable steps for each implementation phase of the OSA strategy. It will contain recommended changes in the business model and technical framework elements that will begin by improving competition and ultimately result in fewer programs that cost less and deliver capability more rapidly.

#### Educate the Naval Engineering, Logistics, and Acquisition Workforce

The success of the OSA Strategy depends heavily on a competent, innovative, and well educated workforce. The Naval Enterprise must produce a workforce that is well-versed in: identifying and managing cross-domain and life cycle dependencies, understanding and responding to adverse vendor behaviors, ensuring that competition yields the desired results, and incorporating OSA best practices as an integral part of program management. The Naval Enterprise shall take the following steps to develop an OSA workforce:

1. Target timely OSA training and communication to optimize acquisition program adoption;
2. Develop training and communication materials, leveraging existing training materials, use cases, and delivery mechanisms when possible;
3. Establish OSA transparency mechanisms to enable the acquisition workforce to become aware of opportunities for collaboration;
4. Work with the Defense Acquisition University (DAU) to develop an Acquisition OSA Qualification Standard;
5. Develop training materials and methodologies to train the non Defense Acquisition Workforce Improvement Act (DAWIA) Naval workforce involved in engineering, logistics, and program management; and
6. Establish an OSA mentoring program for acquisition professionals.





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