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Enabling Software Acquisition Improvement: Government and Industry Software Development Team Acquisition Model

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Enabling Software Acquisition Improvement: Government and Industry Software Development Team Acquisition Model

Joe Heil—Joe W. Heil has worked as a Software Engineer for the Naval Surface Warfare Center Dahlgren Division (NSWCDD) for over 23 years. The majority of Mr. Heil's career was spent as the Software Integrated Product Team Lead for the Tomahawk Weapon Control System (TTWCS). As the TTWCS SW IPT lead, he was responsible for defining the software development processes and coordinating the software development efforts for the TTWCS integrated Industry and Government software development team. Mr. Heil is currently the Senior Software Engineer for the NSWCDD Strategic and Weapons Control Systems Department (K) and is focused on improving software engineering, development, and acquisition.

Abstract

The growth, complexity, and reliance on software (SW) as part of the Department of Defense and Navy (DoD/Navy) warfare systems is continuing to increase. This increase in SW complexity and reliance has been accompanied by an increase in well documented SW intensive system acquisition cost, schedule and technical performance failures. The DoD/Navy is not consistently performing as a smart buyer of software intensive systems. The government and private industry have not been successful in applying the latest software methodologies and technologies nor consistently providing high quality and reliable systems that are delivered on schedule and within budget. The typical acquisition approach utilized over the past several decades of relying primarily on private industry for architecting, designing and implementing SW intensive systems has resulted in the loss of government in-house applied SW expertise necessary to achieve truly open architected systems and systems-of-systems.

The key enablers for improving SW intensive system acquisition are the reconstitution and utilization of government in-house software subject matter experts (SMES) that can lead and work with industry SW engineers as part of an integrated SW Development Team. Figure 1 summarizes the current state and desired future state trends.

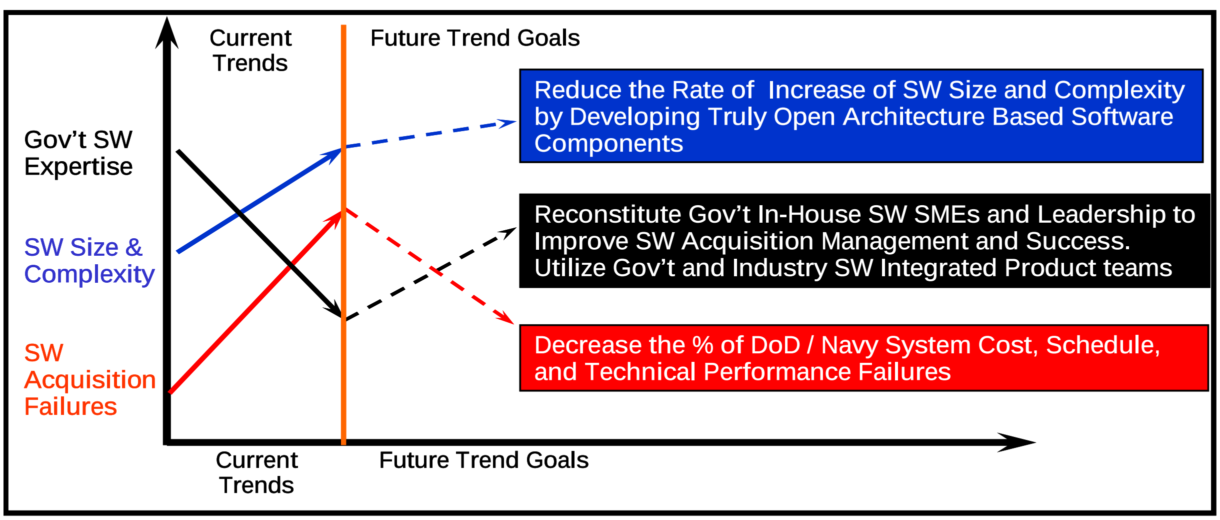

Figure 1. SW Acquisition Trends

Current State: SW Technical Challenges

There are numerous technical challenges associated with the growth and reliance on software within the DoD/Navy's mission critical warfare systems such as:

- Designing and implementing truly Open Architected systems that fully meet the goals of standardized interfaces, scalability, reliability, portability, modularity and reusability; and thereby lead to higher system quality while also reducing cost and schedule.
- Assessing, successfully utilizing, and rapidly integrating the most advanced software technologies and methodologies such as Model Driven Architectures, Service Oriented Architectures (SOA), multi-core parallel processing, automated code generation, cloud computing, next generation programming languages, and agile development processes.
- Integrating the mix of legacy SW components, new Commercial-Off-The-Shelf (COTS) SW components and DoD/Navy developed highly specialized and unique SW components to provide integrated net-centric systems composed of hundreds-of-millions (possibly billions) of lines of code that can execute as systems-of-systems and fully meet mission level objectives and Key Performance Parameters (KPPS).
- Achieving Information Assurance (IA) and protection against SW-based Cyber-Attacks while trying to maximize COTS utilization and Net-Centric communications.
- Maintaining government corporate knowledge of the system architecture, design and technology utilization as the responsibility for system and software development transitions among different private industry organizations during the program lifecycle.

In order to address the SW engineering and development technical challenges listed above, as well as many not listed here, it is imperative that the government maintain the applied software technical experts that can serve as both leaders and team-mates with peer industry software engineers.

Current State: Acquisition Approach

Figures 2 and 3 provide high level models with a rough indication of the relative involvement of government versus industry technical experts and the typical acquisition approach utilized for SW Intensive system acquisition and development. Government engineers are primarily used during the initial system concept, system level requirement phase, and system validation phase of the acquisition process. In the initial stage of system acquisition, the government system engineers define the capability need and the associated highest level system requirements and key performance parameters (KPPs). During the initial phase, government system engineers may work with multiple Industry organizations to perform Technical Assessment of Alternatives (AoA) where industry provide prototypes or advanced technology demonstrations (often proprietary) advertised to fully meet the system capability needs and can be developed in a timely and cost effective manner.

The government then relies almost entirely on Industry technical experts for the detailed system and software architecting, designing, coding and software level integration and test. The System's SW requirements, design, code and test artifacts are developed almost entirely by Industry. Government insight into the detailed software architecture and design is primarily via the utilization of milestone reviews (System Requirement Reviews (SRRs), Preliminary Design Reviews (PDRs), etc.). The government then takes the lead for System Integration, Testing and Certification. And as described in the next section, this acquisition approach fails more often than not with regards to cost, schedule and performance.

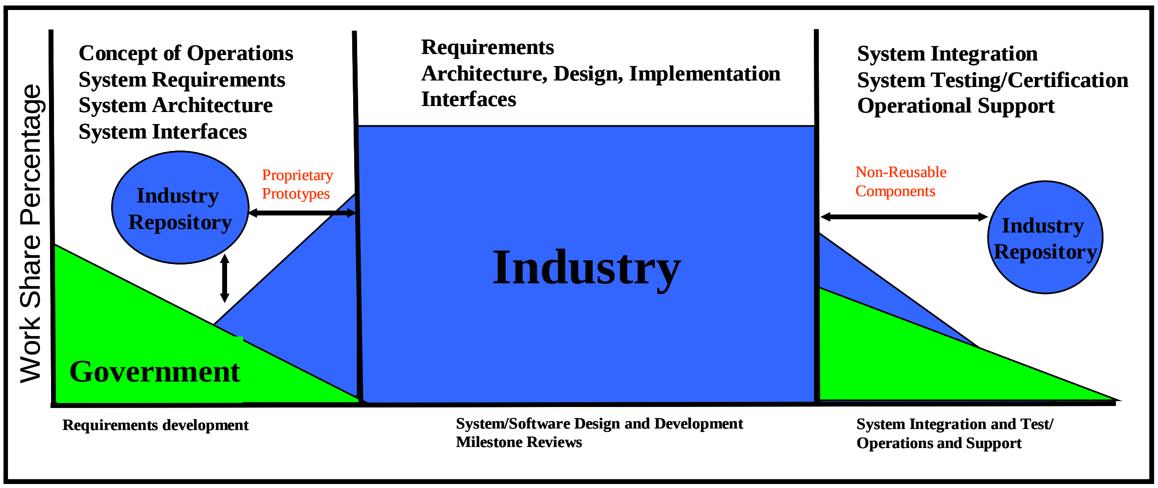

Figure 2. Current Acquisition Approach

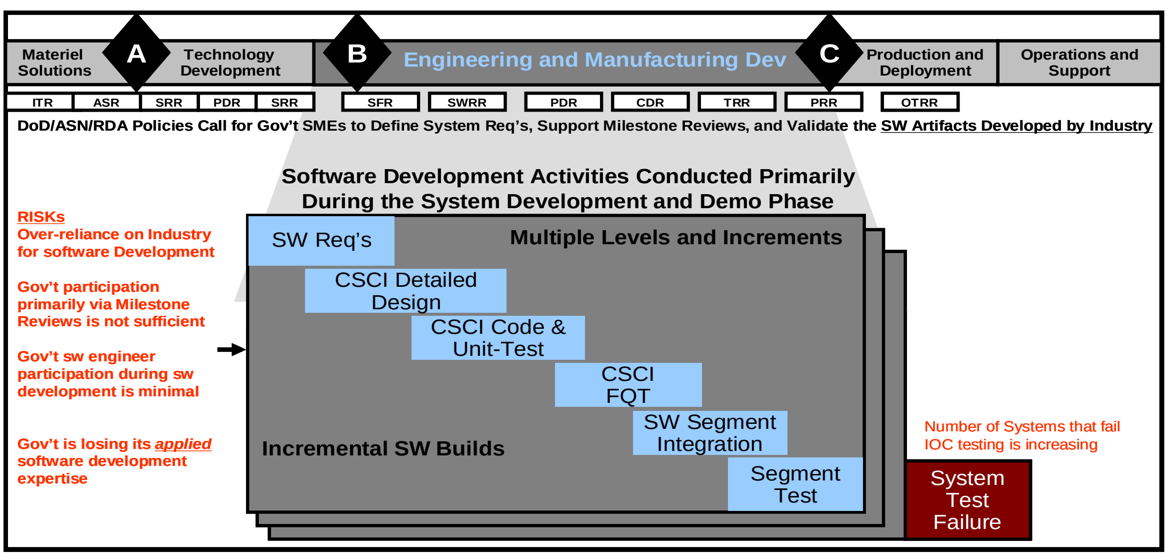

Figure 3. Current Acquisition Approach

Current State: Results

The increase in DoD/Navy SW intensive warfare system cost, schedule, and technical performance failures over the past 20 years are well documented in numerous reports and studies from organizations such as the Defense Science Board (DSB), the Government Accountability Office (GAO), Crosstalk, and Assistant Secretary of the Navy Research Development and Acquisition (ASN/RDA). Figure 4 summarizes some of the key studies and their cost, schedule, and quality metrics.

The November 2002 Report of the DSB Task Force on Defense Software reported:

- Only 16% of programs are completed on schedule and within budget
- Up to 31% of programs are cancelled and the remaining 53% have cost growth greater than 89%
- The average final product includes only 61% of the original intended features.

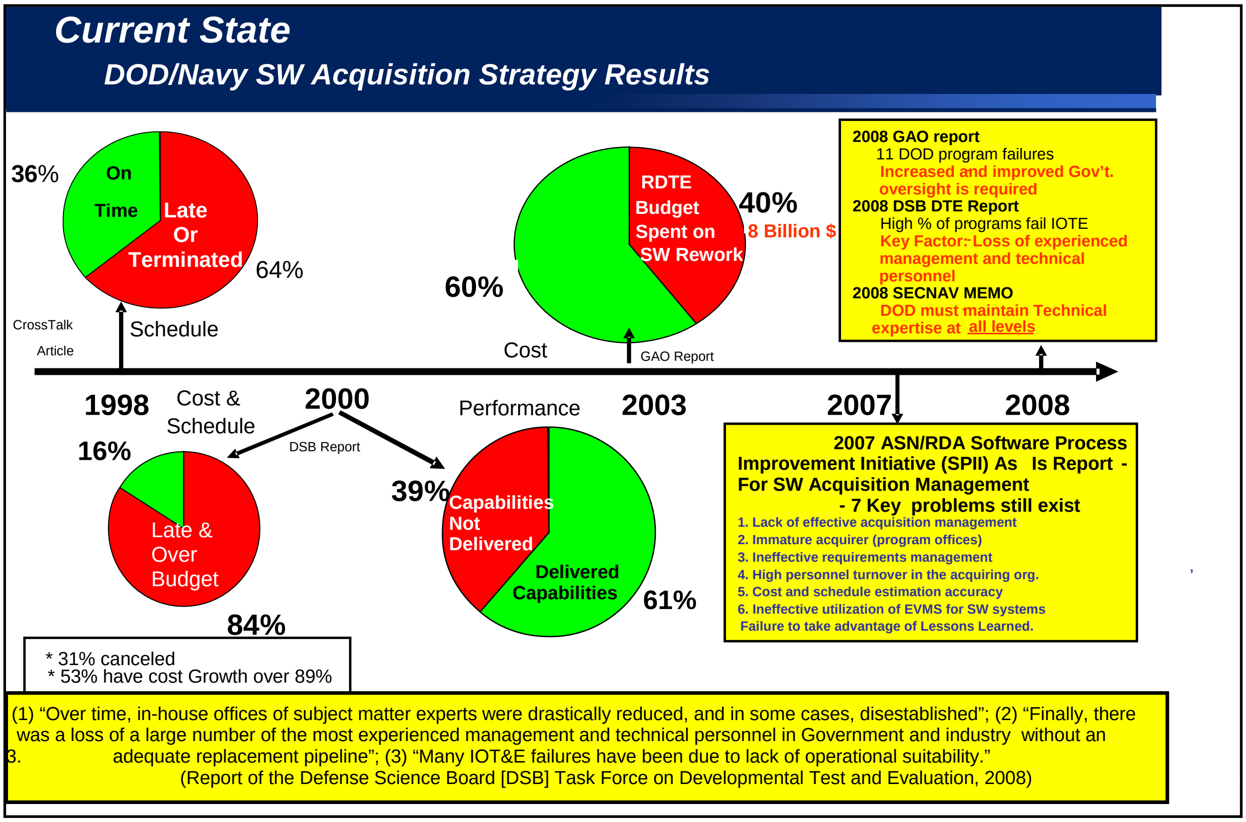

Figure 4. DoD Software System Acquisition Report Findings

In 2004, the GAO reported that the DoD spent 40% of its software development budget reworking software because of quality related issues (GAO, 2004). In 2008 the DSB reported that the majority of DoD weapons systems are failing Initial Operational Testing. In 2008, the ASN/RDA SPII SAM focus team published a report that documented the following critical problems that apply to the vast majority of DoD/Navy SW program acquisition offices:

- Lack of effective management.
- Immature acquirer (program offices).
- Ineffective requirements management.
- High personnel turnover.
- Unrealistic cost and schedule estimates.
- Ineffective utilization of Earned Value Management Systems (EVMS) for SW.
- Failure to utilize of lessons learned.

In 2009, Senator Carl Levin reported that since 2006 nearly half of the DoD's largest acquisition programs have exceeded Nun-McCurdy, and that 95 major defense programs have had their acquisition costs grow by an average of 26% and have experienced an average schedule delay of almost 2 years.

The DoD has lost the ability and expertise required to consistently successfully team with industry to acquire SW intensive weapon systems on time and within budget.

Current State: The Devil Is in the Details

Although software has evolved into one of the most complex and critical elements of mission critical systems, the typical DoD/Navy acquisition strategy tends to treat the software components as black boxes with the internal software architecture and design development (and understanding) left almost entirely in the hands of private industry software engineers. As shown in Figure 5, a typical SW system may include:

- Hundreds to thousands of system level requirements,
- Thousands to tens-of thousands software level requirements,
- Tens to hundreds of external system interfaces,
- Hundreds to tens of thousands computer software components (CSCs),
- Thousands-to tens of thousands internal software interfaces and interactions,
- Millions to hundreds of millions of logic threads,
- Millions to hundreds of millions of source lines of code (SLOC), and
- Billions of software characters.

And note that all it takes is for single erroneous character within the millions of lines of SW to cause a total system failure.

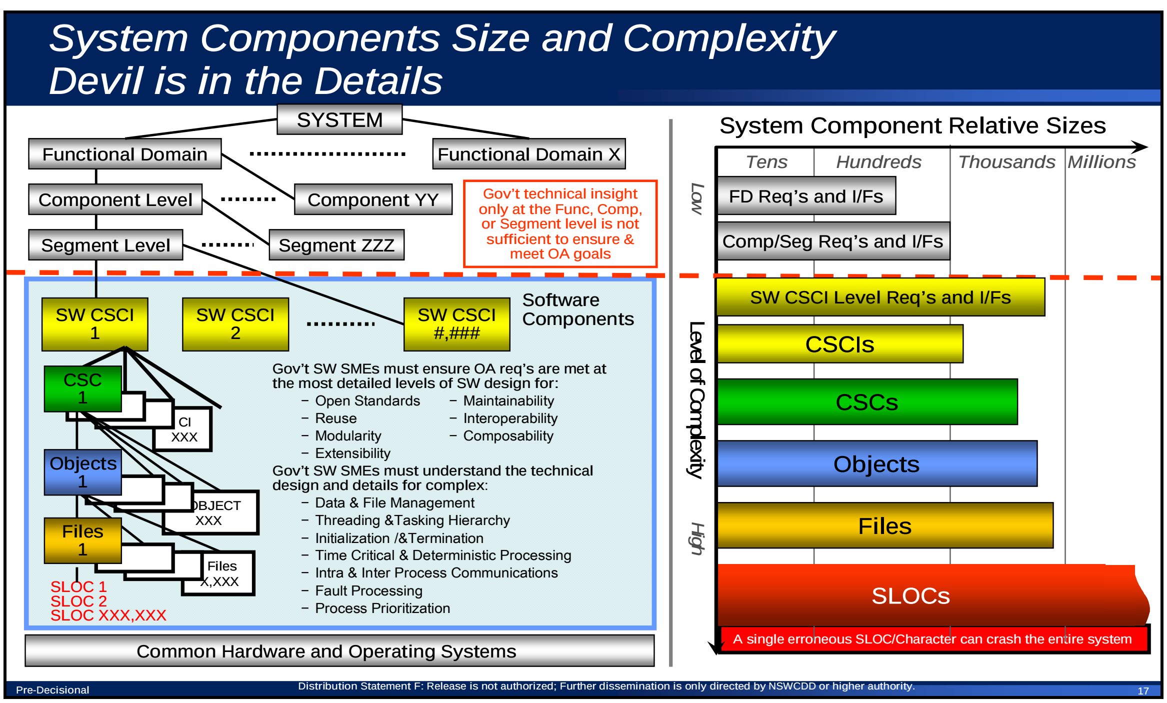

Figure 5. System and Software Complexity

One of the most significant challenges facing the DoD/Navy's complex software intensive system acquisition is the rapid rate of change associated with software technologies, methodologies, processes, processors, and tools. In order for program office leadership to successfully maintain existing software systems, and acquire new software systems, it is imperative that they have access to in-house technical experts that have applied expertise with both the older software environments and the latest cutting edge software technologies and environments.

In addition to having experience working with the latest software technologies, Government in-house software engineers must also be able to apply these technologies to the unique, complex, and challenging context of Navy system functional requirements (e.g., time critical processing, real-time processing, numerous external and internal hardware and software interfaces, complex algorithms, safety critical, and nuclear critical). The current typical acquisition approach limits the government's technical understanding to a few pages of high level system and software architecture diagrams, and understanding and "controlling" the interfaces between the software components only at the highest level of system abstraction, the Government is not able to maintain corporate technical expertise required to successfully acquire software intensive systems.

The allocation of all the software architecture, design, code, and test responsibility to private industry is causing the government to lose the applied SW development experience and expertise to consistently *successfully* perform all of the following critical software system intensive acquisition activities:

- Maintain awareness and expertise in modern SW technologies and methodologies necessary to understand when/if/how these new technologies should be utilized;
- Assess industry's technical approaches, and also provide government developed technical approaches;
- Evaluate industry's technical cost and schedule estimates;
- Ensure Open Architecture (OA) design and verify that the OA design is actually implemented in the SW code;
- Fully understand the technical, cost, and schedule impacts of requirement changes
- Define and manage SW EVMS;
- Define and utilize SW metrics-based control processes; and
- Identify and manage software risks.

Architecting and designing only at the higher levels of system abstraction (i.e., segment, component, and functional domain) is not sufficient for the government to maintain applied SW expertise. The amount of required expertise, experience, and effort required to successfully architect and design the software components increases at each lower level of system decomposition. An *applied* in-depth understanding of software technologies and methodologies is necessary to architect, design, and implement the software components at the CSCI level and below. The government must understand the sub-component SW elements to successfully address the following technical challenges:

- Asynchronous real-time event processing,
- Time Critical (milli/micro/nano second) accuracy and timing,

- Safety Critical requirements,
- Anti-Tampering and Information Assurance protection,
- Data Security/Classification protection and segregation,
- 24/7 system reliability and system accessibility, and
- Protection against Cyber-Attacks.

The typical acquisition approach of Milestone reviews provide too little insight and occur too late in the acquisition schedule as the damage has already been done. Many “design” reviews now focus more on compliance to SW processes versus actually providing an in-depth review of the SW architecture/design/code. Even if private industry provides a detailed and thorough presentation of their software architecture and design at the milestone reviews, the government typically, except for a few rare cases, lacks the applied in-house software experience and expertise to ensure the software components meet all OA objectives including modularity, scalability, reliability, maintainability, and quality; and ensure the implementation artifacts (code) and design artifacts remain consistent with each other. If the government identifies any significant technical software architecture or design issues during the milestone review, the contractor typically responds with such severe cost and schedule impacts that often the only option left is to trade-off planned new capabilities for significant architecture and design corrections.

Some software intensive programs utilize government in-house software engineers to participate with industry during software development. This participation is typically via peer-review during design and code activities. This approach assumes that Government software engineers will be willing to review other engineer’s work rather than being responsible for designing and coding software components themselves. The government cannot attract the best talent, nor sustain highly motivated and high quality software SMEs by limiting their tasking to looking-over-the-shoulders of industry software engineers. Government SW engineers must have hands-on development responsibility in order to maintain expertise.

Future State: SW Acquisition Goals

The primary goal is to improve the DoD/Navy’s ability to consistently deliver high quality SW intensive weapon systems that fully meet the warfighters’ needs, while also delivering these systems in both a timely and cost effective manner.

A second major goal, as shown in Figure 6, is to achieve truly Open Architected systems and move from stove-pipe, proprietary, redundant and non-common systems towards product line multi-platform non-proprietary common reusable systems and software components. Achieving truly OA systems will improve system quality, promote competition and innovation, and reduce cost and schedule.

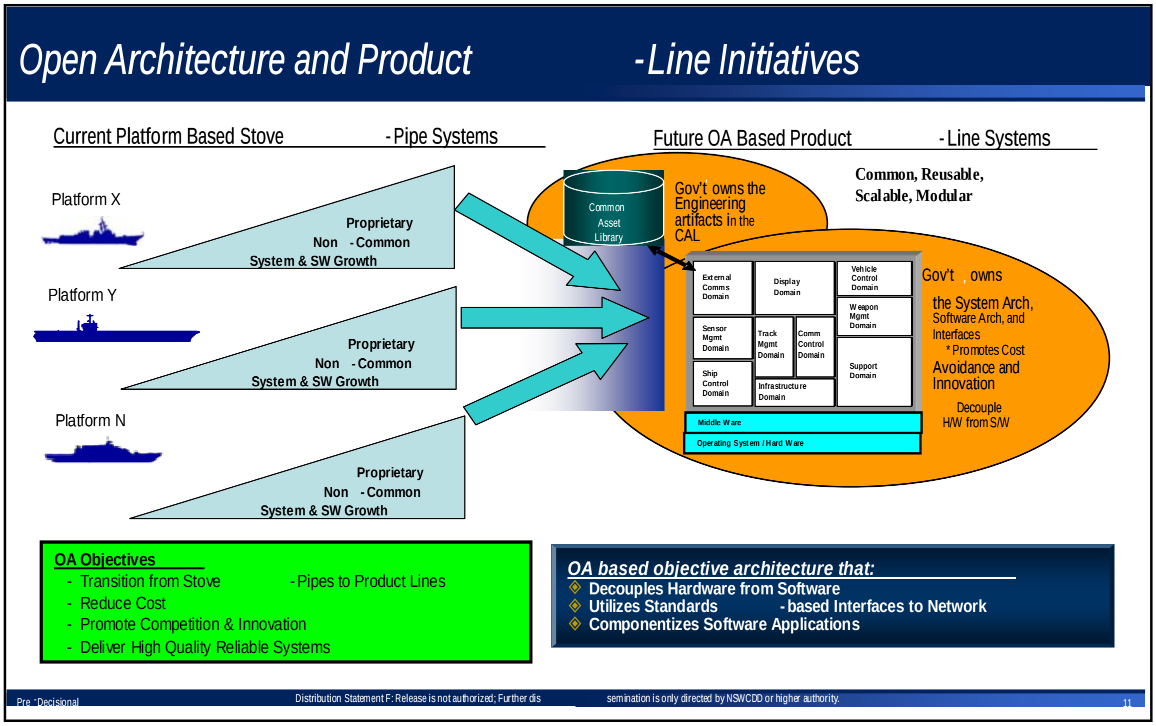

Figure 6. Open Architecture Goal

Future State: Team-Based SW Acquisition Approach

In order to achieve these major goals, the DoD/Navy must reconstitute and maintain a sufficient level of SW expertise with the applied experience required to team with Industry and address the numerous SW development technical challenges. Figures 7 and 8 comprise a high-level model of an alternative SW acquisition approach that enables the government to maintain applied SW engineering expertise.

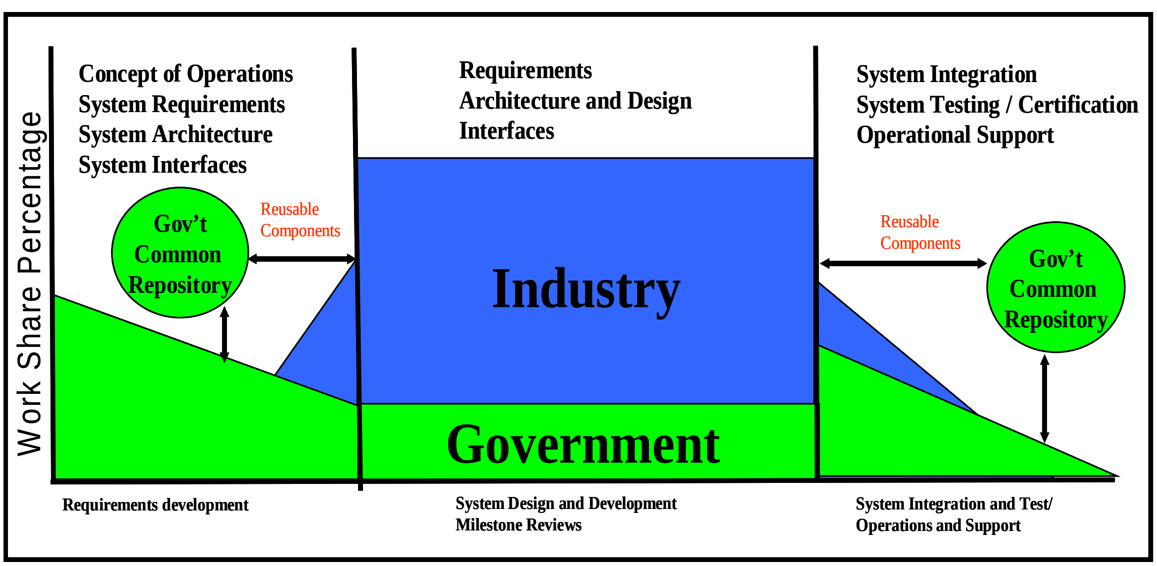

Figure 7. Alternative SW Acquisition Approach

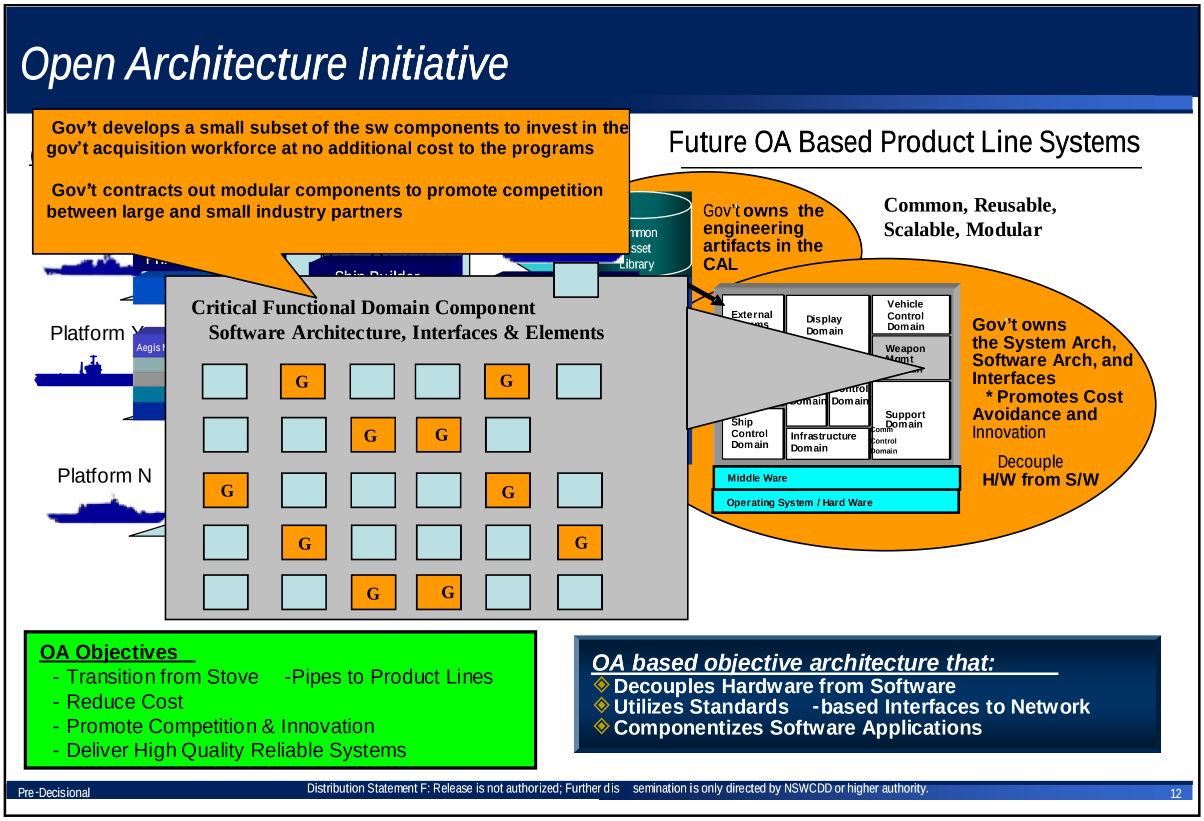

Figure 8. Government SW Development

The key differences between this SW acquisition approach and the typical approach is that the government SW engineers are responsible for developing and delivering a subset of the mission critical tactical system and software components. Government in-house SW engineers are responsible for developing and delivering the associated technical artifacts for their SW components, including requirements specifications, architecture and design documents, code, and test procedures. Note that Industry will still develop the vast majority of the SW components and artifacts.

The government SW engineers are also responsible for providing the critical management products as well including development process documents, metrics, schedules, cost/schedule progress (EVMS), interdependencies, and risks. This is required to develop and maintain in-house SW SMEs with the applied experience required to be able to successfully architect, design, and manage (accurately estimate and track cost, schedule, and risk) the software development effort at all levels of software intensive system decomposition (Functional Domain, Component, Segment, CSCI, and down to the CSCI sub-component Object and Class level).

The government SW engineers are given the opportunity to provide SW prototypes and advanced technology and methodology approaches during the pre-milestone A and B acquisition phases.

The SW artifacts (requirement specs, design documents, code, etc.) are developed by Integrated Government and Industry SW development teams that utilize cross organizational design/code peer reviews to ensure high quality products and conformance to best-practices.

The government SW Development engineers have the same expectations and requirements relative to cost, schedule and technical performance as their industry peers. System testing is performed by an independent government team with a separate management chain of command from the government SW team.

By assigning actual SW development responsibility to in-house engineers, the government can reconstitute and maintain the SW expertise pipe-line as shown in figure 9, and thereby develop the senior level SW expertise required to perform as peer level team-mates with Industry. This approach will provide in-house software SMEs that maintain applied experience and corporate knowledge (as the system evolves and as some of the component development is conducted by different industry organizations over time) with:

- Complex system and software functional requirements such as: Safety critical, Mission critical, Complex external and internal interfaces, Real-time processing Security sensitive data processing, and Complex algorithms;
- Latest software technologies and methodologies; and
- Applied open architecture (modular, scalable, reusable, maintainable, and reliable) software design and implementation at the sub-component level.

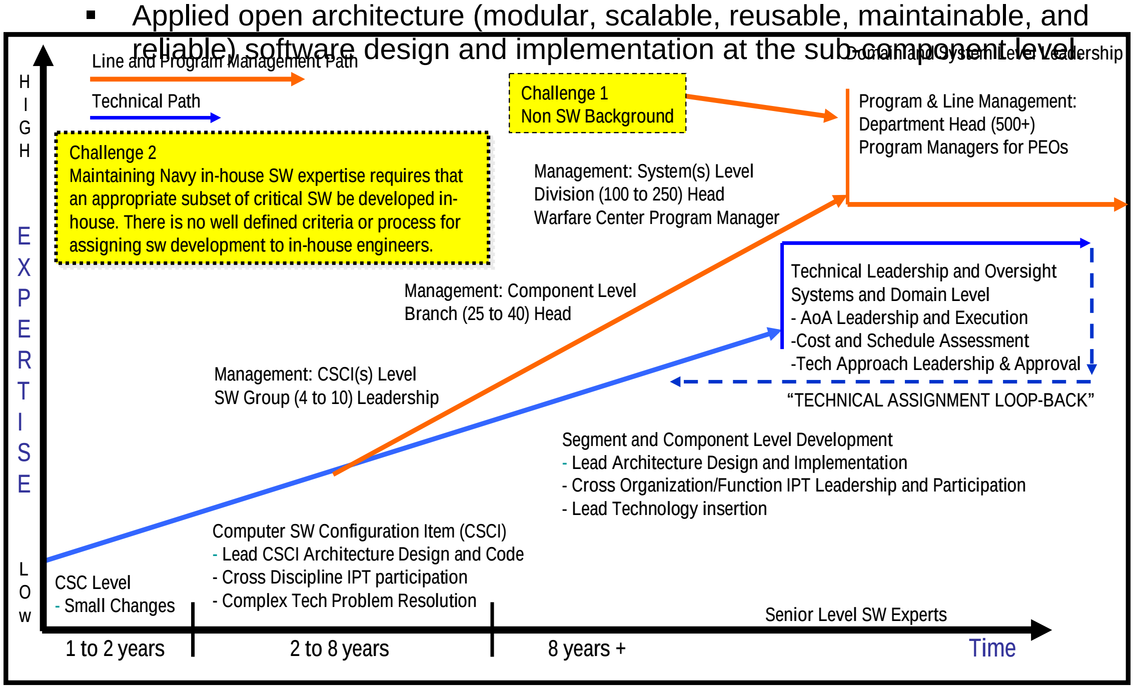

Figure 9. SW Expertise Pipeline Future State: Success Examples

The alternative government and industry SW development team acquisition approach described in the previous section has been successfully utilized for over 50 years by the Naval Surface Warfare Center Dahlgren Division (NSWCDD) for various strategic and tactical weapon and fire control missile and gun systems. For example, NSWCDD government software engineers have been, and still are, responsible for the architecting, designing, coding and testing of many of the most critical and complex (e.g., safety critical, real-time, highly complex algorithms, external and internal interface functionality) software components for programs such as the Tactical Tomahawk Weapon Control System (TTWCS).

The government SW engineers have successfully worked with private industry SW engineers as an integrated SW development team. The cost, schedule, and technical performance of these SW IPTs have been consistently exceptional over multiple decades as compared to the vast majority of complex weapon system programs that have relied primarily on industry for the SW development and have failed (per the references and metrics provided previously). The TTWCS SW IPT has been consistently successful in meeting the SW technical challenges and future state goals as previously described in this paper. Some specific examples are provided in the following paragraphs.

Over the past several decades, the TTWCS SW IPT has consistently successfully delivered software upgraded to incorporate and integrate the latest SW technologies; evolving from Mil-spec processors (ROLM 1666) to modern processors (HP744, X86); from mil-spec operating system (RMX/RDOS) to open system OS (LINUX); from first generation programming languages (Assembly, Fortran) to modern languages (Ada, Java, C, C++).

The SW IPT has successfully incorporated new SW development methodologies; transitioning from functional design to object-oriented design, from waterfall development to spiral/increment development; from human-only generated coding to graphic-user-interface and auto-code generation tools; from point-to-point interfaces to FDDI/ETHERNET H/W and SOA-based SW interfaces.

The TTWCS IP has achieved and demonstrated Open Architecture design and implementation. As shown in Figure 10, the TTWCS SW engineers utilized object-oriented design to achieve scalability and reusability with regards to the goal of easily interfacing with multiple platforms and their unique launching systems. The TTWCS System has been easily upgraded to support not just US Surface Ship Vertical Launching Systems, but also US Submarine and United Kingdom Royal Navy Submarine platforms. When the TTWC system was recently upgraded to interface with the SSGN platform, within less than a year the government SW engineers were able to define the SW req's, document the design modifications, implement and test the associated new Launcher Interface code changes. In addition, SW Components were reused from the TTWCS SW within the SSGN Launching System software which resulted in a faster than usual successful integration of the two systems.

The TTWCS system has successfully met interdependency deliveries with the Tomahawk missile segment upgrades and passed the vast majority of its Initial Operational Test Events.

The resulting quality of the TTWCS SW has been consistently high with the integrated SW meeting all KPPs and with SW quality consistently averaging little over 1 Defect/KSLOC. And more importantly, the TTWCS software developed by the government and industry team has performed exceptionally well in tactical operations.

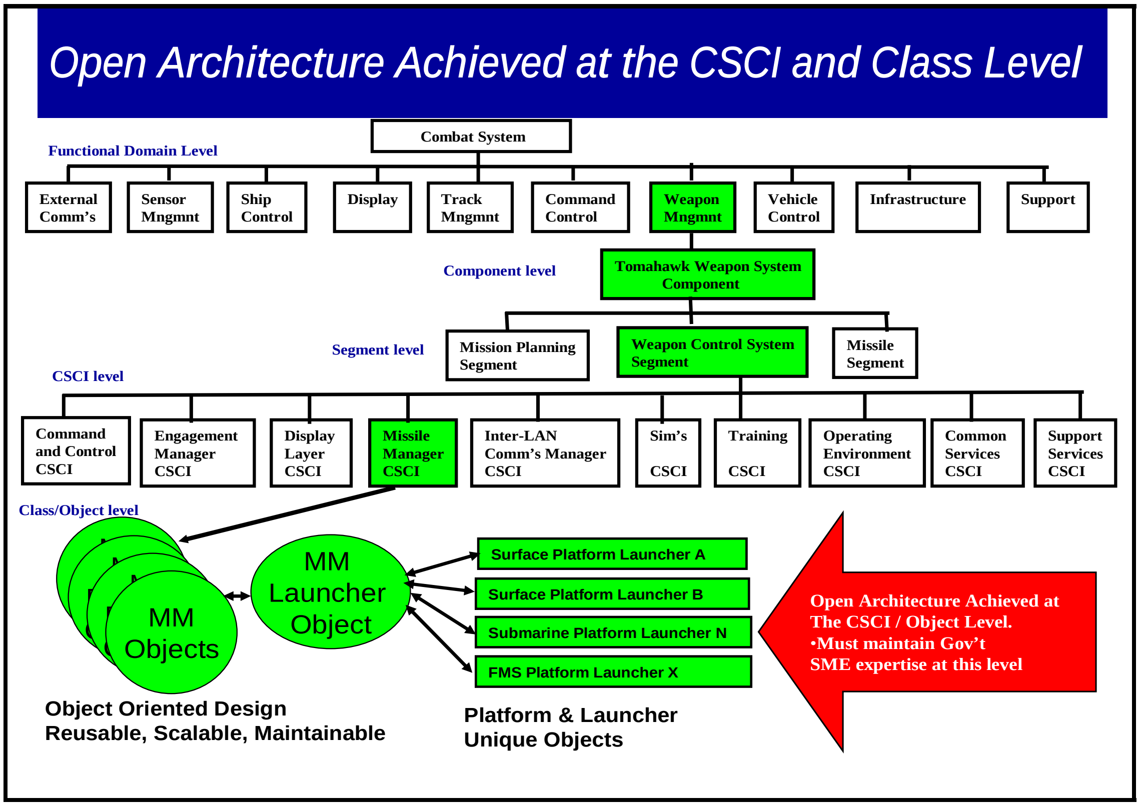

Figure 10. Open Architecture Design

In addition to working for the large (multi-million source lines of code), multi-year TTWCS development effort; the industry and government SW team approach has also been demonstrated to also work well for rapid development efforts. Government engineers have teamed with industry to utilize agile SW development methodology to successfully deliver the integrated sensor and weapon capabilities for marine/army vehicles such as Gunslinger, Full Spectrum Effects Platform (FSEP), and Wolfpack. This integrated agile development team has also been utilized for the Naval Expeditionary Overwatch (NEO) Intelligence, Surveillance, and Reconnaissance (ISR) systems. These rapid development efforts were lead by government engineers that quickly assessed and integrated multi-vendor hardware and software technologies to provide the deployed warfighters with much needed capabilities that met emergent mission critical needs.

Future State: Team-Based SW Development Benefits

As demonstrated by the consistent success of the TTWCS, SLBM, and Rapid Development weapon programs highlighted in the previous section, the government and industry SW development team model is not just a theory. There are many benefits to utilizing this SW acquisition approach. The senior level government SW engineers are capable of working with industry to address the significant SW challenges that include:

Designing and implementing truly Open Architected systems that fully meet the goals of standardized interfaces, scalability, reliability, portability, modularity and reusability; and thereby lead to higher system quality while also reducing cost and schedule.

- Successfully assessing and rapidly integrating the most advanced software technologies and methodologies into the SW development processes, environments and systems.
- Successfully integrating the complex mix of legacy SW components, new Commercial-Off-The-Shelf (COTS) SW and hardware components and DoD/Navy developed highly specialized SW components to provide integrated net-centric systems that can execute as systems-of-systems and fully meet mission level objectives and KPPs.
- Delivering systems with demonstrated Information Assurance (IA) and protection against SW-based Cyber-Attacks, while maximizing the utilization of COTS and Net-Centric architectures.

In addition to addressing the technical challenges above, the reconstitution of in-house SW expertise will also enable mitigation of the following key problems identified in the ASN/RDA SPII SAM AS-IS and T0-BE State Reports.

- The Program Offices will have access to in-house SW experts with the technical and acquisition process experience to aid the program offices in managing the industry development teams.
- The in-house experts will have the applied knowledge to assess industry technical approaches and also their SW development processes. This includes having in-house experience and metrics from SW cost and schedule estimates and thereby be able to provide support for independent cost and schedule assessments.
- The in-house SW experts will have applied experience with developing and implementing system requirements at all levels, and this will enable them to support requirement management and volatility risk reduction.
- The government SW engineers will have in-depth knowledge of various weapon system architectures and maintain the corporate knowledge required to mitigate the risk of program office leadership and personnel turnover.
- The in-house SW engineers will have applied experience with EVMS and can aid the program offices in setting up realistic and meaningful SW-based EVMS processes and tools.
- By maintaining SW engineers with applied experience in both previous and current complex SW development efforts, the program offices will have a source of objective lessons learned and metrics that can be applied to future SW development process improvement.

Another challenge of relying on private industry for 100% of the software development is that it leaves the program office with no leverage over the contractor; and with very few schedule, cost or performance risk mitigation strategies when the private contractor is failing to meet the program needs. By the time the program office realizes the contractor has significant problems, the program is in “too deep” with that company to have any other choice than to continue funding the poor performing contractor and hope for the best.

Firing the contractor and transferring the work to another private industry contractor is rarely a viable option. The impact to cost and schedule is such that the only risk mitigation options include:

- Significantly increasing funding
- Significantly delaying the schedule
- Significantly reducing or eliminating planned capabilities
- Canceling the program

By establishing and maintaining integrated SW development teams, the program office leadership will have the option to augment the contractor SW team with on-site government SW engineers, or transfer the responsibility for SW component development from the contractor to the Government. This can be accomplished easily as the Government software engineers are part of the software development team from the beginning. There will be no need to perform a costly re-competition to assign the work to another private industry team that would be unfamiliar with the program requirements and plan. Under the proposed new software acquisition strategy, the Government would have contracts in place that specify all developed system artifacts become the property of the US Government. This mitigation technique only accelerates the delivery. There is of course still some added schedule risk as the in-house team must work with the contractor to transfer all necessary artifacts to assume full development responsibility. If the program office and development items established an Integrated Development Environment (IDE) however, this transfer of artifact responsibility is relatively easy.

Program offices will also have the option of directing the Government in-house software experts to provide onsite support to aid the contractor in recovering schedule progress or resolving technical problems. Given the DoD approach for rotating the military leaders to gain a wide range of experiences, it is common for a software intensive system to have acquisition program leadership personnel that have no significant training or, more importantly, any applied experience in software engineering. A closely related challenge is that acquisition program office leadership transition may occur at any point during the system development effort.

A single Program manager may not manage the system acquisition and development program from the beginning (version content definition) completely through to the end (through IOC). The development organizations are faced with the challenge of still meeting the previously defined development milestones and delivery dates, while simultaneously changing organizational structures, reporting chain of commands, tasking priority changes, funding reallocation, and development process changes directed by the new leadership. Maintaining an experienced Government SW development organization mitigates the impact of frequent senior leadership changes. The experienced SW development team can provide the following benefits to the acquisition office's new leadership:

- Maintain critical system functional, architectural, and design corporate knowledge
- Aid the new leadership in quickly coming up to speed on the history of the program, the system's architecture and functionality, the various development organization's roles and responsibilities, current development process, and status of the current development efforts (schedule, progress, and risk)
- Provide impact assessment for proposed organizational and/or process changes
- Perform the Technical Authority responsibilities for those leaders without extensive training or applied experience in software intensive systems

Future State: Establishing the Pipe-Line

The DoD/Navy must re-assume leadership of software architecture and design. Government software architecture and technical authority must be demonstrated not just at the highest system composition level (i.e., Objective Architecture Functional Domain level), but must extend down into lower critical sub-component levels as well as illustrated in Figure 10. In-house software SMEs should serve as the software technical authority and the software architects, and lead critical software sub-element development IPTs.

The DoD/Navy must develop and document a software acquisition improvement vision with a quantifiable goal. Critical weapon and warfare system program offices should work with the in-house software development organizations to develop transition plans to achieve the vision goals. This software expertise pipeline must be continually fed and maintained. In order to attract and keep the best and brightest software engineers, the Government must offer:

- Challenging software development and leadership responsibilities
- Opportunities of architecting, designing and implementing solutions to the most complex types of system functional capabilities and problems
- Opportunities to utilize the latest software technologies, methodologies, processes, tools

Government engineers should not be limited to developing tactical software only (where tactical software is defined as software utilized with delivered warfighting systems with strategic or tactical mission critical requirements). They must stay abreast and have applied expertise with all the latest software technologies. In addition to performing tactical SW development, another way to achieve this goal is to assign non-tactical (e.g., system or architecture modeling software, simulation software, testing software, media generation software, data distribution software) to in-house engineers. It is often possible to use the latest software development technologies and methodologies for non-tactical software as the acquisition cycle may be much shorter and the certification process less stringent than for tactical systems

Development of non-tactical and non-critical software components can serve as a test bed and as a cost, schedule, and technical performance risk mitigation strategy for determining if new software technology is of sufficient maturity and capability to be incorporated into the current or next version of critical tactical system(s). The two key questions that must be addressed when determining what software should be assigned to a Government software development organization are:

1. Will this assignment help maintain the software expertise pipeline?
    1. Will this assignment maintain corporate expertise and mitigate the cost, schedule, and/or technical performance risks of existing or future systems?

As directed in the 2008 Mr. Donald Winter SECDEF memo: "This combination of personnel reductions and reduced RDT&E has seriously eroded the Department's domain knowledge and produced an over-reliance on contractors to perform core in-house technical functions. This environment has lead to outsourcing the "hands-on" work that is needed in-house, to acquire the Nations best science and engineering talent and to equip them to meet the challenges of the future Navy." And "In order to acquire DoN platforms and weapons systems in a responsible manner, it is imperative the DoN maintain technical domain expertise at all levels of the acquisition infrastructure."

The current undefined, undocumented, non-standardized, and non-disciplined “ad hoc” assignment of SW development to in-house SW development organizations is insufficient to achieve and maintain the much needed SW expertise pipe-line. The DoD/Navy should develop a well defined and documented software development assessment and assignment process and criteria. This process and criteria will be utilized by software intensive system acquisition program offices to assign software development responsibility to integrated government and software development teams.

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- Defense Industry Consolidation
- EU-US Defense Industrial Relationships
- Knowledge Value Added (KVA) + Real Options (RO) Applied to Shipyard Planning Processes
- Managing the Services Supply Chain
- MOSA Contracting Implications
- Portfolio Optimization via KVA + RO
- Private Military Sector
- Software Requirements for OA
- Spiral Development
- Strategy for Defense Acquisition Research
- The Software, Hardware Asset Reuse Enterprise (SHARE) repository

Contract Management

- Commodity Sourcing Strategies
- Contracting Government Procurement Functions
- Contractors in 21st-century Combat Zone
- Joint Contingency Contracting
- Model for Optimizing Contingency Contracting, Planning and Execution
- Navy Contract Writing Guide
- Past Performance in Source Selection
- Strategic Contingency Contracting
- Transforming DoD Contract Closeout
- USAF Energy Savings Performance Contracts
- USAF IT Commodity Council
- USMC Contingency Contracting

Financial Management

- Acquisitions via Leasing: MPS case
- Budget Scoring
- Budgeting for Capabilities-based Planning

- Capital Budgeting for the DoD
- Energy Saving Contracts/DoD Mobile Assets
- Financing DoD Budget via PPPs
- Lessons from Private Sector Capital Budgeting for DoD Acquisition Budgeting Reform
- PPPs and Government Financing
- ROI of Information Warfare Systems
- Special Termination Liability in MDAPs
- Strategic Sourcing
- Transaction Cost Economics (TCE) to Improve Cost Estimates

Human Resources

- Indefinite Reenlistment
- Individual Augmentation
- Learning Management Systems
- Moral Conduct Waivers and First-tem Attrition
- Retention
- The Navy's Selective Reenlistment Bonus (SRB) Management System
- Tuition Assistance

Logistics Management

- Analysis of LAV Depot Maintenance
- Army LOG MOD
- ASDS Product Support Analysis
- Cold-chain Logistics
- Contractors Supporting Military Operations
- Diffusion/Variability on Vendor Performance Evaluation
- Evolutionary Acquisition
- Lean Six Sigma to Reduce Costs and Improve Readiness
- Naval Aviation Maintenance and Process Improvement (2)
- Optimizing CIWS Lifecycle Support (LCS)
- Outsourcing the Pearl Harbor MK-48 Intermediate Maintenance Activity
- Pallet Management System
- PBL (4)
- Privatization-NOSL/NAWCI
- RFID (6)

- Risk Analysis for Performance-based Logistics
- R-TOC AEGIS Microwave Power Tubes
- Sense-and-Respond Logistics Network
- Strategic Sourcing

Program Management

- Building Collaborative Capacity
- Business Process Reengineering (BPR) for LCS Mission Module Acquisition
- Collaborative IT Tools Leveraging Competence
- Contractor vs. Organic Support
- Knowledge, Responsibilities and Decision Rights in MDAPs
- KVA Applied to AEGIS and SSDS
- Managing the Service Supply Chain
- Measuring Uncertainty in Earned Value
- Organizational Modeling and Simulation
- Public-Private Partnership
- Terminating Your Own Program
- Utilizing Collaborative and Three-dimensional Imaging Technology

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