

Proposed

Navy Software Acquisition Improvement Strategy

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DAHLGREN

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Proposed Software Acquisition Improvement Strategy

◆ Current State

- Problem
- Software Acquisition Strategy
- Recent Findings
- Summary and Conclusions

◆ Future State

- Improvement Recommendations
- Government Software Expertise
- Open Architecture
- Benefits

◆ Summary

Acquisition Problems Supporting Data

◆ Current Acquisition Strategy Reported Results:

- YR 2000: 84% of programs are late and over budget, and deliveries include only 61% of planned capabilities*
- YR 2004: 40% (\$8 Billion) of DoD RDT&E Budget was spent on reworking software due to quality issues**
- YR 2009: DOD's 95 major defense acquisition programs have seen their costs grow by an average of 26% and experienced an average schedule delay of almost 2 years***

Program Offices are Failing to Successfully Scope and Manage SW Intensive Programs

* 2000 Defense Science Board (DSB) Task Force on Defense Software Report

** 2004 General Accountability Office Report

*** 2009 Opening Statement of Senator Carl Levin at Senate Armed Services Committee Hearing, March 3, 2009

Problem

- ◆ Software size, complexity, and reliance is continuing to significantly expand within DoD/Navy critical systems
- ◆ DoD/Navy is Failing to Consistently Successfully Acquire Software Intensive Systems
 - 7 Key Acquisition Management Problems Exist*
 1. Lack of Effective Acquisition Management
 2. Immature Acquirer (Program Offices)
 3. Ineffective Requirements Management
 4. High Personnel Turnover in the Acquiring Organizations
 5. Cost and Schedule Estimation Accuracy
 6. Ineffective Utilization of EVMS for SW Systems
 7. Failure to Take Advantage of Lessons Learned

* 2007 ASN / RDA Software Process Improvement Initiative (SPII) As-Is Report for SW Acquisition Management

Loss of Government In-house Applied SW Expertise

Current State Software Acquisition Strategy



DoD/ASN/RDA Policies Call for Gov't SMEs to Define System Req's, Support Milestone Reviews, and Validate the SW Artifacts Developed by Industry

Software Development Activities Conducted Primarily During the System Development and Demo Phase

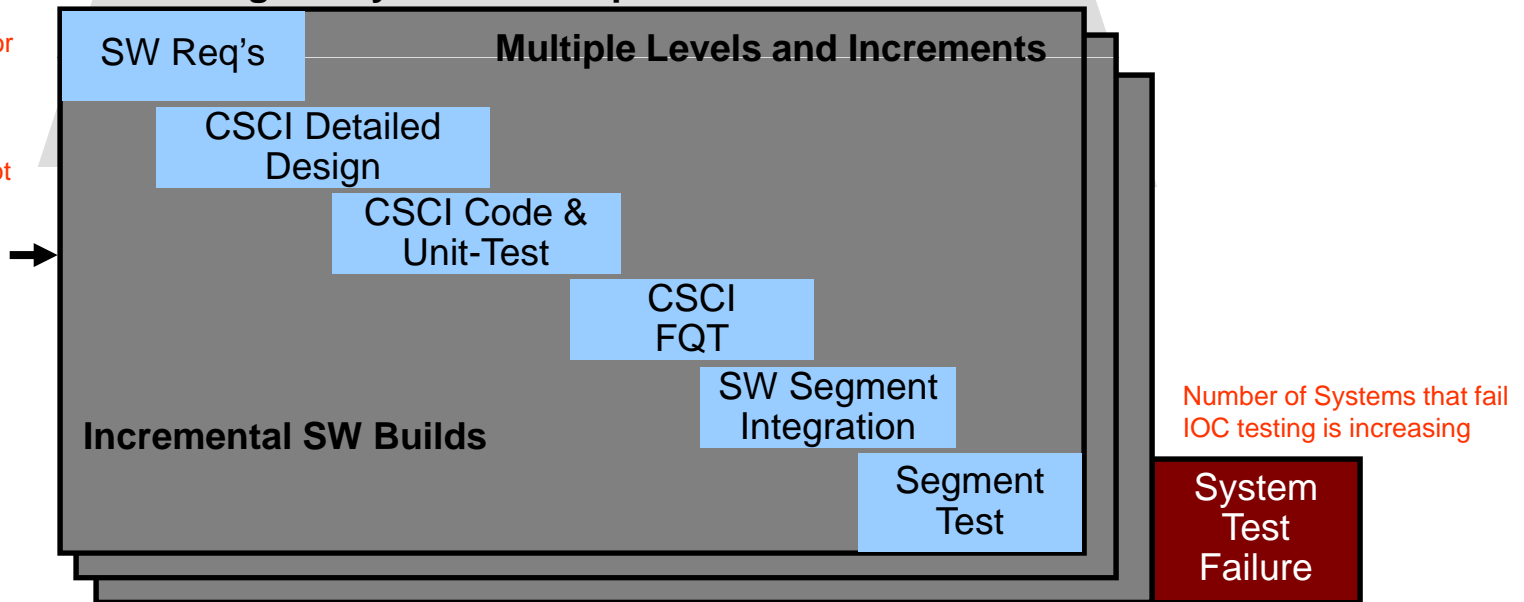
RISKS

Over-reliance on Industry for software Development

Gov't participation primarily via Milestone Reviews is not sufficient

Gov't sw engineer participation during sw development is minimal

Gov't is losing its applied software development expertise



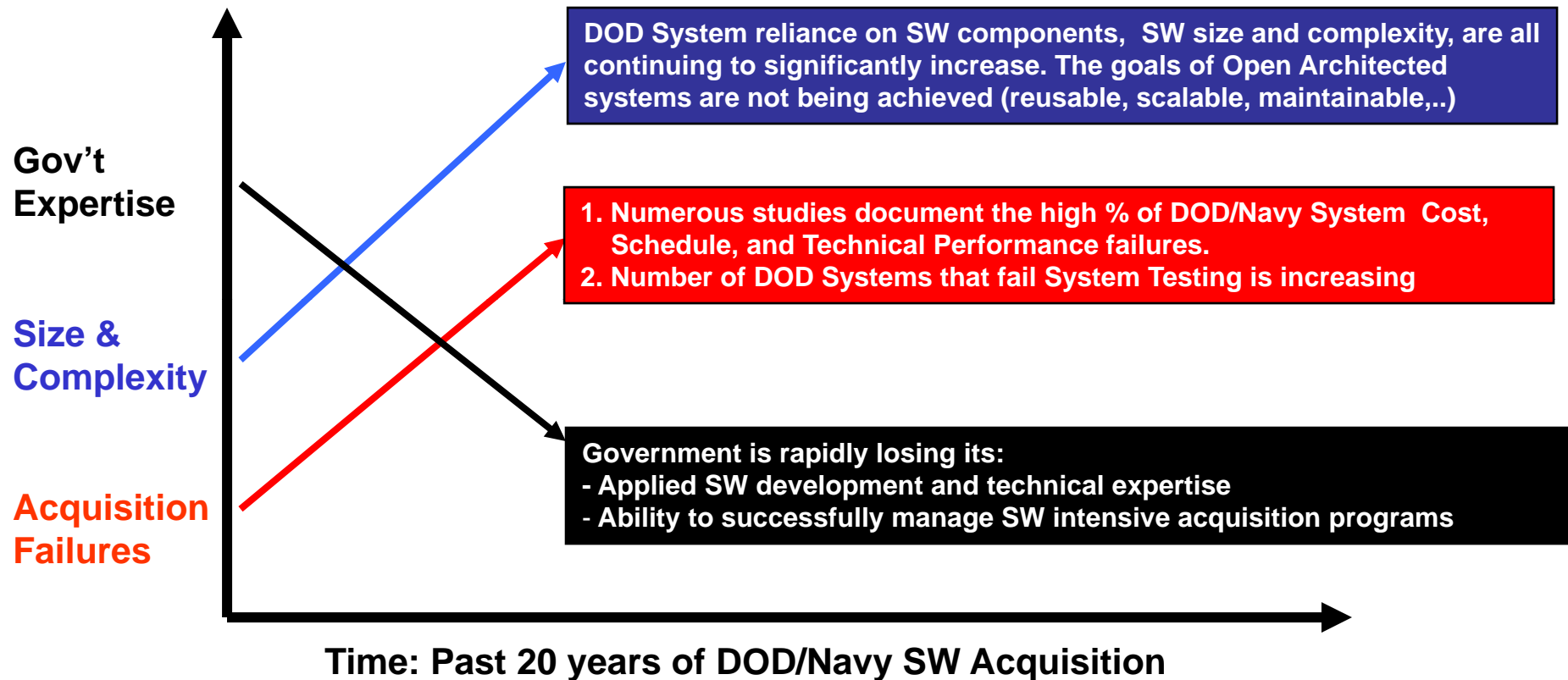
"The combination of personnel reductions and reduced RDT&E has seriously eroded the Department's domain knowledge and produced an over reliance on contractors to perform core in-house technical functions -Department of the Navy Acquisition, D. Winter: SECNAV Memo Dated 10 Oct 08"

Recent Findings & Recommendations

- ◆ 2008 GAO Report
 - Increased and Improved Government Oversight is Required
- ◆ 2008 DSB DTE Report
 - Key Factor is High % of Programs Failing IOTE is Loss of Experienced Management and Technical Personnel
- ◆ 2008 SECNAV Memo
 - DoD Must Maintain Technical Expertise at all Levels
- ◆ Informal on site visits and discussions with several Warfare Center Software Leads indicates that the majority of the critical software development is being contracted out to private Industry

Government Needs to Reconstitute In-House Technical Expertise

DOD/Navy Software Acquisition Current State Summary



“The 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.”

“In order to acquire the 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

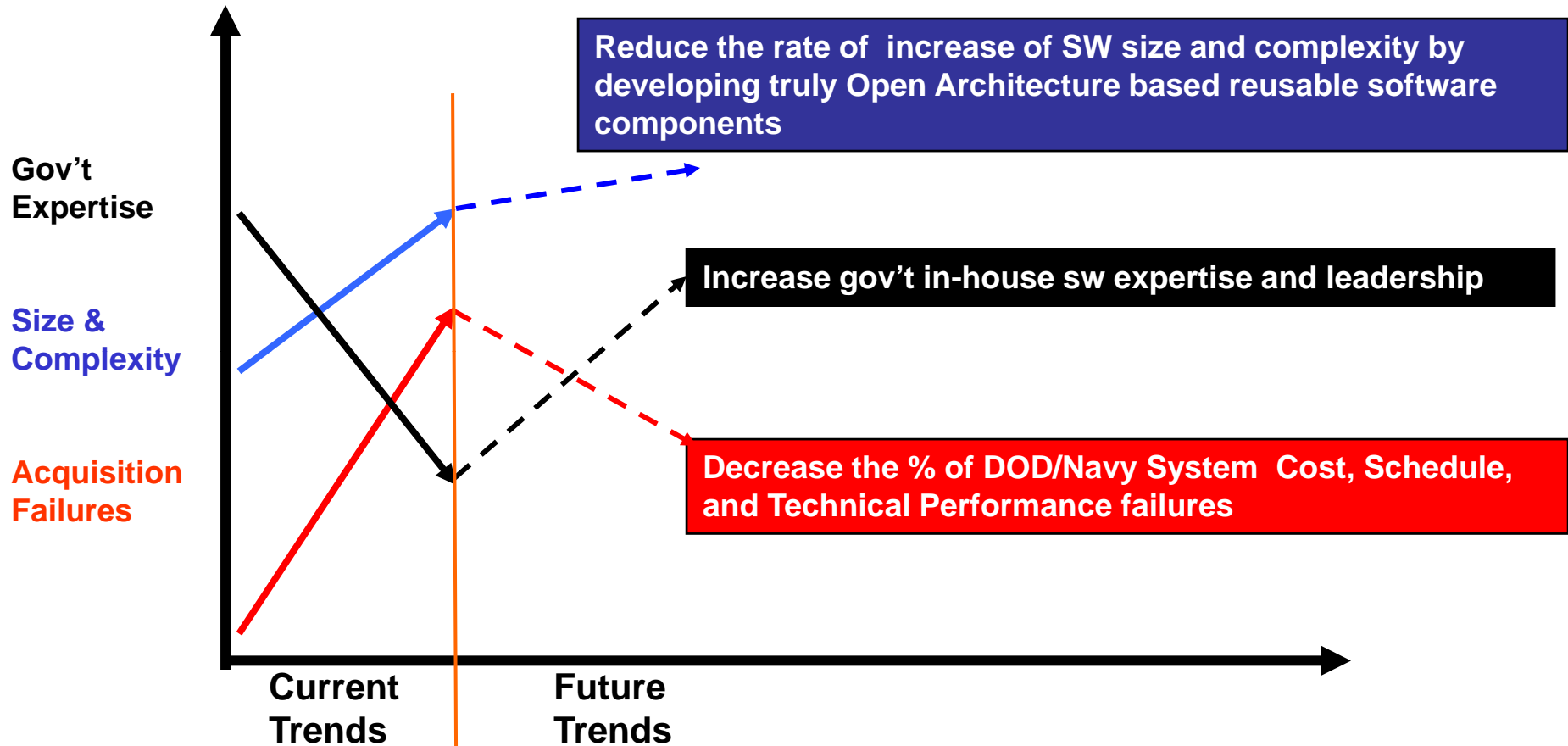
2008, Oct 10, SECNAV MEMO: Department of the Navy Acquisition, D. Winter

Conclusions / Imperatives

- ◆ The Government Must Maintain Applied Software Development Expertise in order to be a Smart Buyer of SW intensive Systems
- ◆ There Must be a Fair Balance Struck Between all of the Following:
 - Industry's Right and Requirement to Make a Fair and Deserved Profit
 - Government's Responsibility to Provide the War Fighter With the Highly Reliable, Safe, and Adaptive Systems
 - Government's Responsibility to Spend the Tax Payers Dollars Effectively and Efficiently

It is Imperative that the Gov't Maintain the In-house Applied SW Technical Expertise Required to Successfully Acquire SW Intensive Systems

Proposed Software Acquisition Strategy Future State

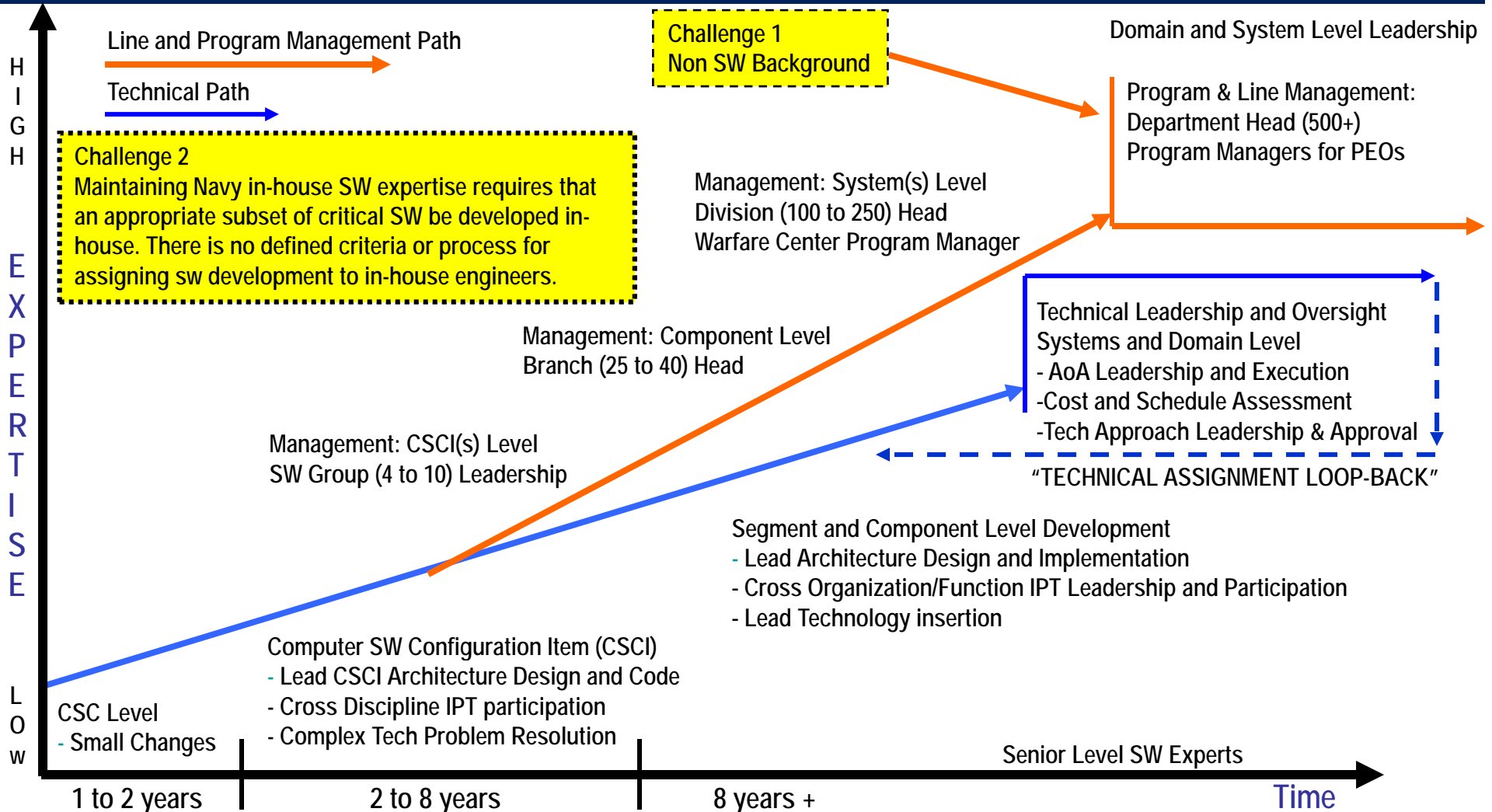


Recommendations

1. Reconstitute the Navy's in-house applied sw development expertise; establish sw pipe-line
2. Utilize government and industry software development Integrated Product Teams

Future State: Strategy Recommendation

Reconstitute Navy In-House Software Expertise Pipe-Line



"In order to acquire the 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".

-Department of the Navy Acquisition, D. Winter: SECNAV Memo Dated 10 Oct 08

Future State: Strategy Recommendation Gov't In-House Software Expert Responsibilities

- ◆ Ownership of the Objective Architecture
 - Determine which SW Components Should be Reused, Modified, or Developed

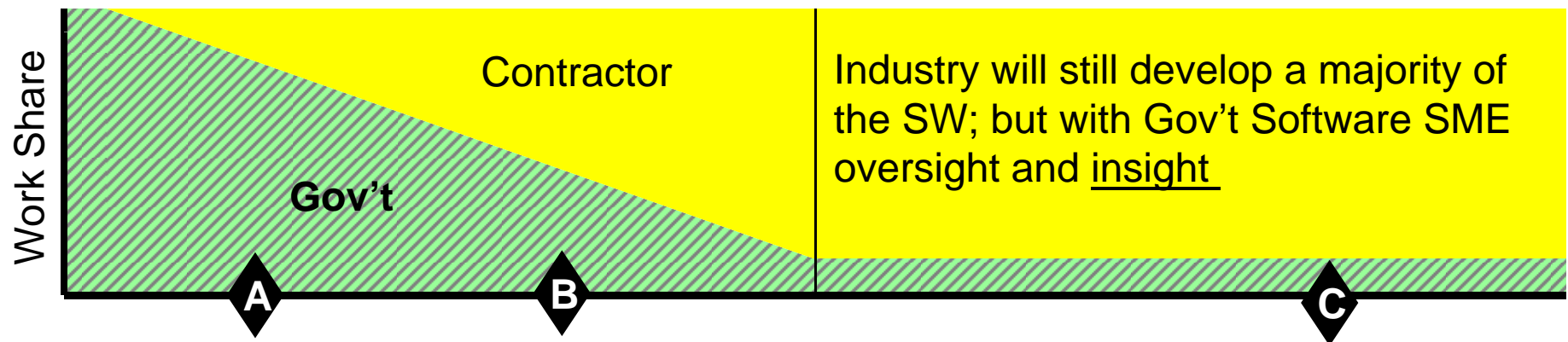
- ◆ Developing a Subset of the Critical and Complex SW Components
 - Maintain Expertise with Complex System Functionality,
 - Maintain Expertise with Latest Software Development Technologies and Methodologies

- ◆ Leading Integrated Gov't and Industry SW Development Teams
 - In-House SW Experts have SW Design Technical Approval Authority
 - Ensure SW meets Open Architecture objectives
 - Ensuring Industry Adheres to Best SW Development Practices

*The Proposed Government And Industry Software Teaming Strategy is already being
Successfully Utilized for a Some Critical Fire Control Systems*

Future State SW Development Responsibility Allocation

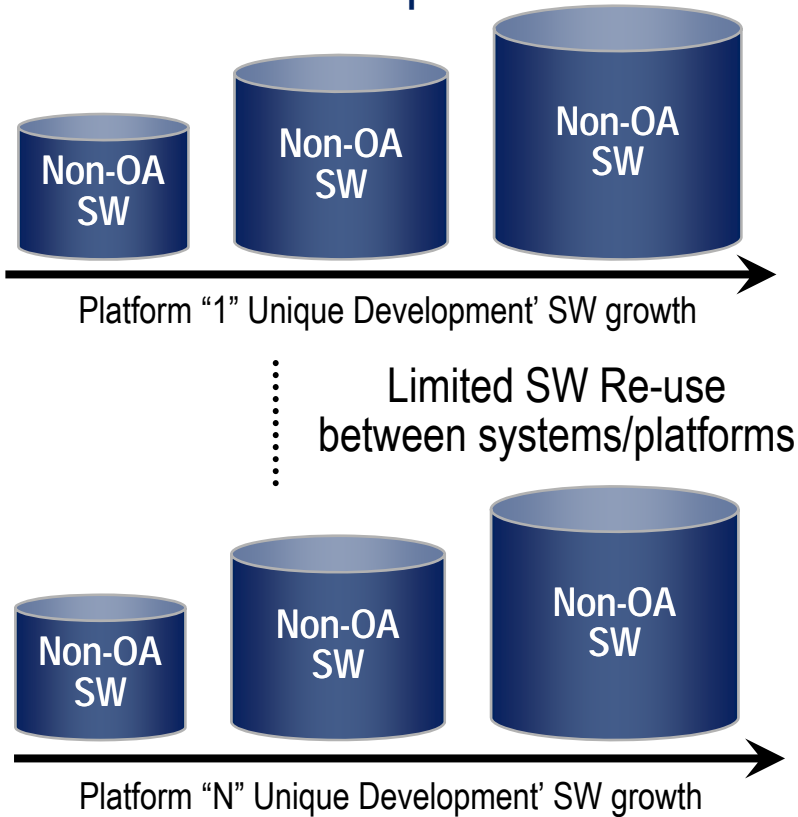
- ◆ Industry will still develop the majority of the software
- ◆ Government in-house SW Experts will provide more SW Leadership and Authority



Future State Goals

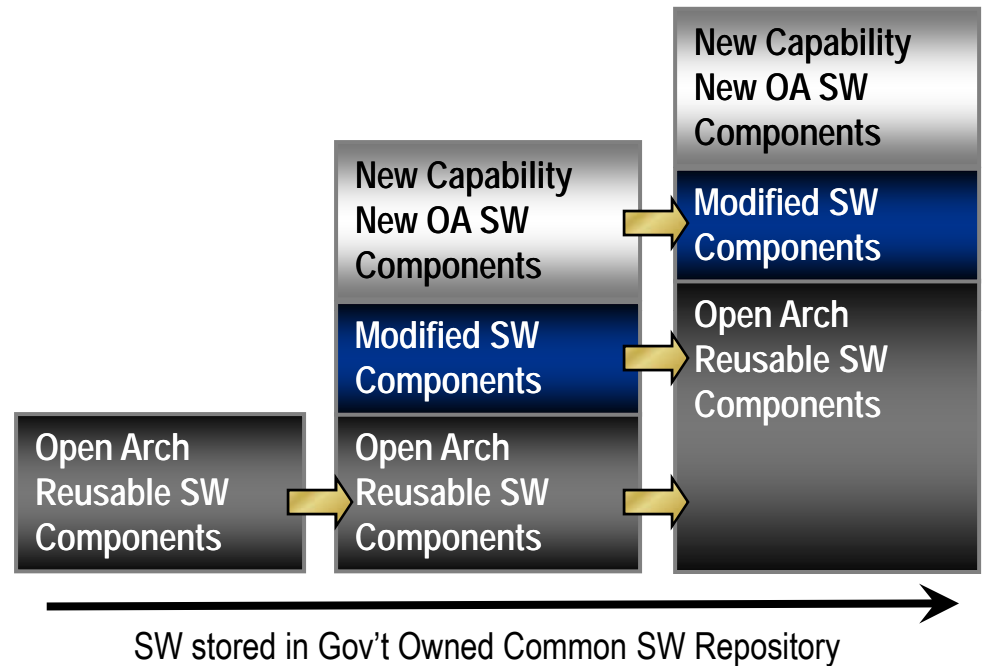
Software Evolution to Open Architecture (OA)

CURRENT : Stove Pipes



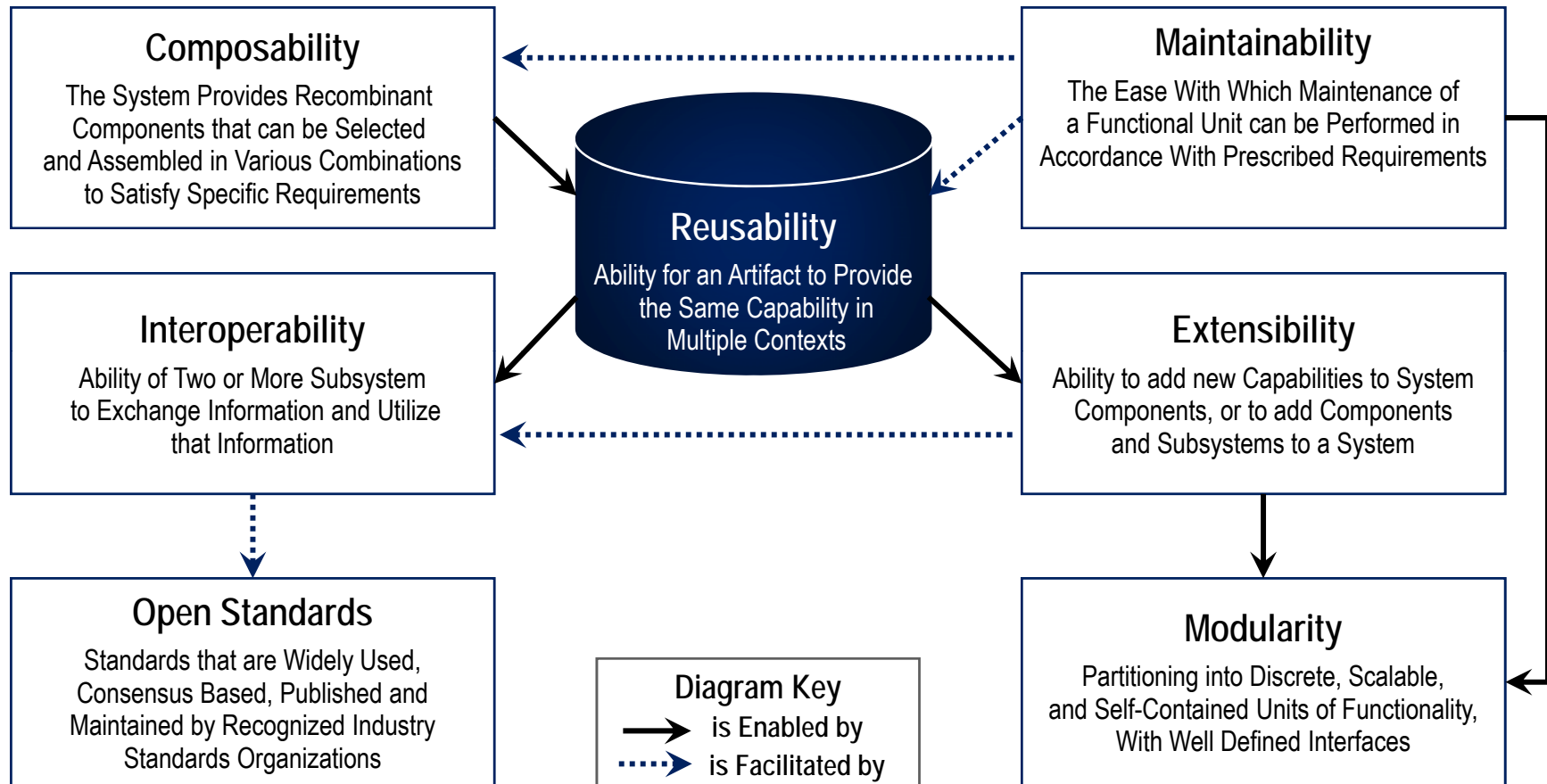
Few Open Arch based designs and software

FUTURE: OA Based Multi-Platform Capable



Establish truly OA based reusable, scalable, modular, and maintainable components

Future State Challenge: Open Architecture Software

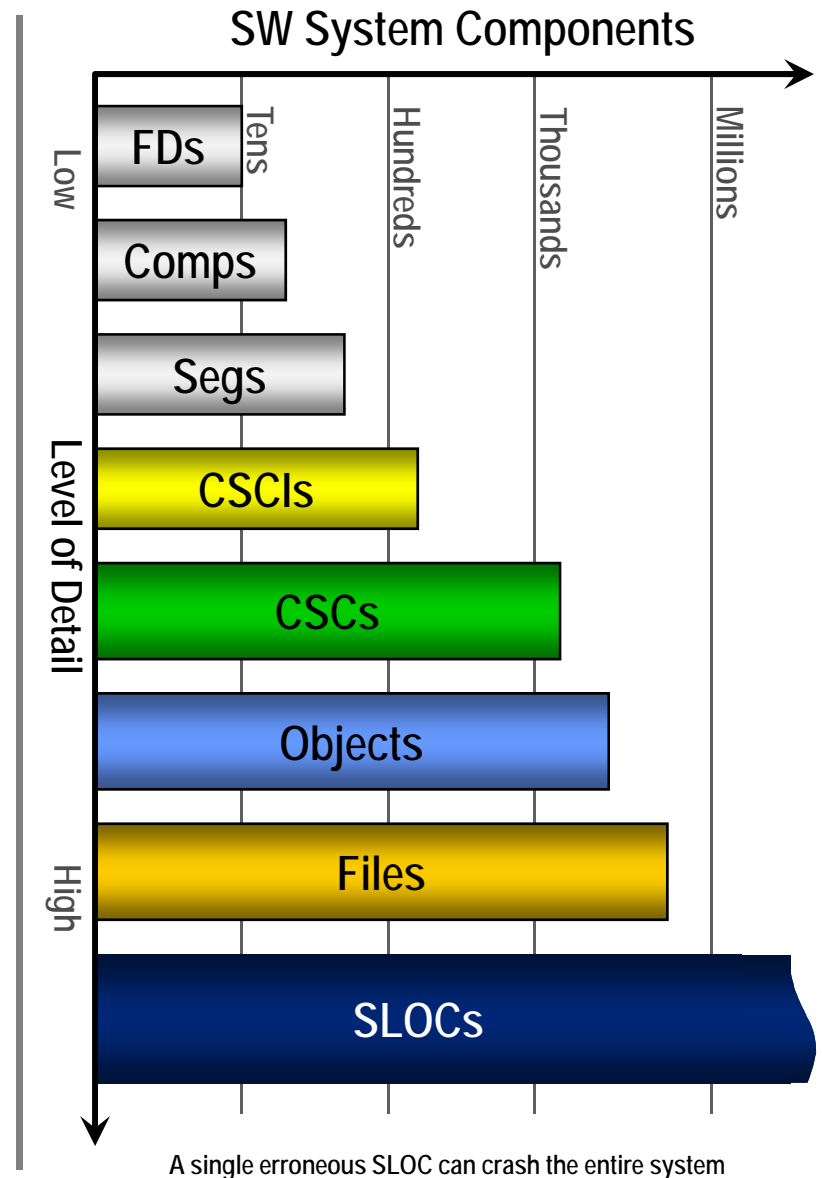
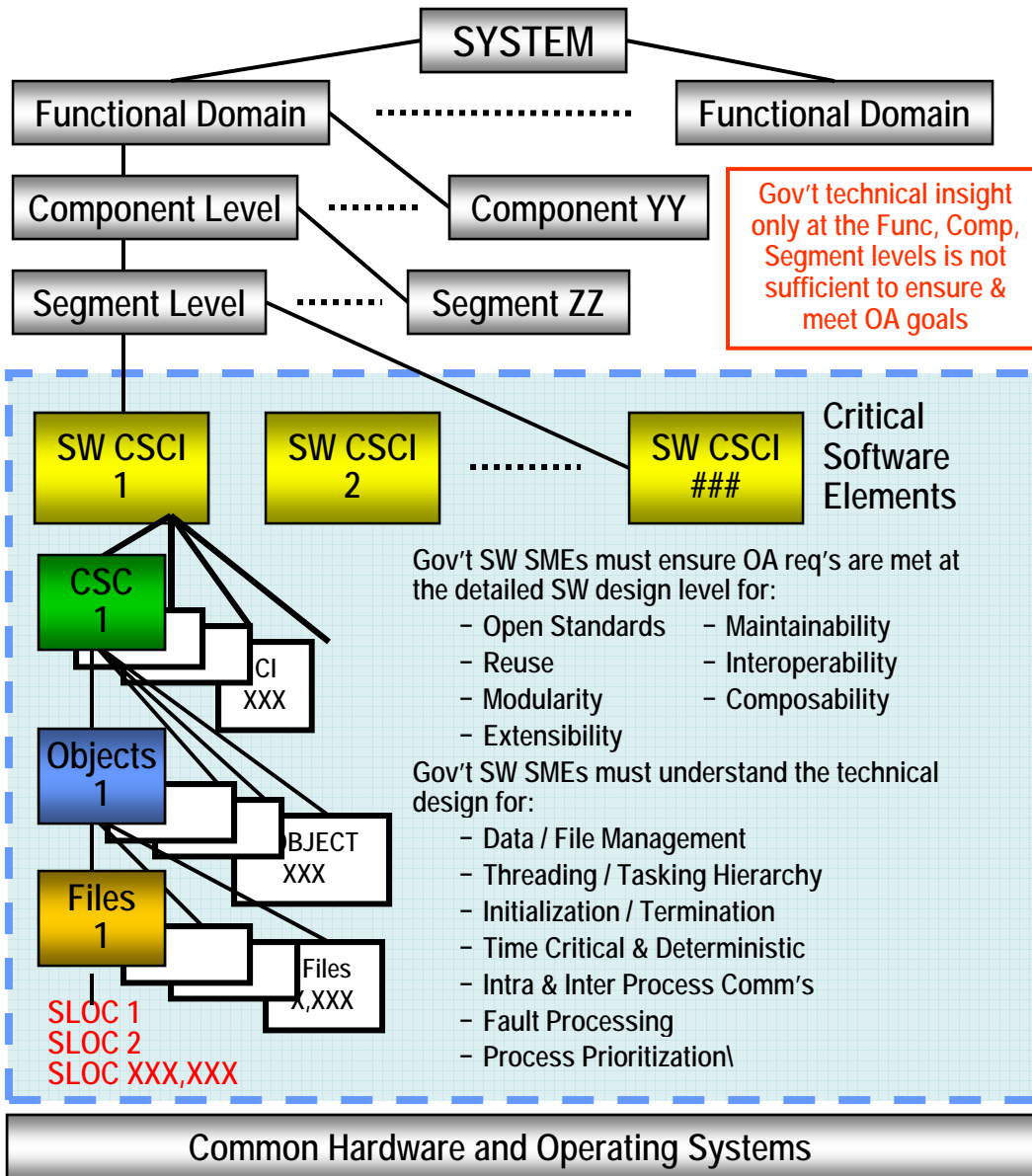


These OA "ILITIES" Cannot be Easily Verified by System Testing.... Government In-House SW Expertise Insight Into Design and Code is Required to Ensure Reusable Software

Designing and Coding for These "ILITIES" is the Key to Saving Significant \$\$\$\$\$\$\$

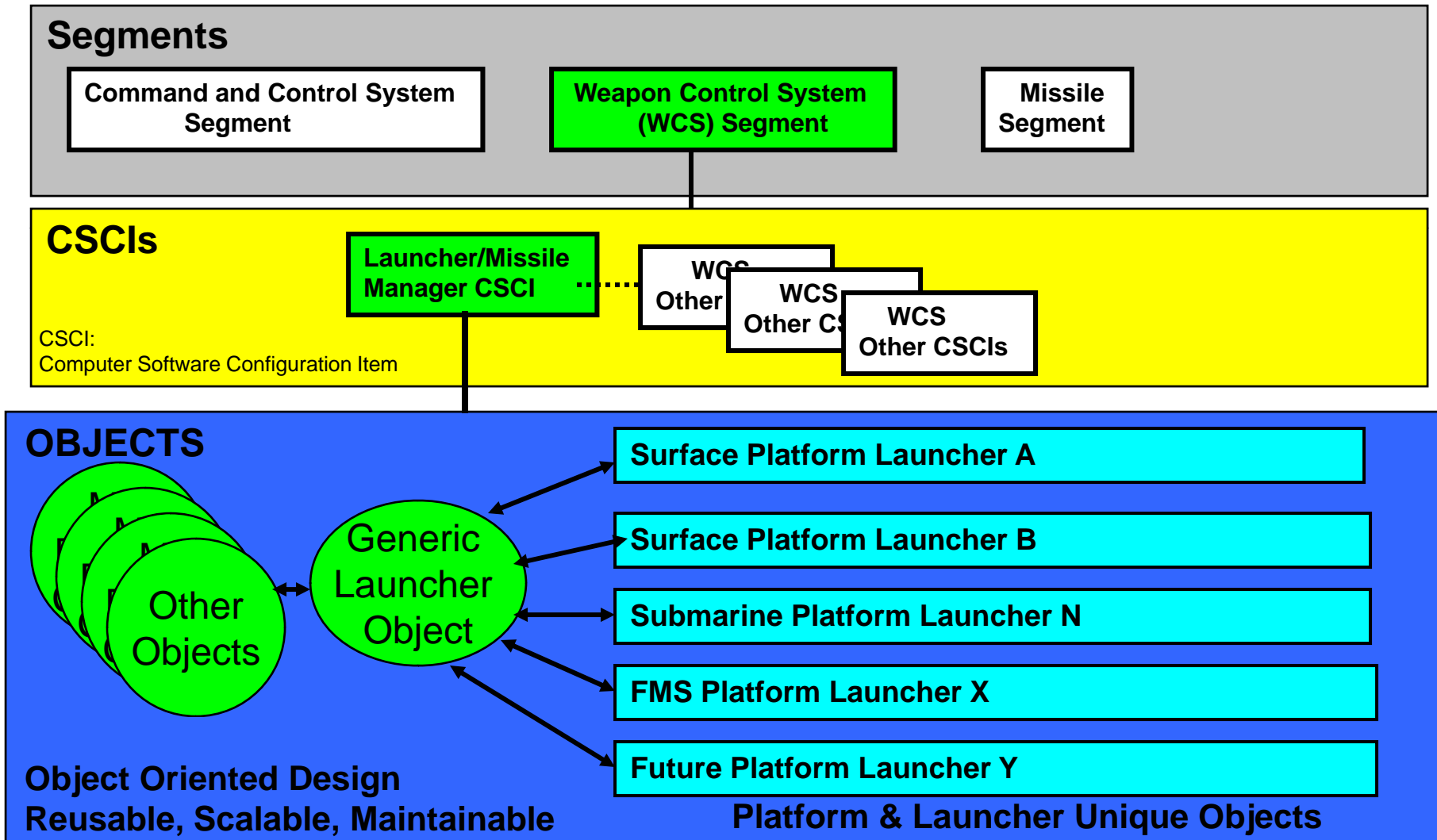
* Reference: OA Architectural Principles and Guidelines v 1.5.6, 2008, IBM, Eric M. Nelson, Acquisition Community Website (ACC) DAU Navy OA Website

Current State Challenge: Levels of SW Complexity / Devil is in the Details



Open Architecture: Example Reusable, Maintainable, Scalable Software Design

◆ Weapon System X



Future State: Benefits

- ◆ By establishing the government sw expertise pipe-line; the government will have the sw expertise required to address the current state Acquisition Challenges and
 - Improve software technical approach/maturity identification and assessment
 - Improve software requirements change management and assessment of the associated impacts to cost, schedule, technical performance and risk
 - Maintain system and software architecture corporate knowledge as program office leadership turns over, and as system development responsibility transitions to different private industry contractors
 - Improve software cost estimation and tracking (EVMS)
 - ★ Lead process improvement efforts based on applied experience and historical data
 - Ensure OA based reliable, maintainable, reusable, scalable, & modular software

Summary

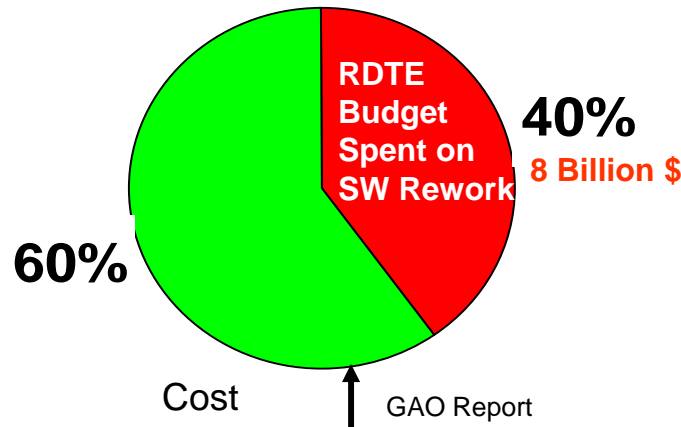
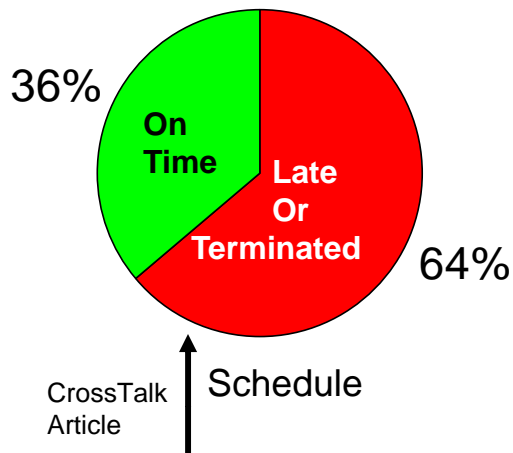
- ◆ DoD / Navy Systems' Software Size and Complexity is Significantly Increasing
- ◆ Navy Applied In-House SW Expertise is Decreasing
 - Program Offices do Not Have the Applied SW Expertise Required to Consistently Successfully Acquire SW Intensive Systems
- ◆ Must Reconstitute and Maintain the Navy's In-House SW Development Expertise
 - Must Maintain Applied SW Expertise and Experience Developing Complex SW With Real-Time, Safety Critical, Multi-Threaded/Process, Complex Interfaces and Algorithms
 - Requires that a Subset of the Complex and Critical Software be Developed In-House

Developing Government SW SMEs will Enable Navy's Goal of Open Architected Systems and Improve the Ability to Consistently and Successfully Deliver Systems That Meet Cost, Schedule, and Technical Performance Goals

Back-Up

- ◆ Current Acquisition State Summary
- ◆ References

DOD/Navy SW Acquisition Current State Summary



2008 GAO report

- 11 DOD program failures
- **Increased and improved Gov't oversight is required**

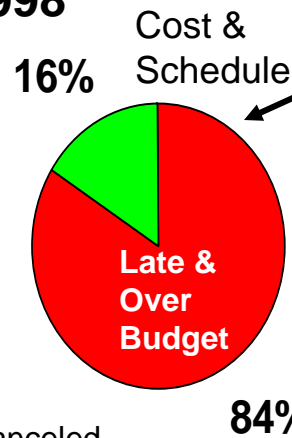
2008 DSB DTE Report

- High % of programs fail IOTE
- **Key Factor: Loss of experienced management and technical personnel**

2008 SECNAV MEMO

- **DOD must maintain Technical expertise at all levels**

1998

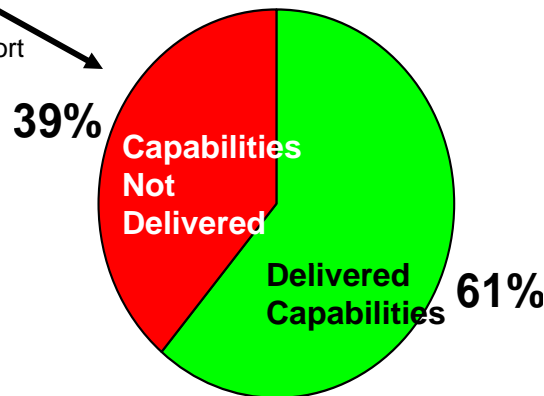


2000

DSB Report

Performance

2003



2007

2007 ASN/RDA Software Process Improvement Initiative (SPII) As-Is Report For SW Acquisition Management

- 7 Key Problems

1. Lack of effective acquisition management
2. Immature acquirer (program offices)
3. Ineffective requirements management
4. High personnel turnover in the acquiring org's
5. Cost and schedule estimation accuracy
6. Ineffective utilization of EVMS for SW systems
7. Failure to take advantage of Lessons Learned.

2008

* 31% canceled

* 53% have cost growth over 89%

The DOD/Navy is not consistently successfully acquiring software intensive systems. The DOD/Navy needs to reconstitute its in-house applied sw expertise

References

Report of the Defense Science Board Task Force on Defense Software, November 2000 Office of the Under Secretary of Defense for Acquisition and Technology

* 84% of program do not complete on budget nor schedule; 31% are canceled; remaining 53% have cost growth exceeding 89%; final product only includes 61% of planned features

2004 General Accountability Office released a report describing the results of a study to identify the practices used by leading companies to acquire software and to analyze the causes of poor outcomes of selected DOD programs. GAO reported :

“In recent years, DOD has attributed significant cost and schedule overruns of software-intensive systems to difficulties in developing and delivering software. DOD estimates that it spends about 40 percent of its Research, Development, Test, and Evaluation budget on software—\$21 billion for fiscal year 2003. **Furthermore, DOD and industry experience indicates that about \$8 billion (40 percent) of that amount may be spent on reworking software because of quality-related issues.**” (GAO. *Stronger Management Practices are Needed to Improve DOD’s Software-Intensive Weapon Acquisitions*. GAO-04-393. March 2004)

2007 SPII Software Acquisition Management (SAM) Team “As-Is State” Report seven consistent primary problems:

1. Lack of effective acquisition management
2. Immature acquirer is challenged to assess developer performance
3. Ineffective requirements management
4. High personnel turnover in the acquiring organization
5. Cost and schedule estimation accuracy
6. Ineffective utilization of EVMS for software intensive acquisition programs.
7. Failure to take advantage of Best Practices and Lessons Learned.

References

- ◆ **Report of the DSB Task Force on Development Test and Evaluation, May 2008**
 - “loss of a large number of the most experienced management and technical personnel ..without an adequate replacement pipeline” is one of the key contributors to the trend of a high percentage of DOD system operationally effective and suitability failures
 - “over time, in-house DOD offices of subject matter experts were drastically reduced, and in some cases, disestablished

- ◆ **2009 Opening Statement of Senator Carl Levin at Senate Armed Services Committee Hearing on DOD Acquisition of Major weapon Systems, March 3, 2009**
 - **DOD’s 95 major defense acquisition programs have seen their costs grow by an average of 26% and experienced an average schedule delay of almost 2 years**

- ◆ **OA Architectural Principles and Guidelines v 1.5.6, 2008, IBM, Eric M. Nelson, Acquisition Community Website (ACC) DAU Navy OA Website**

Acronyms

- ◆ ASN/RDA: Assistant Secretary of the Navy Research Development and Acquisition
- ◆ ASR: Alternative System Review
- ◆ CDR: Critical Design Review
- ◆ CSC: Computer Software Component
- ◆ CSCI: Computer Software Configuration Item
- ◆ CMMI: Capability Maturity Model Integration
- ◆ DoD: Department of Defense
- ◆ DSB: Defense Science Board
- ◆ EVMS: Earned Value Management System
- ◆ FQT: Formal Qualification Test
- ◆ GAO: Government Accounting Office
- ◆ GOV'T: Government
- ◆ IEEE: Institute of Electrical and Electronics Engineers
- ◆ ITR: Initial Technical Review
- ◆ OA: Open Architecture
- ◆ OTRR: Operational Test Readiness Review
- ◆ PCR: Physical Configuration Review
- ◆ PDR: Preliminary Design Review
- ◆ PRR: Production Readiness Review
- ◆ RDT&E: Research Development Test and Engineering
- ◆ SFR: System Functional Review
- ◆ SLOC: Source Lines of Code
- ◆ SME: Subject Matter Experts
- ◆ SPII: Software Process Improvement Initiative
- ◆ SRR: System Requirements Review
- ◆ SVR: System Verification Review
- ◆ SW: Software
- ◆ TRR: Test Readiness Review
- ◆ WCS: Weapon Control System