Surface Warfare Center Contributions for Addressing Warfare System Development Challenges and Improvement Goals

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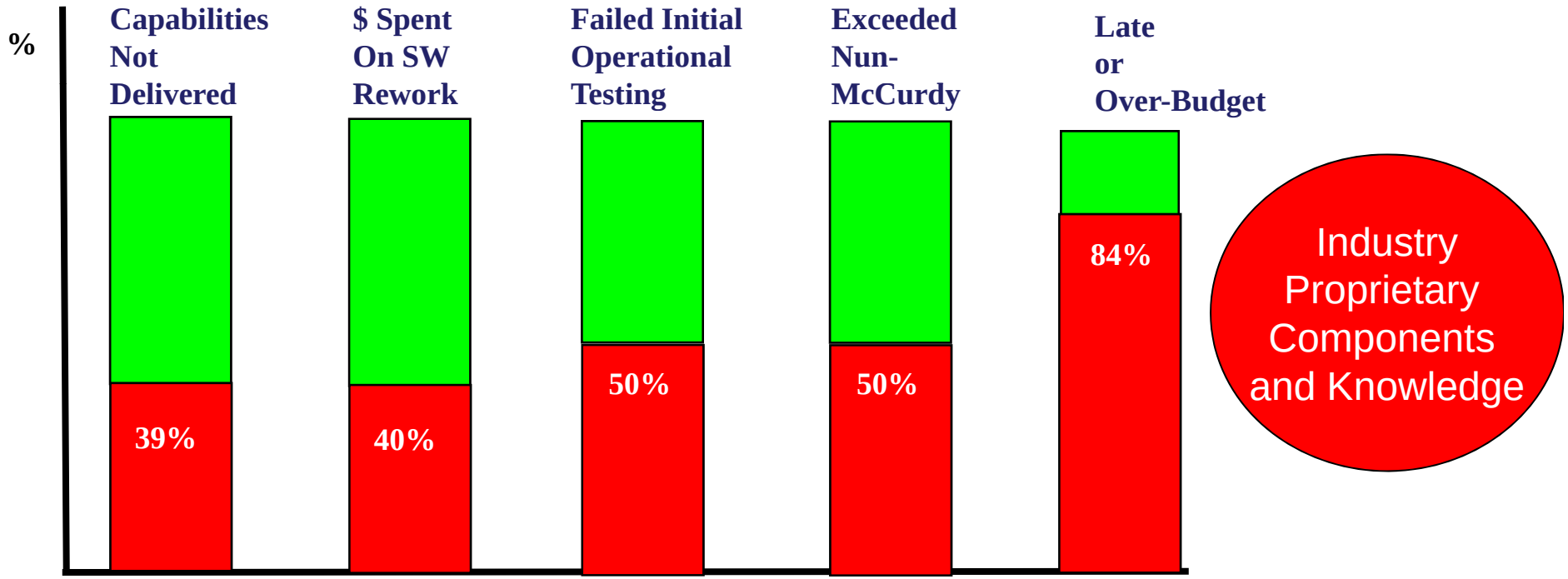
Surface Warfare Centers
Addressing Challenges and Improvement Goals

- Current State Approach and Results
- Future State Challenges and Goals
- Surface Warfare Center Success Examples
- Keys to Success
- Recommendations
- Summary / Benefits

Current State
Typical System Acquisition Approach and Results

Government relies primarily on industry for system architecture, design, and development.

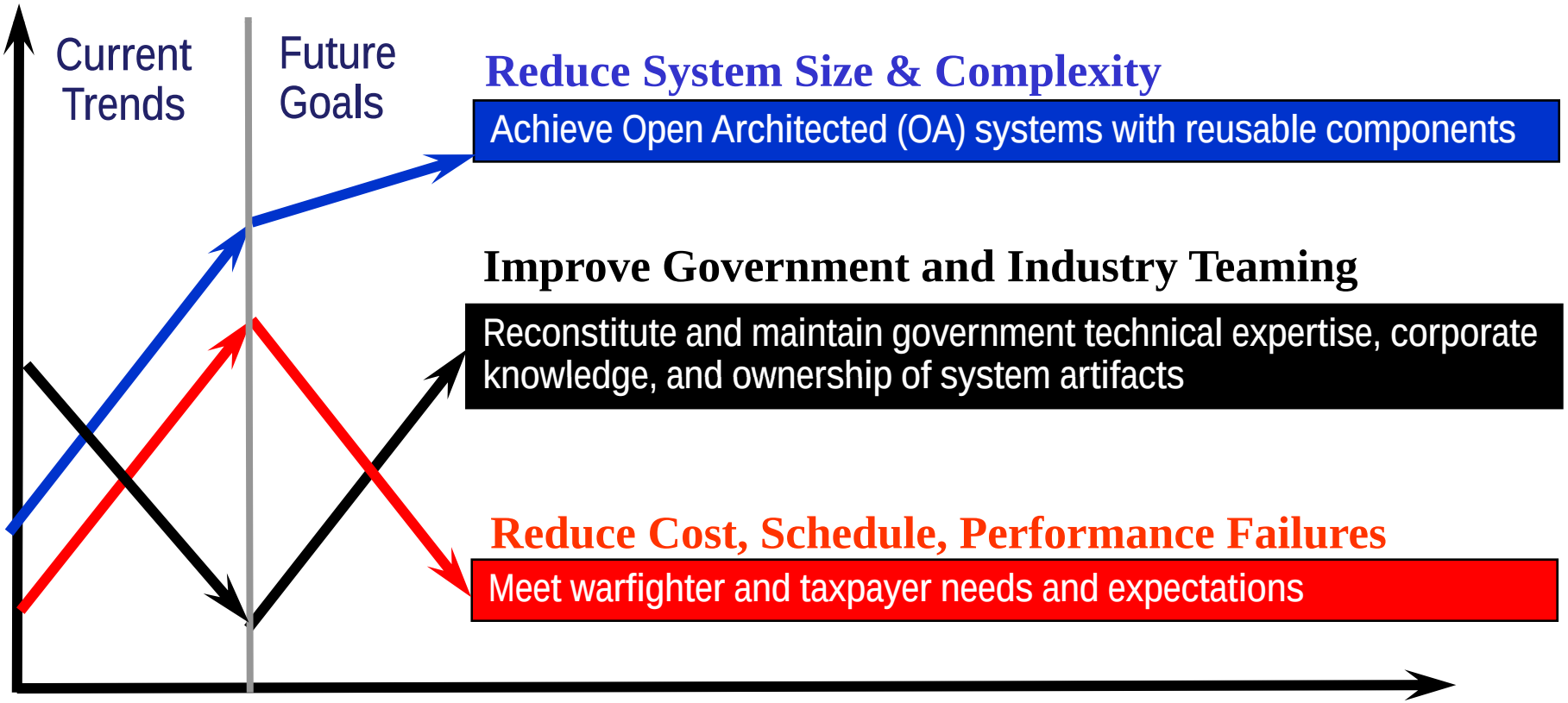
Majority of programs experience cost, schedule and technical performance failures.



References
- 2000 Defense Science Board Report and 2004 General Accounting Office Report
- 2009 Senator Carl Levin Opening statements to Senate Armed Service

Future State Challenges and Goals

- CHALLENGES
  - Rapidly delivering systems on schedule and within budget that meet warfighter needs
  - Achieving Open Architected (OA) systems with reusable components
  - Integrating rapidly evolving software technologies into large and complex legacy (old technology) systems
  - Maintaining Information Assurance (IA)
  - Maintaining government corporate knowledge and control of system architecture and components



Surface Warfare Centers: In-House Software Expertise Success Examples

- Utilization of Government in-house Software Expertise
  - Integrated Government and Industry Software development Teams
  - System Prototyping and Engineering Development Model development
  - Rapid Development efforts
  - Reusable components

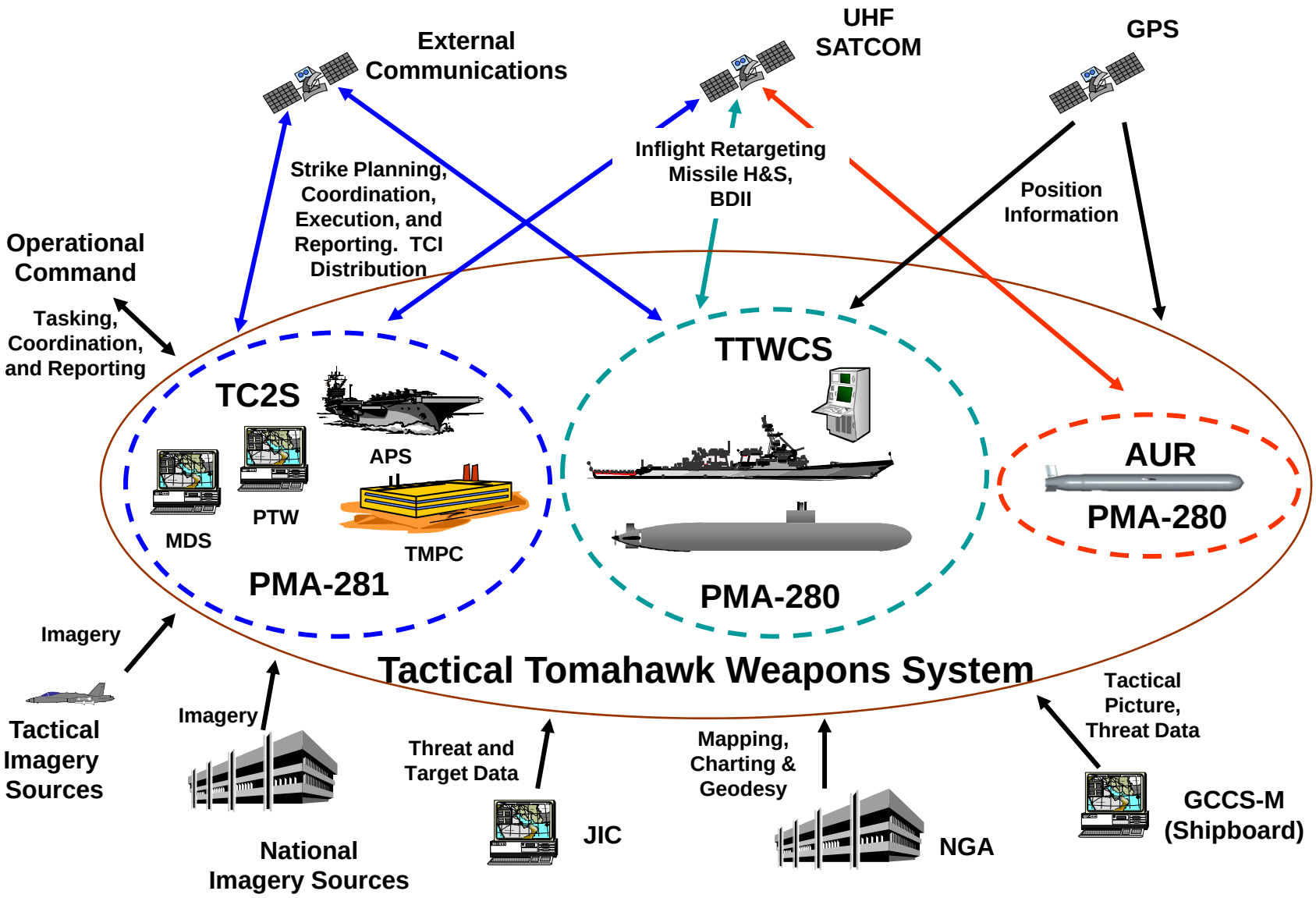
- Example of Successful Programs/Projects
  - Tomahawk Cruise Missile Weapon Control System (TTWCS)
  - Generic Data Extraction Analysis and Reduction (GeDEAR) Framework
  - Cooperative Communication Control Core Engagement (4CE) framework
  - Littoral Combat Ship Surface Warfare Mission Package (LCS SUW MP)

Surface Warfare Centers: Achievements of Success Examples

- Achievements
  - Delivery of reliable, maintainable, scalable and reusable architectures, design, and code that provide multi-platform and/or multi-system capability
  - Integration of a mix of legacy components, new Commercial-Off-The-Shelf (COTS) components, and government engineer- developed reusable architectures and components, while maintaining Information Assurance (IA)
  - Incorporation of complex, real-time, safety critical functional requirements and the associated challenging Key Performance Parameters (KPPs)
  - Continuation and growth of government corporate knowledge and control of the system architecture, design, and technology
  - Government applied technical expertise with current and emerging system and software technologies, methodologies, processes, and tools
  - Delivery of these systems on schedule and within budget

TTWCS Success Example

Integrated Government and Industry Development Team



TTWCS Success Example
Multi-Platform Capability

SURFACE

TICONDEROGA (CG)
22 Platforms
• MK 41 VLS

ARLEIGH BURKE (DDG)
62 Platforms
• MK 41 VLS

ZUMWALT (DDG 1000)
3 Platforms (future)
• MK 57 VLS

SUBMARINE

LOS ANGELES 688
46 Platforms
• CLS/TTL

SEAWOLF
3 Platforms
• TTL Only

SSGN
4 Platforms
• CLS (MAC)

VIRGINIA Class
5 Platforms
• CLS/TTL
• 7 more VA platforms coming

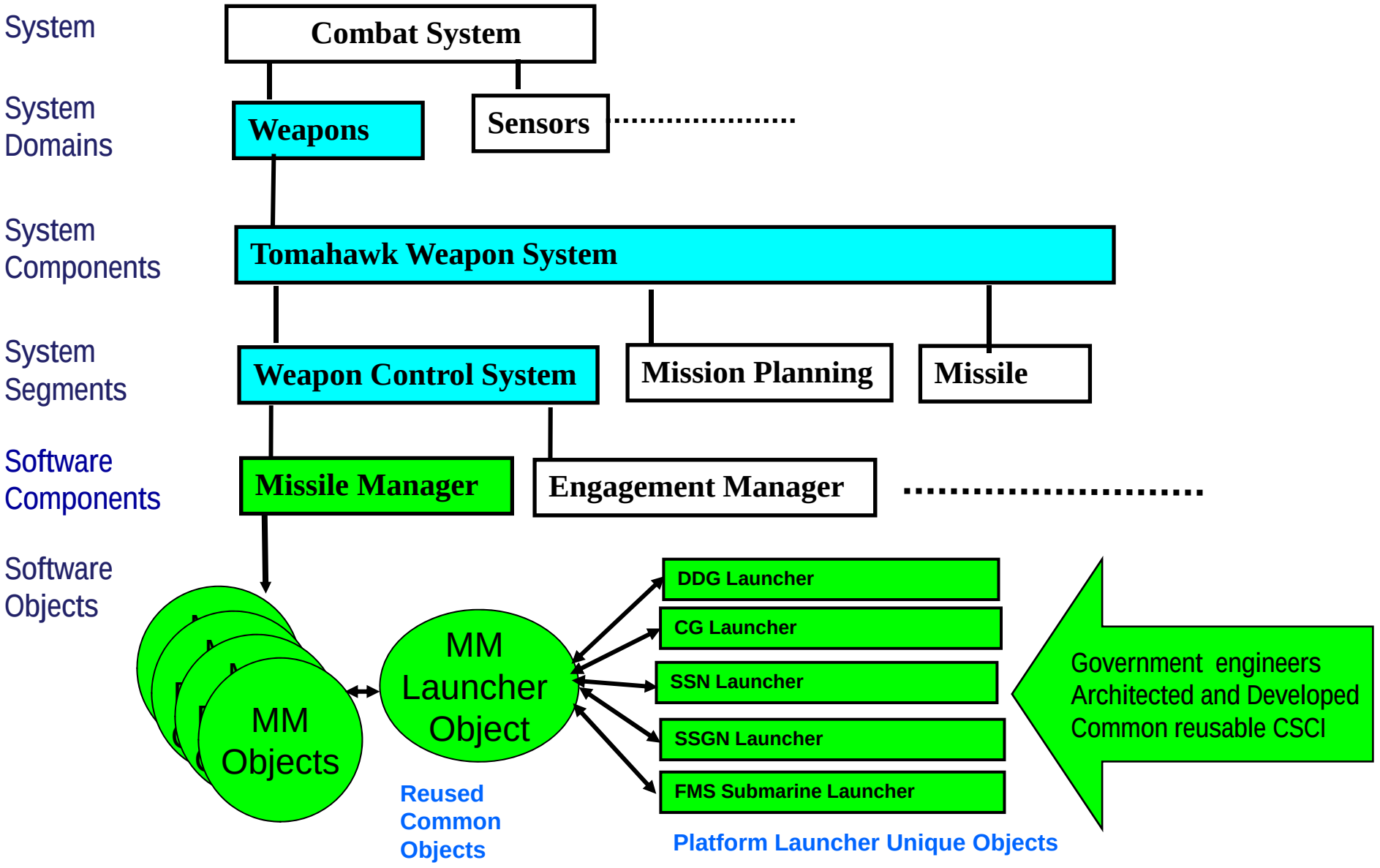
UK

TRAFALGAR
7 Platforms
• TTL Only

ASTUTE
3 Platforms (1 additional being built)
• TTL Only

TTWCS Variants:
- V4 Deployed
- V5.3.x Deployed
- V5.4.0 In-Development (System Test Phase FB1)
- V5.4.1 In-Development (Inc2 CDR next Major Milestone)

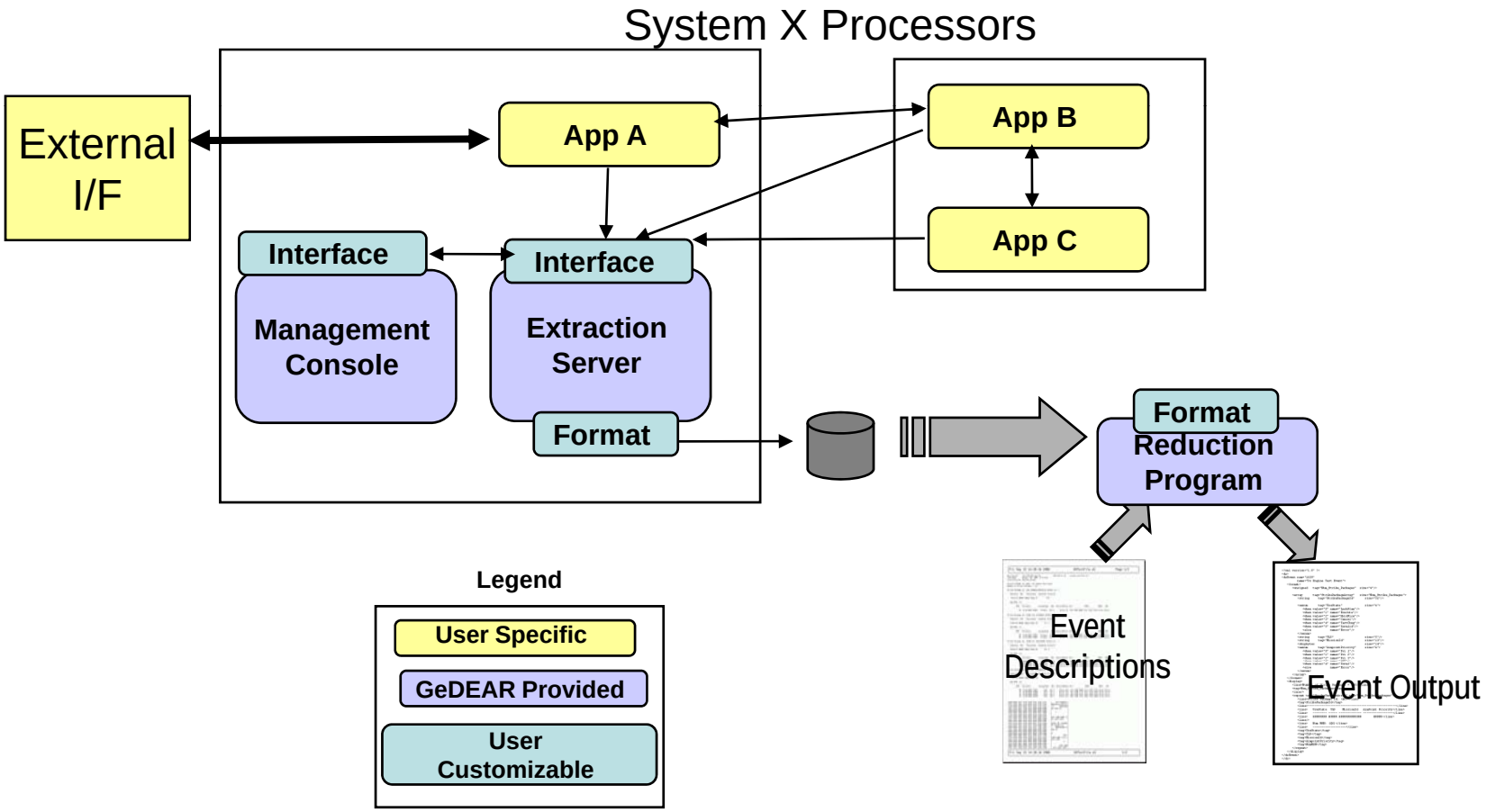
TTWCS Success Example
Tomahawk OA multi-platform capability



GeDEAR Success Example
Multi-System Reusable Component Data Extraction and Analysis

GeDEAR: Generic Data Extraction, Analysis and Reduction Framework:
Successfully utilized by several systems:

-Tactical Tomahawk Weapon Control System (TTWCS)
-Shipboard Protection System (SPS)
- Advanced Multi-configuration Environment Simulator (AMES)
- Littoral Combat Ship (LCS) Surface Warfare Mission Package (SWMP)



GeDEAR Success Example
Reusable Component

- Generic Data Extraction, Analysis, and Reduction Framework (GeDEAR)
  - Allows for integration of a software-based data extraction capability with the minimum of cost or schedule
  - Works across many different data formats, interfaces, platforms, operating systems
  - Provides a foundation for common data extraction, reduction and analysis tools
  - Freely available on forge.mil

- GeDEAR framework consists of a set of tools for adding data extraction, reduction, and analysis capability to a software system
  - No dependencies within tool set
  - Users only use the tools they need
  - Capabilities expanded through the use of user-provided plugins

- GeDEAR quickly and easily integrated into systems
  - Tactical Tomahawk Weapon Control System (TTWCS) – 4 week effort
  - Shipboard Protection System (SPS) – 3 month effort
  - Advanced Multi-configuration Environment Simulator (AMES) – 1 month effort
  - Littoral Combat Ship (LCS) Surface Warfare Mission Package (SUWMP) – 1 month effort

4CE Success Example
Current Rapid Integration Effort

Gunslinger

FSEP

17 DEVELOPERS

Wolf Pack

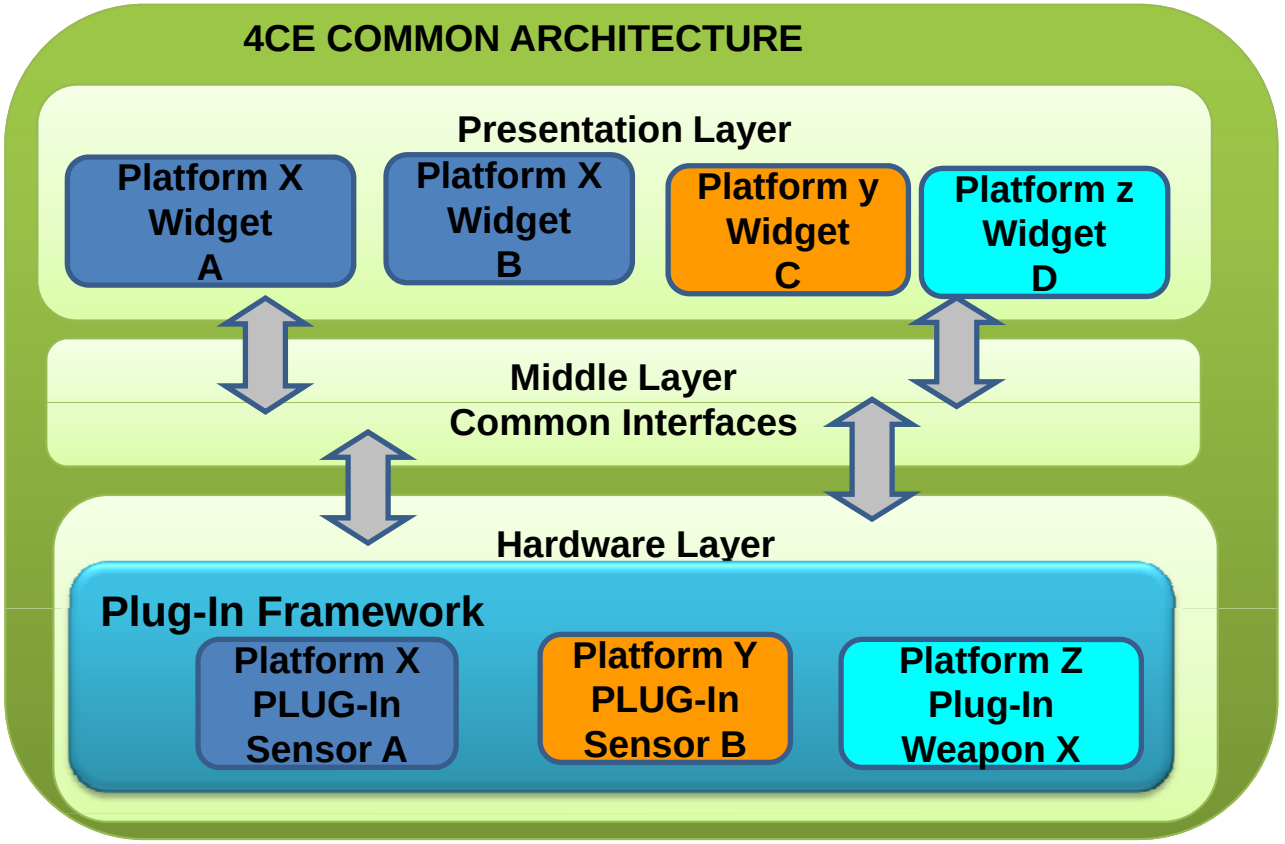
NEO

11 DEVELOPERS

GunPACS

Command and Control Module

4 DEVELOPERS



Easily integrate new sensors or weapons due to:
- 3 Tiered architecture with common interfaces between tiers
- Unique hardware interfaces changes isolated to small plug-ins.

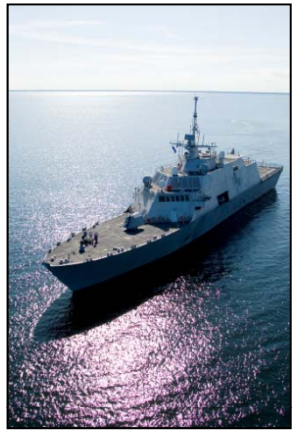
Achieved Goals: Rapid Development and delivery (months vs. years), high quality and reliable Warfighter systems, non-proprietary systems, government developed / controlled architecture

OA Achievements: Scalable, reusable, maintainable, modular.

LCS SUW MP Success Example
LCS Background

- LCS Mission Areas
  - Counter threats
    - ★ Littoral mine, Submarine, Surface
  - Assure maritime access for Joint forces
  - Achieved by
    - ★ Modular mission packages to tailor and optimize the ship for one of these mission areas at a time
- Approach
  - Innovative design for
    - ★ Modularity
    - ★ Rapidly install interchangeable mission packages onto the seaframe
- Precepts
  - Accelerated acquisition
  - Minimum crewing
  - Cost reductions
  - System/software reuse

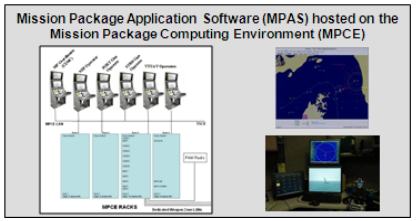
USS Independence (LCS 2)



USS Freedom (LCS 1)

LCS SUW MP Success Example
LCS SUW MP Description

- LCS Surface Warfare (SUW) Mission Package (MP)
  - Incrementally fielded
  - Provides SUW focused mission
  - NSWCDD – technical design agent
    - ★Provide overall systems engineering, development and conduct/ coordination of:
      - » Modularized Gun Mission Module (GMM)
      - » Mission Package Application Software (MPAS)
        - » Command & Control and integration interface between and the ship's Combat Management System (CMS)
    - ★Employed Prototype process, due to:
      - » Accelerated nature of LCS acquisition
      - » Required component designs had not been established

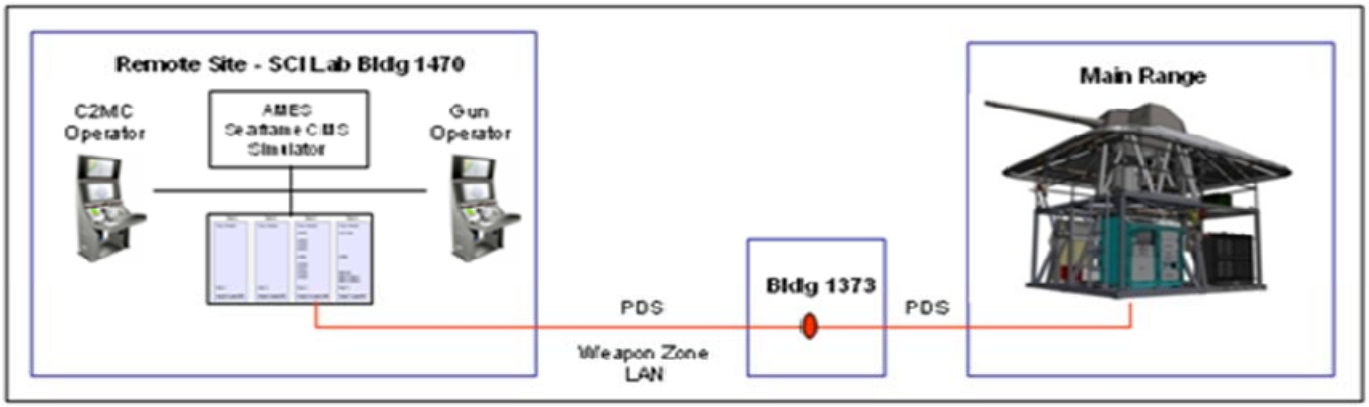


LCS SUW MP Success Example
NSWCDD Expertise

- NSWCDD tenets that allowed work to be done successfully
  - A defined organizational process for software development, integration, testing, configuration management and quality assurance
  - A software (SW)/hardware (HW) element and integrated test approach
  - A SUW MPAS Team that leveraged experienced personnel, processes, and software reuse from the SQQ-89, TOMAHAWK, and MK-160 programs already being supported at NSWCDD.

LCS SUW MP Success Example
Testing

- MPAS Test environment at NSWC Dahlgren
  - Used for End-to-End, Hardware in the Loop (HIL), live-fire test events of the complete SUW MP system prior to shipboard testing
  - Risk mitigation and provides excellent software quality indicators



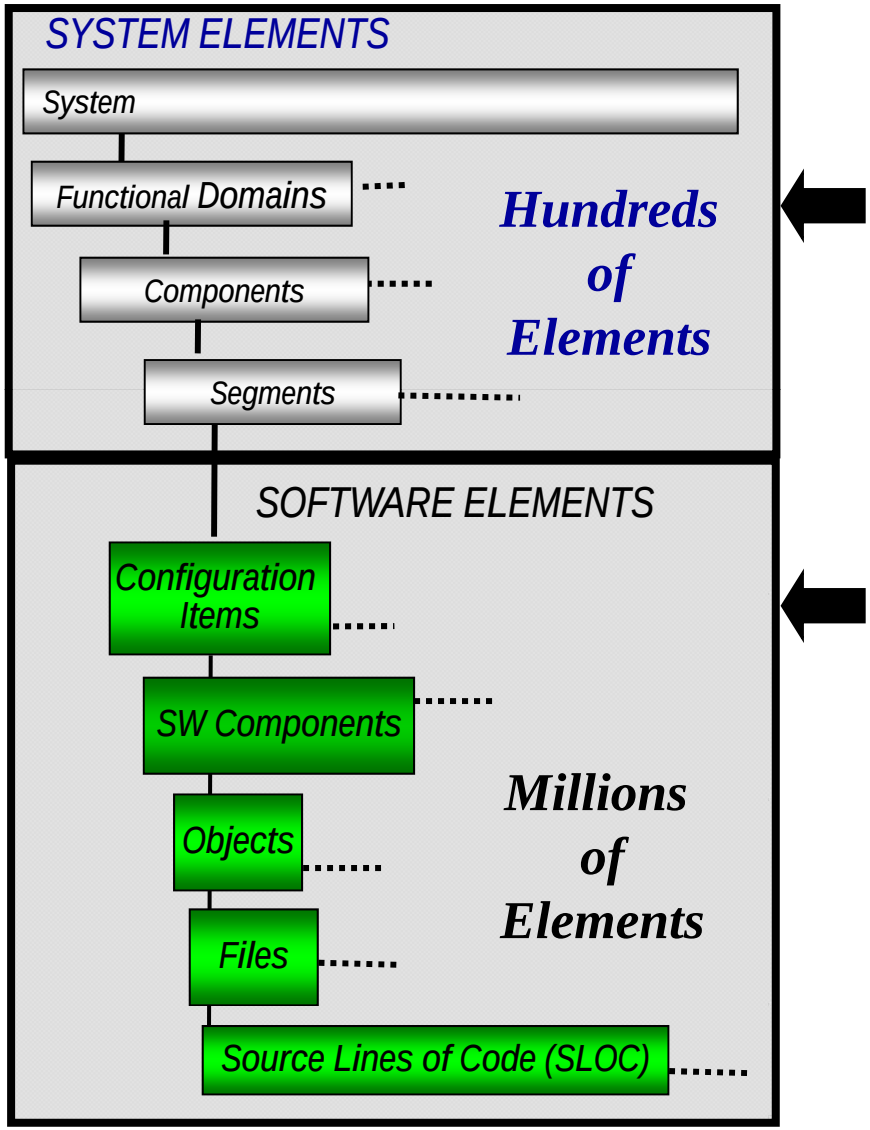
LCS SUW MP Success Example
Summary

- MPAS development and testing at NSWCDD has proven the concept of a government led and developed effort
  - Guided by incremental processes supporting accelerated schedule and rapid prototype approach

- Navy laboratory team brought to this effort:
  - Co-located software and hardware developers
  - Well defined processes
  - Reuse software expertise
  - Without restrictive contractual barriers

Congressman Rob Wittman (R-VA-1): "LCS is the future of shallow water defense, . . .Because (of Dahlgren) efforts, the Navy will be armed with the best package available for littoral warfare and you have made this happen on time and on budget." SUW MP Rollout, July 2008

Key to Success:
In-house Applied Software Expertise



Maintaining government expertise only at the higher levels of System abstraction is insufficient to improve software intensive system acquisition

Government must maintain hands-on applied expertise with rapidly evolving software technologies and methodologies
- ***Required for successful sw cost, schedule and technical performance control***

Current typical software system acquisition approach utilizes government sw engineers primarily as reviewers but not developers

Recommendation
Utilize Alternative Software System Acquisition Approach

- Utilize Government in-house Software Expertise
- To provide
  - Delivery of reliable, maintainable, scalable and reusable architectures, design, and code that provide multi-platform and/or multi-system capability
  - Integration of a mix of legacy components, new Commercial-Off-The-Shelf (COTS) components, and government engineer- developed reusable architectures and components, while maintaining Information Assurance
  - Incorporation of complex, real-time, safety critical functional requirements and the associated challenging Key Performance Parameters (KPPs)
  - Continuation and growth of government corporate knowledge and control of the system architecture, design, and technology
  - Government applied technical expertise with current and emerging system and software technologies, methodologies, processes, and tools
  - Delivery of these systems on schedule and within budget

Alternative SW Acquisition Approach Keys to Success

- Common set of industry & government processes and expectations
- Well defined, documented and maintained:
  - Roles and responsibilities
  - System development processes and metrics
  - Cost, schedule, and performance expectations
  - Integrated Master Schedule (IMS)
  - Interdependency products and associated delivery dates
  - Risk management
- Proactive integrated management of cost, schedule and performance
- Government test team is independent from the development team
- Milestone reviews that include independent competency experts
- Frequent (daily) and structured team communication

Way Ahead

- Apply lessons learned from successful utilization of in-house expertise
- Program Office leaders work with Warfare Center leaders to improve utilization of in-house expertise and faclilities

In-House Software expertise Summary / Benefits

- Government Program Offices
  - Improved Technology, Cost, and Schedule Estimates and Assessments
  - Increased and maintained corporate knowledge
  - Increased acquisition leverage and flexibility
- Industry
  - Improved proposal assessments (smarter partner, not just lowest bid wins)
  - Reduced risk (smarter partner, improved requirements, government accountability)
  - More profit (less dollars on rework and increased system production)
- Warfighter
  - Faster receipt of capabilities
  - Increased capabilities
  - Higher quality and more reliable systems

"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"
- D. Winter: SECNAV Memo Dated 10 Oct 08

BACKUP

References: Need for in-house expertise

REFERENCES: DoD/Navy Leadership recognizes the need to reconstiture government in-house expertise			
DATE	**REPORT / STUDY / MEMORANDUM / POLICY**	**AUTHOR / SPONSOR**	**KEY QUOTES / POINTS / METRICS**
OCT 10 2008	SECDEF MEMO: Department of the Navy Acquisition	SECDEF Donald. C. Winter	"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." "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." "The fraction of RDT&E funding at each warfare Center and Laboratory should be maintained at a level sufficient to develop and sustain the needed technical capabilities of the DON".
NOV 07 2008	Senators Levin and McCain letter to SECDEF	Senator John McCain	Highlights the need for government in-house technical expertise in the acquisition workforce, especially in the technical and business domain
NOV 04 2008	ASN/RDA MEMO: Meeting of the Navy Laboratory/Center Competency Group	ASN/RDA PCD James E. Thomsen	"…strategic imperatives that I have received from the ASN(RDA&A) and SECNAV..." STRATEGIC OBJECTIVE 1: Reverse the over-reliance on contractors performing core Navy acquisition functions. STRATEGIC OBJECTIVE 2: Stewardship of the Navy's Laboraties and Warfare Centers to ensure long term health and effectiveness. STRATEGIC OBJECTIVE 4: Identify and develop skilled Program Managers and their successors
DEC 05 2008	ASN/RDA MEMO: Strategy to Balance Acquisition In-house and Contractor Support Capabilities	ASN/RDA PCD James E. Thomsen	"I expect growth in the organic acquisition workforce, largely offset by a corresponding decrease in outsourced core acquisition (technical and business) functions. I request that each PEO/SYSCOM team submit a time-phased strategy to increase acquisition organic capabilities by reducing dependence on outsourced core acquisition functions."

References; need for in-house expertise (cont'd)

MAY 2008	Report of the Defense Science Board (DSB) Task Force on Developmental Test and Evaluation	Office of the Under Secretary of Defense for Acquisition, Technology and Logistics	" In recent years, there has been a dramatic increase in the numbers of systems not meeting suitability requirements during IOT&E"." "there was a loss of a large number of the most experienced management and technical personnel ...without an adequate replacement pipeline" "changes in developmental test and evaluation alone could not remedy poor program formulation". "sequential workforce cuts in the last ten years had a significant adverse impact on the DOD acquisition capability". "A significant amount of developmental testing is currently performed without needed degree of government involvement or oversight"
FEB 2008	Report to Congressional Committees Best Practices: Increased focus on requirements and oversight needed to improve DODs Acquisition Environment and weapon System Quality (GAO-08294)	Government Accounting Office (GAO)	Analyzed 11 major DOD weapon Systems. "defense contractors poor practices for system engineering activities as well as manufacturing and supplier quality problems" contributed to significant failures wit regards to cost, schedule and technical performance. DOD needs to adopt a knowledge based acquisition approach...high levels of knowledge must be demonstrated at critical decision points in the product development process
2007 2008	ASN/RDA Software Process Improvement Initiative (SPII) Software Acquisition Management (SAM) Focus Team "As-Is" and 'To-Be" State Reports.	ASN/RDA Chief Engineer	Assessed numerous previously existing DOD/Navy studies and reports; and found the following 7 common SW Intensive System Acquisition management problems: Lack of effective acquisition management Immature acquirer (program offices) Ineffective requirements management High personnel turnover in the acquiring organizations Unrealistic Cost and Schedule Estimates Ineffective utilization of EVMS for SW Failure to take advantage of lessons learned 'To-Be" report recommendations for each of the 7 critical problems ALL include requiring the government to train and better utilize Subject Matter Experts (SMEs).

References; need for in-house expertise (cont'd)

SEPT 2009	Mr. James Thomsen (ASN/RDA PCD) presentation at the NSWCDD opening ceremony for the Directed Energy Center	(ASN/RDA PCD)	Raesons why the warfare Centers must continue to exist: 1. Government Smart Buyer. LSI activities should be conducted by Warfare Centers. WC must own and understand complex systems and their architectures. We must understand the cost and technical trade space - prior to industry coming on board. 2. Technology Expertise. We must understand technologies; especially those that are of limited interest to private industry. Need to understand how to apply technology to warfare systems. 3. Immediate Response. Be there for the war fighter/ and in crisis situation . 4. Corporate Research and Development memory. Maintain expertise and knowledge in how technology has been applied in the past to solve problems. 5. Provide specialized facilities. Maintain specialized facilities that Industry can not invest in nor maintain.

References: Dr. Ashton Carter Memo

Findings and Recommendations

TARGET AFFORDABILITY AND CONTROL COST GROWTH

- Affordability is a requirement and will be treated as a Key Performance Parameter.
- Utilize Independent "Will Cost" as well as 'SHOULD COST" assessments.
- Eliminate redundancies within war fighter (system) portfolios
- Make Production rates economical (require affordability analysis)
- Shorten program timelines.

INCENTIVIZE PRODUCTIVITY AND INNOVATION IN INDUSTRY

- Use weighted profit guidelines.
- Provide reward/incentive strategy in acquisition plan.
- Increase utilization of Fixed Price Incentive Firm Target contracts.
- Utilize Progress Payments to incentivize performance.
- Reward business that consistently demonstrate exceptional performance.
- Reinvigorate IRAD and protect the defense technology base

PROMOTE REAL COMPETITION

- Present competition strategy at each milestone review.
- Remove obstacles for competitive bidding.
- Require OA and set rules for acquisition of technical data rights.
- Promote utilization of small business (weighting factor in solicitations).

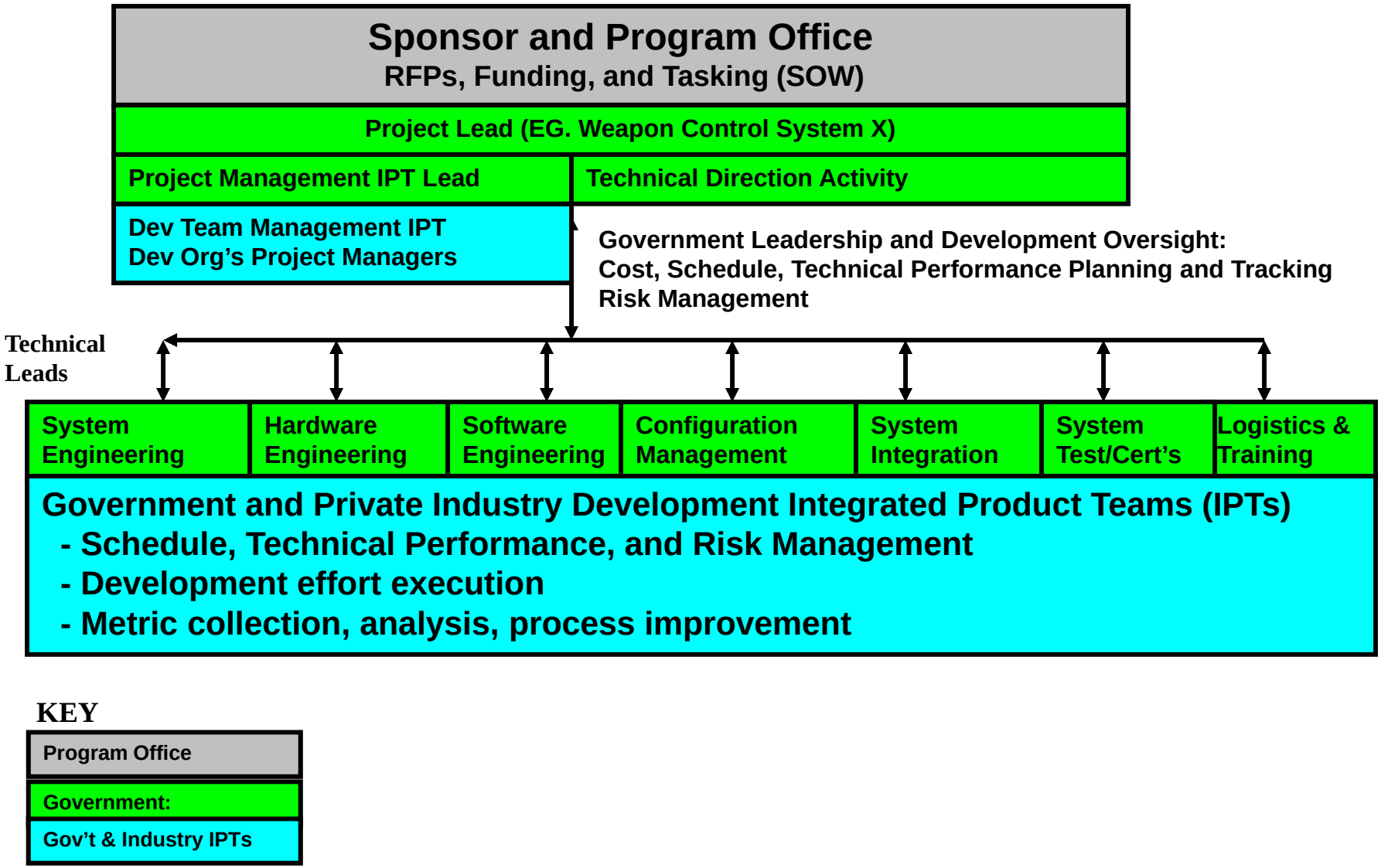
IMPROVE TRADECRAFT IN SERVICES ACQUISITION

- Create senior manager for acquisition of services responsible for governance
- Standardize taxonomy for service contracts
- Assist users of services to define requirements and prevent requirements creep.
- Increase re-competes of knowledge based service contracts.
- Limit the use of time and materials and award fee contracts for services.

REDUCE NON-PRODUCTIVE PROCESSES AND BUREAUCRACY

- Reduce the number of OSD-level reviews: Focus only on major decision points; but remain cognizant of program status and manage risks.
- Eliminate low-value-added statutory processes.
- Steam line Nun-McCurdy review process.
- Reduce by half the volume and cost of internal and congressional reports.
- Reduce non-value-added overhead imposed on industry
- Clarify roles and responsibilities of DCMA and DCAA to reduce duplication of effort and burdens on Industry.
- Increase use of Forward Pricing Rate Recommendations to reduce Admin costs.

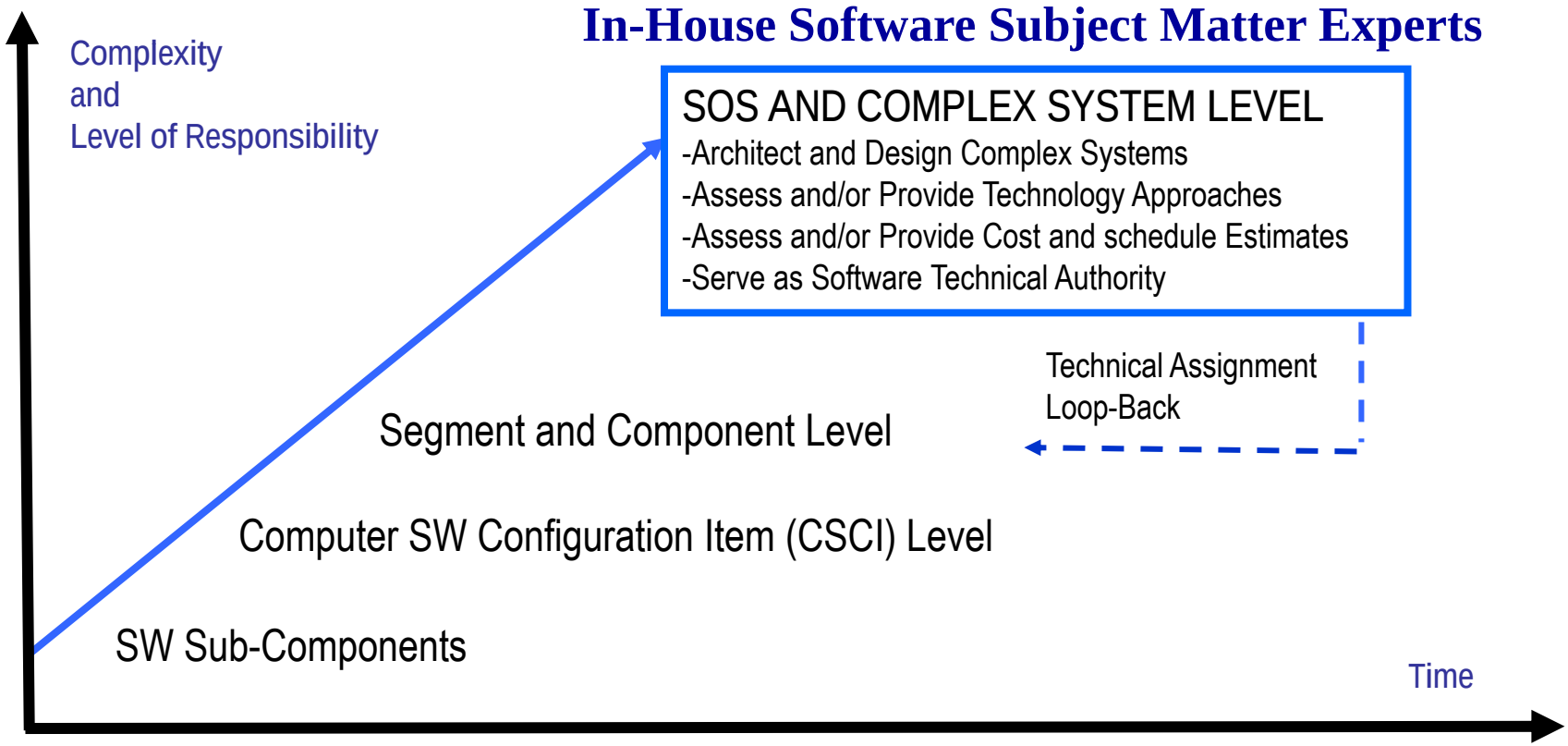
Success Example : Roles and responsibilities



Future State Challenge
Maintaining Government Software Expertise

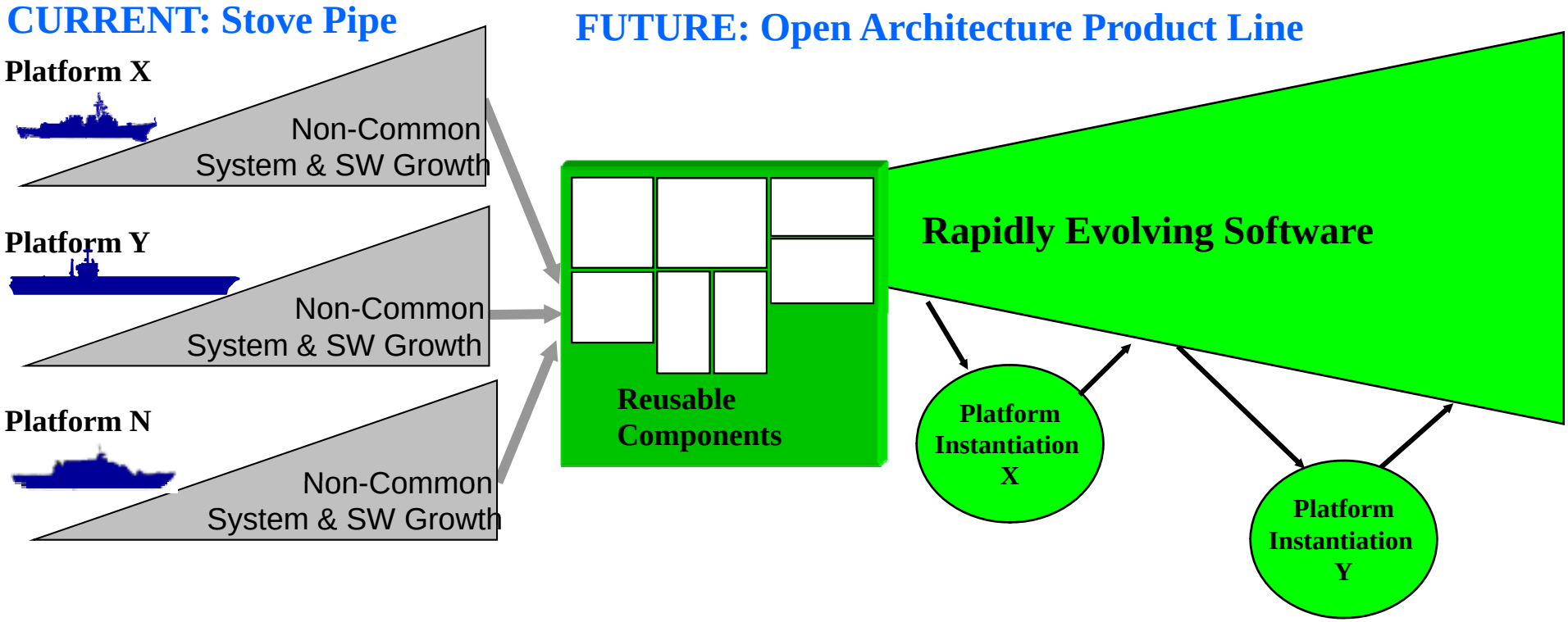
Gov't hands-on software development is required to:

- Maintain expertise with the latest software technologies
- Attract the best software engineers
- Serve as a smart buyer and successfully team with industry



Future State: Software Technical Challenges

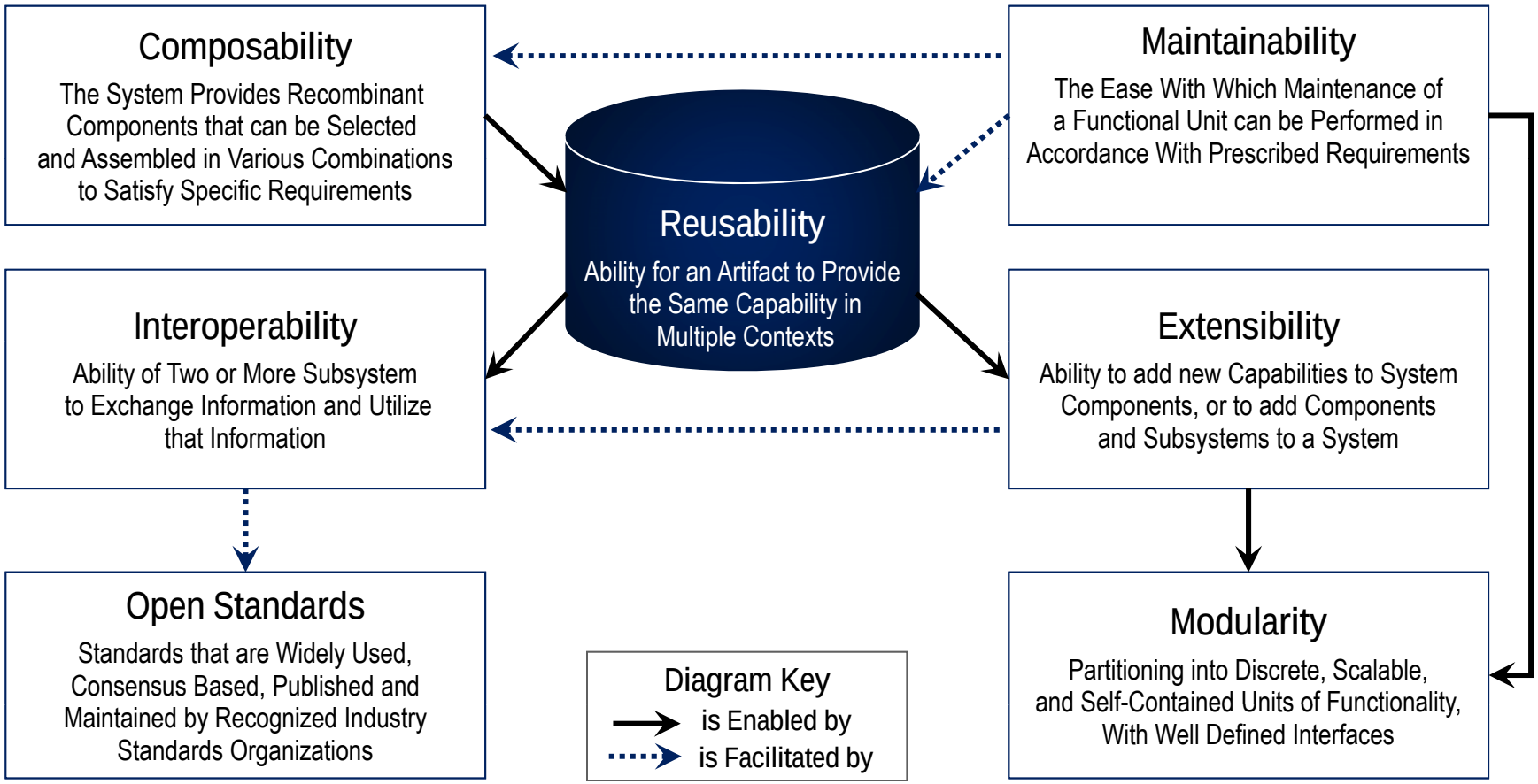
- Achieving Open Architected (OA) software
- Integrating rapidly evolving software technologies
- Integrating legacy and advanced software components
- Achieving Information Assurance
- Fully meeting functional requirements
- Maintaining corporate knowledge and control of the software components



Future State Challenge
Verifying Open Architecture (OA)

OA characteristics can not be easily verified by system testing

Applied SW expertise and insight into design/code is required to assess these characteristics



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