What's So Hard About Software Sustainment?

Moderator
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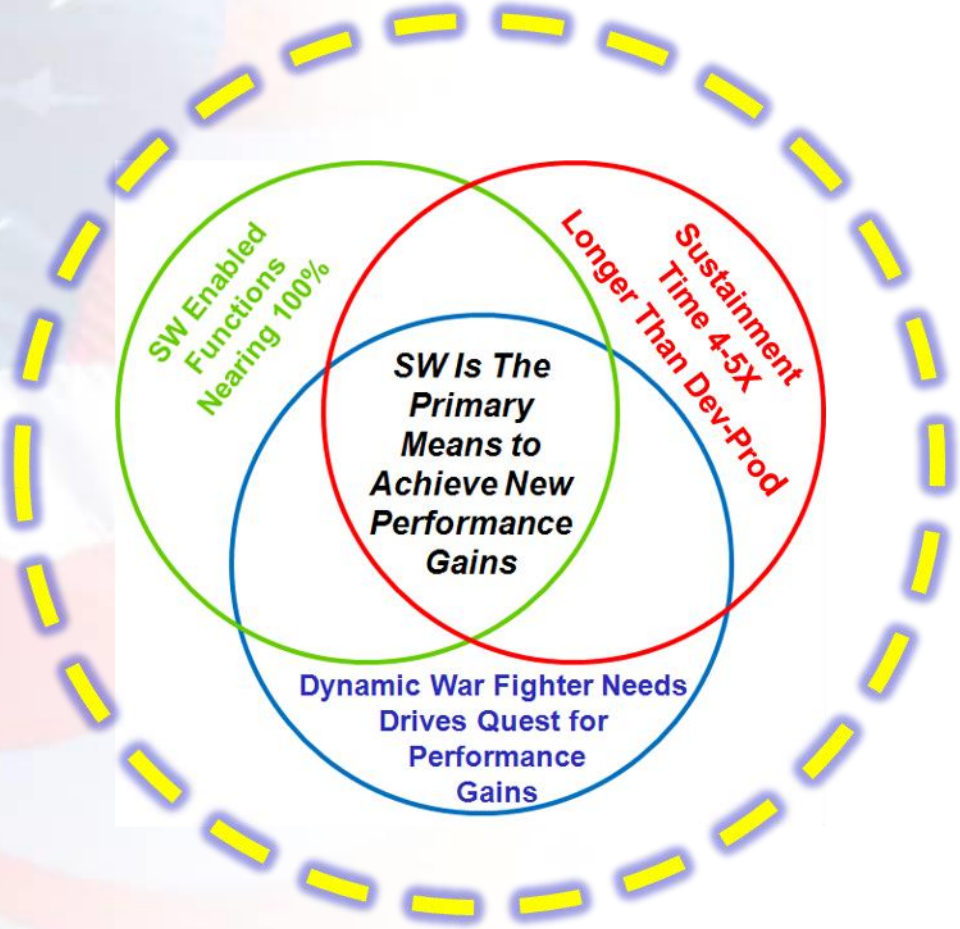
Our Goal Today
Begin a Conversation and Momentum

- **Advance understanding of the critical role and value of software across the life cycle**
- **Highlight the scope and complexity of the coming SW sustainment tsunami**
- **Focus on key DoD corporate challenges and issues to delivering agility (innovation) and affordable SW sustainment**
- **Raise senior level visibility of SW sustainment to become a DoD enterprise strategic management issue**



The Software (SW) Context

- **In midst of transformational change enabled by continual advances in computing, communication, and information technologies**

- **In the engineering of systems, SW is the principal building material enabling transformation**
  - **Architecture**
  - **Agility**
  - **Assurance**

- **Principal means for...**
  - **Delivering business value**
  - **Enabling competitive advantage to the war fighter**
  - **Continued enhancement of functionality and operational capability**

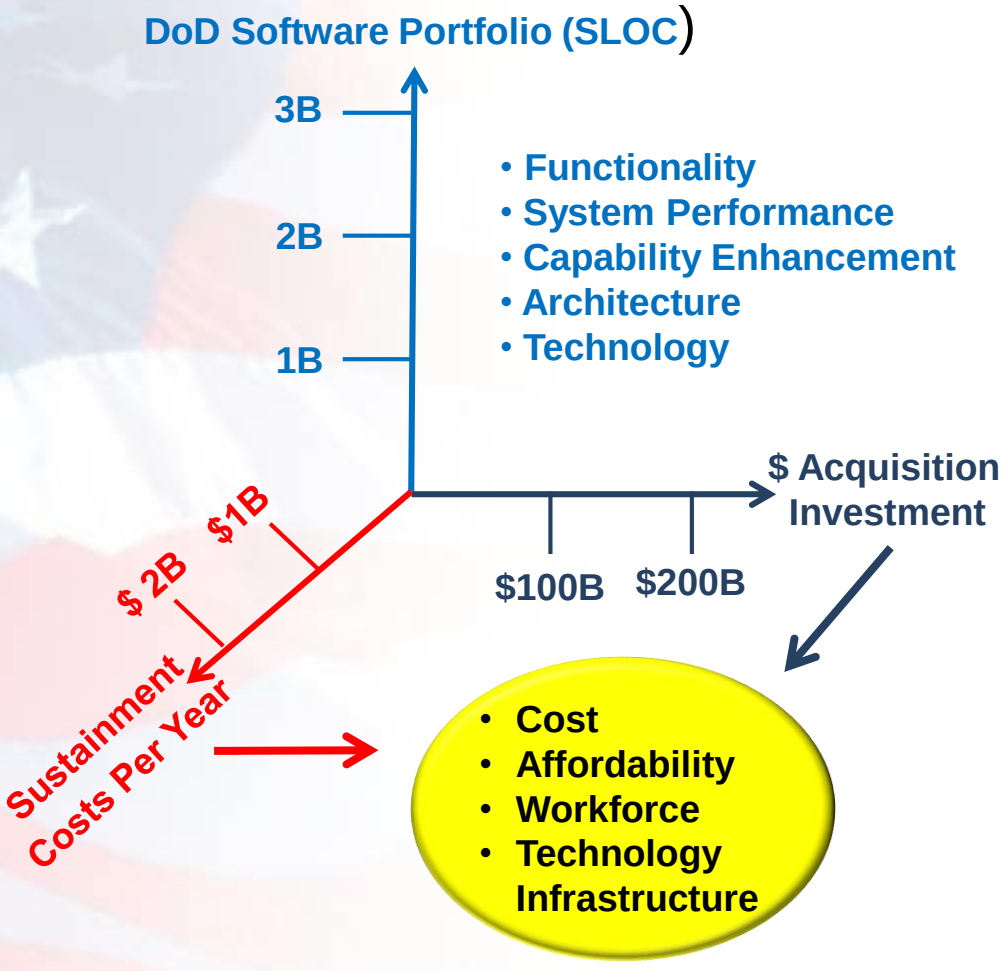
Characteristics of SW That Make It Hard "Just a Few"

- **All systems follow common path …reqmts, dev, test, production, fielding, O&S, enhancement, but…**
- **SW not bound by laws of physics like HW**
- **Not about maintenance but continuous engineering**
- **No plateau of capability in sight on what is possible thru SW**
- **Glue enables "connectedness" of systems**
- **Enables rapid innovation to deliver value**
- **Material of cybersecurity (offensive and defensive)**
- **COTS and the Supply Chain risks**
- **Demands for continuous infrastructure modernization (practice, tools, workforce)**
- **Pace of innovation constrained by policy**

…….

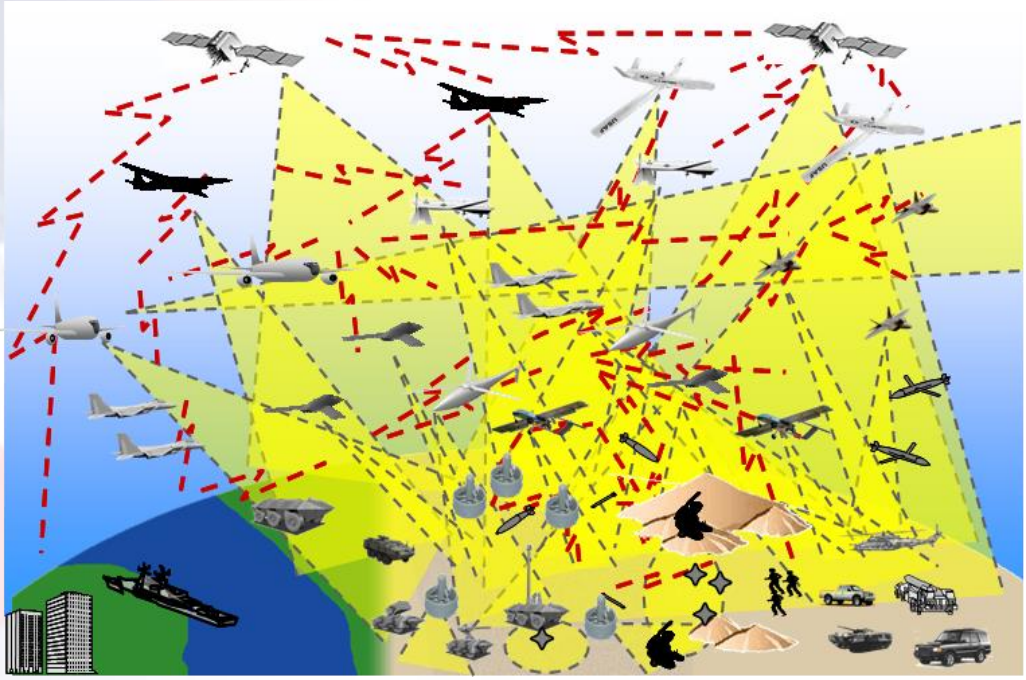
The Sustainment Environment

- SW: story of big #'s
- Size, characteristics (*the demographics*) of SW base not clear
- Impact of legacy + new functionality + new system SW cumulative
- <u>Accurate cost #'s & dynamics uncertain, but it is large #</u>
- Cost insensitive to optempo/force structure size
- Fixed cost infrastructure requiring continual re-investment/modernization
- Increasing impacts of assurance/cyber uncertain
- **Limited enterprise visibility to inform decision making - $, tech investment, programs**



Leadership Imperatives

- **Acquire & <u>sustain</u> software- reliant systems operating interdependently in a complex net-centric, cyber environment to achieve mission success continuously throughout systems' life cycles**
  - **All systems are nodes in a large scale information system**
  - **All systems are SW or controlled by SW by SW**



- **Create technical & program mgmt <u>capabilities</u> to affordably acquire and & <u>sustain</u> systems for their life cycles**

- **Plan & execute in a dynamic policy, governance, advancing technology, & $$$ constrained environment for <u>life cycle program success</u>**

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United States Senate

The Office of Senator Orrin G. Hatch (R-UT)

Software Sustainment

"What's So Hard About Software Sustainment?"

Doug Dynes
Military Legislative Assistant
Senator Orrin Hatch (R-UT)
18 November 2014

Statutory Requirements

- Title 10 U.S. Code
  - § 2460 - Definition of depot-level maintenance and repair
    - (a) In General.— In this chapter, the term “depot-level maintenance and repair” means (except as provided in subsection (b)) material maintenance or repair requiring the overhaul, upgrading, or rebuilding of parts, assemblies, or subassemblies, and the testing and reclamation of equipment as necessary, regardless of the source of funds for the maintenance or repair or the location at which the maintenance or repair is performed. The term includes
      - (1) **all aspects of software maintenance** classified by the Department of Defense as of July 1, 1995, as depot-level maintenance and repair, and
      - (2) interim contractor support or contractor logistics support (or any similar contractor support), to the extent that such support is for the performance of services described in the preceding sentence.
  - § 2464 - Core logistics capabilities
    - (a) Necessity for Core Logistics Capabilities.—
      - (1)It is essential for the national defense that the Department of Defense maintain a core logistics capability that is Government-owned and Government-operated (including Government personnel and Government-owned and Government-operated equipment and facilities) to ensure a **ready and controlled** source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements.

Challenges within the Bureaucracy

- Statutes are “specifically vague” on purpose
  - Statutes must be followed (law), regulations can be waived.
  - Regulations need to interpret the intent of the statute(s) and the means to comply with the statute(s).

- Questions the Department needs to define for Title 10 USC § 2460 and § 2464
  1. How do you “maintain” software and when does the maintenance begin?
  2. Is a statute change necessary, or can the intent of the statute be met through regulation (DoDIs, DoDDs, etc.)?
     - Can maintenance and sustainment be separated with respect to software?
     - Does software present a unique challenge on a weapon system by weapon system basis?
  3. What is meant by “ready and controlled” with relation to software?

- Congressional Concerns
  - Cost (follow the money)
  - Complexity – Integration (percentage of functionality controlled by software)
  - Multi-level security (positive control, deny access)

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Army and Software Sustainment

Susan L. Davis
Chief, Software Quality Division
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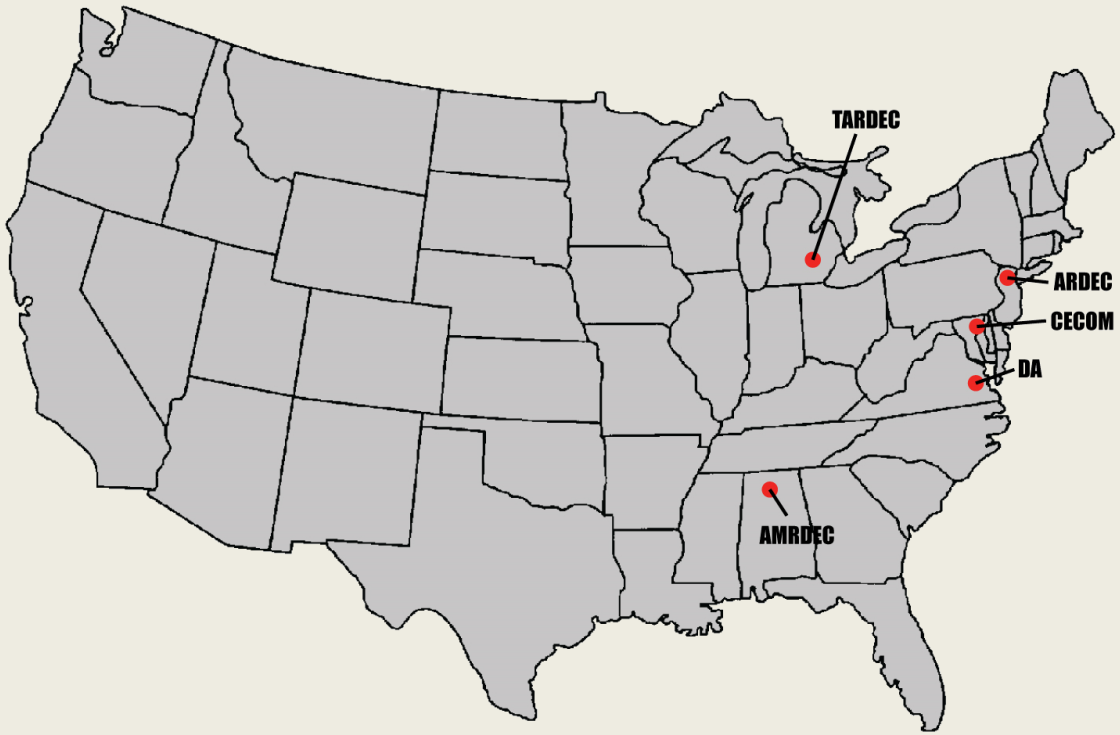
Army's Organic Software Capability

In the 1980's, the Army established Life Cycle Software Engineering Centers (LCSECs) to sustain its fielded systems.

The four Army LCSECs are located at
- Armament RDEC
- Aviation & Missile RDEC
- Tank & Automotive RDEC
- Communications-Electronics Command



Army's Life Cycle Software Engineering Centers

AMRDEC Software Engineering Directorate (SED)

- **30 years as an Army LCSEC.**
- **300 civilians, 3000+ contractors.**
- **>700K ft^2 government facilities (with >80 laboratories).**
- **Provides full spectrum of software engineering across the product life cycle.**
  - Computer Hardware & Software Technology
  - Software Verification and Validation
  - Software Safety & Flight Airworthiness Analysis
  - Interoperability Engineering and Test
  - Software Development
  - Software Intensive Systems Integration
  - Software Configuration Management
  - Software Quality Assurance
  - Information Assurance/Cyber Security
  - **Software Sustainment (less than 10% of efforts)**
  - Software Fielding

SED's operational business model provides low cost, high quality, government owned software products and solutions.

Software Depot Maintenance Challenges

- Smaller budgets with more systems to be sustained.
- Rapid acquisition that did not consider sustainment.
- Limited technical data due to acquisition streamlining activities.
- Neglecting software licensing during development contracting/negotiating.
- Increased use of commercial-off-the-shelf (COTS) software.
- Retrofitting systems with today's Information Assurance (IA) regulations.
- Affordable and available personnel with expertise in old/legacy computer languages and/or military systems.
- Facility, equipment and tools obsolescence.

Software Depot Maintenance Initiatives

- LCSECs Best Practice Forum
- Software License Virtual Inventory
- Software Common Operating Environment (COE)
- Future Airborne Capabilities Environment (FACE)

Air Force Sustainment Center

What's So Hard About Software Sustainment?

November 18, 2014

Generating airpower and achieving "Art of the Possible"

Keep 'em flying … it's what we do!

Software Sustainment

- **Industry focused on technology infusion and innovation**
- **Air Force focused on sustainment**
  - **But nature of software requires early involvement**
  - **AFSC has a large, highly skilled technical workforce regularly producing on-time, on-budget defect free software**
- **Value Proposition – AFSC & Industry Partnership**
  - **Early involvement of organic resources during system acquisition**
  - **System integration labs utilized by both industry and organic resources**
  - **Organic resources involved in system architecture**
  - **Supports a strong public and private Defense Industrial Base**

AFSC Software Sustainment

- **AFSC has invested significantly in software sustainment capability**
  - **AFSC is the AF's Supporting Command for Readiness**
  - **Supporting obsolete weapon systems in addition to today's systems**
- **Cost-Effective Sustainment**
  - **Early AFSC involvement in sustainment can drive significant cost savings and ensure decades of readiness**

AFSC Investment/Involvement/Partnering

AFSC S/W Personnel involved in three distinct ways to ensure low risk cost-effective transition

Benefits

- Develops relationship between OEM and organic resources
- Seeds future sustainment team
- Enhances organic familiarization with architecture
- Reduces transition risk and cost

- Source selection thru FOC
- Data rights input
- Design reviews
- IV&V, DT/OT

- On-site with prime/suppliers during EMD
- Integrated with contractor team
- Sustainment involvement in system architecture decisions

- Ensures seamless transition
- Facility, lab, & Software Development Environment planning
- Personnel (capacity & capability)

Why AFSC Software?

- **Establishing AFSC organic sustainment capability**
  - **Understand initial investment to establish capability**
  - **Manage perceived technical risk**
- **Industry concerned about long-term revenue stream**
  - **Define public/private roles early in program acquisition**
  - **Cost-effective sustainment frees up dollars for new procurements**
- **Achieve Art of the Possible results so we can fight and win the next war!**

We are AFSC

Administrative support provided by SAE International under contract with the U.S. Department of Defense

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November 2014

LOCKHEED MARTIN

Jeff Morris
Vice President, Programs
Lockheed Martin Corporation
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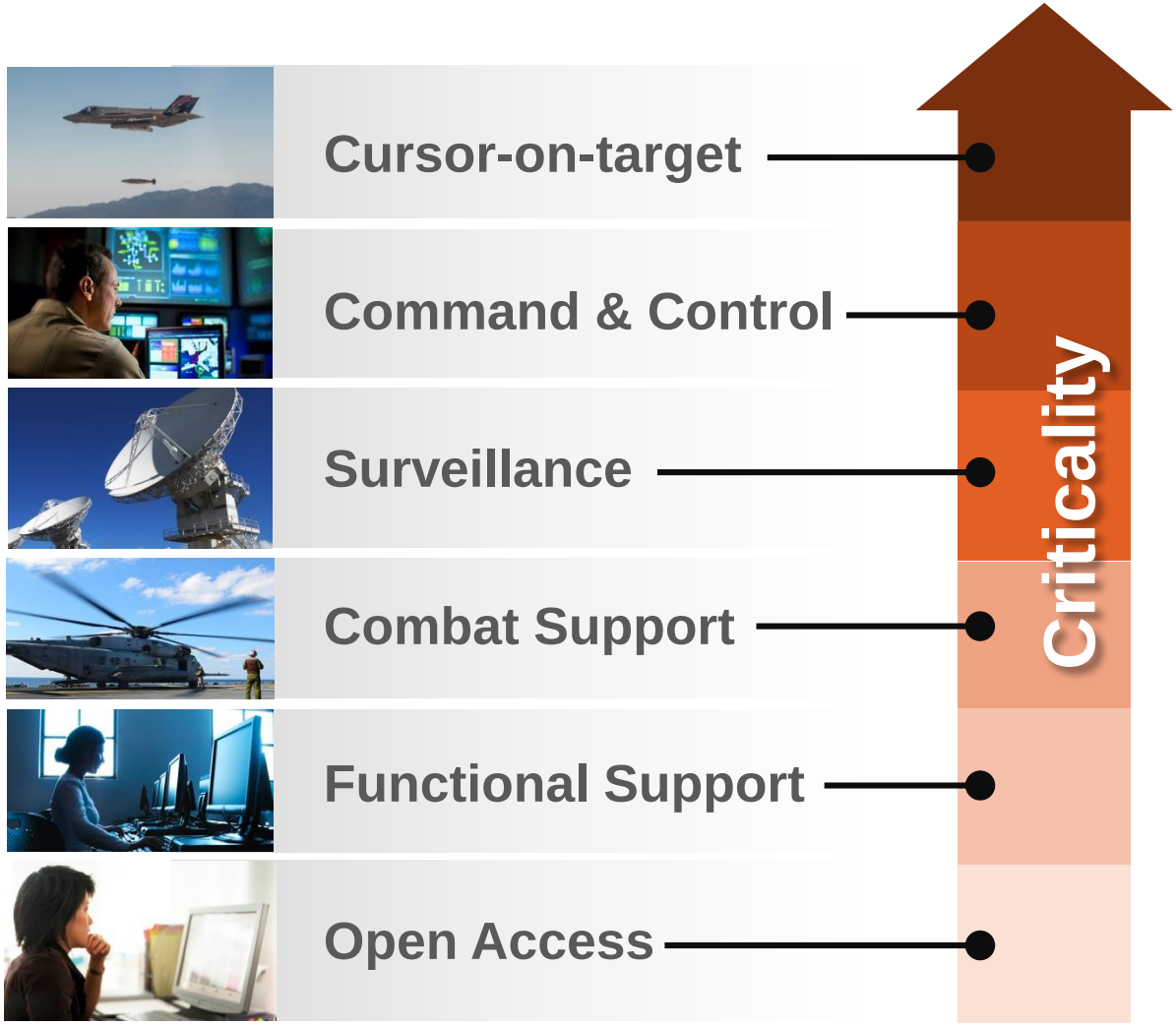
Mission



Software Spans Mission Critical Operations

Software

Reusable

Embedded

Widespread

Autonomous

Inter-dependent

Shared, Replicated, Multiple Copies…

Difficult to Access, Real time, Hidden…

Displays, Controllers, Actuators…

No Human, Layers, Navigation…

Interfaces, Responses, C2…

Software Maintenance is Complex & Expanding

Industry Challenges

Supply Chain

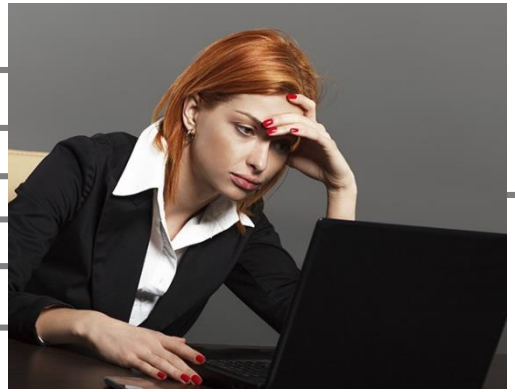
COTS Products

USG In-Sourcing

Evolving Missions

Knowledge Continuity

USG Contracting Models



Affordable Software Sustainment

Industry Must Constantly Adapt

Considerations

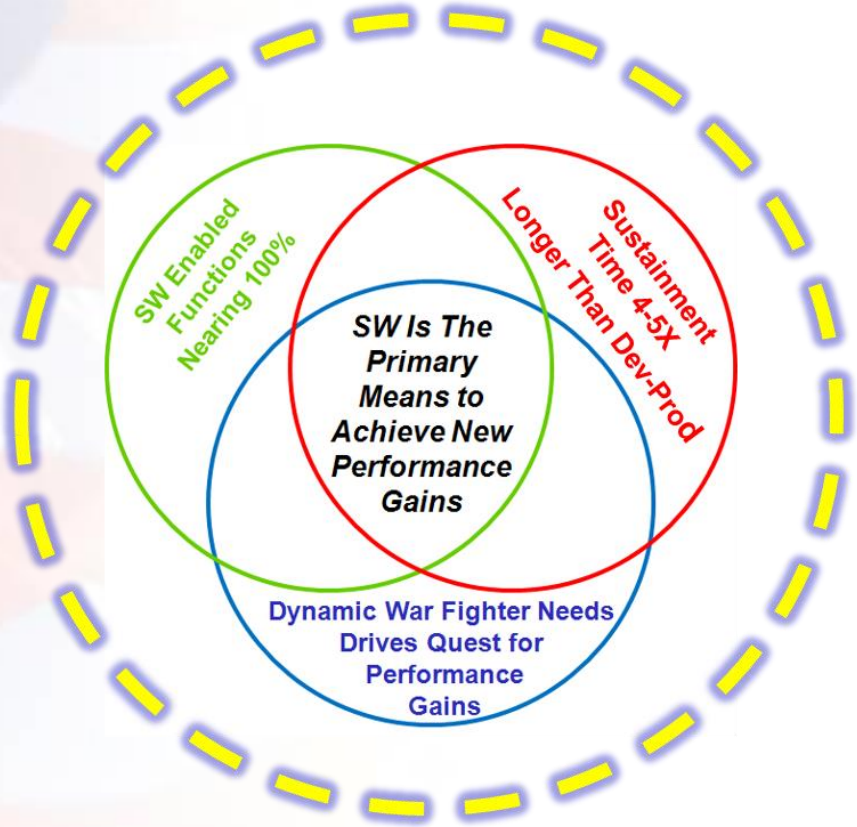
- Should software maintenance policy differ between **mission critical** and non-critical code?
- Does historical **hardware depot maintenance** policy pertain to software?
- Do we have the right **business model** to continually achieve better levels of performance?
- Are there ways to **ensure continuity** of skills over decades?

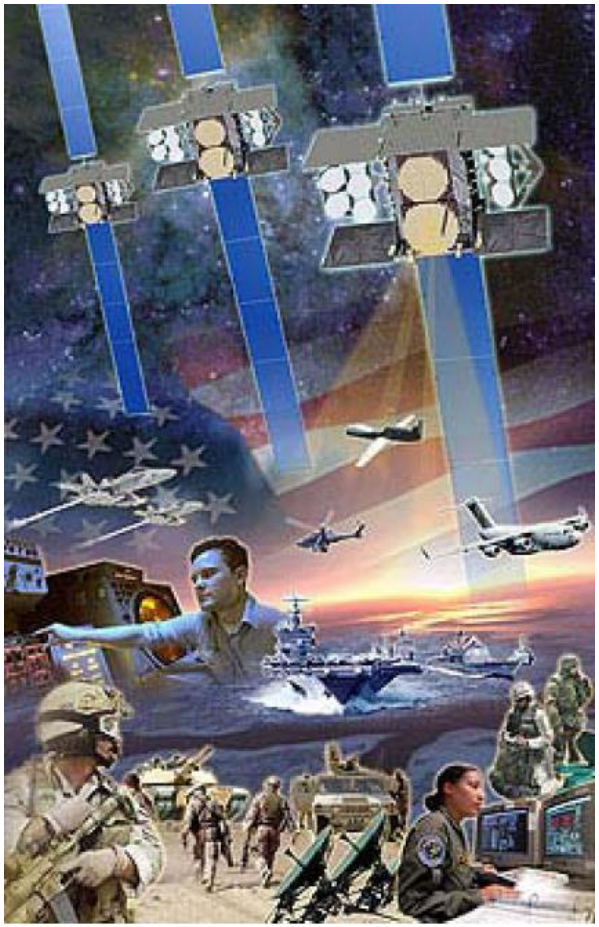
Together We Can Shape the Future

QUESTIONS ?

Bottom Line About SW Sustainment

- Software - foundational to delivering warfighter capability
- Does not follow laws of physics that bound hardware design & failure
- Sustainment is about SW engineering; not maintenance
  - Continuous; spanning decades
  - Confounded by net-centric & cyber environment
- Increasing, unrecognized bow wave of demands (of unknown size, complexity, characteristics, technical debt)
- SW sustainment nests in unaffordable Q&S trends posing major constraints to DoD



Summary Thoughts

- New start pace will slow; impact of legacy + new legacy functionality + new systems in pipeline creates software sustainment tsunami
- Leverage SW sustainment infrastructure to create opportunities to enhance affordability to deliver greater value to address demands
- Change the SW sustainment paradigm; shift to proactive & holistic corporate SW sustainment paradigm
- Create & execute corporate software sustainment policy, program, resource, research, & practice framework to enable senior level decision making