Overview of Department of Defense (DoD) Software Engineering Initiatives

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Elements of a DoD Strategy for Software Engineering

- **Support Acquisition Success**
  - Ensure effective and efficient software solutions across the acquisition spectrum of systems, SoS and capability portfolios
- **Improve the State-of-the-Practice of Software Engineering**
  - Advocate and lead software initiatives to improve the state-of-the-practices through transition of tools, techniques, etc.
- **Leadership, Outreach and Advocacy**
  - Implement at Department and National levels, a strategic plan for meeting Defense software requirements
- **Foster Software Resources to meet DoD needs**
  - Enable the US and global capability to meet Department software needs, in an assured and responsive manner

Promote World-Class Leadership for Defense Software Engineering

NDIA Top Software Issues September 2006

1. The impact of requirements upon software is not consistently quantified and managed in development or sustainment. **“SW Requirements”**
2. Fundamental system engineering decisions are made without full participation of software engineering. **“SE/SW Integration”**
3. Software life-cycle planning and management by acquirers and suppliers is ineffective. **“SW Sustainment”**
4. The quantity and quality of software engineering expertise is insufficient to meet the demands of government and defense industry. **“Human Capital”**
5. Traditional software verification techniques are costly and ineffective for dealing with the scale and complexity of modern systems. **“SW Testing”**
6. There is a failure to assure correct, predictable, safe, secure execution of complex software in distributed environments. **“SW Assurance”**
7. Inadequate attention is given to total lifecycle issues for COTS/NDI impacts on lifecycle cost and risk. **“SW COTS / NDI / Reuse”**

Top Software Issues - 2006 vs. Software Systemic Findings - 2008

National Defense Industrial Association (NDIA)
Top 7 Software Issues
September 2006

- Software Human Capital
- Software Requirements
- Systems/Software Integration
- Software Assurance
- Software Testing
- Software Sustainment
- Software COTS/NDI

ODDRE/SE Systemic Analysis of
Program Support Review Findings

- **Software Human Capital**
  - Resources
  - Quality Level
- **Software Requirements**
  - Engineering
  - Management
  - Acquisition Strategy
- **Systems/Software Integration**
  - Systems of Systems
  - Interoperability
  - Tech Refresh
- **Software Assurance**
- **Software Development**
  - Software Testing*
  - Software Sustainment/Maintenance*
  - Software COTS/NDI*
  - Technology Readiness
  - Software Architecture
- **Software Metrics**
  - Software Metrics
  - EVM
- **Software Engineering Management**
  - Project Planning
  - Management Oversight
  - Software Configuration Management
- **Knowledge Sharing**
  - Process
  - Reporting

Current Software Engineering Initiatives

- **Program Support**
  - Provide software support for acquisition program reviews. Develop independent schedule and defect estimates.
- **Human Capital**
  - Software Acquisition Training and Education Workgroup: Establish SW competencies across the acquisition career fields
  - Reference Curriculum for Graduate Study of Software Engineering: Version 1.0 completed this month, to be sustained by IEEE and ACM.
- **Advance the State of the Practice**
  - Software Sustainment, NDIA Software T&E Summit/Workshop
- **Policy and Guidance**
  - Earned Value Management, Military Handbook for Work Breakdown Structures: MIL-HDBK-881.
  - Oversight of Services' SW Acquisition Process Improvement Programs.

Notional Example of Schedule Feasibility Analysis

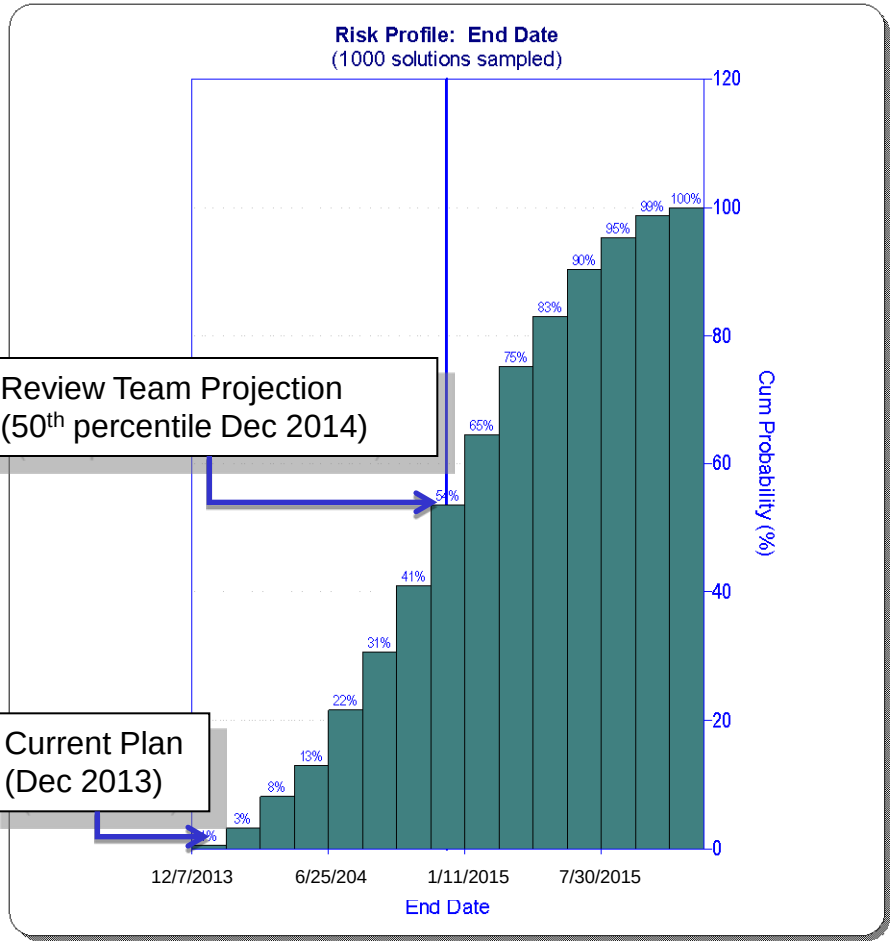
Current Plan (Dec 2013)

Review Team Projection (50th percentile - Dec 2014)

Risk Profile: End Date
(1000 solutions sampled)

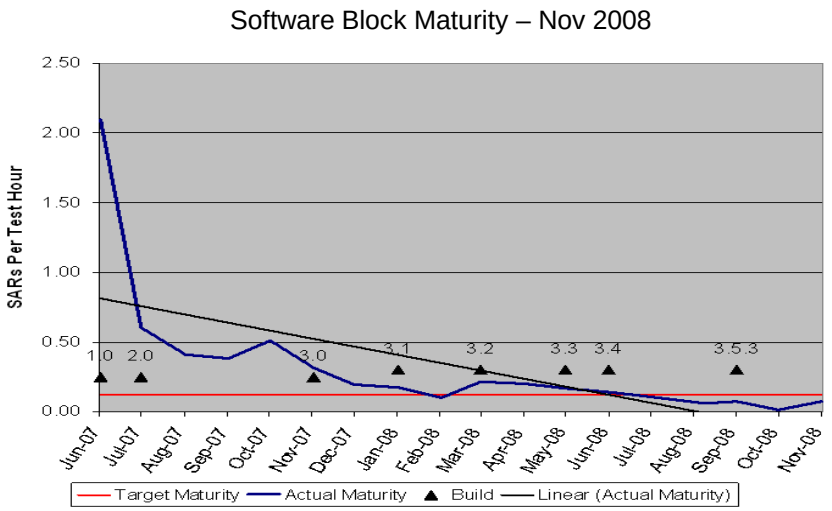
End Date	Cum Probability (%)
1/26/2014	1
3/17/2014	3
5/6/2014	8
6/25/2014	13
8/14/2014	22
10/3/2014	31
11/22/2014	41
1/11/2015	54
3/2/2015	65
4/21/2015	75
6/10/2015	83
7/30/2015	90
9/18/2015	95
11/7/2015	99
12/27/2015	100

Likelihood of delivery to current schedule: less than 1%



Software and Systems Reliability

- **DoD has renewed emphasis on systems reliability and lifecycle costs of shortfalls**
  - DDRE effort underway to consolidate software reliability guidance
- **Starting to use parametric models to project numbers of latent software defects and discovery rates**
  - Used to support:
  - Development of satellite launch plans
  - Aircraft production decisions
  - Operational test readiness reviews
- **Gauging software reliability using Mean Time to Defect (MTTD) discovery**



System Testing DRs / Test Hr
(DT events to IOT&E)

Software Human Capital Efforts

Software Industrial Base Study – July 2007
There is a choke-point in availability of top-tier software managers, architects, and domain experts.
Supply of sufficiently trained SW developers is inadequate near-term.

- **Software Acquisition Training and Education (SATEWG)**
  - Chartered February 2008 by USD(AT&L) to add software competencies to DoD's 13 acquisition career fields
  - Recent accomplishments:
    - Developed software competency framework,
    - Established SPRDE software competencies
    - Gap analysis of SATEWG competency framework and DAU's Software Acquisition Management courses
    - Current focus is on PM, Contracting and Test career fields
- **Graduate Software Engineering Reference Curriculum (GSwERC)**
  - Partnership with Industry and Academia
  - Version 1.0 completed September 2009
  - Transitioned to IEEE and ACM for sustainment

Software Sustainment Challenges

- **Software intensive systems encourage*:**
  - Build-a-little, test-a-little, field-a-little risk reduction
  - Incremental and spiral development efforts
  - Concurrent planning, development and sustainment activities
- **No longer a natural 'break point' where software development can be transitioned to a sustainment organization**
  - Technical capability of Government sustainment organizations reduced due to acquisition reform
- **Planning for software sustainment now a lost art**
  - Acquisition programs no longer produce MIL-HDBK-347 Computer Resource Life Cycle Management Plans

Better planning needed to partition software work among multiple developers and increase competition

*AIAA Infotech Conference 2009, Software Sustainment Challenges in Defense Acquisition

NDIA Software Test and Evaluation Summit/Workshop – Sep 2009

- **Purpose: "Recommend policy and guidance changes to emphasize robust software T&E approaches in Defense acquisition."**
- **Speakers from Government, Industry and Academia**
- **Conducted workshops on:**
  - How much software T&E is enough
  - Software T&E involvement across the lifecycle
  - Emerging paradigms: SOA, SoS, Security
- **Workshops specifically addressed:**
  - Policy & guidance, Human capital, RFP language, SW T&E tools
- **NDIA Software Experts and DT&E sub-committee to produce white paper by December 2009**

Software Measurement and Analysis Improvement Areas

Determine better methods of obtaining cost estimating data

Generate software appropriate WBS

Find best Earned Value Management (EVM) practices for SW

Improve estimation tools, techniques, & practices

Link quality indicators to EVM

Concepts - Requirements - Arch/Design - Development - Maintenance

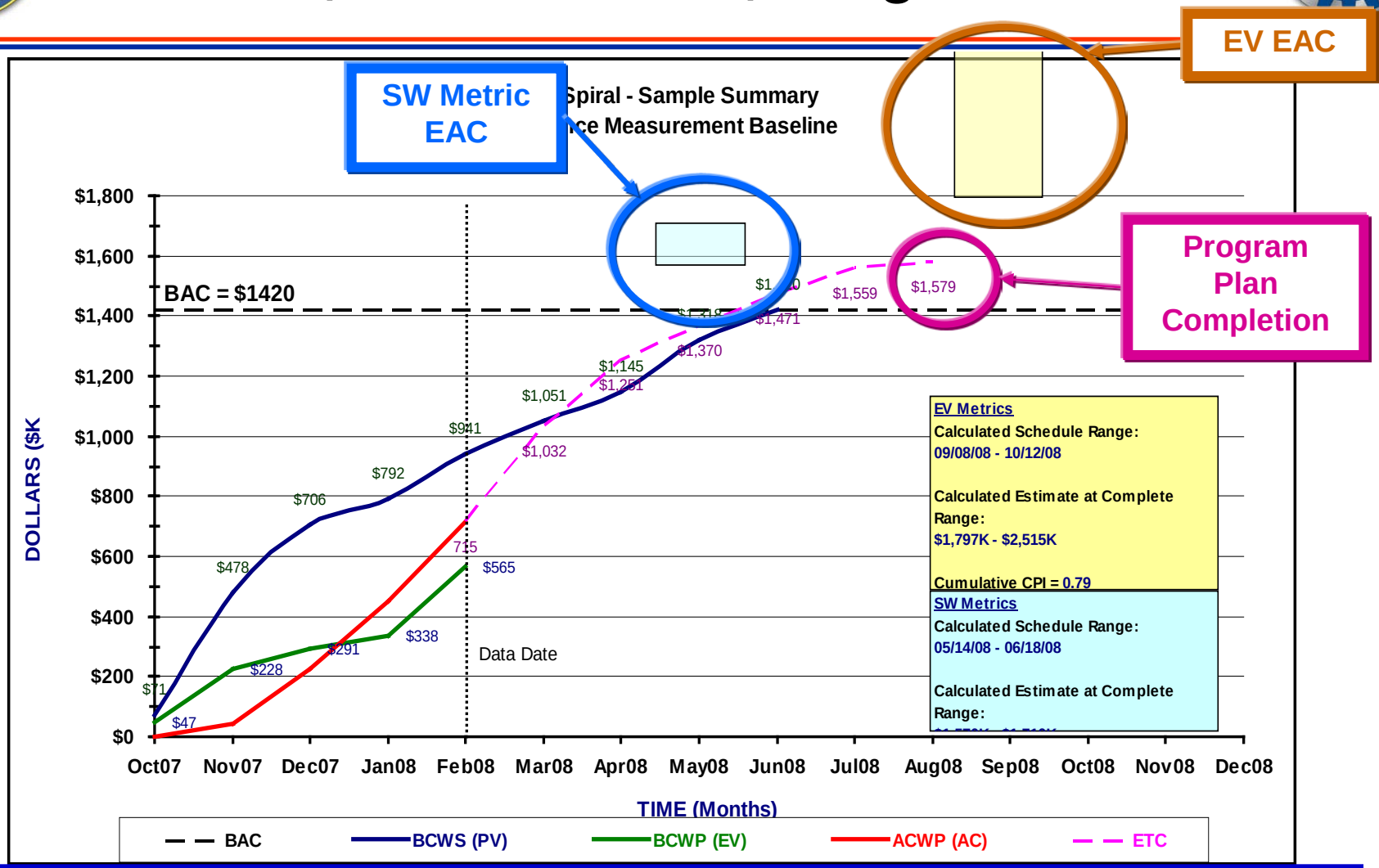
Integrate software guidance into proven management techniques

Software Earned Value Management (EVM) Study/Pilot

- **Develop methods to combine EVM and software metrics to predict cost and schedule overruns**
- **Piloted on a 5-year ACAT 1D software development program**
- **Pilot indicator shows estimate-at-completion (EAC) forecasts for:**
  - Existing program management plans
  - Milestone-based EVM measures
  - Software metrics, i.e, growth profile of size, effort, defects

Equivalent EAC forecasts provide an increased confidence in project plans

Estimates at Completion (EAC) for Metrics, Earned Value, Program Plans



Confidence increases as EACs overlap
Multiple measures reaching the same conclusion

Questions/Discussion

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