Achieving Effective Acquisition of Information Technology in the Department of Defense

Study Conducted by
Computer Science and Telecommunications Board
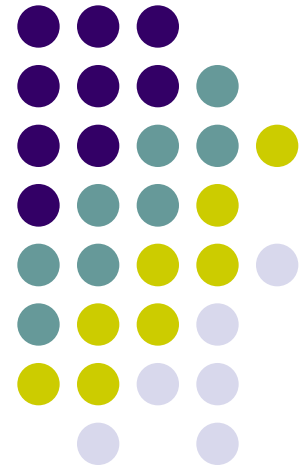National Research Council
Presented by
Dr Steven Kimmel
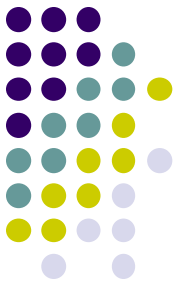Senior Vice President
Alion Science and Technology
to
NDIA 26th Annual T&E Conference
March 2, 2010

Background

The National Academies formed a Study Committee of experts from defense and commercial IT sectors and charged them to assess:

- <u>Legislative</u> requirements and <u>regulatory</u> processes governing IT systems acquisition in DOD
- <u>Commercial</u> IT acquisition best practices
- DOD's acquisition environment, <u>culture</u>, and barriers
- Concepts for systems engineering and testing in <u>virtual</u> environments

Committee on Improving Processes and Policies of the Acquisition, Tech, & Evaluation of IT in the DOD
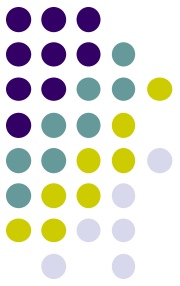
- William Campbell, *Co-Chair,* BAE Systems
- Dawn Meyerriecks, *Co-Chair,* Dawn Meyerriecks, LLC*
- Robert Behler, The MITRE Corporation
- Philip Coyle, World Security Institute
- Renato Dipentima, SRA International (ret.)
- John Gilligan, Gilligan Group, Inc.
- John Goodenough, Software Engineering Institute
- Paul Kern (NAE), The Cohen Group
- Steven Kimmel, Alion Science and Technology
- Deidre Lee, Professional Services Council
- Joshua Levine, ESP Technologies Corp.
- Nachiappan Nagappan, Microsoft Research
- Frank Perry, Science Applications International Corporation
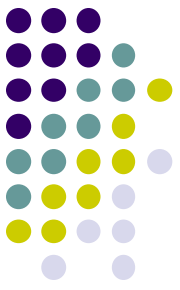- Vaho Rebassoo, The Boeing Company
- Daniel Sturman, Google Inc.

*Dawn Meyerriecks resigned from the committee in October, 2009, upon her appointment as Deputy Director of National Intelligence for Acquisition and Technology.
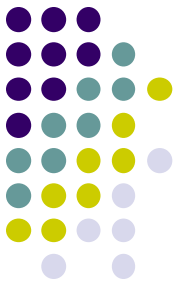
Agenda

- Study Scope

- Findings and Recommendations

- Closing Remarks

New Acquisition process
based on agile acquisition and
Iterative Incremental Development (IID) principles

Study Scope

- This study <u>focused</u> on IT systems that support the DOD <u>Information Enterprise</u>

- To align acquisition approaches with technical characteristics and risks, IT systems were categorized in this report as:

  - Software development and commercial-off-the-shelf integration (SDCI) programs

  - Commercial-off-the-shelf hardware, software, and services (CHSS) programs

- <u>Excluded</u> are the IT-based components embedded in <u>weapons systems</u> or DOD-specific hardware

Findings

and

Recommendations

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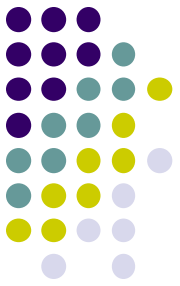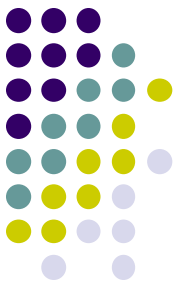
Major Findings

1. DOD systems acquisition policies, expertise, practice, and culture reflect the norms associated with large weapon systems programs

2. Weapon system acquisition processes are often applied to IT systems acquisition, without addressing unique aspects of IT

3. Dollar thresholds for assigning oversight levels on IT programs are much lower than for weapons system oversight -- a disparity that subjects too many IT programs to OSD-level oversight rather than delegation to lower levels that are more agile

4. DOD acquisition, budgeting, and requirements processes are being inappropriately applied to relatively low-dollar IT programs

5. IT program requirements are often written with overly detailed specifications that are inconsistent with the pace of technological change and need for rapid delivery of end-user capabilities
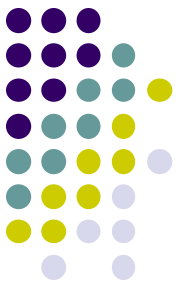
Major Findings (continued)

6. The "waterfall" process used for large IT programs is too document-intensive, time-consuming, and process-bound to respond effectively to end user needs

7. Although program tailoring is an option, DOD has no established best practice for tailoring and it is seldom used

8. The DOD acquisition training curriculum does not adequately address IT system acquisition or facilitate adoption of applicable commercial methods, processes, products, and services

9. DOD is unable to keep pace with the rate of IT innovation in the commercial marketplace, cannot fully capitalize on IT-based opportunities, and seldom delivers IT-based capabilities rapidly

10. With the exception of IT purchased via vehicles like Enterprise Software Initiative contracts, COTS technologies are insufficiently leveraged, excessively tailored, inefficiently tested, and delayed

Major Findings (continued)

11. Absent discipline and end-user advocacy, large acquisition oversight bodies can give undue leverage to low-value-added process requirements or "corner case" desires of any participant, which disproportionately impacts on program cost and schedule

12. **Testing is integrated too late and serially in current DOD IT systems acquisition practices with testing in realistic operational environments deferred until the mandated operational test**

13. **Without regular feedback from a user perspective on IT system development, insight necessary to manage and oversee such programs is inadequate**

14. **The acquisition community has been reluctant to embrace virtualized testing and overtly precluded from re-using or accessing operationally-relevant test data and environments**

Major Findings (continued)

15. **To more rapidly deliver software capability, the commercial world has widely embraced the iterative, incremental, development (IID) approach which deals with complexity and features:**

- **The prominence of the end user's voice**
- **A focus on big R requirements—a concise description of the purpose, mission, and expected outcome of an IT systems acquisition—during early planning**
- **Close integration of developmental and operational test and evaluation into the development cycle**
- **Breaking down a project into incrementally deliverable increments**
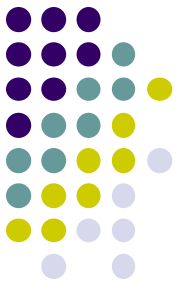
Recommendations

1. Adopt a new acquisition process tailored for IT systems

2. Adopt an iterative, incremental approach for acquiring IT systems

3. Perform continuous testing, with early involvement from end users, in acquiring IT systems

Recommendations (continued)
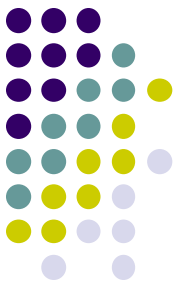
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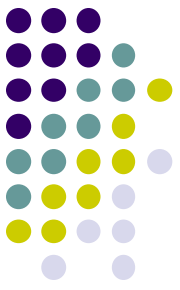
3-1   Adopt continuous testing in IT systems development, and insist on the use of metrics, especially emphasizing measures of end-user satisfaction

3-2   The Acceptance Team should play a lead role in recommending deployment decisions

3-3 Test with users in their actual work or field environment (sometimes referred to as a Beta deployment)

3-4 Accept certification and functional IT system component test results across organizational boundaries

3-5 Use virtual test environments to support both continuous feedback and certification of operationally suitable and effective solution increments
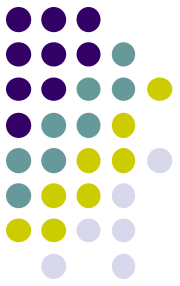
Concluding Remarks

- The imperative—and opportunity—for change has never been more obvious. To fully leverage the potential of IT, it is essential that DOD not simply alter a process that has repeatedly failed.

- Instead, it should shift from deliberate application of the weapons system acquisition process to IT programs to a new process tailored specifically to IT system acquisition.

- Full commitment to this change will touch every aspect of the culture, the processes, and the people.

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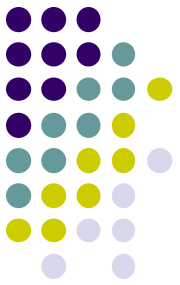
The Final Study Report

- Report available at www.cstb.org
  - Prepub currently available as download
  - Final edited edition available for download and printed books available for purchase March. 2010
- Contact Jon Eisenberg, CSTB Director
  - jeisenbe@nas.edu
  - 202-664-1235

Back-up Study Details

Recommendations

1. Adopt a new acquisition process tailored for IT systems

1-1 Emphasize timeliness and end user mission success in the IT acquisition culture rather than rigid oversight and process compliance

1-2 State IT systems requirements as top-level mission expectations (that is, "big R") rather than as detailed processes or technical solutions; develop the details ("small r") by iterative refinement with users

1-3 Leverage flexibilities within IT acquisition funding to achieve speed and agility in the new acquisition process

1-4 Provide IT systems acquisition professionals with education in modern IT systems and establish minimum competency standards
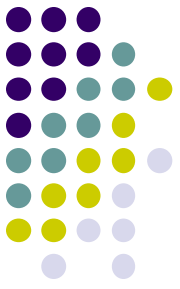
1-5 Use pilot programs to rapidly implement these recommendations

1-6 Propose legislative and regulatory changes to

(1) codify a new agile process for acquiring IT systems and

(2) revise dollar thresholds for IT system acquisition oversight to foster decentralization

Recommendations (continued)

2. Adopt an iterative, incremental approach for acquiring IT systems

2-1   Establish iterative, incremental development (IID) based on agile software development and related approaches as the default

2-2   Allocate top-level mission expectations (i.e., big R requirements) across increments and use each increment to define and satisfy detailed requirements (i.e., little r requirements)

2-3   Establish separate and distinct strategies and processes for acquiring custom versus off-the-shelf IT systems

2-4   Establish, employ, and report measures of success that emphasize the end user experience, including timeliness to field

2-5   Provide a stable budget profile for IID IT programs across multiple increments
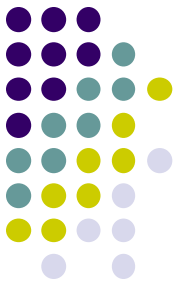
# Iterative Incremental Development (IID) & Agile Acquisition Processes

Iterative Incremental Development (IID)

- Long history of success using IID dating to 1950s in hardware and 1970s in software
    - Trident, LAMPS, Space Shuttle avionics, CCPDS-R, Canadian ATC
- More than 20 year history of recommendations to abandon waterfall and adopt IID
    - 1987 DSB Task Force on Military Software, Brooks et al.
    - 1994 DSB on Acquiring Defense Software Commercially
    - 2000 DSB Task Force on Defense Software
    - 2009 DSB Acquisition of Information Technology
- Yet Defense IT Acquisition remains dominated by waterfall thinking
- IID is fundamentally a communications & learning process that addresses two key issues:
    - Difficulty in specifying detailed requirements up front
    - Complexity in software systems

the mythical man-month
Essays on Software Engineering

Frederick P. Brooks, Jr.
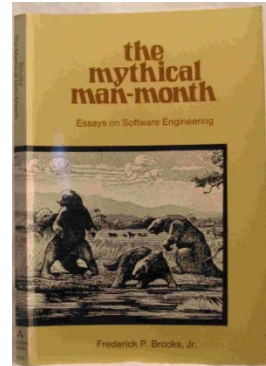
Agile Acquisition Characteristics
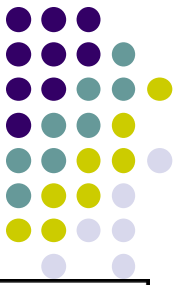
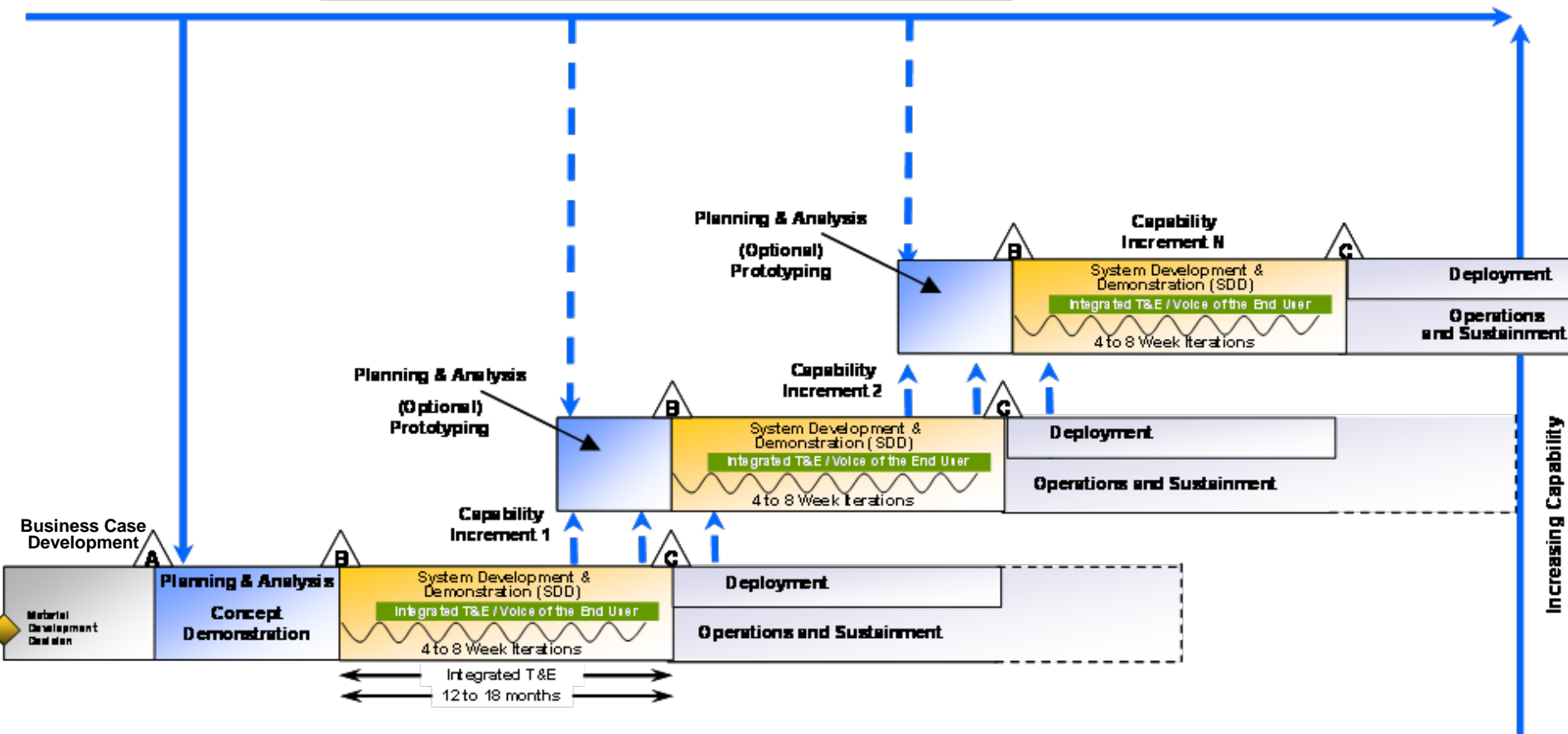| Characteristic	Comments
Liberty to be dynamic	Agility needs dynamic processes while adhering to acquisition milestones.
Non-linear, cyclical and non-sequential	The life-cycle behavior was not like traditional waterfall models or linear frameworks; decreasing cycle times.
Adaptive	Conform to changes, such as capability and environment.
Simultaneous development of phase components	Rapid fielding time may not lend to traditional phase containment (i.e., training and software development together).
Ease of change	Culture shift to support change neutrality; ease of modification built into architecture and design.
Short iterations	Prototyping, demonstrating, and testing can be done in short iterative cycles with a tight user feedback loop.
Lightweight phase attributes	Heavy process reduction, such as milestone reviewers, demonstrations, and risk management.

Emergent Agile characteristics Source: P. Crowe and Robert Clouter. "Evolutionary Capabilities Developed and Fielded in Nine Months" in CrossTalk. Available at http://www.stsc.hill.af.mil/crosstalk/2009/05/0905CroweCloutier.html

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Recommended Approach for SDCI IT System Acquisition

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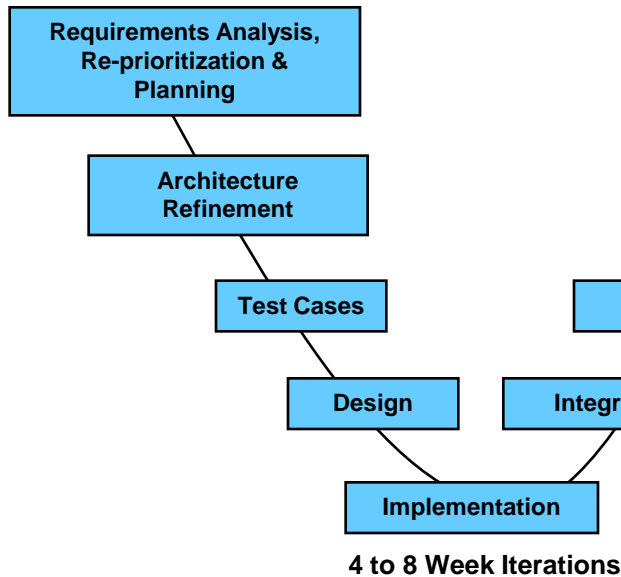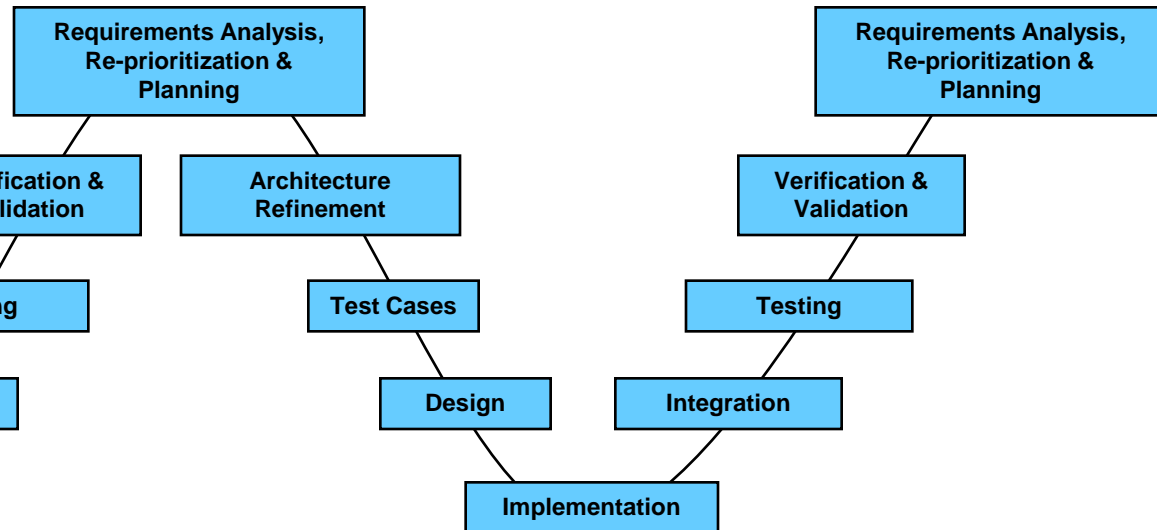Advisers to the Nation on Science, Engineering, and Medicine

Time-boxed Iterations Within Each Capability Increment
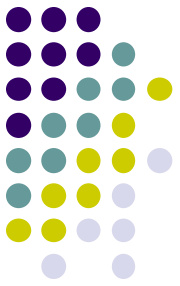
System Development & Demonstration (SDD)

Integrated T&E / Voice of the End User

Requirements Analysis, Re-prioritization & Planning

Architecture Refinement

Test Cases

Design

Integration

Testing

Verification & Validation

Requirements Analysis, Re-prioritization & Planning

Implementation

4 to 8 Week Iterations

Requirements Analysis, Re-prioritization & Planning

Architecture Refinement

Test Cases

Design

Integration

Testing

Verification & Validation

Requirements Analysis, Re-prioritization & Planning

Implementation

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Recommended Approach for CHSS IT System acquisition

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