Agile Systems Engineering: Acquisition Game Changer

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DoD Acquisition Engineering Challenges

1. **Increasingly, urgent demands of the warfighter are requiring effective capabilities to be fielded more rapidly than conventional acquisition processes and development methodologies allow.**

2. **The quantity and quality of Systems Engineering expertise is insufficient to meet the demands of the government and defense industry.**

3. **Systems engineering practices known to be effective are not consistently applied or properly resourced to enable early system definition.**

4. **Technical decision makers do not have the right information or insight at the right time to support informed & proactive decision making to ensure effective and efficient program planning, management & execution.**

5. **The development of systems with a full level of integrity (all technical aspects considered) is longer and more expensive over the entire lifecycle as the technical solution is iterated and reworked in later stages of the development.**

Source: *NDIA Systems Engineering Division Task Group Report, May 2011*

Agile Software Processes Are Mature

- **Agile software development has been in practice more than 10 years[1]**

- **There are 11 well-known agile software development methods[2] currently in use**

- **Major DoD acquisitions with large software content now specify or allow agile software development[3]**

- **SEI Agile Collaboration Working Group is mapping agile acquisition strategy with DoD and industry participation[4,5]**

1: *Agile Software Manifesto for Agile Software Development, Feb 11-13, 2001*
2: Agile Alliance*, http://guide.agilealliance.org/*
3: Northern, Mayfield, Benito, Casagni, *Handbook for Implementing Agile in Department of Defense Information Technology Acquisition,* Mitre Corporation, Dec 2010
4: Lapham, Williams, Hammons, Burton, Schenker, *Considerations for Using Agile in DoD Acquisition,* Software Engineering Institute, Apr 2010
5: Lapham, Miller, Adams, Brown, Hackemack, Hammons, Levine, Schenker, *Agile Methods: Selected DoD Management and Acquisition Concerns,* Software Engineering Institute, Oct 2011

What is Scrum?

- **An Agile software project management methodology that focuses on delivering high quality capability and value at a rapid pace**

- **A Scrum project operates as a series of short iterations and releases**
  - **Every 2-4 weeks produces an increment of potential functionality, where decisions are made to release it as is, or continue to enhance it during another iteration**
  - **Teams are fully empowered and self-organized to determine the best way to build and deliver the highest priority features**

- **Stakeholders, primarily the Customer, sets development priorities**

- **Scrum is simple, straightforward, and efficient**
  - **Practices, artifacts, and rules are few and easy to learn**
  - **No complicated process descriptions**
  - **Planning is structured and occurs at the start of each iteration**
  - **Team is self-organized and self-managing**
  - **Product owner keeps the vision and ScrumMaster guides the team**

Scrum Framework
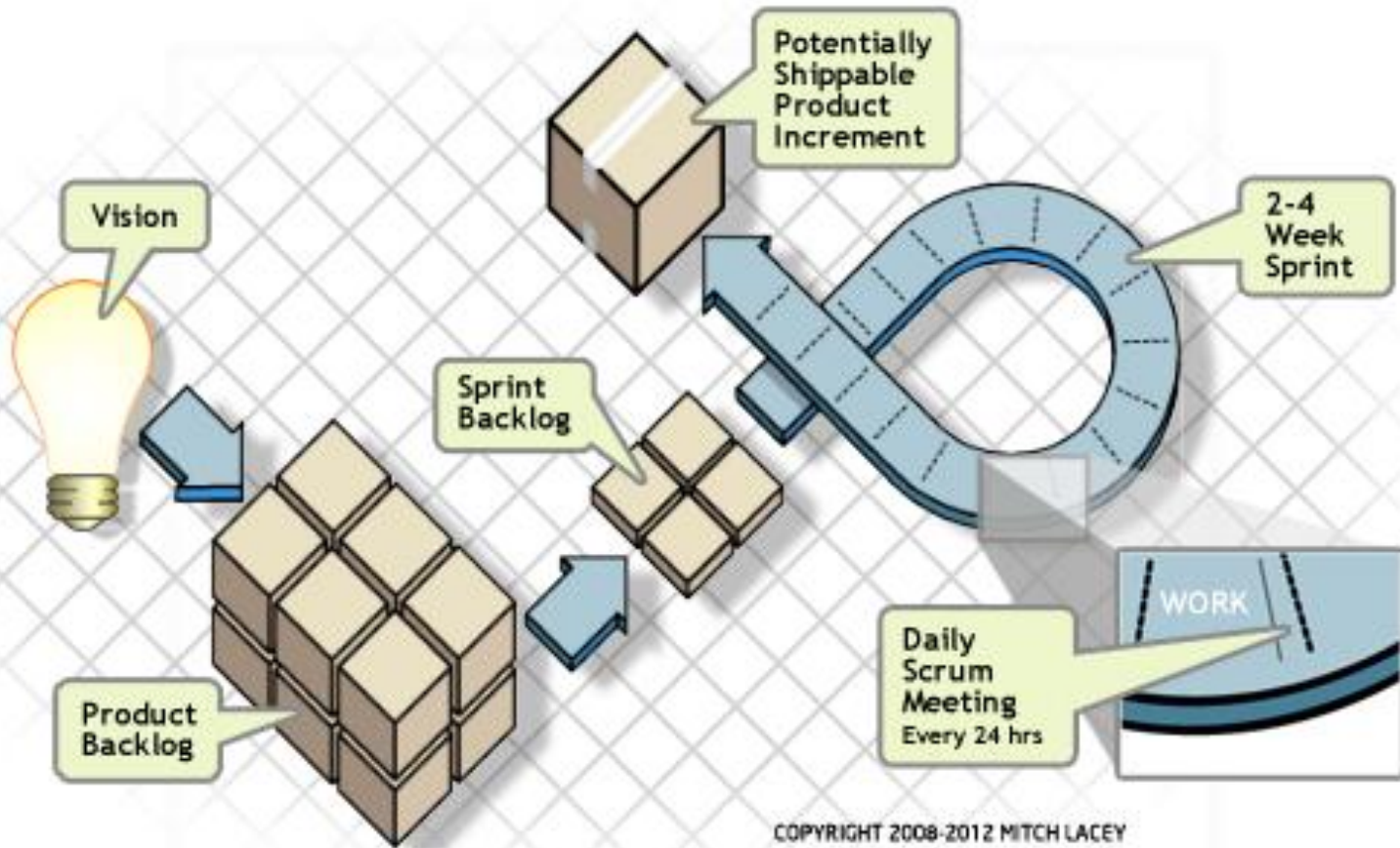
Source: Scrum Alliance, scrumalliance.org/learn_about_scrum
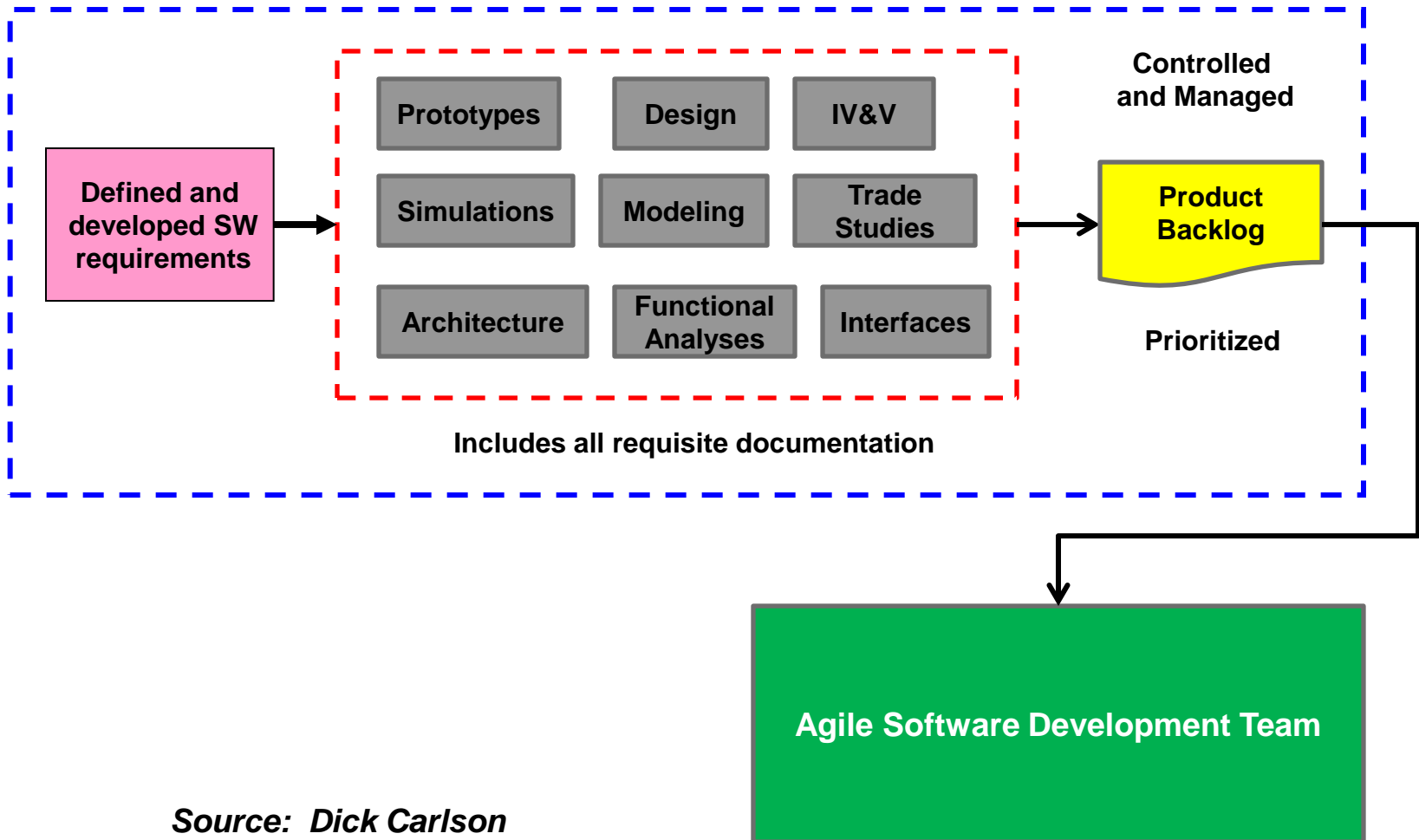
Agile Systems Engineering: An Oxymoron?

- **Systems Engineering teams can implement *Scrum** as their method for project management (as most software teams do)**

- **There are no *Agile Systems Engineering* methods**
  - *Agile*** methods are used by teams to develop software

- **Systems Engineering processes can be adapted to accommodate Scrum project management practices**
  - SE teams using the Scrum framework must tailor their engineering / organizational standard processes
  - Potential improvements to these processes occurs at the completion of each iteration

- **Systems engineering processes that feed requirements to Agile software development teams can benefit from working to the Scrum battle rhythm to increase synergism and collaboration with the sprinting software development team**

*Source: Scrum Alliance, scrumalliance.org/learn_about_scrum
**Source: Agile Manifesto for Software Development, agilemanifesto.org/

Agile Systems Engineering Processes Create Backlog User Stories From Software Requirements

Controlled and Managed

Defined and developed SW requirements

Prototypes | Design | IV&V
Simulations | Modeling | Trade Studies
Architecture | Functional Analyses | Interfaces

Product Backlog

Prioritized

Includes all requisite documentation

Agile Software Development Team

Source: Dick Carlson

Fast, Inexpensive, Small, Tiny (F.I.S.T.)

- **An acquisition framework or method that can be implemented on a project that is cheap, effective, and simple**
  - A very generic (Agile-like) approach that can be applied to any project
- **FIST is a systems acquisition approach created in response to decades of slow, over-run, complex, and huge systems that are either years late, or never deployed despite the costly investment**

- **We shall examine the tenets of FIST in relation to our efforts to identify ways to improve SE practices and processes that optimize collaboration activities with well-established Agile software developments.**

Source: *Lt. Col. Dan Ward, USAF*

F.I.S.T. Values

- **Systems development projects should be done by the smallest possible team of talented people, using a short schedule, a small budget, and mature technologies to deliver innovative solutions to urgent needs**

- **Short timelines increase agility and stabilize requirements, technology, budgets, and people**

- **Short timelines force accountability, ownership, and learning**

- **To maintain short timelines, a project must also exercise restraint over budgets, complexity, and size**

- **Increases to the project's budget, complexity, or size inevitably reduce its speed**

Source: *Lt. Col.* Dan *Ward, USAF*

F.I.S.T. Best Practices Enable Agile Software Projects

- **Minimize team size, maximize talent**
- **Use schedules and budgets to constrain the design**
- **Insist on simplicity in organizations, processes, and technologies**
- **Incentivize and reward under-runs**
- **Requirements must be achievable within short time horizons**
- **Designs must only include mature technologies**
- **Documents and meetings must be short and have as many as necessary; as few as possible**
- **Delivering useful capabilities is the _only_ measure of success**

**Source: _Lt. Col. Dan Ward, USAF_**

F.I.S.T Principles

- **A project leader's influence is inversely proportional to the project's budget and schedule**

- **Creative constraints foster creativity – adding time and/or money generally does not improve outcomes**

- **Fixed funding and floating requirements are better than fixed requirements and floating funding**

- **Complexity is a cost – complexity reduces reliability**

- **Simplicity scales – complexity does not scale**

- **An optimal failure costs a little and teaches a lot**

- **Interaction drives learning, discovery, and efficiency**

- **Talent trumps process**

- **Teamwork trumps paperwork**

Source: *Lt. Col. Dan Ward, USAF*

Applying FIST to Systems Engineering

- **FIST values, practices, and principles are generic, logical, and pragmatic**
- **It involves attitude and behavior modifications**
- **There really isn't a whole lot to learn, in fact there is a significant amount of "unlearning"**
- **Identify a FIST champion who is motivating and influential**
- **Traditional SE processes may need extensive changes**
- **Propose the approach in proposals**
- **Discuss the concept with your customers**
- **Set up a pilot project and share results with the org and customer**

Improve Systems Engineering Processes

- **This presentation is not a complete formula or even a starting point!**
    - **Success requires evolutionary activity in your organization**
- **Allow the team(s) to understand, internalize, and enact changes through execution and retrospection**
- **Use "Inspect and Adapt" methods to promote continuous process improvements**
- **Provide all necessary resources for teams to enable them to execute flawlessly**
- **Maintain transparency in all activities**
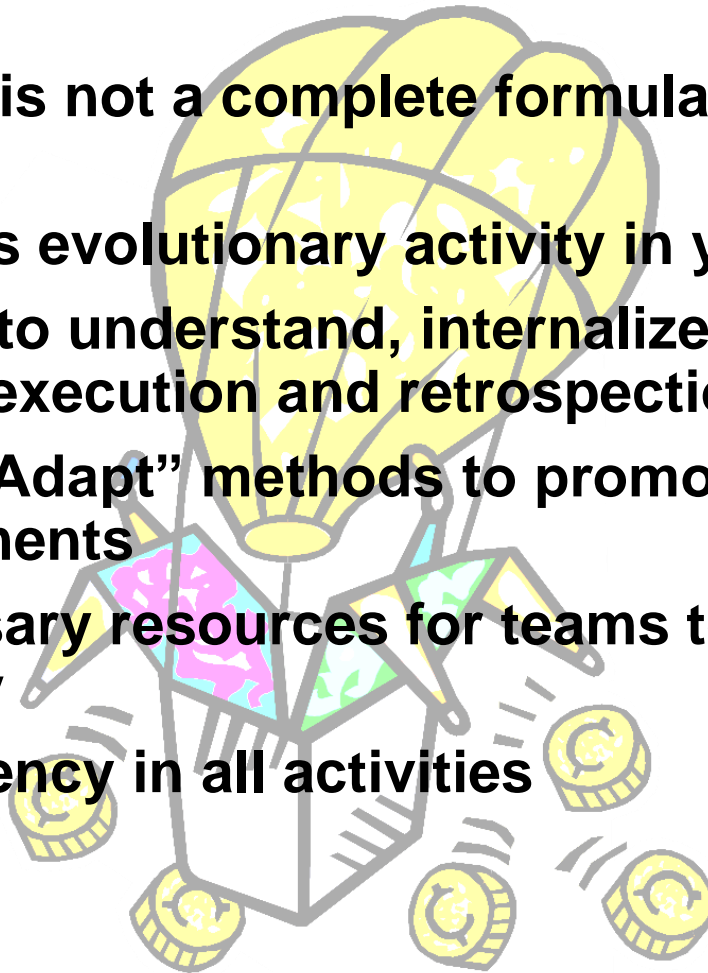
Reaping the Benefits – Road Forward

- **Propose agile and FIST process updates to customer**
  - Emphasize expected benefits of increased productivity, quality, and transparency
- **Integrate into program plan**
  - Get customer and contracts buy-in
  - Adjust milestones
- **Educate team on how to implement and execute the improved approach**
- **Execute, review, and implement changes that improve work flow**
- **Incentivize work completed on time and schedule**
  - Reward teams for improving processes and output
  - Celebrate successes!

Executing

- **Streamline SE activities in accordance with FIST and Scrum**
  - Incremental software requirements development, review, and implementation to complement software Scrum team
  - Focused efficient Trade Study processes aimed at optimizing value
- **Organize and prioritize Systems Engineering activities by employing efficient practices:**
  - Active customer participation
  - Short daily stand-up meetings
  - Planning and estimating
  - Frequent deliveries
  - Short iterations
  - Prioritized requirements
  - Artifact reviews
  - Self-organized teams
  - Simplicity
  - Sustainable pace

Resources

- **Mary Ann Lapham, et al, SEI:** *Agile Methods-Tools, Techniques and Practices for the DoD Community*

  http://www.sei.cmu.edu/library/abstracts/webinars/Tools-Techniques-and-Practices-for-the-DoD-Community.cfm?wt.ac=hpWebinar

  - *Considerations for Using Agile in DoD Acquisition*
    http://www.sei.cmu.edu/library/abstracts/reports/10tn002.cfm?DCSext.abstractsource=SearchResults

  - *Agile Methods-Selected DoD Management and Acquisition Concerns*

    http://www.sei.cmu.edu/library/abstracts/reports/11tn002.cfm?DCSext.abstractsource=SearchResults

  - *Using Agile Effectively in DoD Environments*

    http://blog.sei.cmu.edu/post.cfm/using-agile-effectively-in-dod-environments

- **Lt. Colonel Dan Ward,** *The Simplicity Cycle*

  eBook version: http://www.lulu.com/shop/dan-ward/the-simplicity-cycle/ebook/product-20425769.html
  Paper book version: http://www.lulu.com/shop/dan-ward/the-simplicity-cycle/paperback/product-20425591.html

- *Manifesto for Agile Software Development,* **Feb 11-13, 2001**

  http://agilemanifesto.org/

- **Agile Alliance**

  http://guide.agilealliance.org/

- **Northern, Mayfield, Benito, Casagni, The Mitre Corporation, Dec 2010,** *Handbook for Implementing Agile in Department of Defense Information Technology Acquisition*

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