

# Software Solutions Symposium 2017

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## Agile In Government: A Research Agenda for Agile Software Development

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# Abstract

The SEI team working with Agile in government has built a rich narrative of Agile implementation experiences. The research approach has evolved over the past six years, beginning with the basic question, “Can Agile work in the DoD?” Based on an analysis of the instances we uncovered, we documented lessons learned by early adopters. These Agile leaders sometimes struggled in environments viewed as antithetical to Agile.

As our experience base grew, so did the network of collaborators. Working with Agile innovators, we moved from feasibility to practicality. The basic question became “What does it take to make it work?”

Our work then emphasized supporting practitioners in the field aspiring to make Agile work for them. Making adoption feasible was an essential element of our work. Now we are ready for the next iteration of this cycle, where practice motivates research. Our focus now is on asking “Why does Agile work?”

We now work with an extensive network of collaborators on fundamental research questions that dive deep into the cause-and-effect mechanisms at work. During this presentation we will discuss new research questions that can be addressed with empirical data. The virtuous cycle of research-to-practice-to-research will be illustrated by our past work and future vision.

# Agile In Government

**Can It Work?**

**What Does It Take?**

**Why Does It Work?**

**Past, Current & Future Action Research**



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## Agile In Government **Can It Work?**

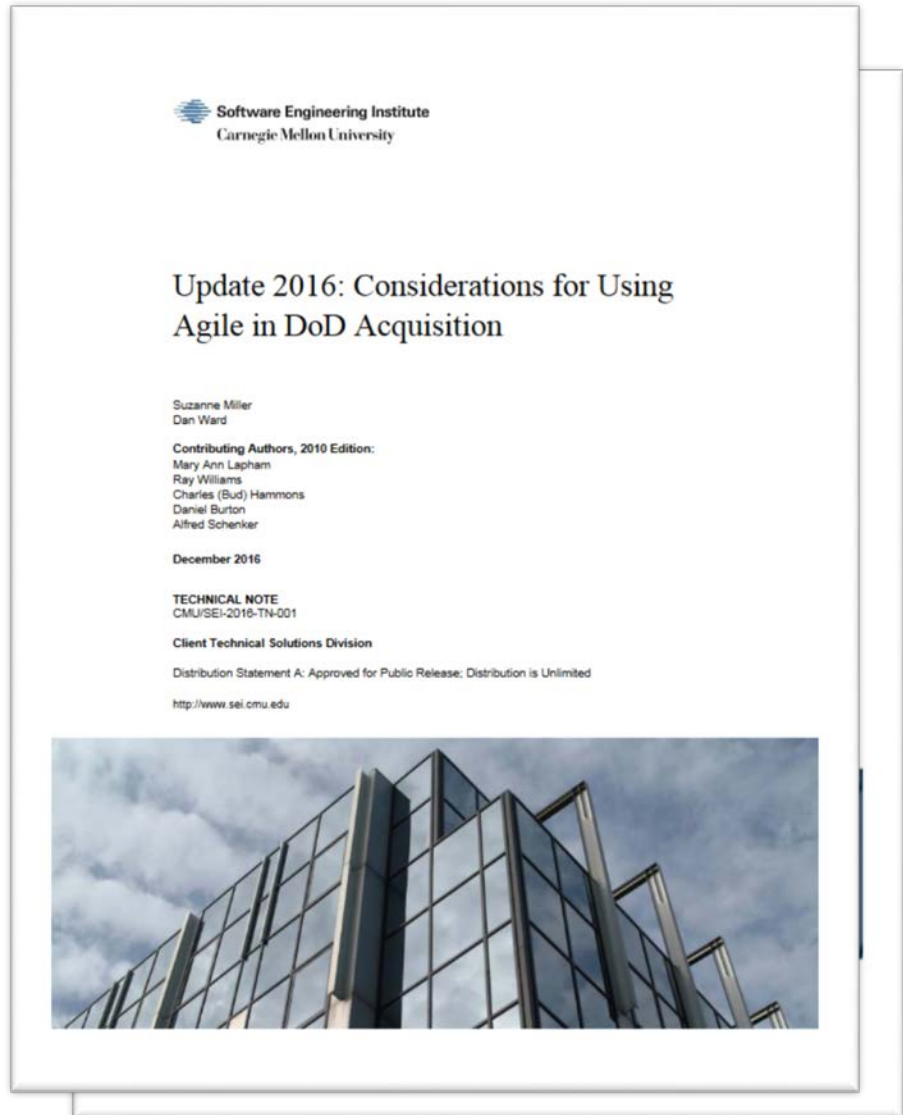
# Considerations for Using Agile in DoD Acquisitions

## Highlights:

- Nothing in DoD 5000.02 prohibits use of Agile
- Acquisition system constraints may need to be tailored
- Organizational culture may present issues to overcome

This report was updated to reflect new DoD 5000.02 guidance published in January 2015

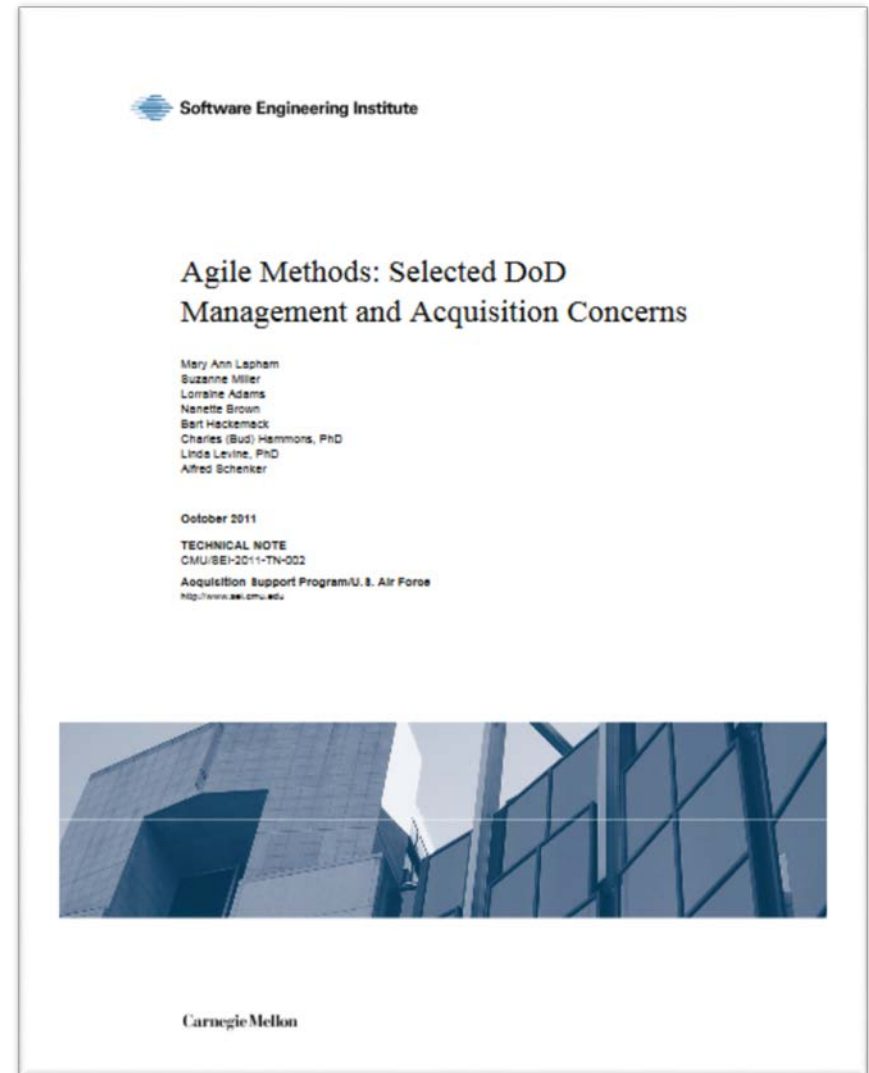
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# Agile Methods: Selected DoD Management and Acquisition Concerns

## Highlights

- Implications of adoption in DoD
- Management and contracting practices
- Technical milestone reviews
- Estimation in planning and execution
- Adopting Agile in DoD IT acquisitions



# Agile In Government: Early Impediments

Focus on elements of the acquisition lifecycle

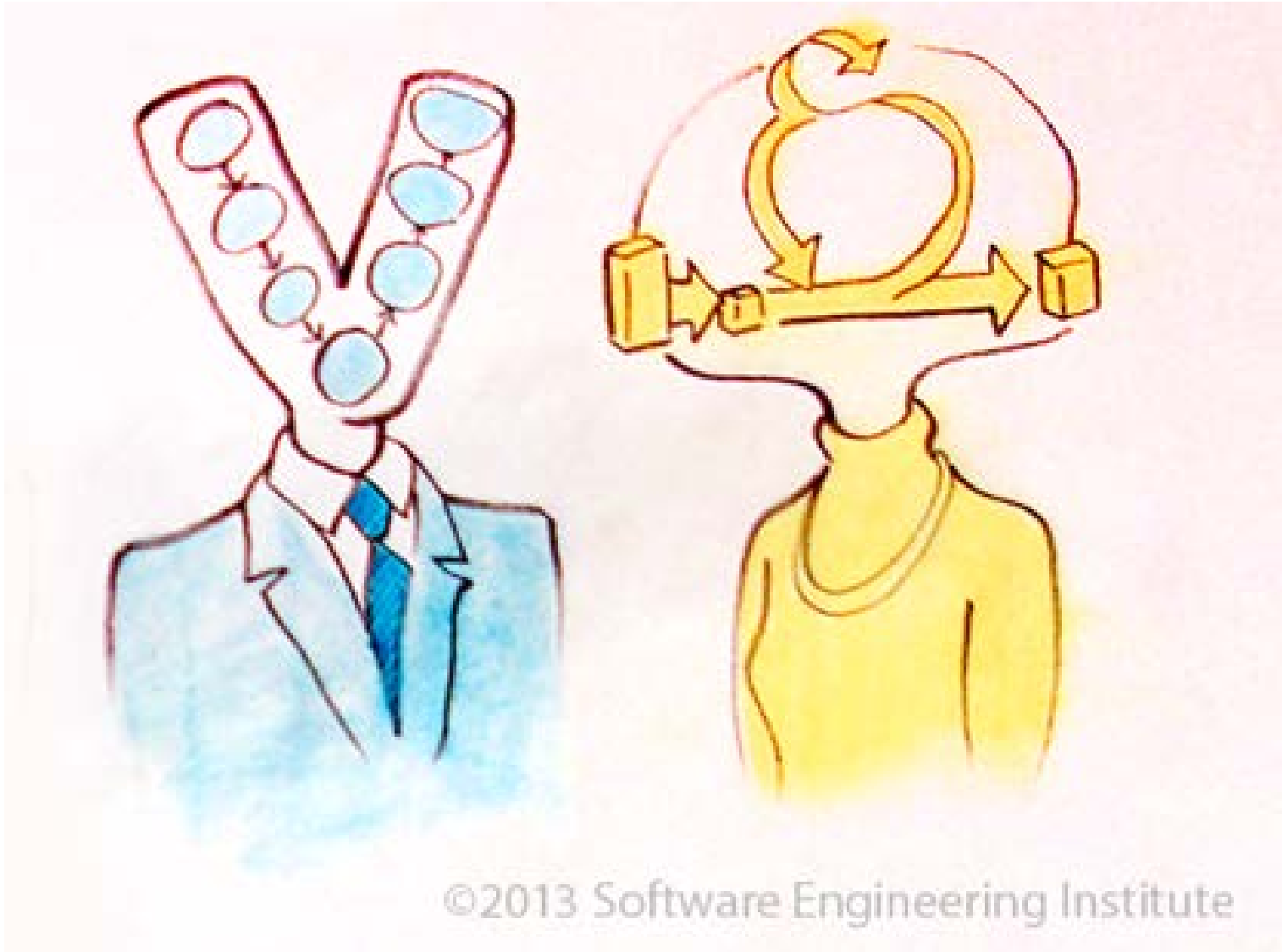
- Compelling information for stakeholders (Decision Authorities)
- Explaining the value proposition motivating Agile
- Terminology differences can be a barrier

SEI's response to the situation

- Formation of the Agile Collaboration Group
- Seeking-out programs using Agile concepts
- Publications & workshops to share experiences



# Courting New Models



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## What Does It Take?

# Agile In Government: Paths for Further Investigation

Systems Engineering

Request For Change

Metrics

Sustainment

Testing

Contracting



# Sample of Topic-Focused Publications

DoD Agile Adoption: Necessary Considerations, Concerns, and Changes

<http://www.crosstalkonline.org/issues/janfeb-2012.html>

RFP Patterns and Techniques for Successful Agile Contracting (Authored by members of NDIA System Engineering Agile Working Group)

[http://resources.sei.cmu.edu/asset\\_files/specialreport/2016\\_003\\_001\\_484063.pdf](http://resources.sei.cmu.edu/asset_files/specialreport/2016_003_001_484063.pdf)

Contracting for Agile Software Development in the Department of Defense: An Introduction

<http://resources.sei.cmu.edu/library/asset-view.cfm?assetid=442499>

Agile Methods and Request for Change (RFC): Observations from DoD Acquisition Programs

<http://resources.sei.cmu.edu/library/asset-view.cfm?assetID=77732>

Agile Software Teams: How They Engage with Systems

|Engineering on DoD Acquisition Programs

<http://resources.sei.cmu.edu/library/asset-view.cfm?assetID=295943>

Agile Methods in Air Force Sustainment: Status and outlook

<http://resources.sei.cmu.edu/library/asset-view.cfm?assetID=312754>

Agile Metrics: Progress Monitoring of Agile Contractors

<http://resources.sei.cmu.edu/library/asset-view.cfm?assetID=77747>

Potential Use of Agile Methods in Selected DoD Acquisitions:

Requirements Development and Management

<http://resources.sei.cmu.edu/library/asset-view.cfm?AssetID=89158>

A Closer Look at 804:

A Summary of Considerations for DoD Program Managers

<http://www.sei.cmu.edu/library/abstracts/reports/11sr015.cfm?DCSext.abstractsource=SearchResults>



# Podcasts and Webinars

Agile Adoption in Government Podcast Series

<http://resources.sei.cmu.edu/library/asset-view.cfm?assetID=493556>

Agile in the DOD Podcast Series

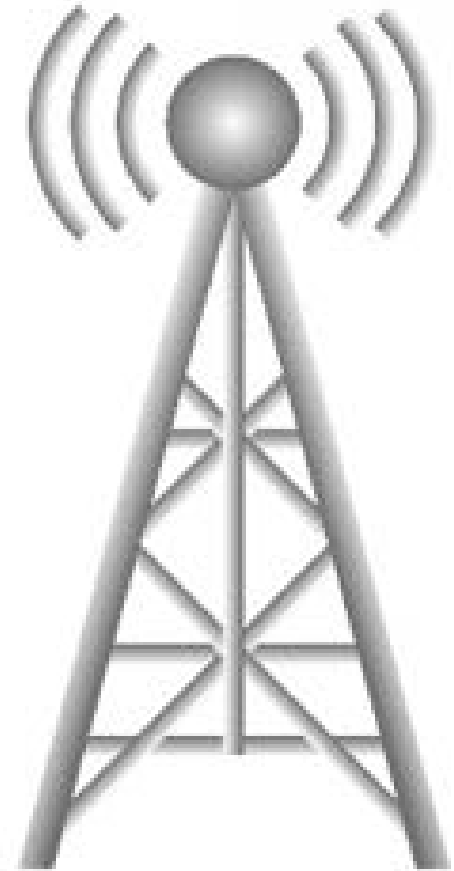
<http://www.sei.cmu.edu/podcasts/agile-in-the-dod/index.cfm>

Practical Considerations for Adopting Agile/Lean in Government Settings

<https://www.webcaster4.com/Webcast/Page/13919586>

Agile Research Forum, Agile Methods: Tools, Techniques, and Practices for the DoD Community

<http://www.sei.cmu.edu/go/agile-research-forum/>



# Tip Of The Spear: Direct Program Support

Our engagements include a rich variety of settings/contexts

- System Program Office (SPO) working with Agile contractor(s)
- Organic government development teams using Agile methods
- Civil and Military organizations revising acquisition policy
- Other government personnel with policy and oversight roles

Through this experience, we have developed

- Workshop and training offerings to address various roles
- Coaching and mentoring of government personnel
- Presentations and collections of experiences for leaders

# Federal/DoD Agile Landscape

Increasingly difficult to dismiss Agile methods as “just a fad”

Government executives are getting smart on Agile

New graduates expect Agile mindset



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## Why Does It Work?



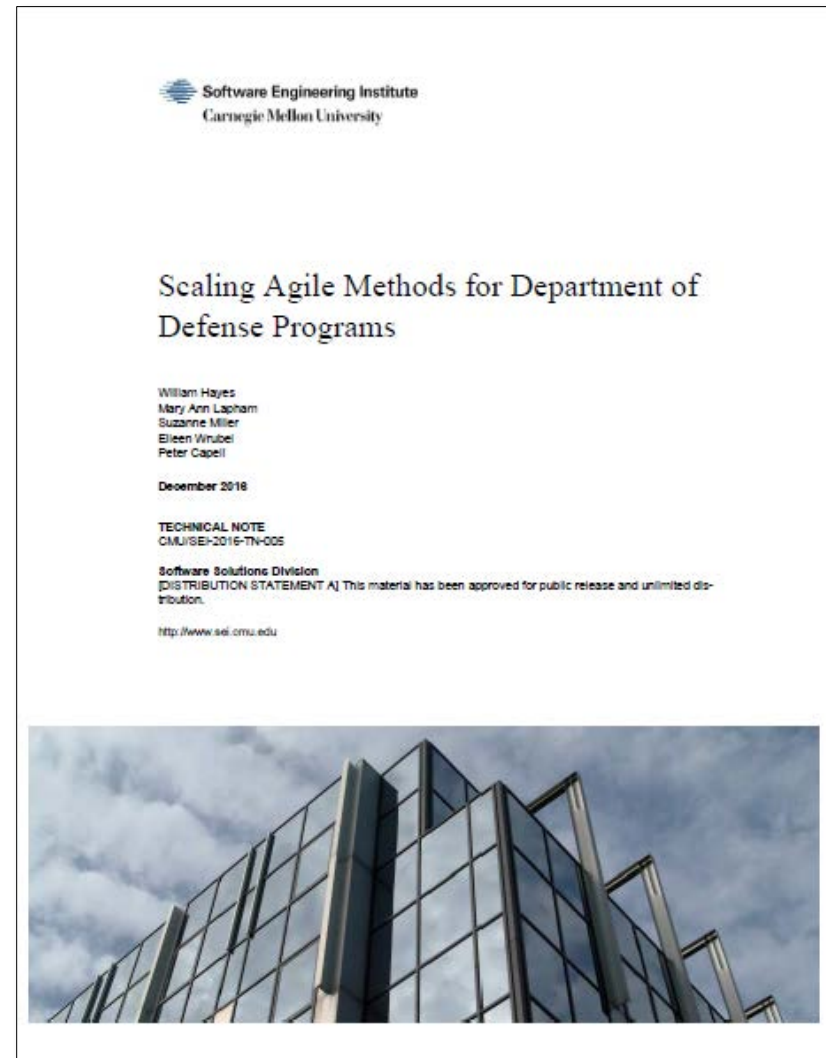
# Scaling Agile Methods for DoD Programs

## Interviewed Industry Leaders

- Scott Ambler
- Craig Larman
- Dean Leffingwell
- Steve Messenger
- Jeff Sutherland

## Important Attributes

- Team Size
- Specialization of Roles
- Iteration Length
- Synchronized Cadence
- Release Definition
- Focus on Batch Size
- Product Owner Role
- User Role



# Two Research Thrusts

## Focus on Practice

Our work in programs is uncovering a range of implementations



## Focus on Theory

Rigorous treatment of Agile and Lean concepts provide research opportunities



# Understand      Analyze      Package

Knowledge-intensive work often involves an evolutionary process

- Understanding the scope and details of the work leads to...
- Analysis of alternatives for constructing the result, followed by
- Packaging the result to provide the usable output sought.

Often, there is not a 'clean break' between these stages, but the intended progression helps in planning and scheduling decisions.

# Taking an Iterative Approach

A more clean break between major process steps is imposed to define iterations

Divide into multiple batches, performing a single lifecycle step per iteration on each

Same division of work, completing all work on each batch during each iteration

Further decomposing work into smaller packages, leading to multiple start-to-finish cycles in each iteration.



# Different Incremental Approaches

## Not Incremental

- Single increment of work, delivered once in a single package

## Incremental Development, Single Delivery

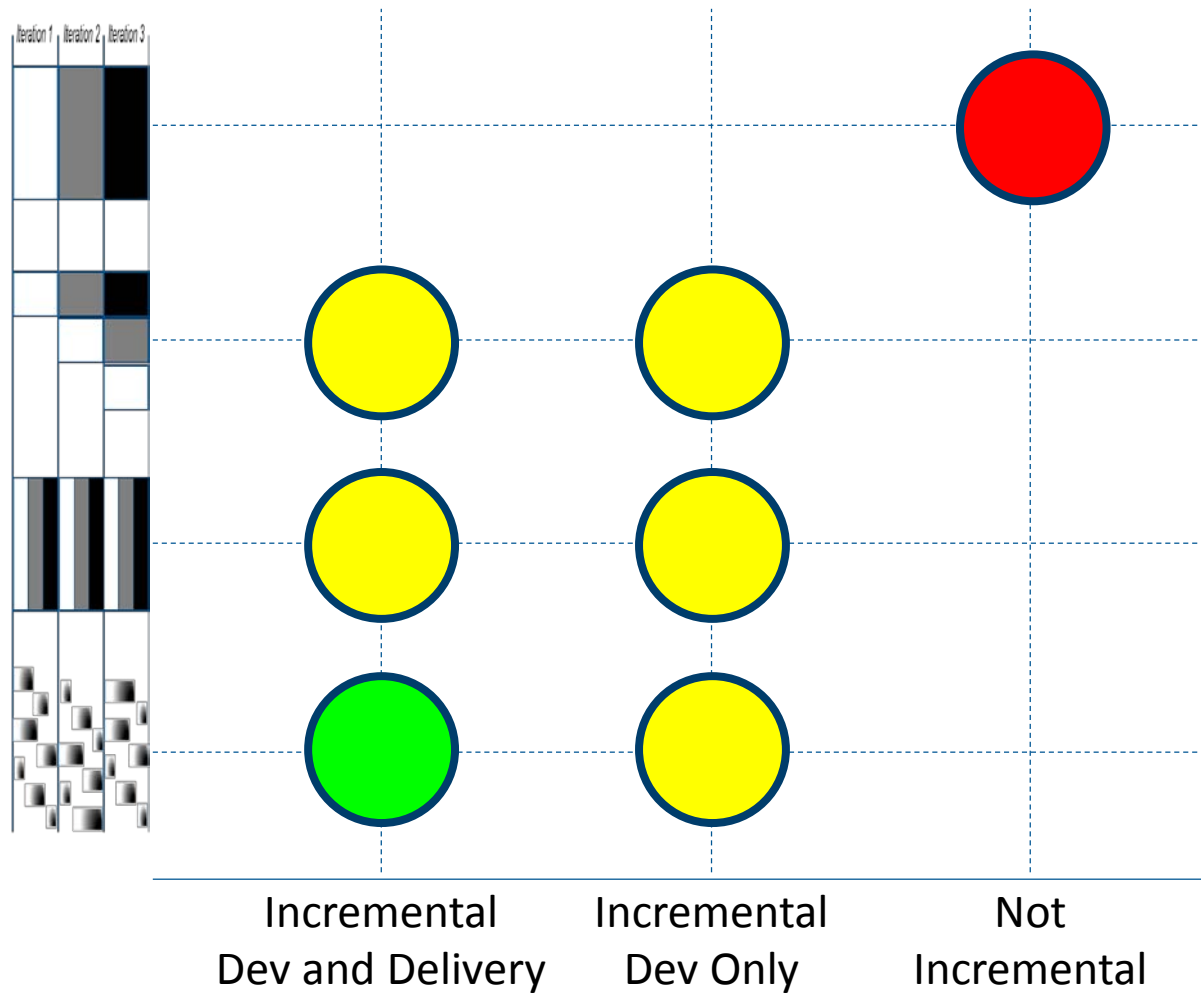
- Work divided into logical subsets for development in pieces, delivered once in a single package

## Incremental Development & Delivery

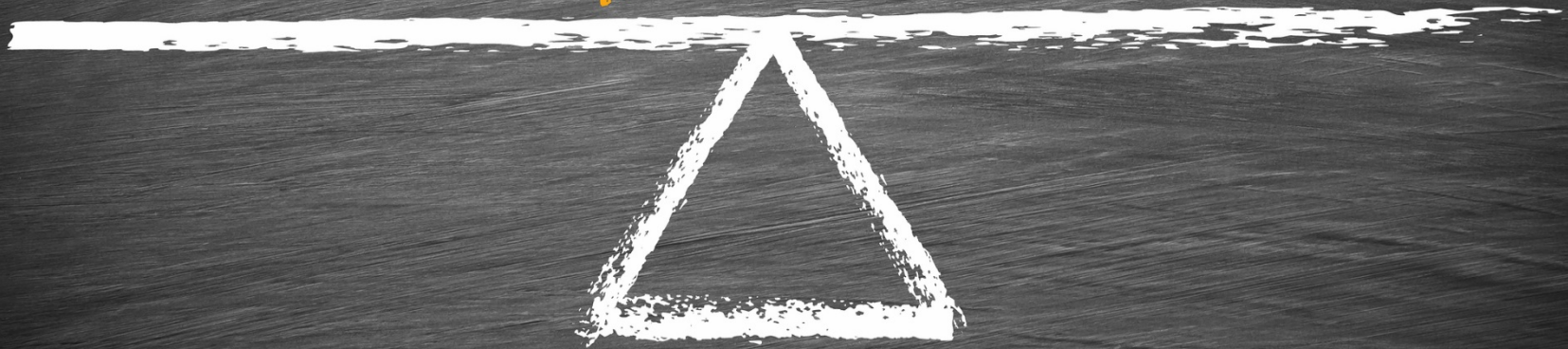
- Work divided into meaningful slices of the total end result, delivered in gradually more complete versions
- Alternatively, delivering new pieces rather than total new versions



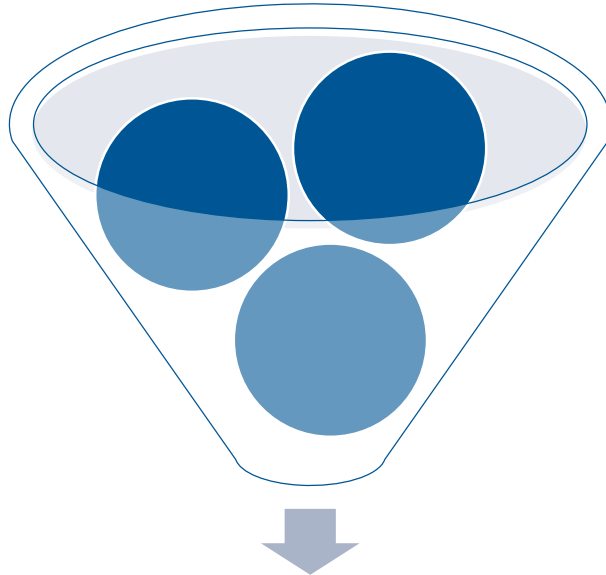
# Incremental and Iterative Combinations



# Theory Practice

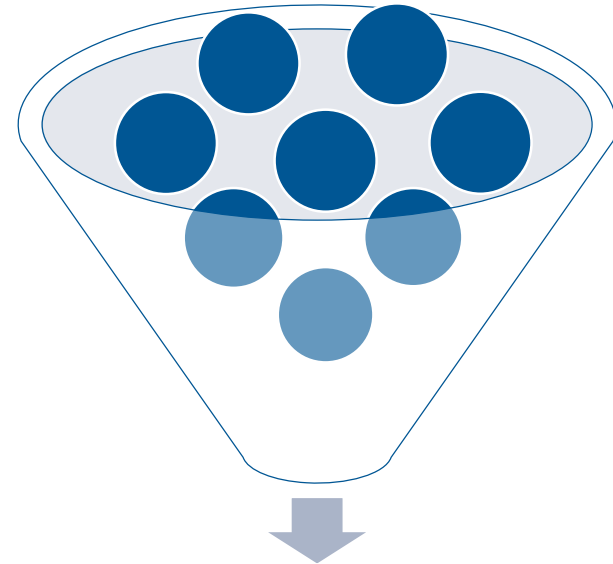


# Hypothesis: Smaller is 'Better'



Work done in larger batches:

- Greater potential coupling
- Change can have a greater ripple effect



Breaking into smaller batches:

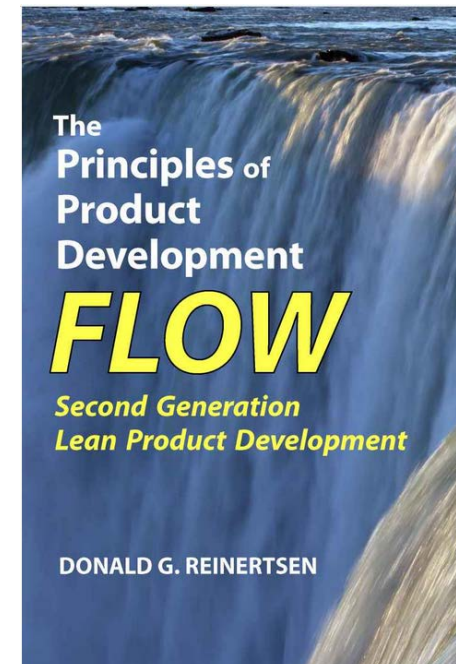
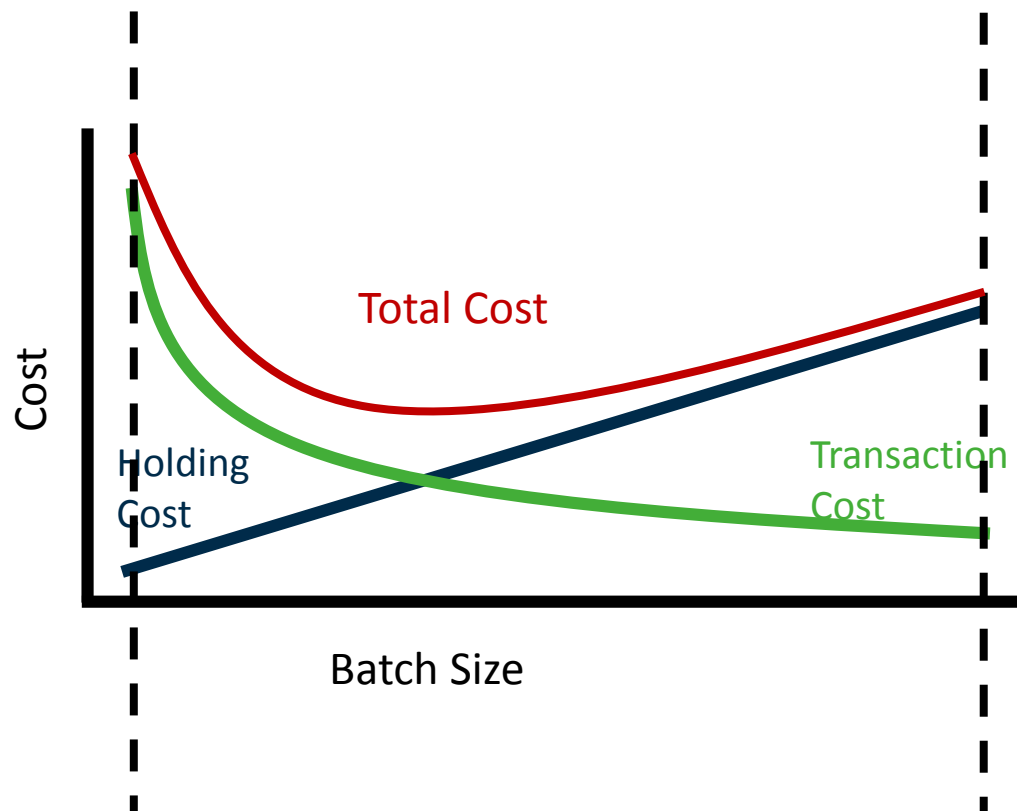
- Greater modularity possible
- Changes can potentially be localized to a greater degree



# Economies of Batch Size

Specify, build  
test & ship a  
SINGLE  
line of code

Specify, then build,  
then test & then ship  
ALL lines of code



U-Curve optimization problem as described in *Principles of Product Development Flow*, by Don Reinertsen

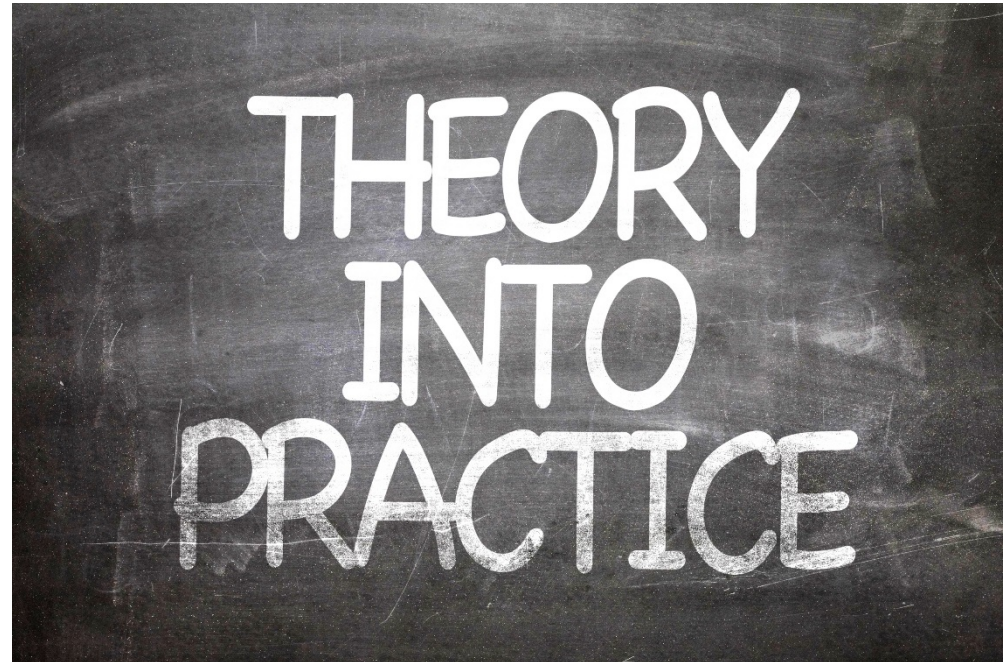
# Hypothesis: Practical Applications Exist

If working in smaller batches does lead to better performance:

- What are the practical applications of this new knowledge?
- How small do we need to go in order to see benefits?
- Can we identify the point of diminishing returns?

What is the effect of context?

- Diverse stakeholders
- Very large systems
- Rigorous V&V



# Summary

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Work with government organizations considering and adopting Agile/lean:

- Informs SEI research through deep understanding of implementation problems,
- Provides a “live laboratory” for exploring alternatives that have worked in other settings, and
- Provides validation environment for assessing impact of problems as well as the mitigating effects of proposed solutions.

