Agile Defense Adoption Proponents Team

The Business Case for Agile Methods

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Introduction

Commercial Industry organizations have been benefiting from the rise of Agile development practices. The practices create a culture of continuous feedback and a focus on early delivery of high-quality software that meets important end user needs.

In fact, Industry has found that Agile projects are 37 percent faster delivering their software to market and are 16 percent more productive. These numbers improve through the use of automated tools. Moreover, this was accomplished without increasing defect counts despite significant schedule compression. (QSMA Study)

The Agile methodology drives a higher rate of user acceptance and satisfaction than traditional methods do (PEX). This higher rate of acceptance is due to the more collaborative approach that the methodology itself requires. In addition, the resulting product is consistently more closely matched to end user needs (USTRANSCOM).

The potential of agile that has been realized in the commercial sector strongly supports these assertions [Rico08]. If DoD is to approach those types of ROI, then they must approach agile as a complete package. To become agile as opposed to doing agile, will include a complete change in the mindset of the DoD organization – this includes back office workers, COTRs, PMs, contractors, etc. Agile governance needs to be adopted, not just agile development practices. The agile effort must exist within a holistic ecosystem in order for it to take root and be successful. With proper executive support Agile and Lean can transform the responsiveness, productivity, and customer satisfaction of organizations. The impact of full-scale executive support of Agile is so great and so sweeping in scope, that the value and impact is felt throughout organizations.

A key communication mechanism in any agile adoption is providing potential adopters with information on return on investment and adoption experiences of others who are similar to them. This issue paper begins to address both of those types of information. We will first provide a summary of ROI information surveyed from the commercial IT industry, followed by several short case studies on successful agile methods use in government contexts or contexts that are similar to what the DoD faces in terms of complexity and criticality. We conclude with some recommendations about adoption that may be of use to DoD acquisition practitioners and managers.
Agile Background – Executive Overview

The widely quoted 1994 Standish Group report stated United States corporations spent about $250 billion per year on around 175,000 IT software development projects; of these, 31.3% were cancelled before completed, 52.7% ended up costing nearly twice the original estimated cost, and only 16.2% were reported on-time and on-budget. In the case of large projects in large companies, only 9% typically came in on-time and under budget (2001). In response, commercial software developers created new technical and management approaches to deal with changing customer needs, rapid technology evolution, and the increasing impact of software failure. The key differentiators in the new methods were collectively called agile, because they found ways to operate in fast-changing environments and decreased the time it took to provide functionality to the customer. As these approaches were more broadly accepted, and their successes were seen in more domains, it became clear that a new way of doing business was eminent.

While the numbers may be different, the DoD faces similar challenges and clearly needs a new way of acquiring software-reliant systems. Significant technology breakthroughs require changes in how systems are acquired and how capabilities are delivered to the war fighter. Multiple reports (e.g. Defense Science Board March 2009, the National Academy of Science report, Achieving Effective Acquisition of Information Technology in the Department of Defense, and NDAA 2010 Section 804) have been published depicting this need. As a result, great effort is underway for evolving our acquisition system to deliver mission capabilities to the war fighter on regular iterative cycles and gain a better return on the dollars spent throughout the acquisition process.

Commercial software developers discovered that achieving agility requires technical, organizational and cultural changes. Development teams, business people, and customers must closely collaborate to realize the benefits of:
- Faster time-to-market
- Ability to respond to changing mission needs and priorities
- Early and frequent delivery of value
- Increased quality and reduced cost through decreased defects
- Decreased risk through regular product demonstrations

Agile software uses prioritized requirements, time-boxed iterative development and adaptive planning or pull scheduling techniques to respond more quickly to change (Schwaber 2001; Highsmith 2004; Larman 2004). Agile methods best fit the needs of software systems when requirements change frequently and are not well understood (Highsmith 2004; Larman 2004; Leffingwell 2007). Improvements in quality from agile approaches are provided through pair-programming and retrospectives, test-first or test-driven approaches, and continuous integration coupled with automated regression testing.
Agile Methods ROI

When the agile community first responded to the challenges of the 1990s, there were no initial quantifiable measures in terms of return-on-investment (ROI). The results were obvious on a project-by-project basis; but, as the years have progressed, it has become apparent the need for research and metrics to capture the results from successful agile project implementations.

Cutter Consortium investigated the performance trends of 7,500 completed projects with specific focus on more than 20 agile releases from five companies. These trends examined schedule, effort, defects, and productivity statistics for various sized projects. A summary of the findings from the data collected by agile practitioners concluded that about 80% of the Agile projects showed improved productivity and were mostly faster in delivering capabilities to the user than when using traditional practices. The quality of the products developed was also positively impacted through a reduced defect trend. Waterfall projects generally showed a higher defect when using large teams and trying to meet faster schedules, sometimes as much as 4 times higher than average. Many agile projects showed fewer defect rates than the average. The best performers were experienced agile projects with a defect trend estimated at 30-50% lower than the average (Mah 2008). Much research has been conducted on the costs associated with defects and the considerable value of finding and removing defects early in the development process.

In Boehm and Basili, data is presented that shows that the cost to repair an error increases exponentially the later it is found (Boehm and Basili 2001). The earlier defects are uncovered the less costly it is to correct. In addition, a study conducted by Paul Grossman (2009) on the return on investment for automated testing, discusses that it costs nearly five times more to fix a coding defect once the system or capability has been released than it is to correct it within an iteration. The further in the life cycle the defect is uncovered, the more hours it will take to fix the defect. Using data from a Grossman, NIST 2002 reported the estimated cost of fixing a defect according to the stage in which the defect is discovered. The following table highlights this data and assumes $75/hour labor as an example of charges expended to correct the defects. Note that the later in the process the defect is discovered the more costly the correction (Grossman 2009).

Therefore, if through the implementation of agile practices, defect trends diminish we can assume a cost savings associated with a declining defect trend and by addressing them early in the development cycle.

<table>
<thead>
<tr>
<th>STAGE FOUND</th>
<th>Coding/Unit Testing</th>
<th>Integration</th>
<th>Beta Testing</th>
<th>Post-Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours to fix</td>
<td>3.2</td>
<td>9.7</td>
<td>12.2</td>
<td>14.8</td>
</tr>
<tr>
<td>Cost to fix</td>
<td>240</td>
<td>728</td>
<td>915</td>
<td>1110</td>
</tr>
</tbody>
</table>

In addition, Rico has conducted specific research to better understand the ROI of agile methods. Time was devoted to investigating and analyzing the findings of 11 related research efforts related to agile methods and ROI (Figure 1: Agile ROI (Rico, 2008)). The conclusion of this study demonstrated that agile methods result in increased cost effectiveness, productivity, quality, cycle-time reduction, and customer satisfaction (Rico 2008).
<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
<th>Findings</th>
<th>Responses</th>
</tr>
</thead>
</table>
| 1998 | Harvard (Thomke et al., 1998)  | 50% reduction in engineering effort  
|      |                                | 55% improvement in time to market                                     | 391       |
|      |                                | 925% improvement in number of changes allowed                          |           |
| 1998 | Harvard (MacCormack, 1998)     | 48% productivity increase over traditional methods  
|      |                                | 58% higher quality associated with more design effort  
|      |                                | 50% higher quality associated with iterative development               | 29        |
| 1999 | Boston College (Fichman et al., 1999) | 38% reduction in time to produce working software  
|      |                                | 50% time to market improvement                                        | 28        |
|      |                                | 50% more capabilities delivered to customers                           |           |
| 2003 | Reifer Consultants (Reifer, 2003) | 20% reported productivity gains  
|      |                                | 10% reported cost reductions                                           | 78        |
|      |                                | 53% reported time-to-market improvements                                |           |
| 2003 | Shine Technologies (Johnson, 2003) | 49% experienced cost reductions  
|      |                                | 92% experienced productivity increases                                  | 131       |
|      |                                | 88% experienced customer satisfaction improvements                      |           |
| 2004 | CIO Magazine (Frewitt, 2004)   | 28% had been using agile methods since 2001  
|      |                                | 85% initiated enterprise-wide agile methods initiatives               | 100       |
|      |                                | 43% used agile methods to improve growth and marketshare               |           |
| 2006 | Digital Focus (Digital Focus, 2006) | 27% of software projects used agile methods  
|      |                                | 23% had enterprise-wide agile methods initiatives                      | 136       |
|      |                                | 51% used agile methods to speed-up development                           |           |
| 2006 | Version One (Version One, 2006) | 86% reported time-to-market improvements  
|      |                                | 87% reported productivity improvements                                 | 722       |
|      |                                | 92% reported ability to dynamically change priorities                   |           |
| 2006 | AmbySoft (Ambler, 2006)        | 41% of organizations used agile methods                                | 4,232     |
|      |                                | 44% reported improved productivity, quality, and costs                 |           |
|      |                                | 38% reported improvements in customer satisfaction levels               |           |
| 2007 | AmbySoft (Ambler, 2007)        | 69% of organizations had adopted agile methods                        | 781       |
|      |                                | 89% of agile projects had a success rate of 50% or greater             |           |
|      |                                | 99% of organizations are now using iterative development              |           |
| 2007 | UMUC (Rico, 2007)              | 70% of developers using most aspects of agile methods                 | 250       |
|      |                                | 26% of developers had improvements of 50% or greater                   |           |
|      |                                | Agile methods are linked to improved website quality                   |           |

*Figure 1: Agile ROI (Rico, 2008)*
Examples of successful agile methods use in government and commercial projects:

More DoD projects than might be expected at first glance have experienced success with agile methods. We highlight a few here that cover both DoD and non-DoD project environments.

Patriot Excalibur (PEX):


Background

PEX is a USAF Government Off-The-Shelf (GOTS) software program with one objective: automate squadron processes. It is comprised of a suite of applications that focus on the three primary functions of a squadron: scheduling, training and Standardization/Evaluation (Stan/Eval). The software is a very traditional line of business application with a web front end and database back end. The team has successfully implemented an agile development model, specifically Extreme Programming, since 2003.

PEX serves over 670 Air Force and National Guard squadrons. The software they produce has been voluntarily adopted across a wide swath of air organizations, even beyond the US borders to Australia's Ministry of Defense. Up through 2011, the main source of funding for PEX has been through allocations from Air Force and National Guard Major Commands (MAJCOMs), rather than through a traditional acquisition program path. This means that the users of the software see sufficient value in it to continue directly paying for its sustainment and evolution. At the time of this writing, PEX has become a significant enough asset to the Air Force that the program is in transition to an ESC program of record, to ensure that it is able to meet the needs of its wide variety of users.

The Challenge

Prior to Agile adoption the delivery cycle was 18 months. Moreover, PEX suffered from low adoption rates and mismatches between delivered functionality and end user expectations. To survive the program had to adapt, and the developers on the team proposed that the government program management adopt Agile methodology. Once the case was made the PM obtained superiors’ support for the decision.

Then the next step was to obtain training. This was outsourced to professional consultants. It was properly believed that if such a change in methodologies was to have a chance of success, then the change effort itself needed a full commitment. Program management recognized that Agile methodology was much more than adopting a few new practices.

At the time the PEX team was less than 20 people. All production was halted and everyone received education on the values, principles, practices, and on the functionality of the Agile project management
tool selected. The next step was to create team processes tailored to incorporate both what had just been learned and mandatory government controls/elements.

The Result

The release cycle for PEX software is approximately every 22 weeks (reduced from an 18 month delivery cycle prior to adoption of agile methods), including the extra iterations needed to go through certification and accreditation. Each release addresses an average of 480 user stories and 10 defects. The software is currently undergoing its second major re-architecting release, moving toward use of AF net-centric infrastructure. They use 2 week iterations to produce interim versions of software for user testing. This rhythm has been sustained now for several years.

Up to this point, PEX has used CPIF (Cost Plus Incentive Fee) time and materials contracts to evolve the system to meet their users' requirements. It has grown from 10 to 96 employees across 4 different contractors that plan and execute the tasks, working in a "badgeless" environment -- when you walk through the door, you don't think about working for contractor 1, 2, 3 or 4; you think about what's best for PEX.

Once a year, PEX hosts a user forum to elicit new user needs and validate their path forward with existing batches of user needs, expressed as user stories. In 2011, this event drew over 200 PEX users from across the country and around the world. All PEX development, test, and deployment personnel are required to attend the event, even remote employees. Relatively new users were provided with tutorials on parts of the system they may not be using yet. Veteran users attended smaller requirements forums where they interacted directly with PEX developers and managers to help shape the expression of user needs and their priority. Presentations and dialogue about PEX's present trajectory and future focus were also a part of this event.

Once the user forum is over, user interaction doesn't stop. From the beginning, PEX has invested in hiring subject matter experts -- user surrogates with recent, relevant field experience -- to work alongside developers as they evolve PEX's software. They bring the user focus home to the developer and keep it in front of them throughout the iterations that flow toward a release.

PEX’ practice of Agile had to evolve to accommodate its growth. Recently the team management brought in an Agile consultant for a 4 day refresher course and a hard critique of current practices. This contributed to a reorganization of roles and more tailoring. Agile requires continuous introspection and improvement.
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USTRANSCOM

Change was eminent. Time from requirements gathering to fielding has typically taken years in the DoD environment. The USTRANSCOM team was asked to reduce the time to fielding capabilities from years down to months to get functionality into the hands of the users. It has been widely recognized and communicated that “... the ability of the acquisition process to deliver operational performance of major systems within predicted cost and schedule has not improved over the last 20 years and the economic and security environment has changed substantially (Kadish 2006)” This was an opportunity for this program to rise to the challenge and meet the new and emerging expectations of delivering frequent, incremental value to our users.

To support this transition effort the program needed trained and experienced team members to help with the implementation of Agile principles and to support the teams through the cultural shift. Agile coaches were identified to address this need and worked regularly with the development teams to ensure a solid transition. Specific guidance was provided through a documented CONOPS identifying how the Agile teams would collaborate throughout the iterations and how they could leverage the new information gleamed throughout the process to adjust and make product improvements in the next cycle and increase process efficacy.

Background

USTRANSCOM’s IT systems are assembled from decades of legacy components delivered via large acquisition programs. They have a significant investment tied up in legacy systems that have extensive “code debt”, resulting in utilization of less than 25% of systems resources and approximately 80% unshareable, unused capacity. General McNabb, Commander of USTRANSCOM, challenged this emerging Agile development organization to create, from scratch, a new Enterprise Portal (iDistribute.mil) that would provide access to operational data, with an emphasis on the presentation of data to operators and would effectively replace many of its brittle legacy systems.

In 2010, this approach resulted in successful delivery of a significant new platform, the iDistribute.mil Portal, achieved in ten months from initial requirement to fielded capability. This contrasts with the typical 5 plus year timeframe of their legacy processes for fielding a new system.

The Challenge

The greatest challenges the team faced going into this effort was in the underutilization of an expensively produced systems with poor user acceptance rates.

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1 software code that is left in the code base but is unused because its function is not readily discernible, so no one wants to risk removing it and suffering from difficult to investigate failures
The Results

Some observations and notable results of the Agile approach by the USTRANSCOM team include the following:

- Due to frequent releases, users got to ‘touch/experience’ the tool as it was being built. This kept the command engaged in the process.
- With each release, there was an opportunity for testing, and training, which gave a sense of ownership to the operational community.
- Developer / Operator relationship has been very collaborative - the Agile process assists the command in defining the requirements and assuring that the product will truly meet the operator’s needs.
- This was an Inclusive process - it involves many of the end users in development and testing, which results in a soft rollout\(^2\)
- Ownership of tool by the command has increased their skin in the game. From their perspective, they developed it and they named it.
- Finally, the system resulting from the use of Agile is one that the operators are actively using and providing feedback on.

BMC Case Study

Background

BMC is a commercial software development house developing cloud-based products and custom software solutions.

Development Environment

BMC employs over 900 developers and testers, geographically dispersed with 11 teams in 5 locations: Austin, Houston, Santa Clara, Israel and India. They use Scrum agile development methods, trained and coached by Rally, a consultancy specializing in supporting adoption and management of agile projects.

Challenges

For a recent project, BMC was challenged with combining three individual product architectures into one infrastructure within an extremely short timeframe of 10 months. This project involved enlarging the use of agile practices to many of the 900 BMC developers, a scale previously not attempted by BMC. In addition, many of the team members were made available via a matrix style of management, where their primary supervisor was not part of the agile project. This meant that many of the team members were subject to being pulled away to fight fires in their home organization with little notice.

Adoption

To facilitate the scaling of agile practices in the BMC environment, Rally guided the entire team, from executives to engineers, through a series of adoption support events -- training, coaching sessions, "

\(^2\) A soft rollout is one where many of the operational users have experienced the system through prototypes, training, and testing activities prior to the actual fielding.
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retrospectives, etc -- to enable them to fully practice Agile development processes, including managing multi-team agile projects. This training involved a three part approach that kick started widespread adoption of the Agile methodology.

Part of was the development and introduction of BMC Specific Agile Methodology Guidelines which served as a framework for the specific agile practices adopted at BMC. The second part of the training was the Executive Training, coaching and Follow up for the executive development management team.

The third and final part consisted of customized tooling, training, and mentoring for the initial Agile Deployment teams. This final piece was replicated numerous times over a period of a year as new teams were brought into the Agile methodology. Ongoing coaching services to maintain the Agile adoption were sustained for an extended period of time.

Results

BMC succeeded in delivering the product within the 10 month time frame. Their continued use of agile practices has resulted in regularly delivering high-quality releases in a fraction of the time that would previously have been required. Subsequently, BMC was nominated for an ADT Innovator’s Award in the Application Engineering category. Even more important than the external success, internal factors such as increased employee engagement, individual team productivity increases of 20-50%, and increased employee empowerment encourage BMC’s management to keep going down this path.

BMC has recently combined their agile development methods with Lean Requirements practices, resulting with higher ROI across their lean/agile practices suite, and even better alignment with customer needs. This has resulted in delivery of critical customer functionality faster than even with their initial use of agile methods.

Census Bureau - ICS

Background

The United States Census is a decennial census mandated by the United States Constitution to gather statistics on the U.S. population. The data collected helps determine the number of seats states have in the U.S. House of Representatives. In the 2010 Census, this data also helps communities receive more than $400 billion in federal funds each year. "Because Census deadlines are mandated by the Constitution, there's no question that the execution, performance and timing of our software development operation was critical," said Erika Peace, technical project manager at ICS. "Rally provided the right tools at the right time so we could cost-effectively deliver technology more accurately aligned with our client's business objectives."

The Challenge

Software development requirements are defined by the mandate that decennial U.S. Census figures are based on actual counts of every person dwelling in U.S. residential structures. Delivery dates are immovable, as the Census Bureau is required by law to report the nation's population and the allotment of seats in the U.S. House of Representatives for each state by the end of December. The 2010 Census Agile
ICS software development team also had to adapt to changing requirements and unique circumstances, such as the challenges around accurately counting "group quarters," like college students living in dormitories.

The Results
ICS uses Agile for its Work on the U.S. Census Bureau's 2010 Decennial Census. Agile helped ICS deliver mandated requirements 50% faster using 1/3 staff of previous efforts and demonstrates best practices for improving U.S. government's outsourced IT operations [Rally].

Through the use of the Agile methodology and automated tools, ICS software development team to deliver the Census Bureau's paper-based operations control system (PBOCS) software over 50% faster than delivery times of the 2000 or the 1990 census software, with just 1/3 of the staff. By tracking its software development process with an automated tool, ICS not only delivered software requirements and met immovable deadlines, but exceeded expectations by delivering an additional software module.

Certifications and Training Options

The Importance of Training Across the Acquirer-Developer Spectrum

Industry experience has found that with proper executive support Agile and Lean can transform the responsiveness, productivity, and customer satisfaction of organizations. The impact of full-scale executive support of Agile is so great and so sweeping in scope, that the value and impact is felt throughout organizations. Training lays the foundation for programs so that they can continue to adapt the process to meet the needs of their specific environment, but we shouldn’t underestimate or negate the need for agile practitioners to participate in the process.

Multiple authors in the agile development community and across the commercial and government agile adoption communities assert that adopting agile practices reflects a culture change even more than a skills and knowledge acquisition (Sidky and Smith 2009). In the spectrum of difficulty of adoption of new technologies or practices, changing culture is the more difficult and time consuming than changing procedures, skills, structure, or strategy (Adler and Shenhar 1990). When attempting a culture change across a diverse audience, many different kinds of communication and implementation support mechanisms are needed to support successful adoption (Garcia and Turner 2006). However, training stands out as particularly important because effective training can include information and opportunities for exercising new cultural norms as well as being a vehicle for supporting knowledge and skill acquisition. The training that is needed for agile adoption includes training for development practitioners, development managers, acquisition staff, acquisition program managers, and acquisition oversight bodies.

The training and certification that is mentioned in this section is based on offerings from industry that would apply to any software development efforts. There would be a need to incorporate the agile principles and concepts into the DAU offering so the needs of the DoD community can be met.
Scrum Alliance Certifications
Most widely recognized certifications are the ones governed by the Scrum Alliance. These certifications cover Scrum, a specific Agile methodology. Entry level certifications are the Certified Scrum Master (CSM), Certified Scrum Product Owner (CSPO), and Certified Scrum Developer (CSD) certifications.

CSM
- Achieved through 2 day certification class
- Over 95,000 CSMs (as of 7/21/11)
- CSM class presents overall Scrum framework targeted towards a general understanding of Scrum
- Recommended attendees: Project Managers, COTRs, Program Managers, development team members.

CSPO
- Achieved through 2 day certification class
- Over 10,000 CSPOs (as of 7/21/11)
- CSPO class presents Scrum framework targeted towards the business and product manager perspective. Focus includes requirements and planning.
- Recommended Attendees: End user representatives, Program managers

CSD
- CSD achieved through 5 day training course or taking a CSM (or CSPO) course followed by a 3 day training course
- Relatively new certification, first CSD classes early 2010
- Over 250 CSDs (as of 7/21/11)
- Targets the Scrum delivery team members

Advanced Scrum Alliance certifications include the Certified Scrum Practitioner (CSP), Certified Scrum Coach (CSC), and Certified Scrum Trainer (CST)

Project Management Institute's (PMI) Agile Certified Practitioner (ACP) Certification
- Certification requires a test, similar to the PMP exam
- First ACP exams to be given in September 2011
- Eligibility requirements for the certification include:  
  - Education: high school diploma, associate’s degree, or global equivalent
  - General project management: 2000 hours (12 months) working on project teams within the past years
  - Agile project management experience: 1500 hours (8 months) working on project teams using Agile methodologies within the past 2 years
  - Agile project management training: 21 contact hours of Agile project management training

Lessons Learned

Through years of trial and error, Industry practitioners have learned numerous lessons from which the DoD can benefit. Following is a list of key areas, with areas specific to the DoD elaborated upon in some detail [Rally]:

1. **The Importance of effectively using retrospectives to continually evolve the process.** As we continue to respond to the section 804 mandate the importance of being able to reflect and assess current DoD acquisition processes and how they might be modified to support and better enable the adoption of Agile principles and practices.

2. **The importance of collaboration between government and the development organizations to meet mission success.** Agile requires full-team collaboration on commitments; the importance of collaboration is that it ensures correct priorities are being set so the developers can respond to the evolving needs of the users.

3. **While we acknowledge the importance of individuals and interactions over tools,** as we scale agile practices over larger teams the right toolset can provide the level of transparency for communicating progress and improve the quality of our products by implementing tools to support automated testing, continuous integration and etc.

4. **Trained and experienced personnel are critical to making teams successful.** In particular, the experienced personnel can help manage and understand the impact of change across the entire agile organization.

5. **Active participation of the Product Owner is critical to project success.** Product owners need to be engaged in the process so they can communicate the ongoing goals and priorities enabling the teams to effectively plan the releases and prioritize the activities so they can execute.

6. **Avoid Reverting to Form**
   Experienced Agile personnel are critical to mitigating the tendency of organizations to revert back to known yet ineffective practices that fail to produce results in this environment.

7. **The importance of engagement at all levels in the organization.** Successful adoptions of agile can be associated consistently with a passionately engaged executive sponsor.

8. **Agile is an empirical process.** We don’t know everything up front and will continue to learn as we execute and deliver on our commitments.

9. **Transparency and open communication are critical to continued mission success.** Agile adoption is that it requires honesty and open communication between the government and development organizations. The time box inspections and regular product reviews can foster a level of transparency that some organizations may be unaccustomed to. When issues are identified in these regular meetings it is important for the participants to work together as a single team to resolve those issues.
Conclusions and Recommendations

Improved productivity, quality, time-to-market, and customer satisfaction are common goals of the DoD and commercial sector. Industry has demonstrated that the implementation of Agile practices can produce significant results in these areas. It is believed that similar trends can be seen in the DoD environment keeping in mind there are particular hurdles that need to be addressed with the current DoD business model and acquisition process. It is critical for industry and DoD to work together to implement Agile principles and practices so the experiences and lessons learned from industry can be leveraged. While positive ROI trends are witnessed on Agile programs, it is important to note that some of the benefits can be more difficult to quantify. Agile methods emphasize the frequent release of capabilities to the users based on business or mission value along with regular inspection to improve process efficacy. Being able to quantify the return on investment in getting high-priority capabilities into the hands of the users, particularly those in the field, early and frequently, is difficult to quantify but from the users’ perspective having this capability can be invaluable.
REFERENCES


Appendix A  Scrum Training Detail

Training options

Training is a critical activity in the transition to Agile practices. Agile training is available from a variety of vendors. Scrum Alliance Certified Scrum Trainers provide Certified Scrum Master and Certified Scrum Product Owner training. Scrum Alliance Registered Educational Providers (REP) project CSD training. the Certified Scrum Master two-day course is the most common.

Scrum.org approved trainers from training for Scrum.org certifications. ICAgile recognized trainers provide training for ICAgile certifications. General Agile and Scrum training is also available from vendors not associated with the Scrum Alliance, Scrum.org, and ICAgile.

The diagrams below identified some of the other training opportunities available.

Scrum.org

- Founded by Scrum co-founder Ken Schwaber
- Certification and class offerings to Scrum Alliance offerings
International Consortium for Agile (ICAgile)
ICAgile (http://www.icagile.com) realizes that the transition to Agile is a journey. The training and certification roadmap is comprised of multiple levels representing different experiences and specialties.

- New certification covering the overall concepts of Agile
- ICAgile Associate certification covers overall Agile concepts
- Advanced Agile certification features specific skill in aspects of