Report to Congress
on
Software Development Activity Completion
Section 874 of the National Defense Authorization Act for Fiscal Year 2018 (P.L. 115-91)

Office of the Under Secretary of Defense
For Acquisition and Sustainment

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Executive Summary

As required by section 874(h)(1) of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2018 (P.L. 115-91), the Under Secretary of Defense for Acquisition and Sustainment (USD(A&S)) herewith provides the completion report on the Agile software activity for the section 874 pilots. This report summarizes the individual software development pilots, their key success areas and challenges, and legislative change opportunities to better support Agile software acquisition. The report makes recommendations for improving Agile adoption within the Department of Defense (DoD) based on pilot observations.

USD(A&S) approved Service- and Agency-nominated programs to pilot Agile software development practices consistent with section 874. The section 874 piloting effort began in the first quarter of fiscal year 2019 (1QFY19) and was completed in 4QFY19. The section 874 pilots are in various stages of transition and although the period of observation for the section 874 pilots was a year, many of the pilots had initiated transition activities up to two years prior. This allowed observation of some of the later-lifecycle impacts of Agile practices.

Leveraging the flexibilities provided by the FY18 NDAA, these pilots had senior-level support to adopt Agile practices. The FY18 NDAA language relieved the pilots from some of the traditional, time-intensive acquisition processes and documentation. This removed the need to do upfront analysis and documentation that aimed to predict technical needs across the entire life of the program. Instead, pilots were allowed the flexibility to do analysis in smaller time windows, and documentation and project tracking at a level that they considered sufficient for their needs. These changes were necessary to be consistent with Agile methodologies, which emphasize flexible scope, requirements, and iterative design and development.

USD(A&S) identified important successes in meeting the intent of the Pilot Program. The pilots all successfully adopted Agile/iterative software practices as required by section 874, and many adopted supporting technologies such as Development, Security, and Operations (DevSecOps) consistent with modern software practice. All section 874 pilots delivered versions of working software far faster than similar traditional acquisition programs. These software deliveries were useful for pilots in obtaining feedback from the user community, enabling a better understanding of the systems to be built, working through technical challenges, and demonstrating initial development team capabilities.

Technical and cultural challenges are being addressed in adopting Agile practices within the Department. Agile principles are new to the Department and not yet consistently followed across all acquisition stakeholders, impacting delivery speed and workload. The Defense Acquisitions System is making progress but is still learning how to adjust processes and reporting to adhere to Agile best practices. The Department has begun a number of initiatives, including the development of an Adaptive Acquisition Framework with a software-specific acquisition pathway, creation of an interim budget activity for software and digital technology pilot programs within Research, Development, Test and Evaluation (RDT&E) appropriations to provide pathfinders a single appropriation for software capability delivery. Work remains within OUSD(A&S) and other stakeholders in the acquisition ecosystem to design processes for Agile software acquisition that retain focus on quality and cost-effectiveness. This report presents a way forward recommendation to transition the Department to Agile and overcome the challenges identified in the section 874 pilots.

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1 Overview

Pursuant to section 874(h)(2) of the National Defense Authorization Act (NDAA) for Fiscal Year 2018 (Public Law 115-91), this document provides the Agile software activity completion report for the Section 874 pilots. DoD USD(A&S) approved seven acquisition programs nominated by Services and Agencies to pilot Agile software development practices consistent with section 874. The piloting effort began in the first quarter of fiscal year 2019 (1QFY19) and was completed in 4QFY19. The report identifies the individual software development pilots and their key successes and challenges. It also presents recommendations for continuously improving Agile adoption across the Department of Defense (DoD) based on the observations of the pilots and their experiences.

2 OUSD(A&S) Pilot Activities

2.1 Pilot Engagement Approach

The Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD(A&S)) defined a three-phased approach for all section 874 pilots, to include assessment, planning, and execution phases. The OUSD(A&S) met with each pilot during the assessment phase to ascertain their initial level of Agile maturity and provide additional guidance as needed. During the pilot planning phase OUSD(A&S) assessed the pilot teams' readiness and plans for pilot execution. During the pilot execution phase OUSD(A&S) engaged with the pilot teams to draw data-driven observations and conduct analysis for developing the recommendations contained in this report. OUSD(A&S) engaged pilots in a non-obtrusive manner with a "light touch" approach that focused on accessing existing program management tools and reporting mechanisms vice additional data calls.

To execute this approach, the OUSD(A&S) formed a Core Team for Agile Acquisition of Pilots (CTAAP). Each pilot was assigned a Pilot Advisor to provide Agile subject matter expertise to teams throughout the pilot lifecycle.

2.2 Community of Practice

Section 869 of the John S. McCain NDAA for FY2019 (P.L. 115-232) directs the USD(A&S) to develop a Community of Practice (CoP) to assist DoD pilots in adopting Agile software acquisition. The Agile Pilots CoP provides an environment where CTAAP Pilot Advisors and Agile subject matter experts (SMEs) can collaborate and share information, and pilots can contribute lessons learned and best practices from implementing Agile methodologies within DoD. The CoP is currently limited to NDAA Agile Pilot Programs and advisors within these programs, but external users will be added to the CoP as the DoD expands the use of modern software development techniques. The Agile Pilots CoP aspires to be a grassroots effort supporting the cultural change to Agile and DevSecOps practices in software-intensive programs within the DoD. This initiative is being implemented in collaboration with the Defense Acquisition University (DAU) and is integrated with existing and emerging Agile-related training. The CoP also facilitates sharing of the CTAAP-developed best practice whitepapers throughout the community.

A&S is currently studying a strategy for expanding the Community of Practice to increase collaboration DoD-wide by leveraging existing communities of practice from Services/Agencies and industry.

2.3 Agile Characteristics

Adopting Agile software development practices necessitates fostering and supporting new characteristics. This section describes the characteristics of a successful Agile Program.

- **Early and Continuous User Engagement**

Early and continuous engagement with users enables the program to solicit feedback early and often. The faster feedback loop allows the program to learn quickly and often with the users. Additionally, the engagement and discussion with users builds trust between the users and the development team.

- **Adopt Both Mindset and Methodology**

Agile programs adopt not only a methodology that is consistent with agile principles they also adopt a common orientation that is shared by everyone on the team. If everyone on the team understands and embraces a common cultural mindset focused on realizing the benefits of Agile development – communication is better, and everyone listens and works together to make sure the project is on track.

- **End-User Integration**

Agile programs establish a feedback loop with their users as early as possible and continuously engage with their users throughout the development lifecycle.

- **Continuous Learning**

Agile programs train the entire workforce which includes but is not limited to leadership, legal, contract, development, requirement, finance, and test & evaluation teams.

- **One Team Approach**

Agile programs adopt a “One-Team” approach that breaks down functional silos. Traditional development organizes teams according to functional areas such as requirements and testing. In contrast, Agile promotes stakeholders working together as part of development and operations. This approach avoids organizational handoff and promotes true collaboration.

- **Shift Left & Automation**

Agile programs work to identify and fix defects early. Agile programs use automation to the maximum extent possible to support the shift left. Test automation and Test-Driven Development (TDD) provide focus on collecting data early and throughout development in order to identify defects and issues early in order to fix them early. This dedication to data avoids late discoveries and leads to more efficient and effective development with the result of getting high quality software to the user faster and more cheaply.

- **Emergent Requirements and Architecture**

Agile programs can incorporate high-level requirements and architectural guidance to guide the overall direction of work. However, detailed requirements, architecture, and design are developed in an emergent, iterative manner, as opposed to a predictive, up-front model. This provides the ability to address changing needs and priorities continuously, in frequent activities designed to take stock of progress and plan the next increment based upon the latest available knowledge.

- **Distributed Decision Making**

Agile programs push down decisions to where the best information resides for that decision. This enables programs to communicate intent, produces accountability and responsibility at all levels while improving the speed of decision making overall.

- **Deliver Early and Often**

Agile Programs deliver software as early and often as possible, in small increments of capability. This improves trust between developers and users. Agile programs value working software over documentation and exercising the feedback loop to elaborate the design.

- **Adhering to a "Software is Never Done" Mindset**

Agile programs continuously deliver and have moved away from a "development versus maintenance" lifecycle approach. Once the solution is fully developed and delivered, the system is not handed over to a different (sustainment) team. The solution will continue to evolve as priorities dictate.

- **DevSecOps Adoption**

Agile teams embrace "Lean" practices to promote continuous integration and continuous delivery with security woven through the entire software development cycle. This includes developing or leveraging a modern cloud-hosted architecture with appropriate security controls applied to properly harden the solution. Modern software tools help support this in a continuous fashion. For example, security analysis and testing of the software code can occur every time the software is integrated, providing confidence in the security of every delivered version.

3 FY18 NDAA Section 874 Pilot Participants

The pilots selected by the USD(A&S) represent a cross-section of the Services/Components and span a blend of warfighting and business systems.

Army Pilots:

- **Defensive Cyber Ops/Cyber Analytics (DCA)**

Cyber Analytics Big Data Platform (BDP) is a software system for ingesting and storing large data sets, building data-science analytics, and visualizing the results. The system allows critical decisions for cyber operations to be based on a richer and broader set of information. As disparate heterogeneous big data platforms have come online to support big data analytics, Government organizations have a growing need to share analytic results and datasets across the many environments. The vision of the BDP implementation is to deploy full stack big data solutions in multiple domains, using gap-filling Command and Control (C2) messaging and secure orchestration that enable real-time defense activities supporting the community partners of interest. Community partners include: the Defense Information Systems Agency (DISA), National Security Agency, Department of Homeland Security Office of Cybersecurity and Communications, Department of Energy (DOE); U.S. Cyber Command, Air Force, Navy, Marines, and U.S. Army Cyber Command.

- **Defense Cyber Operations/Mission Planning (DCOMP)**

PhalanX supports cyber mission planning and cyber mission execution for the U.S. Army's Cyber Protection Brigade. It combines visualization, automation, integration, and collaboration with force management into a single web-based application to create a virtual battlespace for cyber warriors. This centralization provides a common operating picture for cyberspace

commanders, staff, and operators by integrating wargaming, control, intelligence threat and vulnerability analysis, execution and assessment of cyber operations, mission command, and planning.

Navy and Marine Corps Pilots:

- **Maritime Tactical Command and Control (MTC2)**

MTC2 started a small-scale software development activity related to the Global Force Management Data Initiative. The capability will focus on the scheduling of Naval group compositions, such as a Carrier Strike Group or Amphibious Readiness Group. MTC2 will leverage Agile development for this effort with an initial delivery to U.S. Fleet Forces within three months, and a subsequent delivery each month thereafter. MTC2 will collect customer feedback and will add it to the product backlog to be incorporated into future software releases.

- **Marine Corps Recruiting Information Support System II (MCRISS II)**

The MCRISS II pilot used an Agile Scrum framework approach to manage software development. Agile sprints addressed portions of system capability to derive specifications, conduct design and development, and perform testing. The MCRISS II system uses a Platform as a Service (PaaS) solution to provide mobile and offline capability and cloud-based technology to support Marine Corps recruiters. The system streamlines the recruiting business process, provides remote capability via mobile technologies, enhances reporting capabilities, and will decrease future software costs by reusing code and ensuring net-centric interoperability. MCRISS II enables recruiters to tailor dashboards to track applicants from their initial meeting through boot camp to entering the fleet.

Air Force Pilots:

- **Air and Space Operations Center (AOC) Pathfinder (aka Kessel Run)**

The AOC Pilot Team built the Target Discovery Manager product to help analysts identify potential targets and organize them in a way that will reduce redundant mission work and lead to more accurate targets working their way throughout the Joint Targeting Cycle to be prosecuted faster by the AOC. The product was added to the broader Kessel Run portfolio as the AOC Pathfinder continues to provide lessons learned on scaling Agile software within the Air Force.

- **Cyber Mission Platform (CMP)**

The U.S. Air Force is operationalizing and normalizing existing cyberspace capabilities, organized by mission threads consisting of Platforms, Accesses, and Payloads. CMP provides the framework for cyber platforms. It includes an application program interface/standard interface for existing/future weapon systems to maximize flexibility and efficiency for developers, testers, trainers, and operators.

DISA Pilot:

- **National Background Investigation Services (NBIS)**

The NBIS pilot established the initial foundation for NBIS to create not only the NBIS V2.0 capabilities but also the Agile organization and Agile practices that will enable the continuous evolution of NBIS capabilities to realize the “Trusted Workforce 2.0” vision. The goal of “Trusted Workforce 2.0” is to transform the security clearance process supporting federal employee and contractor background investigations and re-investigations.

4 Pilot Program Results

This section provides an overview of NDAA specifications and pilot execution against those specifications. Key pilot program successes and challenges that they experienced are also include

4.1 Execution against NDAA Specifications

The NDAA section 874 guidance specified the areas of interest below for the Pilots to focus efforts. The successes and challenges noted in the following provide additional Pilot effort.

- **Streamlined Processes**
  - Summary of NDAA Direction: Pilots were encouraged to streamline their processes to support Agile delivery. Specific areas of relief were provided in the areas of earned value management (EVM) or EVM-like reporting; development of an integrated master schedule (IMS); use of traditional life cycle methodologies; and additional relief from upfront detailed planning and requirements artifacts and processes.
  - Pilot Execution: All pilots accepted the relief provided to them under NDAA in the areas of EVM, IMS, traditional lifecycles, and detailed upfront planning. These reliefs were validated through pilot period of performance as important accelerators.

- **Agile Roles and Responsibilities**
  - Summary of NDAA Direction: Pilots were requested to include specific roles, specifically a Program Manager (PM) with programmatic decision-making authority and a Product Owner (PO), Engineering Lead, and Design Lead. As defined in the section 874: "A program manager that is authorized to make all programmatic decisions within the overarching activities objectives, including resources, funding, personnel, and contract or transaction termination recommendations. A product owner that reports directly to the program manager and is responsible for the overall design of the product, prioritization of roadmap elements and interpretation of their acceptance criteria, and prioritization of the list of all features desired in the product. An engineering lead that reports directly to the program manager and is responsible for the implementation and operation of the software. A design lead that reports directly to the program manager and is responsible for identifying, communicating, and visualizing user needs through a human-centered design process."
  - Pilot Execution: All pilots were able to fill the necessary roles in accordance with their execution plan. However, the role of the PO proved especially challenging to some pilots due to the time and level of engagement required. Some pilots also faced difficulties in delegating decision-making authority to the program level.

- **Development of a Plan**
  - Summary of NDAA Direction: Pilots were requested to develop a plan containing the overall vision; a roadmap; a rapid merit-based contracting procedure; a continuous user engagement approach, to include frequent and iterative user feedback and validation; and incorporation of commercial best

practices related to modern application development, testing, integration, monitoring, and deployment.
    - Pilot Execution: All pilots developed an execution plan in accordance with NDAA direction. All plans were approved by the Service Acquisition Executive (SAE) or Component Acquisition Executives (CAEs) and served as the basis of execution and monitoring for the piloting activity.

- **Program Schedule and Software Delivery**
    - Summary of NDAA Direction: The NDAA section 874 guidance requested that pilots implement award processes that take no longer than three months (if additional action was required); frequent and iterative user engagement and validation; delivery of a functional prototype or Minimum Viable Product (MVP) within three months from award; and follow-on delivery of iterative development cycles no longer than four weeks apart.
    - Pilot Execution:
        - All pilots planned frequent and iterative end-user validation of developed features and their usability.
        - All pilots satisfied the requirement to deliver a prototype or MVP in three months or less from contract award and subsequently continue to deliver capability no more than four weeks apart.
        - In many cases, the delivery requirement was met through a functional prototype pilots delivered to a proxy environment (rather than production) to support existing constraints on software assurance and configuration management processes.
        - Pilots noted and recognized the need to implement DevSecOps practices in order to consistently and quickly deliver value to the warfighter and at a high level of quality.

- **Integrated Tools and Metrics**
    - Summary of NDAA Direction: The guidance requested inclusion of a modern backlog tracking tool as well as Agile development metrics to track the pace of work, completeness of scope of testing activities, and delivery progress relative to the product roadmap and goals for each iteration.
    - Pilot Execution: All the pilots implemented Agile tools to help manage backlogs but noted that consistency and quality of tool setup and tool usage varied. Each pilot continues to expand usage of metrics and focuses on improvements to overall metrics approach.

4.2 Observed Pilot Successes

This section describes key successes identified by the CTAAP while observing the section 874 Agile pilots.

- **Pilots were able to repeatedly deliver capability using predefined iterations**

Several pilots, particularly those supported by automation and infrastructure, delivered working software earlier than section 874 directed (delivery of an MVP within 3 months of an award and successive iterations no more than 4 weeks apart).

It is important to note that several pilots had begun the transition to Agile and DevSecOps prior to their selection as an 874 pilot - that is, they had established contracting vehicles, adopted agile processes with on-going efforts. In the cases where pilots chose to deliver code directly to the operational environment, having an existing DevSecOps infrastructure already in place was an important enabler. The CTAAP also observed situations in which pilots, which had stood up their own development and deployment infrastructures, made them available to other programs to help them begin improving their DevSecOps capability.

- **A Variety of Agile Approaches Are Suitable for the DoD**

All pilots had noteworthy successes in implementing their chosen Agile approach (Scrum, Scaled Agile Framework (SAFe), or eXtreme Programming (XP)). The pilots chose their specific methodology to support their pilot specific outcomes. Pilots chose SAFe if they needed an Agile methodology that supported scaling. Others focused on establishing an organic software development expertise and selected eXtreme Programming. To improve the likelihood of adoption, the pilots considered their organizational culture when selecting an Agile framework. The CTAAP recognized all these approaches and deemed them suitable to support transition to Agile.

- **Programs Engaged Effectively with Their User Communities**

Pilots used the Agile transition to improve engagement with their user communities. Pilots understood the importance of user involvement and actively engaged and requested support from their users. The users participated in software demonstrations and backlog grooming activities. Pilots reported that their users had a higher level of participation than prior to Agile and the design and development work benefited from this active engagement. Several pilots displayed an ability to overcome challenges (e.g., due to emerging requirements or better understanding user needs) and adjust their MVP and roadmap accordingly. Pilots demonstrated the ability to respond to change and adjust work to meet user needs.

- **Decision Making Was Largely Pushed Down to the Appropriate Owners**

An important Agile principle is to push decisions down to the lowest appropriate level, so that decisions can be made by the personnel who have access to and an understanding of the relevant data and experience. Requiring that decisions be made at higher levels of authority can introduce severe delays into a program and thwart the goal of delivering warfighter capability quickly. In the 874 pilots, design and development questions were generally addressed by POs, allowing teams to stay on schedule. Many Program Executive Offices (PEOs) delegated decision authority to PMs, which enabled teams to be more responsive in addressing their user communities as outlined above.

- **Continuous Authority to Operate (cATO) Is a Key Enabler to Frequent Delivery of Capability**

Although not a universal experience, where pilots were able to receive approval to deploy software to production quickly with a continuous or reciprocal Authority to Operate, the teams were able to deliver working software more frequently by avoiding the need to go through an entire ATO process for every version of the software.

- **Testing and Accreditation Can "Shift Left" to Avoid Program Delays**

Most pilots made a notable effort to integrate developmental and operational testing, and accreditation functional areas of security and operations earlier in the development process. Including these testing stakeholders in the planning and execution phases allowed the pilots to

begin work earlier and address problems continuously, thereby avoiding late bottlenecks and improving processes over time. However, more work remains to integrate Operational Testing and security accreditation activities in support of continuous and ongoing delivery of capability.

- **Training and Coaching Are Effective**

All pilot teams received training in Agile as well as coaching assistance from SMEs. The need for different training models changed over time as the teams progressed through their Agile transitions. Training courses developed by DAU under Section 891 or other institutions were generally perceived as useful and were effective. Training provided all pilot stakeholders with a common understanding of Agile processes, terminology and expectations. Pilots reported that it was helpful for external stakeholders (senior decision makers, contracting personnel, etc.) to attend training along with the pilot personnel to better understand the goals and Agile process. Dedicated coaching was useful when the pilots began their transformation in earnest, transitioning to as-needed coaching / consulting engagements when the process fundamentals were in place and the teams needed less frequent but more targeted information.

- **Developmental Test (DT) Activities Are Becoming Part of Development**

DT has become an intrinsic part of the development process because it supports rapid and confident software development. Developers following the practice of automating unit tests have the confidence of their test community and are demonstrating how frequent and upfront testing can maintain software quality.

4.3 Observed Pilot Challenges

This section identifies challenges observed by CTAAP while pilots executed Agile practices in support of development. The challenges are generally due to Agile practices not being consistently followed by all stakeholders in the DoD acquisition ecosystem, which impacts delivery speed and workload. The specific observations are:

- **Application of Continuous and Automated Test Practices**

Integration and automation of test activities have started but more work remains to be done in this area. Tool usage and experience across development/test teams vary but over time this should improve. Requiring additional time in the schedule to certify every release to operations would impact schedules and be incompatible with an Agile cadence.

- **Requests for Detailed Predictive Requirements and Architecture**

While all pilots used Agile tools (notably Jira) to manage requirements, there is still significant demand from acquisition elements for a traditionally based, predictive requirements and architecture model. The desire for complete detailed requirements upfront introduces downstream practices that Agile pilot programs are trying to avoid, such as large planning efforts that lead to large, costly, and high-risk execution efforts.

- **Organization Change Is Required**

Some of the pilots identified limited availability of POs to participate in Agile practices as an issue. Often the PO that is needed for development support is also relied upon by their area of expertise (i.e. medical facility, aircraft). Organization change and practices must address sharing knowledge to support solution development and meeting the business/warfighter responsibilities. For some pilots, organizational changes during their execution phase increased the number of PO

resources available. Active warfighter/end-user participation in development activities is critical to producing solutions that meet organization and user needs.

- **Communication across All Stakeholder Types Is Critical but Not Well Supported**

All pilots can benefit from improved tools to support open, cross-team communication and ease of sharing. The ability to "chat" with team members who are consultants and/or Government employees is both desired and necessary, as communication channels in a knowledge-intensive product such as software are critical. Firewalls and technology restrictions limit access to some communication tools.

- **Additional Training in Agile Is Required**

The population of DoD acquisition professionals who have experience in Agile approaches is still small. Pilots must continue to cover training and coaching costs for the foreseeable future as they re-align to use Agile approaches.

- **Appropriations Do Not Match the Technical Work of Software Acquisition**

The Defense Innovation Board's Software Acquisition Practices Study recommended that the Department fund software development efforts using a single appropriation that allows for development, production, modification, sustainment and maintenance of software. Not surprisingly, some pilots noted that using Agile methodologies blurs the line between development and sustainment work, and therefore funding should be combined under one appropriations category. Where pilots must balance across appropriations categories, they experience challenges. Program management overhead is required to map the work to an appropriation category and justify/defend the mapping afterward; predictive planning and appropriation of funds years in advance; and appropriations for cloud architecture and services (e.g., cloud services for platforms, software, and infrastructure), for which unclear guidance exists today as to applicable colors of money.

- **Lack of Existing Enterprise Solutions across the DoD**

Modern development and deployment infrastructure are necessary to support Agile development activities. Some pilots have been able to build such infrastructure, but not all have access to the requisite expertise and experience to deploy infrastructure necessary to consistently support Agile delivery in a cost-effective and efficient manner. While there are initiatives across all the Services to develop such infrastructure at the enterprise level, these solutions are not universally available, creating a quandary for programs without access.

- **Pre-Pilot Decisions**

Some pilots encountered challenges with the legacy of earlier acquisition decisions, which are not consistent with Agile delivery approaches.

5 In-progress Activities Based on Observed Issues

The section 874 pilot program provided the Department with the ability to observe in real time the points of friction between the participating programs and existing acquisition policy, which hindered the goal of delivering software capability to the warfighter / end user more quickly. The Department has already begun to address several issues where high payoff is expected, without waiting for Congressional direction. This section summarizes the lessons learned from the pilots and the ongoing activities that address them.

- **Incorporating Modern Software Technology Trends**

Agile and DevSecOps are current technology trends that are leading to the transformation of acquisition and software development to deliver capability to users quicker and more efficiently. In particular, pilot experiences with the level of automation that becomes possible in DevSecOps demonstrated the importance of that technology for supporting speed with quality. Multiple initiatives underway in the Services and the DoD Chief Information Officer (CIO) are working to develop shared enterprise resources to allow this technology to be deployed cost-effectively at scale. The Office of the Deputy Assistant Secretary of Defense for Acquisition Enablers (ODASD(AE)) within the Assistant Secretary of Defense for Acquisition (ASD(A)) organization will continue to assess emergent technology trends to be quicker to adopt and promote software development practices and digital infrastructure offerings that improve DoD's ability to deliver software in a secure, continuous manner. DASD(AE) should work with enterprise solution developers to support program planning and adoption by developing an over-arching strategy, roadmaps, and supporting execution plans that describe planned DevSecOps capabilities, available release dates and terms of usage that are prioritized based on DoD needs.

- **Advising and Guiding the Transition to Agile**

Moving from traditional to Agile approaches for the pilots was not trivial, requiring changes in technology, process, workforce, and other dimensions. The CTAAP team provided Pilot Advisors to work with participating programs on this transformation, and has expanded since then to work with additional programs not on the original list. Experiences from the pilots have also informed the Software Acquisition Pathway which is currently under development and which will provide a process that more easily supports Agile approaches. Other organizations within the DoD, such as the Defense Digital Service, Defense Acquisition University (DAU), the Under Secretary of Defense for Research and Engineering (USD(R&E)), and groups within the Services are all building up more capacity to work with programs on this transformation.

- **Promoting Cultural Change**

Culture is a critical enabling factor for improving adoption of organizational agility. This requires a top-down and bottom-up approach to encouraging Agile adoption. The Department is working to promote such culture change through activities like developing the Software Acquisition Pathway policy and guidance, which provides a process based on iteration, user engagement, constant feedback and learning, and other principles that are necessary ingredients of an Agile culture. USD(R&E) and the Director, Operational Test and Evaluation (DOT&E) are developing a new, integrated test and evaluation policy that emphasizes efficiency and effectiveness in all acquisition pathways. Other activities such as DAU training courses aim to disseminate these principles and supporting processes more broadly. To support Agile transformation more broadly, all acquisition stakeholders should continue to review acquisition and programmatic decision-making authorities to ensure that decision making takes place at the appropriate level to promote Agile and improve accountability at all levels of the organization.

- **Moving User Acceptance and Other Equities Earlier in the Development Process**

The certification community should focus on more consistently shifting the User Acceptance and other activities earlier and throughout the software development life cycle to better support continuous delivery while preserving their independent validation role. The relevant stakeholders are working on instantiating Agile principles as relevant for their duties; one example of this is the Integrated T&E policy being developed by USD (R&E) and DOT&E.

Another example is the DevSecOps T&E guide being produced this fiscal year by USD(R&E). Additional efforts within the Services are helping to define these new procedures. For example, USAF's Continuous Authority to Operate (ATO) Playbook presents a mechanism for incorporating ATO certification earlier in the process rather than as a time-intensive activity late in the lifecycle. DISA and USD(R&E) developed and are piloting a unique developmental evaluation framework for DevSecOps that serves as the core strategy of DT&E efforts.

- **Expanding Agile Training and Guidance**

DAU is continuing to engage with stakeholders both internal and external to the Department to develop robust Agile training that can be provided across the acquisition ecosystem, to stakeholders in multiple functional areas: program management, contracting, requirements, testing, security/certification and other acquisition elements. Additionally, the CTAAP is working on multiple white papers as well as a more comprehensive Agile guidebook based on the observations from the pilot programs.

- **Establishing a Community of Practice Federation Strategy**

As reported in Section 2.2 of this document, USD(A&S) has developed a CoP to support the needs of the pilot programs and their Service stakeholders. As we have done so, we have interacted with multiple other CoPs on Agile, DevSecOps, and related topics that have been stood up within the Services and other DoD organizations. We have begun to develop a Community of Practice federation strategy to promote sharing of information between these multiple communities of practice and further disseminate lessons learned and collaboration opportunities related to modern software methodologies.

6 Way Forward Recommendation

The experiences from our pilot programs also identified additional needs for access to information and plans, which are needed for the Department to scale up the adoption of modern software practices, such as Agile and DevSecOps, to programs beyond our initial set of pilots.

- **Establish an Agile/DevSecOps Focal Point**

OSD should establish a group to serve as a Focal Point to promote Agile best practices, expand knowledge of DevSecOps approaches, and support the transition of programs from waterfall to Agile. These personnel should promote the Agile principles and DevSecOps practices of continuous integration and continuous delivery, integrated testing, and integrated security.

7 Legislative Opportunity

An additional point of friction was encountered, which would require legislative endorsement:

- **Software Appropriation Category**

The Department is considering creation of an interim budget activity for software and digital technology pilot programs within Research, Development, Test and Evaluation (RDT&E) appropriations to provide pathfinders a single appropriation for software capability delivery. A limited set of pilots, nominated by the CAEs, would use a single appropriation for development, production, modification, sustainment and maintenance of software. If successful, the

Department would work with the Congress to institutionalize unique software and digital technology appropriations.

Rationale: As discussed in Section 4.3 (under “Appropriations Do Not Match the Technical Work of Software Acquisition”), this effort will address a problem area identified by several of the pilot programs, in which the current approach to appropriations does not match the technical work of software acquisition.