

Lessons Learned in Incorporating Agile Software Development on Joint Secure Air-combat-training System (JSAS)

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Presented by Brian Hulet

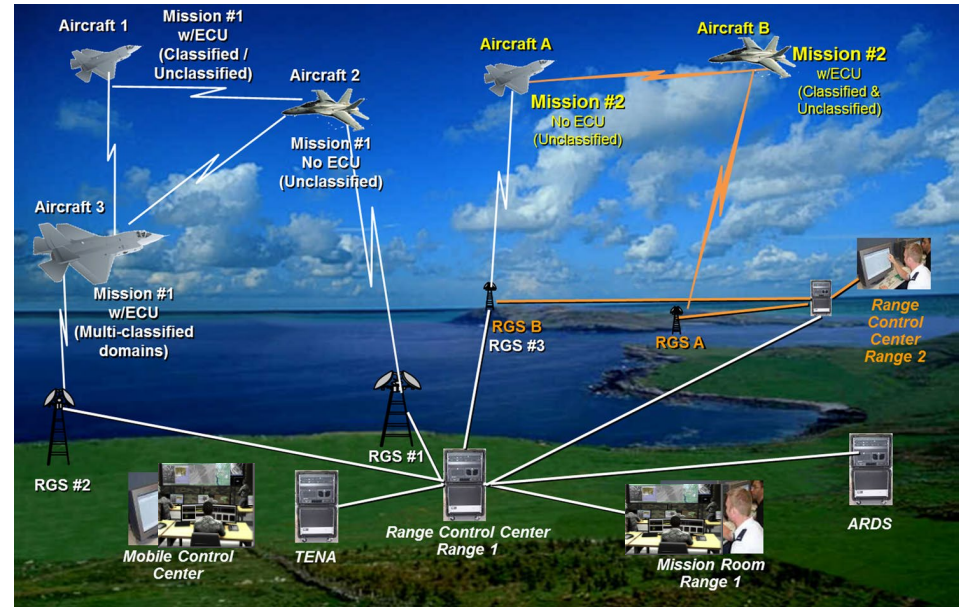
Abstract

- Joint Secure Air-combat-training System (JSAS) is Collins Aerospace's family of test and training systems. DoD Test Ranges CRIIS and US Navy's TCTS II are programs of record in the JSAS portfolio. JSAS provides and collects data across user-defined areas via secure connected-communications and secure platform interfaces.
- Recent SW development for CRIIS transitioned to using Agile SW processes which includes OS migration, simplified HMI/GUI interfaces, and other feature sets. This briefing will cover the lessons learned for CRIIS as envisioned by Collins Aerospace to meet the continued needs for Live, Virtual, and Constructive (LVC) enabled systems for test and training including standards based open architectures, certified RMF-hardened Multi-Level Security and distributed mission operations.

Presentation focuses on the Agile Transition, Implementation and Lessons Learned

High Level Overview of JSAS 1.0

- High Accuracy Time Space Position Information (TSPI)
- Multiple Independent Levels of Security (MILS) Capable Test/Training System
- Aircraft Bus Connectivity
 - 1553
 - Fibre Channel
 - Ethernet
- 3 Aircraft Subsystems
 - External Pod
 - Internal Air Cooled
 - Internal Liquid Cooled
- Connections to Existing Infrastructure
 - TENA
 - ARDS

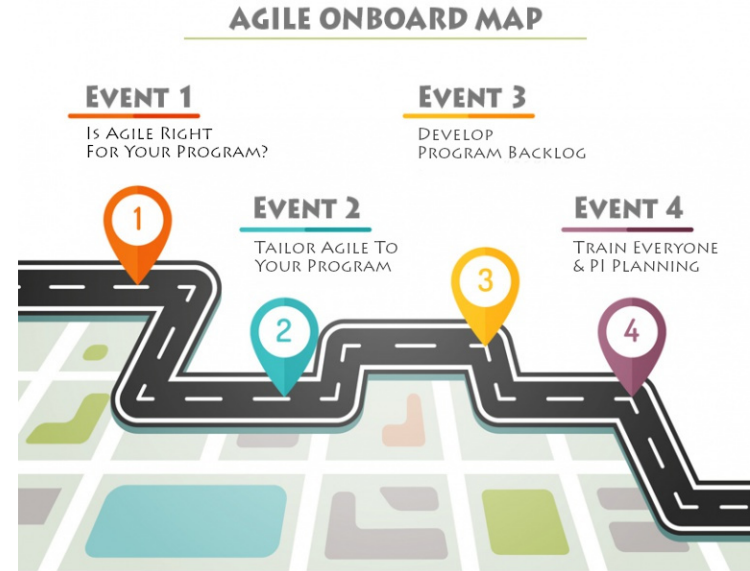


Test and Training Instrumentation Department

- 9 teams comprised of 150+ engineers focused on test and training instrumentation
 - CRIIS
 - TCTS II (EMD phase)
 - RPI/AWBS
- Teams organized around discipline (Systems, Software, Hardware) and function [e.g. datalink, embedded security, System Control Console (SCC) software]
- Traditionally have implemented a waterfall development model
 - Integration of System of Systems developments a big challenge/risk
- Software development teams recently converted to Agile development model
 - SCC software team implemented Agile at the beginning of development (July 2018)
 - Additional software teams transitioned to Agile based on success of SCC team
 - Some SCC team members added to other teams for continuity across department

Agile Transformation Team

- Collins Aerospace resource for transitioning to Agile planning and execution environment
- Led by an Agile Champions
- Four step process the ends with a trained team ready to launch into Agile development
- Agile champion continues to support program during execution phase
- Provides collection of resources for reference



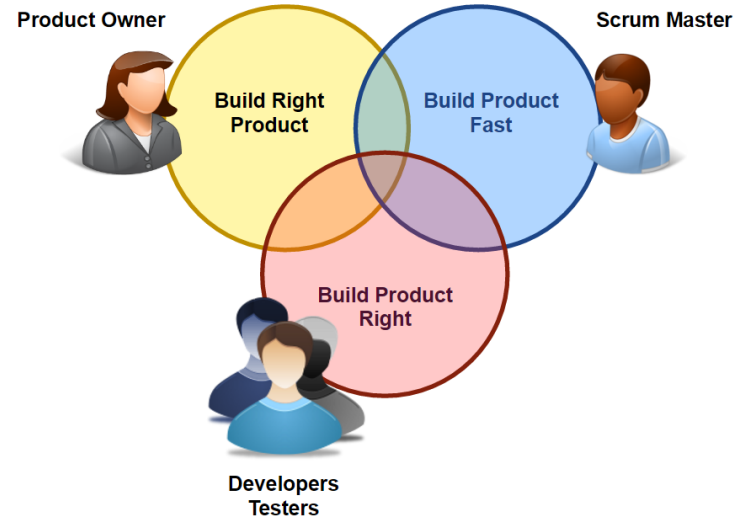
Business Case for Agile (Event 1)



Customer Buy-in a Critical Component of Decision to Implement Agile

Defining Agile Approach (Event 2)

- Audience: Program Manager, Technical Project Manager, Project Engineers, Cost Account Managers, Schedulers
- Designed and documented Agile approach for program
- Matched leaders to Agile roles
 - Scrum Master – Ensure product team works efficiently and quickly
 - Product Owner – Has the vision for the product that the team is building
 - Release Train Engineer – Implemented for multiple Agile team developments to keep program working together efficiently (TCTS II)
- Defined Sprint/Increment Calendar
 - 4 week sprints/quarterly increments for SCC team

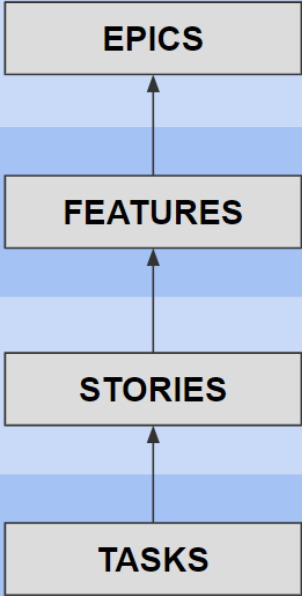


Develop Backlog of Work (Event 3)

- Program Increment (PI) Pre-planning Meeting to develop initial backlog for PI planning
- Define epics and a Lean Business Case for each
 - Epics break work down broad system capability with a common objective
 - Can cross PI boundaries
 - Lean Business Case describes the epic, how success will be measured, what is in scope, et al.
 - **Control Accounts for executing assigned scope/budget defined at Epic level**
 - Minimizes number of network activities team charges to and tracks
- Break down epics into features
 - Deliverable piece of functionality that fits within a PI
 - Managed as part of Team Backlog
 - **Lowest level tracked in Integrated Master Schedule (IMS)**
- Break down features into stories
 - Smaller set of work that can be accomplished within a sprint
 - Stories for initial PI take priority and backlog is expanded based on scheduled features

Epics ← Features ← Stories

Agile Work Breakdown Structures

CONTAINER	DESCRIPTION	TIMEFRAME
 EPICS	<ul style="list-style-type: none">• Broad system capability• Clearly describes the customer value• Fixed Intent (we know what this is today)	<ul style="list-style-type: none">• Maps to a release
FEATURES	<ul style="list-style-type: none">• Feature of an Epic• Smallest functionality that an end user or customer cares about• Clearly describes the customer value	<ul style="list-style-type: none">• Fits within a Program Increment• 8-12 weeks• Goes into the Program Backlog• Managed on a Program Board
STORIES	<ul style="list-style-type: none">• Story that further subdivides a Feature• Variable Intent (team determines how to implement)	<ul style="list-style-type: none">• Fits within a Sprint• 2-4 weeks• Goes into the Team Backlog• Flows across the Team Scrum Board
TASKS	<ul style="list-style-type: none">• Certification artifact• Verification tasks• "Tasks" that apply to all stories	<ul style="list-style-type: none">• Fits into 1 or 2 days• Linked to the story

Tasks for unit test, auto test, pull request, HMIDD update included for each story

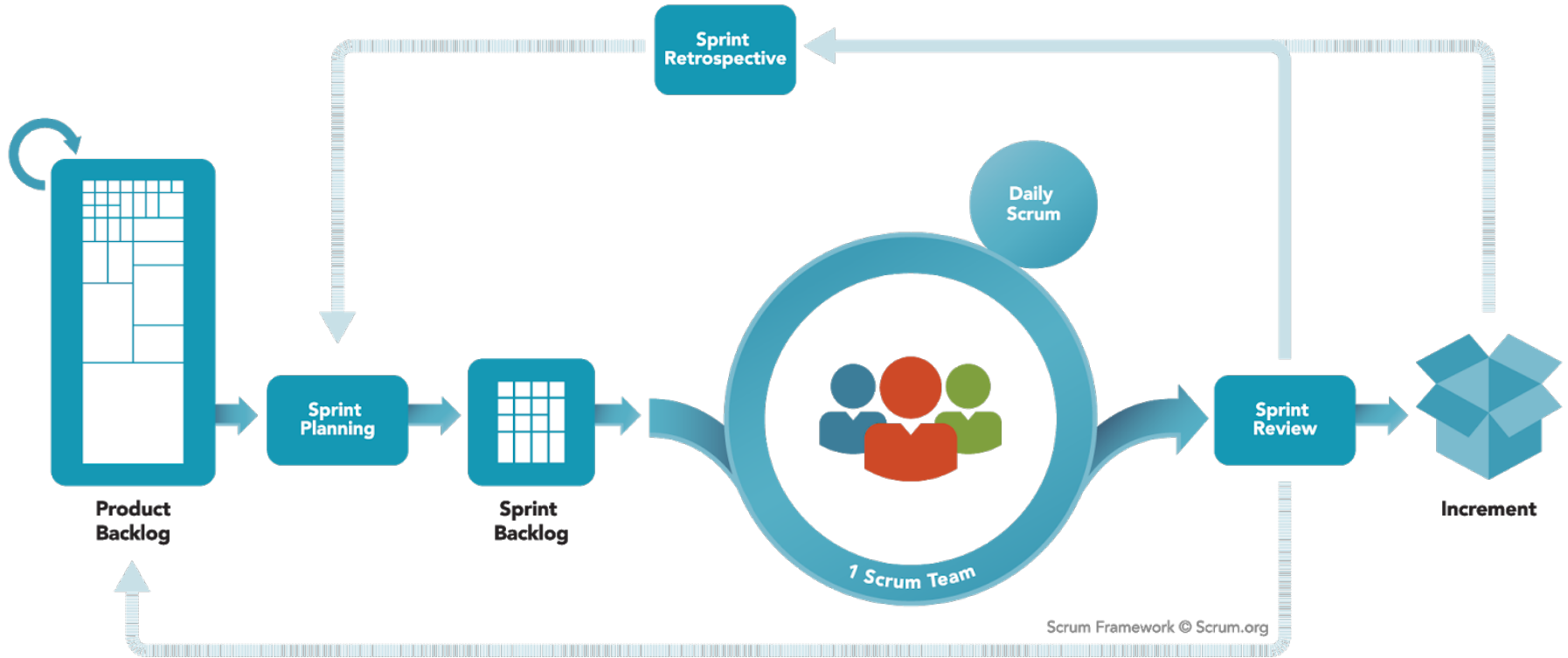
Team Training and Program Increment Planning Meeting (PIPM) (Event 4)

- Training event held for Agile 101 Workshop
 - Entire team included in addition to customer
 - Held at offsite location for 2 days
 - Instructor-led by practicing Agile Champions
 - Hands on exercises to understand scrum method, relative estimation of story points, scrum roles, etc.
- Separate event held for first PIPM
 - 2 day event included customer to define PI1
 - Backlog was somewhat immature and some backlog grooming was done in parallel
 - Going forward, PIPM is done internally at department level
 - 2-day offsite meetings initially; transitioning to tailored onsite meetings
 - Iterative Design Reviews with customer held quarterly
 - Hands-on demo, retrospective, PI plan review, design artifacts review

SCC Agile Team Overview

- Currently 17 team members
 - Engineering manager is an Agile Champion
 - Product Owner is Integration and Test Lead in System Integration Lab
 - Larger than recommended scrum team size due to work on a common CSCI
 - Consists of Software and System Software engineers
 - Mainly co-located in a common area (preferred)
 - Dedicated Agile spaces for each team planned for future
 - Some offsite support included
 - Separate System Integration Lab used for integration and demos
 - Daily standup held for team (WebEx provided) – 15 minutes
 - Weekly Story Writing Meeting – 30 minutes to 1 hour
 - Smaller team that ensures stories have sufficient detail for team to assess
 - Now includes customer representatives
 - Weekly Backlog Grooming – 1 hours
 - Full development team meets to discuss stories in backlog and assign story points

Scrum Framework for SCC Agile Team



SCC Team Agile Toolset

- Atlassian Collaboration Tools
 - JIRA for Agile Project Management
 - Bamboo for Continuous Integration and Test of Full Build
 - Bitbucket for Continuous Code Reviews
 - Confluence for Documentation
- Squish for Automated GUI Testing
- EA Model-based Message Framework Testing
- Git for Version Control Repository

User Feedback and Implementation

- Initial plan for range user feedback was quarterly demos/hands-on time at Incremental Design Reviews (IDRs)
- Current plan includes range users at monthly demos to maximize participation
- **Near term plan is to provide snapshot software releases to range users every other sprint**
 - Streamlined release process to delivery quickly but still retain configuration control of releases
 - Software limited to evaluation only and not used for operations
 - Customer coordinates range user feedback into comprehensive list
- User feedback changes and enhancements are added to program backlog and prioritized

Range User Feedback and Hands-on Demos Important Part of Risk Mitigation Plan

Lessons Learned

- Transition to Agile fairly seamless with the investment in pre-planning and training
- Team efficiency has improved over time after first couple of sprints
- Estimating of story points remarkably consistent relative to hours/point
- 4 week sprints have continued to work well for SCC team and Department
 - Some teams utilize 2 week sprints but stay within overall calendar (e.g. Sprint 1a, 1b, 2a, ...)
- Having a larger SCC agile team for a common CSCI outweighs the benefits of the recommended team size range (17 vs. 3 – 9)
 - Collaborative Agile toolset critical for managing project
 - Team dynamics critical with larger team
- Continuous user feedback critical to building the right product
- Continuous automated build and test critical to building the product right

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Biography

Brian Hulet is a Technical Project Manager for Collins Aerospace Test and Training Instrumentation Department. A systems engineer by trade, Brian served in various Systems and IPT Lead roles for the development of the Common Range Integrated Instrumentation System and now supports its production, sustainment and enhancement activities. Brian previously served as the lead development engineer of the Improved Remote Strafe Scoring System in use on US Navy and US Air Force Tactical Training Ranges. Brian enjoys kayaking and hiking with his wife and three children and is preparing himself for life as an empty nester in a few short years.