



Case Study of a Program using an Agile Software Development Process

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Contents

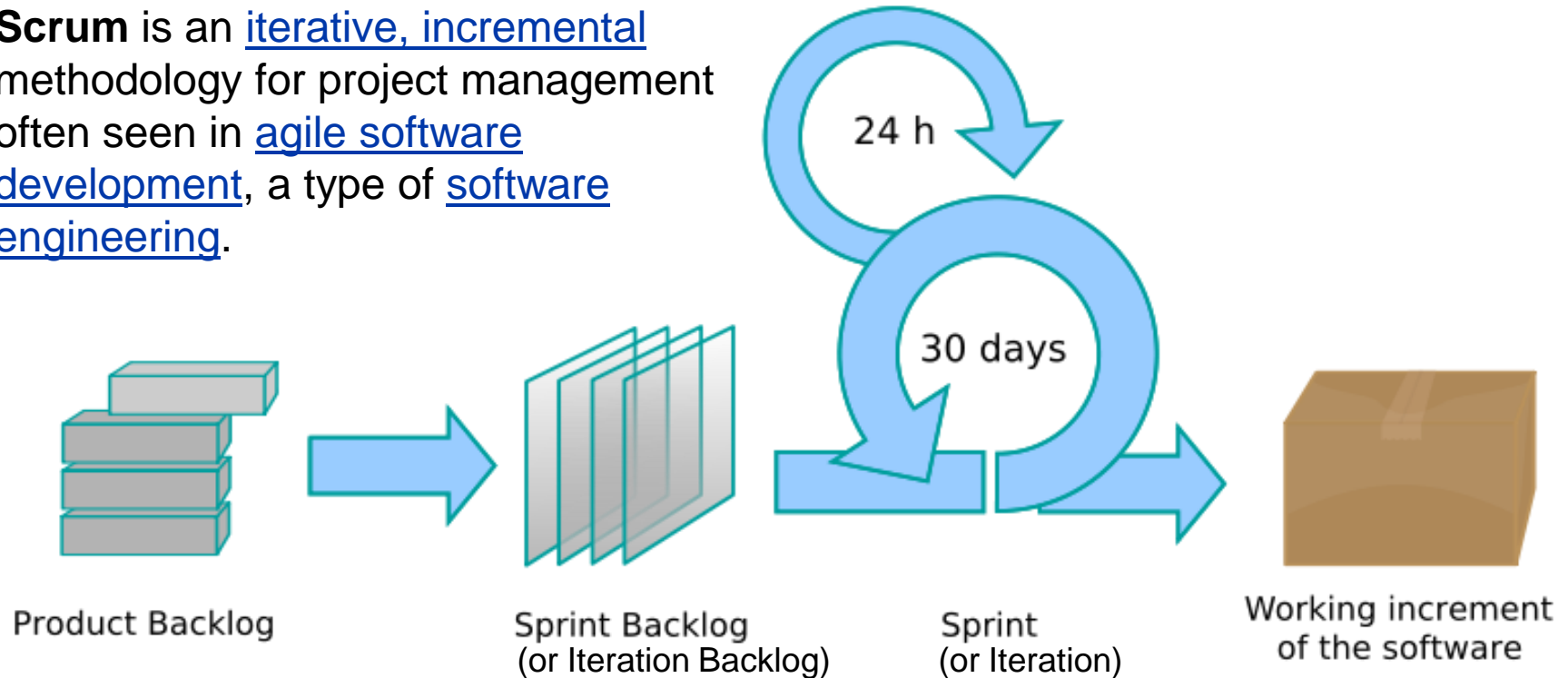
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- **Introduction to Agile**
- **Major Defense Acquisition Program Description**
- **JTRS Enterprise Network Management (JENM) Program**
- **Contract Specifics**
- **Systems Engineering Role**
- **Agile and Earned Value Management (EVM)**
- **Program Reviews and Contract Requirements – Hybrid Agile**
- **Metrics and Productivity**
- **Continuous Integration**
- **Interviews Summary**

Introduction to Agile (Scrum)

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Scrum is an iterative, incremental methodology for project management often seen in agile software development, a type of software engineering.

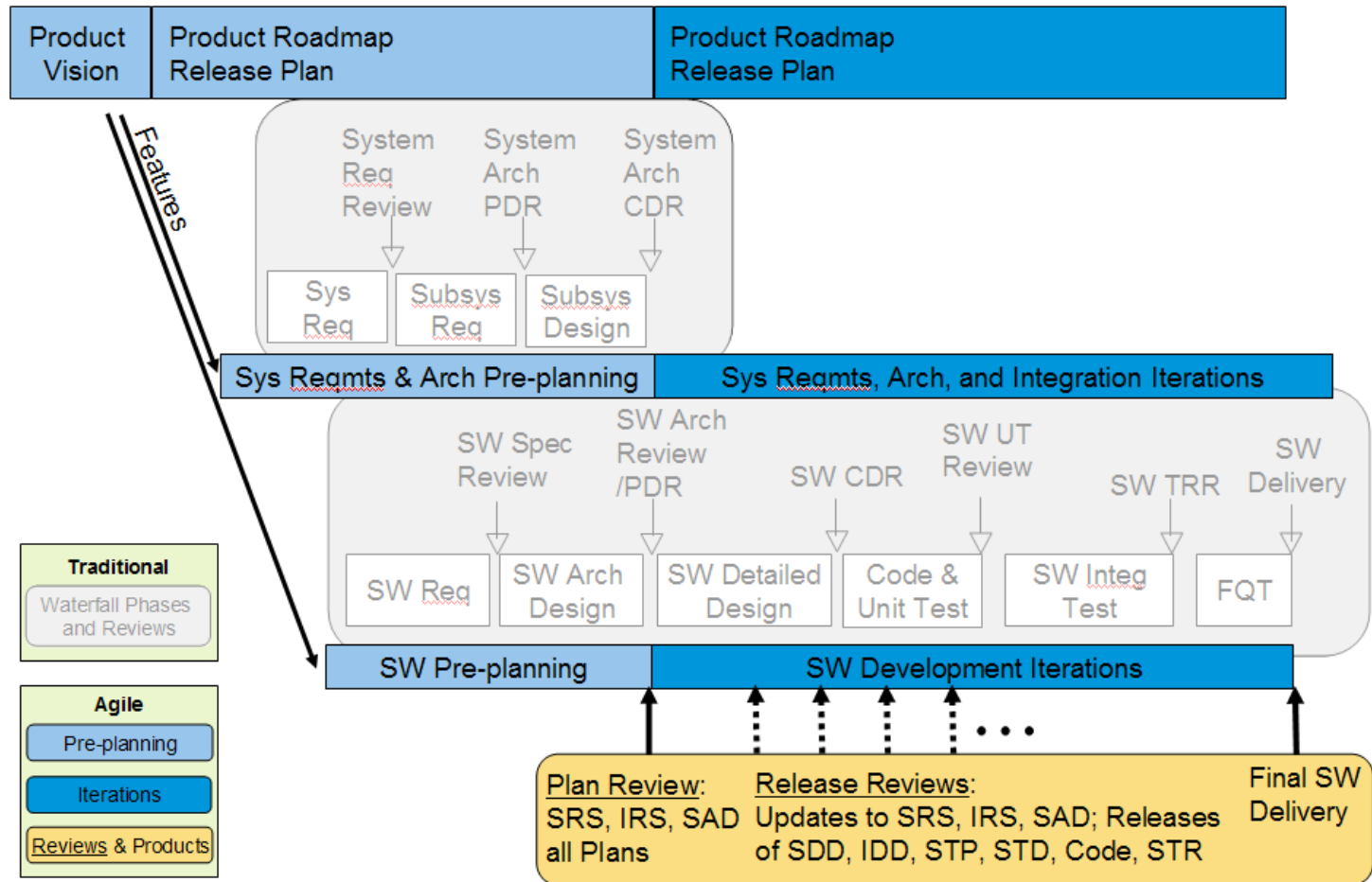


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http://en.wikipedia.org/wiki/File:Scrum_process.svg

Joint Tactical Networks programs have traditional customer review schedules

Agile and Customer Milestone Reviews

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Once the plans are in place, the product backlog iterations begin

3-Week Iteration Timeline

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15-min. Standup Meeting – Occurs Daily

Iteration Planning

Vision and Scope

- Product Owner presents high-priority stories to the team to complete
- Team estimates all product backlog items selected
- Attendees: Product Owner, ScrumMaster, Team Members

Timebox: 2 h

Detailed Planning

- Team breaks select high-priority stories into tasks and estimates in hours
- Team commits to the work
- Attendees: Product Owner, ScrumMaster, Team Members

Timebox: 2 h

Iteration Execution

Team Members

- Select / estimate work tasks
- Create or modify: design, code, unit tests and documentation
- Participate in peer reviews
- Raise impediments
- Ask Product Owner clarifying questions
- Respond to Help Needed requests
- Update Taskboard

Product Owner

- Reviews stories to be included in product backlog
- Grooms product backlog (add, modify, remove, prioritize)
- Answers team questions to clarify stories and acceptance tests
- Accepts completed tasks
- Is customer proxy
- Revises Release Plan

ScrumMaster

- Removes team member's impediments
- Shields team members from all interruptions
- Fosters team cohesion
- Facilitates daily stand-ups
- Monitors iteration progress
- Reports status as required
- Participates in "Scrum of Scrums"

Iteration Review

Demonstration

- Team members demonstrate the working software products and discuss iteration progress.
- Attendees: Product Owner, ScrumMaster, Stakeholders, Team Members

Timebox: 0.5-1 h/team

Retrospective

- ScrumMaster facilitates team to identify what worked and what needs improvement.
- Team adjusts accordingly in next iteration.
- Attendees: ScrumMaster, Team Members

Timebox: 1 - 2 h

Days 2-14

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Teams start and end iterations together

Major Defense Acquisition Program Description

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- **A technology project or acquisition program shall be categorized based on its location in the acquisition process, dollar value, and Milestone Decision Authority (MDA) special interest**
- **ACAT I – Acquisition Category I (per Defense Acquisition Guidebook)**
- **Major Defense Acquisition Program (MDAP)**
 - Dollar value: estimated by the Under Secretary of Defense (USD) Acquisition, Technology & Logistics (AT&L) to require an eventual total expenditure for research, development, test and evaluation (RDT&E) of more than \$365 million in fiscal year (FY) 2000 constant dollars or, for procurement, of more than \$2.190 billion in FY 2000 constant dollars
 - MDA designation
- **Milestone Decision Authority (MDA) designation as special interest**

<https://acc.dau.mil/CommunityBrowser.aspx?id=332542>

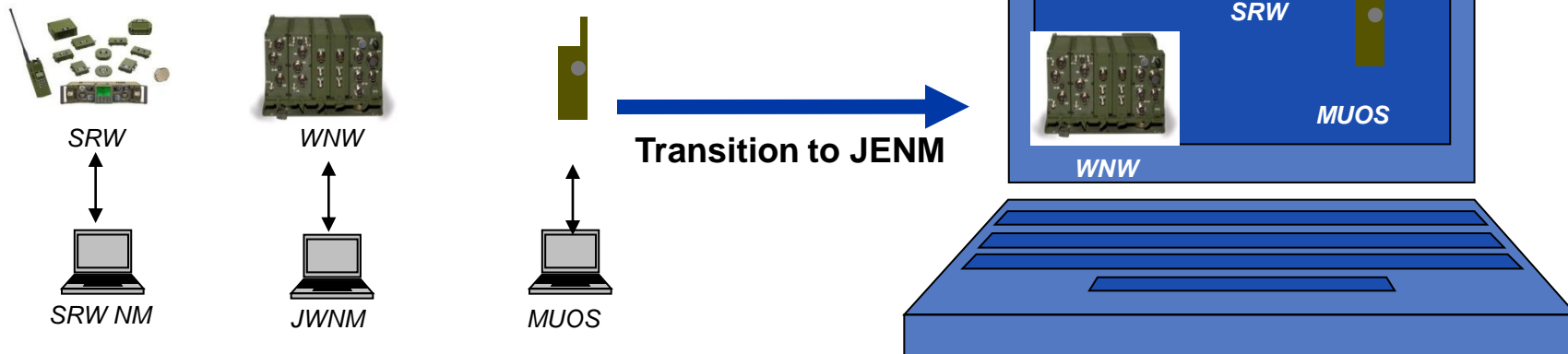
JTRS Enterprise Network Manager (JENM)

A Joint Tactical Networks (JTN) Program Management Office (PMO)
Contract (Formerly Network Enterprise Domain (NED) PMO)

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- **JENM is a heterogeneous network management system unifying warfighters**
- JENM is the first-ever-developed network manager that
 - **Integrates** existing JTRS waveform network management systems into a single, plug-and-play environment,
 - **Establishes** a single network, bringing together planning and operations for the Wideband Networking Waveform (WNW), Soldier Radio Waveform (SRW) and Mobile User Objective System (MUOS), and
 - **Manages** the entire enterprise.
- Reduces number of separate laptop computers required to manage joint tactical radio networks in the field
- Provides integrated situational awareness of radio networks, rather than giving separate views for each network type
- Allows one user, with one laptop, looking at a single screen to simultaneously manage multiple networks.
- Provides wireless, ad hoc network management that requires no communications infrastructure

Previous approach had separate NM for each WF or Hardware set



Contract Specifics

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- **Indefinite Delivery Indefinite Quantity (IDIQ Contract)**
- **Task Order 1 started April 16, 2010 for 24 months with 3, 1 year options**
- **Work managed by task orders**
- **Work includes integrating legacy products.**
- **Support to field testing, such as NIE**
- **Contract Language is not unique to Agile**
- **Priority order of work items (or features) might change, but not requirements**

Network Integration Evaluation (NIE)

WHAT IS THE NIE?

The Army has fundamentally changed the way it develops, evaluates, tests and delivers networked capability to its operating forces. The Agile Process aims to improve efficiency and effectiveness, while reducing the amount of time and resources necessary to respond to rapid changes in Soldier requirements. The NIE, as a key part of the Agile Process, assesses potential network capabilities in a robust operational environment to determine whether they perform as needed, conform to the network architecture and are interoperable with existing systems. The NIE ensures that the network satisfies the functional requirements of the force, and relieves the end user of the technology integration burden. The NIE, as part of the Agile Process, is a series of semi-annual, Soldier-led evaluations designed to further integrate, mature and rapidly progress the Army's tactical network. During the ...

Software team started with a prioritized list of work items (features)

Systems Engineering Role – Requirements

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- **System/Subsystem Specification (SSS) - 807 requirements**
- **Software Requirement Specification (SRS) - 1605 requirements, all traced from SSS, all mapped to Features in the software**
- **Software progress tracked by Features complete each release**

Software team develops highest priority features for the next release

Systems Engineering Role – Test

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- **Test Cases test Features and track Features completely tested versus planned**
- **Systems Engineering and Software Test Engineering do not work in iterations**
- **Software Test receives software at the end of each iteration**

Software Test Engineering tests Features

Systems Engineering Role – Deliveries

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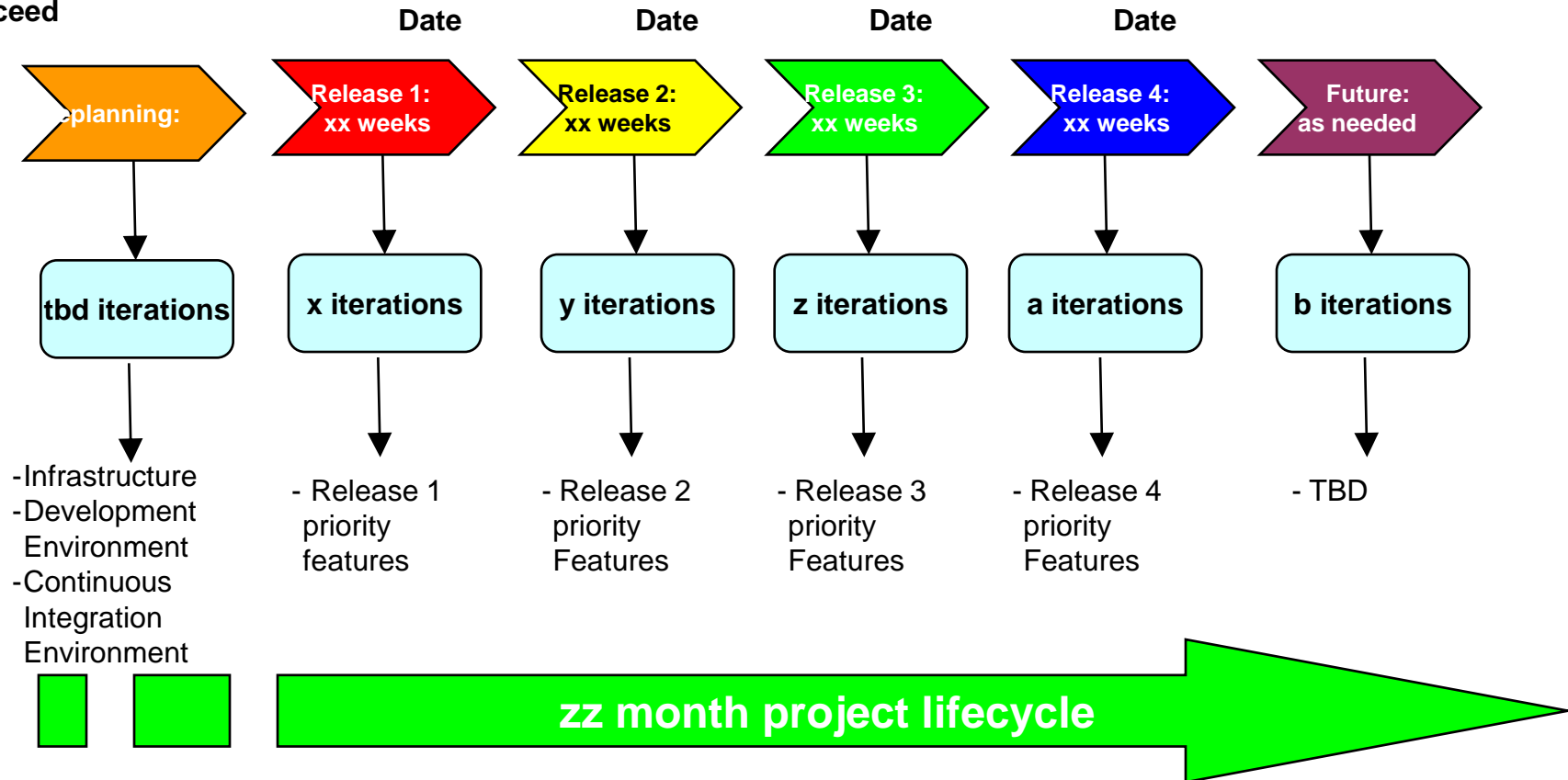
- **Software Engineering maintains the requirements, design and test scripts within iterations**
- **CDRL content is updated each iteration**
- **Assembled into the CDRLs for formal deliveries by systems engineering**
- **Releases CDRLs according to the Integrated Management Schedule (IMS)**

Formal CDRL deliveries accomplished

Agile Roadmap Template

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Authority To Proceed



Each release is potentially deliverable

Agile and Earned Value Management (EVM)

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- **Each software release is a milestone deliverable**
- **Progress reported weekly on the % complete story points for each release's planned total story points**
- **Story points are the estimated effort to complete a backlog item, or user story**
 - Example, some features might have a total of 120 story points and 10 user stories
 - Others might have 20 story points and 2 user stories
- **Business value is in the completion of the feature**
- **A release might have a partial feature delivered that will be finished in the next release**

Features are measured in story points, a measure of effort or complexity

Reference: *AgileEVM - Earned Value Management in Scrum Projects* by Tamara Sulaiman, Brent Barton, and Thomas Blackburn; AGILE 2006 IEEE Computer Society Conference.

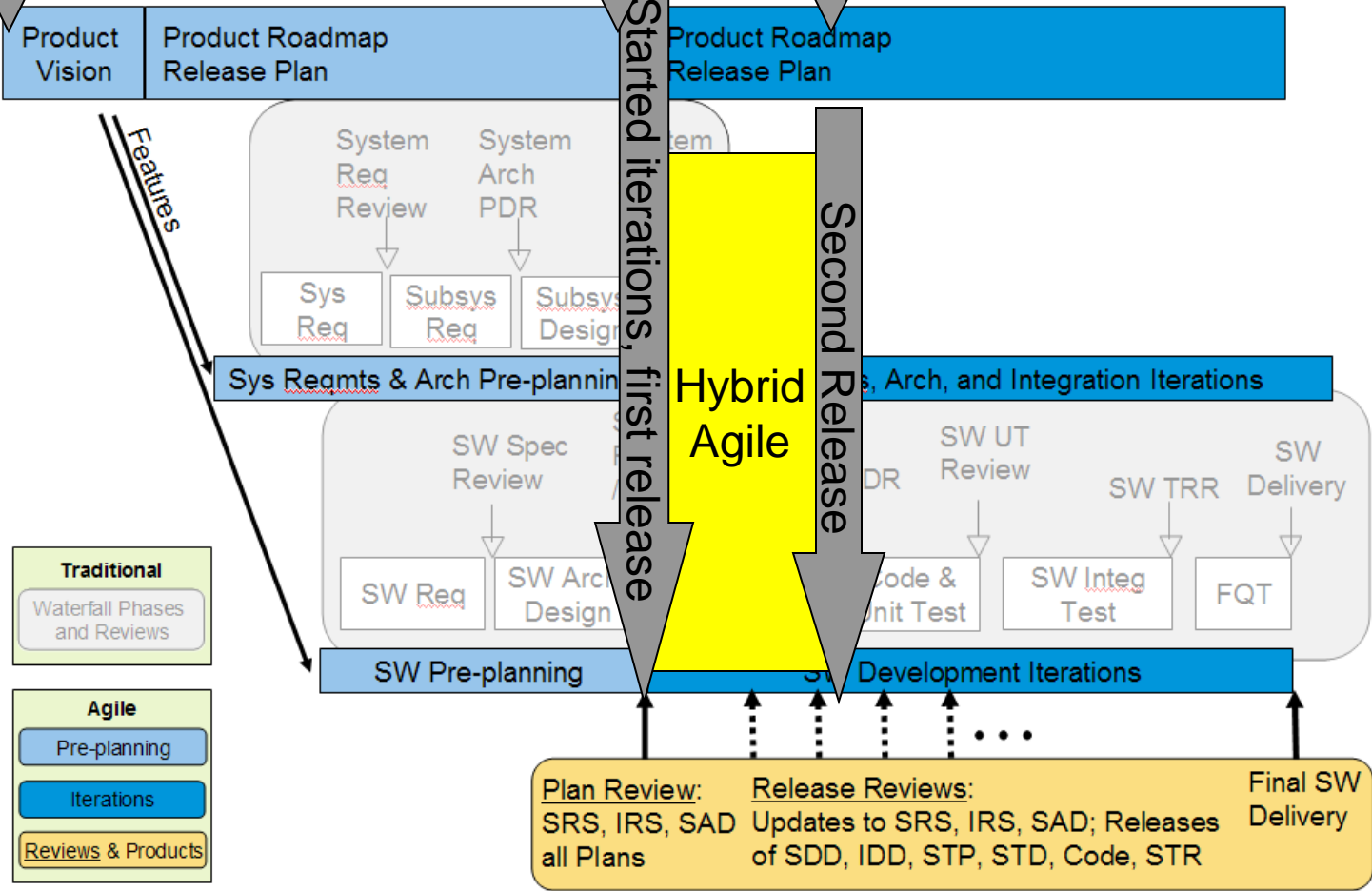
Hybrid Agile

Contract Start April 2010

Level

PDR Feb 2011

CDR Jul 2011

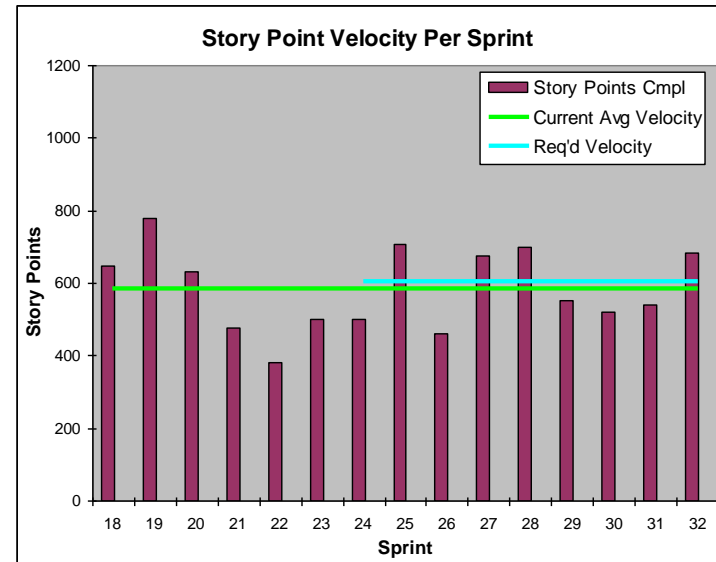
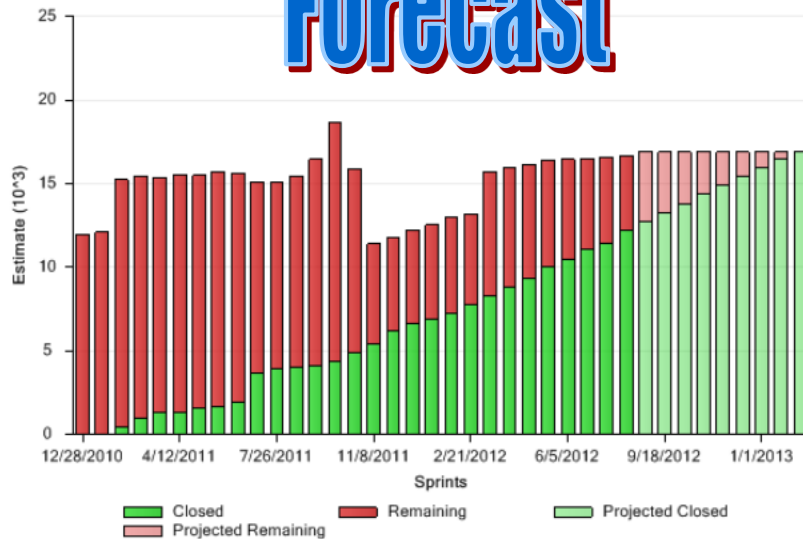


Hybrid: CI team continued with 2 week sprints, SW Developers worked detailed design until CDR

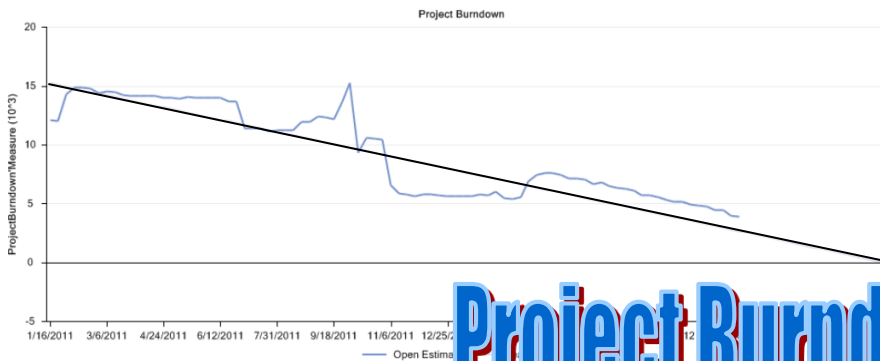
Metrics used to track progress

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Forecast



Velocity



Project Burndown

Customer attends the demonstrations every 3 weeks and has visibility of the detailed progress

Productivity

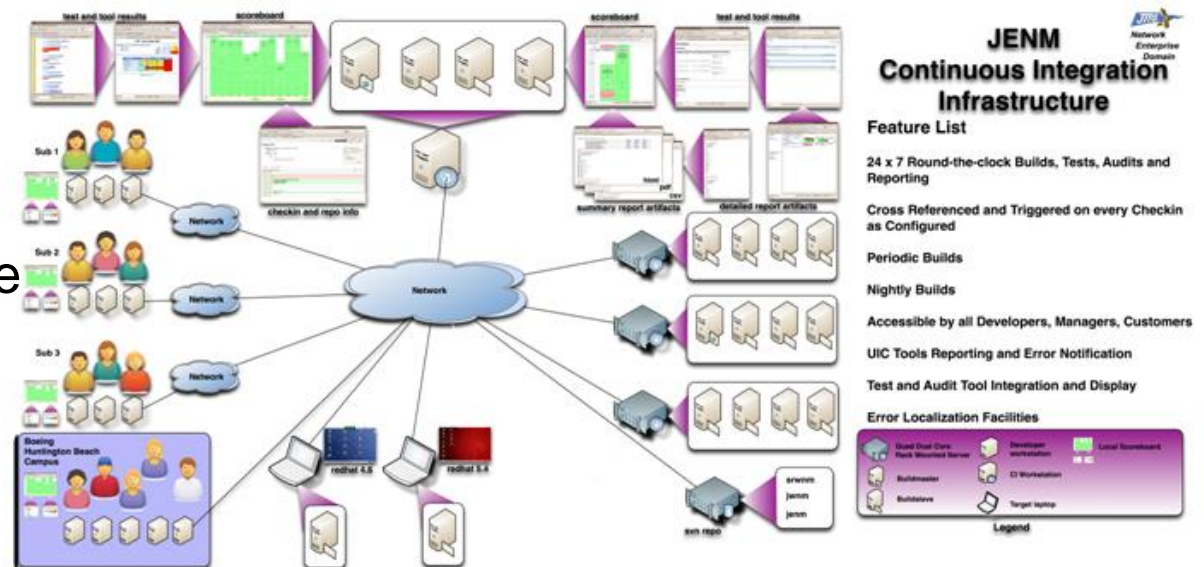
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- **Productivity is Source Lines Of Code (SLOC) per hour**
- **Analyzing cumulative productivity each release**
- **Effective Source Lines of Code (ESLOC):**
 - Factors for integrating and reusing the legacy products
 - Factors for the autogenerated software: user interface software, other
- **Improvement of 100%**
- **FQT is not complete**
- **Boeing Agile Software Process (BASP)**
 - Scrum
 - Continuous Integration
 - Automated Testing

Continuous Integration, Automated Testing

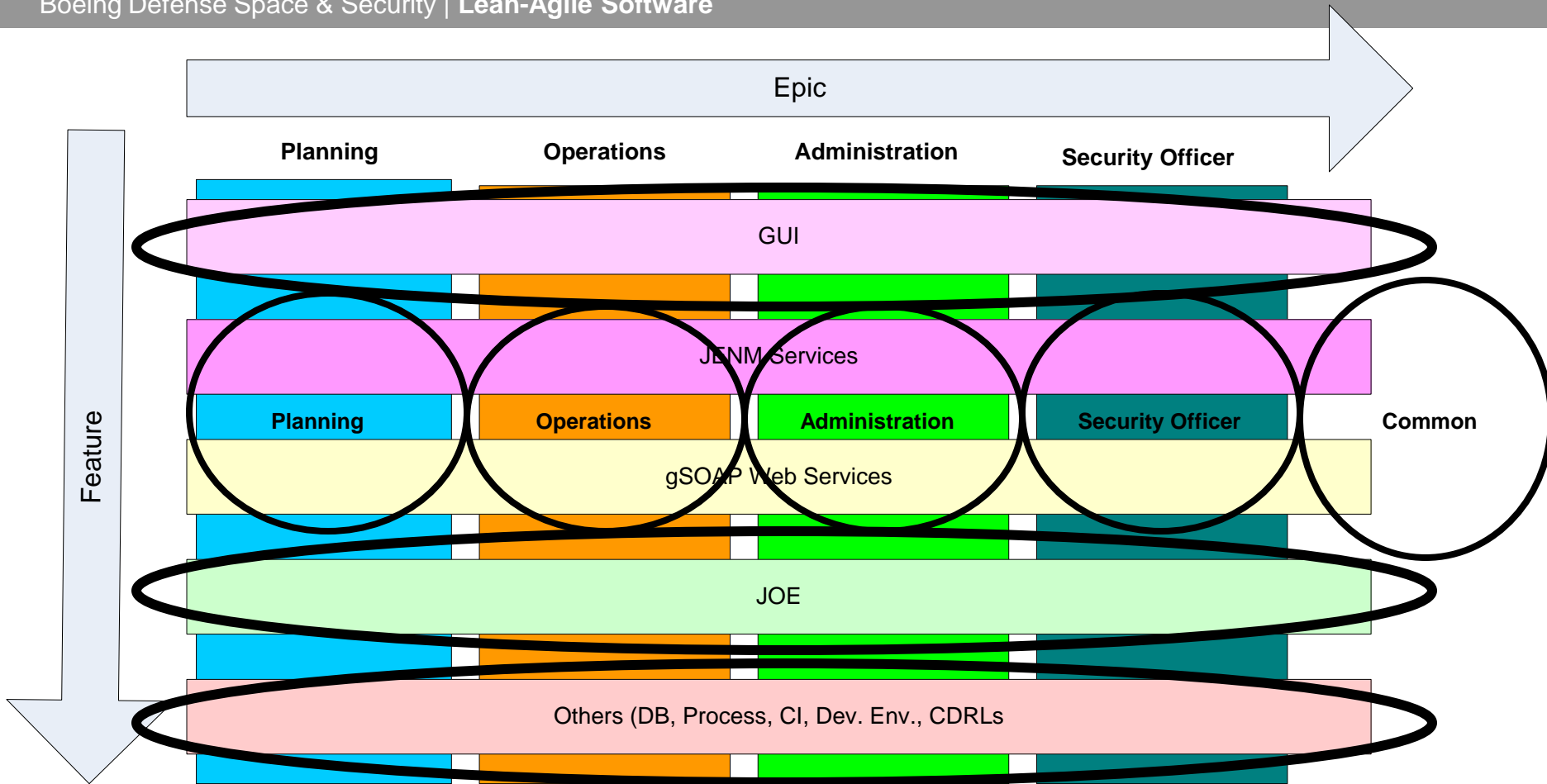
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- Code repository
- CI Server Environment
 - Build master
 - Build slaves
 - Run unit tests
 - Run status tests
 - Analyze source code
 - CI Scoreboard



Agile Teams Established

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And now a word (or two) from the team . . .

Agile Challenges

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- **Learning the process**
- **Planning the work**
- **Maintaining the design**
- **Too many conflicting stakeholders**
- **Define the roles across the program, at the system level**
- **Customer waterfall schedule**
- **Defining the backlog to trace the requirements**
- **Agile and EVM**

Interviews with 30% of the team including Customers, Product Owners, Technical Owners, ScrumMasters, Schedulers, SQA, and Team Members

What do you like about Agile?

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- **Potentially deliverable product every 3 weeks**
- **Do builds quicker**
- **Better than waterfall**
- **Prefer the agile testing in smaller chunks, rather than getting the whole thing at once**
- **Agile keeps everybody accountable and gives a tremendous amount of visibility and data**
- **Don't like agile, prefer 6 month iterations**
- **Agile builds relationships with suppliers**
- **The stakeholders were impressed in the demonstration**

Other team answers

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- **If you could change one thing what would it be?**
 - Reduce the amount of change
 - Maintain the design better
- **What was the biggest surprise for you?**
 - It is rigorous
 - It is working
 - The customer supports it
 - The customer says they approve of agile, but they still want all the rigor of the waterfall method
- **Anything else?**
 - Team members stated: Our customer keeps giving us new requirements using Agile as the rationale for why we should be able to absorb them.
 - Customers stated: We haven't changed the requirements

Multi-company team has produced working software often in a dynamic environment with changing priorities. Agile minimized the impact.

Author Biography

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- **Phyllis R. Marbach is a Senior Software Manager in Boeing Defense Space and Security (BDS). Phyllis has more than 30 years experience in aerospace programs including satellites, chemical lasers, the International Space Station, and various propulsion systems. Currently she is a team lead with the Lean-Agile Software Services (LASS) for the Agile Coaching Team and an active Agile Coach who has worked with Unmanned Air Systems, Radio, Satellites and research programs. phyllis.r.marbach@boeing.com**
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