SYSTEMS ENGINEERING RESEARCH CENTER | AIRC ACQUISITION INNOVATION RESEARCH CENTER | SERC RESEARCH REVIEW 2026

Space Systems Command Military Communications & Positioning, Navigation, and Timing Directorate – Mission Engineering and Integration of Emerging Technologies

WRT-1069

U.S. Space Force Satellite Communications & Positioning, Navigation, and Timing (SATCOM and PNT) Program Office

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Project Overview

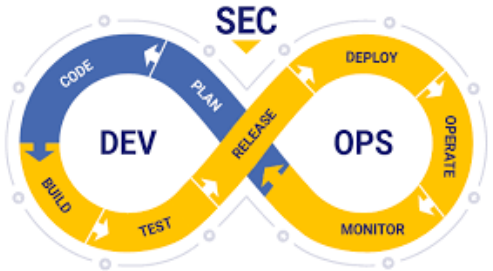
- **Improve DoD competitiveness**: Specifically - improve existing DoD space-based software acquisition pathway – *but generalize as needed for other domains*



- **Goals**:
  - Determine the mission engineering methods, analysis, and metrics to transition from traditional DoD 5000 waterfall development environments to agile/DevSecOps processes
  - Includes integration of emerging technologies and related education for the future workforce.

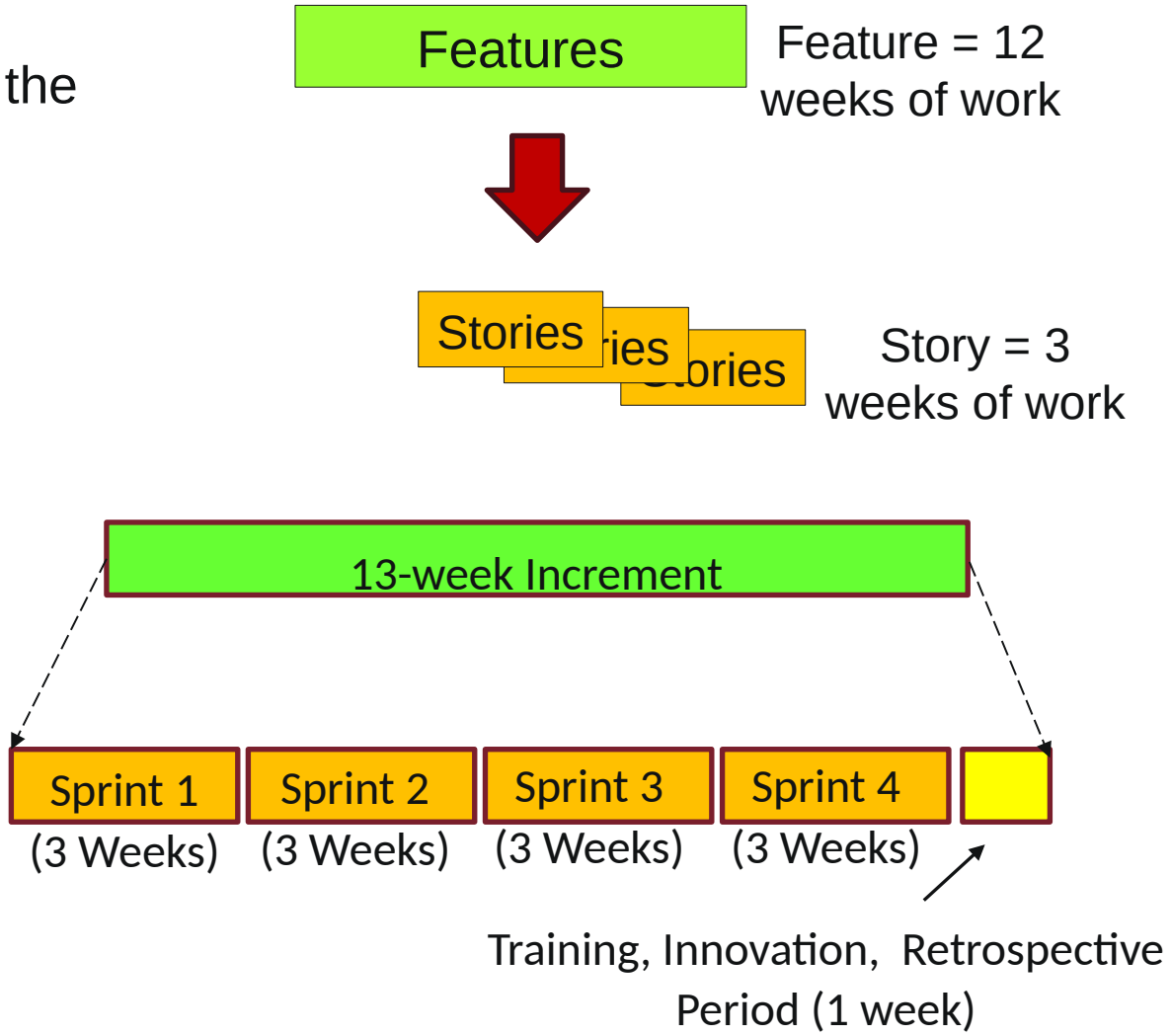


- **Funding agency**: U.S. Space Force Satellite Communications & Positioning, Navigation, and Timing (SATCOM and PNT) Program Office

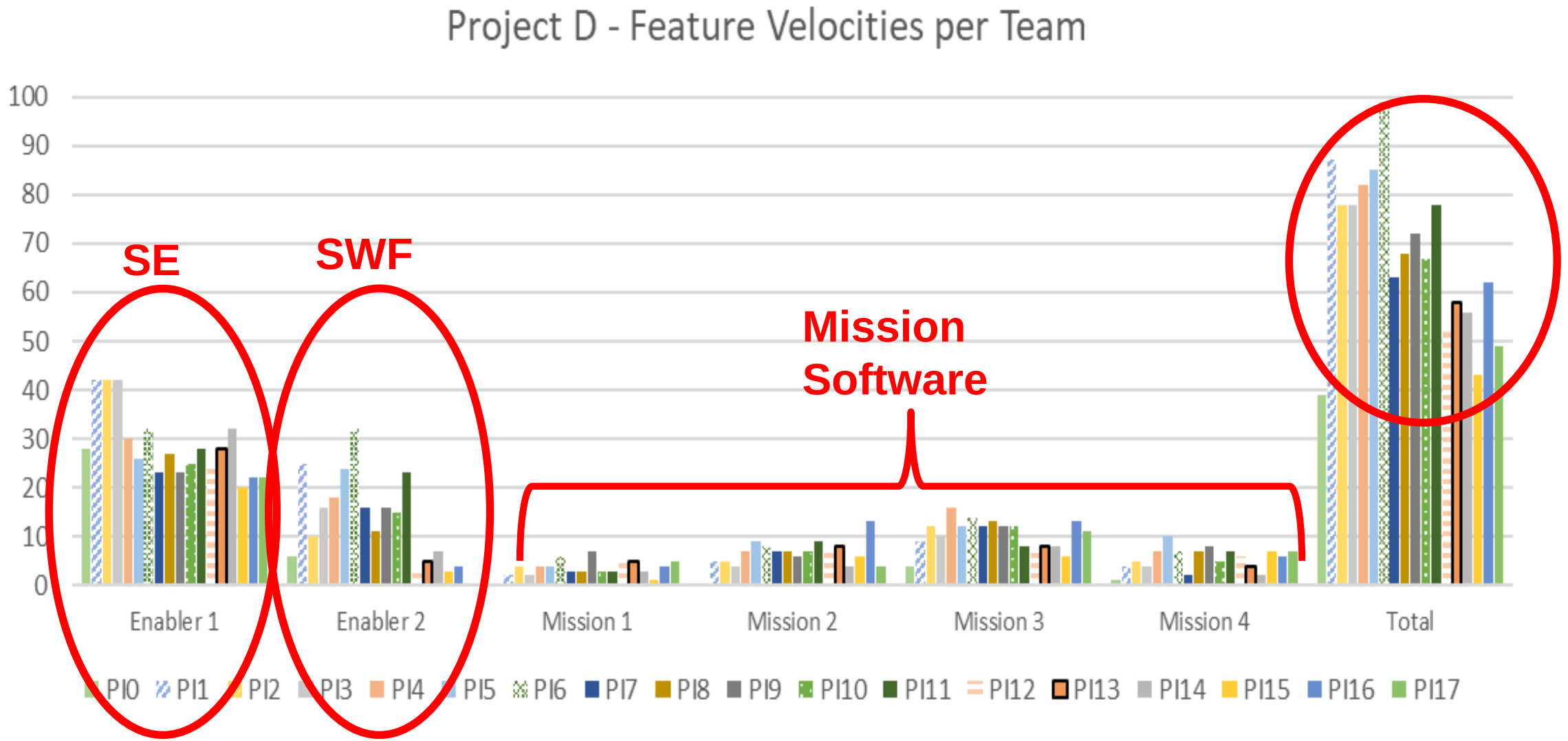


Project D

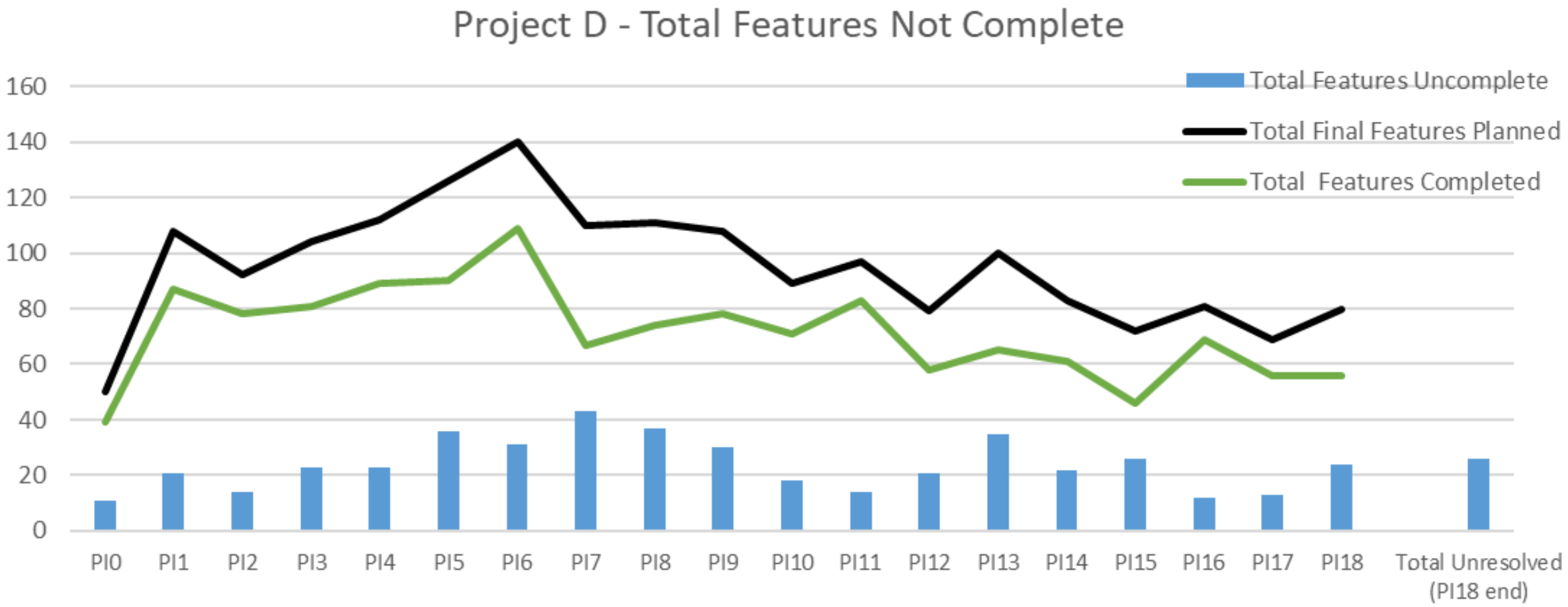
- Hybrid project
  - Roughly 70% agile / 30% waterfall (mainly in the programmatic area)
  - Duration: 75 months (currently in month 49)
  - Software lines of code (SLOC): ~100K-150K
- Agile implementation
  - Method: Modified SAFe® implementation
  - Program Increment (PI): 13 weeks in duration with four 3-week sprints
  - Last week of PI reserved for demonstrations, training, innovation and if necessary, “catching –up”
  - Six scrum/sprint teams (4 are mission-focused teams, 2 are enabler teams)



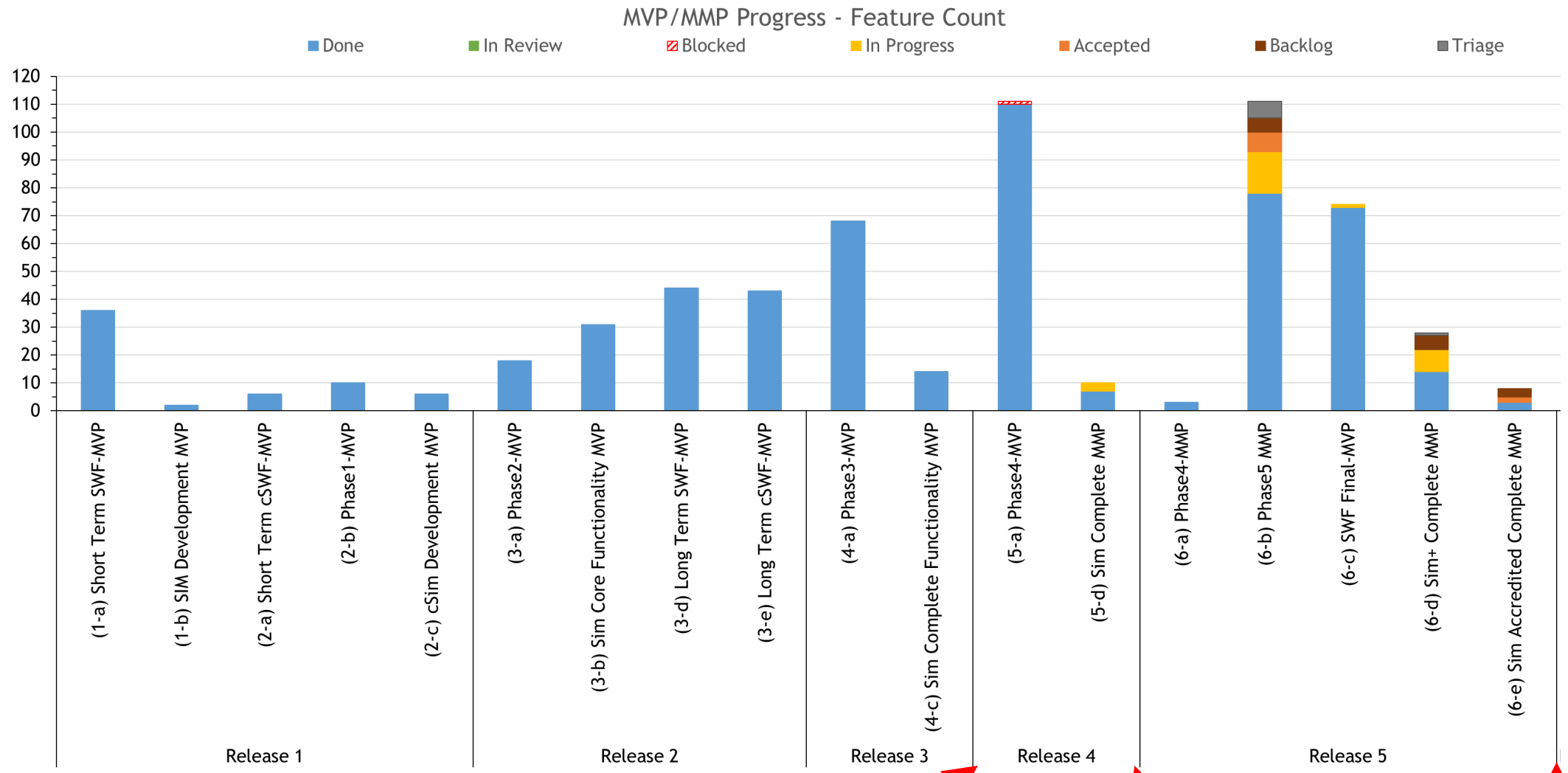
Feature Velocities



Features Slipping from PI to PI



Are We Delivering Value Despite Features Slipping to Future PIs?

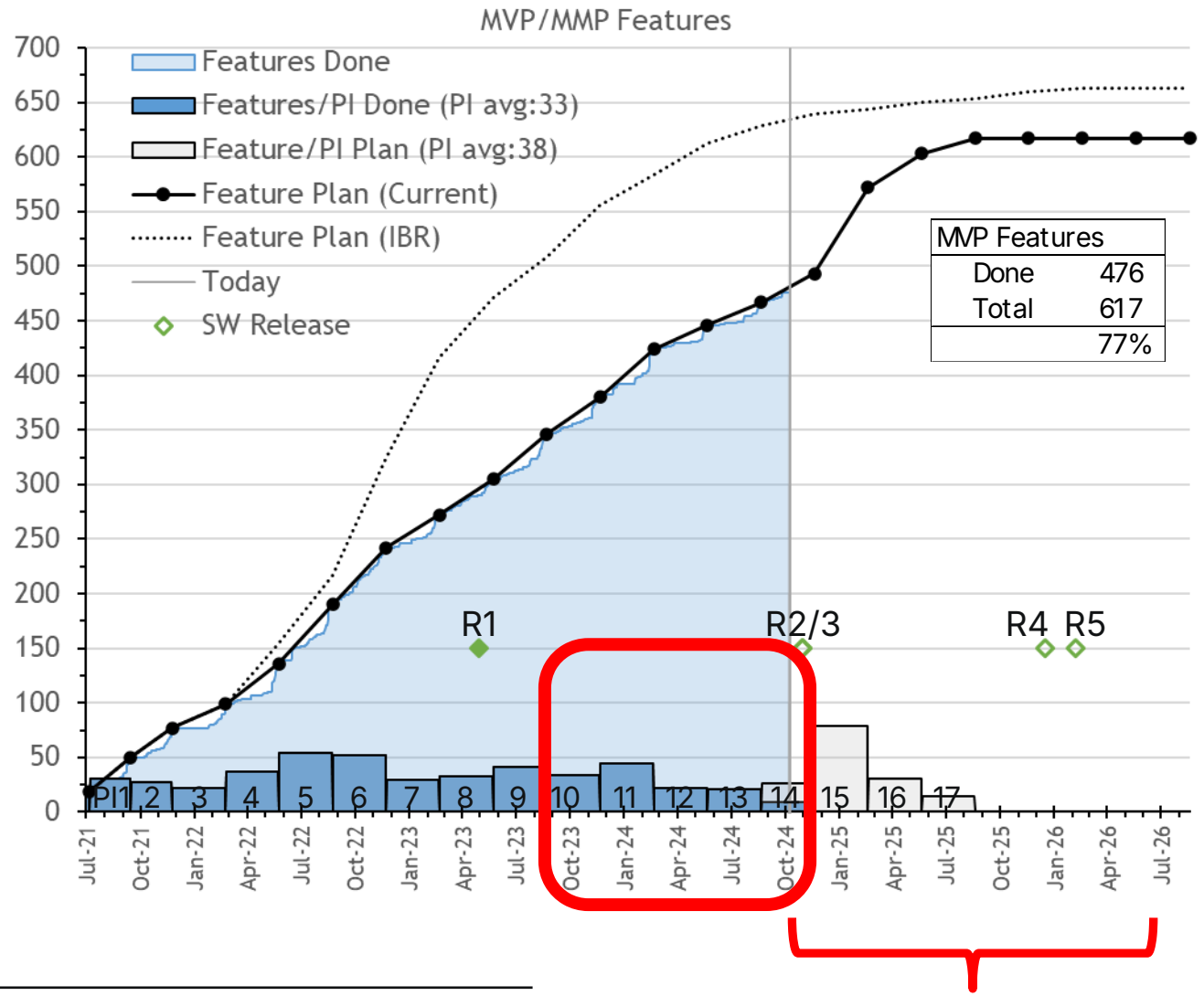


Major Release 1

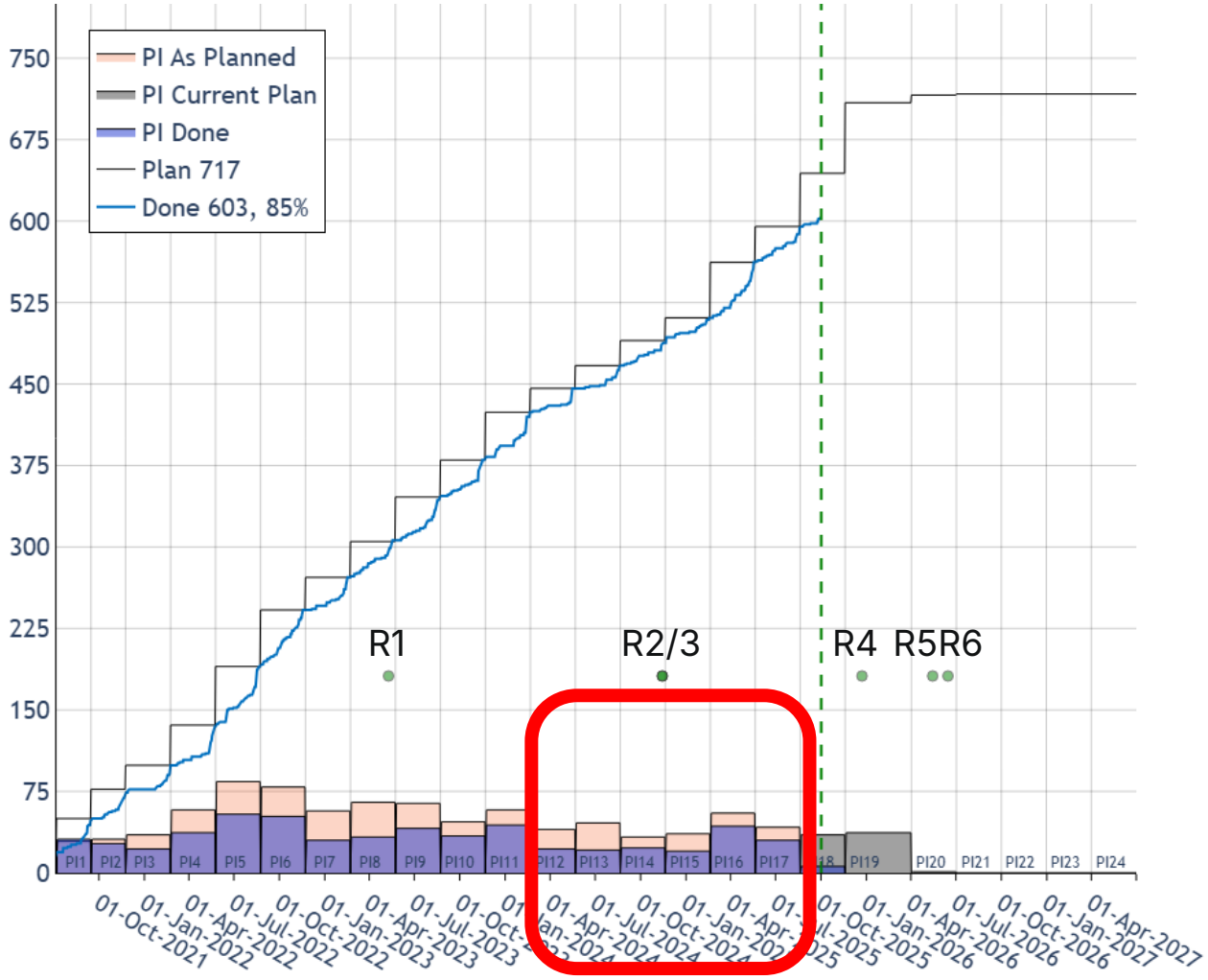
Major Release 2

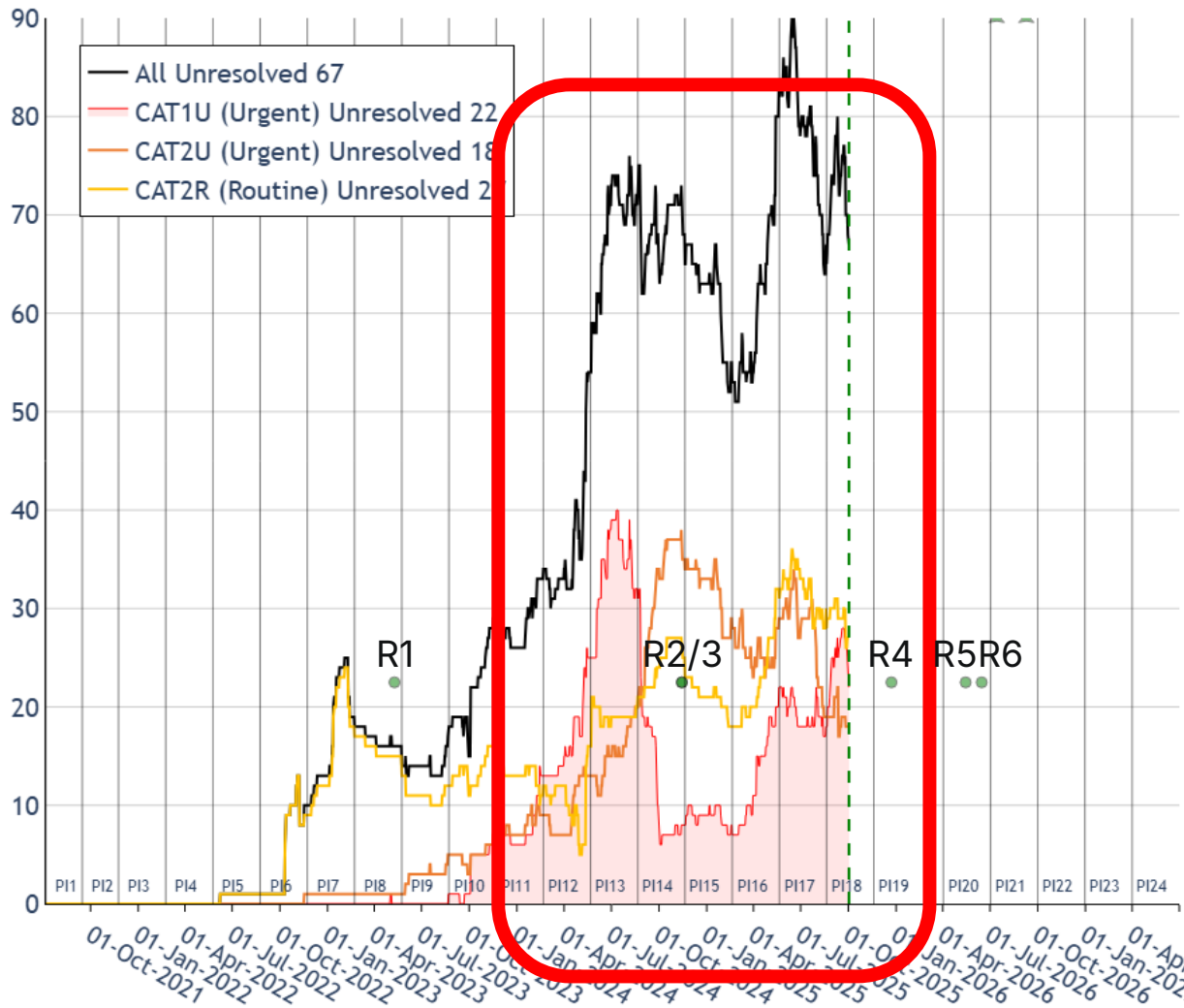
Major Release 3

Bow Waves in Agile – Year Ago



Bow Waves in Agile





"Bugs" discovered during testing

The bow wave was addressed via schedule extension…for now

Some Reasons for the Building of a Bow Wave

- Blockages
  - Lack of resources (software license issues, external dependencies, test facilities etc.)
- Competition for workforce
  - In many cases, team members work multiple projects and can be “pulled” depending on project priorities (new hires = expensive learning curve)
- Underestimating code complexity
  - Some of this can be attributed to “discovery”
  - Can also be attributed to a lack of understanding of the system requirements
- Bugs & DRs due to delayed integration and testing of the system
  - The high-priority bugs & DRs consume workforce effort and crowd out mission features which become delayed.

Recommendations/Observations

1. **Upfront engineering**: Perform some upfront engineering to help populate the project backlog, map features with compliance requirements, ***identify end-to-end test cases***, and to identify dependencies as early as possible in the program.
2. **Not all staff skillsets are equal**: The amount and diversity of talent needs to be constant, so they can be moved/re-arranged to react to the changing needs (be agile) of the program.
3. **Near operational test environments**: Establish (early in the program) a near operational environment and high-fidelity simulators (for horizontal I&T)…put this before system development starts in terms of priority…need to start I&T (at all levels) as soon as possible. Black box portions of the environment if necessary.
4. **Sprint Margins**: Plan margin into the sprints to handle unexpected events such as new technology insertion and/or unexpectedly complex stories (**Agile 101**).
5. **Licensing and other IP issues**: get licensing, IP, accreditation, certification and other programmatic issues resolved early.

Recommendations/Observations (Cont.)

6. **Training:** Need for on-board and continuous training to ensure team members (both the contractor and acquisition team) are on the same page
7. **Costing Challenges**: For projects that are costed using "T-shirt sizes, costing needs to be segmented into development, integration and testing, and bug (problem) work-off. Also need sufficient number of T-shirt sizes to cover smallest to largest work packages
8. **Custom tools**: Be prepared to customize performance tracking tools
   - Applies to all teams…government and development contractor
   - Issues:
     - Software incompatibilities
     - Foreign ownership of tools
     - Access challenges (e.g., VPN, security concerns, etc.)
     - EVM lags actuals – sometimes by months.

OSW Already Is Aware of The Challenges

- Methodologies to address these challenges are addressed in the Software Acquisition Pathway defined under **DoWI 5000.87**.
- Unfortunately, these methodologies have not proven sufficient.
- **Observation**: We recognize the problem, but we lack the necessary productivity and automation tools – the so-called "***power tools***" to be used by acquisition personnel (*who are overburdened*) to address known systems development challenges.
  - AI-based tools?
  - Data analytical tools
  - Tools that provide real or near-real time situational awareness that are cognizant of user roles.

Next Steps: AI Aides

- Explore LLMs that:
  - Collect, retain and make available knowledge of the system (i.e., corporate knowledge retention)
  - Requirements verification tools (i.e., do the test artifacts, the software, and the system architecture/design that are produced meet system/mission requirements?)
  - Requirements decomposition tools (i.e., requirements->features->stories->expected test results that link to acceptance criteria).
- Questions to be answered:
  - Are existing AI solutions working?
  - What other AI tools need to be developed and tested?
  - What issues (e.g., hallucinations) do we need to detect and mitigate?
  - What is the ROI to the warfighter, government and the taxpayer?

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Thank you!

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