Orion Agile Test & Verification - IEEE Standards Subcommittee Review

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Orion Test and Verification

Sprint

- Development Sprint DIT (Lvl. 4)
  - Products:
    - Completed User Story – Conditions of Satisfaction
    - Completed Product Feature – Acceptance Criteria

Sprint + 1

- FSW Integration Sprint DIT+ (Lvl. 5)
  - Products:
    - Integrated Flight Software
    - Integrated Product Features
    - Flight Train Release Objectives
    - Completed Integrated Testing

Sprint + 2

- Mission Integration Sprint DIT++ (Lvl. 6 & 7)
  - Products:
    - Completed SRS Success Criteria
    - Integrated FSW in target environments (VTB, Lab)
    - Integrated Mission Testing (essentially validation tests)
    - Mission Train Release Objectives
    - Completed V&V Dry-runs

Sprint + ?

- Verification & Validation Run for Record
  - Products:
    - Verified SRS Success Criteria
    - Validated Mission Test Runs

- Labs ISP Testing
  - Products:
    - Integrated Syncronization Points
    - Integrated Lab testing with flight hardware and/or simulations
The Definition of Done for User Stories and/or Product Features must contain test artifacts

- Coding Standards check
- Static Analysis
- Dynamic Analysis (optional)
- Development Integration Test
  - Assures that the code meets the Conditions of Satisfaction for the User Story
  - Assures that the code meets the Success Criteria for the Product Feature

Lockheed Martin and NASA are using JIRA as a tracking tool for software development on Orion
Regression Testing

♦ Automation

- Automated tests at all levels will all the engineers to run tests that otherwise they “don’t have time to run”
- Orion has developed an automated test architecture that allows code to be run at the partition level with python scripting
- PLATO won the Software of the Year award at NASA Johnson Space Center
- Adopted by Lockheed Martin to ease the burden of regression testing
Challenges of Agile Testing

- When schedule pressure begins to exert forces on the code developers, they respond by complaining about the rigor of the Definition of Done for User Stories/Product Features.

- There are multiple platforms that are used for verification of a test case / script:
  - Software only
  - Emulated embedded software with simulations of other systems
  - Emulated embedded software with real hardware/firmware
  - Real embedded software with real hardware/firmware
Challenges of Agile Testing (2)

♦ Software Requirement Specifications (SRS) are not flexible
  ▪ Agile is geared toward a development environment where the needs of the User are understood and adapted at the Sprint Team level
  ▪ NASA has contracts that are not flexible from the standpoint of requirements

♦ Orion is so large (>300 software developers and testers) that coordination of Sprint Teams, stakeholders, etc. can be difficult
  ▪ SAFe is supposed to help address that
  ▪ SAFe is relatively new
  ▪ Orion is the largest known program to attempt SAFe