U.S. Department of Transportation

ITS4US

IT'S TRANSPORTATION FOR ALL OF US

Task 2-G:
System Test Planning

Elina Zlotchenko

ITS4US Program Manager

ITS Joint Program Office

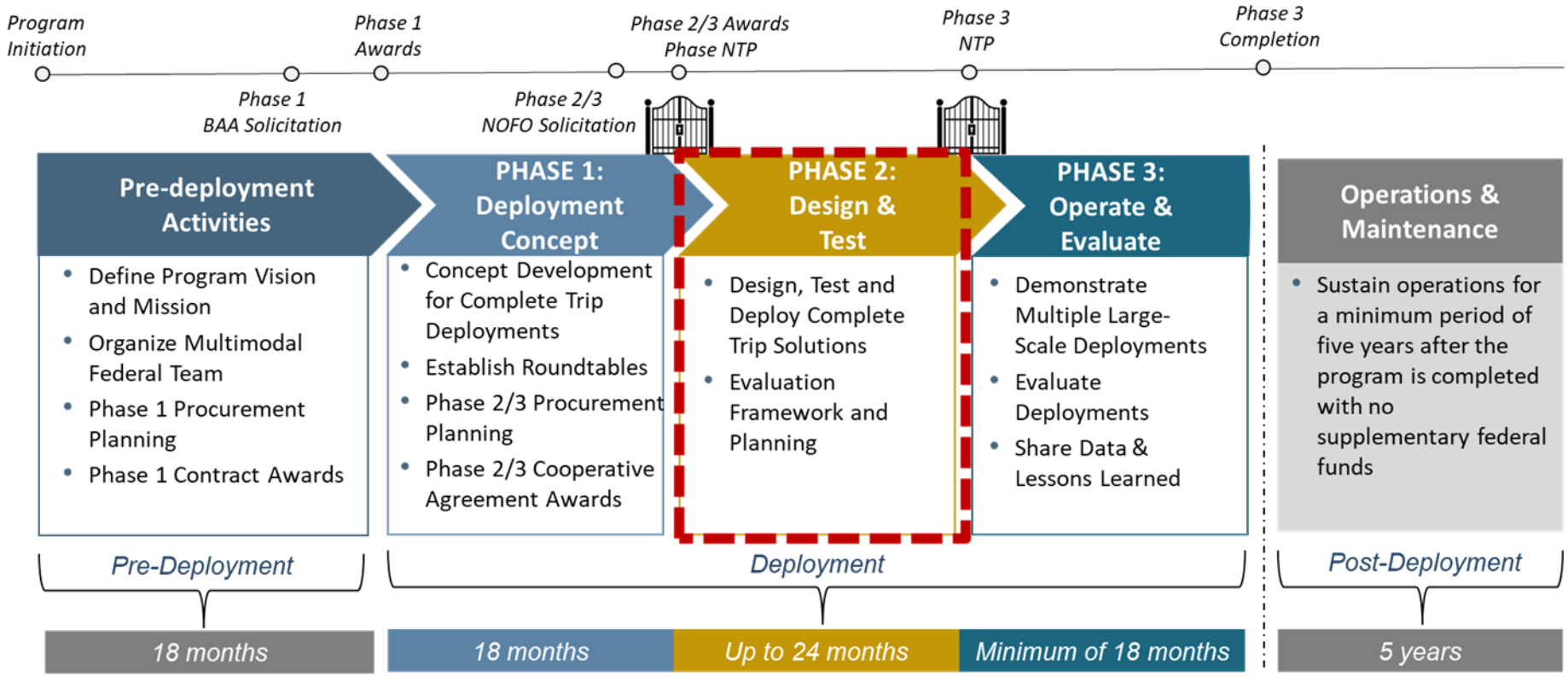
ITS4US Program Overview

- A USDOT Multimodal Deployment effort, led by ITS JPO and supported by OST, FHWA and FTA
- Supports multiple large-scale replicable deployments to address the challenges of planning and executing all segments of a complete trip

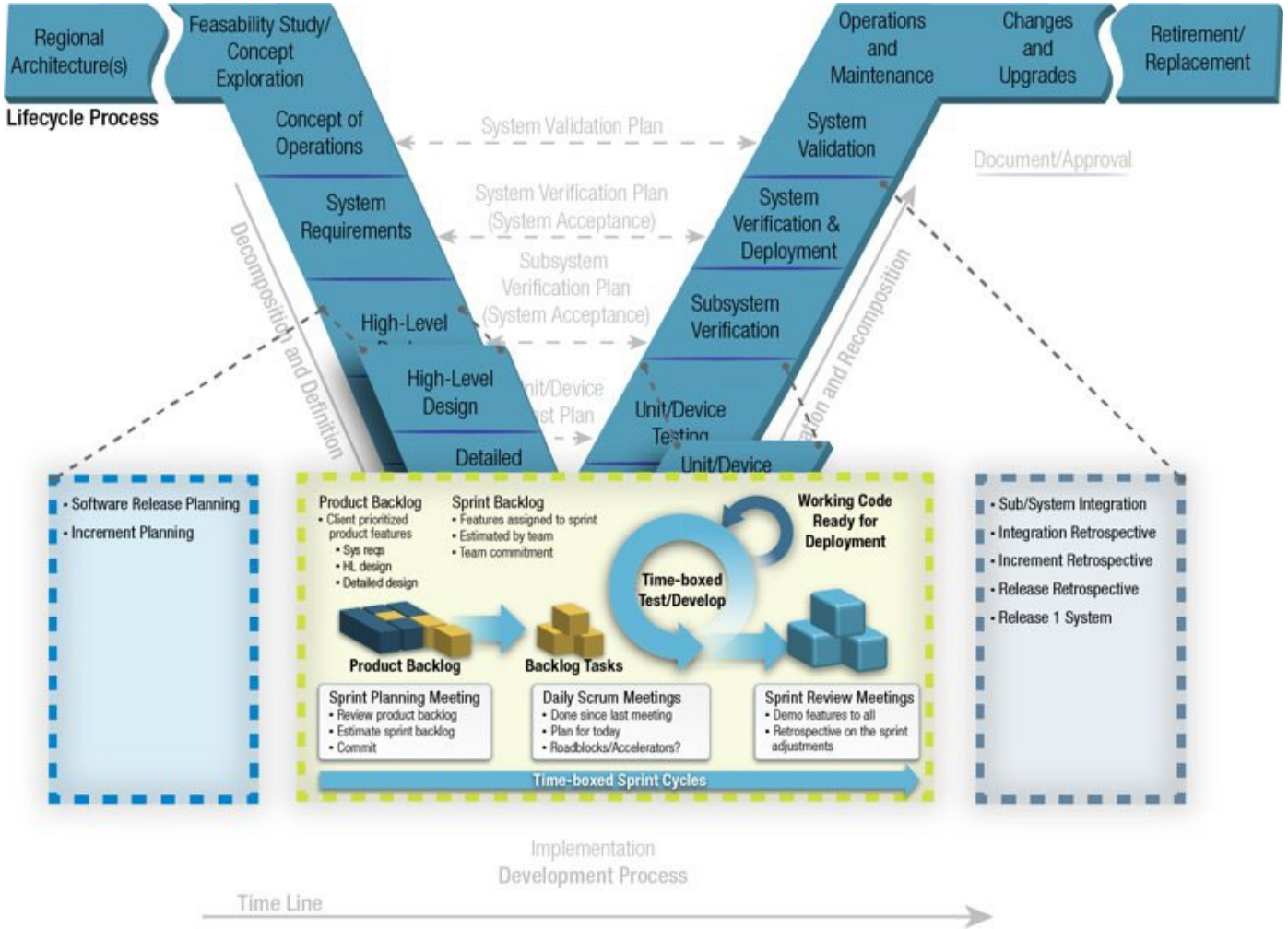
ITS4US
IT'S TRANSPORTATION FOR ALL OF US

Vision: Innovative and integrated complete trip deployments to support seamless travel for all users across all modes, regardless of location, income, or disability

Deployment Phases



Systems Engineering "Vee" Diagram



(Source: FHWA 2007 and modified by Noblis 2017)

Task 2-G:
System Test Planning

Deborah Curtis

Highway Research Engineer
FHWA-Office of Operations, Research, and Development

ITS4US Systems Engineering Subject Matter Expert

2-G System Test Planning

Task 2-G extends from Month 1 to Month 15. This task includes the creation of a comprehensive System Test Plan (STP) and Operational Readiness Plan (ORP) documenting the planning of relevant tests and demonstrations to verify system capabilities and performance and show overall deployment readiness. The results of the tests will be documented and reported under Task 2-H.

Deliverables

1. System Test Plan (STP)
2. Operational Readiness Concept Briefing
3. ORP
4. ORP Walkthrough

2-G Deliverables

- Draft, Revised & Final System Test Plan (STP)
  - Each site shall document their approach to verifying their system meets its requirements and user needs.
- Operational Readiness Concept Briefing (Washington DC/TBD)
  - Each site shall prepare a briefing to present aspects of the deployment to be considered in assessing operational readiness.
- Draft, Revised, & Final Operational Readiness Plan (ORP)
  - Each site shall document tests and demonstration elements to cover the aspects from the Operational Readiness Concept.
- ORP Walkthrough (Washington DC/TBD) and Workbook
  - Each site shall prepare a workbook and conduct a walkthrough to review and discuss the draft ORP and solicit feedback.

2-G Key Activities

- **System Test Planning**
  - Document process for verifying system requirements / user needs and associated supporting materials / schedule.
  - Includes your Agile test processes.
  - Does not require detailed test procedures but needs to demonstrate that your test processes will ensure the requirements and user needs are verified and validated.
- **Operational Readiness Concept**
  - Define concepts to assess operational readiness of the overall deployment.
- **Operational Readiness Plan**
  - Document testing and demonstration activities and related technical content, and conduct associated technical walkthrough.
  - The final series of full system tests to demonstrate the system is ready for operations.

2-G Important Items to Consider

- System Test Planning for Agile developments
  - It's understood that full detailed test plans are not feasible for most Agile developments, however it is expected that Agile developments do involve testing during sprints and releases
  - A common Agile test process might include user demonstrations at the end of each sprint followed by a suite of regression tests to ensure the new sprint doesn't break existing systems/capabilities
- Templates for STP and ORP are a starting point
  - As with the SAD, ICD and SDD, the goal is to provide STP and ORD templates that are useable for most projects, however changes are expected from each site
  - Each projects development processes will likely require different test approaches, as you are identifying your test processes, please feel free to reach out to the SE team with any questions and potential changes to templates
- The goal of system test planning is to ensure that the system test processes support the development and integration processes and help minimize the risk of finding major discrepancies during full system testing

2-G Challenges and Possible Strategies

- **Potential Confusion on Test Documentation**
  - Issue: Unclear expectations on what test planning should be documented.
  - Possible Strategy: Identify areas of test documentation that are unclear and schedule a meeting with the SE team to discuss changes to the templates. Test documentation templates are a starting point and it is expected that each site will tailor those templates to best fit their needs.
- **Timing of Test Planning and Execution**
  - Issue: Agile approach may incorporate regular testing in conjunction with development.
  - Possible Strategy: Define and document overall testing strategy in advance, and then incorporate more details and results as testing and development progress. The goal of the system test planning is to help ensure that the test process is vigorous enough to find major issues well before final system testing.

2-G Lessons Learned

- Experience with product development is not a substitute for systems engineering skills needed to reduce risks to large disparate systems.
- Not having requirements specifications for software, firmware and hardware that will be procured outside the development team adds cost and schedule risks.
- Testing concepts based on individual products is no substitute for testing on large systems.
- Conducting integration testing before full system testing can help make troubleshooting discrepancies easier
- Not following best practice of documenting as-built versions of the implemented system will negatively impact successful operation of the system and increase maintenance costs.
- https://www.its.dot.gov/pilots/disparate_systems.htm

Relationship between SE Tasks

- Phase 2 SE activities build on the SE activities in Phase 1, adding more technical detail and refining user needs and requirements as appropriate
  - Traceability between the User Needs, Requirements, System Design and Testing is very important in Phase 2
- Phase 2 activities, whether traditional waterfall processes or Agile, become more connected and interrelated
  - Acquisition plans may be heavily reliant on system requirements to drive procurement efforts
  - Installation plans will be driven by requirements and system design
  - A logical test program that builds from lower-level Unit/Component tests, to integration testing to full system testing will be verifying system requirements, validating user needs and demonstrating that the system is ready to enter operations
- Phase 2 activities can move very quickly and the USDOT SE Team is always available to help with any questions and concerns that arise during any of the Phase 2 SE activities

References for SE Session

- Phase 1 Connected vehicle pilot deployment program phase 1 : lessons learned : final report. (bts.gov)
- Phase 2 Connected Vehicle Pilot Deployment Program: Driving Towards Deployment: Lessons Learned From the Design/Build/Test Phase (bts.gov)
- Architecture Reference for Cooperative and Intelligent Transportation
- https://www.its.dot.gov/pilots/thea_obu.htm
- https://www.its.dot.gov/press/2018/nycdot_airsupport.htm
- https://www.its.dot.gov/pilots/disparate_systems.htm

ITS4US Contact Information

Elina Zlotchenko
Program Manager, ITS JPO
Elina.Zlotchenko@dot.gov

Visit the ITS4US Deployment Program Website:

https://its.dot.gov/its4us/

ITS4US Deployment Program Video

https://youtu.be/pztl1lRyXAc