Real-Time Human-in-the-loop Simulation

Scope and Fidelity

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Introduction

- We are in a business of validating advanced ATM concepts
- We face a difficult question of what, when, where, and how different studies need to be conducted
- The scope and level of study varies from concept to concept
- Often we need to make decisions about what is adequate fidelity?
- Often iterative process - build a little, demonstrate a little, test a little, and implement a little…..

Scope

- Different types of human-in-the-loop studies
  - Storyboarding
  - Cognitive walkthroughs
  - Early User Involvement Events
  - Prototypes
  - Demonstrations
  - Part-task studies
  - End-to-end studies/Full-mission studies
  - Shadow mode testing
  - Field tests

NASA's Technology Readiness Levels

- **TRL 1 -** Develop operational concept
- **TRL 2 -** Develop research plan and identify critical feasibility issues
- **TRL 3 -** Develop initial requirements
- **TRL 4 -** Requirements update
- **TRL 5 -** Pre-development prototype evaluation
- **TRL 6 -** Final high fidelity and integrated system demonstration of transfer prototype

Fidelity

- Fidelity Levels
  - Functional - Functions and capabilities
  - Physical - Look and feel
  - Participant - Simulation pilots/controllers
- Adequacy of a simulator - Depends on who you ask and how much you want to pay?
  - Does simulator offer adequate fidelity?

Fidelity

- Fidelity is study specific
  - Depends on attributes of a simulator that are important to the study
- Different Methods to assess fidelity
  - Classification (A, B, C)
  - Qualitative methods
  - Quantitative methods

Importance-Performance Matrix for Fidelity Assessment

Importance

Performance

	Very Low		Moderate		Very High
Very Low					climb rates
Moderate					
Very High					

High Importance, High Performance - Desirable
High Importance, Low Performance - Undesirable
Low Importance, Low Performance - Who cares?

Summary

- Don’t forget cognitive walkthroughs
- Iterative process
- Assess fidelity needs
- Validation through demonstrations, simulations, field testing, …