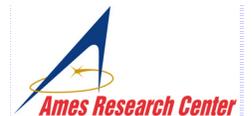




Systems Evaluation and Assessment (SEA) Sub-Element

Real-Time Simulation Validation

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SEA Sub-element**





System Evaluation and Assessment General Tasks

- Develop scenarios and metrics for evaluation of the SLIC concepts
- **Conduct an initial validation assessment of the VAST real-time tools**
- Conduct an initial assessment of the selected concepts
- Conduct an initial assessment of the integrated concepts
- Conduct the final evaluation of the integrated concept(s) using the VAST tools



Real-time Simulation Validation Overview

- **Purpose: To test real-time toolbox in FY04 (Not to test a VAMS concept!)**
- **System Evaluation and Assessment (SEA) is responsible for experimental requirements**
 - **Approach**
 - **Select a concept that has been tested in previous work (field or simulation or other)**
 - **Configure the real-time tools to test this concept using the current set of tools**
 - **Attempt to replicate the findings from previous work using the real-time toolbox to validate the toolbox development**
 - **Provide pathways to future tests in the real-time environment**





Real-Time Simulation Validation Issues

- **A topic for the validation study must be relevant to general VAMS themes**
 - **The topic should offer an opportunity to test more than one airspace domain (e.g., TRACON + En route) for human-in-the loop considerations**
 - **The topic should test other models and tools along with the human-in-the loop considerations**
 - **The topic should be in-line with topics expected from VAMS concepts**
- **The requirements should not redirect the development efforts that will be ongoing for the real-time toolbox**
- **The experimental requirements should help prioritize the development of the toolbox**



Real-Time Simulation Validation Parameters and general approach

- **Include at least two facilities**
- **Test at least two parts of the triad**
- **Emphasize common architecture and data management and analysis**
- **Sequential testing prior to FY04 test**
- **Should be concerned with automation topics, with an emphasis upon human factors**
- **Development of real-time simulation environment should be closely related to some of the development requirements for the advanced concepts derived from the SLIC subelement**



Real-Time Simulation Validation Thoughts about our approach

- **To validate, we're looking for results that are consistent with "baseline" data**
 - **Extensive fast-time study**
 - **Real-time simulation**
 - **Field site evaluation**
 - **Common findings across studies**
- **Human factors issues testing by specific event**
 - **Failure**
 - **Blunder**
 - **Coordination requirement**



Real-time Simulation Validation

General Plan: Arrival sequence with surface operations

- **Nominal operations will be comparable to previous data (capability validation)**
- **Abnormal events will demonstrate how the capability can be used to examine human factors issues related to the development of distributed, automated systems**
- **Simulation operations using expanded VLab facility will demonstrate how experimenter can conduct an evaluation from one central location**
- **Simulation will collect parameters of operation which are useful for upgrading models and for fast-time operations**





Real-time Simulation Validation Operations

- **Multiple arrival streams at operational capacity into terminal area (possibly DFW)**
 - **Minimum spacing between aircraft**
 - **Normal but busy for pilots and controllers**
- **Self-spacing operations**
 - **Controller has overall responsibility for TRACON arrival operations**
 - **Controller can clear suitably equipped aircraft for self-spacing**
- **Aircraft landing and taxiing**
- **Other surface traffic represented**



Real-time Simulation Validation

Creation of abnormal event

- **After some time of normal but busy operations, simulate a problem on the surface that constrains the traffic movement (possibly a disabled vehicle on a taxiway, runway incursion).**
 - **This should constrain the arrival flow as well as the surface movement, thereby creating more challenges**
- **Fail one or more of the automation tools or represent corrupted data**
 - **This should create challenges throughout the system if we create a failure on a critical system**
- **Blunder (e.g., aircraft turns onto runway)**
 - **This may constrain most of the traffic in the airport area**



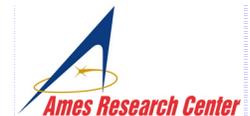
Real-time Simulation Validation Automation tools that might apply

- **FAST tools for the controller**
- **Cockpit display of traffic for the pilots**
- **Self-spacing algorithms**
- **SMS for controller surface tool**
- **T-NASA for pilot surface tool**



Real-time Simulation Validation Facilities

- **CVSRF simulator (Advanced Concept Flight Simulator)**
- **Airspace Operations Laboratory (AOL)**
- **Future Flight Central (hopefully it has SMS integrated)**
- **Facility outside Ames (controller simulator at NTX)**
- **Ability to use Vlab-type capabilities**





Real-time Simulation Validation

Data collection requirements

- **Emphasis will be on validating the test environment**
 - **Objective data**
 - **Discrete data**
 - **Continuous data**
 - **Time synchronization data**
 - **Subjective data**
 - **Video/audio capabilities**



Real-time Simulation Validation

Participants and Research Team Involvement

Participants

- Commercial pilots
- TRACON controllers
- Tower controllers

Research team involvement

- Research representative of surface operations and automation for controllers
- Research representative of surface operations and automation for pilots
- Research representative of TRACON operations and automation for controllers
- Research representative of TRACON operations and automation for pilots
- SEA research team





Real-time Simulation Validation Some Remaining Issues

- **What will our metrics be for the validation of the real-time simulation environment?**
- **What are the appropriate scenario events to test the simulation?**
- **How will we map between the requirements for the real-time simulation environment and the non-real-time simulation environment?**
- **Is the integration of facilities and exchange of data between them too difficult for this time frame?**