



Virtual Airspace Modeling & Simulation - TIM 4, Feb. 10-11, 2004

An Overview of the Airspace Concept Evaluation System Development Cycle

Lisa J. Bjarke
VAST Level III Manager
Aerospace Operations Modeling Office
NASA Ames Research Center

Presented at the
VAMS Technical Interchange Meeting #4
February 11, 2004



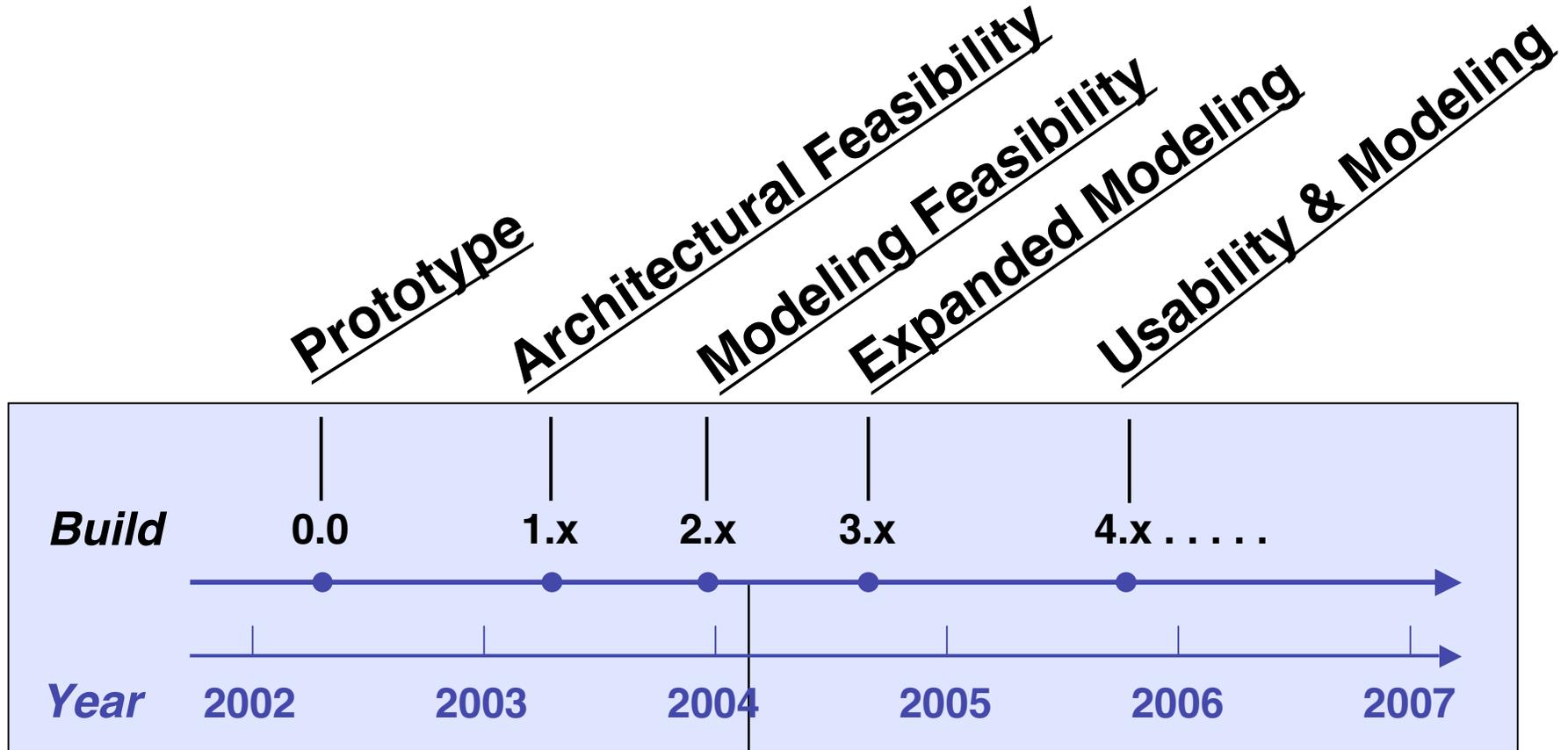
Session Objective

- Provide overview of ACES development cycle
- Introduce the community to range of applications that have been accomplished using the ACES toolkit
- Provide VAST-RT status and interim test results

- ACES provides NASA with a toolkit that may be configured to analyze a variety of airspace concepts
 - System-wide understanding is sought
 - Concepts may depart significantly from today's paradigm
 - Models may be microscopic or macroscopic in detail and may be replaced with little change to other models
- ACES uses advanced integration methods
 - Agent framework eases model development and validation
 - Standards-based communications, via HLA, ease integration of existing simulators
- ACES is a long-term solution with near-term utility
 - Early software builds show feasibility of using mixed-fidelity models to assess impact of new concepts
 - The distributed run-time environment is scalable
 - The architecture design is also expected to support development of tactical simulations in the future

ACES Build Cycle Timeline

Virtual Airspace Modeling & Simulation - TIM 4, Feb. 10-11, 2004



Status at TIM #4

Prototype - Proof-of-Concept

- Demonstrate proof-of-concept by integrating the selected infrastructure with agent-based software enabling non-real-time, NAS-wide simulation

Build 1.x - Basic Modeling Foundation

- Develop architecture, run-time capability, and establish initial set of models
- Develop simulation control, data collection and visualization
- Target ability to assess economic impact of new technology and model dynamic effects of interactive elements

Build 2.x - Modeling Feasibility

- Target ability to model and assess impacts of constraints
- Enhance performance and expand modeling, improve data access and usability
- Initiation of some external ACES model development/co-development activities

Build 3.x - Expanded Modeling and Basic Usability

- Improve usability and increase modeling fidelity
- Target adding cognitive human performance and ability to model the effect of communications, navigation, and surveillance

Work in Progress: APEX-ACES Integration

- APEX (Architecture for Procedure Execution)
 - An application for generating adaptive, intelligent human behavior in complex, dynamic task environments
- Simple ATC Simulation
 - Scenario
 - 14 aircraft flying from LAX to SFO
 - Two ARTCC Centers (ZLA and ZOA)
 - After an aircraft enters ZOA, the aircraft agent sends a message to Center ATC Agent
 - Center ATC Agent sends an event message to APEX ATC Agent through TCP/IP socket
 - APEX ATC Agent perceives event, selects procedure and sends command (change heading) to ACES agent
 - ACES agent sends change-heading message to aircraft

- ACES model has been developed to interact with the Advance Airspace Concept (AAC) conflict detection and resolution algorithms
- ACES passes conflict data to AAC CD&R module
- AAC CD&R module generates trial resolution plans and submits them to ACES
- ACES evaluates trial resolution plans for additional conflicts and submits remaining conflicts back to AAC CD&R
- ACES accepts final resolution maneuver (if any) from AAC CD&R

Results Presentations

- Preliminary analysis of three VAMS operational concepts using ACES Build 1.2 – L. Meyn and T. Romer
- Creation of a performance graph for the National Airspace System varying demand and capacity using Build 1.2 – S. Zelinski
- Evaluation of new modeling features using Build 2.0.2 – P. Cobb
- VAST-RT Interim Test Results – S. Malsom