



Simulation Based Acquisition for the Artemis Program

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Artemis Program**



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Artemis System Overview



- Active Standoff Chemical Warfare (CW) detection system
- Near-real-time identification of CW agent vapors and aerosols
- Autonomous operation
- Detailed mapping and tracking of threat clouds
- Modular design for ease of integration
- Warfighter benefits
 - Maximum warning and battlefield awareness
 - Enables preventive measures versus countermeasures



**Simulation Based Acquisition for the
Artemis Program**





What Is Simulation-Based Acquisition (SBA)*?



- SBA is an Acquisition Process in Which DoD and Industry are Enabled by Robust, Collaborative Use of Simulation Technology That is Integrated Across Acquisition Phases and Programs.
- SBA is a Revolutionary Acquisition Initiative
 - Emphasizes modeling and simulation (M&S) as a primary tool
 - M&S applied and sustained throughout the life cycle
 - Virtual life cycle product validation before production
 - Enables iterative development and integrated product and process development
- Major Impact on Test and Evaluation Culture and Purpose
 - Digital representations are tested
 - Physical test articles are primarily for model verification and validation

* From NAVAIR Acquisition Guide – <http://www.ntsc.navy.mil/Resources/Library/Acqguide/sba.htm>



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Why Use SBA on the Artemis Program?



- SBA Can Significantly Reduce Overall Program Risk and Cost By:
 - Analyzing user requirements
 - Understanding cost and risk
 - Developing a performance specification that directly reflects user needs
 - Evaluating system design prior to “bending metal”
 - Applying virtual testing prior to full systems test
 - Developing a robust training system
 - Supporting production qualification testing

SBA provides the methodology to successfully manage user expectations throughout the lifecycle of the program.



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The SBA Process Utilizes A Variety of Simulation Tools



- The Total Ownership Cost (TOC) Model
 - System model for evaluating cost of various technologies
 - Provides a ROM TOC for the Warfighter
- The Combat Development Model
 - Integrated, battlefield employment model for evaluating various employment concepts and scenarios
- The Executable Model
 - High fidelity system model built upon a detailed system architecture
 - Validates architecture by implementing desired use cases
 - Provides system performance predictions to support system specification development, design tradeoffs, virtual testing and system data analysis
- Training Tool
 - Integrates the combat development model with war-game simulators to train the Warfighter

Briefing will emphasize Executable Model development



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System Architecture Development Follows Strict Development Protocols



Definition

Architecture: The structure of components, their relationships, and the principles and guidelines governing their design and evolution over time.

DoD Integrated Architecture Panel
1995, based on IEEE STD 610.12

Terminology

Framework: Guideline for a common approach for system architecture development

Architecture Views: Perspectives used to develop the system architecture (operational, systems, technical)

Use Cases: Scenarios

Views

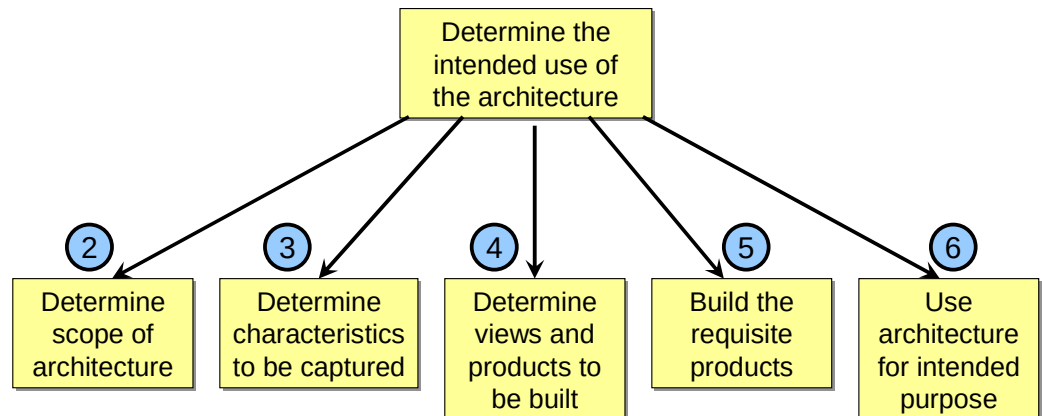
Operational View: Tasks and activities required to accomplish missions

Systems View: Systems and interconnections providing functions

Technical Standards View: Minimal set of rules governing the interaction of elements



Process

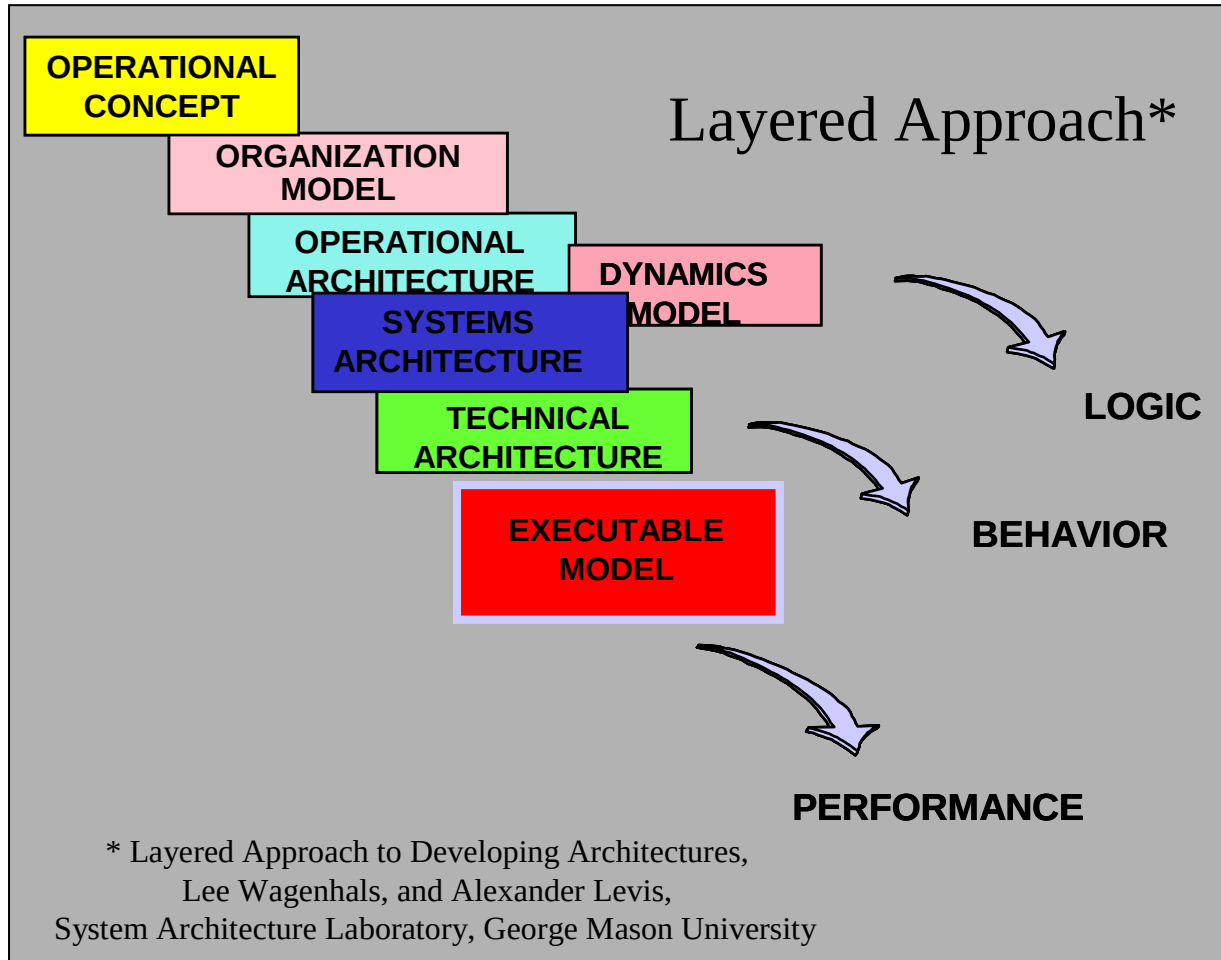


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Layered Development Approach Insures Architecture Will Support Executable Model Development



Stage 1

Domain information is collected
Emphasis is on operational views
Products: Structural diagrams

Stage 2

Develop the system and technical views
Emphasis is on systems, system interconnections, networks and performance parameters
Products: Behavior diagrams

Stage 3

Develop the executable model
Emphasis is on the analysis of system performance and the dynamics of the architecture
Product: Executable Model



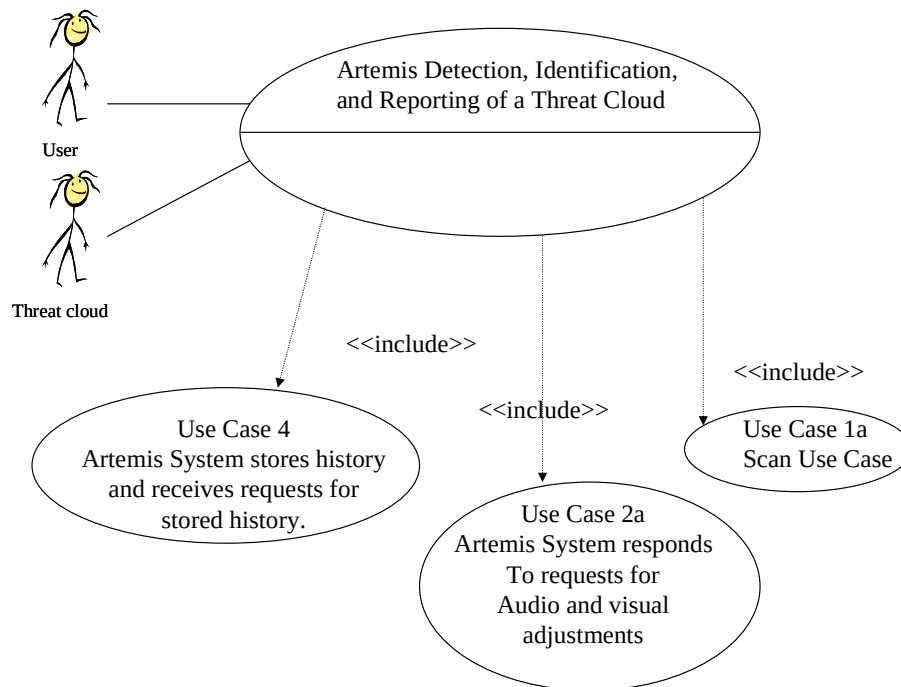
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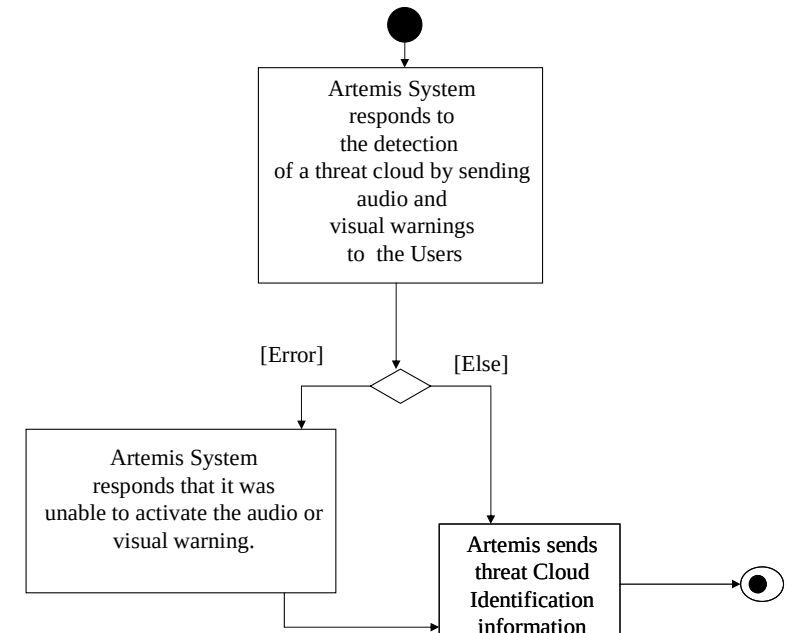


Architecture Use Case Development Example (1)

Detection, Identification and Reporting a Threat Cloud



Use Case Diagram: Defines Scenario
What will be done?



Activity Diagram: Defines System Response
How will it be done?

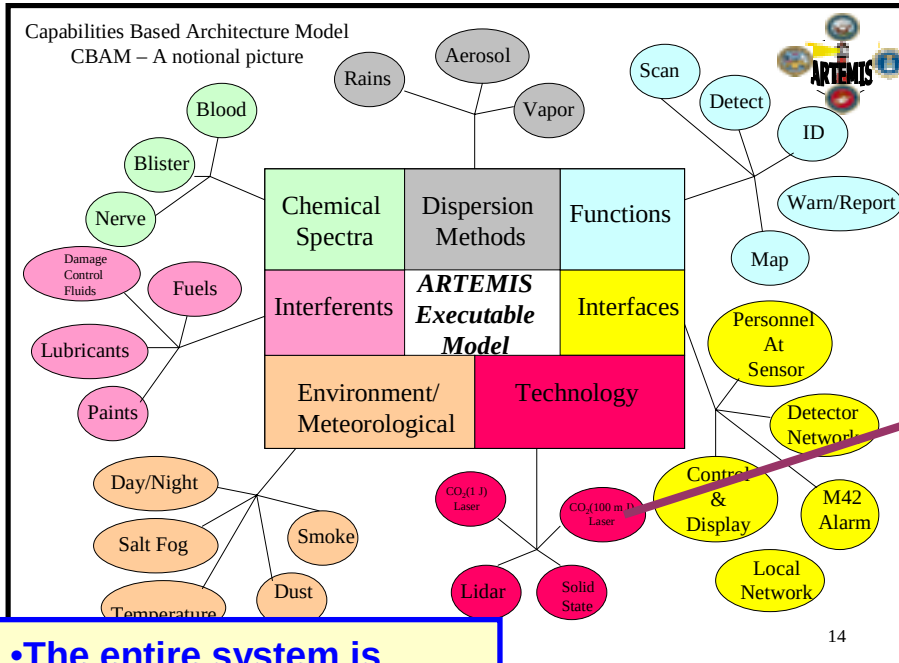


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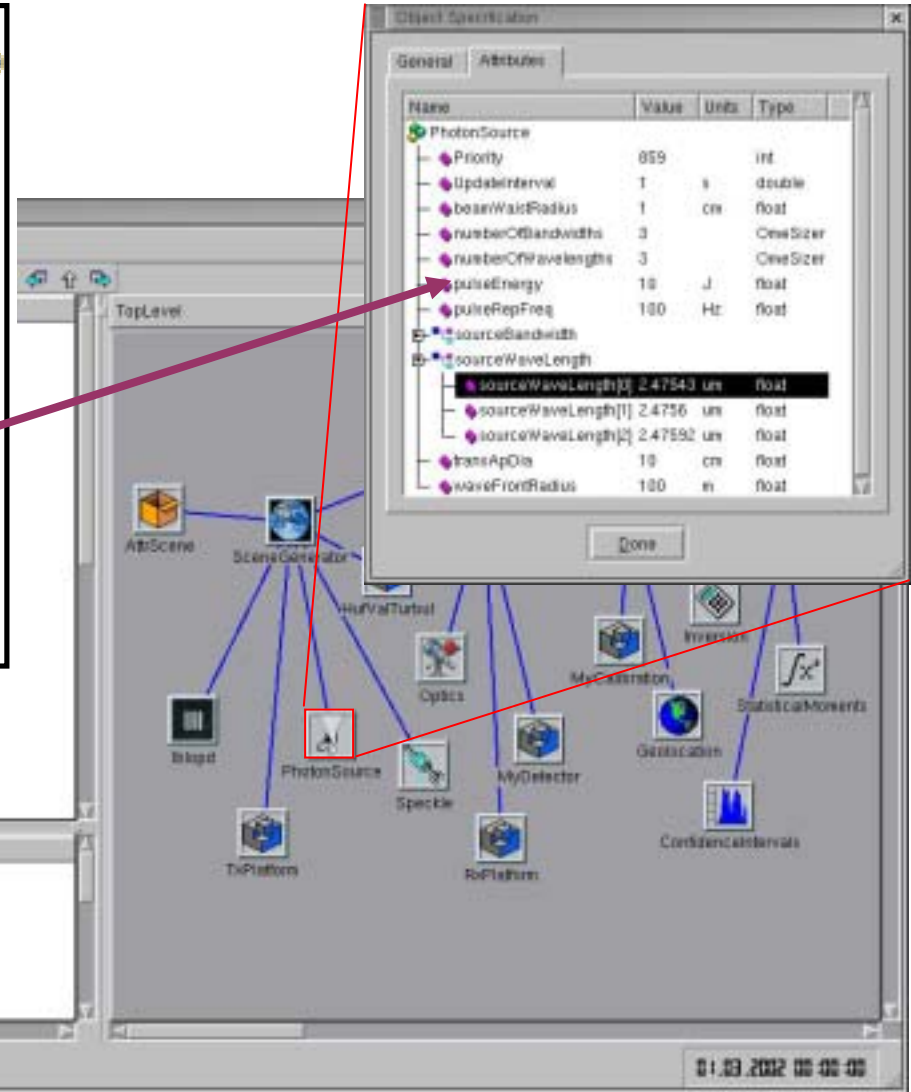




The Design of the Executable Model is Derived Directly from the Completed Architecture



- The entire system is represented by unique functional blocks
- Tools are built as modules contained in dynamic link libraries
- The attributes of each module define its characteristics



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What is the Artemis Capabilities-Based Architecture Model (ACBAM)



- High fidelity, object-oriented system simulation of active standoff detectors
- Implemented using ITT Industries SPEED toolbox
 - Uses OmeChron simulation environment
 - Mimic the way a systems engineer may draw a block diagram of a system.
 - Mimic the way the physical phenomena occur within the system.
 - Utilizes time and event based execution models
 - Hierarchical architecture and inheritance enables multiple fidelity implementations
- Integrates “best of the best” models into a single system evaluation
 - DIRSIG for complex 3D spatial and spectral background representations
 - Radiative transfer: LBLRTM using HITRAN and PNNL databases
 - VLSTRACK for target cloud dispersion
 - Various sensing subsystem models reused from past developments

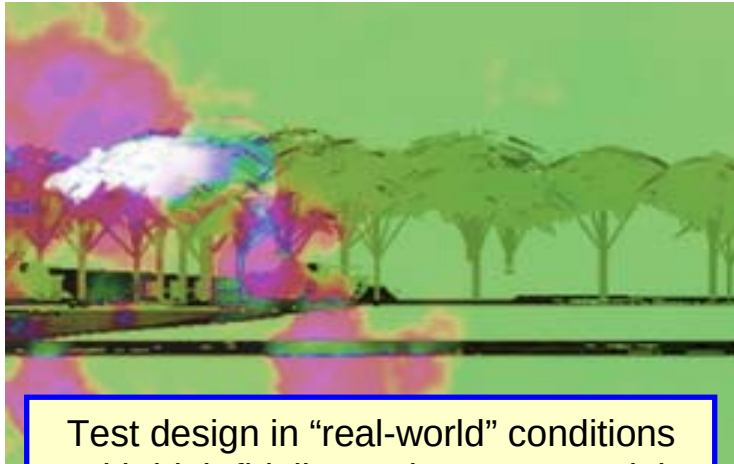


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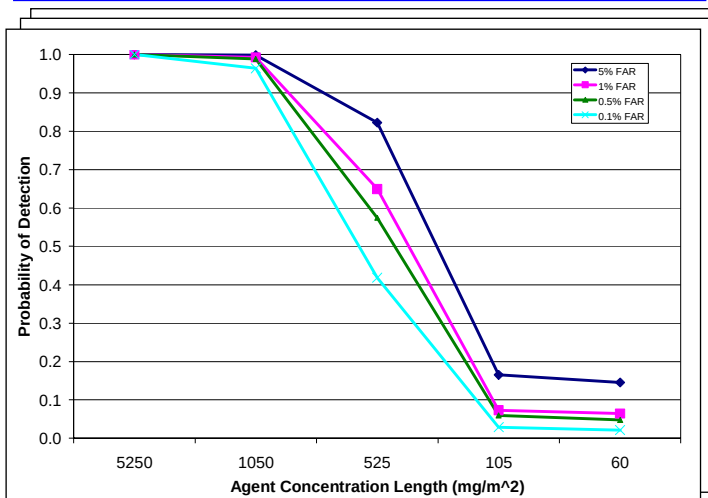




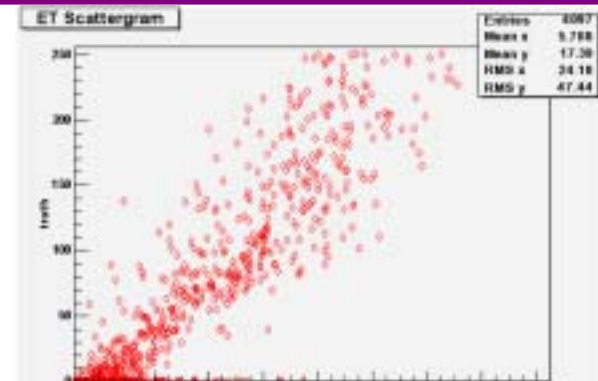
ACBAM Enables Design Optimization, Performance Evaluation and Test Troubleshooting



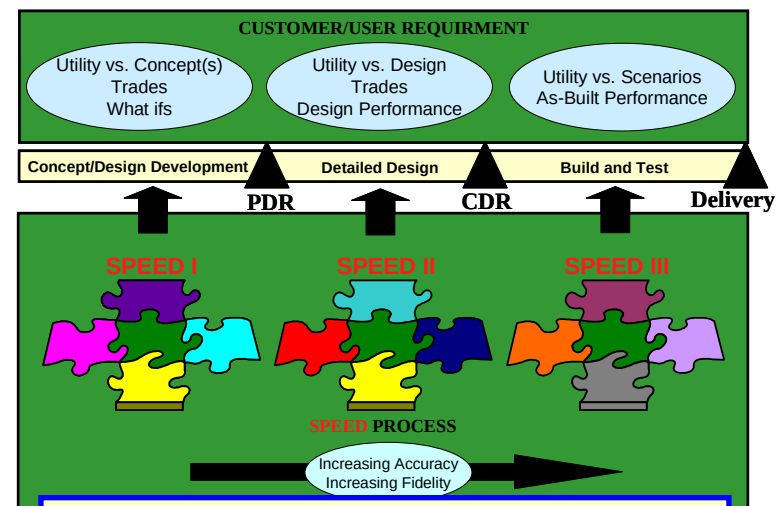
Test design in “real-world” conditions with high fidelity environment model



Explore Trade Space through multiple parameter studies



Evaluate algorithms and product quality with realistic instrument output



Simulation fidelity can increase as system design matures

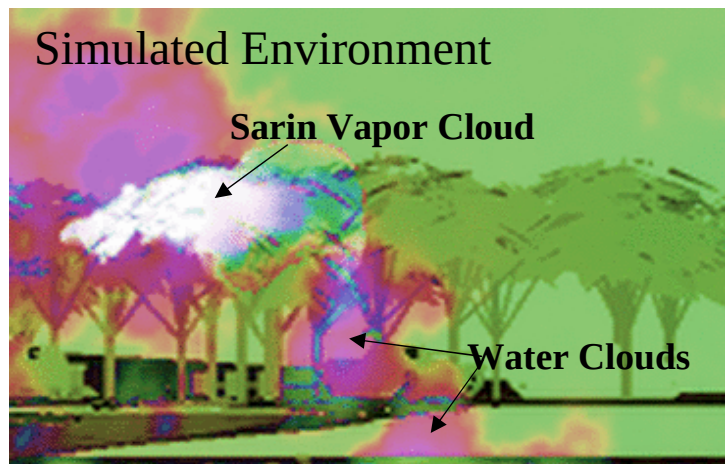


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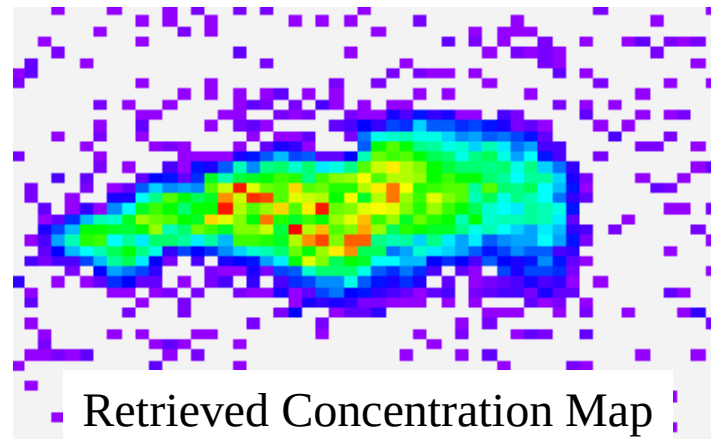




ACBAM Beta Version is Currently in Test – Initial Full Version Release in 12/03

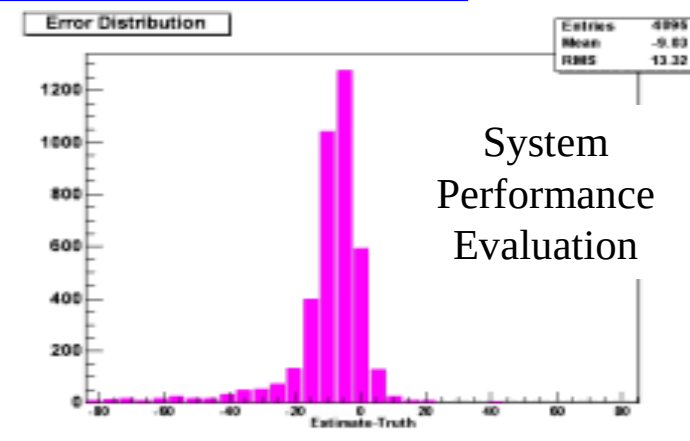
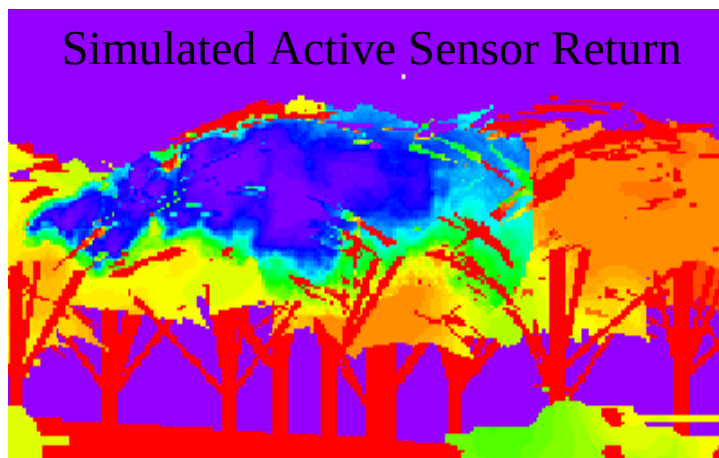


Processing of on and off absorption line spectral channels to estimate gas concentration



Performance assessment of specified system configuration

Complex 3D environment interrogated and sensed by active sensor



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ACBAM Will Continue to Evolve to Support Program Needs Throughout the Life Cycle



- Post Milestone A
 - System Requirements Definition
 - ACBAM captures the logic, behavior, performance and effectiveness of the system utilizing proposed technologies
 - **ARE WE DEVELOPING THE RIGHT SYSTEM?**
- Post Milestone B
 - System Development and Demonstration
 - ACBAM will evaluate proposed design solutions, propose “best value testing” and predict test results
 - **ARE WE DEVELOPING THE SYSTEM RIGHT?**
- Post Milestone C
 - Production, Deployment, Operations and Support
 - ACBAM will evaluate production solutions, emerging technology, new design solutions and CONOPS changes
 - **WHAT IS THE VALUE AND RISK OF CHANGE?**



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