MITRE M&S Capabilities in Support of FAA and DOD

Andy Anderegg
April 24, 2008
National Airspace System Performance Depends on Many Complex Interrelationships

ATM/CNS Systems

Planning and Dispatch
Air Crews
Traffic Flow Management
Air Traffic Control
Military
Modeling and Analysis Framework

NAS-wide Modeling and Analysis

Regional Modeling and Analysis

Local Modeling and Analysis

CNS Modeling and Analysis

ATM Modeling and Analysis

Industry-structure Modeling and Analysis
Objectives of the CAASD Integrated ATM Lab
CAASD ATM R&D Model

The Integrated ATM lab is an integral phase in our research model.
Integrated ATM Laboratory Architecture

Surface

Terminal

Simulation Infrastructure

Cockpit

En Route

TFM
Gate-to-Gate Simulation
AviationSimNet®

AviationSimNet® is a lab environment designed and built by MITRE independent sponsored research to bridge air traffic management labs over the Internet safely and efficiently.

- Bridges MITREs ATM lab with labs at other organizations
- Simulates ATM voice and data communications
- Reusable and reconfigurable software environment
- Facilitates worldwide collaboration of real-time human-in-the-loop laboratories
Value: Faster Turnaround to Solutions

Outcome 5
14 Months
Near Term Procedural Enhancements

Visualization

Human-In-The-Loop Evaluations

Field Evaluations

Surface Markings

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Initial Workshop

Demonstrations And Pilot Evaluations/Simulations

Field Evaluations in PVD, BOS

Draft AC Developed/Published

Portions Mandated
Value: Faster Turnaround to Answers

Models

- SDAT
- TAAM
- CRS
- TARGETS
- GRASP

Enroute Simulation

- Terminal Simulation
  - Human Factors
  - Roles and Responsibilities
  - Validation

Outcome 6
Airspace Design and Analysis

National Airspace Redesign
MITRE’s Collaborative Experimentation Environment (CEE)

Zach Furness, MITRE (zfurness@mitre.org)
Valerie Gawron, MITRE (vgawron@mitre.org)
February 22, 2008
Multi-Agency Coordination – A Continuing Concern

“As the post-September 11 interagency threat resolution process matures, it is important for agencies to develop mechanisms and procedures that enable effective and efficient coordination.”


“...action be taken to facilitate the sharing of terrorism information by establishing an ‘information sharing environment’ that would combine policies, procedures, and technologies that link people, systems, and information among all appropriate federal, state, local, and tribal entities...”

– GAO-07-375, “Progress to Address Security After 9/11”

“During the Federal response to Katrina, four critical flaws in our national preparedness became evident: Our processes for unified management of the national response; command and control structures within the Federal government; knowledge of our preparedness plans; and regional planning and coordination. ”

– “The Federal Response to Hurricane Katrina: Lesson Learned”
Why Experimentation?

- Experimentation enables observing, quantifying, understanding, and predicting the impact of policy, procedures, and technologies on multi-agency operations through human-in-the-loop interaction

- Experimentation helps answer the “big questions”
  - Who should lead and who should support?
  - What policies, procedures, and technologies are needed?
  - Where do these apply?
  - When should they be used?
  - How should they be used?
What is the Collaborative Experimentation Environment (CEE)?

- A re-configurable, distributed environment of simulations and operational systems for the purpose of:
  - Understanding the implications of new policies, procedures, and technologies on multi-agency operations *early* in development
  - Generating quantitative data that could be used to inform sponsors and validate policy and acquisition decisions
  - Leveraging existing internal and external simulations, systems, services, and applications to support Net-Centric Experiments (NETEXs)
  - Targeting Joint Interagency Intergovernmental Multinational missions
  - Providing an environment for industry and government to demonstrate concepts and evaluate technologies

**Vision:** Quantify Multi-Agency Mission Effectiveness
CEE Goal – Identify How To

Get the right information

at the right time

and the right media

in the right language

at the right level of detail

1900 Fuel Truck Departs POL facility

1100 Missile Transport Truck observed on route to SAM site

1400 Fuel Truck Arrives at SAM site

to the right people

Get the right information and the right media at the right time in the right language at the right level of detail
CEE Strategic Goals and Key FY08 Targets

- Solve critical problems in multi-agency operations through experimentation
  - Identify operational and technical gaps in Domestic Events Network (DEN) operations among FAA, DoD, DHS, and IC during rogue aircraft scenario

- Quantify the value of collaboration systems for end-users
  - Measure the end-to-end performance during mission simulations

- Integrate existing assets and maturing technologies
  - Build connection between John Hopkins University Advanced Physics Laboratory (JHU/APL) and MITRE CEE to demonstrate the utility of federated labs in analysis of National Leadership Command Capabilities for Assistant Secretary of Defense Network and Information Integration (ASD (NII))

- Advance the state-of-the-art in experimentation
  - Validate measures of multi-agency mission performance
# Near Term Schedule and Milestones

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Overview of NETEX 08-01 Scenario

Response Phase (5:00 – 6:00)
Attempt to ID possible target of interest (TIO) and intercept. Primary interactions between CONUS air defense, civil ATC, then first responders.

Assessment Phase (1:00 – 5:00)
Attempt to determine state and condition (whether mechanical failure or hostile intent). Primary interactions between operations and intelligence. Domestic events network and secure video teleconference initiated.

Verification Phase (0:15 – 1:00)
Attempt to re-establish communications. Primary interactions between gander ATC and the air carrier.

Identification Phase (0:00 – 0:15)
Loss of contact. Primary interactions between aircraft and Gander oceanic ATC (non radar environment).

Original Flight Plan Path
Actual course taken, outside normally used airspace

1404z loss of contact

Gander Oceanic FIR

1100z
NETEX 08-01 Operational Architecture

ACME Lab (MITRE Bedford)

F16 Pilot (XPlane)

MITRE McLean SIF Lab

MITRE 2 McLean ATM Lab

Airline Dispatcher

Civil Air Comms

Boston Center Sector Controllers

Boston Center Supervisor

Domestic Events Network (DEN) (Meeting Place)

ATCSCC Herndon

Air Traffic Security Coordinator (ATSC)

Link16

AWACS

Eastern Air Defense Sector

White Cell (FAA ATC, NAVCanada)

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Current CEE Technical Reference Model

Operational Systems (Real or Emulated)
- GCCS
- C2PC
- CAASD Earth
- CRCT
- DSR
- MCC

Translators
- JSAF OTH
- COT
- JDT
- BCS-F
- AWS
- ADAPT

Simulation / Visualization
- JSAF
- AWSIM
- X-Plane
- Falcon View
- GRAIL

Simulation Gateways
- JSAF OTH
- JSAF GRAIL
- RCAT
- TASF
- JDT

Simulation Infrastructure
- DIS
- DIS/ITP
- ITP
- HLA

Management Applications
- REDSIM Data Logger
- Scenario Manager
- Asset Registry

Comms and Network
- M-Tunnel
- Internet
- DREN

Existing C2C
Existing CAASD
Future Planned
Backups
Acronyms

- GCCS – Global Command and Control System
- EADS – Eastern Air Defense Sector
- JSAF – Joint Semi-Automated Forces
- DIS – Distributed Interactive Simulation
- ITP – Integrated Target Generator Protocol
- C2PC – Command and Control PC
- CRCT – Collaborative Routing Coordination Tools
- GRAIL – GRAIL Real-Time Infrastructure Laboratory
- MCC – Mission Critical Chat
- COT – Cursor on Target
- BCS-F – Battle Command System – Fixed
- HLA – High Level Architecture
- RCAT – Reconfigurable Cockpit and Avionics Testbed
- TASF – Terminal Area Simulation Facility
- ADAPT – Automatic Detection and Processing Terminal
- DREN – Defense Research and Experimentation Network
- AWS – Airborne Web Services