

Homeland Security Perspective on Modeling and Simulation (M&S)

From Science....Security



From Technology....Trust



**Homeland
Security**

George R. Ryan
Director T&E / Standards



Homeland Security

FROM SCIENCE...SECURITY

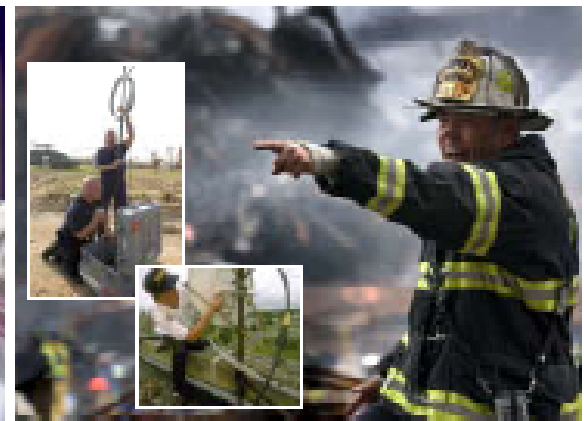
Explosives



Chemical/Biological



Command, Control, & Interoperability



Borders/Maritime



Human Factors



Infrastructure/Geophysical



FROM TECHNOLOGY...TRUST

How is M&S used for Homeland Security?

Current Capabilities

- National Infrastructure Simulation & Analysis Center (NISAC)
- Interagency Modeling and Atmospheric Assessment Center (IMAAC)
- Homeland Security Institute (HSI)

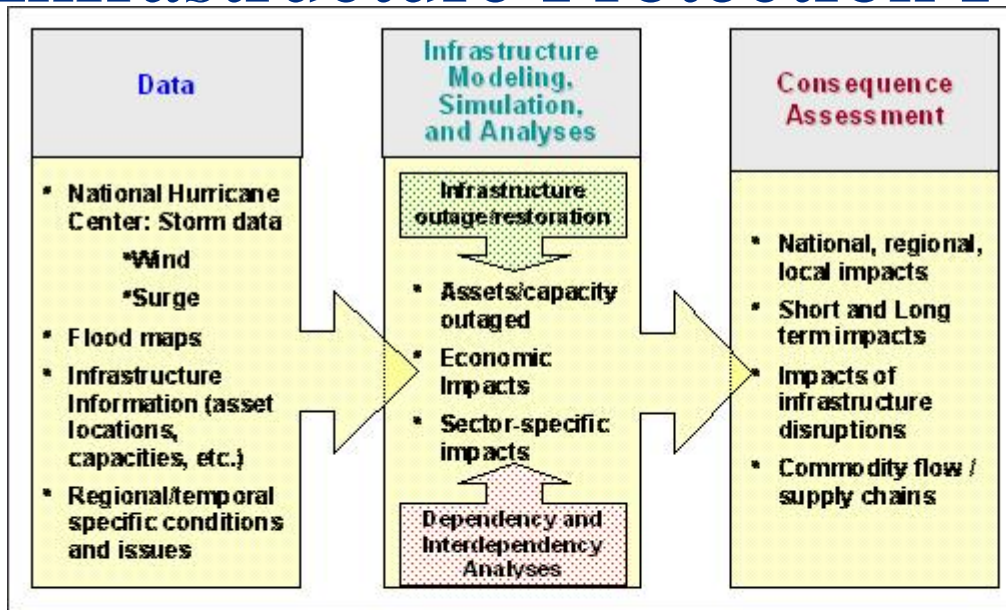
Some Emerging Capabilities

ACTIVITIES	M&S PROJECTS AND PROGRAMS
FEMA	National Exercise Simulation Center
Border & Maritime Security	Secure Border Initiative Systems Engineering and Modeling & Simulation Project
Chemical & Biological	Foreign Animal Diseases Modeling Project
	Joint Agro-Defense Office (JADO) will establish the Joint Modeling Operations Center (JMOC)
Command, Control, Interoperability	Visual Analytics and Physics-based Simulation Program
Explosives	Computational models to predict aircraft vulnerability to Home-made Explosive threats
Human Factors	Group Violent Intent Modeling Project
	Open Source Modeling Applicability Project
Infrastructure & Geophysical	Real-time Decision Support Tool Project
	Training, Exercise & Lessons Learned (TELL) Project
	Integrated Modeling, Mapping and Simulation Program

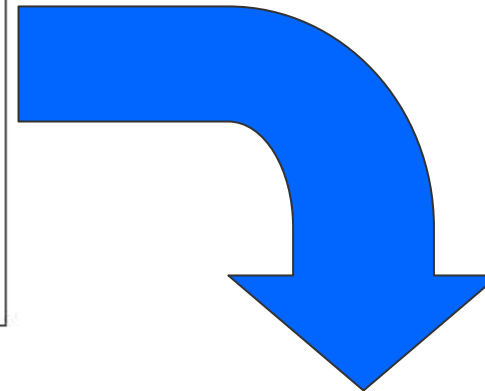
M&S is integral to analysis and supports decision making at many levels



Example: NISAC support of National Infrastructure Protection Plan



NISAC Delivers Infrastructure Analysis



Home
Security

Example: IMAAC support to National Response Plan

INTERAGENCY MODELING AND ATMOSPHERIC ASSESSMENT CENTER

Overview

- The National Response Plan designates the Interagency Modeling and Atmospheric Assessment Center (IMAAC) as the single Federal source of airborne hazards predictions during an Incident of National Significance (INS). IMAAC is responsible for producing and disseminating predictions of the effects from hazardous chemical, biological, and radiological releases.
- Knowing the downwind impact from such releases is a key component of developing a common operational picture for response decision making from the local through the Federal levels. In the interest of providing decision makers with immediate information to protect public health and safety, IMAAC also supports responses to major atmospheric releases leading up to an INS.

Composition of IMAAC

The IMAAC goal is to draw upon and coordinate the best available capabilities of participating agencies. The current IMAAC agency Federal partners are the Department of Homeland Security, the Department of Defense, the Department of Energy, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (Department of Commerce), the Nuclear Regulatory Commission, and the National Aeronautics and Space Administration. IMAAC is not intended to replace or supplant dispersion modeling capabilities that Federal agencies currently have in place to meet agency-specific mission requirements. Rather, it provides interagency coordination to use the most appropriate model for a particular incident and for delivery of a single Federal prediction to all responders.

Why the IMAAC?



Responders need a single, unambiguous, accurate prediction for immediate decision making in the event of a major hazardous atmospheric release. IMAAC provides access to complex modeling tools that incorporate real-time location-specific meteorological data, demographic and geographic data, and first-hand observations about the release from the incident site. IMAAC provides 24/7 experts to run the modeling system, quality assure results, and assist decision makers in the interpretation of model predictions.



Examples: HSI support to DHS using M&S

System Interaction Modeling

- Challenge: What is the most efficient means of screening personnel/cargo using various technologies or processes?
- Typical Tools: Discrete Event Models; Monte Carlo Methods; Markov Process Analysis

Resource Allocation Modeling

- Challenge: What is the optimal strategy for allocating scarce resources in the face of a knowledgeable and learning enemy?
- Typical Tools: Optimization tools and techniques as well as classical game theory (mixed strategy games)

Training

- Challenge: How to conduct effective training and operational exercises across functional and geographical areas?
- Typical Tools: Simulation-based scenario drivers; distributed networking capabilities

Deterrence/Behavioral Modeling

- Challenge: What is the most effective means of coordinating the movement or activities of large groups of individuals?
- Typical Tools: Agent-based modeling tools, Java, C++, Significant computational capacity for processing and visualization of data.

M&S in Perspective

Analysis

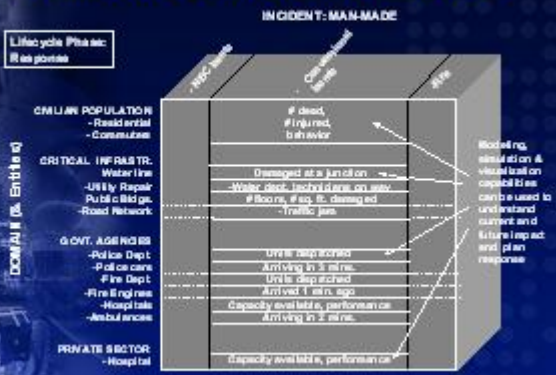
Skilled analysts match the right M&S and data to answer the question at hand

Data

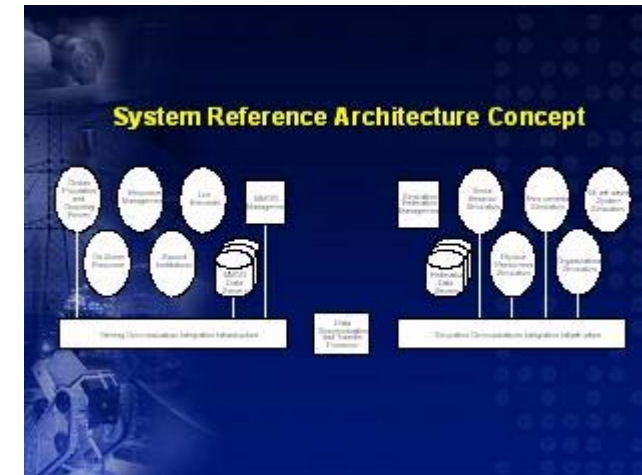
M&S



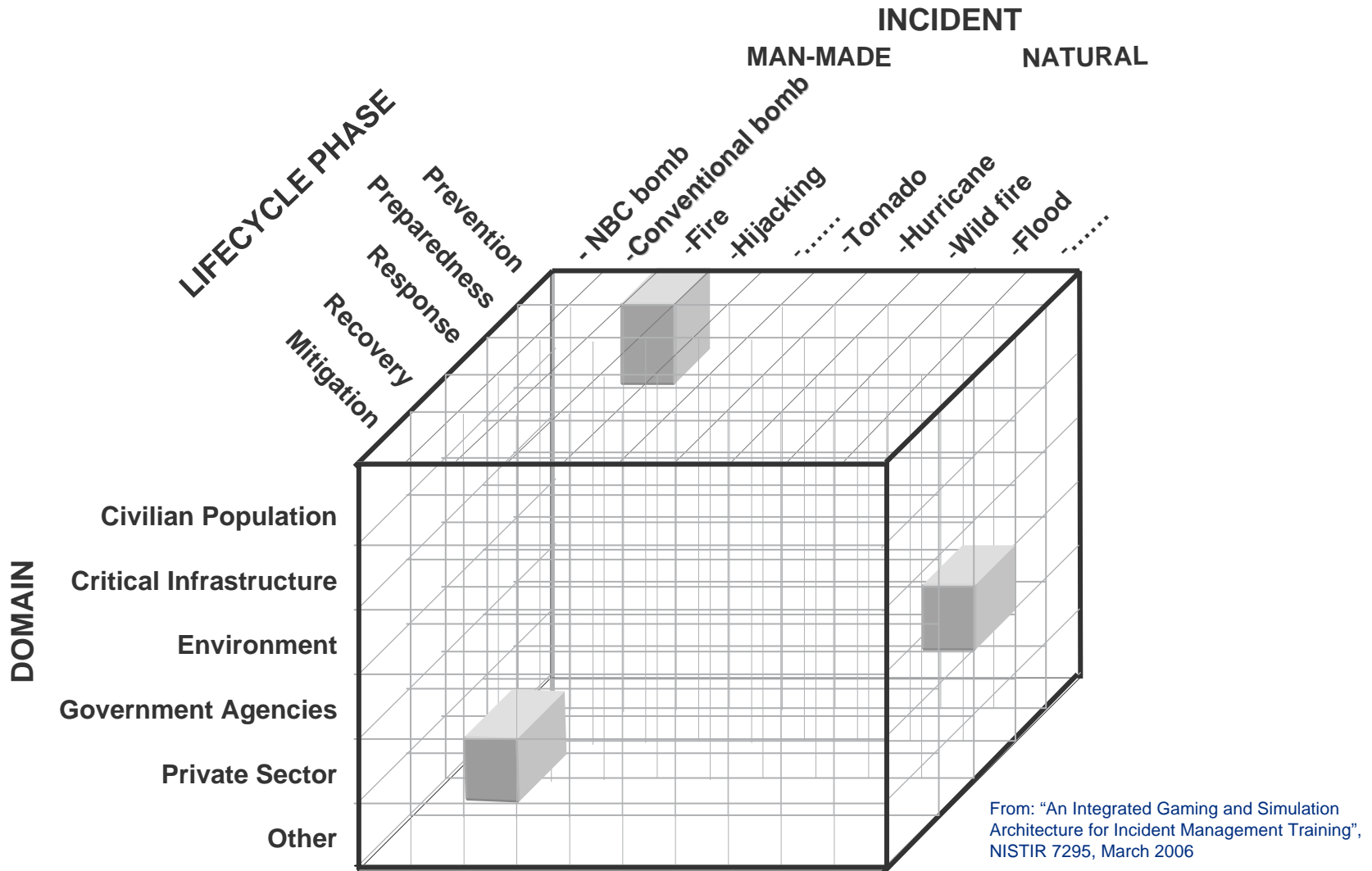
Framework – Examples of Incident Data



System Reference Architecture Concept



Framework For Incident Management (FIM)



Homeland Security

**Cells Represent Potential M&S Applications:
Many potential uses for Incident Management!**

Framework – Examples of Incident Data

**For LIFECYCLE PHASE:
Response**

INCIDENT: MAN-MADE

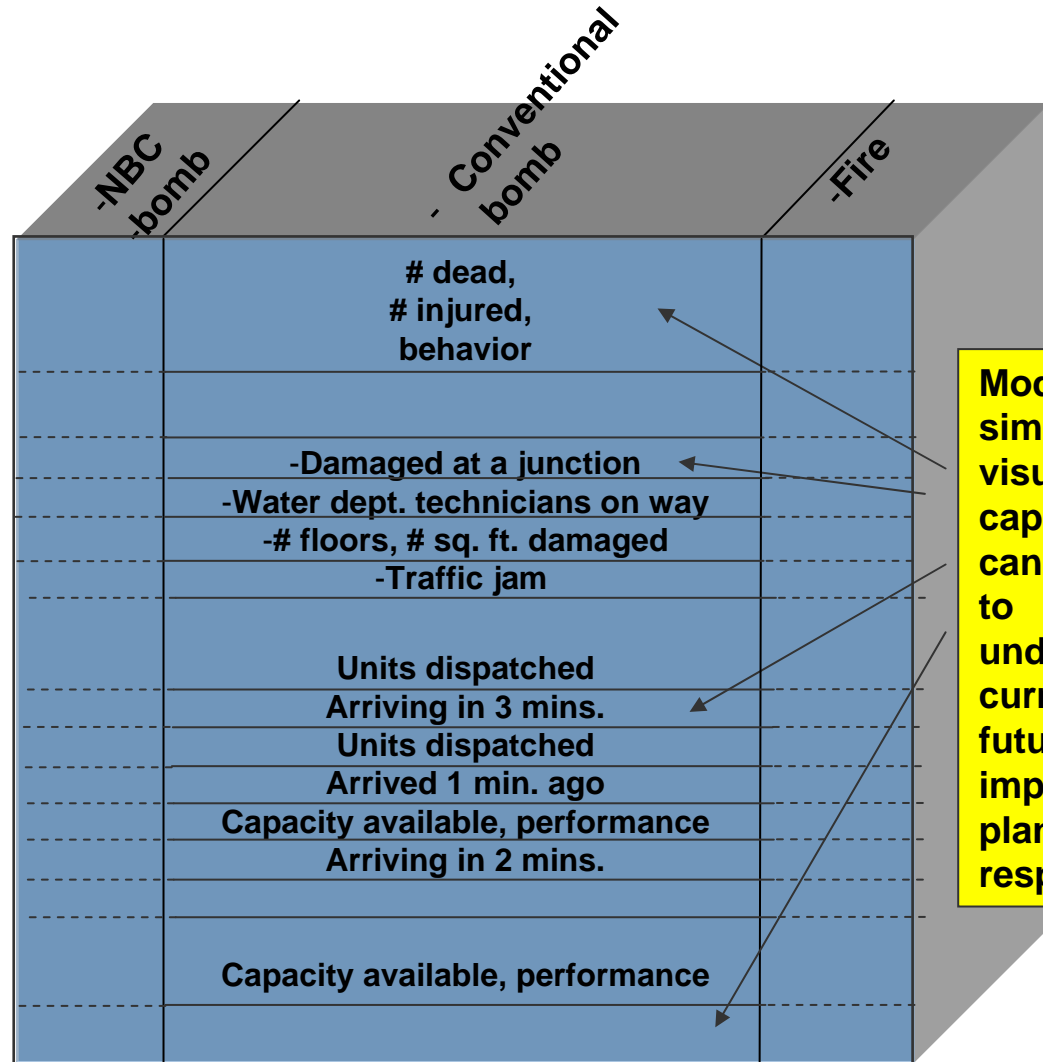
DOMAIN (& Entities)

CIVILIAN POPULATION
- Residential
- Commuters

CRITICAL INFRASTR.
-Water line
-Utility Repair
-Public Bldgs.
-Road Network

GOVT. AGENCIES
-Police Dept.
-Police cars
-Fire Dept.
-Fire Engines
-Hospitals
-Ambulances

PRIVATE SECTOR
- Hospital



**Modeling,
simulation &
visualization
capabilities
can be used
to
understand
current and
future
impact and
plan
response**



**Homeland
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Needs for Homeland Security

Analysis

- Understanding of key processes/phenomena
- Ability to make rapid damage estimates
- Quantification of uncertainties

Data

- Timely access to critical data sets; e.g. for emergent situations
- Standards for data portability
- Visualization for rapid assessment of large data sets and/or data streams

M&S

- Standards and development processes to promote “open systems” development of new capabilities
- Multi-scale modeling
- Verification & Validation
- Programmers and algorithms for effective utilization of massively parallel processors (High Performance Computing)



Issues for National M&S Framework

- Better coordination across all federal agencies
- Improvements to the computing infrastructure to better integrate data and advance computational capabilities
- Sustaining a skilled workforce – analysts and Subject Matter Experts – to support national needs
- Education of (non-technical) decision makers on the benefits and risks of using M&S for decision support



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Back-Up Slides

DHS S&T Points of Contact

Division	Email
George Ryan	George.R.Ryan@dhs.gov
Dr. Charles Hutchings	Charles.Hutchings@dhs.gov