

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

From Science....Security



From Technology....Trust



**Homeland  
Security**

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**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)

## Some Emerging Capabilities

ACTIVITIES	M&S PROJECTS AND PROGRAMS
FEMA	<b>National Exercise Simulation Center</b>
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	<b>Visual Analytics and Physics-based Simulation Program</b>
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
	<b>Integrated Modeling, Mapping and Simulation Program</b>

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



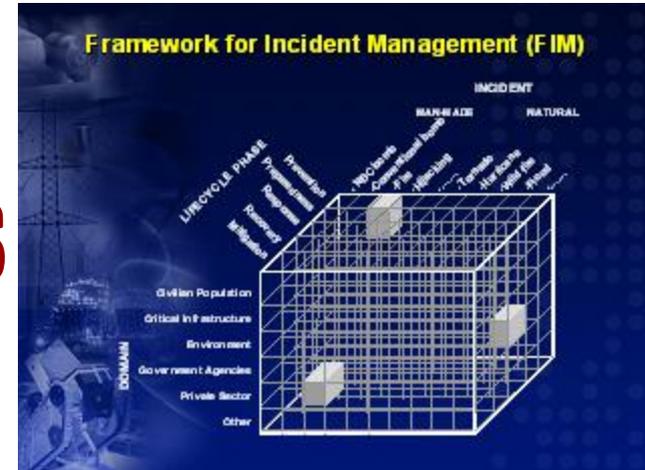
# M&S in Perspective

# Analysis

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

# Data

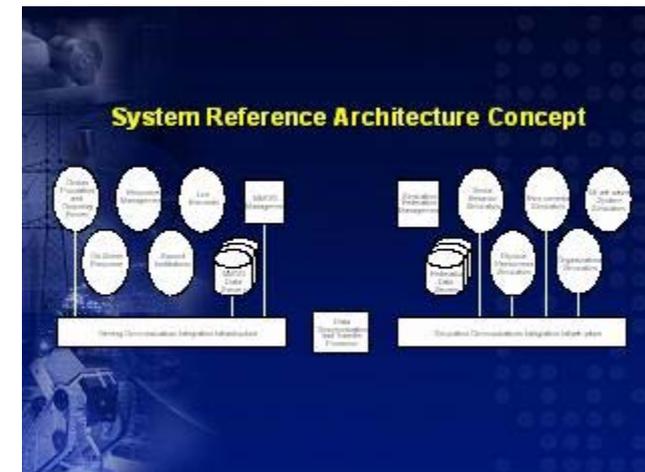
# M&S



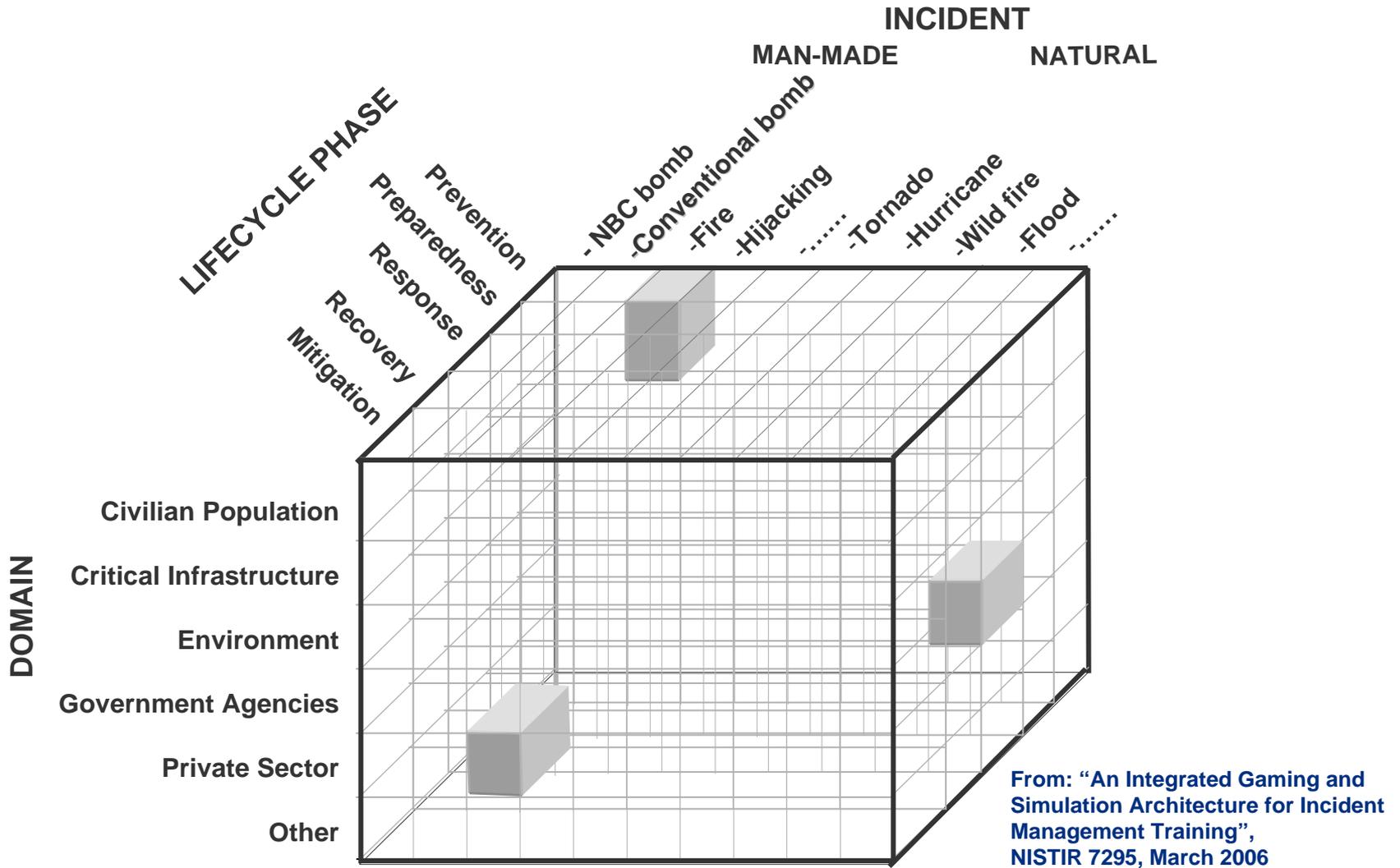
## Framework – Examples of Incident Data



## 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**

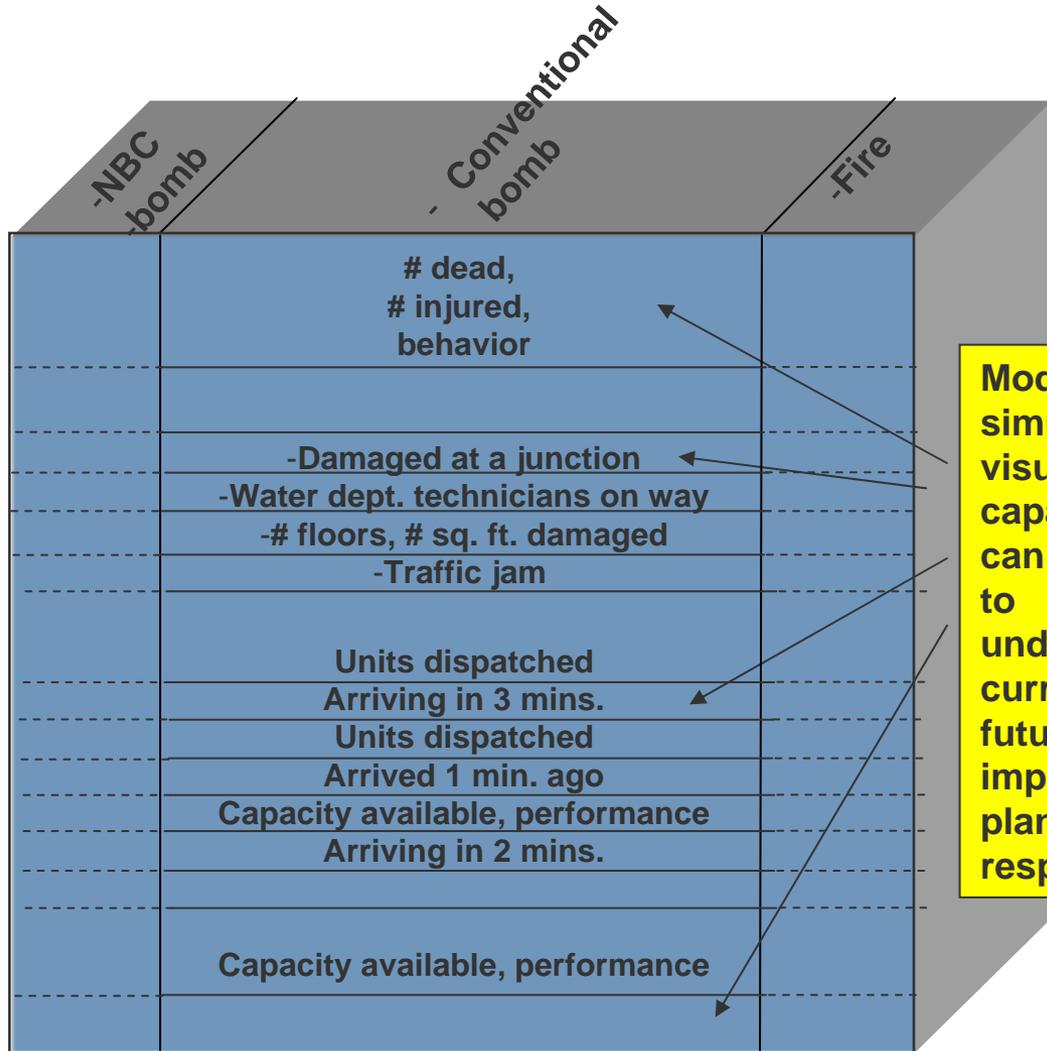
**DOMAIN (& Entities)**

**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  
Security**

# 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 and model interoperability
- Verification & Validation

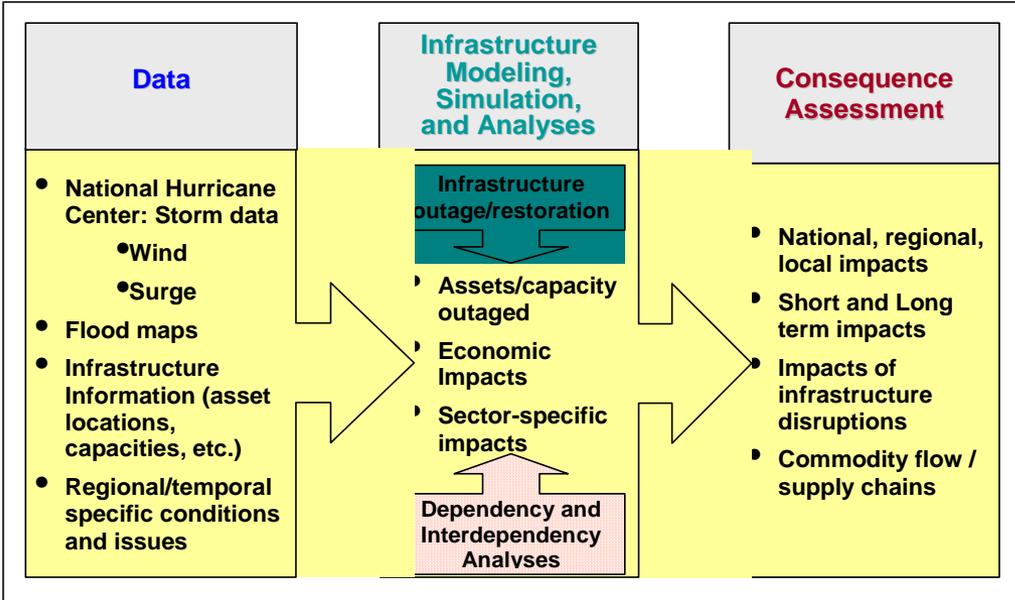




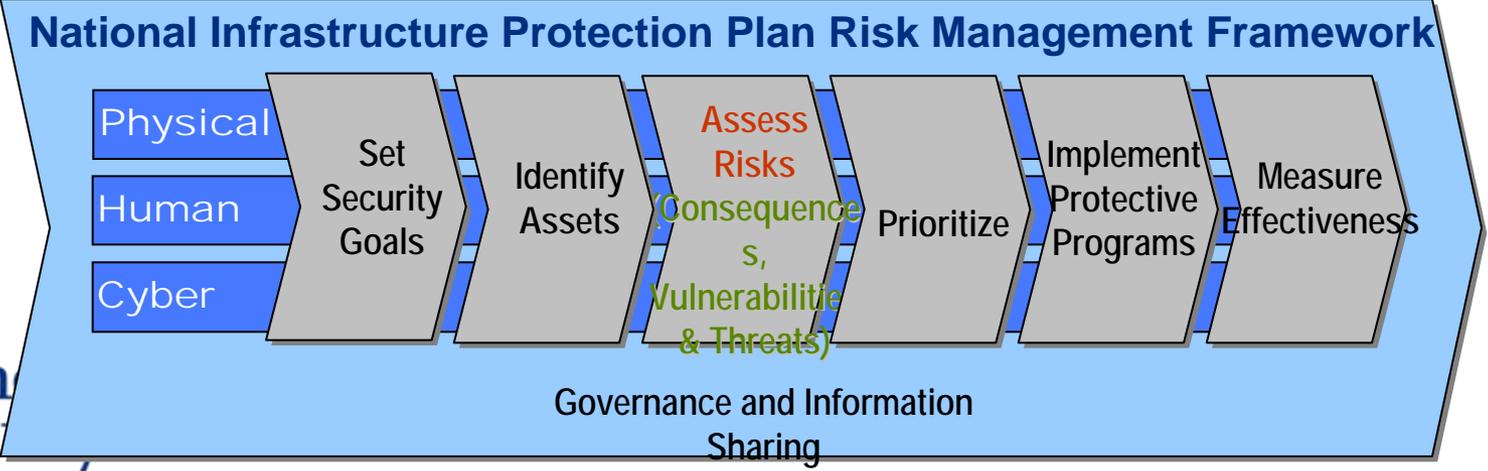
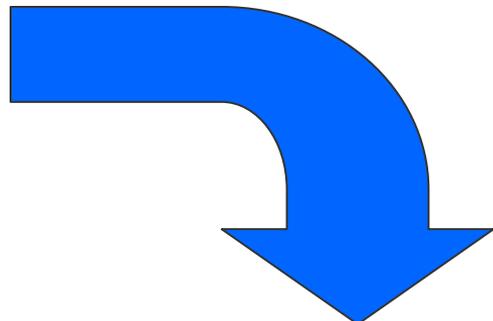
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# Back-Up Slides

# Example: NISAC support of National Infrastructure Protection Plan



NISAC Delivers Infrastructure Analysis



# 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.

