SAND2015-1906PE

SHERPA
Mission Partner Kick-Off

11/4/2014

DHS S&T Program Manager

Chase Garwood

Department of Homeland Security (DHS)
Science & Technology Directorate (S&T)
Resilient Systems Division (RSD)
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Homeland Security
Science and Technology

Meeting Agenda

Time	Agenda Item
8:30 AM	Registration
9:00 AM	Welcome & Introductions
9:15 AM	Review Engagement Mission, Charter, Purpose, Objectives
9:30 AM	Mission Partner Value-Add Propositions: What is in it for me?
10:00 AM	SHERPA Initial R&D Roadmap (demo)
10:45 AM	**BREAK**
11:00 AM	SHERPA Requirements Gathering Process
11:15 AM	Stakeholder SHERPA Requirements Discussion
11:45 AM	Closing Remarks & Next Steps
12:00 PM	**ADJOURN**
1:00 PM	Optional: Tech Deep Dive #1 (room 6-102)
2:00 PM	Optional: Tech Deep Dive #2 (room 6-102)

REVIEW ENGAGEMENT MISSION, CHARTER, PURPOSE, OBJECTIVES

Mission Partner Engagement Objective

Purpose Statement

To contribute to the creation of SHERPA requirements leading to technical solutions that address the planning and response needs of mission partners.

Objectives

- Objective 1: Provide input, evaluate progress, and provide planning and response guidance of SHERPA technical solutions.

- Objective 2: Evaluate the application of SHERPA capabilities to address planning and response stakeholder needs.

Mission Partners

Department of Homeland Security

FEMA

- National Integration Center
- National Preparedness Assessment Division
- National Exercise Division
- National Planning Division
- Response Division
- Regions I - IX

National Protection and Program Directorate

- Office of Cyber & Infrastructure Analysis
- Office of Infrastructure Protection

Office of Health Affairs

- BioWatch

Department of Energy

Office of Electricity Delivery and Energy Reliability

- Infrastructure Security and Energy Restoration (OE-30)

State of California

- California Exercise Simulation Center
- California Office of Emergency Services (Planning & Flood)

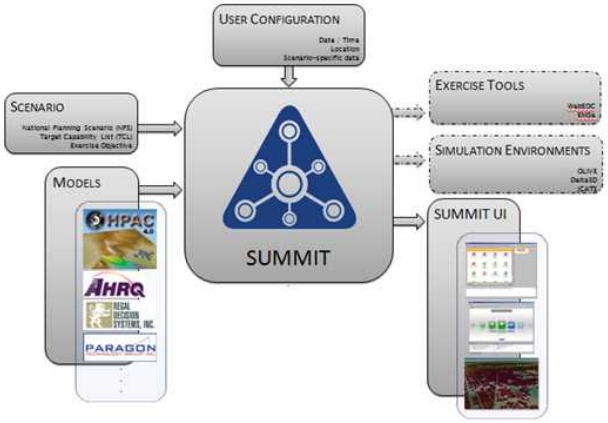
MISSION PARTNER VALUE-ADD PROPOSITIONS:

WHAT IS IN IT FOR ME?

SUMMIT SUPPORTED

EXERCISES

Great Partnership on SUMMIT creation with FEMA/NED

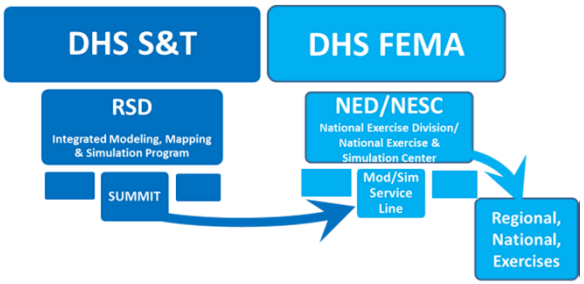


SUMMIT

Platform technology developed for FEMA National Exercise Division to link together "best-in-class" modeling and simulation tools to enable analysts, emergency planners, and incident managers more effectively, economically, and rapidly prepare, analyze, and train during exercises.

SUMMIT Innovation

- Extendable repository of Templates, Slots, and Model Wrappers
- User-supplied description & usage meta data
- Slots categorized by Taxonomy (syntax and semantics)



FEMA NED Transition

Mission Needs Extracted from Application/Pilots

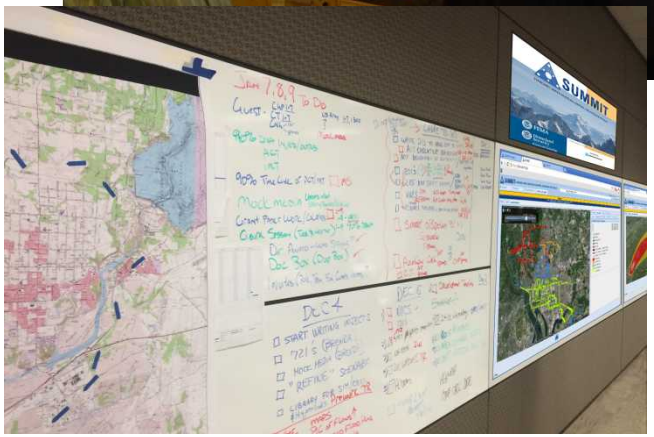
Partner		Core Capability Supported	Mission Needs
FEMA	Regions	• Planning (THIRA) • Long-Term Vulnerability Reduction	• Enables Regions to validate applicant THIRAs and the 94 other disparate areas to calculate science-based effects for a broad range of threat/hazards. • Analyses results across jurisdictions can be aggregated to establish Regional capability targets. • THIRA analyses can be securely stored and accessed for subsequent THIRA, exercise, or response event.
FEMA	NPAD	• Planning • Situational Assessment	• Analyses generated by states/locals/security areas can be reviewed to understand the assumptions, models, and data used in capability target planning of submitted THIRAs.
FEMA	NIC	• Planning • Operational Communications • Transportation Assessment	• Enabling PPD-8 aim for an integrated, all-of-Nation, capabilities-based approach to preparedness [and response]
FEMA	NED	• Planning • All Core Capabilities Based on Exercise	• Enabling PPD-8 aim for an integrated, all-of-Nation, capabilities-based approach to preparedness [and response]
FEMA	NPD	• Planning • All Core Capabilities Based on Objectives	• Enables FEMA HQ and regions to develop robust response plans based on multiple science-based scenarios and assumptions
FEMA	NRCC	• Planning • Risk & Disaster Resilience Assessment	• Allows rapid request for information response during operations. Enables conduct of what-if analyses and decision support, as well as integrate data from operational tools with predictive M&S.
FEMA	MOTF	• Situational Assessment • Operational Communications • On-Scene Security & Protection	• Provides platform technology to enable complex simulation and analysis of a broader range of hazards and threats allowing support of more disaster declarations.
DOE		• Long-Term Vulnerability Reduction • Risk &Disaster Resilience Assessment	• Enables efficient and effective analysis sharing across federal agencies enhancing response.
DHS/NPPD		• Public & Private Services & Resources • All Core Capabilities Based on Objectives	• Provides a scalable ability to perform a rapid, automated, and integrated analysis for the full range of complex, cascading events (man-made or natural disaster) that threaten United States critical infrastructure and key resources.
DHS/OHA		• Public Health & Medical Services • Environmental Response/Health & Safety	• Enables integrated multi-domain (outdoor, indoor, subway) data generation for BioWatch planning, training, and response applications

SHERPA Problem Statement

DHS is not making full, effective use of Modeling and Simulation (M&S) to support Disaster Response Planning and Operations

Project Objective:

Provide USG (FEMA, OHA, NPPD) a **scalable M&S platform** to efficiently produce data for multiple scenarios or archive, share, and reuse any data utilized in plan creation for future planning, comparative analysis or during emergency response operations.



Current Gaps

- **Integration:** currently disparate systems prohibit complex, cascading analysis, sharing, and collaboration
- **Uncertainty:** Planning only done for single scenarios and response does not typically convey uncertainty
- **Reuse:** data from planning not archived and used during response or subsequent planning

Desired Outcome

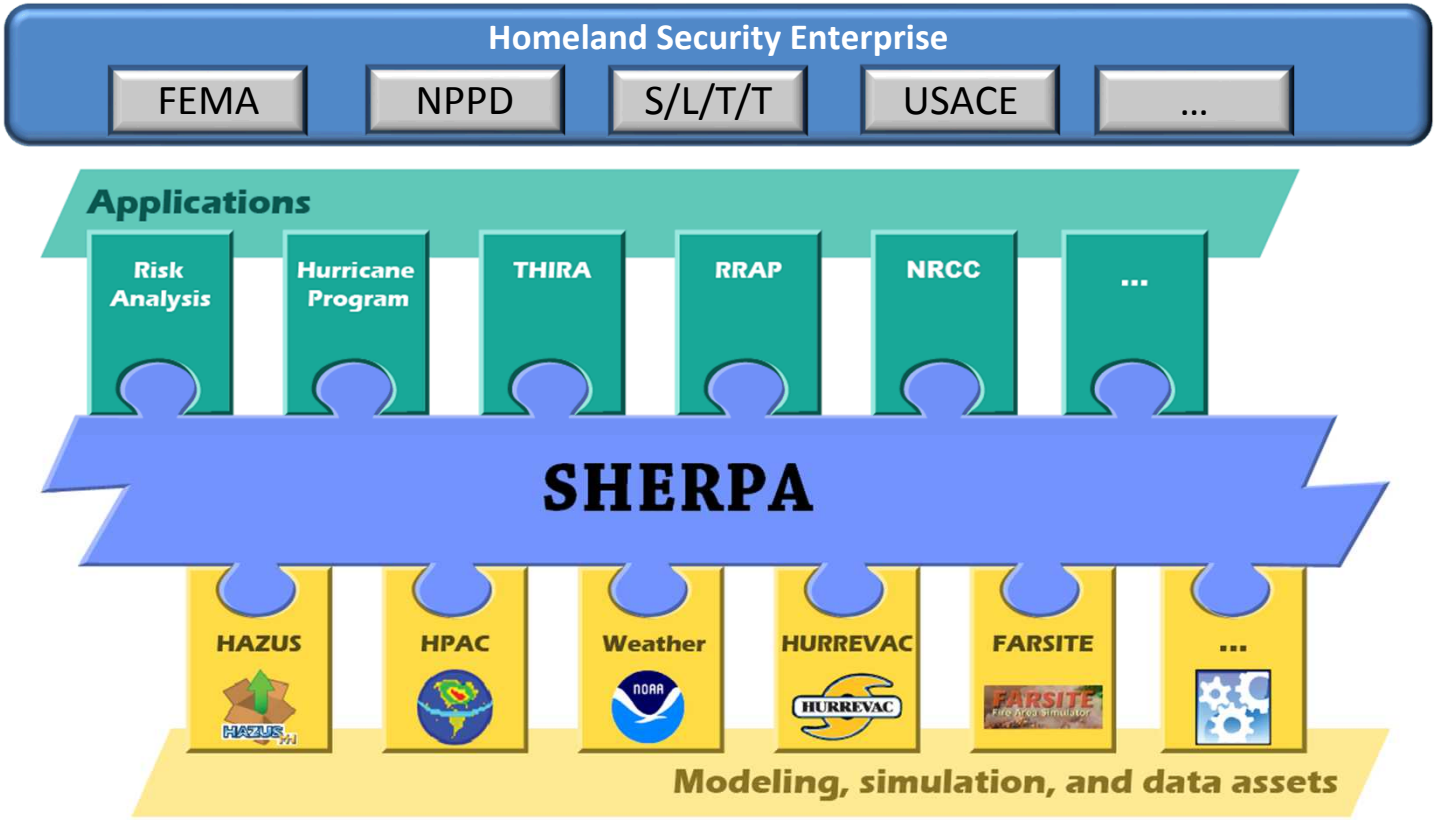
- Enhanced national preparedness (e.g., THIRA) through robust multi-scenario planning capability
- Dramatically shorten the time to respond to disaster requests for information (RFIs)

Value-Add to Mission Partners

Partner	Mission Needs	Value-Add
FEMA – Regions	• Enables Regions to validate applicant THIRAs and the 94 other disparate areas to calculate science-based effects for a broad range of threat/hazards. • Analyses results across jurisdictions can be aggregated to establish Regional capability targets. • THIRA analyses can be securely stored and accessed for subsequent THIRA, exercise, or response event.	SHERPA will make **THIRA applications and national preparedness assessments**: science-based, robust across a range of scenarios, standardized and reusable, and easy to aggregate across regions and the nation
FEMA – NPAD	• Analyses generated by states/locals/security areas can be reviewed to understand the assumptions, models, and data used in capability target planning of submitted THIRAs.	
FEMA – NIC	• Enabling PPD-8 aim for an integrated, all-of-Nation, capabilities-based approach to preparedness [and response]	
FEMA – NED	• Enabling PPD-8 aim for an integrated, all-of-Nation, capabilities-based approach to preparedness [and response]	
FEMA – NPD	• Enables FEMA HQ and regions to develop robust response plans based on multiple science-based scenarios and assumptions	SHERPA will enable for **crisis action planning and response operations:** what-if analyses, live data fusion and analysis, and presentation of uncertainty.
FEMA – NRCC	• Allows rapid request for information response during operations. Enables conduct of what-if analyses and decision support, as well as integrate data from operational tools with predictive M&S.	
FEMA – MOTF	• Provides platform technology to enable complex simulation and analysis of a broader range of hazards and threats allowing support of more disaster declarations.	
DOE	• Enables efficient and effective analysis sharing across federal agencies enhancing response.	
DHS/NPPD	• Provides a scalable ability to perform a rapid, automated, and integrated analysis for the full range of complex, cascading events (man-made or natural disaster) that threaten United States critical infrastructure and key resources.	
DHS/OHA	• Enables integrated multi-domain (outdoor, indoor, subway) data generation for BioWatch planning, training, and response applications	

Model-Sim-Situational Awareness Platform

Enabler for Homeland Security Enterprise



Enabling PPD-8 aim for an integrated, all-of-Nation, capabilities-based approach to preparedness [and response]

R&D Roadmap

1. *Rapid generation of impact libraries under variable inputs*
2. *Scalable, big-data storage and analytics for planning factors*
3. *Ingesting and fusing live-data for predictive simulation during response*
4. *Visualization and communication of results for planning and decision making under uncertainty*

R&D and Value Mapping for SHERPA

	Planning Focus			Response Focus		
	SHERPA Capability →					
	Batch	**Large-scale Model Run Library Creation**	**Model Library Analytics**	**Live Data Fusion**	**Operational Data Analytics**	**Visualization and Uncertainty**
R&D Capability	Capability to run hundreds of scenarios automatically by specifying a range of input parameters	Archive library of batch runs that can be queried using the basic informatics described below	Ability to search library of batched results for parameter values *(e.g., max/min)*	Capability to incorporate real-time data feeds from other tools or sources that are important for response operations. For example, the use of live data for the configuration of models *(e.g. inverse plume modeling based on environmental sensor data feeds).*	Capability to perform analyses/data manipulation of real-time operational data to support decision-making. Analytics performed on results to provide an initial testable hypothesis of incident scope, scale, impact and resource needs or other decision support via what-if analysis.	Human factor-informed data representation for intuitive interpretation of data and data uncertainty for use by a variety of client types including mobile computing platforms.
Mission Partner Value Add Example	For THIRA and national planning, can determine effects and identify targets across a representative set of scenarios, and prepare for worst-case and/or likely-case scenarios. *(e.g., can deliberately decide to plan for likely-case scenarios, not just worst-case)*			For USG response in a developing event, can do what-if analyses to inform response decisions *(e.g., prioritize where to send federal resources).* Can show uncertainty in analysis results, so that response operations can be adjusted to account for uncertainty *(e.g., evacuation will take 10 hours plus/minus 5 hours, so start evacuation at 6 a.m. in case it takes 15 hours)*		

SHERPA INITIAL R&D ROADMAP

BATCH: *capability creates rich scenario datasets for analyses, stored in Model Run Libraries*

1 scenario with 1 set of inputs

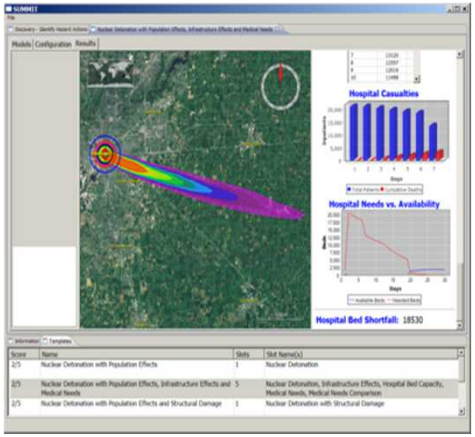
- 1 bio-release location
- Winds W 15mph
- Static population (e.g., home)

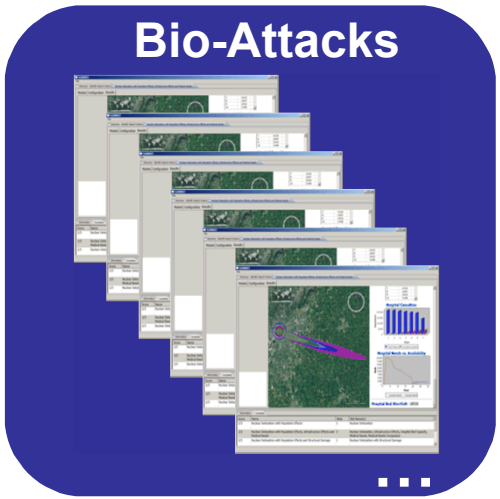
1000s of scenarios with varying inputs:

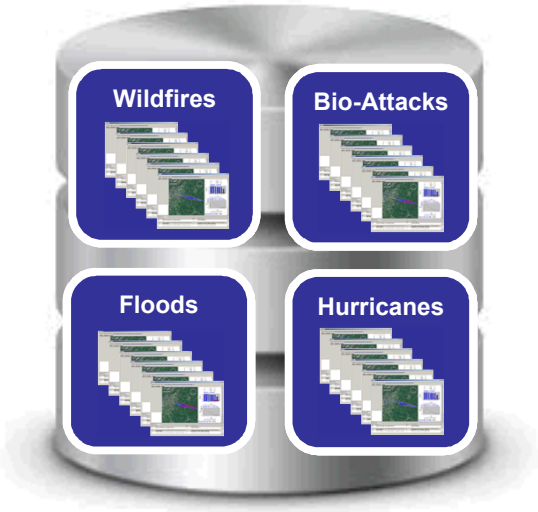
- Multiple release locations
- Varying weather conditions by time of year
- Population distributions for home and work

SHERPA Model Run Libraries

- Multiple hazards libraries



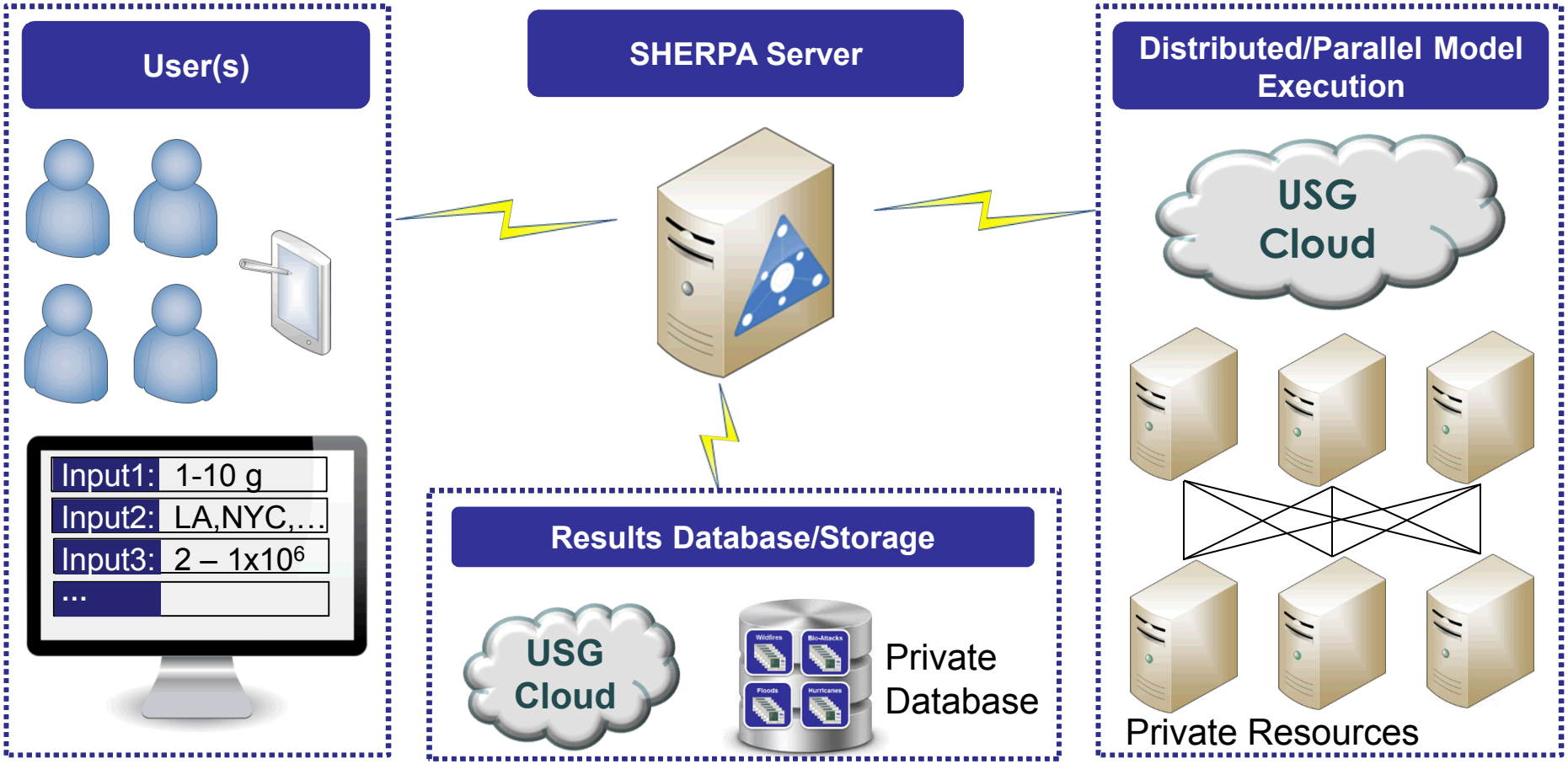




Can use libraries of scenario runs <u>to guide and validate plans</u>:

- What set of scenarios should the plan should cover?
- Do the response plans address possible scenarios? Worst-case scenarios? Most likely scenarios?

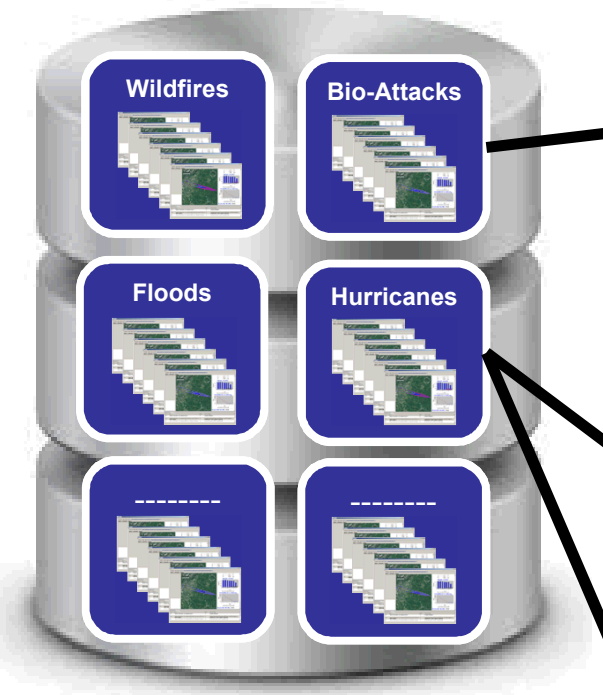
LIBRARY CREATION: *distributed parallel execution of simulations rapidly creates and stores libraries*



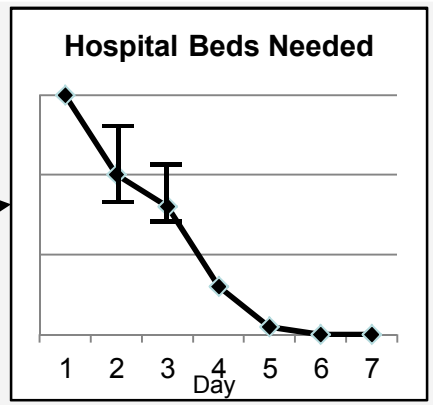
During planning or incident, rapidly create libraries by leveraging existing USG infrastructure to produce outputs and reduce analysis time to inform crisis planning and response operations

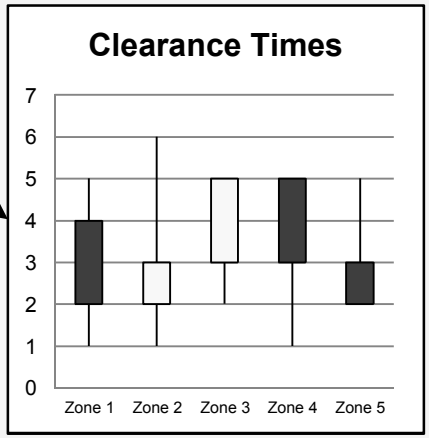
DATA ANALYTICS: *Analytics on model run libraries enable robust, risk-informed planning and response*

SHERPA Model Run Libraries



SHERPA Analytics





3rd Party Analytics

For PLANNING
Query bio-attack library for all scenarios in planning region.

Use medical surge requirements output data to calculate THIRA request for medical surge capacity.

Deliberately plan for the worst, most likely, or other cases.

For RESPONSE Operations
Query hurricane library for scenarios with similar hurricane track and category.

Time the evacuation order based on a statistical calculation of clearance times for conditions at hand.

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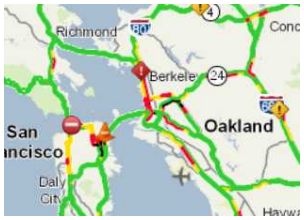
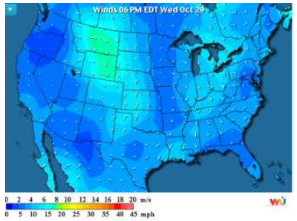
LIVE DATA: *Ingest live data to configure models and perform more tailored analysis and RFI support*

Data Feeds



Live traffic feeds



Weather

FEMA GeoPlatform

The National Shelter System

Shelter Information Management

HAVBED

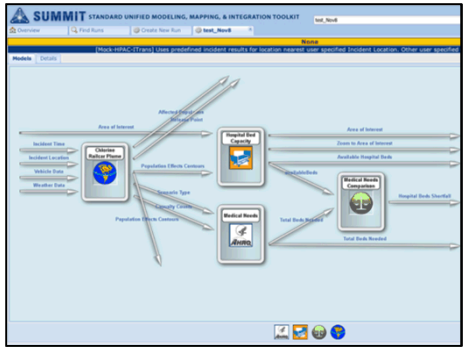
HavBED

Fuel

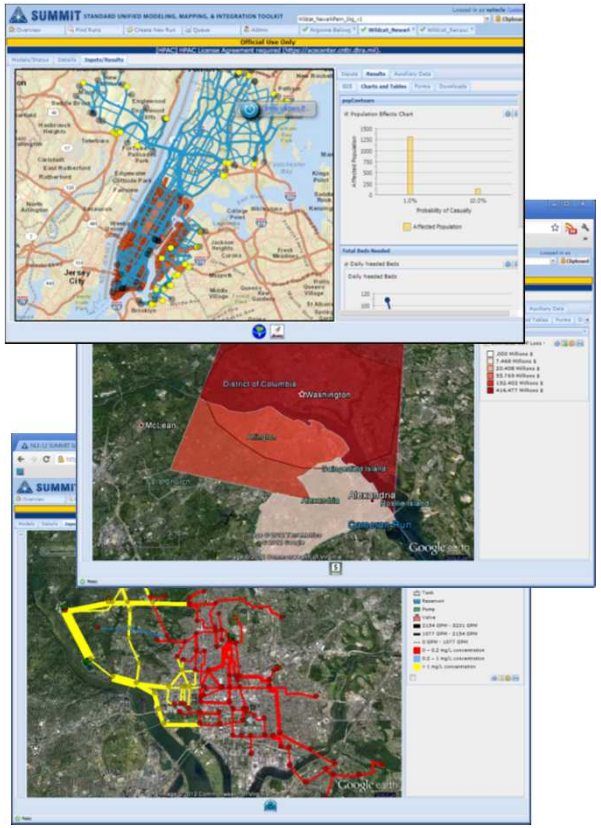
GasBuddy.com

...

SHERPA Template

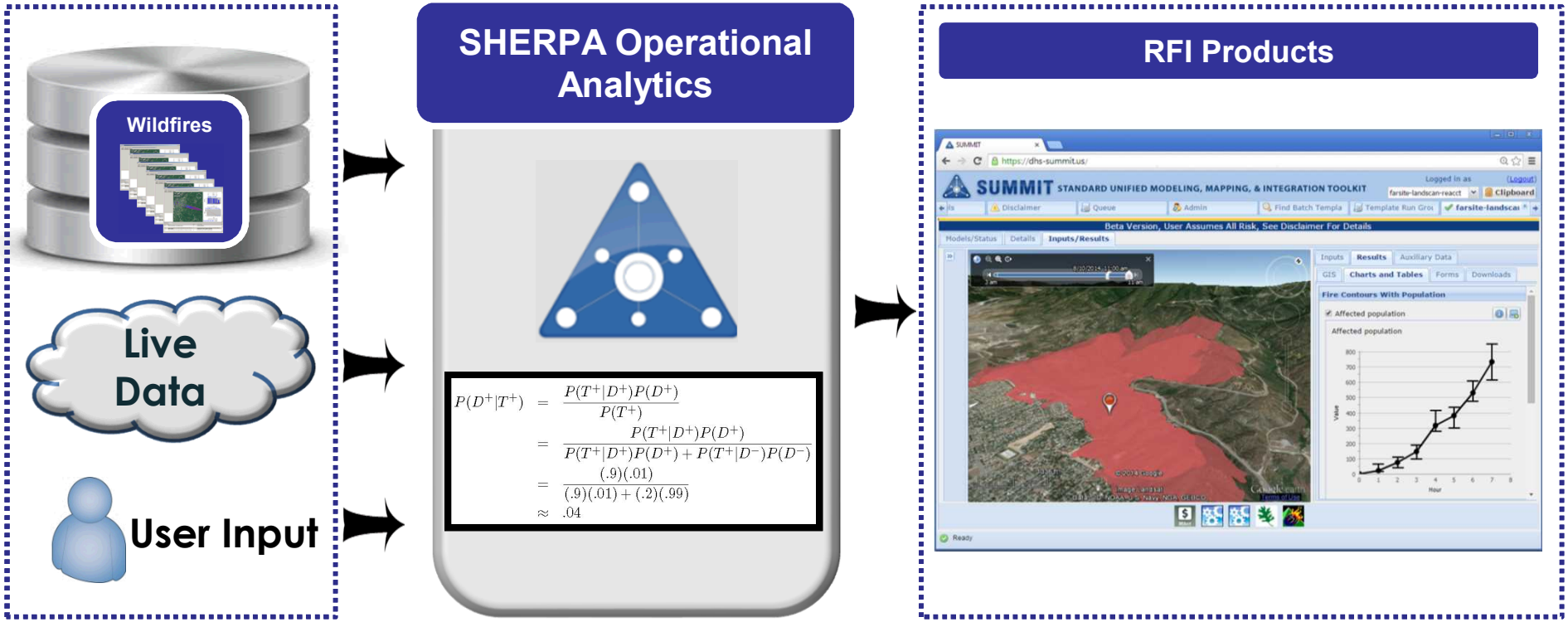


RFI Products



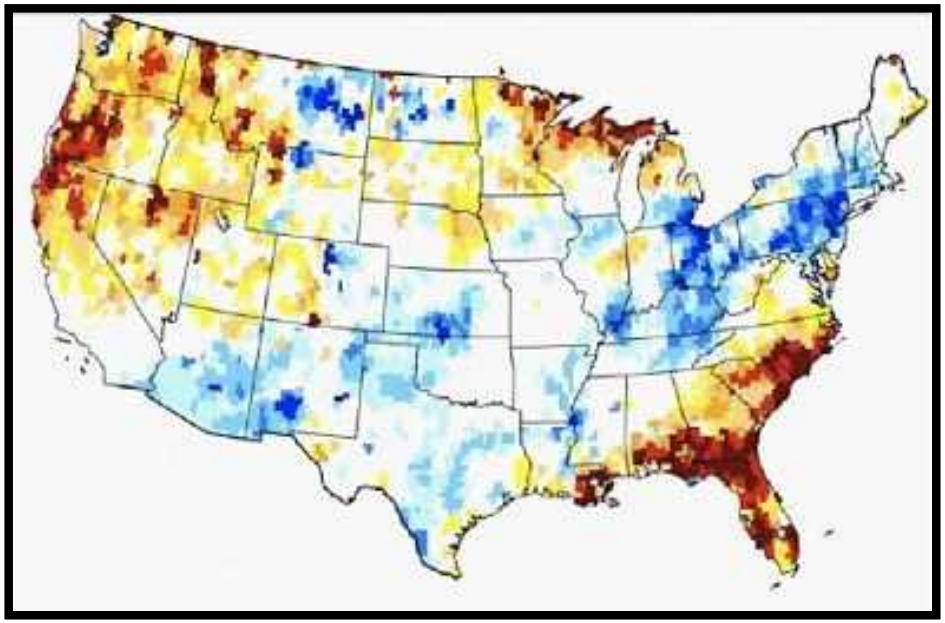
During an event, as live data becomes available, they are automatically input into scenario runs, to refine outputs with best-available information for crisis planning and response operations

OPERATIONAL ANALYTICS: *Fusion of live data with model run libraries supports rapid, real-time response and planning*



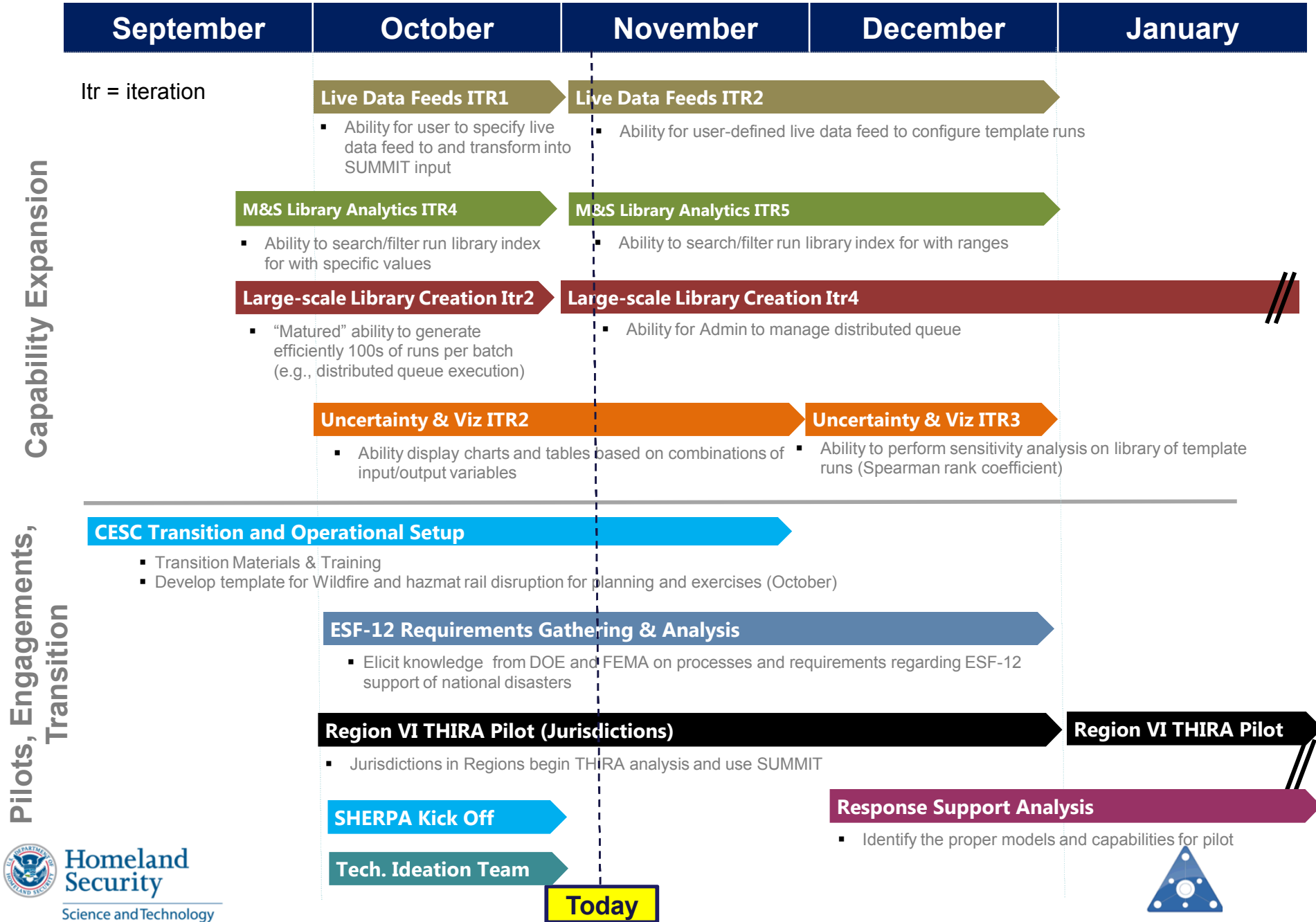
Modeling and simulation libraries fused with live data in seconds during emergency planning can be utilized during response operations to guide plan executions and questions such as "How bad could this get?" and "What are we prepared to handle?"

VISUALIZATION AND UNCERTAINTY: Convey variability and uncertainty of data to enable risk-informed decision making



Visualization will enable the user to intuitively interpret complex interdependencies and data uncertainty to obtain situational awareness and support decision making during planning and early hours of response where information is sparse and uncertainty is highest.

Snapshot: SHERPA Project Roadmap (FY15 Q1)



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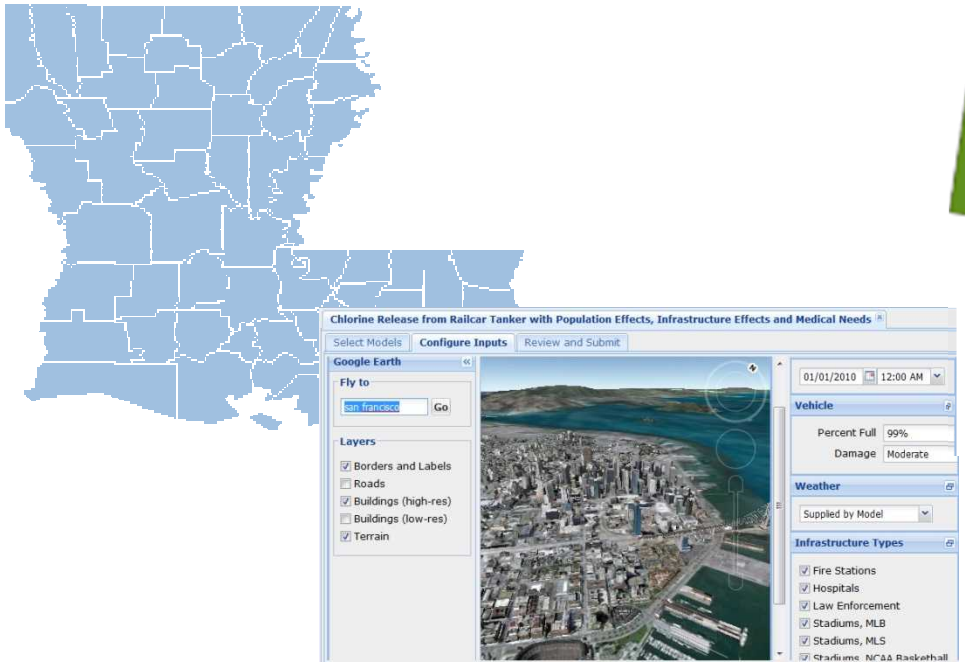
SHERPA THIRA Pilot Support

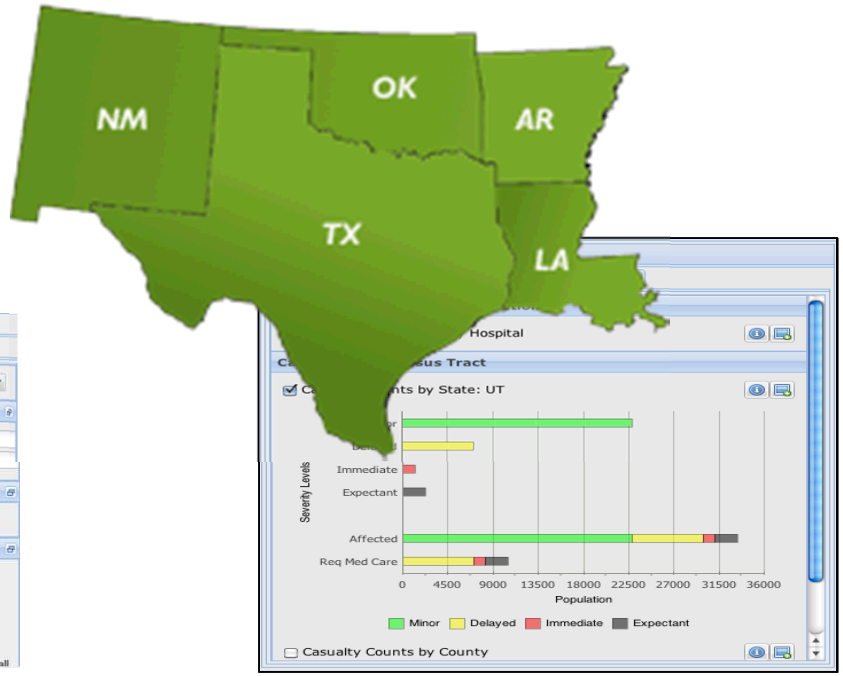
Louisiana GOHSEP

- Supporting 2014 THIRA planning
- Using SHERPA to support consequence assessments for threat/hazard scenarios



FEMA Region VI

- Supporting 2014-15 THIRA results vetting
- Training for use in year-round preparedness activities.



SHERPA REQUIREMENTS GATHERING PROCESS

Mission Needs

Partner	Core Capability Supported	Mission Needs
FEMA – Regions	• Planning (THIRA) • Long-Term Vulnerability Reduction	• Enables Regions to validate applicant THIRAs and the 94 other disparate areas to calculate science-based effects for a broad range of threat/hazards. • Analyses results across jurisdictions can be aggregated to establish Regional capability targets. • THIRA analyses can be securely stored and accessed for subsequent THIRA, exercise, or response event.
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DHS/OHA	• Public Health & Medical Services • Environmental Response/Health & Safety	• Enables integrated multi-domain (outdoor, indoor, subway) data generation for BioWatch planning, training, and response applications

Discussion *(Refer to Handout)*

- What additional modeling capability is needed to address gaps/needs for you *(given the Mission Needs presented on the handout)*?

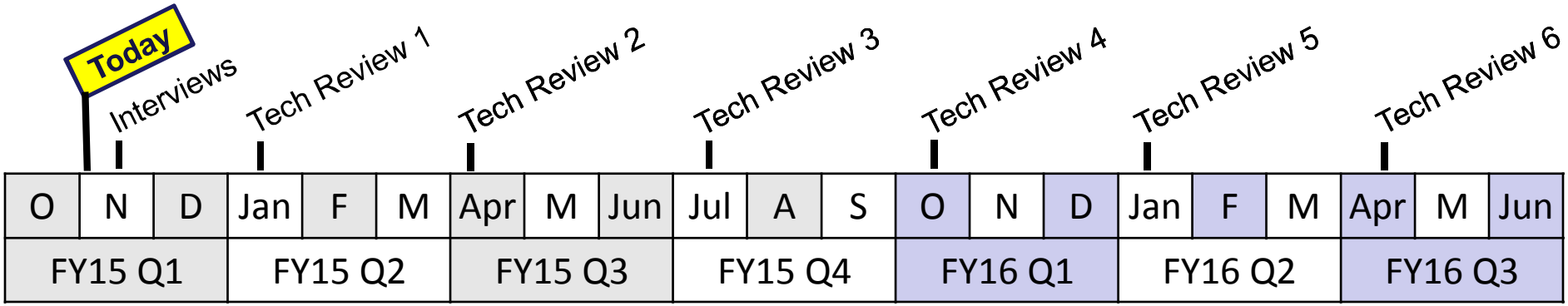
- What SHERPA operational attributes *(i.e. requirements)* are needed to enhance preparedness and response capabilities? *(e.g.: Real-time data feeds, customized report generator)*

- If your organization wanted to deploy SHERPA, what are the top 5 hurdles *(e.g. server deployment)?*

CLOSING REMARKS & NEXT STEPS

What do we need from you?

- **Ideation Team Commitment**
  - Initial phone interview
    - *~1 hour*
  - Quarterly in-person meetings
    - *~ 6 meetings*
    - *Review/evaluate capabilities and guide development*
  - Optional: Pilot activities to evaluate capabilities



ADDITIONAL SLIDES

Presidential Policy Directive / PPD-8: National Preparedness

- Signed by President Obama on March 30, 2011. Evolved from and superseded Homeland Security Presidential Directive 8 released under President George W. Bush.

THE WHITE HOUSE
WASHINGTON
March 30, 2011

PRESIDENTIAL POLICY DIRECTIVE/PPD-8

SUBJECT: National Preparedness

This directive is aimed at strengthening the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyber attacks, pandemics, and catastrophic natural disasters. Our national preparedness is the shared responsibility of all levels of government, the private and nonprofit sectors, and individual citizens. Everyone can contribute to safeguarding the Nation from harm. As such, while this directive is intended to galvanize action by the Federal Government, it is also aimed at facilitating an integrated, all-of-Nation, capabilities-based approach to preparedness.

Therefore, I hereby direct the development of a national preparedness goal that identifies the core capabilities necessary for preparedness and a national preparedness system to guide activities that will enable the Nation to achieve the goal. The system will allow the Nation to track the progress of our ability to build and improve the capabilities necessary to prevent, protect against, mitigate the effects of, respond to, and recover from those threats that pose the greatest risk to the security of the Nation.

The Assistant to the President for Homeland Security and Counterterrorism shall coordinate the interagency development of an implementation plan for completing the national preparedness goal and national preparedness system. The implementation plan shall be submitted to me within 60 days from the date of this directive, and shall assign departmental responsibilities and delivery timelines for the development of the national planning frameworks and associated interagency operational plans described below.

National Preparedness Goal

Within 180 days from the date of this directive, the Secretary of Homeland Security shall develop and submit the national preparedness goal to me, through the Assistant to the President

- Calls on federal departments and agencies to **work with the whole community** to develop a national preparedness goal and a series of frameworks and plans related to reaching the goal.

- ... **an integrated**, all-of-Nation, **capabilities-based approach** to preparedness [and response]

SHERPA Project Roadmap (FY14 Q4)

	June	July	August	September	October
Architecture Capability Expansion	**Batch Itr1** ▪ Ability to generate multiple runs	**Batch Itr2** ▪ Ability to view simple batch analysis ▪ Data set generation	**Batch Itr3** ▪ Ability for the user via a GUI specify ranges and linear distributions	**Batch Itr4** ▪ Ability for the user via a GUI specify ranges and distributions of input parameters and SUMMIT selects parameters to run (e.g., latin hypercube/monte carlo sampling)	
	Itr = iteration	**M&S Library Analytics ITR1** ▪ Ability to create index run library (e.g. summary table) to searchable tables of parameters and characteristics (e.g., run ID, input parameters, out parameters)	**M&S Library Analytics ITR2** ▪ Ability to use GUI to view library index for a group of runs	**Uncertainty & Viz ITR1** ▪ Ability to calculate and create statistical analysis table on user defined run index library	
				Large-scale Library Creation Itr1 ▪ "Prototype" ability to generate efficiently 100s of runs per batch (e.g., distributed queue execution)	
				M&S Library Analytics ITR3 ▪ Ability to use GUI to mix and match batch runs to create new run library index	
			Code Hardening		
		Model Wrapping ▪ 1) United Nations IED 2) US Census Geoserver model, 3) DHS trucking/pallet 4) Imperial College Asteroid, 5) NOAA HYSPLIT 6) LLNL HotSPOT 7) FARSITE wildfire 8) LandScan Population Data			
Pilots, Engagements, Transition		**CESC Transition and Operational Setup** ▪ Identify the proper models and capabilities for pilot (July) ▪ Develop a formal agreement for transition of SUMMIT to the CESC ▪ Transition Materials & Training (September) ▪ Develop template for wildfire and hazmat rail disruption for planning and exercises (October) ▪ Deploy SUMMIT software			
				Establish Technology Ideation Team ▪ Engage FEMA Region VI, ▪ Elicit knowledge on M&S gaps ▪ Scope pilot support of R6	
					Region VI THIRA Pilot
					SHERPA Kick Off

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SHERPA Project Roadmap (FY15 Q2)

December	January	February	March	April

M&S Library Analytics ITR6
- Ability to search template runs for specifics values (e.g., specific XML datatype values - complex XML)

Large-scale Library Creation Itr4
- Ability for Admin to manage distributed queue

Large-scale Library Creation Itr5
- Ability to efficiently store 1000's of runs

Uncertainty & Viz ITR4
- Ability to display sensitivity analysis visualizations on library of template runs (Spearman rank coefficient)

Uncertainty & Viz ITR5
- Ability to calculate Cumulative Distribution Functions of selected outputs across a wide variety of datatypes

Operational Data Analytics ITR1
- Ability to weigh individual scenario likelihoods based on non-GUI user defined operators/values (Bayesian Inference)

Oper. Data Analytics ITR2
- Ability to weigh individual scenario likelihoods based on GUI input user defined operators/values (Bayesian Inference)

Live Data Feeds ITR3
- Ability to poll live data feeds for input and automatically configure and launch template run

Live Data Feeds ITR4
- Create UI to allow users to configure live data feed polling

GeoPlatform ITR1
- Ability to create operators for transforming SUMMIT data to a format appropriate for posting on GeoPlatform

Capability Expansion

CESC Software Deployment
- Deploy SUMMIT software on CESC computers

Region VI THIRA Pilot (FEMA Region)
- Regions begin their THIRA and evaluate jurisdictions applications using SUMMIT/SHERPA

Response Engagement
- Demo or pilot planning with response stakeholder

Pilots, Engagements, Transition

Itr = iteration

Homeland Security
Science and Technology

SHERPA Project Roadmap (FY15 Q3)

March	April	May	June	July

Capability Expansion

M&S Library Analytics ITR7

- Ability to search template runs for range values (e.g., polygon overlap in Montana)

Uncertainty & Viz ITR6

- Ability to visualize Cumulative Distribution Functions of selected outputs with user defined probability thresholds across a wide variety of datatypes

Uncertainty & Viz ITR7

- Ability to specify uncertainty of model wrapper and to calculate aggregate template run uncertainty

Operational Data Analytics ITR3

- Ability to transform live data feed into operator/value

GeoPlatform ITR1

- Ability to create operators for transforming SUMMIT data to a format appropriate for posting on GeoPlatform

GeoPlatform ITR2

- Ability for user to push SUMMIT data to GeoPlatform

Operational Data Analytics ITR4

- Ability to use live data feeds to automatically weight individual scenario likelihoods (i.e., target live data to specific template run groups)

Large-scale Library Creation Itr6

- Ability to efficiently store 10^6 runs

Large-scale Library Itr3

- Robust ability to generate efficiently 100s of runs per batch (e.g., distributed queue execution)

Pilots, Engagements, Transition

FEMA Technical Assistance

- FEMA evaluates THIRA applications and lessons learned from SUMMIT deployment

Itr = iteration

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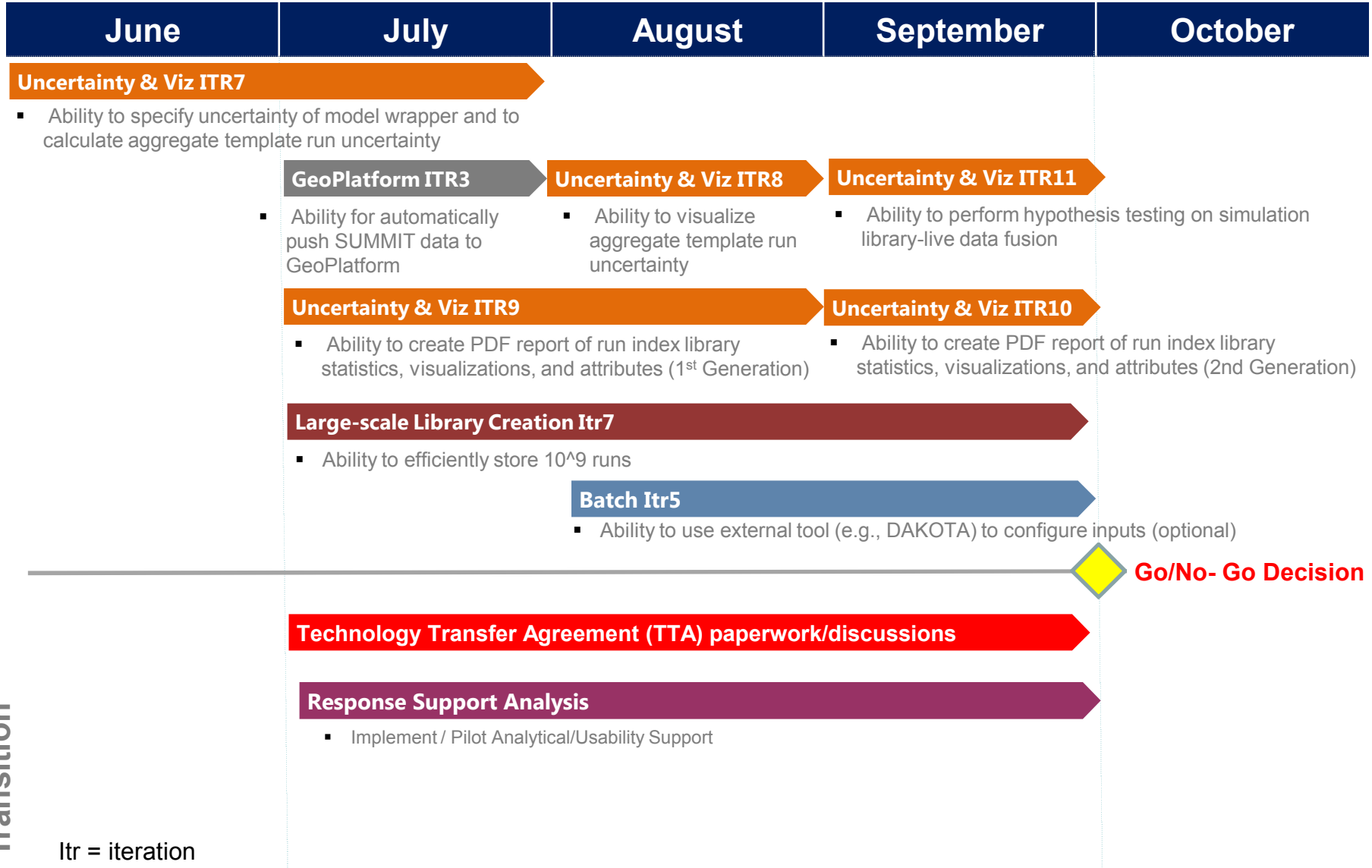
SHERPA Project Roadmap (FY15 Q4)



Itr = iteration

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