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National Infrastructure Simulation and Analysis Center (NISAC) Overview

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NISAC History & Mission

- The National Infrastructure Simulation and Analysis Center (NISAC) is
  - A program of the DHS Office of Cyber Infrastructure Analysis (OCIA)
  - Established under The USA PATRIOT Act of 2001
  - A collaboration between national laboratories
    - Sandia National Laboratories
    - Los Alamos National Laboratory
    - Pacific Northwest Laboratory (added in 2015)
  - The work of 40 – 50 researchers

Sandia National Laboratories

Los Alamos

NISAC Modeling and Analysis Goals

Provide fundamentally new modeling and simulation capabilities for the analysis of critical infrastructures, their interdependencies, vulnerabilities, and complexities

Aiding decision makers with

- *policy assessment,*
- *mitigation planning,*
- *education & training,*
- *near real-time assistance to crisis response organizations*

Program Capabilities

- Interdependencies and System Modeling

  Interdependencies and system modeling capabilities provide the foundation for all products including asset prioritization, natural disaster planning and other impact analyses.

- Economic and Human Consequences

  A mixture of proprietary commercial software and in-house modeling and simulation capability to provide first-in-class estimates of population and economic impacts.

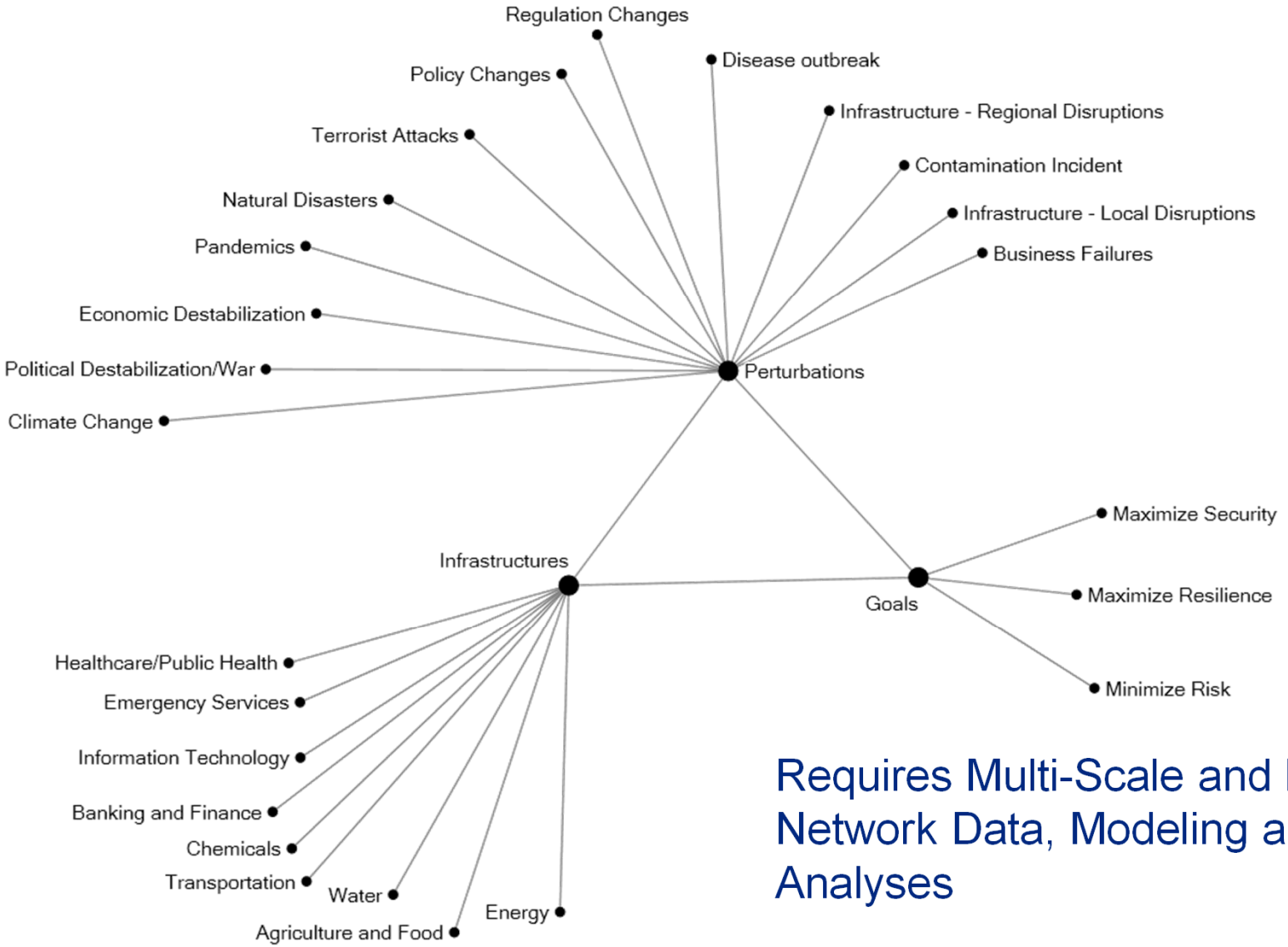
- Asset and Facility Operations Modeling

  Representation of likely infrastructure operator responses to external events and the operational impacts of those responses.

- Fast Integrated Hazards Analysis / Integrating Architecture

  A common integrated simulation environment provides consistent consequence estimates across event analyses and to expand event scenarios to multiple cascading events.

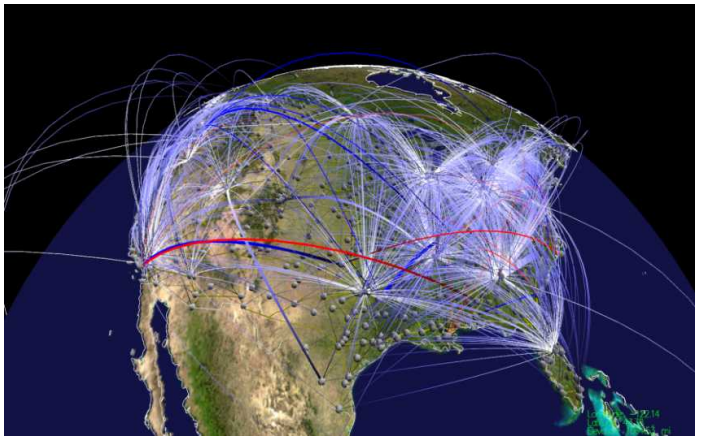
Long-term Applied Research Goal:
Understand Infrastructure Risks and Engineer Solutions



Requires Multi-Scale and Multi-Network Data, Modeling and Analyses

Why We Model

- **The domains in which we work are:**
  - Large
  - Complex
  - Dynamic
  - Adaptive
  - Nonlinear
  - Behavioral



Agent-based supply chain disruption model

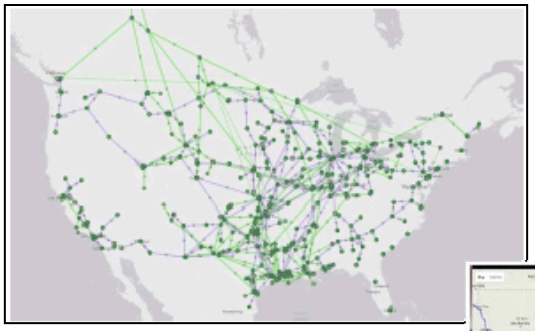
- **Too complex for mental models to be effective decision tools**
- **Identify when/where things break, and any cascading effects**
- **Quantifying consequences of disruptions in very complex systems**
  - Acute: Sudden but temporary loss of a assets or function due to attack, accidents or natural disasters
  - Chronic: Gradual change in condition (environment, infrastructure supply or demand for infrastructure services) due to changing stresses, population dynamics, innovations, aging infrastructure

Model to gain insight – experiment with the model not the system

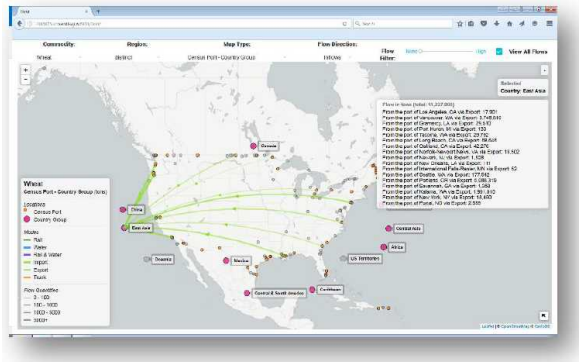
Deployed Data Visualization, Analysis and Modeling Capabilities

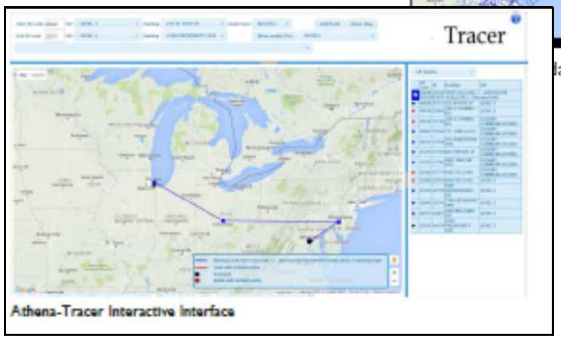
DHS Resources

FASTMap (Dependencies)
FASTMap 2015
NetFlow Dynamics (NFD)
MS River Commodity Explorer (MSCX)
Athena Internet Model Visualizer
Multimodal Transport



ata for selected river segment (simulated).



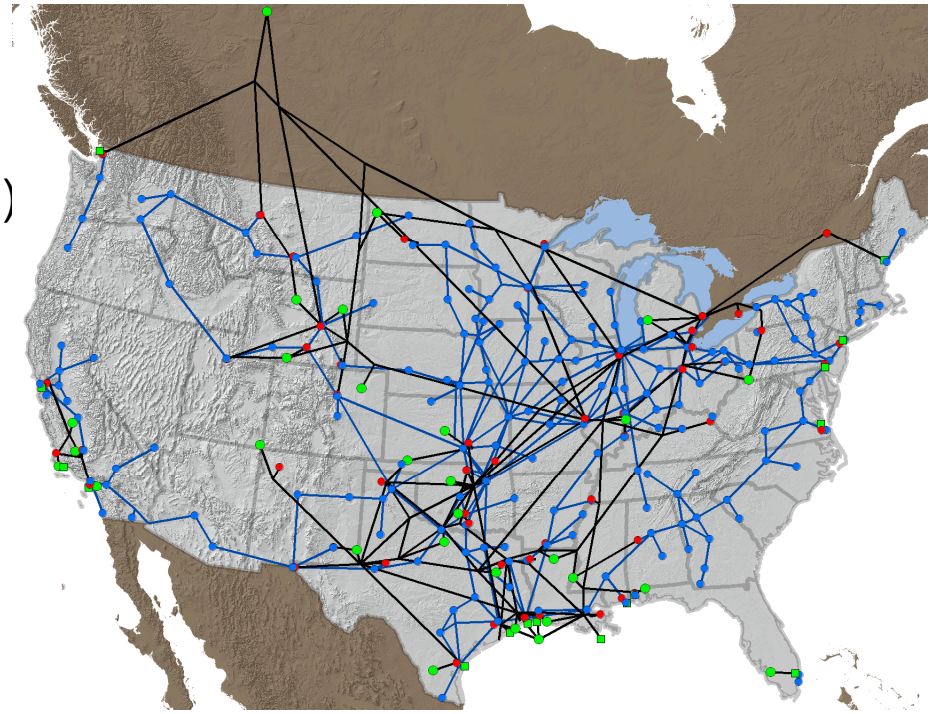


Athena-Tracer Interactive Interface

NISAC Landing Page: https://dhs-nisac.sandia.gov/

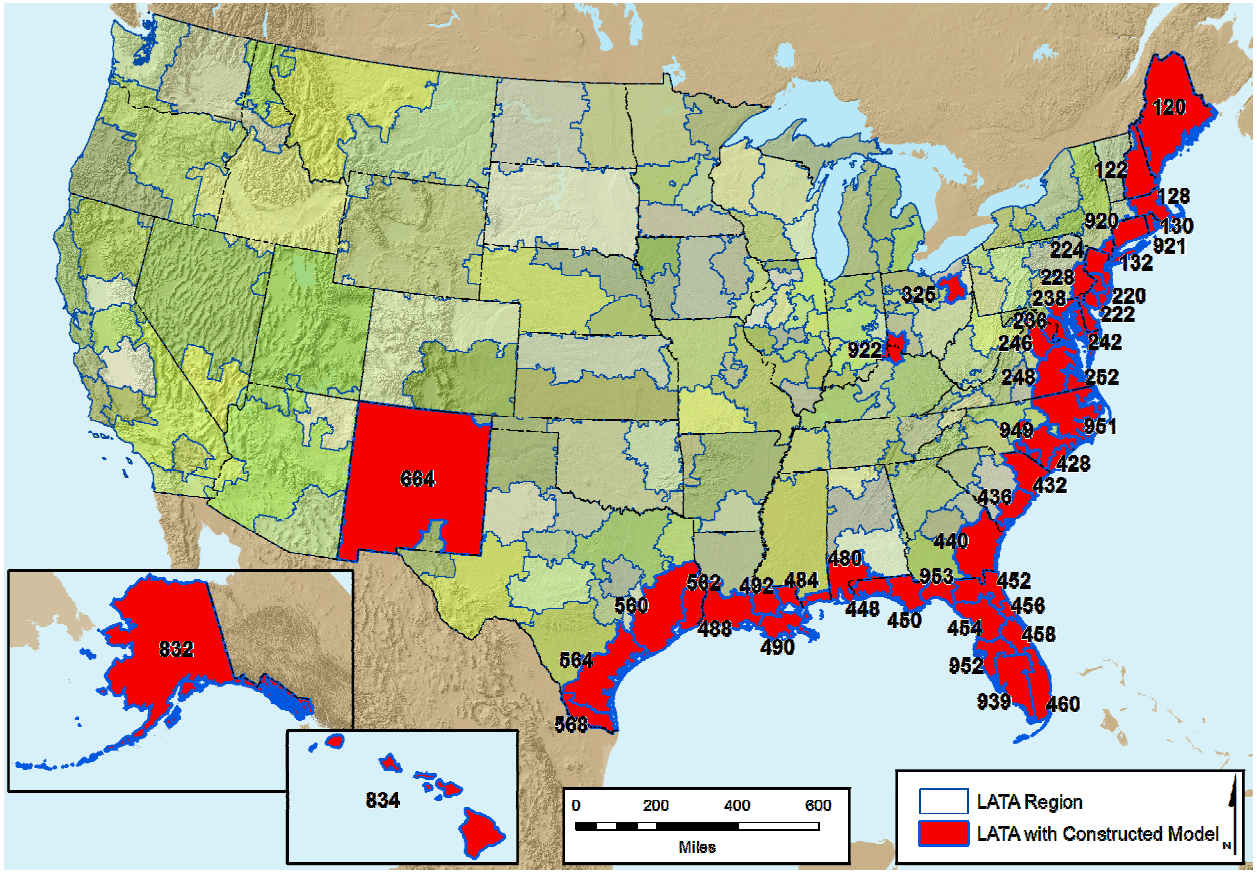
Energy – Petroleum Fuels: Crude Oil and Refined Products Interacting Networks

- Goals:
  - understanding risks of specific incidents (hurricanes, earthquakes, equipment failures)
  - identifying effective risk mitigations
- Approach:
  - incident and scenario-based analyses
  - national network flow dynamics model



For references and contact information see:
http://www.sandia.gov/nisac

Voice Model (Developed LATA Models)



FASTMap History:
Rapid Analysis and Situational Awareness

- FASTMap was developed in support of crisis action response efforts of the National Infrastructure Simulation and Analysis Center (NISAC) for the Department of Homeland Security
- Driven by:
  - The need to respond more quickly (hurricane analysis went from a 3 day to a 12 hour turnaround)
  - The need for fast production of maps, graphics, and statistics for decision makers
  - The need to free analyst time from routine data processing tasks
  - An increased number of areas of concern for the customer
- Uses:
  - Provides situational awareness for key infrastructures
  - Serves as a platform for visualizing model results
- Access:
  - Used in multiple environments by DHS and other customers
- Enhancement:
  - FASTMap is being enhanced to allow direct incorporation of models

FASTMap is used in multiple environments by DHS and others

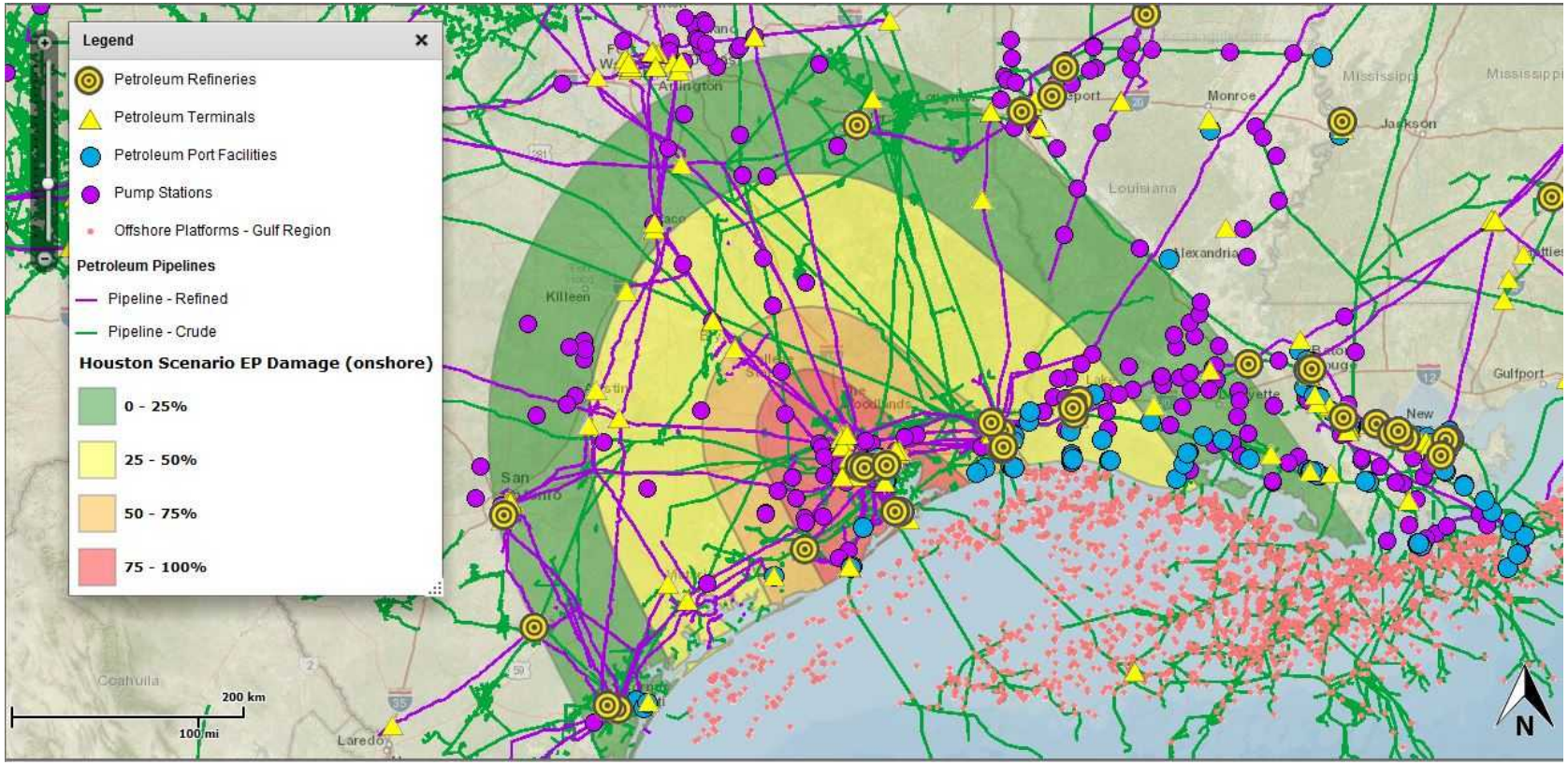
- Unclassified Access: FASTMap is accessible on the web with a Sandia CryptoCard; planned for cloud deployment
- Crisis response: Our DHS customer (DHS/OCIA) uses FASTMap for infrastructure maps and statistics as part of their crisis action response
- Data: Infrastructure data for that instantiation is from HSIP Gold and other Sandia-purchased data sources
- Classified access: FASTMap is also available on the web over JWICS with MIDB data

FASTMap is being enhanced to allow for direct incorporation of models

- DHS is currently funding the incorporation of the Regional Economic Accounting (REAcct) economics model into FASTMap and the automated generation of telecommunications outage contours
- Models can write to a space that FASTMap can read in a format it can display
- Can allow models to interact without major rework or changes in user interface
- Allows analysts and algorithms to work in the environment best suited for the problem

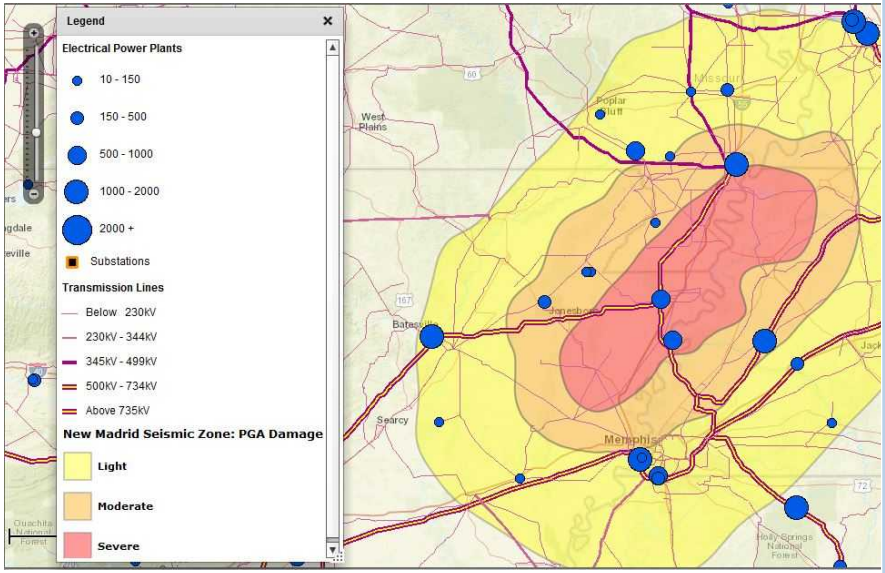
FASTMap is used to address many situational awareness questions

- "What's in and around the impact region for infrastructure(s) I care about?"



FASTMap is used to address many situational awareness questions

- "What are important statistics relative to those infrastructures?"



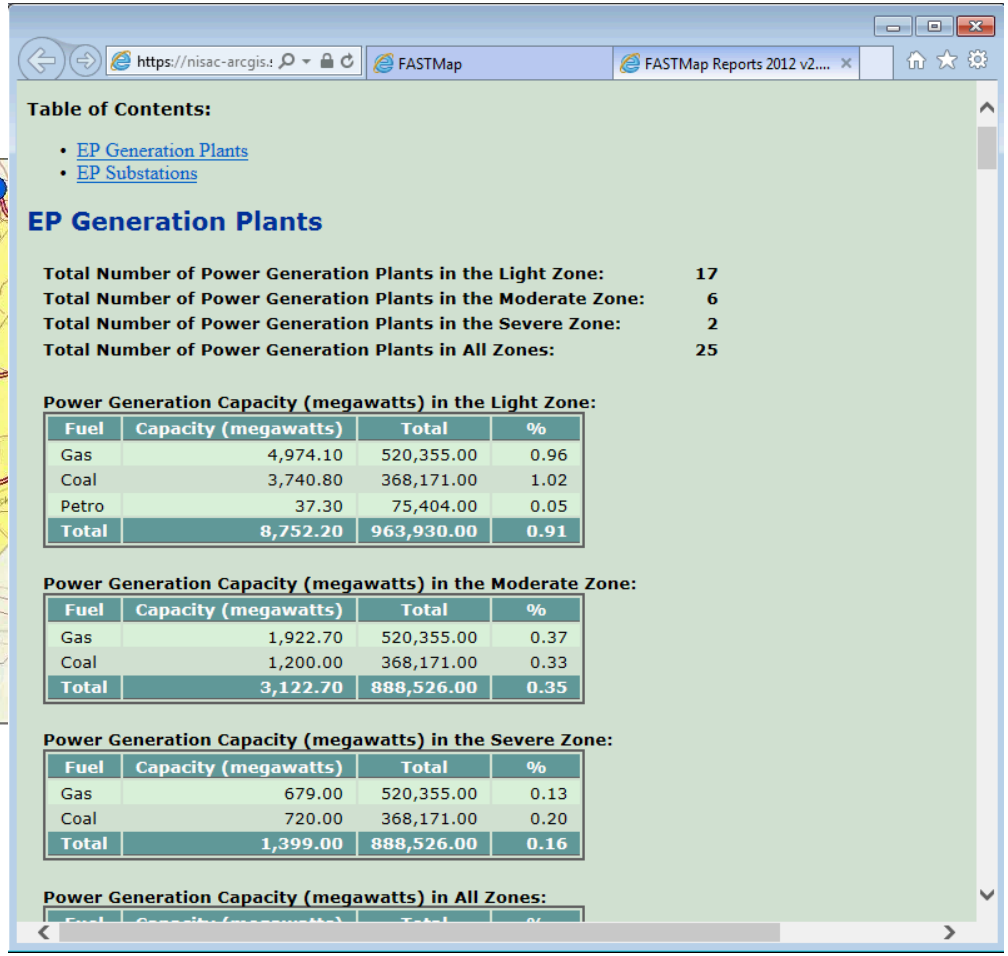


Table of Contents:

- EP Generation Plants
- EP Substations

EP Generation Plants

Total Number of Power Generation Plants in the Light Zone:	**17**
Total Number of Power Generation Plants in the Moderate Zone:	**6**
Total Number of Power Generation Plants in the Severe Zone:	**2**
Total Number of Power Generation Plants in All Zones:	**25**

Power Generation Capacity (megawatts) in the Light Zone:

Fuel	Capacity (megawatts)	Total	%
Gas	4,974.10	520,355.00	0.96
Coal	3,740.80	368,171.00	1.02
Petro	37.30	75,404.00	0.05
Total	**8,752.20**	**963,930.00**	**0.91**

Power Generation Capacity (megawatts) in the Moderate Zone:

Fuel	Capacity (megawatts)	Total	%
Gas	1,922.70	520,355.00	0.37
Coal	1,200.00	368,171.00	0.33
Total	**3,122.70**	**888,526.00**	**0.35**

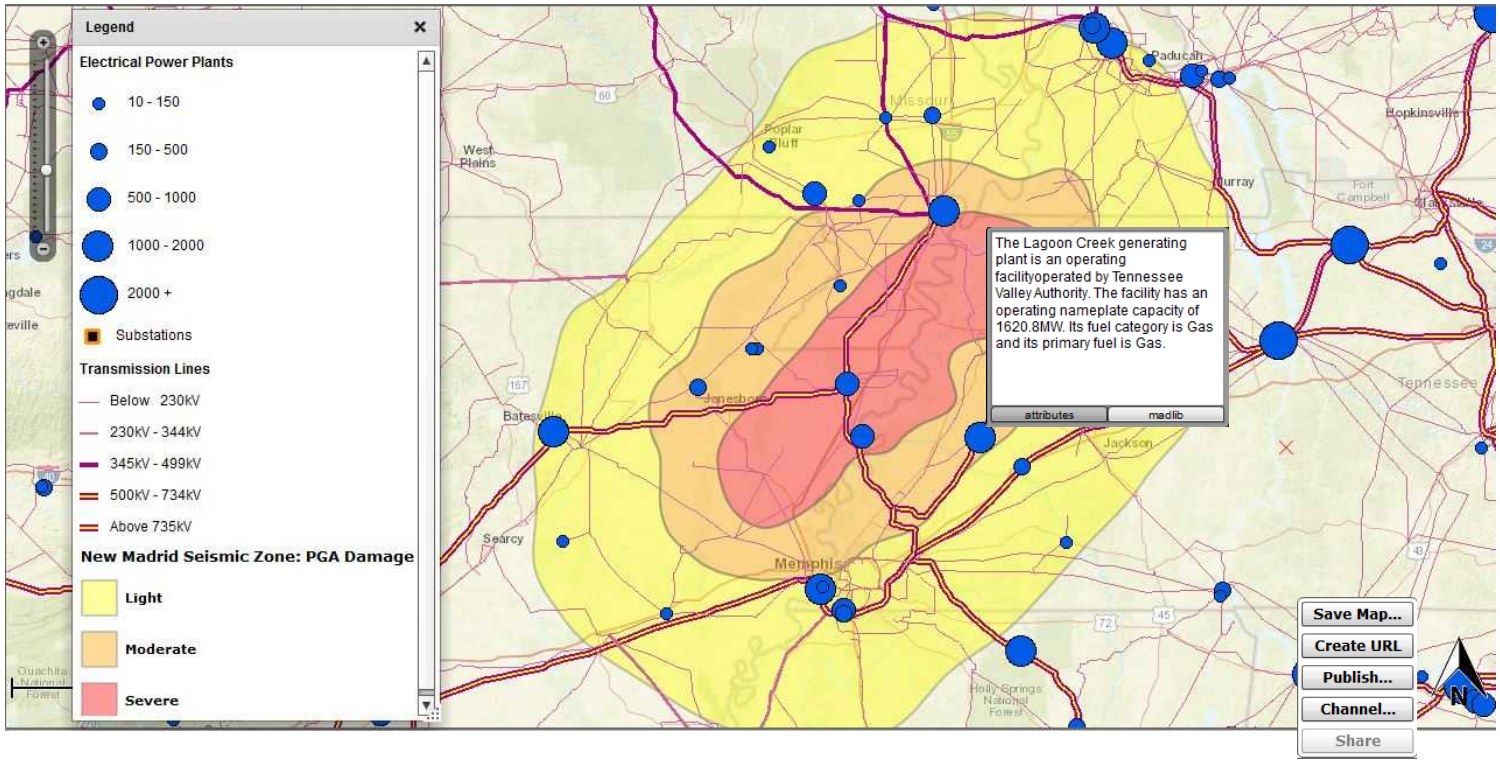
Power Generation Capacity (megawatts) in the Severe Zone:

Fuel	Capacity (megawatts)	Total	%
Gas	679.00	520,355.00	0.13
Coal	720.00	368,171.00	0.20
Total	**1,399.00**	**888,526.00**	**0.16**

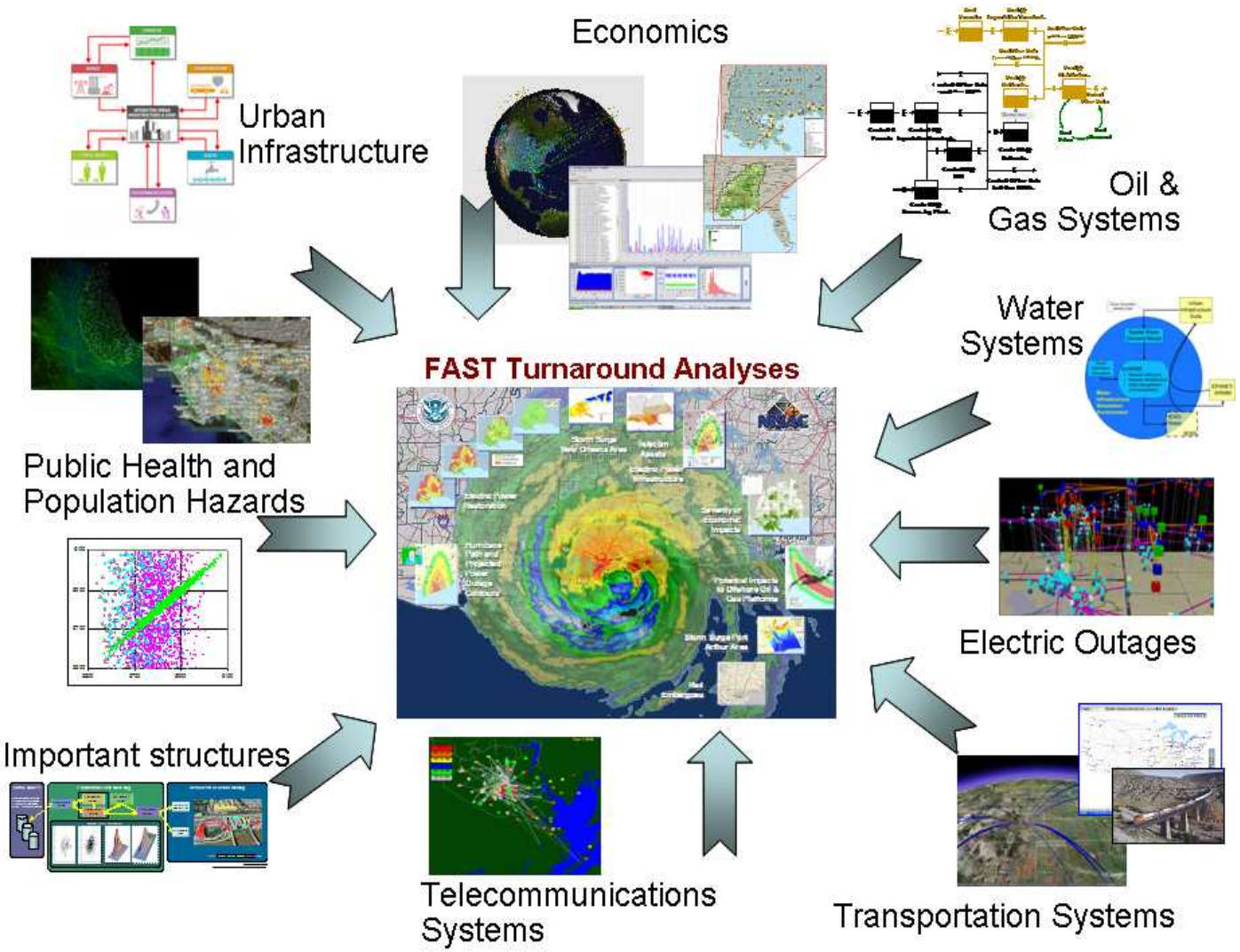
Power Generation Capacity (megawatts) in All Zones:

FASTMap serves as a platform for visualization of model results

- Enables production quality map for reports and presentations
- Enables information sharing via URL or real-time channel feed

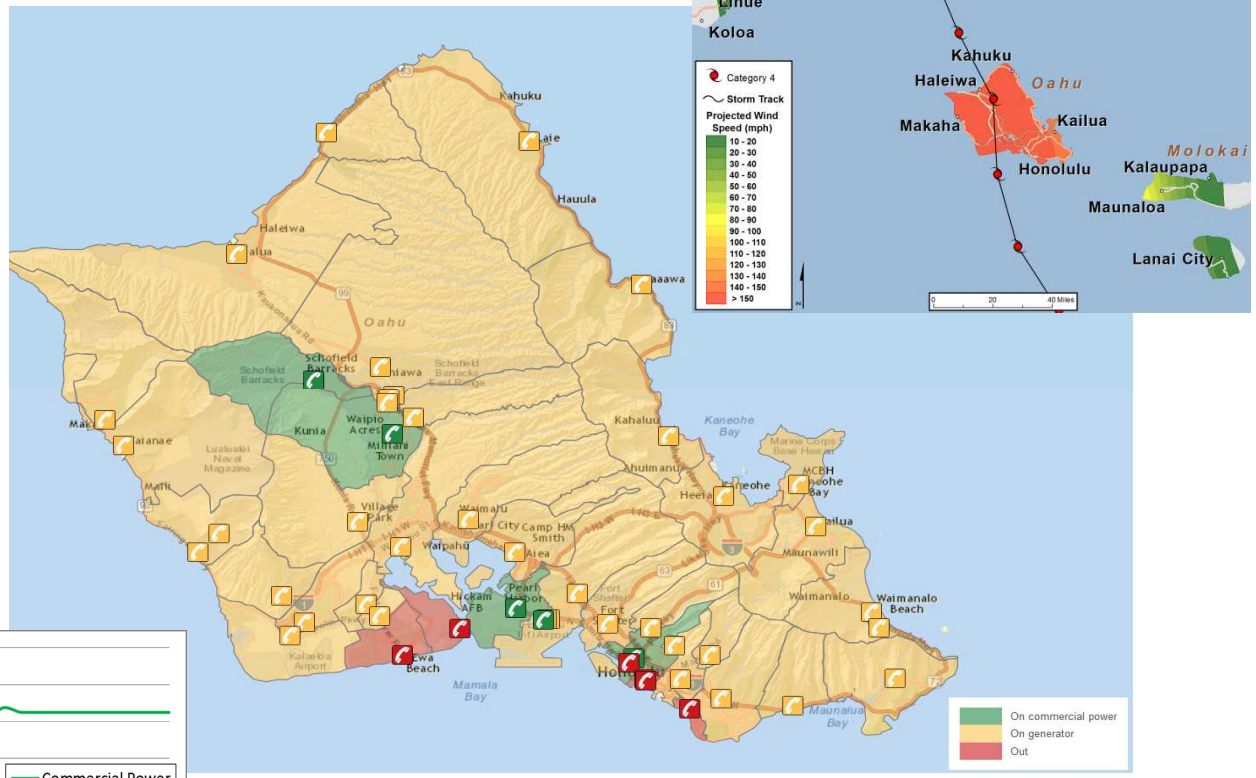


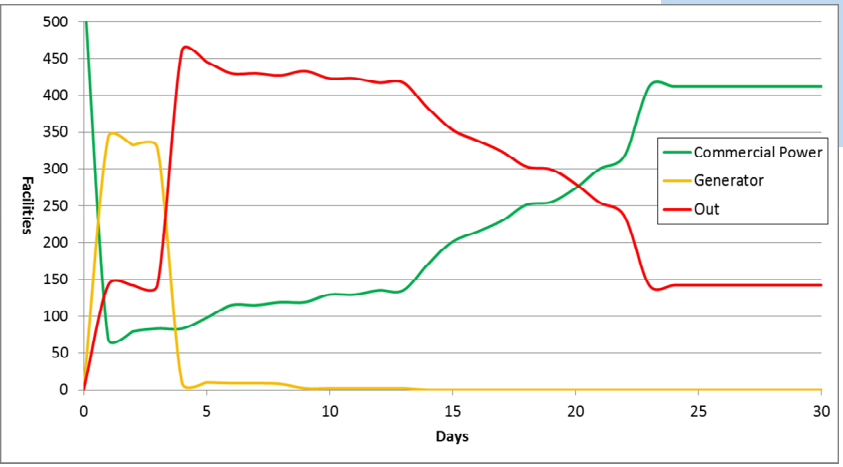
Hurricane Impacts Analysis
Integration of Multidisciplinary Skill Sets & Expertise



Hawaii Interdependency: Category 4 Hurricane Electric Power and Communications

- Widespread resulting power outage
- Communications assets move to generator power
- Duration of outage results in refueling issues





- Inoperable communications assets results in potential degradation of response and restoration capability

Questions?