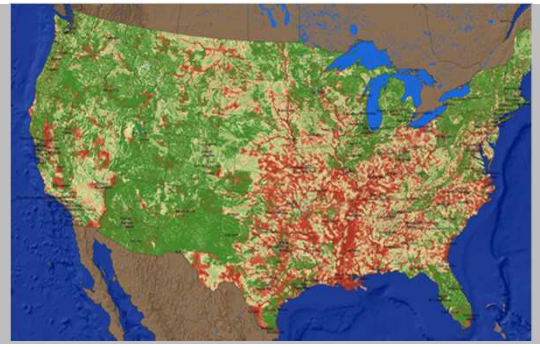
SAND2016-11423PE

Exceptional service in the national interest

Sandia National Laboratories



Homeland Security

Science and Technology

Sandia Disaster Management & Resilience (DMR)

U.S. DEPARTMENT OF ENERGY | NNSA

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Our Origin

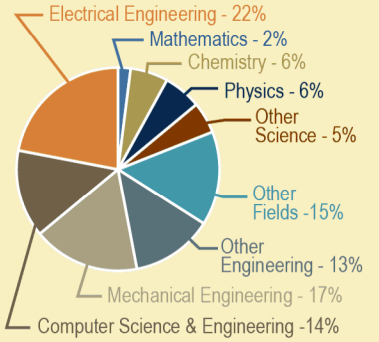
July 1945: Los Alamos creates Z Division (engineering)

November 1, 1949: President Truman establishes Sandia Laboratory as Engineering Lab from Z Division

Decades Addressing National Security Challenges

1950s	1960s	1970s	1980s	1990s	2000s	2010s
Nuclear weapons Production and manufacturing engineering	Development engineering Vietnam conflict	Multiprogram laboratory Energy crisis	Missile defense work Cold War	Post-Cold War transition Stockpile stewardship	START Post 9/11 National security	Cyber, biosecurity proliferation Evolving national security challenges

Our Workforce



12,609 Total workforce

10,307 Regular employees

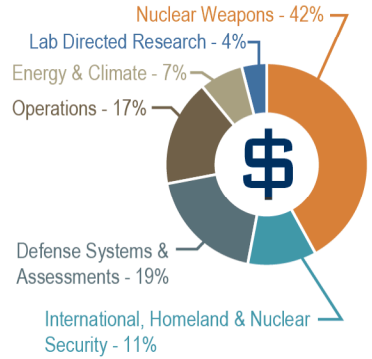
5,790 (56%) Advanced degrees

Our Budget

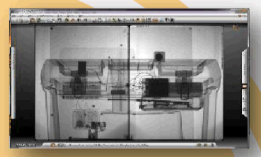
$3,165M FY15 Lab costs

$143M Lab directed R&D

$56.9M **DHS work** (S&T, NPPD, TSA, CBP, ICE, FEMA, DNDO...)



Our Successes



X-Ray Toolkit (XTK), image processing and analysis software, helps emergency responders perform effectively in the high-stress, time-critical act of **disabling IEDs** is **deployed to more than 20,000 users** in many of the 467 recognized non-military bomb squads across the U.S.

Sandia lab-directed **research** in decontamination foam used in 2001 anthrax clean ups and **transitioned to commercial sector.**

2016: **Small business** developing explosive detectors **teams with Sandia** experts to improve the machine's speed, distance and accuracy for market launch.

Sandia National Laboratories

Working With Us

- Federally Funded Research and Development Center **(FFRDC)** subject to Federal Acquisition Regulation (FAR) Requirements
- Broadly **prohibited from competing with industry**, and primarily work with DHS through Interagency Agreements (IAAs) via DOE
- Homeland Security Act of 2002 **authorizes DHS special access** to Sandia to assist any component in accomplishing its mission.

Our Facilities

- Albuquerque, NM
- Livermore, CA
- Kauai, HI
- Carlsbad, NM
- Pantex & Amarillo, TX
- Tonopah, NV

National Nuclear Security Administration

Sandia's Homeland Security Programs

We reduce the risk to our nation by providing research, analysis, and engineered solutions for keeping our homeland safe.

- Provide analysis and systems engineering to the Department of Homeland Security Components
- Develop advanced technologies for detecting radiological and nuclear sources
- Develop innovative concepts for biological agent warning and response, decontamination, and medical diagnostics
- Support emergency management training, preparedness, and response to catastrophic incidents
- Provide equipment to safely destroy chemical weapons to meet treaty obligations

Aviation and Explosives Security

Chem-Bio National Security

Weapons Remediation

Nuclear and Radiological Security

Borders and Maritime Security

Disaster Management and Resilience

Policy and Initiatives

Strong History of First Responders Partnerships

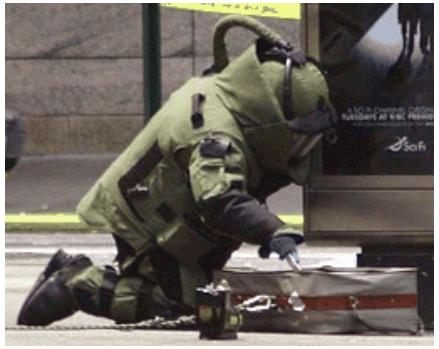
- **Modeling & Simulation Enhanced Training & Exercises**
  - TELL, SUMMIT
- **Metrics & Requirements**
  - Water Resilience, NHP
- **Enhanced Planning**
  - FEMA IND Response, NHP
  - 100 Resilient Cities Initiative
- **States & Local Stakeholders**
  - California Office of Emergency Services (CalOES)
  - New York City, NY
  - Norfolk, VA

Full Scale Exercise Example: Urban Shield

Problem

The IED response community lacked a standard set of user-friendly and sophisticated image processing tools to perform effectively in the high-stress, time-critical act of disabling IEDs.

X-RAY TOOLKIT™



Customers: FBI, Bomb squads, States

Tools and Methods

- Supports image acquisition from a variety of commercial scanners and provides image enhancement, measurement, and markup tools.
- Features mosaic-stitching, dose prediction, file management, sharing tools, 3D visualization, and the ability to create training scenarios and after-action reports.
- SME-driven, software engineered toolbox.

Impact

- Provided free to all government entities
- X-Ray Toolkit (XTK) has been deployed to more than 20,000 users in many of the 467 recognized non-military bomb squads across the U.S., and become the defacto standard for the community.

Subset of Sandia Capabilities Relevant to Disaster Management & Resilience

Sandia National Laboratories

- Improvised Explosive Device Defeat
- Technology-Enhanced Training
- Decision Support Tools
- Resilience Metrics
- Countering Violent Extremism
- Real-time Information Sharing
- Systems Analysis and Requirements Generation
- Wearable Sensors

Improvised Explosive Device Defeat

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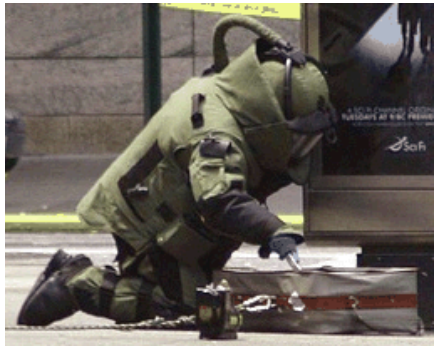

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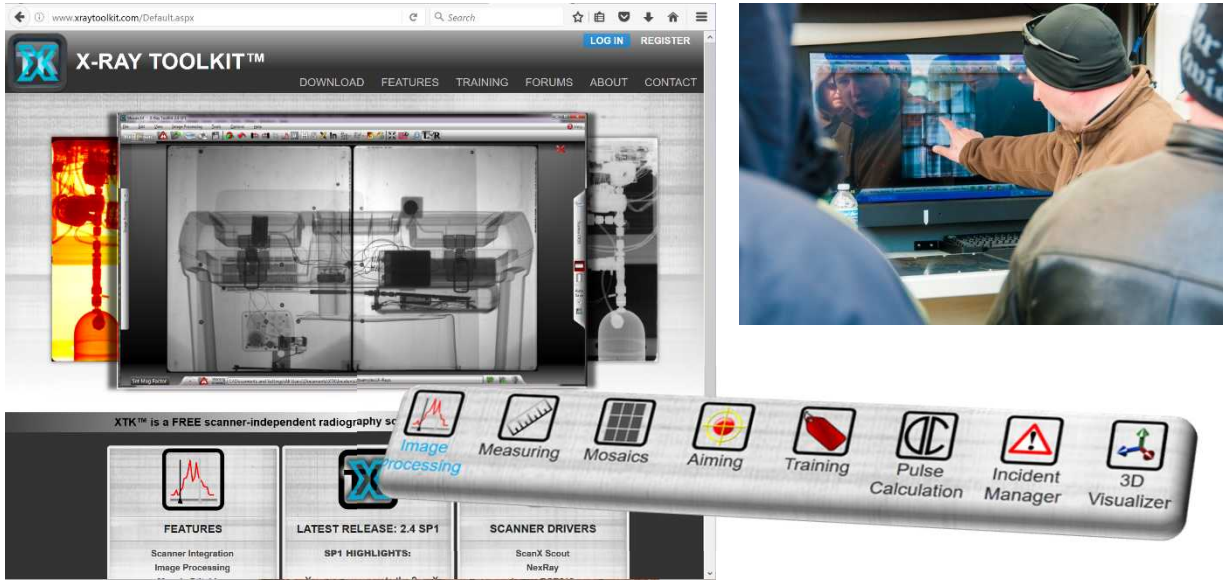

http://www.xraytoolkit.com

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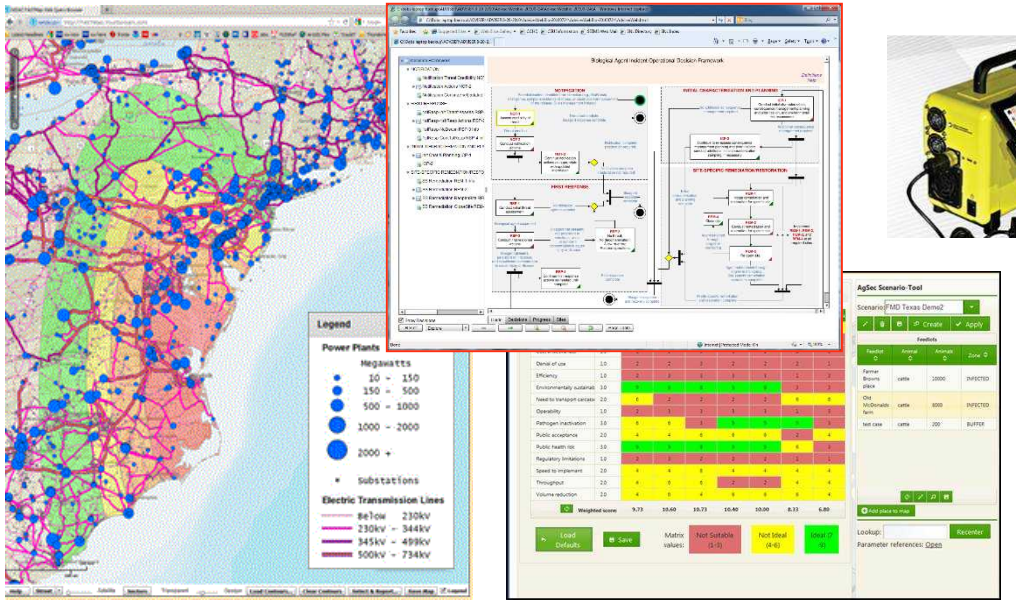
Decision Support Tools

Problem

How can government resources be best utilized to plan, respond, and recover from natural or man-made disasters?

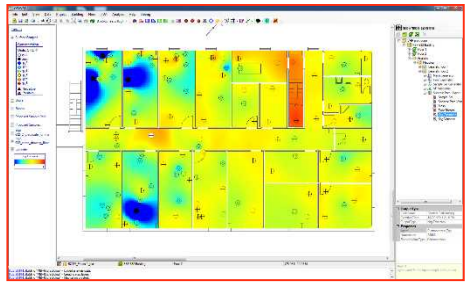
1. Which assets and functions have been impacted?
2. How long will significant functions and the overall recovery take?
3. What are the interdependencies, and how will these be factored into the restoration strategy?
4. What resources are needed, and where do get applied?

Customers: FEMA, DHS S&T, EPA, DoD, CSTs



Tools and Methods

- Knowledge Elicitation
- Optimization
- Logistics modeling
- Risk analysis
- Requirements/metrics Trade-off studies
- Software Engineering
- Technology Evaluation



Impact

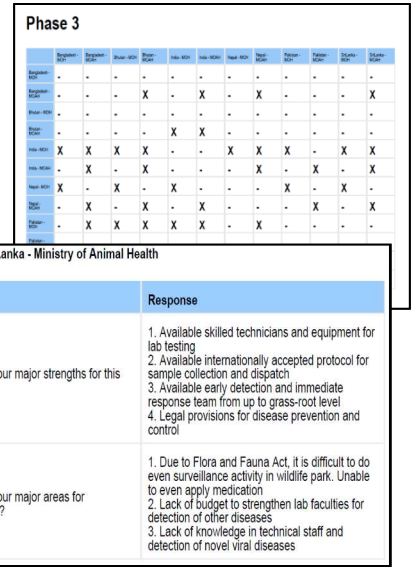
- Suite of web-based tools have been utilized by the first responder community in planning applications and delivered to DoD and EPA.
- SNL has worked with federal/state entities (e.g., USEPA, National Guard Civil Support Teams (CSTs)) since 2007 to develop applications to meet their needs for field deployable solutions

Technology-Enhanced Training

Problems

- Bio-chem Readiness requires methodologies for agencies to systematically evaluate and refine plans and protocols
- Complex international events require input across agencies and borders and timely report development
- Technologies must be remotely accessed, multilingual

Customers: DoS, Skoll Global Threats, DoD/DTRA

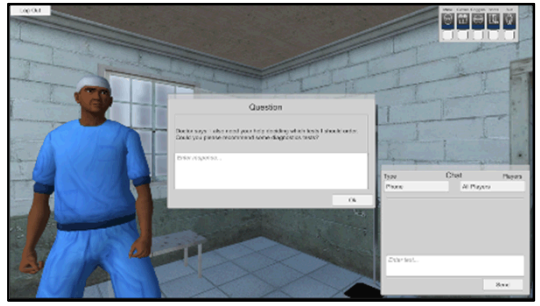


Tools and Methods

- Web-based, multiplayer, multilingual, **virtual simulation**/TTX with communication tracking
- Web-based participant-led **data collection tools** for TTX and planning workshops, with communication tracking
- Unique **After Action Review** utilizes participatory-based qualitative methods with real-time report development
- Augmented reality

Impact

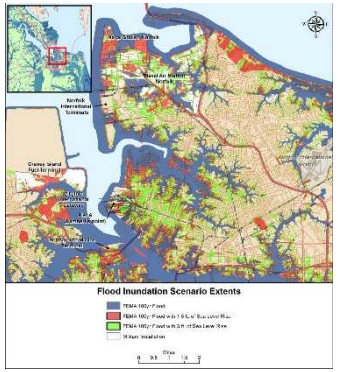
- Supported multiple international exercises and positioned to transition to broader audience for sustainable utilization by the international and domestic community.



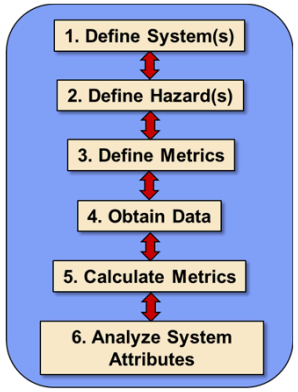
Resilience Metrics

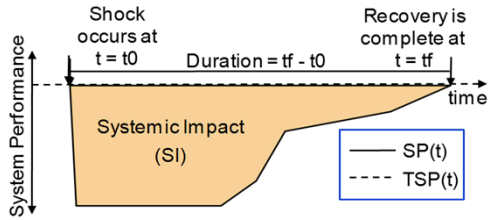
Problem

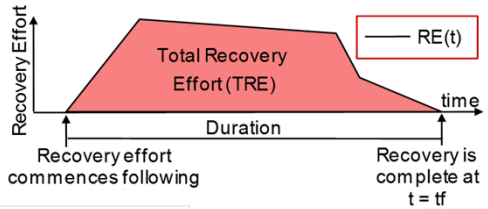
How can Norfolk, VA plan the infrastructure improvements that will most greatly enhance the region's resilience to flooding?



Customers: 100 Resilient Cities, Norfolk, VA

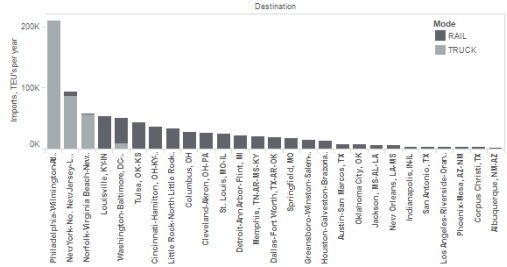


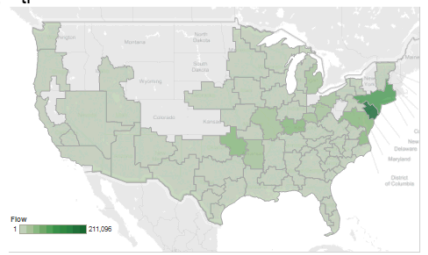




Resilience Costs =

$$\frac{SI + \alpha \times TRE}{\int_{t0}^{tf} |TSP(t)|dt}$$





Tools and Methods

- Pioneered development of resilience measurement methodology.
- Developed modeling capabilities to assess efficacies of preparedness interventions on resiliency.
- Quantitative analytics
- Employed Infrastructure and dependencies analyses

Impact

- Provided Norfolk city officials and regional asset owners with actionable information to plan infrastructure improvements.
- A single four-day, 100-year flood event in Hampton Roads would cause on the order of $355-606 million in detrimental impacts to global production.
- Highlighted the infrastructure behaviors, interdependencies, and the economic analyses that determine these impacts.