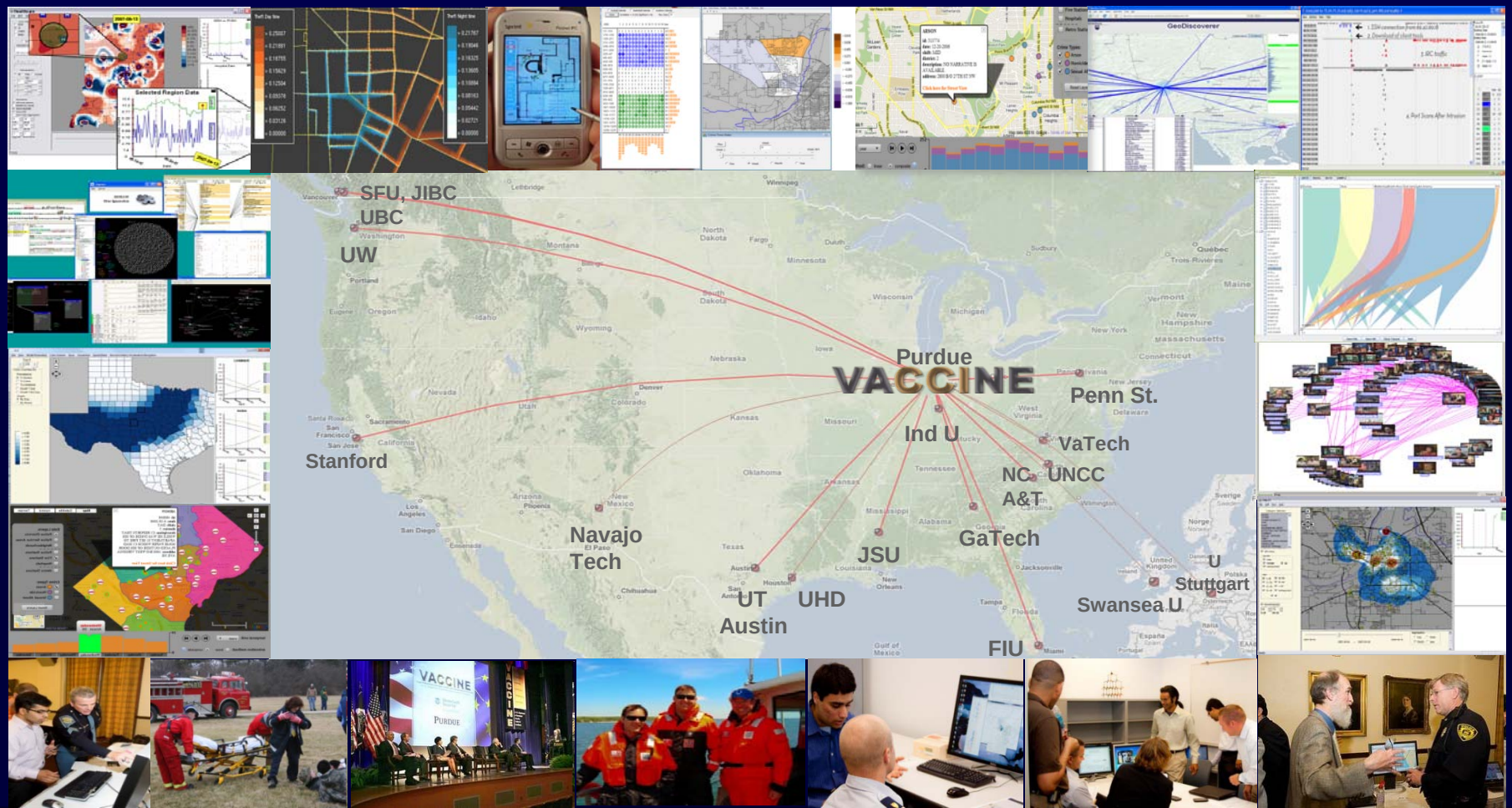
VACCINE

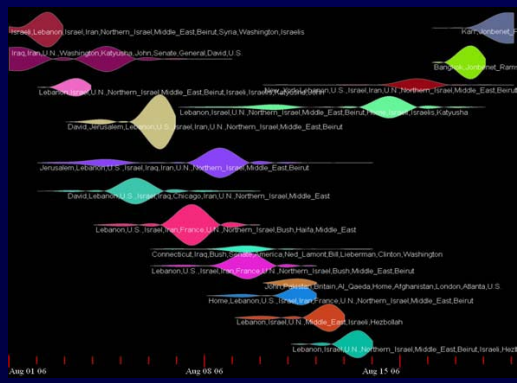
Visual Analytics for Command, Control, and Interoperability Environments

A U.S. Department of Homeland Security Center of Excellence

# Predictive Interactive Visual Analytics for CCI: Planning, Response, and Resiliency



# VACCINE Mission



- Provide visual analytic and scalable solutions for all 2.3 million extended homeland security personnel
  - 185,000 DHS personnel, 350,000 law enforcement personnel, 750,000 homeland security practitioners, 2.3 million extended personnel
- Achieve excellence in visual analytics and visualization sciences
- Educate homeland security stakeholders and the next generation of talent

# Research Approach and Plan

- Evolving, effective, and enduring research by tight integration with stakeholders
- Driven by our stakeholders – all 2.3 million extended public and private homeland security professionals
- Visual Analytics
  - Interactive visual/cognitive analytic environments based on novel research in visual analytics, algorithms, information transformation, cognitive and interaction science, creating precise information environments

Full-scale exercise February 2008

# Some VACCINE Regional and Corporate Partners

- Indiana Department of Homeland Security
- Indiana State Department of Health
- Indianapolis Public Safety
- Charlotte Mecklenburg Police Department
- Lafayette, West Lafayette, Purdue Police Departments
- Tippecanoe County EMA & Sherriff's Department
- Harrisburg, PA Police
- Coast Guard Sector Boston, Seattle, LA
- Joint Harbor Operations Command Center
- Port of Seattle
- Indianapolis Public Safety
- USCG District 9
- Motorola
- Harris Corporation
- Boeing
- Next Wave Systems, LLC
- Banfield, The Pet Hospital
- Raytheon
- MacDonald, Dettwiler and Associates
- Oculus Info Inc.
- Kx Systems
- Bank of America
- Duke Energy
- World Vision International
- Gates Foundation
- Kimberly Clark
- Hallmark

# VACCINE Government Partners

- U.S. Coast Guard
- Federal Emergency Management Agency
- Customs and Border Patrol
- National Geospatial Intelligence Agency
- National Science Foundation
- Army Research Office
- Department of Defense
- Department of Health and Human Services
- U.S. Dept. of State
- National Institute of Justice
- National Maritime Intelligence Center
- Defence Research & Development Canada
- Foreign Broadcast Information Service
- US-CERT
- Oak Ridge National Laboratories
- US Army Corps of Engineers-ERDC
- Pacific Northwest National Laboratory
- ARL CERDEC & ARDEC
- US Attorney's Office (David Capp)

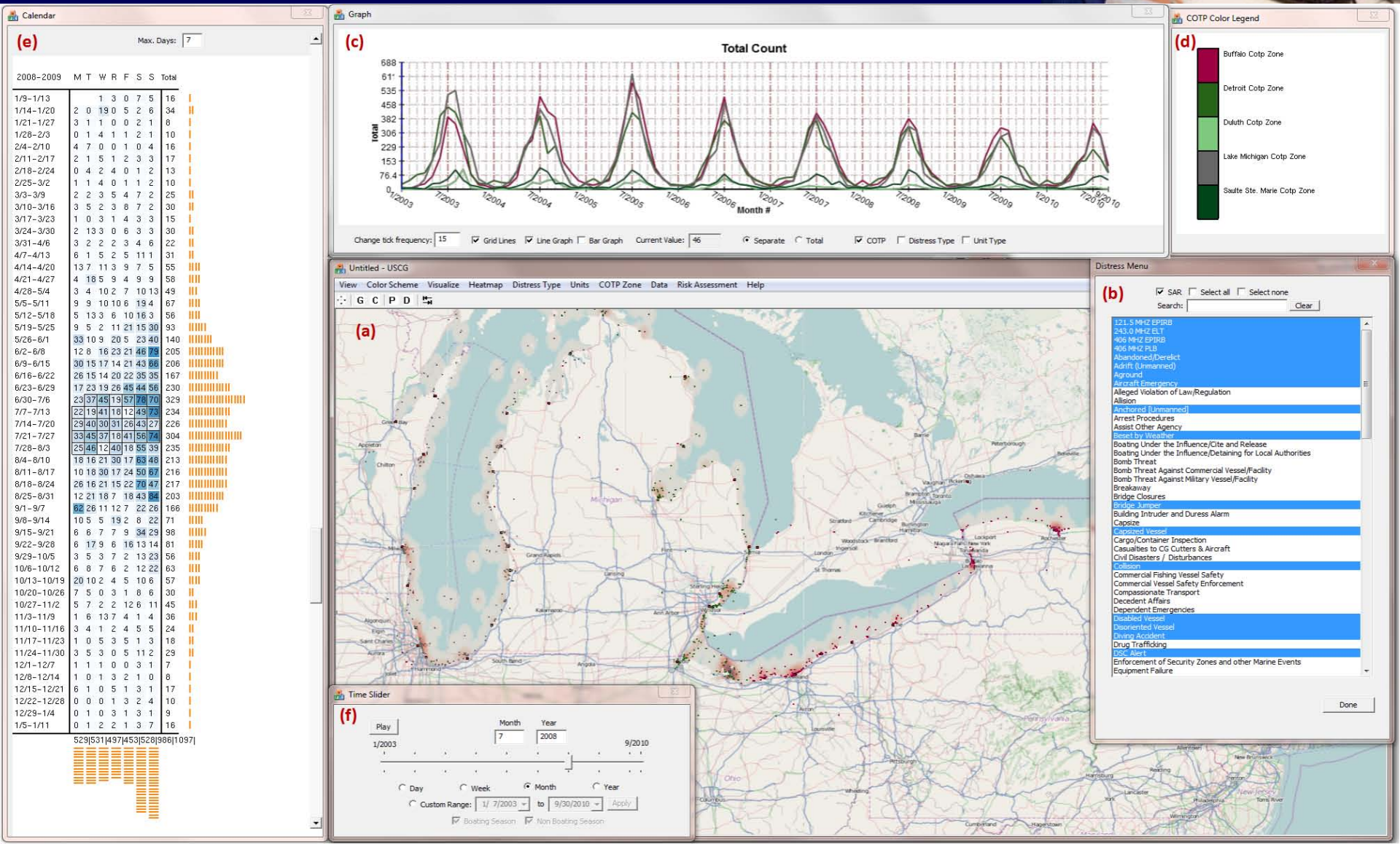
# What We Do

- Enable effective decision making through interactive visual analytic environments
- Enable effective communication of information
- Provide quantitative, reliable, reproducible evidence
- Enable user to be more effective from planning to detection to response to recovery
- Enable proactive and predictive visual analytics

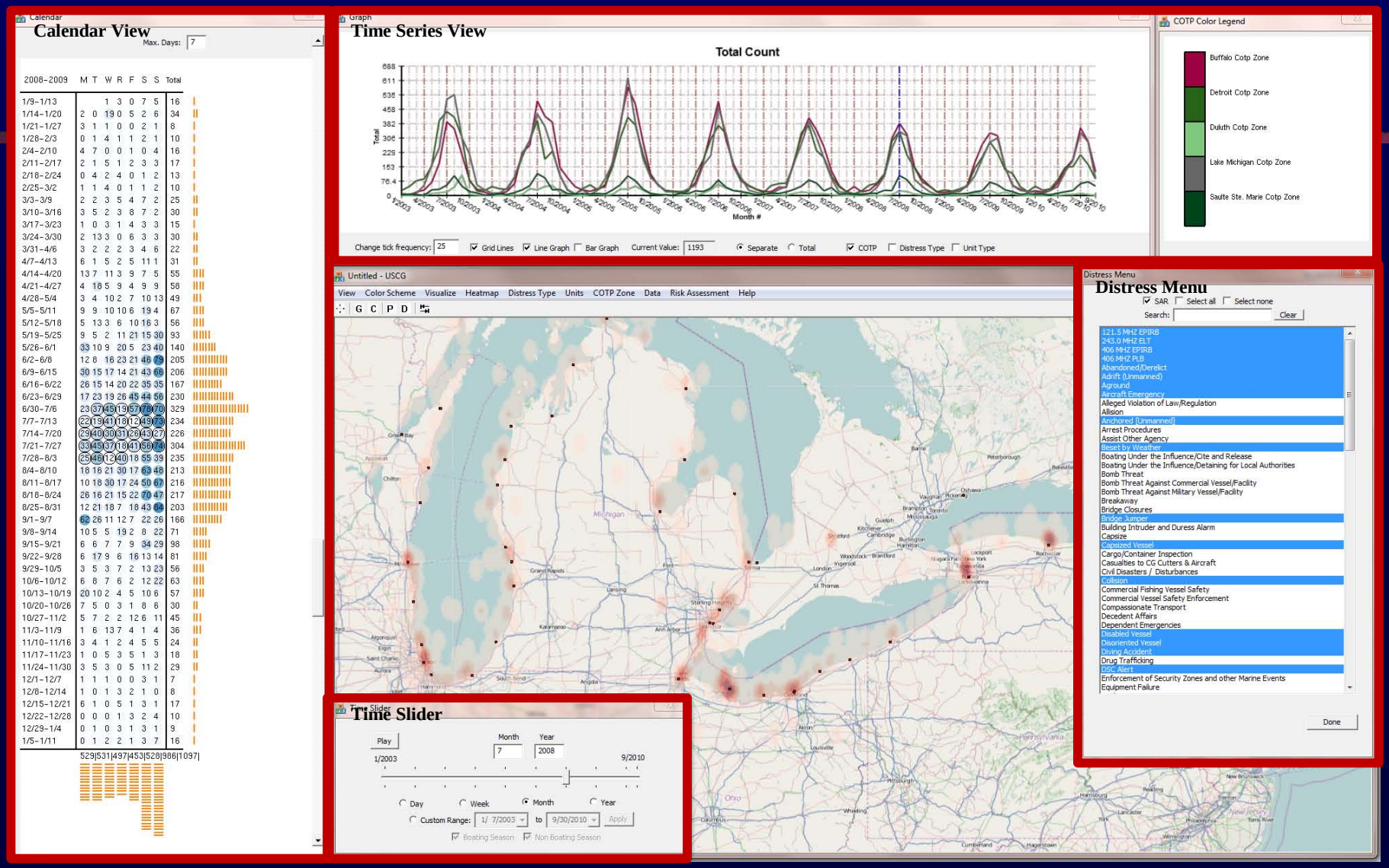
# Example of Visual Analytics for Strategic Planning, Risk Management, and Recovery

- Trend analysis, clustering, anomaly detection
- Interactive, multi-day, month, day, type investigation
- Purpose:
  - Planning for resiliency
  - Long-term analysis
  - Predictive analytics
  - Training
  - Detection and investigation
  - Response
  - Recovery, remediation

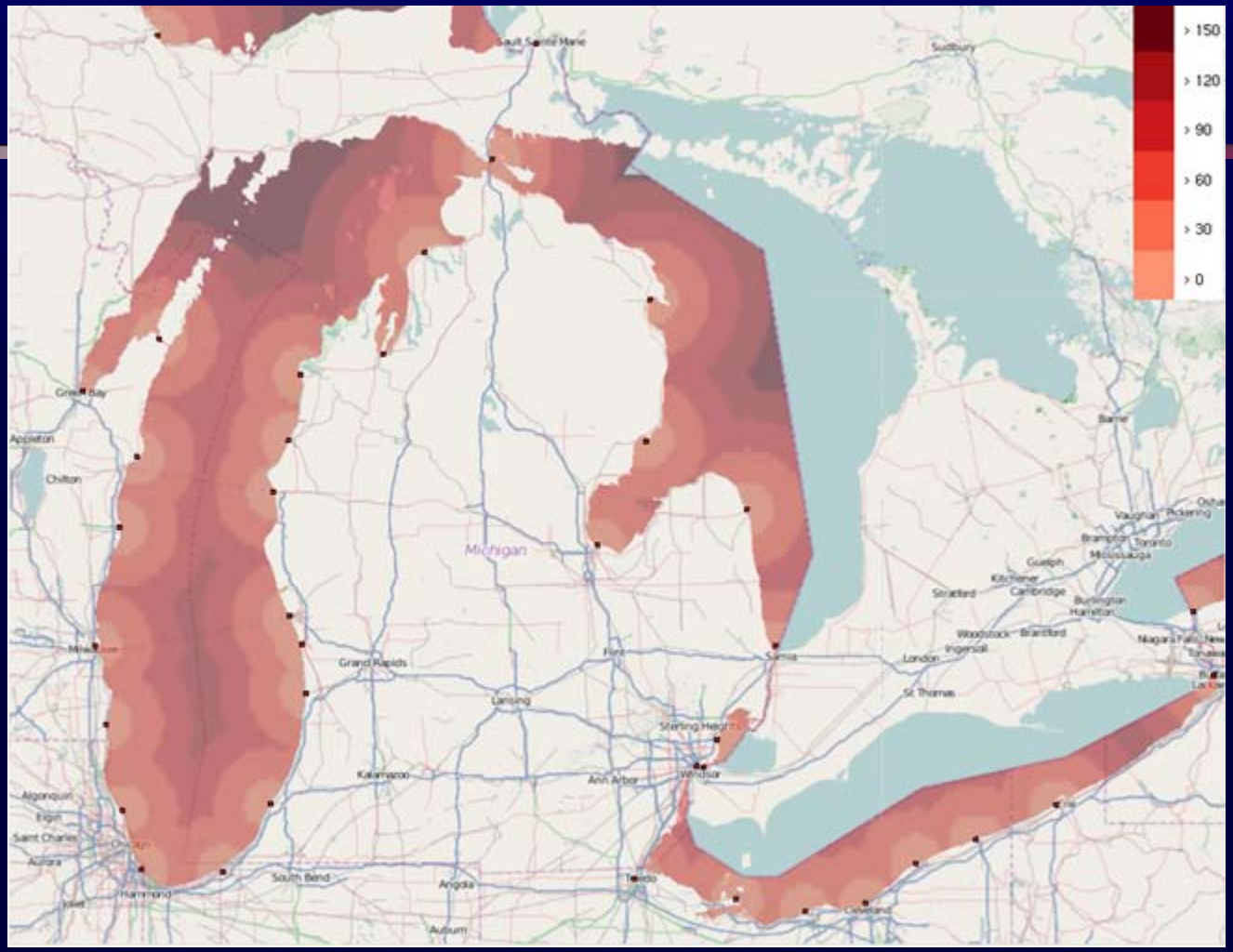
# Example: USCG D9 Search And Rescue Operational Analysis



# System Overview

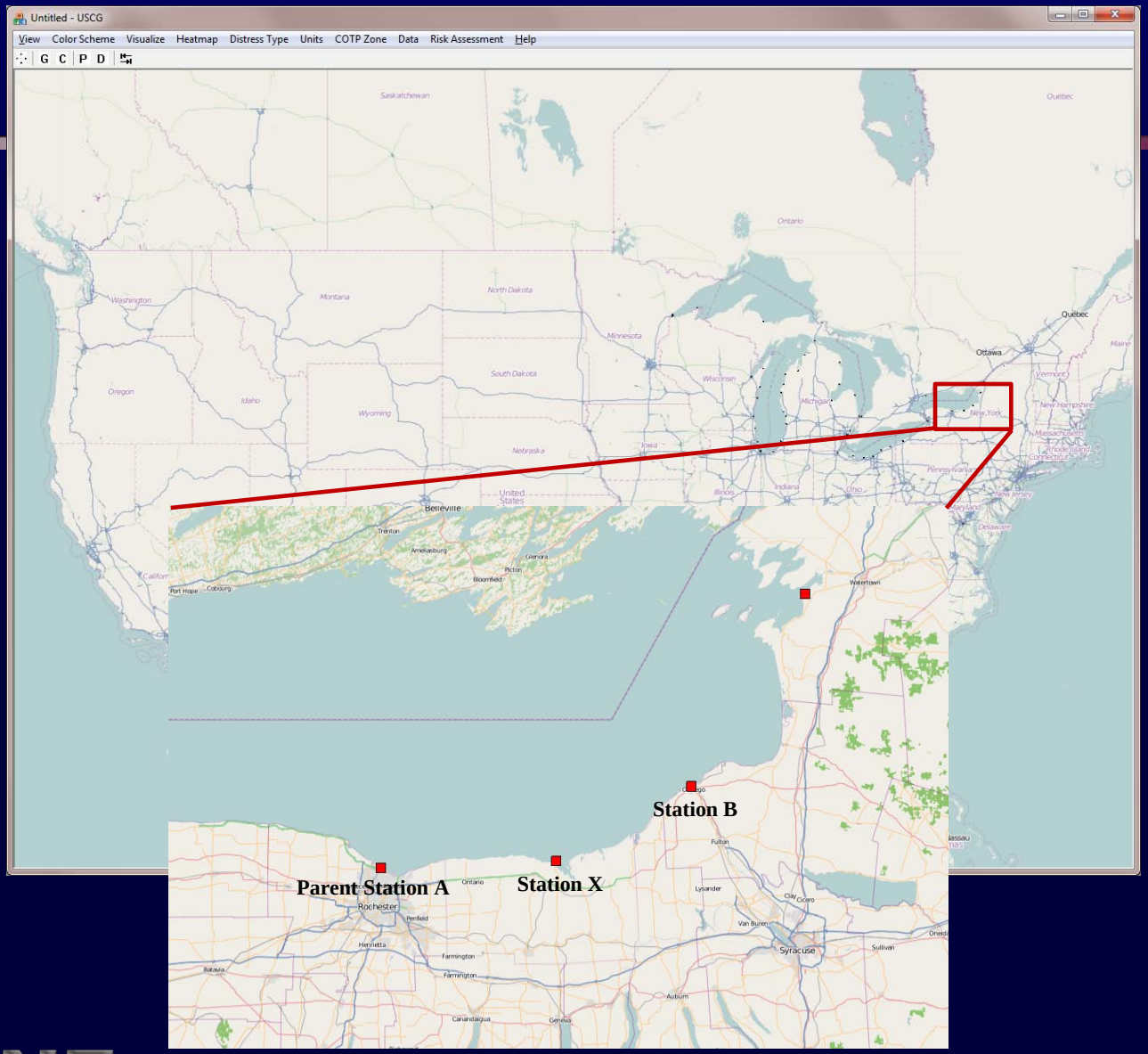


# System Features: SAR Risk Profile

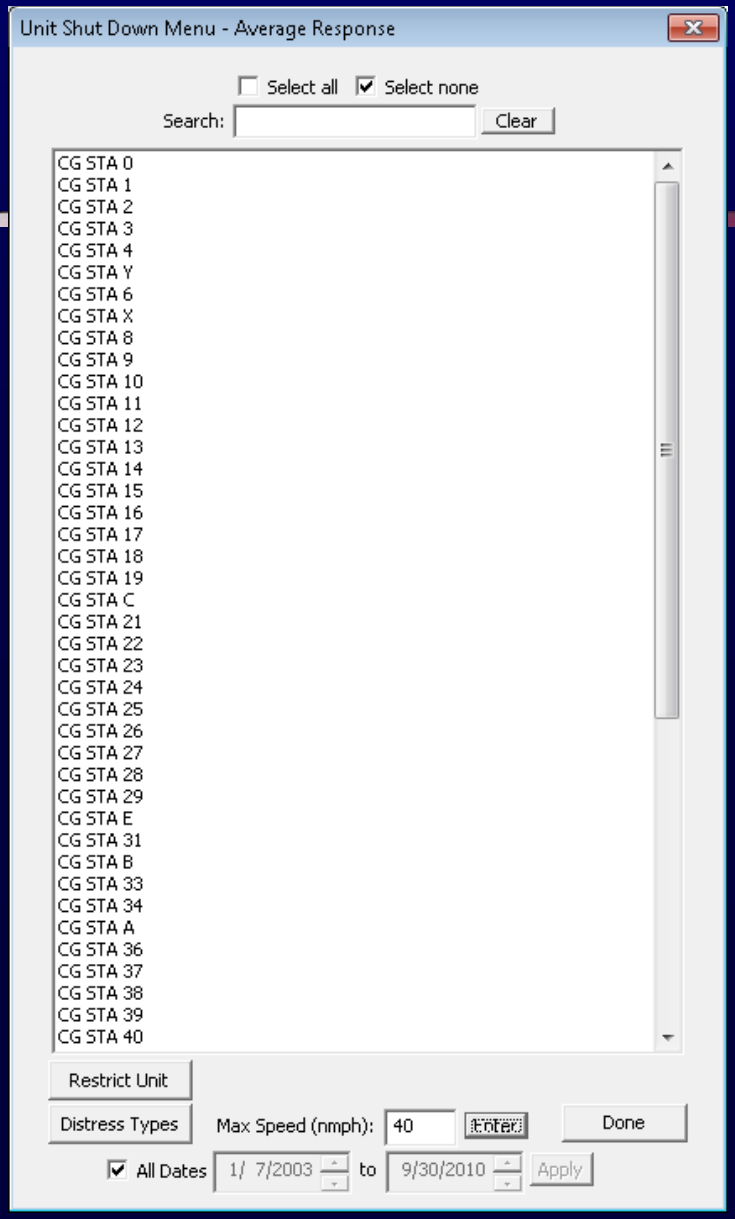



Time taken by CG stations to deploy an asset to the Great Lakes to respond to a SAR incident.

# Risk Assessment Scenario



# Risk Assessment Scenario – contd.



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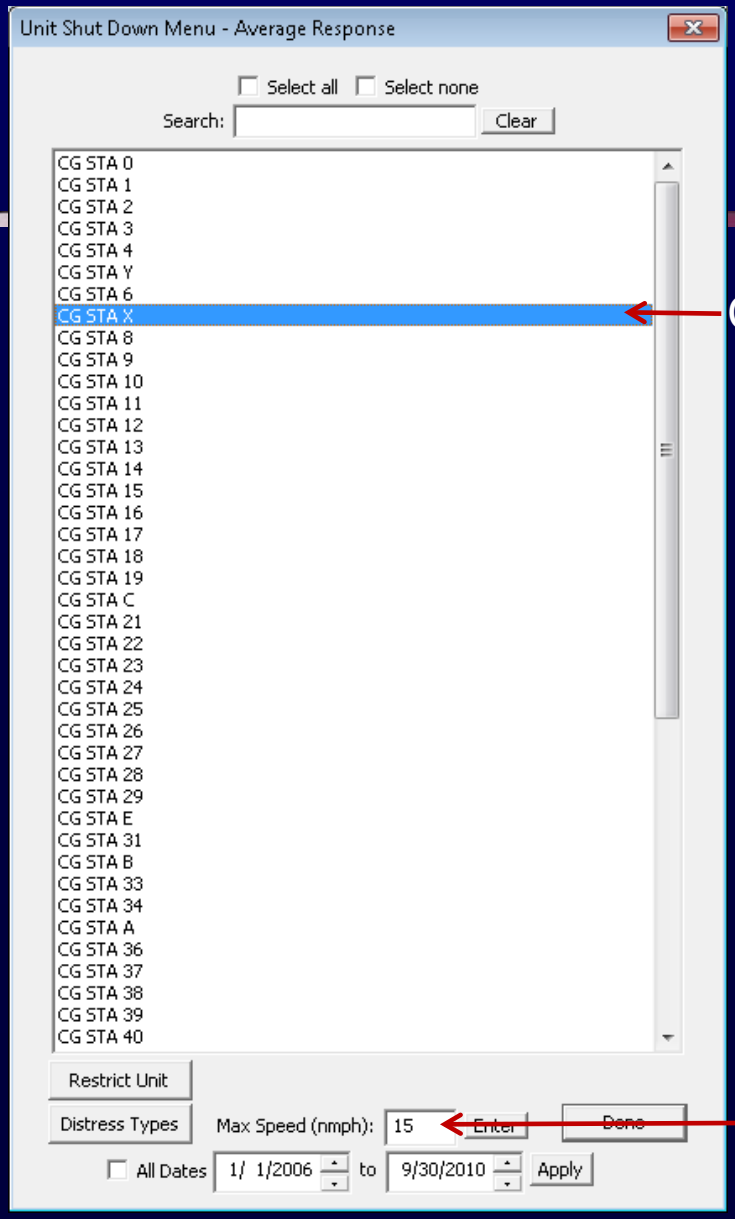
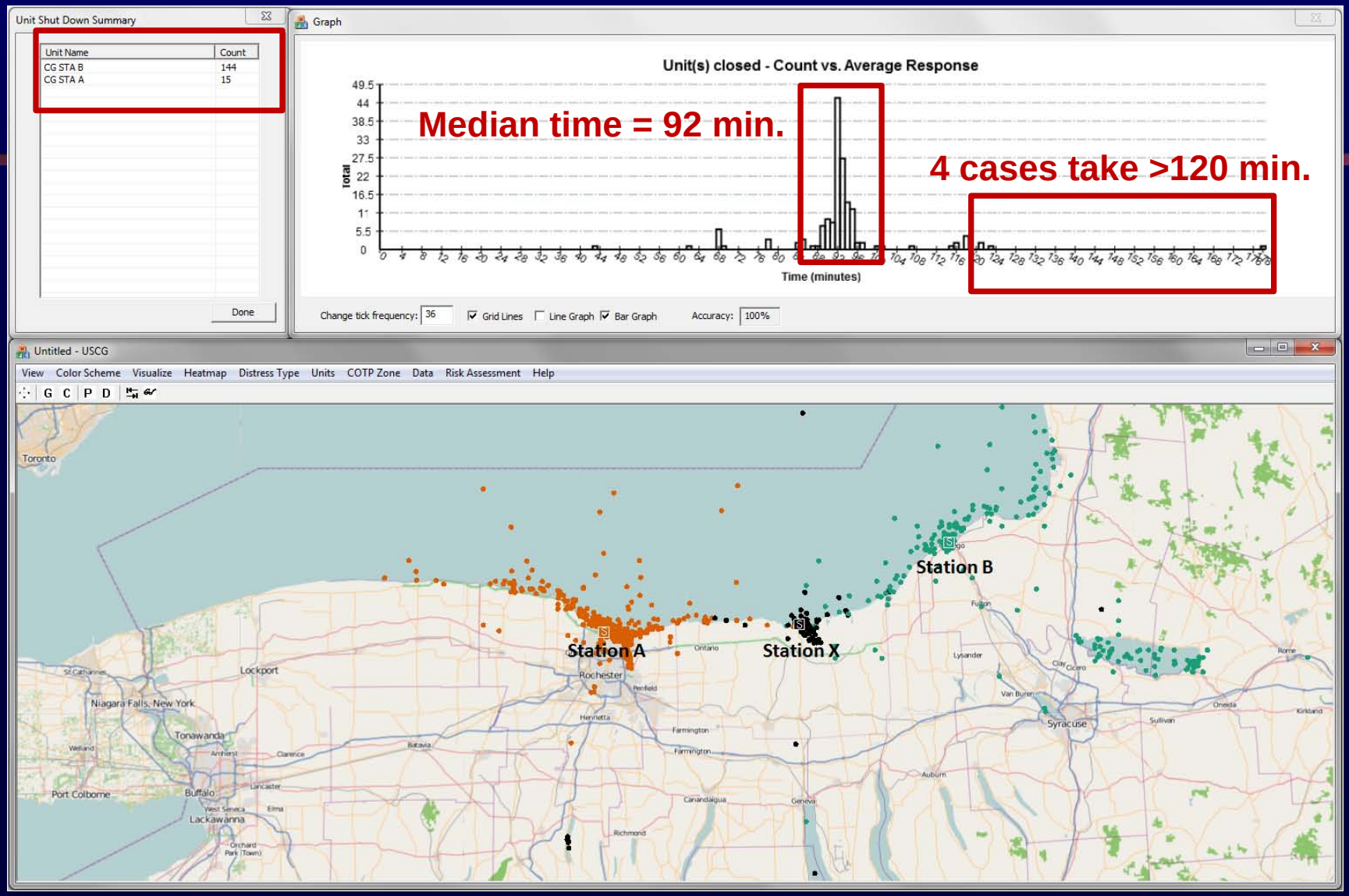



Close AUXOP Station X

Set asset speed

# Risk Assessment Scenario – contd.



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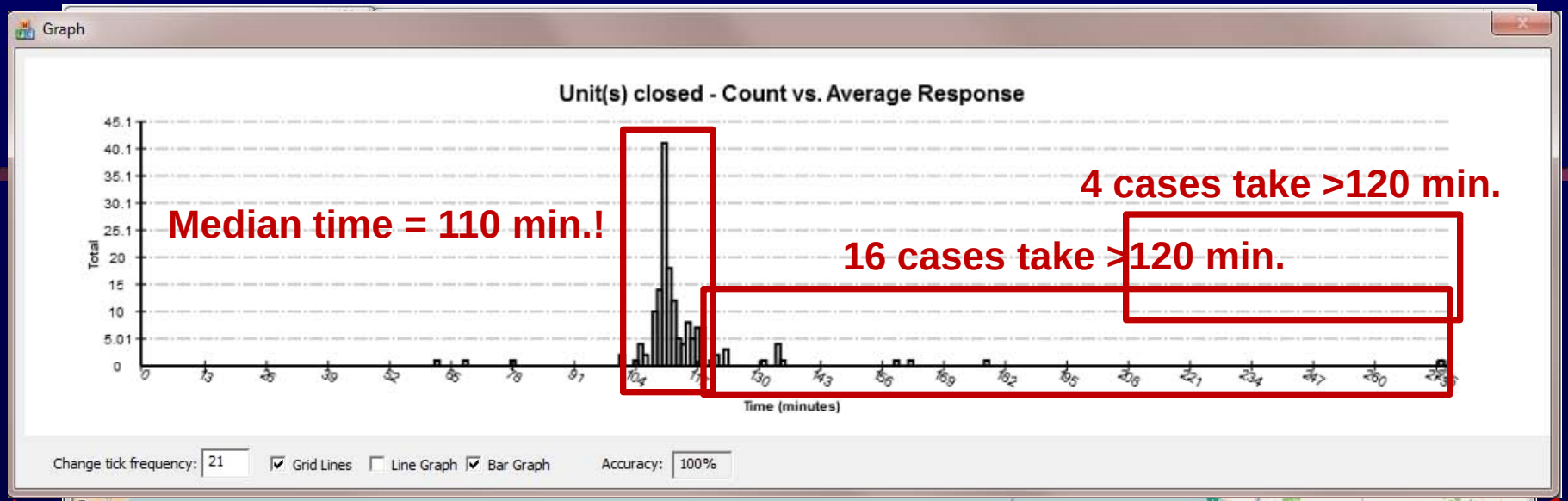
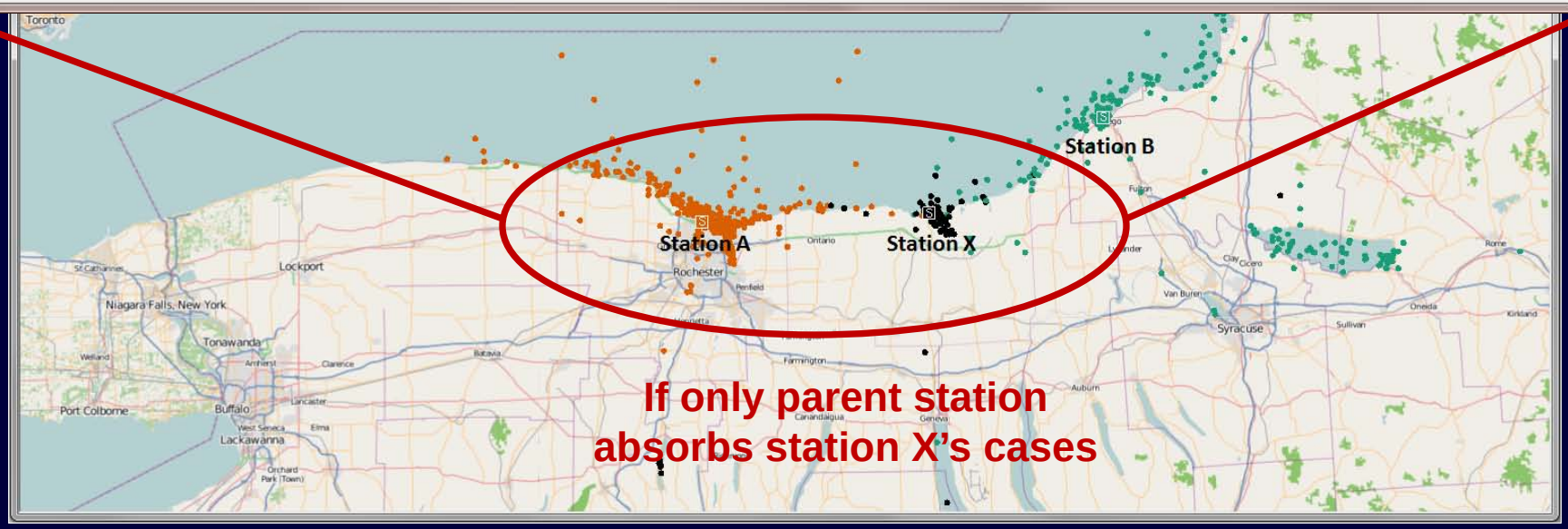
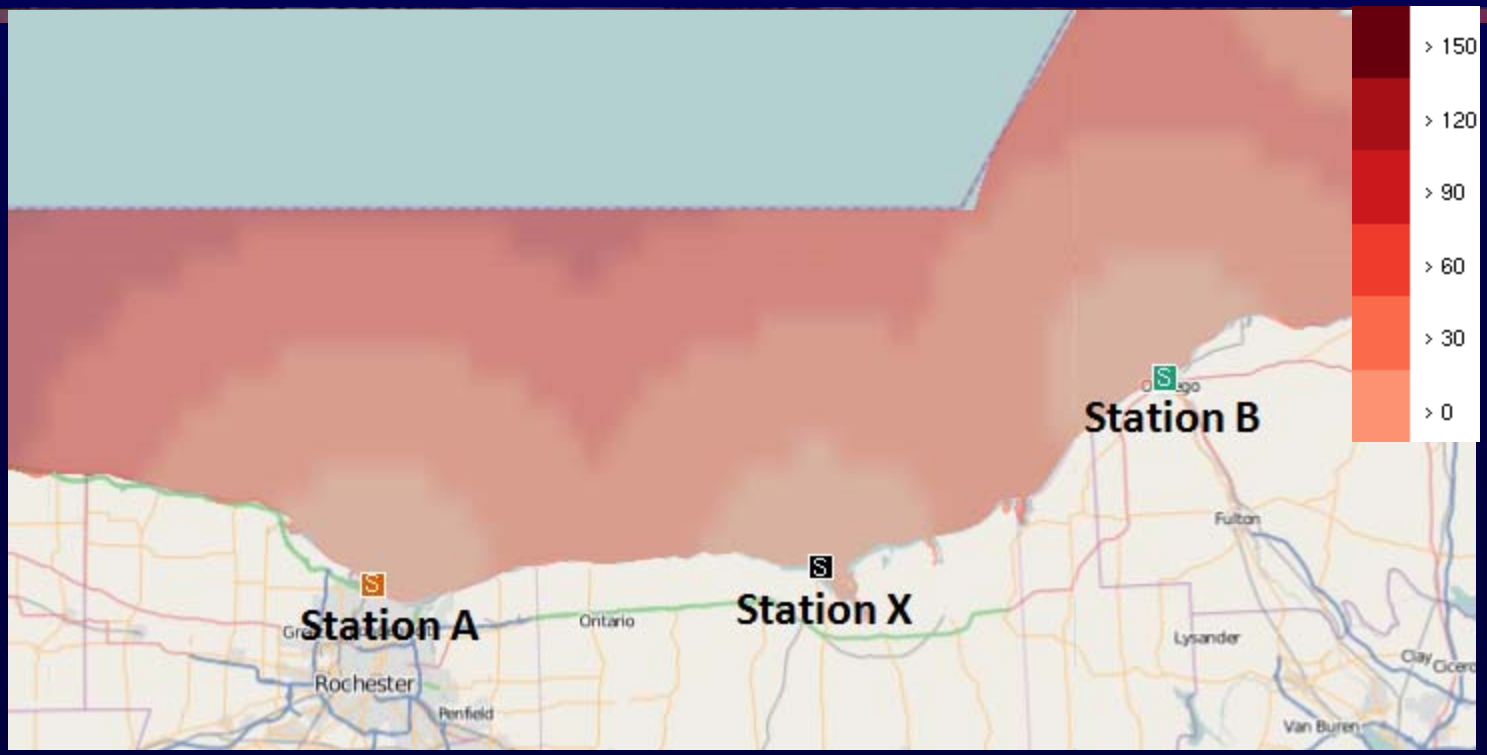


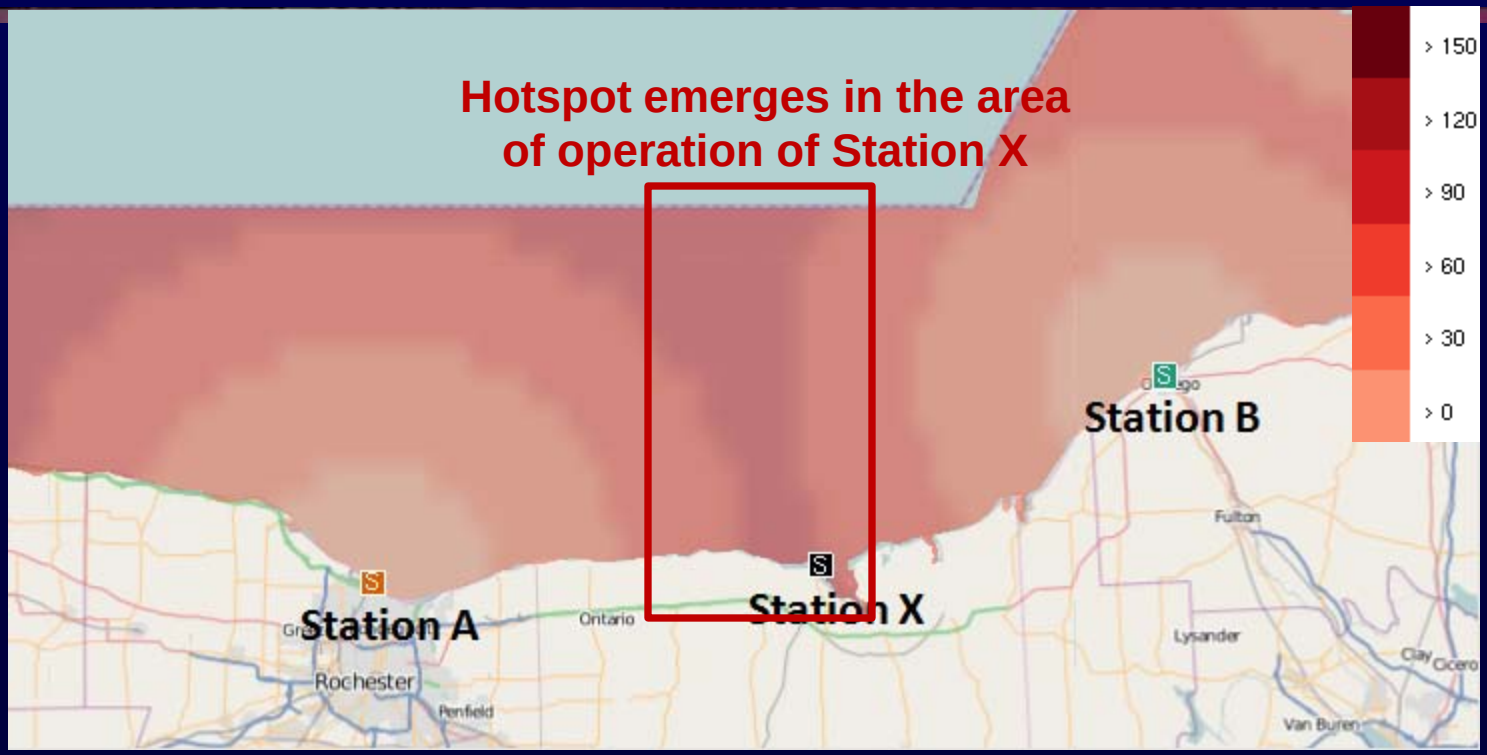



# Risk Assessment Scenario – contd.




Average response time risk profile when station X is operational

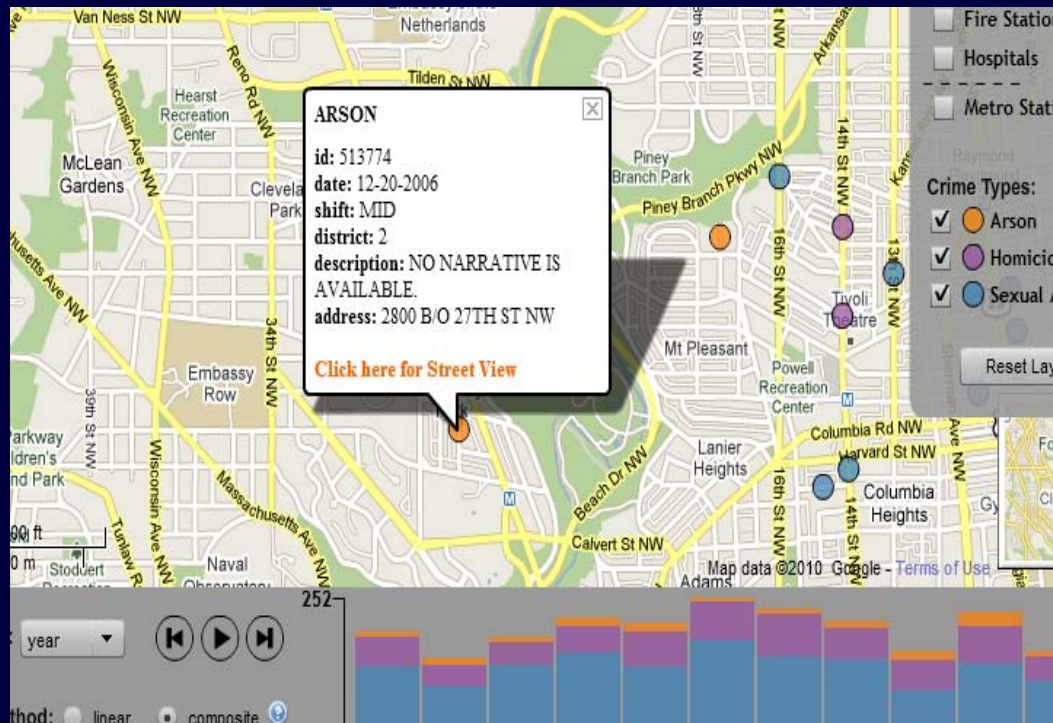
# Risk Assessment Scenario – contd.




Average response time risk profile when station X is closed

# Visual Analytics Uses for Public Safety

- Trend analysis, clustering, anomaly detection
- Interactive, multi-day, month, day, type investigation
- Purpose:
  - Planning for resiliency
  - Long-term analysis
  - Predictive analytics
  - Training
  - Detection
  - Investigation
  - Response
  - Recovery, remediation

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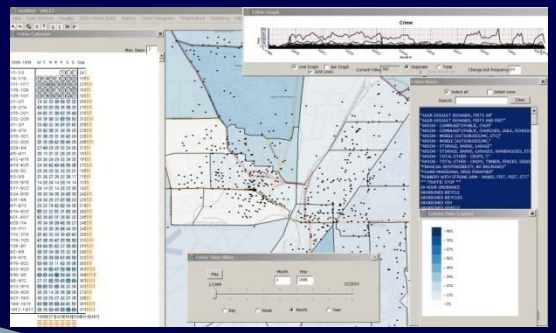
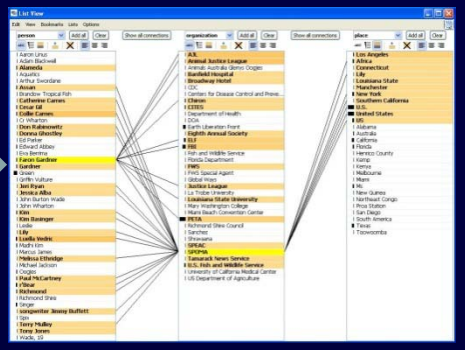
# VACCINE Public Safety Consortium

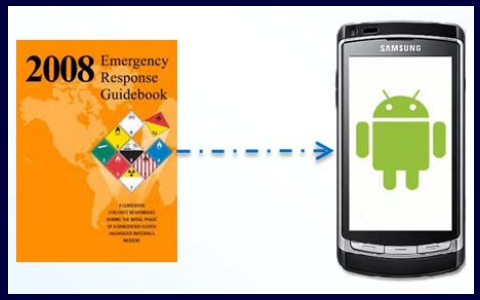


Transition

Transition

Transition





# Technologies in the Transition Cycle

- **VALET -** Visual Analytics Law Enforcement Toolkit
  - Deployed for Test & Evaluation Feedback - 2010
  - Lafayette PD, W. Lafayette PD, Purdue PD, Tippecanoe County Sheriff
- **GARI -** Gang Graffiti Automatic Recognition and Interpretation
  - Initial Prototype Deployment Scheduled May 2011
  - Indianapolis Gang Task Force, Lafayette PD, Purdue PD
- **CGSaRVA -** Coast Guard Search and Rescue Visual Analytics
  - Deployed for Operational Use – USCG LANT - 2010
- **MERGE -** Mobile Emergency Response Guide
  - Initial Prototype Deployment Scheduled May 2011
  - Indianapolis Fire, Lafayette Fire
- **Ulearning (Captico)-** Training portal for S&T and COE Technologies
  - Deployed for Test & Evaluation Feedback - March 2011

# Technologies in the Transition Cycle

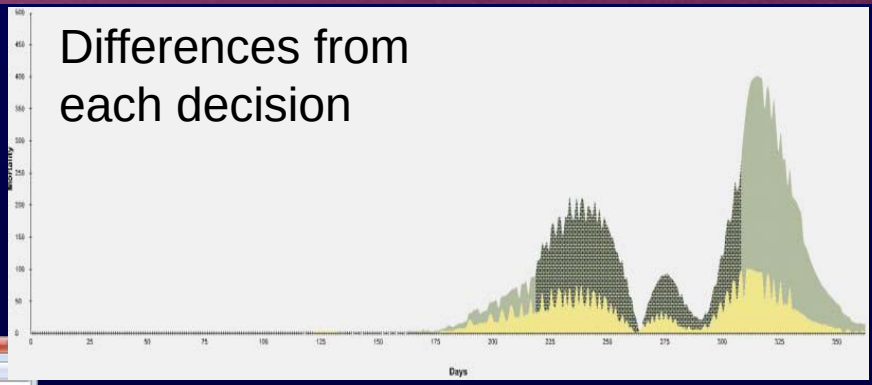
- **JigSaw –** VA for Exploring and Understanding Document Collections (Georgia Tech)
  - Deployed for Test & Evaluation Feedback Dec - 2010
  - Indianapolis PD,
- **PROTECT** - Port Resilience Operational / Tactical Enforcement to Combat Terrorism
  - Collaboration with CREATE
  - Prototype July 26, 2011
- **COE Explorer –** Exploring the Centers of Excellence (Purdue, SFU)
  - Collaboration with CCICADA
- **CrimeViz -** Sensemaking about criminal activity in space and time (Penn St)
  - Testing in progress with Harrisburg PD
  - Prototype deployment planned for Q2 2011 Harrisburg PD, JIBC
- **ISIS -** Infovis System for Investigating Intrusions (Stanford)
  - Awaiting deployment to US CERT

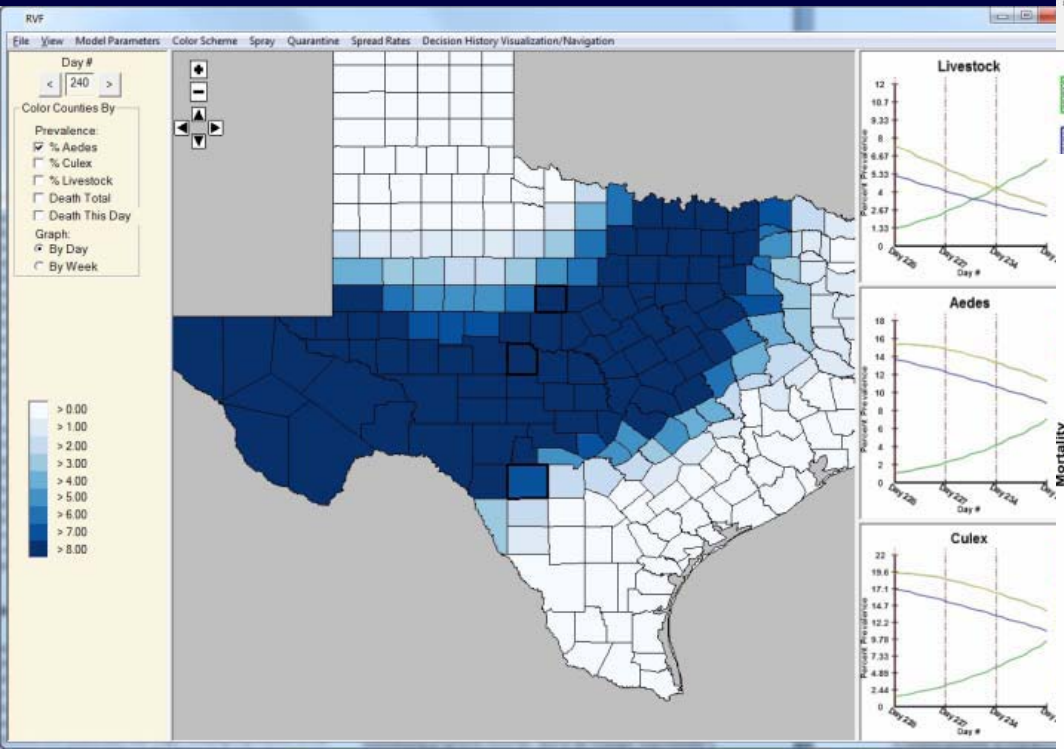
# Some Visual Analytic Examples

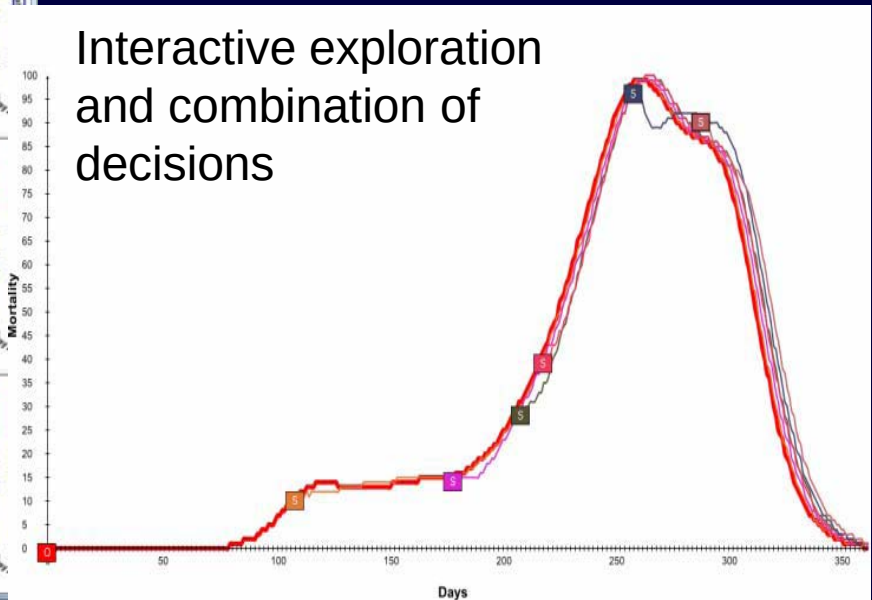
- Integrated predictive models and decision making
- Spatiotemporal visual analytics
- Predictive visual analytics
- Public health and pandemics
- Realtime plume decision support
- Mobile apps

# Example Decision Analysis Linked Displays – Example with 3 Decisions

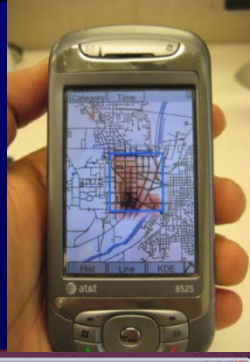
Partnership with FAZD



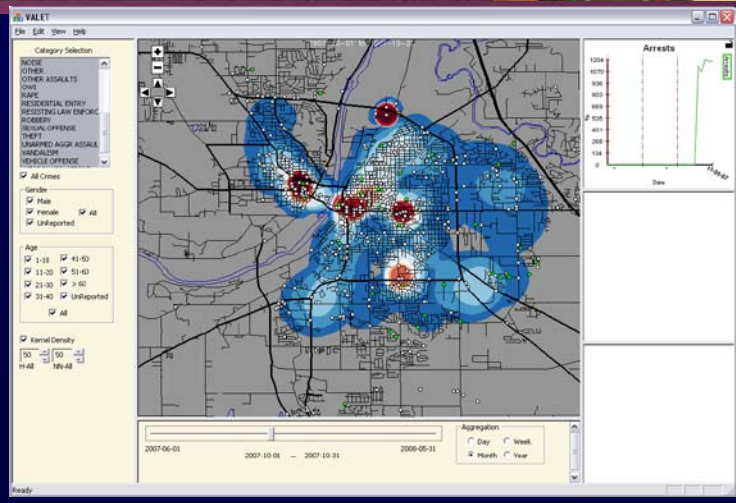



# Scalable Visual Analytics for Law Enforcement



## VALET Toolkit

- Linked statistical and spatial visualization for analysis
- Scalable from desktops to mobile devices for off-field and in-field investigation
- Compare datasets for potential correlations



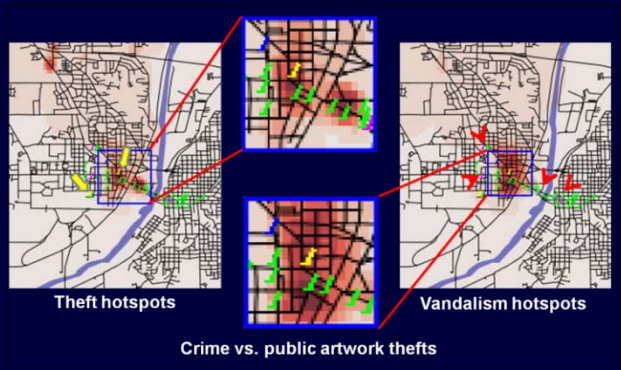

Desktop VALET

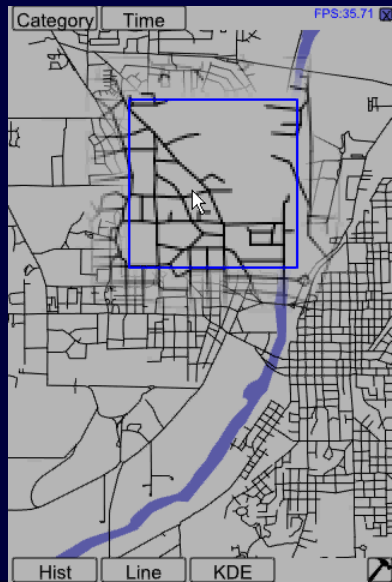
## Datasets:

- West Lafayette – crime, traffic
- Tippecanoe County – arrests, incidents

## Partners: WLPD, LPD, TCSD

Team: Purdue, UNCC, Rutgers, PSU




Mobile VALET

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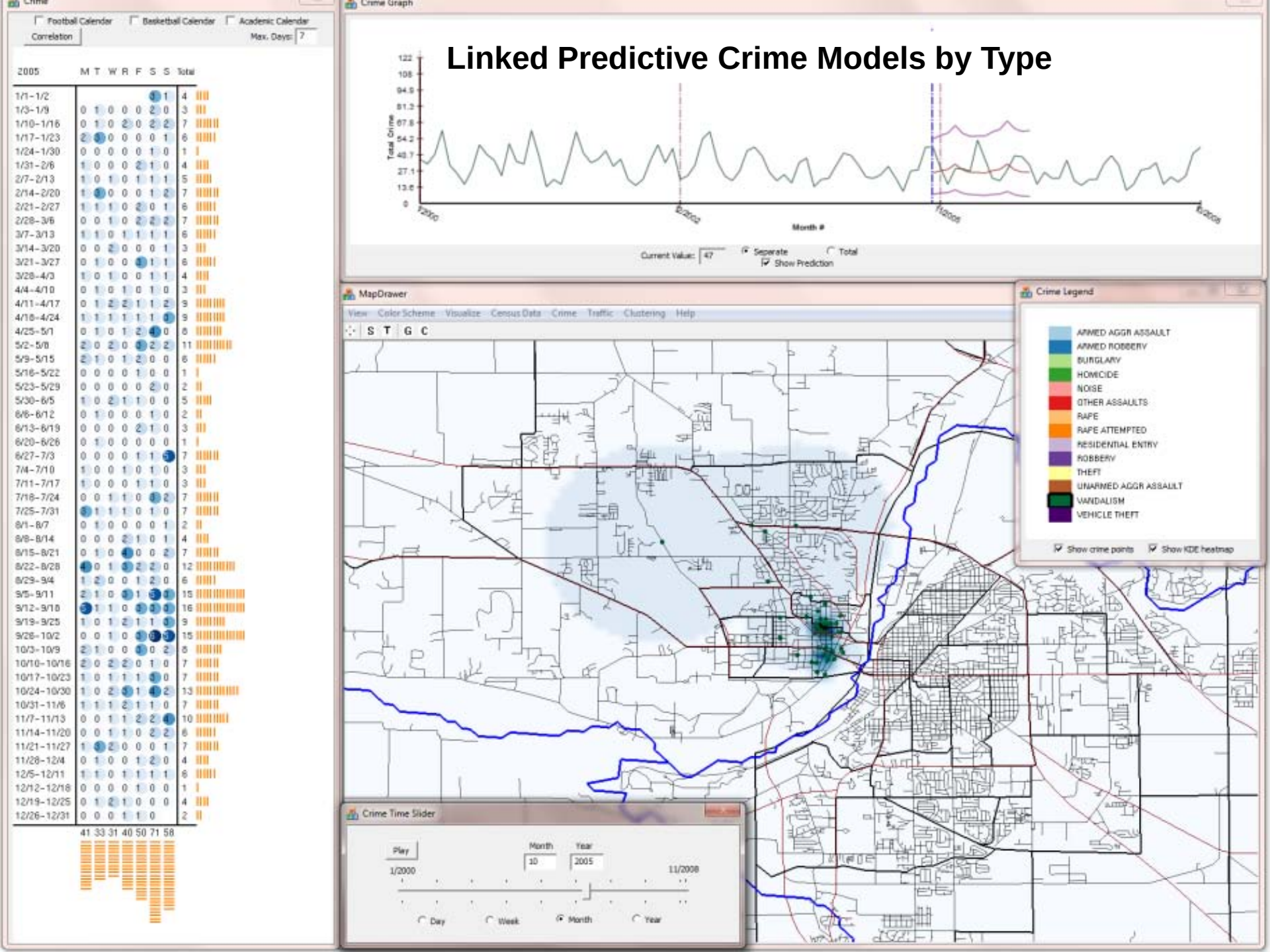
# Linked Predictive Crime Models by Type



# We Have an App For That!

## Our Mobile Tools

- VALET
- Evacuation Planning
- Rosetta Phone
- Hazmat app
- Gang graffiti app
- Tatoo app

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# For Further Information

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