ArcGIS Solutions for Emergency Management: An Overview

Jeff Baranyi
Emergency Management
Promoting safer, less vulnerable communities...

- Create the framework within which communities reduce vulnerability to hazards and cope with disasters.

- Coordinate and integrate all activities … to mitigate against, prepare for, respond to, and recover from … disasters.

...with the capacity to cope with hazards and disasters.
Emergency Managers Face A New Normal

Costs, Size and Frequency of incidents are all increasing
Operations Section
Has the ultimate responsibility for response...

...coordinating all moving parts on an incident.
Esri was founded to help solve some of the world’s most difficult problems.

When disaster strikes, we’re here to support you.
We can help when your capacity is exceeded

Esri Disaster Response Program (DRP)

- ArcGIS Software
- Workflow Implementation
- Geospatial Data
- Technical Support

Request Assistance and Explore Resources:

www.esri.com/disaster

Request Assistance via Email:

disaster_help@esri.com

...to support your organization's response efforts
We support disaster response operations with GIS

For more than 26 years, we’ve provided disaster support worldwide as part of our corporate citizenship

- 1994 Northridge Earthquake
- 1995 Oklahoma City Bombing
- 1997 Hurricane Mitch
- 1998 FEMA Project Impact
- 2001 WTC and Pentagon Attacks
- 2003 Space Shuttle Columbia Disaster
- 2004 La Conchita Laguna Landslides
- 2004 Indian Ocean Tsunami
- 2005 Pakistan Earthquake
- 2006 Indonesian Earthquake
- 2007 Peru Earthquake
- 2007 Niigata Earthquake Japan
- 2008 China Earthquake
- 2009 Australia Bush Fires
- 2009 Influenza A – H1NA Outbreak
- 2010 Haiti Earthquake
- 2010 Chile Earthquake
- 2010 Tennessee Flooding
- 2010 Deepwater Horizon Oil Spill
- 2010 Pakistan Flooding
- 2010 Atlantic Hurricane Season
- 2010 Fourmile Canyon Fire
- 2010 Australia Flooding
- 2011 Spring Tornadoes
- 2011 Japan Earthquake and Tsunami
- 2011 US National Level Exercise
- 2011 Thailand Flooding
- 2011 Turkey Earthquake
- 2012 Duluth (MN) Flooding
- 2012 Philippines Flooding
- 2012 Hurricane Sandy
- 2013 Boston Marathon Bombing
- 2013 West Text Explosion
- 2013 Colorado Flooding
- 2013 Typhoon Yolanda/Haiyan
- 2014 Washington Mudslide
- 2014 CUSEC CAPSTONE Exercise
- 2014 Napa Earthquake
- 2014 MH17
- 2014 Ebola Outbreak
- 2015 Nepal Earthquake
- 2015 South Carolina Flooding
- 2015 Flint Water Crisis
- 2015 European Refugee Crisis
- 2016 Texas Flooding
- 2016 Wisconsin Flooding
- 2016 Louisiana Flooding
- 2016 Hurricane Matthew
- 2016 Gatlinburg / Southeast Fires
- 2017 Louisiana Tornadoes
- 2017 Atlanta I-85 Collapse
- 2017 Polio Outbreak
- 2017 Peak 2 Fire
- 2017 Hurricane Harvey
- 2017 Hurricane Irma
- 2017 Hurricane Maria
- 2017 Hurricane Nate
- 2017 Northern California Wildfires
- 2017 Southern California Wildfires
- 2018 North East “Bomb Cyclones”
- 2018 California Wildfires
- 2018 Columbia Gas Explosion
- 2018 Hurricane Florence
- 2018 Hurricane Michael
- 2019 Spring Flooding
- 2019 Hurricane Dorian
Internally, Organizations Are Challenged

Latency and lack of actionable information...

- Paper Processes that Do Not Scale
- Silo Point Solutions
- Limited Staff Resources
- Difficulty controlling the public message

...puts mission critical decision at risk.
We can help you prepare in advance
Common operational challenges

• Understand the potential impact from an incident
• Estimate and deploy limited resources
• Monitor rapidly changing conditions
• Assess and report damage
• Provide real-time operational briefs
• Communicate effectively with the public and media
Maintain Situational Awareness
Monitor changing conditions. Put your plan into action. Brief your team in real-time.
Conduct Damage Assessment
Understand potential impact. Conduct damage assessments. Monitor reporting thresholds for your disaster declaration.
Manage Public Information
Disseminate critical information that raises awareness and drives action.
An Complete and Integrated System
Supporting Emergency Management Operations

Maintain Situational Awareness
Conduct Damage Assessment
Manage Public Information

...that enables mission critical decisions that can save lives and property.
Why chose Esri to implement this solution?

Maximize the value of your investment...

- Reduce deployment time and the burden on your staff.
- Access technology experts that know how to help solve your challenges.
- Connect with other Emergency Management leaders through our extensive network.

... and get results more quickly.
Demonstration
Deploy the Solution Templates for Operations using the Deployment Tools

http://solutions.arcgis.com/shared/help/deployment-tool
The results of this operation lays down the apps, maps, and feature services.
Situational Awareness – Cal OES – Wildfires Summer

Cal OES displays current information on the wildfire situation using a series of dashboards in their command center to help them monitor and convey the status of the fire situation in California so they can make more informed decisions that can save lives and property.
Know Your Zone apps
City of New Bern, NC

Zombie Infestation (EXERCISE)
Community Lifelines
Chris Vaughan – FEMA GIO
Community Lifelines

A CONSTRUCT FOR OBJECTIVES-BASED STABILIZATION EFFORTS

A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security.

- Lifelines are the most fundamental services in the community that when stabilized enable all other aspects of society.
- Lifelines exist during steady-state and are normally provided by sources organic to the community.
- When disrupted, decisive intervention (e.g., rapid service re-establishment or employment of contingency response solutions) is required.
# Key Datasets for Lifelines

## Built Environment
- Power Plants
- Retail Gas Stations
- Crude production
- Petroleum refineries
- Natural Gas facilities
- Petroleum Terminals
- Electric Substations
- Shelters
- Home Improvement Stores
- Grocery Stores
- Hotels / Lodging
- Distribution Facilities
- Crop & Animal Production
- Residential/Mobile Home Park
- Wastewater Plant
- Water Treatment Plant
- Nursing Home
- Blood Banks
- Pharmacies
- Hospital / Urgent Care
- EMS Stations
- Dialysis & Burn Centers
- Landfill / Superfund Sites

## Energy
- Nuclear Plants
- Toxic Release Facility
- Chemical Facilities
- Biological Facilities

## Food/Water/Shelter
- Food/Water/Shelter

## Health/Medical
- Health/Medical

## Hazmat
- Hazmat

## Primary Data Source
- HIFLD (Open & Secure)
- USDA
- Esri
- US EPA
- US Census
- HHS

## Demographic, Social Vulnerability, and Insurance Coverage
- Population
- Housing Units
- Total Households
- Average Household Size
- Population under Age 5
- Population over Age 65
- Population under 18
- Percent Disabled
- Household with one disable person

## Economic Indicators
- Manufacturing
- Distribution Centers
- County GDP per Capita
- Below Poverty Rate (%)
- Persistent Poverty Total (Yes/No)
- Persistent Poverty Child (Yes/No)
- Unemployment Rate
- Median Household Income
- Median Home Price
- Historic IA Registration Total
- Retail
- State & Local Gov’t Finances

## Common data:
- HAZUS, THIRA, NFIP, Response, Recovery (IA/PA)

- HIFLD data is the primary source used for the built environment. There are inherent currency and accuracy (Geospatial & Attribution) issues identified within this national foundational catalog. Please reference back to HIFLD metadata catalog for specific layer information.
- Variable list will expand as requirements change with lifeline maturity.
DATA | Steady State & Operational Data integration

Steady-state “foundational” data via authoritative Bounded Crowd (FLSTT)

Disaster Models

Crowdsourcing

Imagery

Crisis Management Systems

Mobile Applications

Transactionally (Event-based)
- Authoritative reporting (WebEOC)
- Volunteer Geographic Information
- Field Observations (mobile apps)

Back to “Foundational” Data

Requirements:
- Building outlines with unique FID
- Unifying Schema
- Interdependency
- Resilience
STEP 7: CALCULATE CASCADING IMPACT

Example: Static data for Transportation lifeline
- Highways: Total length
- Roads and street network: Total length
- Airports: # of points
- Bus stations: # of points
- Railroads: Total length
- Railroad station: # of points

HIFLD, HSIP

Number of points, total length of lines, total area of polygons

<table>
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<tr>
<th>Lifeline</th>
<th>Potential impact</th>
<th>Actual impact</th>
<th>Predicted impacts</th>
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<tr>
<td>Energy</td>
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<tr>
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<td>3</td>
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<tr>
<td>Safety &amp; Security</td>
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<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Calculate lifeline impact (either actual or predicted)
US NATIONAL GRID (USNG) DIVISION:
A STANDARD VISUAL OUTPUT FOR AT-RISK AREAS

THE U.S. NATIONAL GRID

A standardized grid reference system that is seamless across jurisdictional boundaries. Used as a common geographic framework for response.

USNG 1 Km Grid Cells
USNG 5 Km Grid Cells
CONOPS | Prioritizing Operational Support and Resource Requirements

Conceptual Model Framework

- Hazard and intensity
- Structural Impacts
- Remote Sensing

Results: 48-24hrs pre landfall

Estimated Resource Requirements:

Results

Trend Analysis:

- Built Environment
- Damage Functions
- Modeling
- Population vulnerability
- Exposure and impacts

Results: 24-72hrs post landfall

- Hazard and intensity
- Built Environment
- Remote Sensing

Damage Functions

American Community Survey

- Wind
- Riverine Flooding

CONOPS

Prioritizing Operational Support and Resource Requirements

Estimated Resource Requirements:

Results

Trend Analysis:
Predictive output that displays areas of greatest risk based on:
• Social vulnerability
• Population
• Building location and types
• Hazard data

Assist in guiding the photo collection for field teams and aerial imagery.

Determine areas where FEMA should focus their efforts.
Guanica Case Study | Ground Photos

Crowdsourcing

US&R

CAP

FEMA

2020 Disasters Crowdsourced Photo Gallery

2020 Guanica

Image Metadata

Date: 15/01/2020

Location: Guanica

Image Name: GUANICA_20200115_103015.jpg

GIS Information

EPSG: 3354

View Image
Guanica Case Study | Air Photos

- CAP UAS Photos
- CAP UAS LiDAR
- Hand-held
- Pod-based oblique imagery

Potential Damage to Sewage Treatment Plant, Guanica, PR

Area of enlarged photos

Potential Buckling/Damage

Image: CAP/WaldoAir, c. Jan 21 2020
Guanica Case Study | Satellite

Coliseo Mariano
Tito Rodriguez
Base Camp

Source: HM0476-18-C-0044, © Year, Planet Labs Inc
Future | Artificial Intelligence: Object Detection
Welcome to the Puerto Rico Earthquake hub. We developed this site to help you find all of the apps, maps and data associated with this incident. FEMA and our federal partners use geospatial tools and methods to estimate and measure impacts, which allows all of us to make well-informed and timely decisions.

Cover image by the US Geological Survey.
Print Your Certificate of Attendance

Print Stations Located in 150 Concourse Lobby

Tuesday
12:30 pm – 6:30 pm
Expo
Hall B

5:15 pm – 6:30 pm
Expo Social
Hall B

Wednesday
10:45 am – 5:15 pm
Expo
Hall B

6:30 pm – 9:30 pm
Networking Reception
Smithsonian National Museum of Natural History
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