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Remote Sensing and Incident Support

Department of Homeland Security

February 22, 2013



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Introductions and Goals

Today's Webcast will be Presented by:

Chris Barnard – DHS Remote Sensing Advisor

Chris Vaughan – FEMA Geospatial Information Officer

- The goal of today's meeting is to familiarize participants with the principles of remote sensing.
- Solicit thoughts and recommendations from participants on ways to expand the use of remote sensing for incident response.
- Provide participants with information where Federal partners publish remote sensing data during emergency incidents.

Agenda

- Remote Sensing 101
- The efficacy of remote sensing to support incident response
- DHS remote sensing landscape
- Remote sensing and the Inter-agency GeoCONOPS
- DHS current approaches to remote sensing
- DHS S&T contributions – Remote Sensing Users Study
- Remote Sensing Resources
- Questions and discussion

Value of Remote Sensing

- Provides synoptic view of the affected area
- Provides the ability to make accurate measurements and estimates over a large area
- Data can be collected when access is blocked by water or debris
- Provides a detailed record of conditions
- Can be easily combined with other data layers in the GIS environment
- Is comparatively easy to share (and getting easier)

Remote Sensing 101

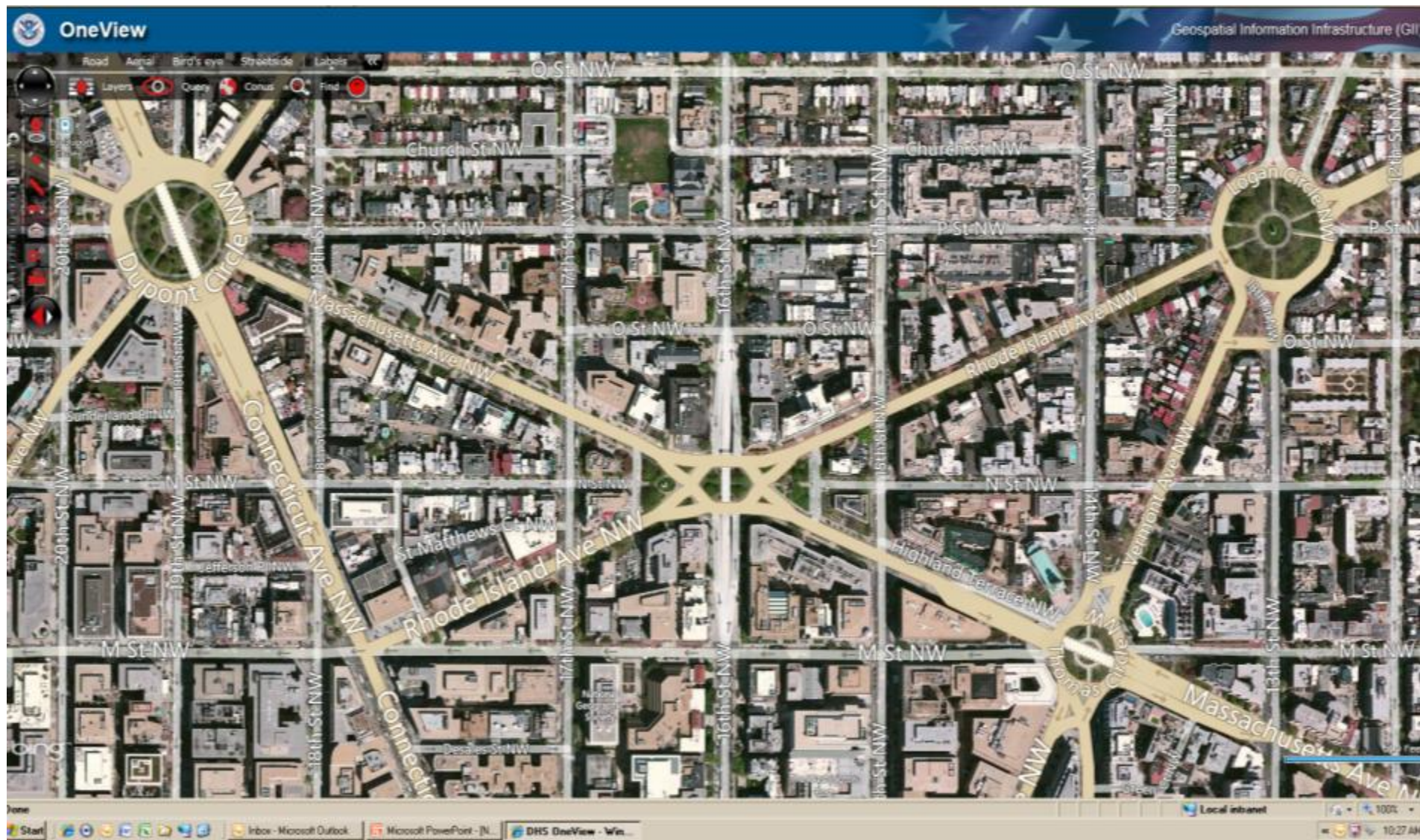
- Remote sensing is a growing and dynamic area encompassing a growing number of sources.
- Remote sensing information can include imagery, elevation information (lidar or IFSAR), video, thermal or other types of sensors
- Remote sensing can also include imagery collected by individuals, stationary cameras, vehicles and drones.
- Imagery must be processed to accurately reference a location on the earth's surface (georeferencing) to be usable in GIS systems.



Remote Sensing Basics

- In order for the imagery/data to be geographically accurate, you need the following:
 - One or more known points on the ground (by surveys)
 - Accurate location of the camera at the instant of exposure
 - Attitude and orientation of the camera at the instant of exposure
 - Accurate measurement of the terrain in the area of the photograph
- Given these inputs, a raw image can be processed to accurately portray locations on the ground

Orthophotography



Aerial Oblique Imagery



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Oblique Imagery for Law Enforcement



Calexico, California



Nogales, Arizona



Commercial Satellite



2008 Presidential Inauguration



Aircraft - Vertical



Bing Maps.



Surdex Corp.



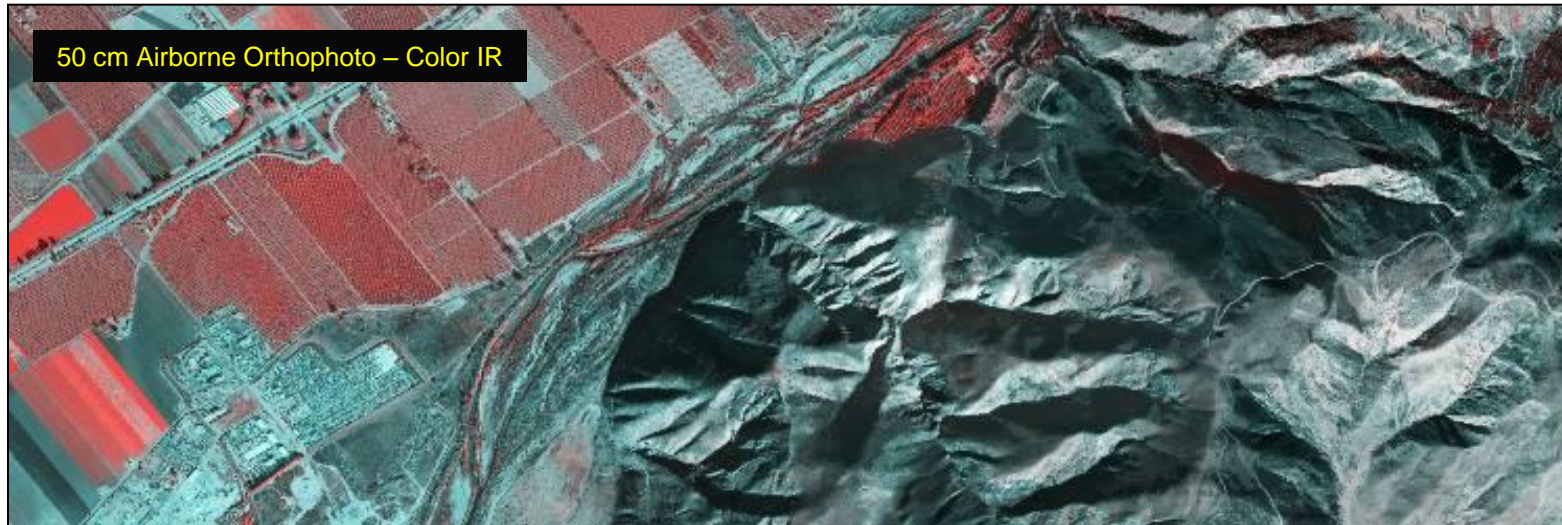
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False Color Infrared and Natural Color

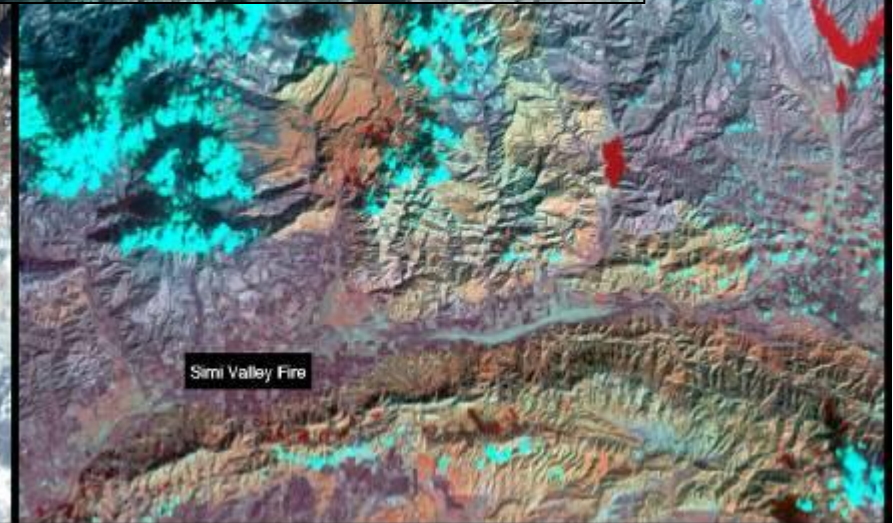


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Multispectral imagery



0.0um 2.1um 1.65um



NASA ER-2 1 November 2003 17:30 GMT

MASTER (MODIS / ASTER Airborne Simulator)



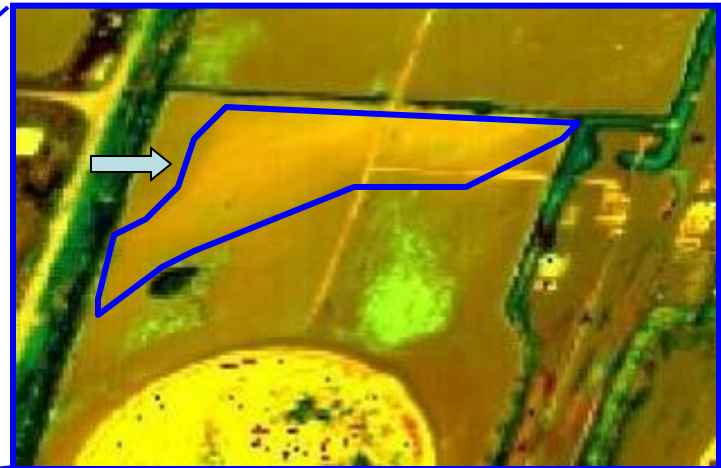
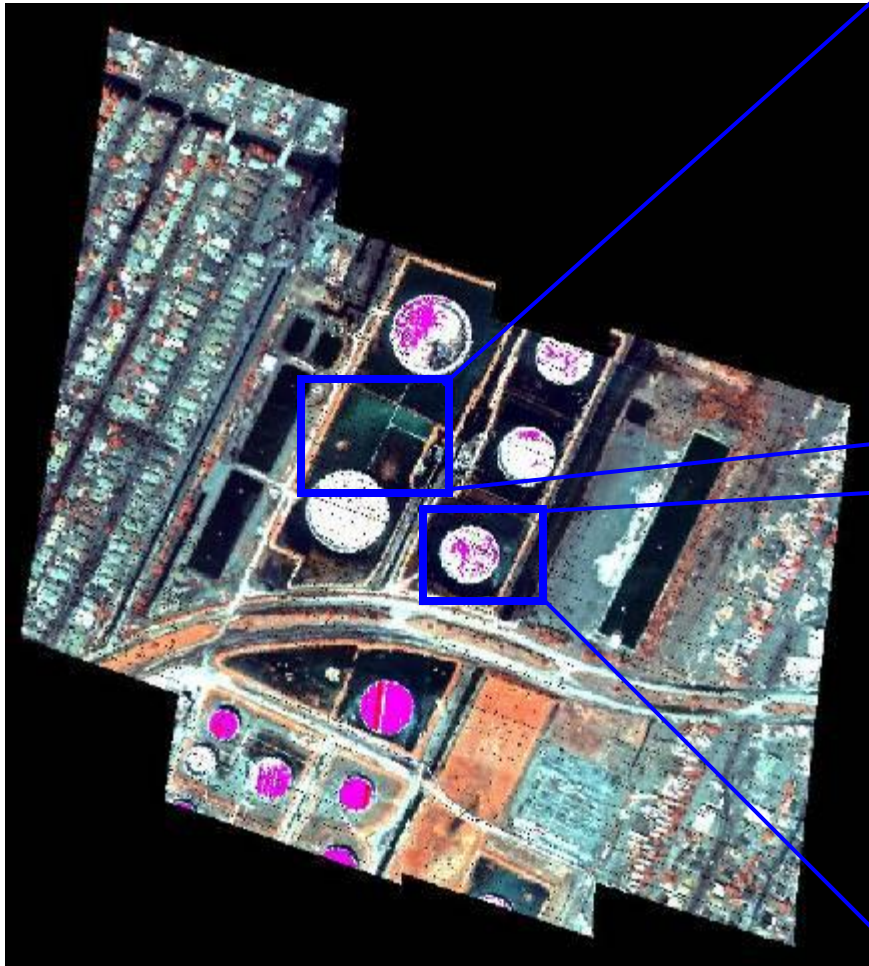
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Hyperspectral

HHT 150 MURPHY OIL REFINERY, MAREUX, LA
GEO: 29°56'20"N / 89°56'15"W MGRS: 16RCU5702257737
IMAGE ID: 2005-09-08_18-51-32_HSI_CAL0_0
TOT: 1351 Local DATE: 20-SEP-05 SENSOR TYPE: SPECTRAL



Hydrocarbons within Bermed area

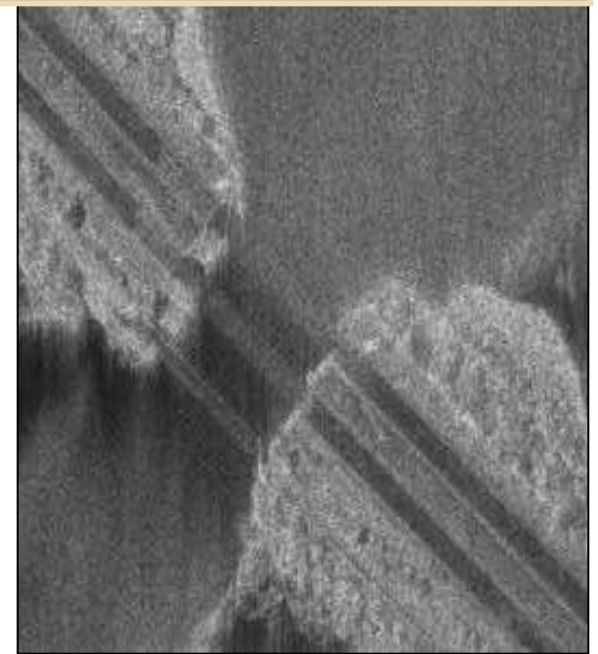
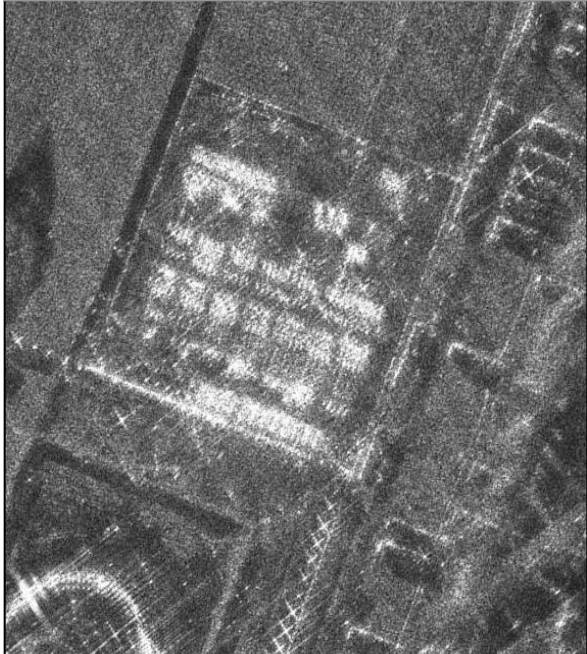


Analyst Name: Belinda McKinney, NASIC

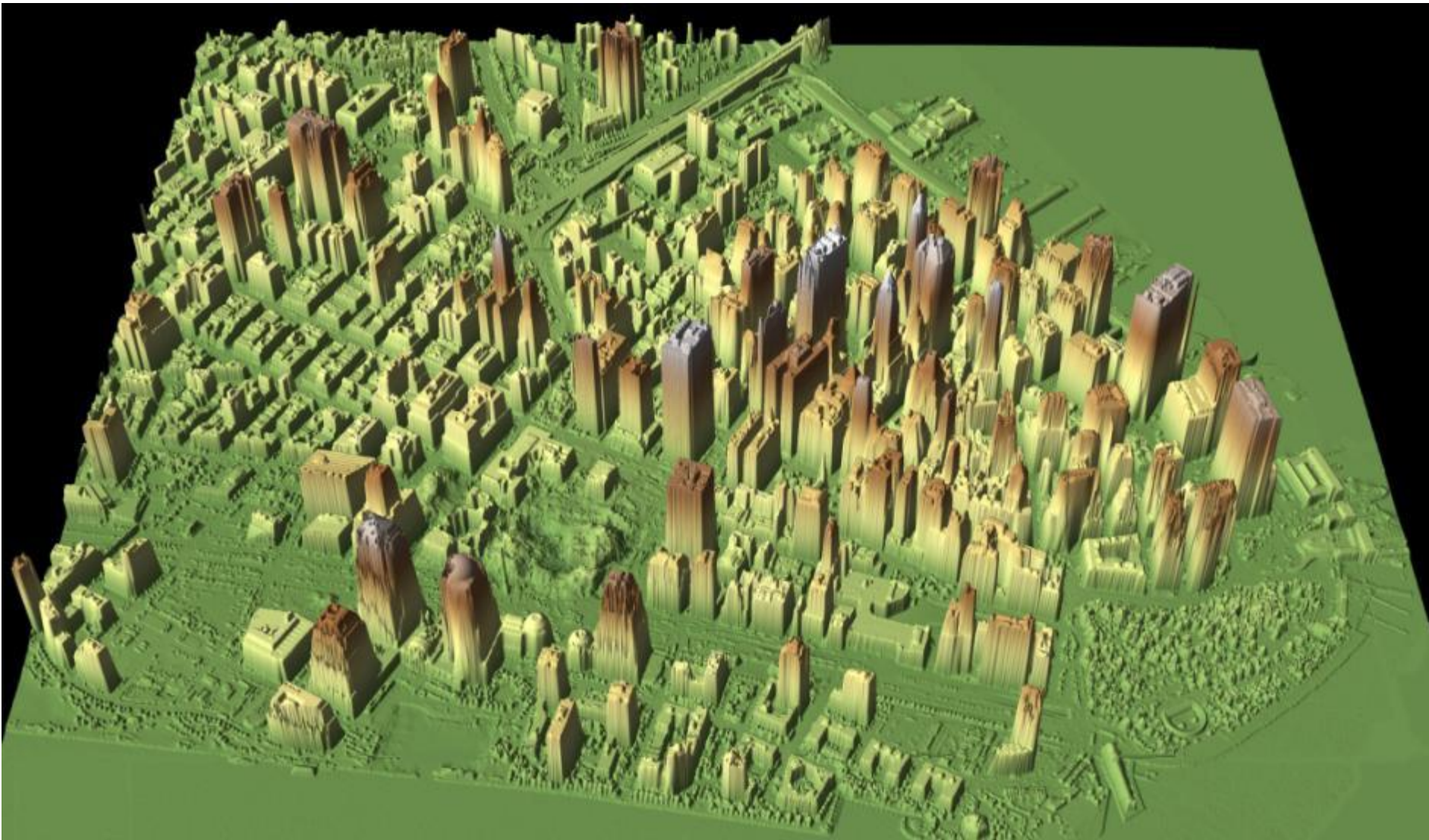


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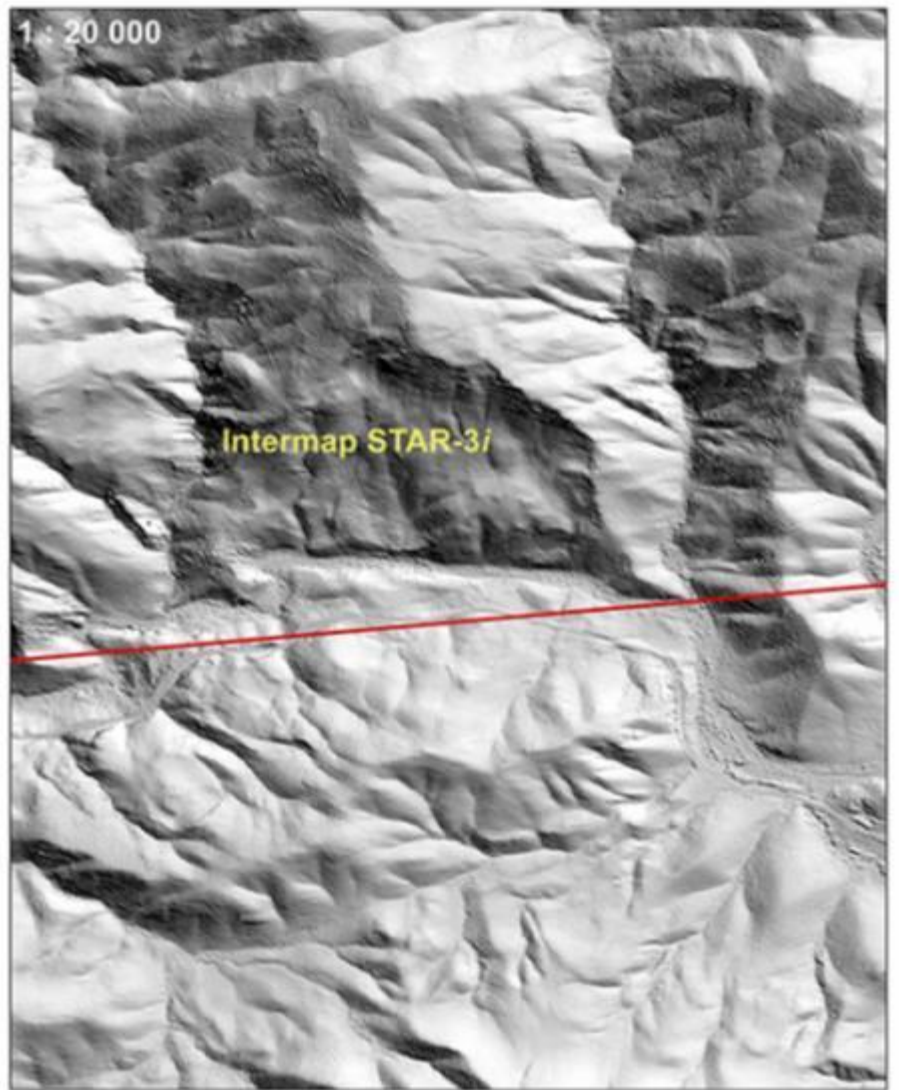
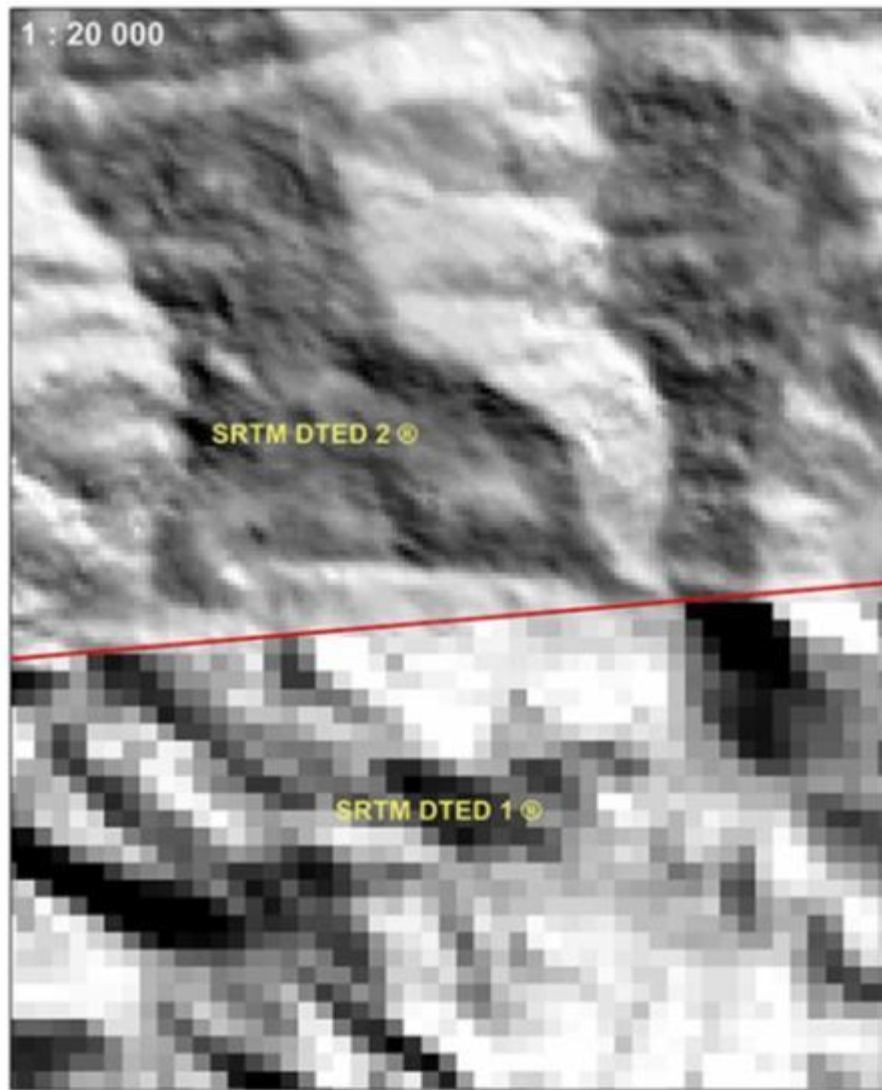
Video and Radar



Lidar

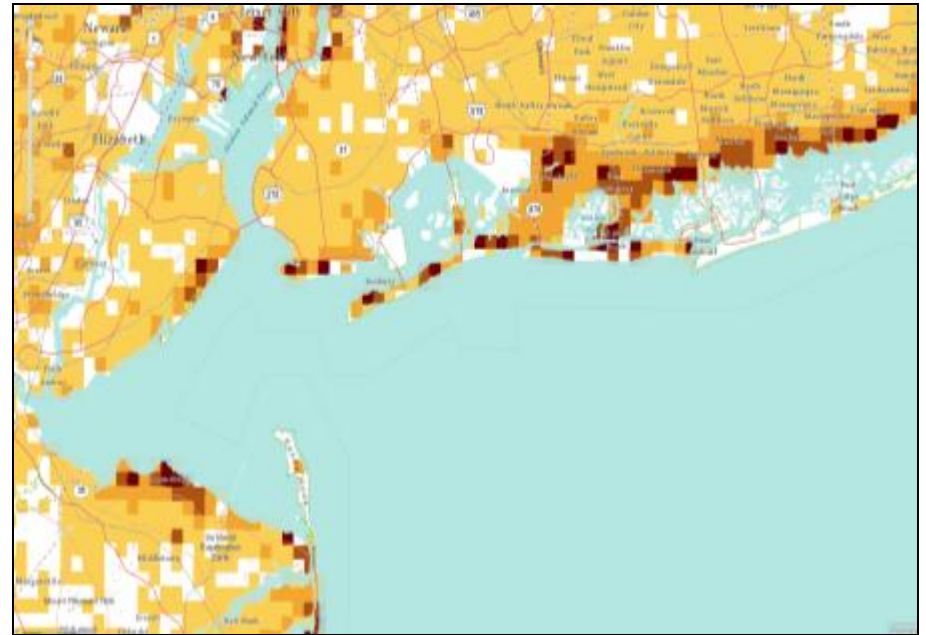


Synthetic Aperture Radar



More Things that you will Need

- Define the Area(s) of Interest – these can be points or areas.
- How much detail do you need to see?
- How accurate does the map need to be?
- How quickly do you need the information?
- Do you want to see just the picture or do you want someone to extract information from the photo?
- Do you need to share the imagery with anyone else?



DHS Remote Sensing Landscape

- DHS has capabilities for remote sensing which are mission-focused.
- DHS has 22 components with emergency and non-emergency imagery requirements.
- FEMA is designated as the lead federal agency during Stafford Act declarations.
- Several DHS missions have airborne capabilities
- DHS is primarily a consumer of imagery/products
- The issues and barriers that exist with the effective use of remote sensing are a result of the maturity of the geospatial community rather than technology gaps.

DHS Remote Sensing Landscape

Some Major Issues

- Effective Use of Social Media and Crowd Sourcing
- Leveraging the Mobile Environment
- Effective Sharing of Mission Information
- Dealing Effectively with Public and Restricted Information
- Making it Easy to Search for and Incorporate External Information
- Filtering the Noise During a Major Incident

Remote Sensing and FEMA

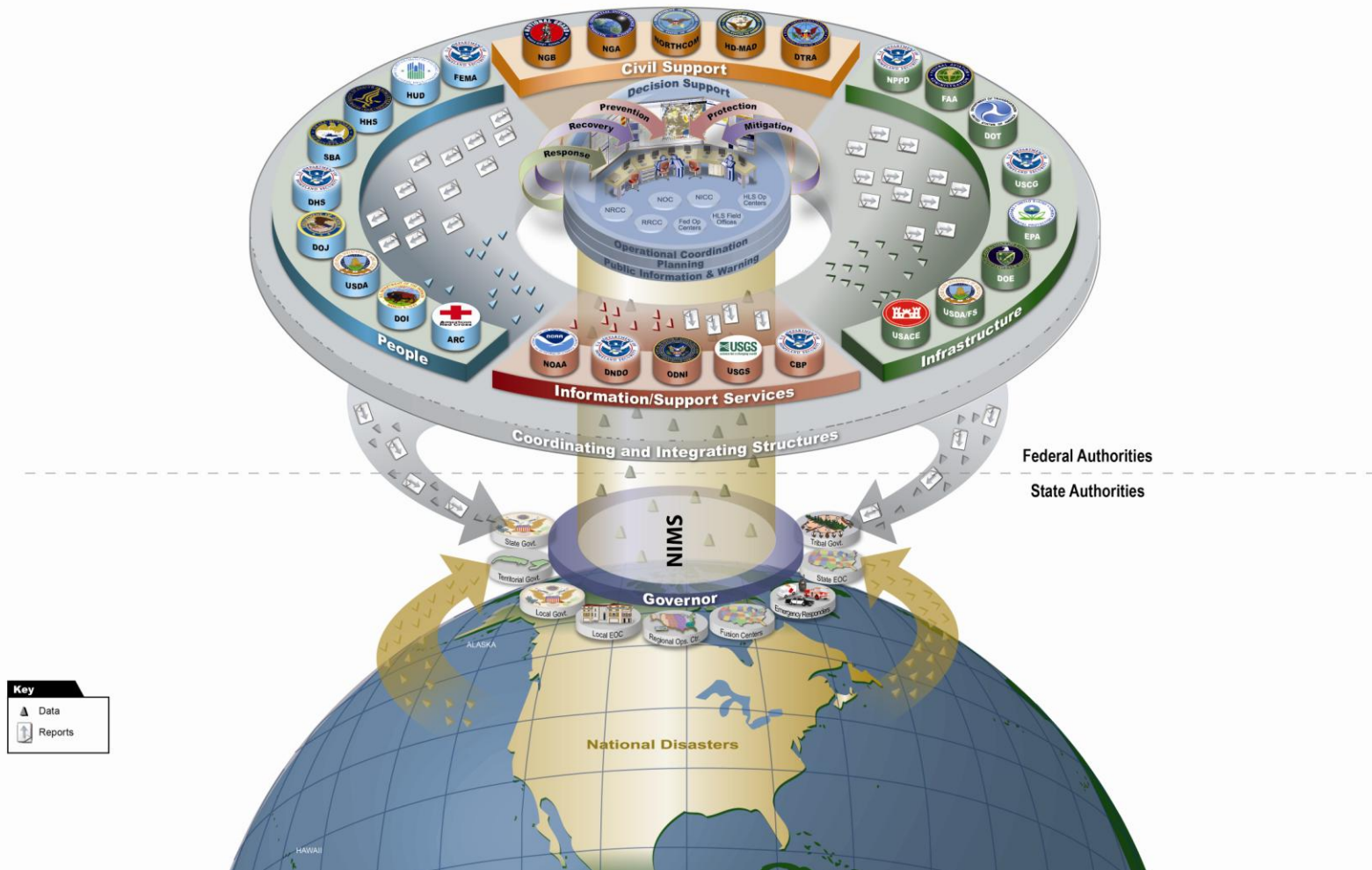
Perspective from Superstorm Sandy

- Effective Coordination and Information Sharing:
 - First Responders
 - State Emergency Operations Centers
 - FEMA Joint Field Offices
 - FEMA Regional Offices
 - FEMA Deployed Support Personnel
- Use of predictive models to direct resources and prioritize response and recovery missions.
- Leverage of interagency partner information

Geospatial Concepts of Operations (GeoCONOPS)

Geospatial CONOPS Community Model

04/16/12



GEOCONOPS as a instrument to....

- Improve coordination and de-conflict mission overlap
- Refine SOPs and clarify operational needs
- Go beyond product and map production toward dynamic data feeds, more real-time situational awareness, and reliable impact assessments
- Fill data gaps and improve information sharing
- Stimulate innovation and operational excellence through common understanding and awareness



GeoConOps Validation – National Level Exercise

NESC Mission: To enhance the Department's all-hazards preparedness and response mission through the promotion of **effective and efficient** large-scale exercises and the application of modeling and simulation to these exercises.

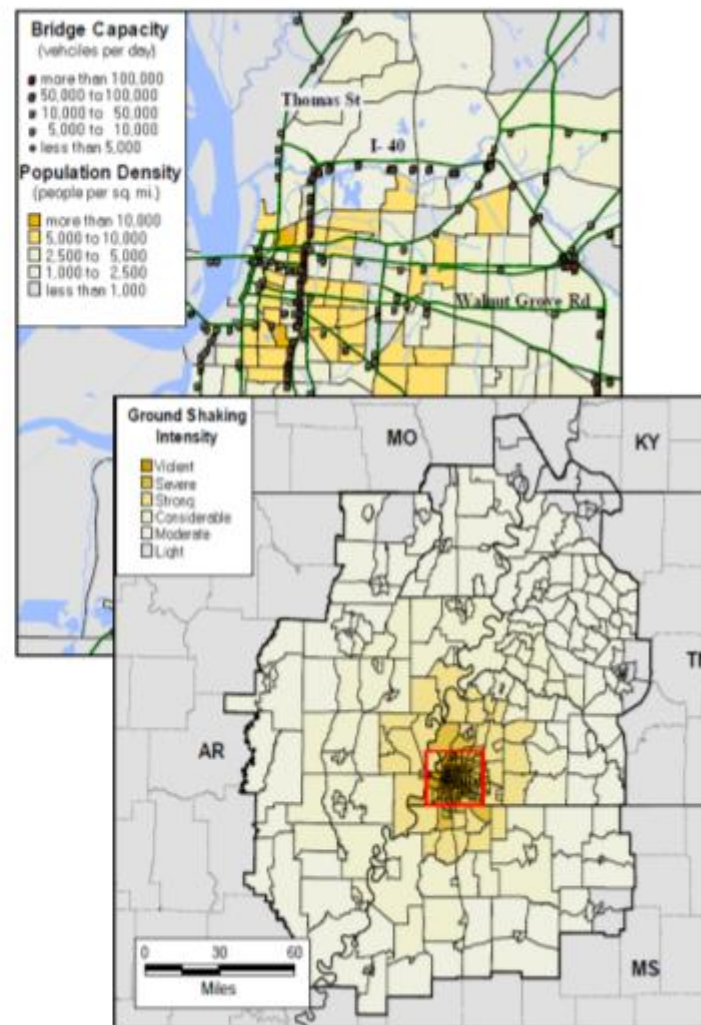
#1 Challenge: Change the Culture of Exercises – introduce Modeling & Simulation as a way of increasing efficiency and creating higher yield metric based exercises (e.g. run/rerun)

New Madrid Earthquake Scenario

- Magnitude 6.5
- Epicenter in Downtown Memphis
- 5 State Region
- Impact to multiple FEMA Regions
- Debilitating to the heavily impacted communities

GeoCONOPS Applied:

- Observe Geospatial Activities
- Support Simulation Cell
- Observe the Federal mission partner operations
- Validate/Verify Geospatial:
 - Activities
 - Roles
 - Information requests
 - Information sharing



Remote Sensing and the GeoCONOPS

- Develop SOPs for Product Types and Delivery Schedules to Support Different Types of Incidents
- Assist the Community to Define Standard Imagery Products for Different Incident Types.
- Assist the Community to Develop Best Practices to Share Information.



Component Requirements Matrix

		FEMA					USCG		CBP		USCIS	USSS	NPPD	TSA	DNDO	
Specification		US&R	IA	PA	Mitigation	Debris	Blue Roof	SAR	Port Security	OBP	OFO			IP		
Georeference																
	Projected		X	X	X	X	X		X	X	X	X	X	X	X	X
	Units (Feet/Meters)															
	Accuracy (+/- Feet)	20	2	5	20	20	5	20	2	15	15	5	5	5	5	5
Orientation																
	Vertical	X		X	X	X	X	X	X	X	X	X	X	X	X	X
	Oblique		X		X								X	X		
Spatial Resolution (inches)																
	6"		X						X		X		X	X		
	12"	X		X	X	X	X			X	X	X			X	X
	>36"							X		X	X					
Clarity																
	Cloud Free	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Type																
	Natural Color	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	FCIR				X					X	X			X		
	Pan													X		
Image Processing																
	Ortho		X	X	X	X	X		X	X	X	X	X	X	X	X
	Rectification Only	X						X								
	Seamless				X				X	X	X	X	X	X		
Dissemination																
	KML			X	X		X		X	X	X	X	X	X	X	X
	Web Mapping Service		X		X			X		X	X					
	FTP	X	X	X	X	X	X							X		
	Portable Disk		X		X				X	X	X	X	X		X	X
Format																
	GeoTIF	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	JPEG 2000									X	X			X		
	NITF															
	Mosaic		X	X	X	X			X	X	X	X	X	X	X	
	Tile	X			X		X	X		X	X					
Documentation																
	Metadata	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Archive				X									X		
Turnaround (Hours)																
	Pre-Incident								>72	>72	>72		>72		>72	>72
	Post-Incident	6	48	48	>72	48	48	6		>72	>72	48		48		



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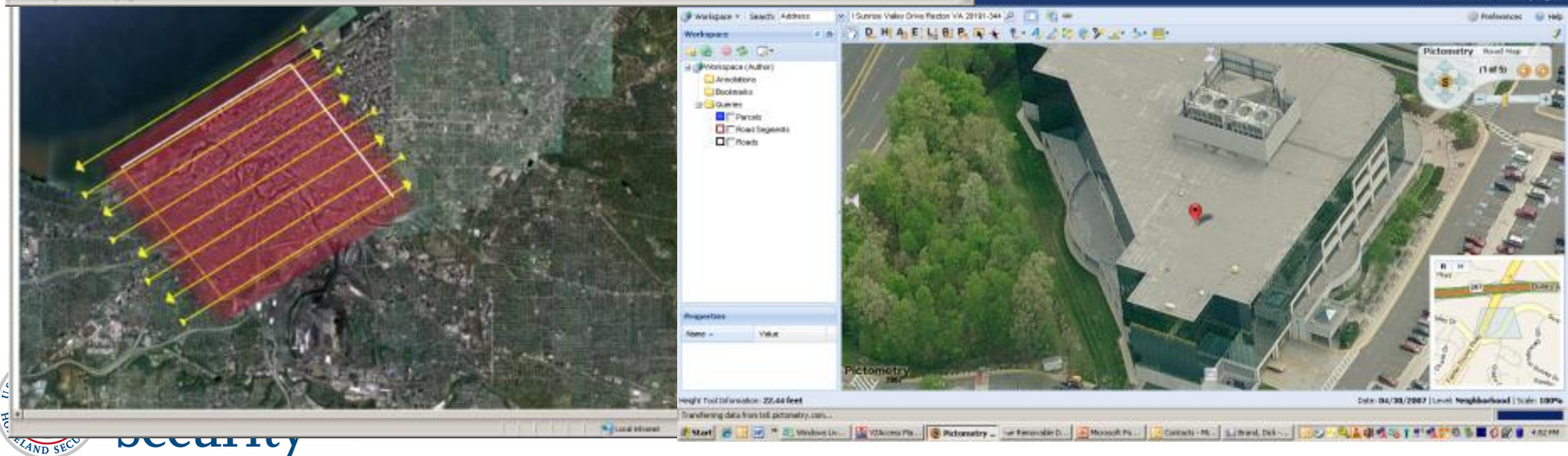
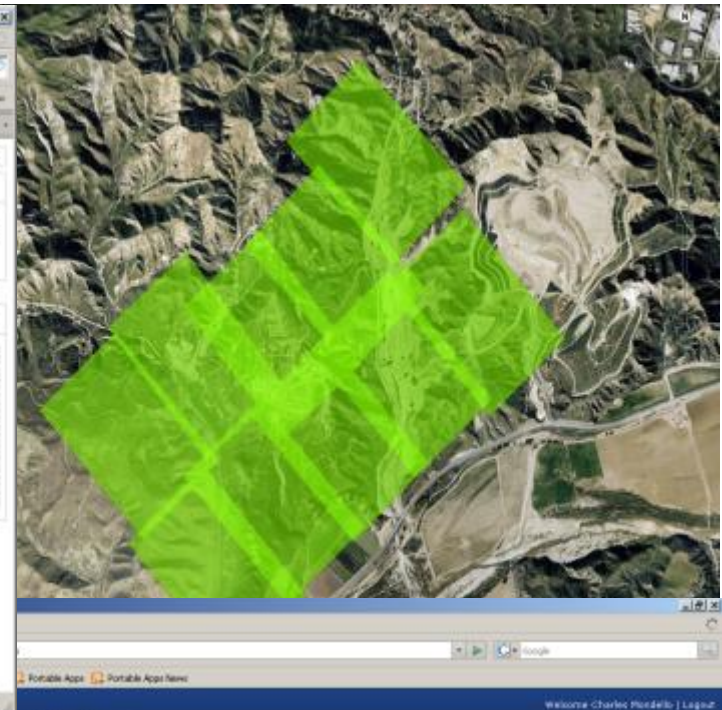
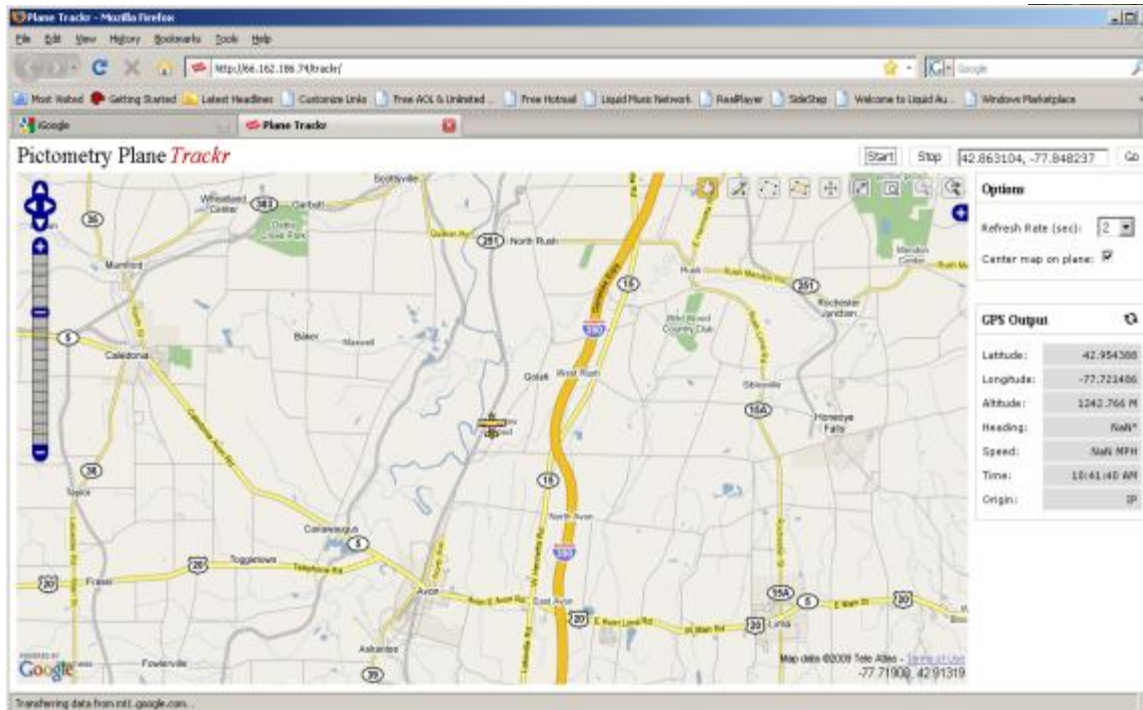
DHS Approach to Remote Sensing

- Leverage interagency licenses for commercial satellite information
- Invoke the International Charter when applicable
- Utilize commercial content providers including Microsoft, Google and Esri.
- Enterprise professional services contracts for specialized airborne collections.
- Coordinate with local government agencies to identify current, high resolution imagery for pre-event planning.
- Coordinate with federal partners to obtain post-event imagery.

DHS S&T Support – Real-Time Access



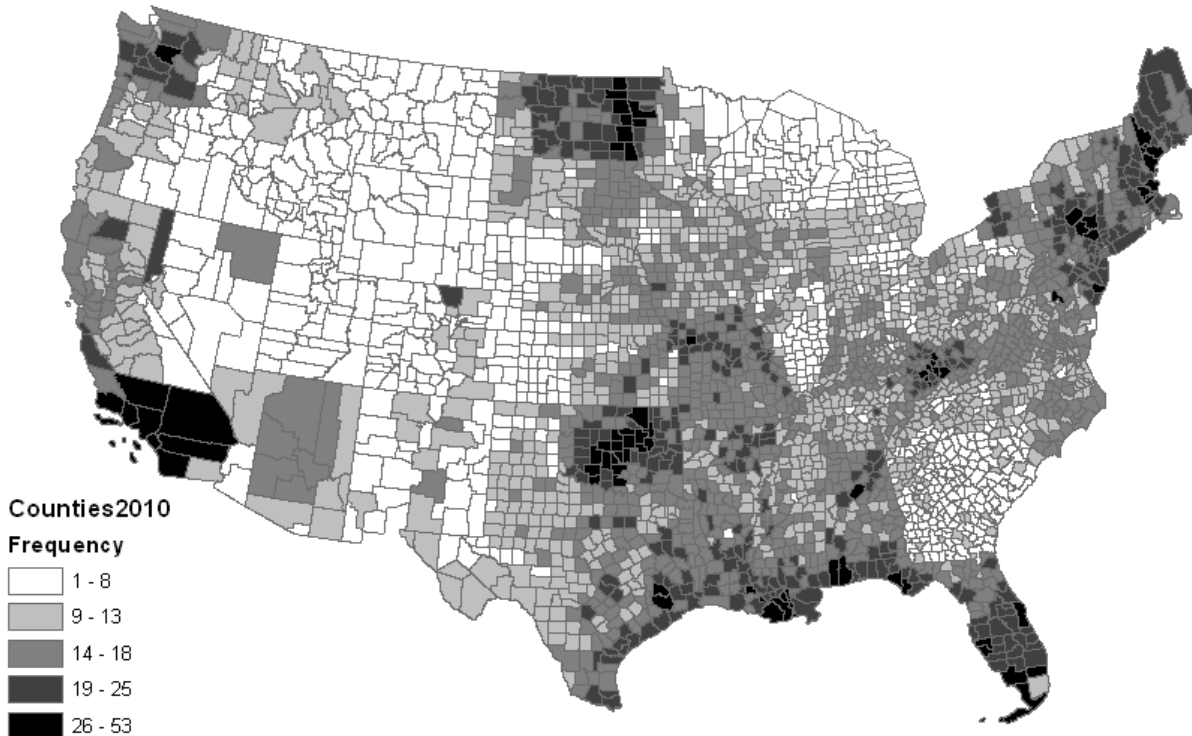
Real Time tracking and Flight Planning



State and Local Expectations for Remote Sensing

DHS Science and Technology Directorate sponsored a survey in 2010. A total of 475 counties responded which represents 14.7% of counties nationwide

Frequency of Disaster Declarations by County



Geospatial and Remote Sensing Data Use
By States and Counties in Disaster Response:

A Nationwide Survey

A Nationwide Survey sponsored by the Department of Homeland Security, Science and Technology Directorate

Authored by:
Michael E. Hodgson, Sarah E. Batterby, Shufan Liu, and Leanne Sulevski

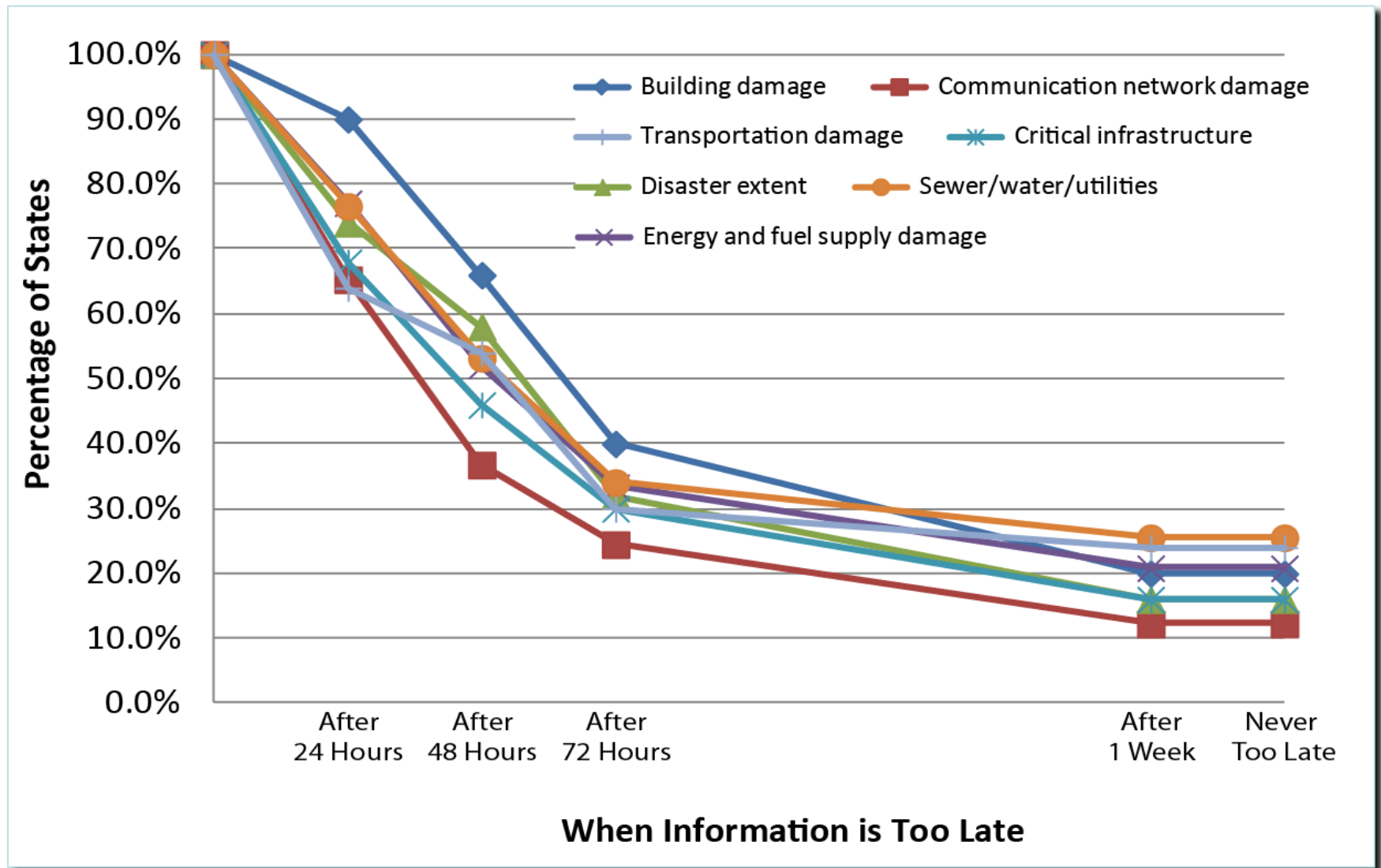
Remote Sensing is Important

Select the three types of baseline data (pre-event) that you feel have the **HIGHEST** priority to have high quality data for in the response and/or recovery phases following a disaster:

FEMA region	RESPONSE (percent)													N
	Building footprints	Building/parcel characteristics	Communications networks	Energy and fuel supplies	Critical infrastructure	Hydrography	Land use or land cover	Population distribution	Sewer/water/utilities	Shelter locations	Elevation	Transportation networks	Aerial imagery	
1 & 2	23.5	0.0	35.3	11.8	76.5	11.8	0.0	0.0	11.8	11.8	17.6	35.3	58.8	17
3	17.6	17.6	26.5	23.5	58.8	17.6	0.0	26.5	17.6	14.7	11.8	29.4	38.2	34
4	15.7	18.3	44.3	27.0	73.0	7.8	1.7	18.3	13.9	20.9	7.0	13.0	38.3	115
5	18.5	18.5	36.1	26.1	64.7	10.1	1.7	22.7	17.6	11.8	7.6	23.5	40.3	119
6	13.7	21.9	45.2	27.4	71.2	2.7	4.1	21.9	16.4	17.8	1.4	11.0	45.2	73
7	17.5	12.5	40.0	30.0	67.5	5.0	0.0	10.0	22.5	17.5	17.5	12.5	47.5	40
8	14.8	37.0	33.3	29.6	66.7	3.7	11.1	14.8	22.2	7.4	0.0	29.6	25.9	27
9	6.3	12.5	12.5	18.8	75.0	18.8	6.3	12.5	12.5	18.8	25.0	37.5	37.5	16
10	8.0	24.0	36.0	20.0	72.0	8.0	0.0	16.0	16.0	12.0	8.0	48.0	32.0	25
All Counties	15.9	18.9	38.2	25.8	68.9	8.4	2.4	18.7	16.7	15.7	8.2	21.0	40.3	466
All States	4.1	18.4	20.4	20.4	73.5	4.1	0.0	32.7	6.1	22.4	16.3	38.3	44.9	50



Time-of-Delivery is Crucial



Likelihood of Use

In the next Federally Declared disaster, does your [county / agency] expect the Federal Government (e.g., DHS/FEMA, NASA, NOAA) to collect airborne or satellite imagery to assist in the response and recovery process... (check all that apply)

RESPONSE (percent)

FEMA Region	...regardless of whether requested	...only if requested	...with no cost	...with shared cost	...no expectation	N
1 & 2	40.0	20.0	53.3	6.7	46.7	15
3	18.2	15.2	39.4	0.0	54.5	33
4	20.0	20.9	50.0	3.6	42.7	110
5	16.4	21.8	44.5	2.7	53.6	110
6	16.4	25.4	53.7	4.5	43.3	67
7	10.3	38.5	33.3	7.7	61.5	39
8	8.0	32.0	28.0	16.0	48.0	25
9	26.7	26.7	60.0	0.0	33.3	15
10	12.0	24.0	48.0	12.0	52.0	25
All Counties	17.3	23.9	46.0	4.8	48.7	439
All states	30.0	46.0	54.0	22.0	22.0	50



How Counties Acquire Incident Data

Is your [county / agency] using any of the following methods for acquiring spatial data during the response / recovery phases of a hazard event? (check all that apply)

FEMA region	RESPONSE (percent)										N
	Mobile GIS data collection	Crowd sourced / VGI	Free internet download	Buy data	Exchange with other agencies	Free from commercial provider	Helicopter / plane fly over	Satellite / aircraft image collection	Boots-on-the ground	Other*	
1 & 2	26.7	26.7	40.0	0.0	53.3	13.3	53.3	13.3	86.7	0.0	15
3	34.8	0.0	17.4	4.3	39.1	8.7	43.5	30.4	95.7	0.0	23
4	46.9	14.6	36.5	14.6	34.4	17.7	58.3	31.3	82.3	7.3	96
5	37.6	8.6	39.8	6.5	45.2	6.5	38.7	23.7	83.9	4.3	93
6	22.1	10.3	50.0	5.9	42.6	17.6	42.6	20.6	69.1	4.4	68
7	45.9	10.8	48.6	5.4	35.1	16.2	35.1	27.0	75.7	0.0	37
8	45.0	10.0	45.0	5.0	70.0	5.0	35.0	30.0	75.0	5.0	20
9											14
10	31.6	10.5	47.4	5.3	63.2	15.8	36.8	21.1	89.5	0.0	19
All Counties	37.1	10.9	41.3	8.3	43.1	13.5	45.5	26.0	80.8	4.7	385
All states	38.0	18.0	42.0	12.0	86.0	38.0	74.0	68.0	90.0	8.0	50

Regions with fewer than 15 counties responding have been removed.

*Other responses - county: GIS (3); Virtual Alabama; On site imagery from Blackberry; International Charter; USGS HDDS; Blueprints / as built

* Other responses – state: none given



Remote Sensing Resources - USGS

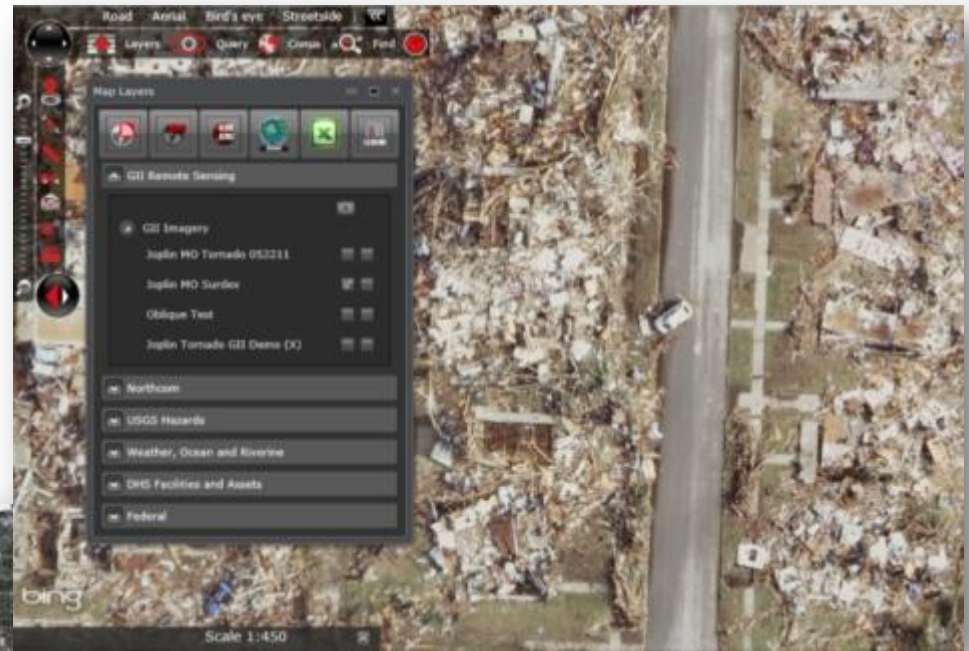
<http://hdds.usgs.gov/hdds2/>

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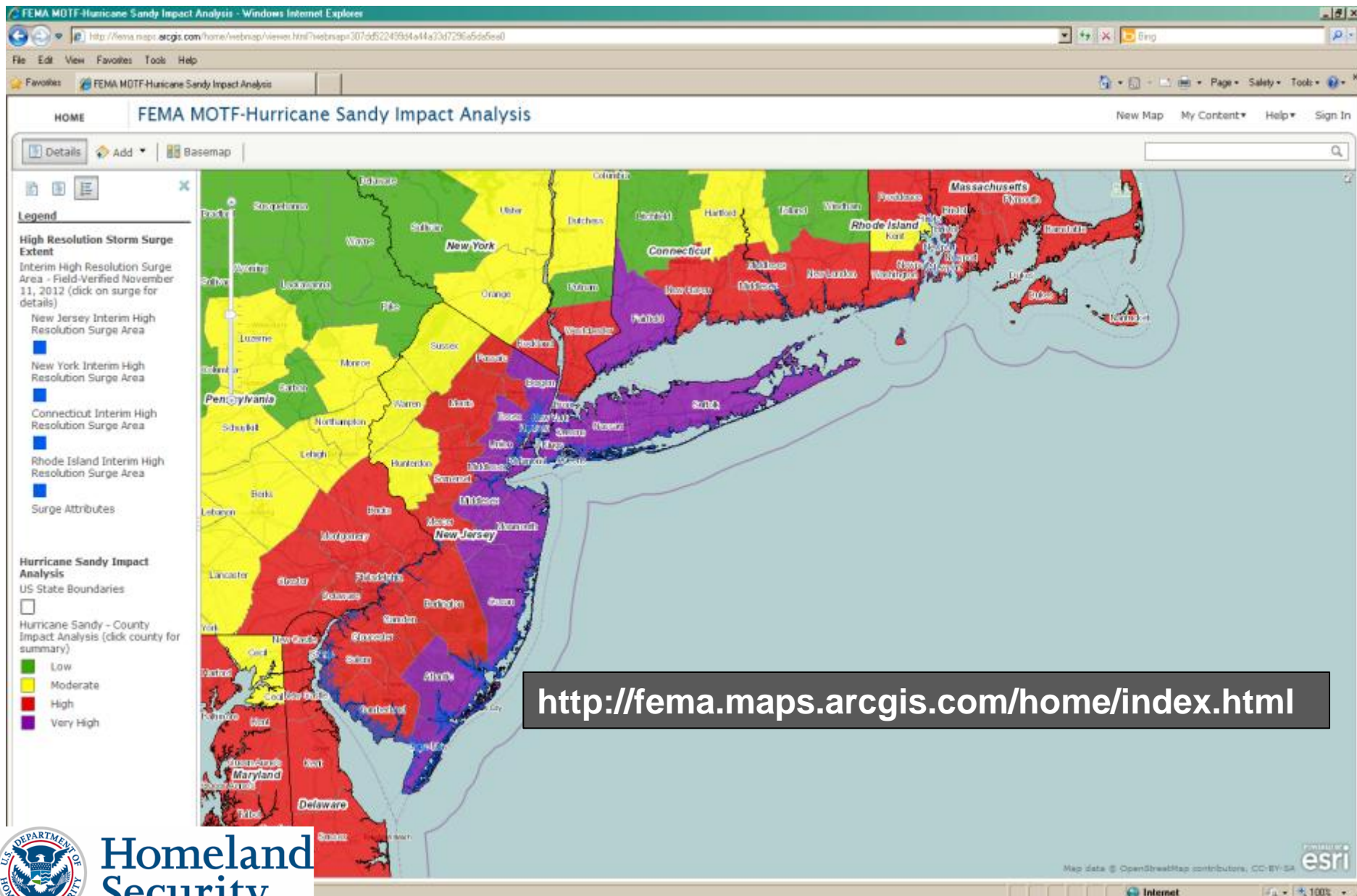
Remote Sensing Resources - DHS

- Provides Access to DHS Mission Imagery via OGC Compliant Web Services.
- The Capability is **NOT** Designed to Replace Existing Dissemination Platforms or Portals.
- ***The DHS GII is a Restricted Site and Requires an HSIN Account for Access***

<https://gii.dhs.gov/OneView/>



Remote Sensing Resources - FEMA



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Remote Sensing Resources - NSGIC



Create Account

LOG IN

HOME

DATA LAYERS

STATUS MAP

DIRECTORY

MY PROFILE

GETTING STARTED

ABOUT

SUPPORT

NAPSG

National Alliance for Public Safety
GIS Foundation

HIFLD

Homeland Infrastructure
Foundation-Level Data

CARAT

Capability and Readiness
Assessment Tool

U.S. National Grid

USNG National Implementation
Center (TUNIC)

NSGIC

National States Geographic
Information Council

GeoCONOPS Full Guide

Federal Interagency Geospatial
Concept of Operations v4.0

GeoCONOPS Quick Start

Federal Interagency Geospatial
Concept of Operations

Sources for GIS Data

State GIS Clearinghouse Sites &
Select Federal Sites

Geospatial Platform

Trusted geospatial data, services,
and applications

Digital Coast

Coastal data, tools, training and
information

<http://gisinventory.net/>

Welcome to the Public Safety Interface of the GIS Inventory

The GIS Inventory is produced by the National States Geographic Information Council (NSGIC) as a tool for states and their partners. Its primary purpose is to track data availability and the status of geographic information system (GIS) implementation in state and local governments to aid the planning and building of Spatial Data Infrastructures. The Public Safety interface is a critical new component of the GIS Inventory. It was designed with assistance from the National Alliance for Public Safety GIS Foundation (NAPSG).



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Thank you for Your Time Today

Questions and Discussion

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