



# Infrastructure Visualization



Homeland  
Security

Michael Clements

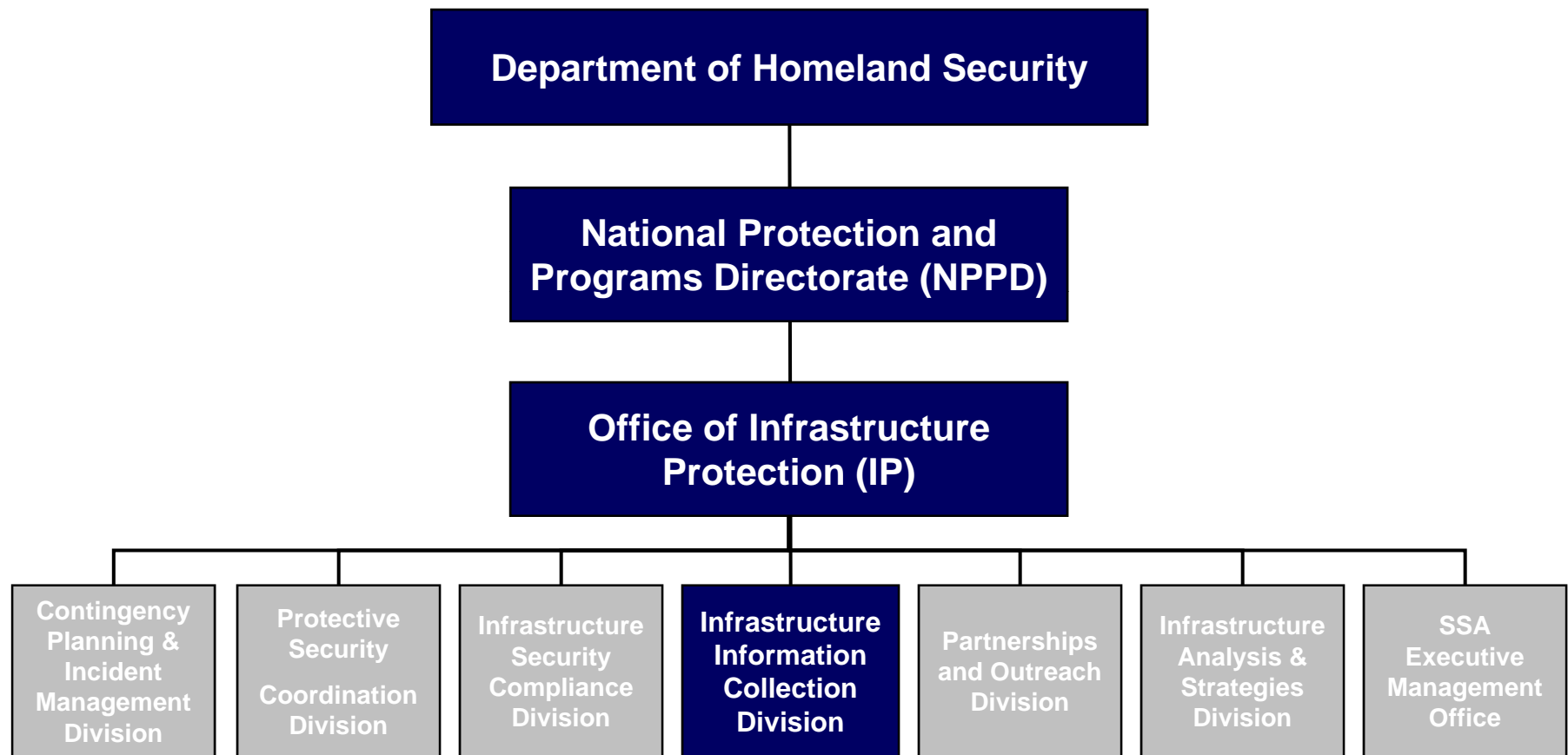
Branch Chief, Infrastructure Visualization Branch

Infrastructure Information Collection Division

Office of Infrastructure Protection

National Protection and Programs Directorate

# The DHS Office of Infrastructure Protection



# IICD's Vision and Mission

## VISION:

- Provide DHS **enterprise** solutions for the collection, protection and sharing of infrastructure data
  - **Create more relevant infrastructure information.**
  - **Develop persistent awareness** of the Nation's infrastructure.
  - **Enable timely and informed actionable decisions** to protect, secure, analyze, and restore the Nation's infrastructure.
  - **Enable protected access** to infrastructure information.

## MISSION:

- **Lead** the Department's efforts to protect and provide standardized, relevant, and customer-focused infrastructure information to homeland security partners.



# Infrastructure Information Collection Division

IICD leads the DHS effort to gather and manage infrastructure data by developing partnerships and leveraging enterprise solutions in the following areas:

Data Collection	Data Management	Data Visualization
<ul style="list-style-type: none"><li>▪ Automated Web-based collection tools</li><li>▪ Data integration system</li><li>▪ Federal automated vulnerability and risk assessment IT tools</li></ul>	<ul style="list-style-type: none"><li>▪ Data collection processes and requirements</li><li>▪ Discovery and sharing of data</li><li>▪ Data standardization and quality assurance</li><li>▪ Common terminology to categorize infrastructure</li><li>▪ Data protection and dissemination policies</li></ul>	<ul style="list-style-type: none"><li>▪ 2D and 3D geospatial Web-based viewers</li><li>▪ Static and dynamic geospatial data from multiple systems</li><li>▪ Geospatial production</li><li>▪ Remote sensing</li></ul>



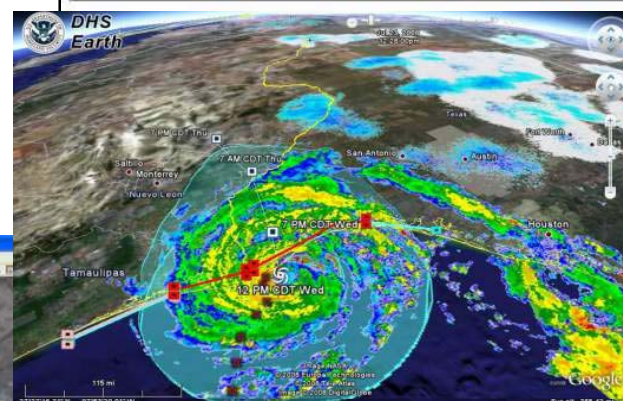
# Infrastructure Visualization Branch

## ■ IVB Challenges

- Visualize the Nation's CIKR in a geospatial context
- Understand the Nation's infrastructure landscape
  - CIKR interconnectivity and inter-dependence
  - CIKR relationship to physical environment
- Applying understanding of CIKR in context of dynamic, all-threats, all-hazards environment
- Provide information to DHS leadership for timely, actionable decisionmaking

## ■ IVB Response

- iCAV suite of tools
- Geospatial Production
- Remote Sensing



Post-Incident Imagery Overlay

# Infrastructure Visualization Branch (IVB)

- **Integrated Common Analytical Viewer (iCAV)** – Web-based suite of tools provides geospatial visualization and analysis capabilities to the DHS enterprise and Federal, State, and local partners, as well as access to authoritative CIKR data and dynamic, real-time situational awareness data for informed CIKR decision making.
- **Remote Sensing** – Provides a direct interface to the Federal interagency remote sensing community to leverage remote sensing data collection capabilities and resources to support geospatial production and other IP missions.
- **Geospatial Production** – Provides geospatial displays, mapping and imagery products to support Office of Infrastructure Protection (IP) requirements and inform on impacts to CIKR planning, preparedness, and protection efforts.

# iCAV and DHS Earth

Putting Data to Work to Enable the Homeland Security Mission



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# Integrated Common Analytical Viewer (iCAV)

## What is iCAV?

- Suite of Web-based geospatial tools accessing the DHS Geospatial Information Infrastructure to provide imagery, foundation-level infrastructure data, mission-specific data and dynamic situational information in a geospatial context
  - Uses ESRI software via the DHS Enterprise License Agreement
  - Includes a KML data service for use in Google Earth, MS Virtual Earth, ESRI ArcExplorer
  - Leverages OpenLayers to display map data newest generation of web browsers
  - Is standards based to easily integrate with DHS mission systems
- Built by the DHS Office of Infrastructure Protection in close coordination with the DHS Geospatial Management Office
- Leverages the Homeland Security Information Network (HSIN) for user verification and authentication
- Provided **free of charge** to the DHS enterprise and Federal, State, local, and private-sector partners across the country





# Integrated Common Analytical Viewer (iCAV)

## Who Benefits from iCAV?

- iCAV customers include a wide range of homeland security and infrastructure protection partners across the country who support both steady-state and contingency operations
  - DHS Enterprise, including:
    - DHS Office of Infrastructure Protection
    - DHS National Operations Center and National Infrastructure Coordination Center
    - All other DHS components
  - Joint Field Offices
  - State and Local Fusion Centers
  - Other State and local users
  - Private Sector partners via HSIN Critical Sectors portal
- iCAV is the geospatial viewer for the Constellation/Automated Critical Asset Management System (C/ACAMS)
  - Provides another point of access for State and local users, as well as private sector partners



# iCAV Applications Overview

- Provides free geospatial visualization and analysis capabilities with three Web-based viewers:
  - iCAV Classic
  - iCAV Next Generation (NextGen)
  - DHS Earth
- Provides access to:
  - Authoritative CIKR data
  - Dynamic, real-time situational awareness data
- User authentication via Homeland Security Information Network (HSIN)
  - Access to Federal, State, local, private sector users via HSIN credentials
- iCAV Unclassified - Operating 24/7/365



**iCAV Classic**

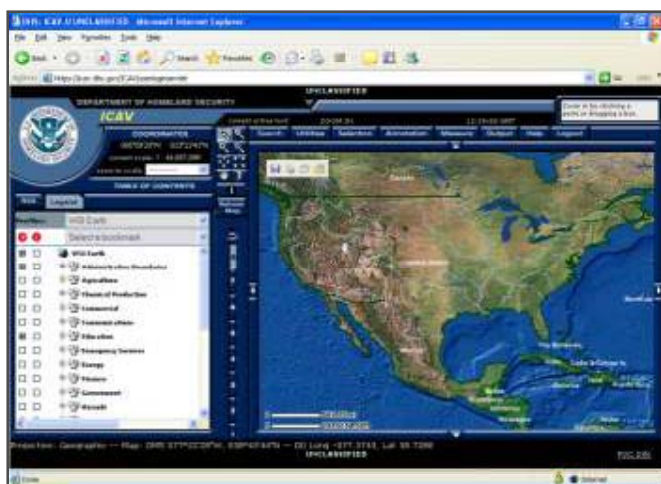


**DHS Earth**

# iCAV Classic and iCAV NextGen

## iCAV “Classic”

- First generation DHS Enterprise Geospatial tool with light analytical capability
- Built on National Geospatial-Intelligence Agency’s (NGA) Palenterra tool
- Provides access to Homeland Security Infrastructure Program (HSIP), 133-cities imagery, and Web-mapping services for dynamic, real-time data feeds



## iCAV Next Gen

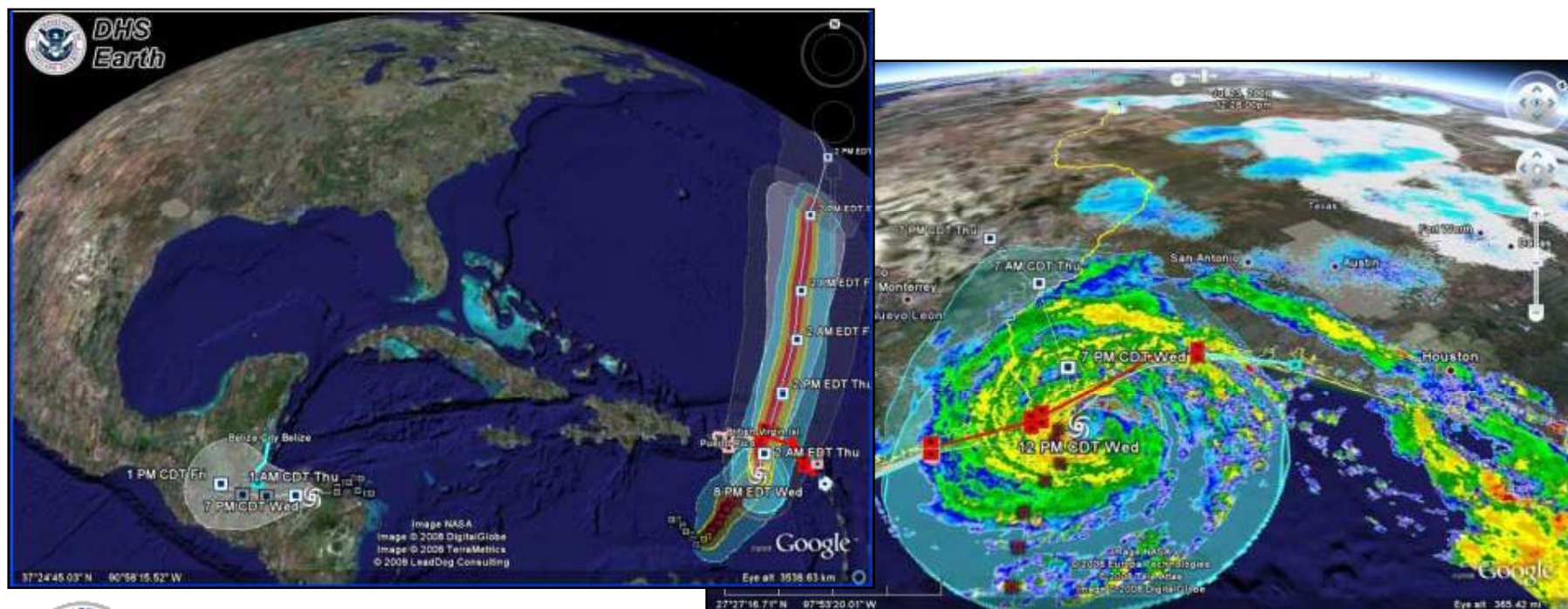
- Builds on the success of iCAV Classic by:
  - Improving user interface
  - Making data easier to find and use
  - Enhancing analytical capabilities based on needs expressed by users
- Deployed in May, 2009
- Web-based training available at [www.jsrts.org/dhs/icav](http://www.jsrts.org/dhs/icav)





# DHS Earth

- Based on Keyhole Markup Language (KML) file standard to leverage intuitive user interface, rapid data ingest, and visualization of 3D globe-based viewers
- Provides pure visualization capability and access to Web-mapping services to view real-time, dynamic situational feeds on top of HSIP data layers
  - Significant real-world use during recent hurricanes for situational awareness, remote sensing mission planning, and infrastructure impact visualization (maps and imagery)



# DHS Earth

- DHS Earth is available now at <https://earth.dhs.gov>
- Access to DHS Earth requires:
  - HSIN credentials
  - Google Earth, Arc GIS Explorer installed on desktop
- Technical highlights include:
  - All HSIP layers
  - Google imagery base
  - HurricaneMapping.com
  - LandScan data
  - GeoMAC and MODIS fire data
- DHS Earth leverages Google Earth Pro or ArcGIS Explorer platform to visualize any .kml/.kmz files published to support operational planning, incident response, etc.



# iCAV Application Comparison

- System similarities:
  - Secure (password-protected through HSIN credentialing)
  - Access to authoritative CIKR data
  - Infrastructure and geospatial data visualization
  - Real-Time situational awareness
- Application differences:

## iCAV Classic

- 2D visualization
- Basic analysis capabilities
- Thin client, browser based

## iCAV NextGen

- 2D visualization
- Advanced analysis capabilities
- Improved search capabilities
- More intuitive user interface
- Ability to ingest data

## DHS Earth

- 3D visualization
- No analysis capabilities
- Faster data access and Webpage refreshing
- Easy-to-use map interface
- Ability to ingest data



# Infrastructure Remote Sensing

Accessing mission critical situational awareness data to support decision making

# Remote Sensing Scope and Purpose

Monitor, Lead, and Drive IP's Remote Sensing Needs

- Purpose:

- Provide IP with a way to gather, validate, and communicate CIKR situational awareness requirements to the remote sensing community.
- Establishes IP's ability to task the federal interagency remote sensing community during steady state operations.
- Allows IP to align remote sensing processes and requirements with FEMA's remote sensing structure for Stafford Act events.



Remote Sensing allows IP to take proactive steps to meet our situational awareness needs



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# Remote Sensing Mission

- Expand remote sensing knowledge base across IP and IP stakeholder community
  - Provide training to IP divisions on remote sensing capabilities available to support their requirements
  - Provide awareness to private sector of what's possible from IP, what timelines and priorities are
- Build lasting partnerships across the interagency community to ensure remote sensing capabilities are available when we need them
  - Establish relationship with other DHS component to incorporate and leverage sensor development opportunities in response to IP remote sensing requirements
  - Conduct outreach to develop processes to automatically ingest and leverage remote sensing capabilities during both steady state and incident response operations
  - Improve coordination with FEMA, Interagency Remote Sensing Coordination Cell (IRSCC), and interagency partners to better understand federal remote sensing processes and capabilities



# On-Going Remote Sensing Coordination

- IICD represents the Office of Infrastructure Protection at the Interagency Remote Sensing Coordination Cell (IRSCC)
  - The Interagency Remote Sensing Coordination Cell (IRSCC) is:
    - An interagency body of remote sensing experts and capabilities that plans, coordinates, acquires, analyzes, publishes, and disseminates situational knowledge during incidents
  - The goal of the IRSCC is to create a process to coordinate, synchronize, collaborate, and track remote sensing data acquisition activities and capabilities
- IICD Remote Sensing Coordination activities
  - U.S. Army Corps of Engineers/TEC: Imagery Analysis
  - Civil Air Patrol: Sensor data integration with iCAV
  - NGA: Proper Use Memorandum established to access NGA-funded imagery
  - Domestic Nuclear Detection Office (DNDO): Sensor data sharing via iCAV
  - Environmental Protection Agency: Streaming access to ASPECT imagery
  - NOAA:
  - CBP: Integrating Predator, other FMV and imagery platforms, into disaster response operations

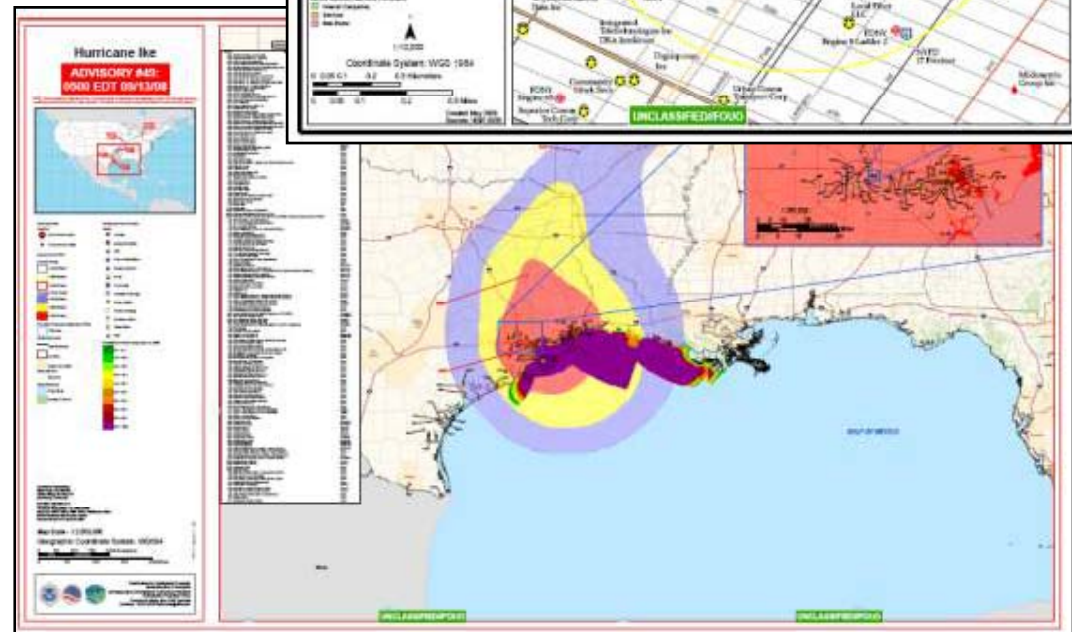
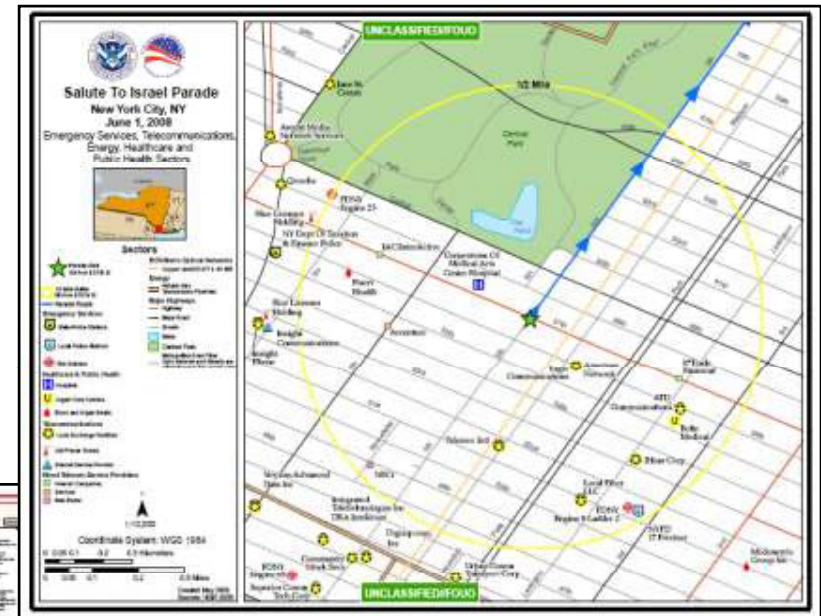
# Infrastructure Geospatial Production

Putting Data to Work to Enable the Homeland Security Mission



# Geospatial Production Overview

- Provides tailored, requirement- and incident-specific mapping and imagery support:
- Provides event-driven situational awareness and steady state mapping for:
  - The President
  - DHS Secretary, Under Secretary, ASIP
  - State Governors
  - PSA's/ILO's
  - NICC
  - Private sector
  - State/Local Government
  - First Responders
  - PSA's
  - USCG
  - USSS





# Geospatial Production Overview

- Established in response to 2007 wildfires in Southern California
- Support three general types of events:
  - Terrorist Attacks
  - Natural Disaster
    - 2007: Hurricane Hanna, Tropical Storms Dean and Erin, California Wildfires
    - 2008: Hurricanes Ike and Gustav
      - Over 150 individual CIKR situational awareness products produced
  - Steady State
    - NSSE's/Special Events: Super Bowl, UN General Assembly, RNC/DNC
    - Specialized Products: Bomb Squad Maps, Nuclear Plant IOC Maps



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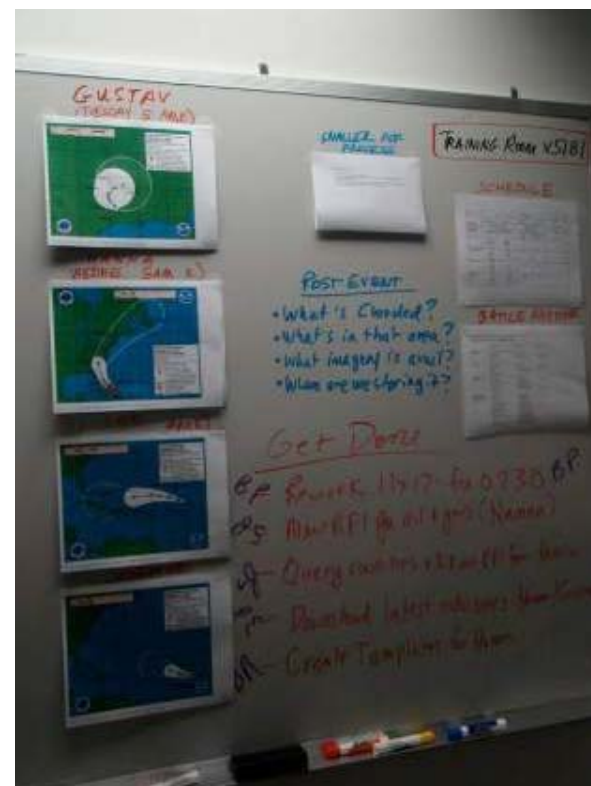
# Geospatial Production Overview

- Geospatial Production Team
  - 5 federal employees
  - 8 on-site contractors (ESRI)
  - 9 field contractors (BAH)
- Hardware
  - High end geospatial workstations
  - Dual Monitors (standard)
  - Servers for data storage
  - 60" high end HP plotters
- Software
  - ESRI software:
    - ArcGIS Desktop ArcINFO 9.3 (ArcINFO is the highest licensing level)
    - ArcGIS extensions including (but not limited to):
      - Spatial Analyst
      - PLTS (Production Line Tool Set)
      - Maplex
      - Image Analyst



# Emergency Production

- Focus is Critical Infrastructure and Key Resources
- Incidents of national significance
  - Natural, manmade, or technological hazards that produce catastrophic losses in terms of
    - Human casualties
    - Property destruction
    - Economic effects
    - Public morale and confidence
- Emergency response
  - Requirements driven production
  - Surge support
- Increasing interagency coordination on production efforts with National Geospatial-Intelligence Agency (NGA), Department of Defense (DoD)





# Product Formats

- Map Templates
  - 8.5"x11"
  - 11"x17"
  - Wall Maps
  - Map books
  - PDF, KML, other electronic formats
- Standard Layer Files
  - Based on the 18 CIKR sectors outlined in the IP Infrastructure Taxonomy
  - Standard:
    - Symbols
    - Label properties
- Standard Datasets
  - HSIP
  - EPA Risk Mgmt Program
  - Tier 1 & Tier 2 datasets



# Geospatial Production Challenges

- Challenge: Providing timely situational awareness on map products
  - Response: Coordination with the NICC for infrastructure situational awareness. Utilization of online tools (GeoMAC/HurriVac) to gather current conditions.
- Challenge: Fulfilling all Requests for Map Products
  - During the 3 week period of Hurricanes Ike and Gustav, over 300 requests were made
  - Response: Fulfilling multiple requirements at once. Employment of web-based geospatial visualization tools for rapid-response production.
- Challenge: Ensuring end users receive needed products
  - Response: Coordination with the NICC for product distribution. HSIN web portal use for wide audience dissemination.



# Homeland Infrastructure Foundation-Level Data (HIFLD) to the Regions

Leveraging the HIFLD Model for Regional Information Sharing Partnerships



**Infrastructure Information Collection Division**

**Office of Infrastructure Protection**

**National Protection and Programs Directorate**

**U.S. Department of Homeland Security**



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As of 15 Aug 2009



# Homeland Infrastructure Foundation Level Data (HIFLD) Evolution



PHASE 1	PHASE 2	PHASE 3	PHASE 4
<ul style="list-style-type: none"> <li>• <b>HIFLD Start</b> <ul style="list-style-type: none"> <li>• Started with 3 organizations and 13 people</li> <li>• No common data usage or standards</li> <li>• PowerPoint and Clipart were standard</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>HIFLD Now</b> <ul style="list-style-type: none"> <li>• Represents a Federal government "best practice" for interagency collaboration and partnership</li> <li>• Now 299 organizations and 2000+ members</li> <li>• HSIP Gold has become de facto standard</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>HIFLD Next</b> <ul style="list-style-type: none"> <li>• Federal / State Governments and Private Sector Partner collaboration within PSA areas</li> <li>• Bring coordinated Federal support to the states (states requested)</li> <li>• Improved HSIP data sharing</li> </ul> </li> </ul>	

# Mission Need

- Identified requirement for increased and sustained collaboration between Federal, State, and local infrastructure protection stakeholders has been expressed by:
  - National State Geospatial Information Committee (NSGIC)
  - National Association of Counties (NACo)
- Identified requirement to strengthen Federal, State, Private sector partnerships remains
  - Continuing to mature partnerships on the protection and security fronts
  - Focus on data sharing, geographic information system (GIS) interaction and collaboration
- Identified requirement to provide infrastructure information prior to incidents to enhance preparedness, response, and recovery
  - Extend awareness and reach of Federal Infrastructure Protection resources is necessary for enhanced infrastructure protection
  - Regional program has the potential to save \$Ms spent on commercial data and redundant capability

# Capability Framework

- Capability similar to the national level HIFLD Working Group, but focused at the State and local levels will support efforts to provide geospatial data, information, and applications to State, local governments and to strengthen Federal, State, and local preparedness for homeland security and defense
- HIFLD regional workgroups in the PSA Areas will provide a venue for the PSAs, other Federal representatives (DHS IA, FEMA, DoD, USGS, DOJ, EPA, DOE), State GIS coordinators, State Emergency Operation Center (EOC) representatives, State Fusion Centers, National Guard Joint Operations Centers (JOC), and other stakeholders to promote domestic infrastructure information gathering, sharing, protection, visualization, and spatial analysis.



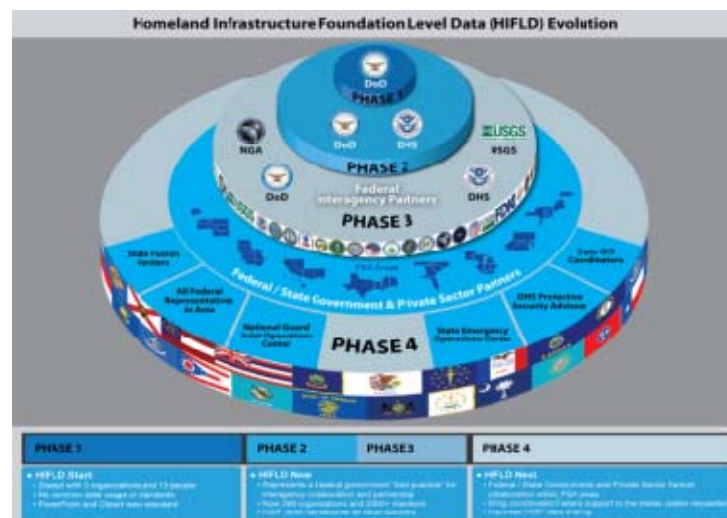
## HIFLD Phased Implementation

- ▶ **Phase I-III: Complete**
- ▶ **Phase IV Alpha: Information Gathering** (Store in Geodatabase/Shapefile)
  - Identify Federal Sponsors ([DHS/IICD](#), DCIP, ISE PM) / Leads for each Area ([PSA](#))
  - Prioritize PSA Areas for implementation based on resources (2-3 initially)
  - Identify PSA Area Participants and Collect Contact Information
  - Identify Regional / State Meetings that already exists ([leverage](#))
  - Identify Regional Staffing
- ▶ **Phase IV Bravo: Layout Regional Meeting Schedule**
  - Layout Regional Themes and Venues
  - Layout Initial Agendas ([thread – infrastructure data and GIS support to IP](#))
- ▶ **Evolve into Data and GIS Technology Integration Activities**



# Mission

- Advance the success of the national level HIFLD Working Group by deploying a similar capability into the eight PSA Areas as part of a “HIFLD to the Regions” effort
- Focus support on State and Local priorities and issues to:
  - Extend Awareness and Reach of Federal Infrastructure Protection Resources
  - Increase and Enhance Regional Activities
  - Strengthen Federal, State, local and Private Sector Partnerships



# Goals

- Support the Protective Security Advisors (PSA) in working with HIFLD members and contributing partners in the PSA Areas to promote domestic infrastructure information gathering, sharing and protection, visualization, and spatial analysis
  - Encompasses Homeland Security; Homeland Defense; Civil Support; and Emergency Preparedness, Response and Recovery
- Provide geospatial support and foundation data to support improving national Critical Infrastructure Key Resources (CIKR) preparedness enabling a better understanding of shared risk, information about terrorist threats, hazards, vulnerabilities, and allocation of resources where risk is greatest, thereby safeguarding our Nation's CIKR



# Objectives

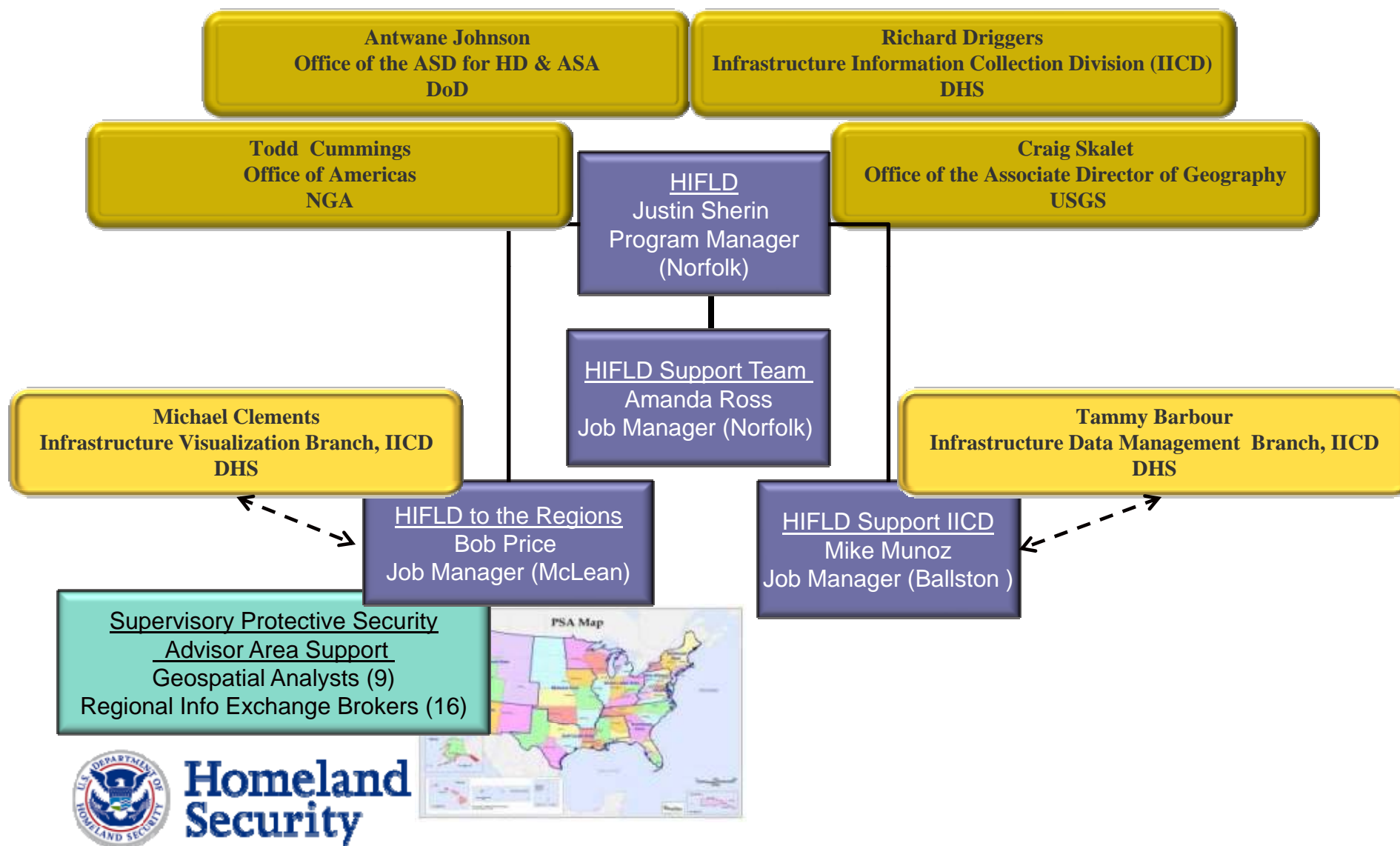
- Enhance situational awareness and support to Infrastructure Protection activities at the State and Local level
  - Integrate GIS efforts
  - Increase collaboration and dynamic sharing of data
  - Enhance support for Infrastructure Protection field operations
- Meet DHS Assistant Secretary for Infrastructure Protection's Guidance:
  - Provide better geospatial products and capabilities for Protective Security Advisors
  - Leverage remote sensing capabilities to enhance infrastructure protection
- Provide education and awareness of Federal data management and GIS efforts to the Protective Security Advisor Areas
- Contribute to the National Information Sharing Environment
  - Support Federal and State government geospatial data and information



# Objectives (continued)

- Support Structured Data Management by continuously improving HSIP Gold infrastructure data and accelerating the build out of HSIP Freedom data sets
- Increase understanding and assisting in the resolution of regional data and technical requirements and issues
- Provide Continuity of Operations data services, IDW for States, States for Counties, and Counties for Cites
- Decrease infrastructure data buys over time

# HIFLD to the Regions Team



# HIFLD to the Regions Team



- ★ Geospatial Analyst
- ★ Info Exchange Broker
- ▲ Supervisory PSA Area



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# HIFLD to the Regions Summary

- Meets DHS Assistant Secretary for Infrastructure Protection guidance to improve support to PSAs
- Meets PSA program's primary goal to build and sustain effective CIKR partnerships and coordination mechanisms across Federal, State, local, and private sector stakeholder communities
- Provides infrastructure and GIS data, information and applications to State and local governments
- Strengthens national preparedness for Homeland Security / Defense
- Improves data sourcing for HSIP Freedom and infrastructure protection
- Models a National Information Sharing Strategy and Information Sharing Environment
- Shares cost across agencies to meet common mission goals



# Homeland Security