Infrastructure Visualization for Domestic Response
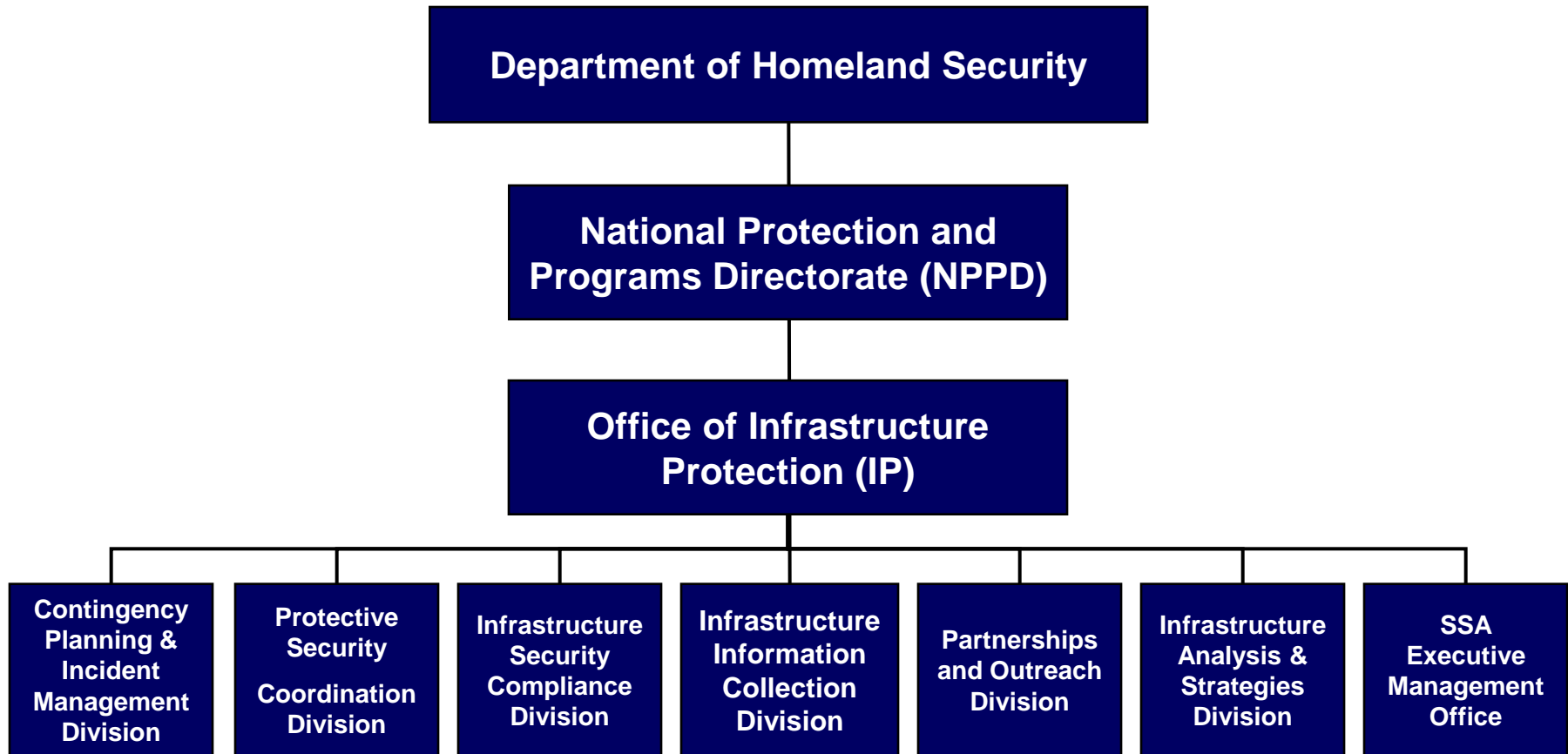
Mike Clements

Branch Chief, Operations Support Branch

Infrastructure Information Collection Division

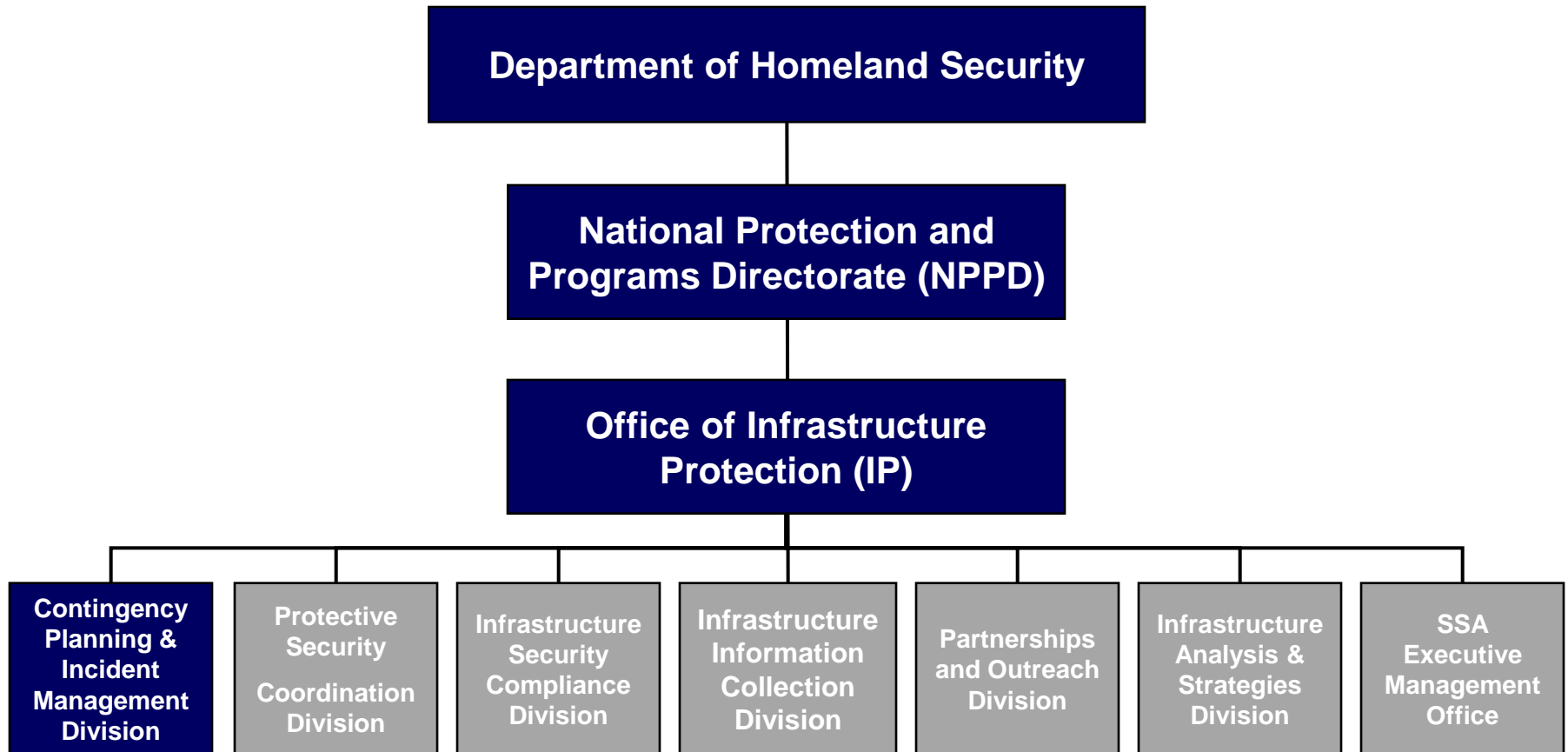Office of Infrastructure Protection

National Protection and Programs Directorate

1

The DHS Office of Infrastructure Protection

Department of Homeland Security

National Protection and Programs Directorate (NPPD)

Office of Infrastructure Protection (IP)

| Contingency Planning & Incident Management Division | Protective Security Coordination Division | Infrastructure Security Compliance Division | Infrastructure Information Collection Division | Partnerships and Outreach Division | Infrastructure Analysis & Strategies Division | SSA Executive Management Office |

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Contingency Planning and Incident Management Division

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| Contingency Planning & Incident Management Division | Protective Security Coordination Division | Infrastructure Security Compliance Division | Infrastructure Information Collection Division | Partnerships and Outreach Division | Infrastructure Analysis & Strategies Division | SSA Executive Management Office |

Homeland Security

Critical Infrastructure

What is it and why is it important to the nation?

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Context for Infrastructure Protection

|	
Mix of threats	• **Biological, nuclear, chemical, or terrorist attacks** • **Accidents, disease outbreaks, H1N1 virus** • **Natural disasters (hurricanes, earthquakes, landslides, tornadoes, etc.)**
National Priorities	• **Prevent catastrophic loss of life** • **Manage cascading impacts on U.S. and global economies** • **Identify gaps, overlaps, and shortfalls in protection**
CIKR Protection Framework	• **Collaboration between Federal departments** • **Coordination with State and local governments** • **Information sharing with private sector partners who own and/or operate 85% of CIKR**

Homeland Security
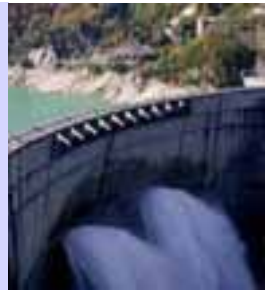
IP's Core Incident Management Capabilities

Situational Awareness
Collects, maintains, and shares information about CIKR threats

Information Sharing
Disseminates relevant CIKR information throughout partnership network

Risk Assessment and Analysis
Evaluates CIKR data for accuracy, importance, and implications

Decision Support
Provides recommendations for CIKR protection, prioritization, or restoration to IP leadership
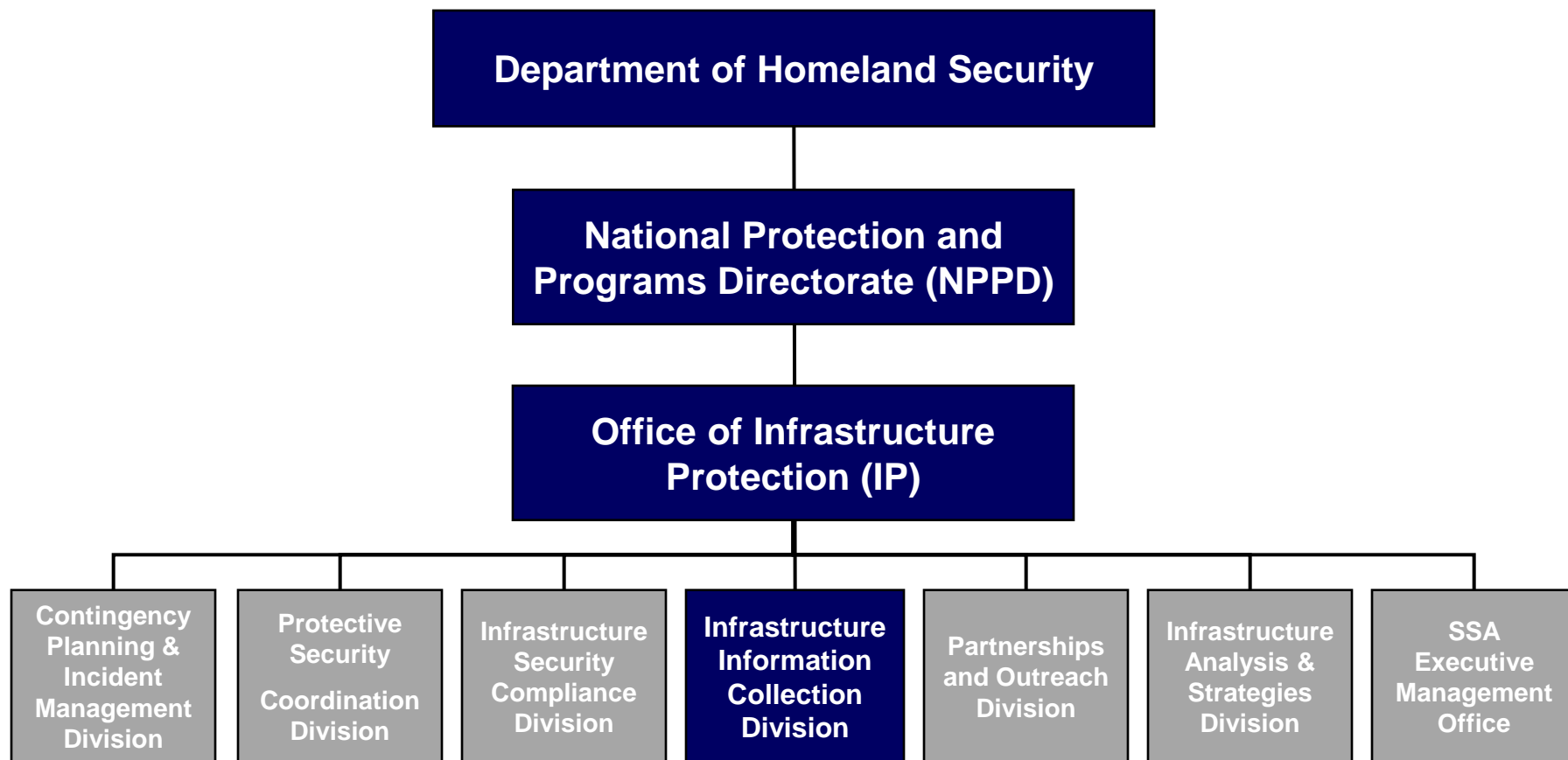
Future Operations
Supports decisionmaking for actions required 24-72 hours post-incident

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DHS/IP Incident Response Framework

President of the United States

National Security Council

Secretary of DHS

National Protection and Programs Directorate

Office of Infrastructure Protection

Private Sector Owners & Operators

Contingency Planning & Incident Management Division

- Readiness
- Contingency Planning
-Business Continuity
-Incident Management Cell
- National Infrastructure Coordination Center

Regional Response Coordination Centers

Joint Field Offices

State and Local EOCs

Sector Coordinating Councils

Infrastructure Liaison and Support Staff

Protective Security Advisors

ISACs

Homeland Security

Infrastructure Information Collection Division

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| Contingency Planning & Incident Management Division | Protective Security Coordination Division | Infrastructure Security Compliance Division | Infrastructure Information Collection Division | Partnerships and Outreach Division | Infrastructure Analysis & Strategies Division | SSA Executive Management Office |

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.

Homeland Security

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
- Automated Web-based collection tools - Data integration system - Federal automated vulnerability and risk assessment IT tools	- Data collection processes and requirements - Discovery and sharing of data - Data standardization and quality assurance - Common terminology to categorize infrastructure - Data protection and dissemination policies	2D and 3D geospatial Web-based viewers - Static and dynamic geospatial data from multiple systems - Geospatial production - Remote sensing

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Infrastructure Visualization

Providing Geospatial Context to Enable CIKR Protection
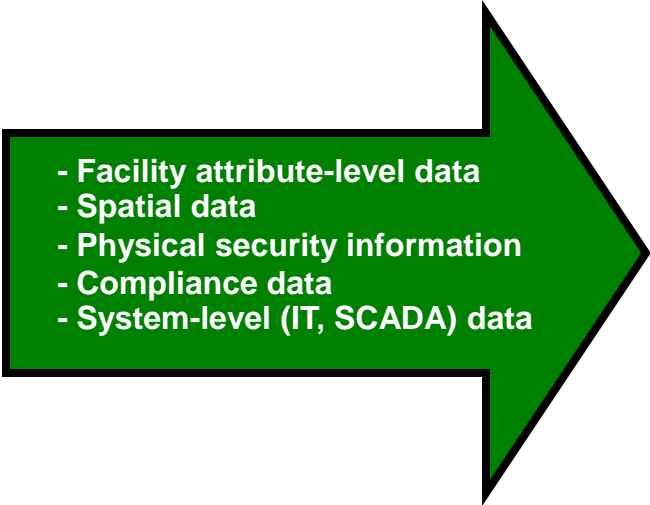
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Understanding Infrastructure Data

- Infrastructure isn't just a row in a table or some bytes on a server

  - Understanding where a facility is on the Earth helps understand how it relates to the infrastructure around it, how best to protect or respond in an incident

- DHS/IP is in the business of understanding all facets of the Nation's CIKR and providing the context to understand it
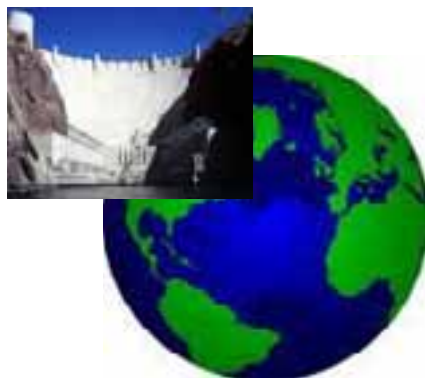
- Facility attribute-level data
- Spatial data
- Physical security information
- Compliance data
- System-level (IT, SCADA) data

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Infrastructure Information Management

- **<u>Challenge:</u>** In order to effectively understand and protect the Nation's CIKR, the infrastructure community must be able to ***<u>use</u>*** the vast stores of dynamic, constantly changing infrastructure data

- **<u>Solution:</u>** To address this challenge, IP is working with Federal, State, local, and private sector partners to build tools and capabilities to:

  - *Visualize* infrastructure data in a geospatial context

  - *Analyze* infrastructure data "on the fly"

  - Make analysis *accessible* to decision-makers and the infrastructure protection community by building value-added products

Presenting data geospatially provides context and meaning

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Infrastructure Visualization (IV) Project

- **IV Project Goals**

  - Visualize the Nation's critical infrastructure and key resources (CIKR) in a geospatial context

  - Understand the Nation's infrastructure landscape
    - CIKR interconnectivity and inter-dependence
    - CIKR relationship to physical environment

  - Apply an understanding of CIKR in a dynamic, all-threats, all-hazards environment

  - Provide information to DHS leadership for timely, actionable decision making

- **IV Project Capabilities**

  - iCAV Suite of Tools

  - Remote Sensing

  - Geospatial Production
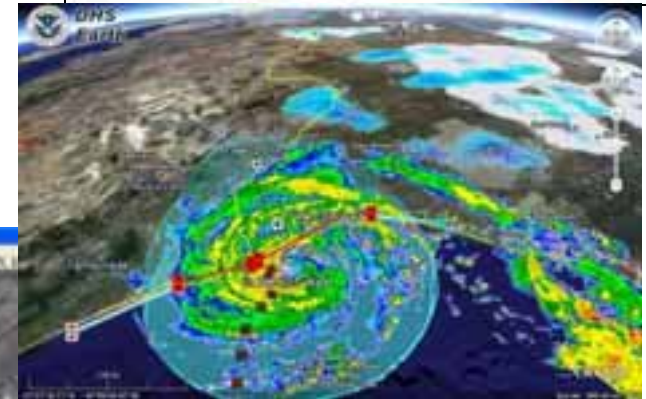
Post-Incident Imagery Overlay

Homeland Security

iCAV and DHS Earth

Putting Data to Work to Enable the Homeland Security Mission

Homeland Security

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

- iCAV is the geospatial viewer for the Automated Critical Asset Management System (ACAMS)

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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 (IP, I&A, National Operations Center and National Infrastructure Coordination Center)

  - 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 Automated Critical Asset Management System (ACAMS)

  - Provides another point of access for State and local users, as well as private sector partners

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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

DECOMMISSIONED ON NOV 17

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

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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)
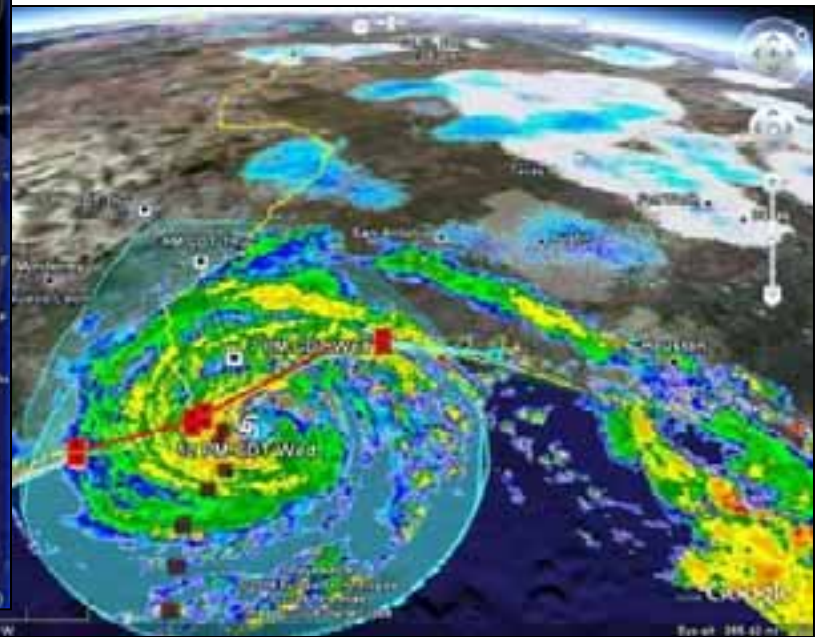
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Remote Sensing Support

Accessing mission critical situational awareness data to support decision making

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Infrastructure Remote Sensing

- Mission
  - Provide IP with an understanding of, and access to, Federal interagency remote sensing resources to enable infrastructure protection planning, response, and recovery activities

- Scope
  - Develop and maintain partnerships and collaborative strategies, plans, and approaches with Federal remote sensing partners to support CIKR remote sensing needs
  - Serves as the NPPD and IP representative to the Interagency Remote Sensing Coordination Cell (IRSCC) Executive Committee.
    - The IRSCC is a formal body of Federal remote sensing experts providing critical coordination of the remote sensing requirements and capabilities throughout the prevention, preparedness, mitigation, response, and recovery spectrum of disaster operations.

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

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Infrastructure Remote Sensing

Objectives

- Leverage relationships across interagency remote sensing networks to identify and collect resources to meet the needs of IP, State, local, and private sectors stakeholders

- Develop infrastructure-related imagery analysis products on post event/incident imagery

- Build IP's remote sensing knowledge base and support improved awareness of Federal interagency remote sensing capabilities across the IP stakeholder community

- Provide expertise to the IP Assistant Secretary and other DHS and IP decision-makers

Infrastructure Geospatial Production

Creating the picture that says 1000 words (or more)

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Geospatial Production

- 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

- Geospatial Production Team
  - 5 federal employees
  - 8 on-site contractors (ESRI)
  - 8 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

Sims Bayou Waste Water Treatment Plan – Before

Sims Bayou Waste Water Treatment Plan – After

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Geospatial Production

- 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

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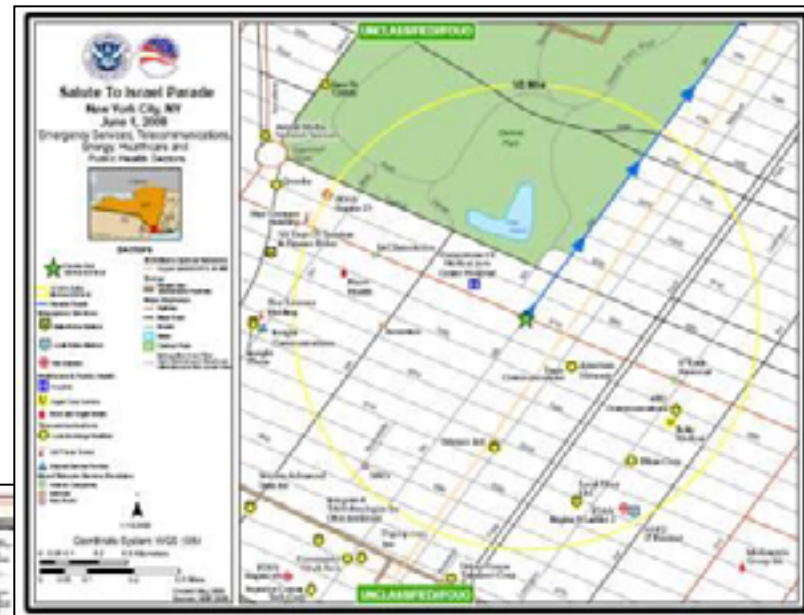
Emergency Production

- Focus on Critical Infrastructure and Key Resources (CIKR)
  - National-level CIKR list is maintained by IP, updated for incidents based on the geographic scale of incident impacts

- 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), U.S. Army Corps of Engineers (USACE)

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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
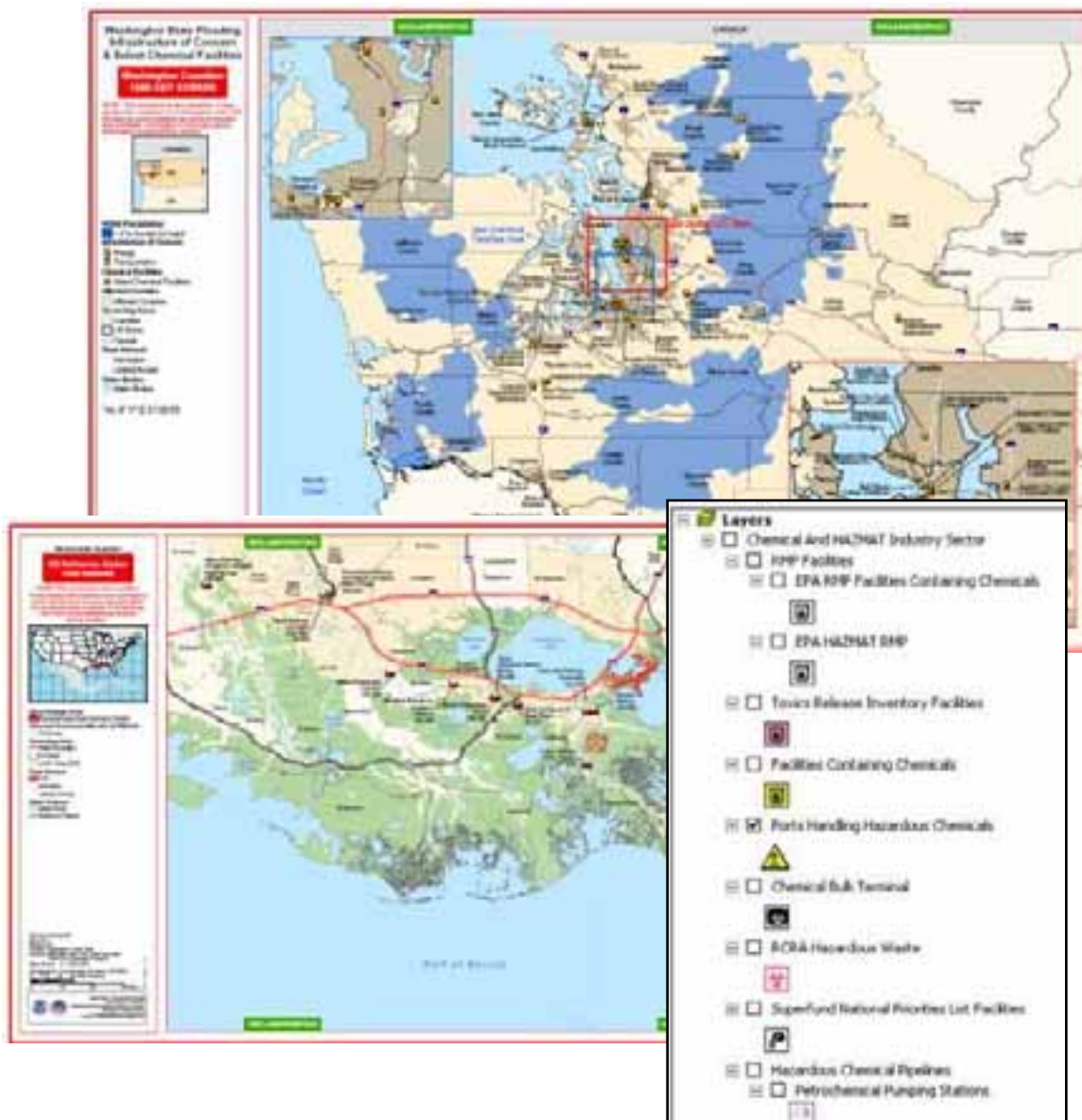
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IP GIS In Practice

Lessons Learned and Products from Real-World Events

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Geospatial Support Lessons Learned

- Data and products must be easily shared in the field
  - Limited bandwidth makes file size very important

- Data and products must be easily shared in the field, ***and quickly***
  - Given response timelines, even for non-life saving missions, responders and CIKR owners/operators need the data quickly or it just isn't useful
  - <48 hours for point target imagery is required

- Data and products must be adequately protected, but (paradoxically) still allow widest dissemination possible
  - CIKR geospatial products, imagery and site data can be sensitive and should be protected to avoid competitive use by commercial rivals, but should be easily accessible to responders

- Paper products are great, but printing is an issue in the field
  - Field GIS teams must be self-sufficient

- Don't build relationships in the field during events, build them ahead of time
  - Trying to figure out where to get data during an incident is not efficient

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Geospatial Support Lessons Learned

- Version control for data and products is a big issue
  - Naming conventions could help, but standardization across Federal, State, and local agencies is challenging

- Having a one-stop-shop for products and data is a great approach, if you can do it
  - Everyone posts data and products in different places, making search and discovery a difficult prospect
  - Analysts and customers must scour multiple web sites, FTP sites, and message boards

- Leadership expectations must be managed
  - A Predator or satellite imagery isn't always the best answer
  - Try to convince customers to relay the problem they need solved, not the asset they want

- You'll never be able to meet everyone's needs
  - There's too much demand and there's a lot of redundancy, so try to focus on organizational strengths and missions
  - IP is good at CIKR geospatial production, so we try to focus only on that

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How IP Is Addressing These Challenges

- DHS/IP will continue to improve on the iCAV suite of tools to bring the latest in GIS technologies and tradecraft to the DHS enterprise and field responders
  - Leveraging new technologies wherever possible (GeoPDF, handhelds, bandwidth compression with KML)

- DHS/IP is developing new tradecraft based on customer feedback and field-level experience
  - Social media and crowd-sourcing for real-time GIS data

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DHS
Earth

Oblique Hurricane Ike 008.jpg
Oblique Hurricane Ike 009.jpg

INVISTA Victoria Plant

Oblique Hurricane Ike 012.jpg

185

Oblique Hurricane Ike 011.jp

Image © 2008 DigitalGlobe
© 2008 Tele Atlas

Google

28°42'34.61" N   96°56'40.04" W   elev 20 m   Jun 28, 2005   Eye alt   4.33 km

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