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GIS for Emergency Managers

How to Task Your GIS Function

Sponsored by: U.S. EPA Region 7

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Course Objectives

- Enhance local agencies' capacity to develop/maintain situational awareness during an emergency or disaster through the use of geographic information systems (GIS).
  - Increase understanding of the Situation Unit's purpose/function under the Planning Section.
  - Self-assess current capabilities and identify tools, concepts, and procedures to improve internal and external information sharing.
  - Increase familiarity of available GIS applications and their use in an EOC environment.

Agenda

- Role of GIS in Emergency Preparedness & Response
- The Situation Unit – Role and Responsibilities
- Geospatial Introduction
  - Hardware
  - Standards & Templates
  - GIS Software
  - Map Requests and Tracking
  - Distributing Products
  - Data Management
- Break
- Siouxland Sub-Area Atlas
- Practical Exercise

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The Role of GIS in Emergency Response

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Mitigation and GIS

- GIS technology provides the capability to map and analyze hazards of all types and visualize their potential impacts
- When hazards are mapped with critical infrastructure, population densities, and other community values, vulnerabilities can be observed, modeled, and better understood
- Priorities for mitigation can be established
- Contingency and response plans can be developed

Mitigation and GIS

- GIS optimizes the planning analysis process
  - **Identify and map natural and technological hazards**
    - Earthquake faults
    - Ethanol processing and storage facilities
  - **Identify and map critical values at risk**
    - Population densities
    - Natural resources
  - **Identify values at risk that reside within impacted areas**
    - Model potential events and display projected areas of extreme, moderate, and light damage that could be caused by the event
  - **Develop site-specific strategies for mitigation to reduce losses**
    - Evaluate and model alternative mitigation strategies

Preparedness and GIS

- GIS technology is utilized for preparedness
  - Site selection for adequate evacuation shelters
  - Selecting and modeling evacuation routes
  - Identification and mapping of key tactical and strategic facilities
  - Training and excises to test preparedness
  - Key capability for the command and control information system
- Data Management
  - Gathering, managing, processing, and distributing information
- Situational Awareness
  - Being aware of what is happening around you

Response

- Assists in the mobilization of emergency services and resources to support first responders
- GIS supports the response mission:
  - Provide warnings and notifications based on location
  - Determine appropriate shelter activations and routing for affected populations
  - Identify locations and capabilities of resources
  - Establish the capability to collect and share information
  - Support incident management operations and personnel
  - Maintain incident status and progress
  - Prepare maps, briefs, and status reports to leadership

Recovery

- Restore the affected area to its original state
- GIS supports the recovery mission:
  - Identification of damage
    - Overall damage costs and priorities for reconstruction
    - Locations of business and supplies necessary for reconstruction
  - Asses critical infrastructure damage
    - First aid and health
    - Additional shelter needs
    - Optimum locations for public assistance
    - Alternate locations for government operations
    - Alternate transportation routes
    - Monitoring progress by specific location
    - Publishing maps to share information with the public

Situational Awareness During Response and Recovery Operations

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- Timely situational awareness is essential
  - Maintain understanding of events, incidents, and developments to anticipate
- GIS provides situational awareness through a Common Operational Picture (COP)
  - Relevant GIS Data: base data, critical infrastructure, imagery, hazards, etc.
  - Event Data: sensors, cameras, traffic, incidents, etc.
- COP enhanced by:
  - Linked response plans, contingency plans, and other documents linked by location for which they were developed

Situational Awareness During Response and Recovery Operations

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- GIS provides accurate situational awareness through a COP
- Examples
  - Maintaining and displaying the status of emergency and nonemergency events
  - Designating and mapping incident locations/perimeters
  - Site selection analysis for:
    - Hot zones
    - Incident Command Post (ICP) locations
    - Additional evacuation sites
    - Staging areas
    - Drop points / Distribution sites
    - Division and branch boundaries
    - Intersections to be closed

Field Operations

- Response and recovery require close information exchange between the field and EOC
- GIS provides the capability for rapid data exchange
- Provides stakeholders with accurate situation status
- Provides the pubic with timely information
- Mobile GIS data can be easily integrated with the COP
- When the COP is current, better decisions can be made

Data Management

- GIS provides a platform for managing data
  - Geographic data
  - Documents (plans, photographs, etc.)
- Access information based on geographic location
  - Emergency response plans
  - Mitigation Plans
  - Contact lists
- Management of resources
  - Public safety resources and civilian resources
- Dynamic Data
  - Camera feeds, weather, and traffic

Data Management

Without comprehensive data management, it is difficult to achieve and maintain accurate situational awareness!

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The Situation Unit

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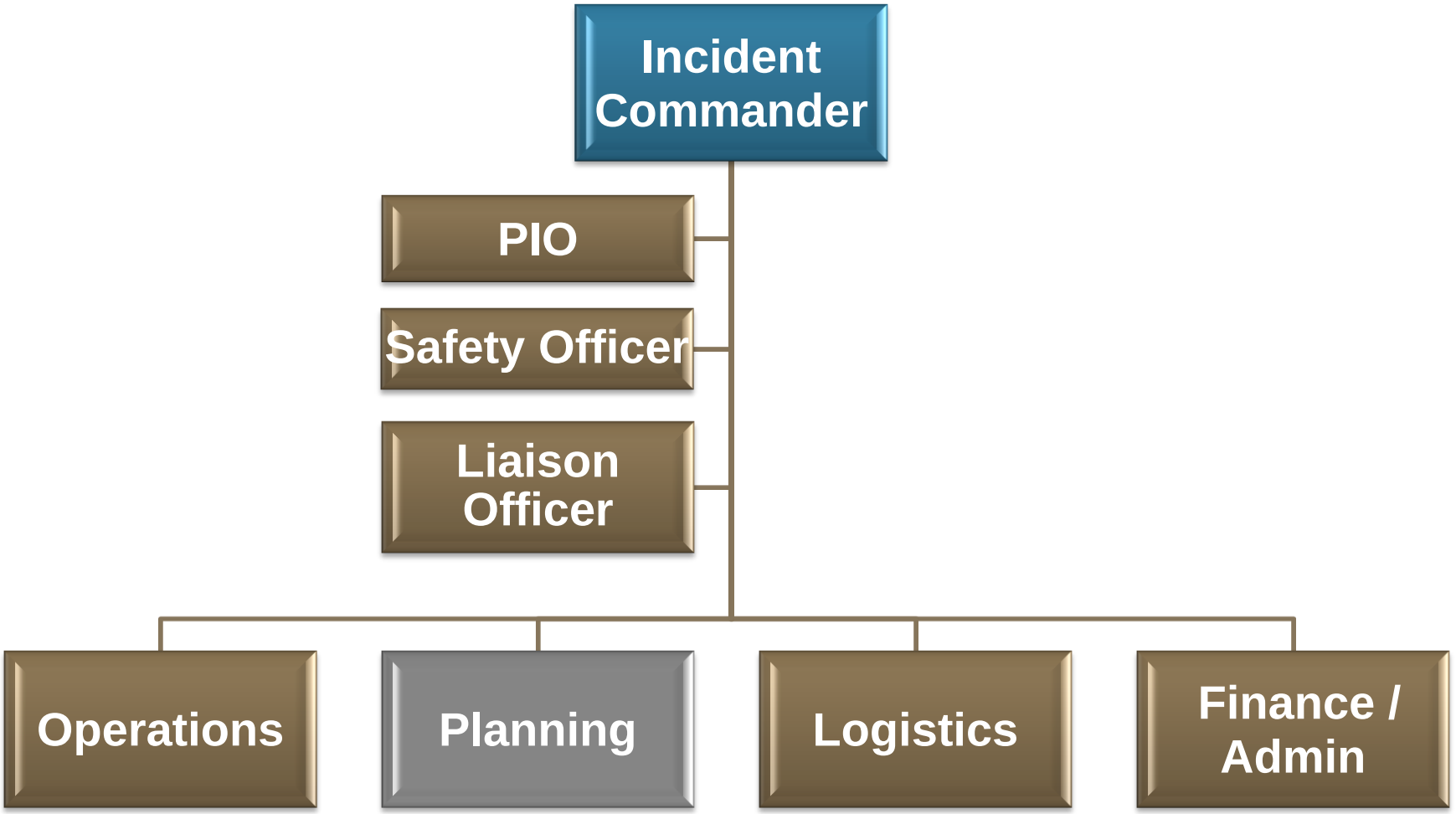
The Situation Unit

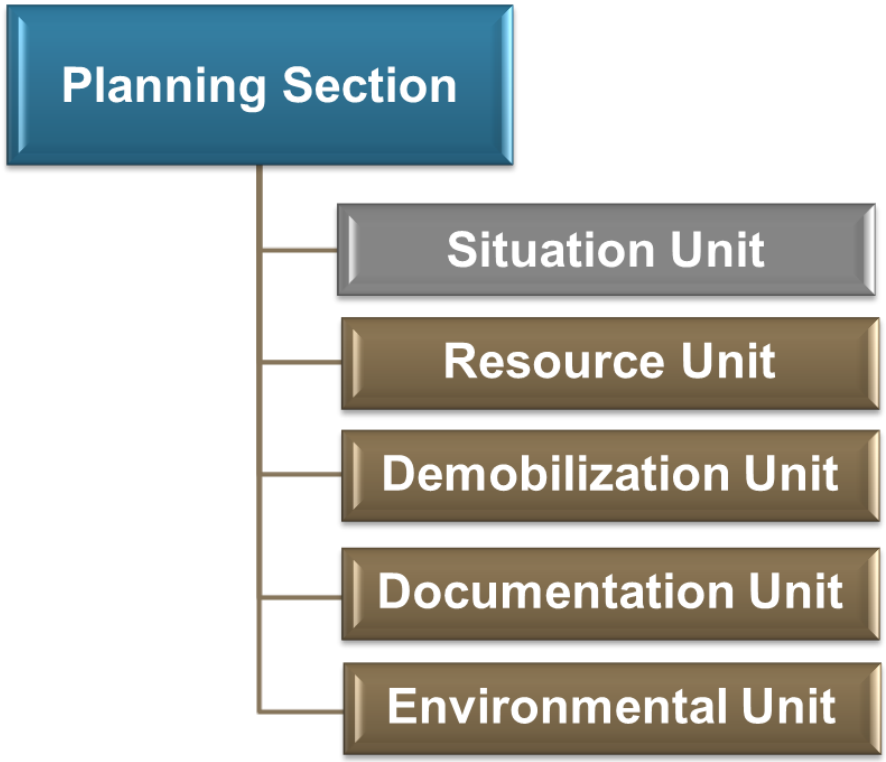
Incident Command System (ICS) Organization

ICS Organization



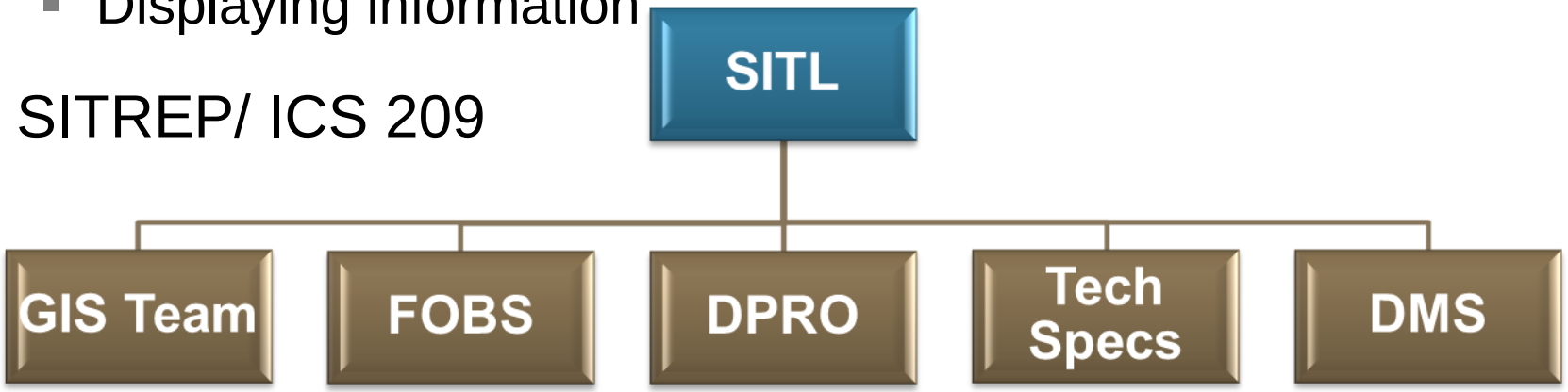
Planning Section

- Collects, evaluates & disseminates information on:
  - Incident Status
  - Predicted probable course of events
  - Alternative strategies and control operations
  - Resource status
- Facilitates planning meetings and briefings
- Supports and facilitates incident planning



The Situation Unit

- Situation Unit is responsible for:
  - Determining information needs
  - Gathering information
  - Processing information
  - Displaying information
- SITREP/ ICS 209



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The Situation Unit

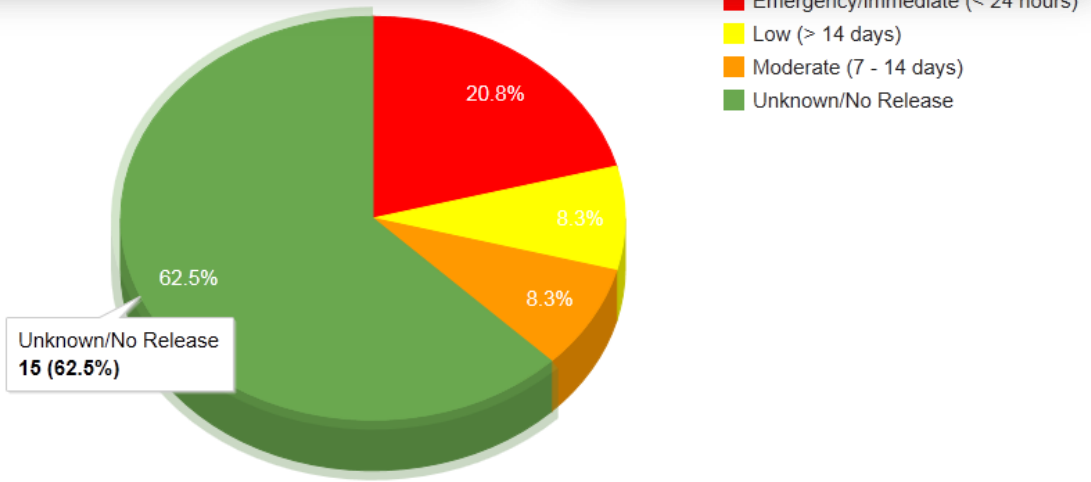
Mission and Functions

Situation Unit's Mission

- Provide Incident Management Team (IMT) with timely and accurate information on the status of the incident on a scheduled basis
- Respond to requests for information
- The information provided to the IMT is:
  - Intelligence
    - Incident status
    - Risks & threat
    - Projections
    - Suggested mitigation techniques
    - Logistical

Situation Unit Mission

- Provides information to the IMT in the form of displays:
  - Maps
    - Situational
    - Tactical
    - Logistical
    - Forecasts
  - Charts
  - Diagrams
  - Graphs
  - Reports
  - Imaging



Functions of the Situation Unit

- To perform the functions of a Situation Unit Leader, we have to understand the situation!

Functions of the Situation Unit

- Understand the situation
  - What has happened?
  - What progress has been made?
  - What are the perimeters?
  - What is the incident growth potential?
  - What are the threats?
  - What are the opportunities?

Functions of the Situation Unit

- Collect and organize status information relevant to the incident
- Analyze and evaluate incident information
- Prepare and display incident information
  - GIS Mapping
- Submit reports and provide documentation
  - ICS 209
  - Weather forecasts
- Assist with assembling the Incident Action Plan (IAP)

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Situation Unit

ICS Form 209 and Incident Action Plan (IAP) Development

ICS 209 Form

- The purpose of the form is to convey incident status and projection information
- Used to plan for future impacts and to allocate resources
- Used by the Incident Management Team and involved personnel as an incident briefing
- Used by the Information Officer as guide for information releases
- Completed daily and included in the IAP
- Good outline of the Situation Unit Leader job

Situation Unit Leader & the Incident Action Plan

- Situation Unit Leader Incident Action Plan inputs are based on Tactical Plan determined at the planning meeting
- Coordinate with Plans Chief and Operations Section Chief at Planning Meeting
- Not all Situation Unit products go into the Incident Action Plan
  - Incident Action Plan contains information required for shift resources to accomplish their assignment

Required
Incident Action Plan Maps

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- Planning Map
  - Is the basis for supporting what gets documented in the ICS 215 planning worksheet
  - Where are the branches, divisions, and so forth?
- Incident Action Plan Map
  - Overview of entire incident including facilities, geographic divisions, incident status, etc.
  - Typically follows ICS form 204
- Traffic Map
- Facilities Map
- Incident Prediction Map

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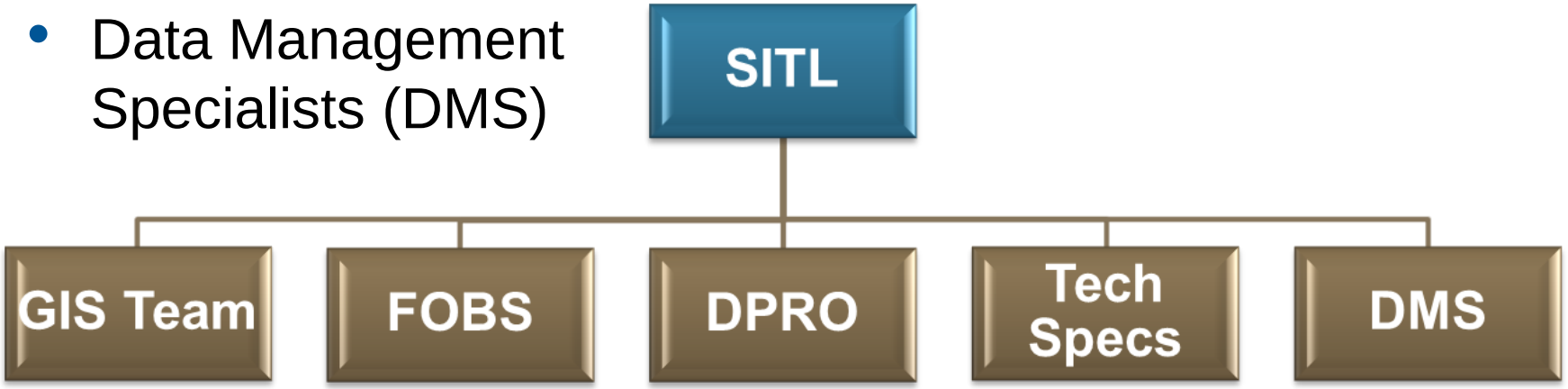
Situation Unit

Staffing the Situation Unit

Staffing

- GIS Team
  - Manager
  - Staff (GISS)
- Field Observers (FOBS)
- Display Processors (DPRO)
- Technical Specialists (Tech Specs)
- Data Management Specialists (DMS)



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Situation Unit

Intelligence and Information Products

Intelligence & Information Products

- The Situation Unit is responsible for providing the IMT with **Intelligence**
- Intelligence vs. Information
  - Intelligence is information that has been evaluated, analyzed and processed into a useable format for the Incident Management Team
  - Information from all sources relative to the incident must be gathered
  - We must plan how and what information will be needed
  - We must consider the past, present and future of the incident
  - Information can be flawed

Types of Information

- Incident status
- Operational progress
- Information relevant to others
- Threats / Risks
- Hazards
- Transportation
- Rehab / Decon / Disposal
- Communication
- High tech

Sources of Information

- Local jurisdiction
  - Maps, blueprints, charts
  - Preplans, permits, inspections, maps
  - “Right to know” docs
  - Databases
  - Past incidents
  - Resources
- News media
- Internet
- Imaging
- Debriefing of incident personnel

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Geospatial Introduction

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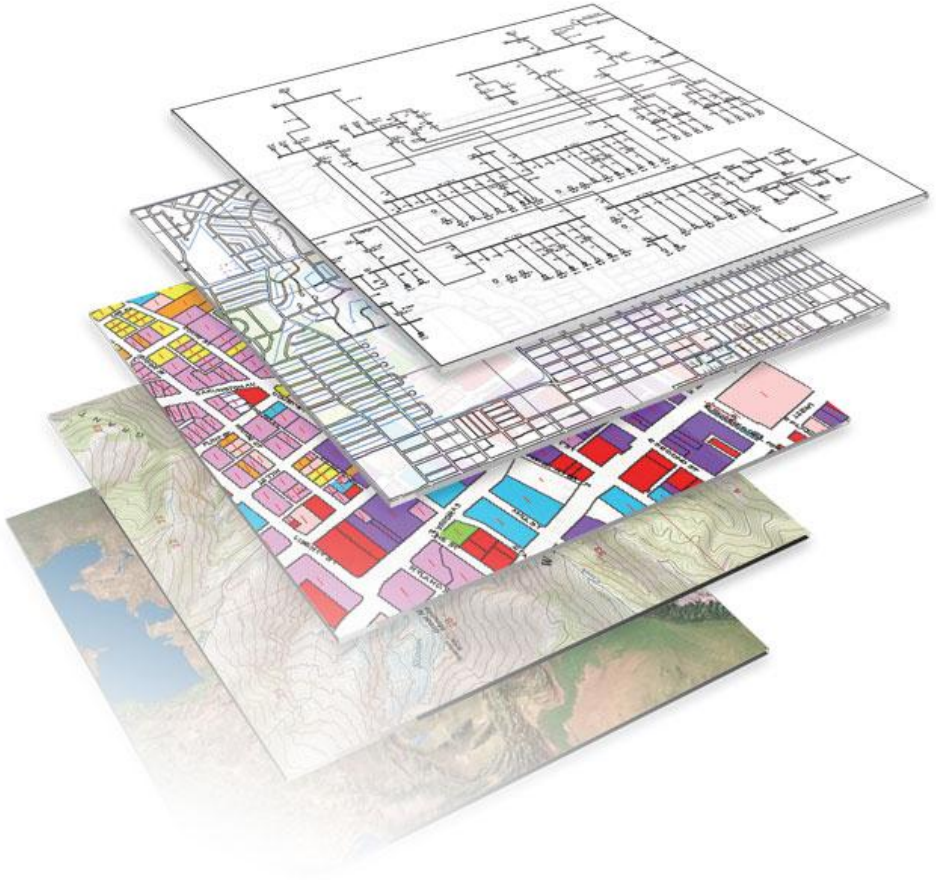
Geographic Information System

- A Geographic Information System (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information



Why Use GIS?

- Time
  - Much faster than creating detailed paper maps from scratch
- Flexibility
  - Change map layers and characteristics
  - Multiple sizes and formats of output
- Distribution
  - Easily shared and published data and products
- Centralization
  - Singular view of data and analysis
- Functionality
  - Tools and data can be used anywhere

Objectives for GIS in Emergency Response

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- To provide emergency responders with mapping, database, and geospatial analysis capabilities wherever needed
  - Provide map output in a variety of electronic and paper formats
  - Provide basic geospatial data via multiple access methods
  - Quickly generate spatial data layers from internally and externally generated monitoring information
  - Acquire external geospatial data and make it available across the entire operating environment
  - Provide documented products and data suitable for archiving
  - Quickly mobilize to become operational in a wide range of scenarios

Challenges for GIS in Emergency Response

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- Accessing large datasets (roads, hydrography, imagery) with limited digital communications
- Providing data access and exchange capabilities in the field when intranet access is limited
- Providing enough processing and disk space in the field to support GIS
- Assembling monitoring information databases quickly
- Providing on-demand, large-format paper output to field operations
- Having trained and skilled staff and equipment available for immediate, long-term, deployment

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Geospatial Introduction

GIS Software

GIS Software

- Desktop GIS
  - ArcGIS Desktop
  - ArcGIS Explorer
  - Google Earth
- Web-based GIS
  - ArcGIS Online
  - Google Maps
  - Bing Maps
  - Custom applications
    - ArcGIS Viewer for Flex
    - ArcGIS Viewer for Silverlight
    - ArcGIS API for JavaScript
- Mobile GIS
  - ArcGIS
  - ArcPad
  - Google Maps
  - Google Earth
  - Custom applications

ArcGIS Desktop

- ArcGIS Desktop is the GIS software predominately used by GIS Professionals
  - Three primary components:
    - ArcCatalog - used to organize and manage GIS data and to create metadata
    - ArcMap – used to view, edit, and analyze spatial data and to create maps
    - ArcToolbox - contains wizards for geoprocessing, data conversion, and data analysis
- Three versions
  - ArcView – “Basic”
  - ArcEditor – “Standard”
  - ArcInfo – “Advanced”
- Price: $1,500 ↑

ArcGIS Explorer

- Free GIS viewer
- You don’t have to be a GIS Expert
- Easy way to view, share, and present your GIS data
- Connects directly to ArcGIS Online basemaps and layers
  - Aerial Imagery
  - Topos
  - Census Data
- Customizable
  - Personalize with logos and color themes
  - Remove tools, add new tabs, enable or disable capabilities
- Add photos, reports, and videos to your maps
- Limited spatial analysis

Google Earth

- Free GIS viewer
- Google Earth is a virtual globe, map and GIS program that was created by Keyhole, Inc.
- Provides aerial imagery of the Earth's surface
- Allows address search or entry of latitude/longitude coordinates
- Allows you to create your own data and easily share with your colleagues
- Provides multiple layers of free geospatial data
- Use of software restrictions
  - For personal non-commercial/non-governmental use
  - Google Earth Pro: $399

ArcGIS Online

- GIS web application allowing for the creation, sharing, and search of geographic information via the web
- Ready to use with nothing to install or setup
- Share maps and data on web pages or in web mapping applications
- Ready-to-use content
- Easily add data
- Free version
  - All data is open to the public
- Paid version
  - 5 users = $2,500 per year
  - 50 users = $10,000 per yer

Customized Applications

- Web driven GIS tools and mapping information bundled into a “viewer”
- Uses “cloud-based” technology
  - ArcGIS Server
- Securable, customizable, and scalable
- Requires no software installation
- Easily distributes large volumes of information
- Can be hosted internally
- Great collaboration tool
- Mobile data access

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Geospatial Introduction

Infrastructure and Hardware

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Geospatial Introduction

Map Standards and Templates

Map Standards

- ALL MAPS SHOULD STAND
  - S – Scale
  - T - Title
  - A – Author
  - N – North Arrow
  - D – Date
- All map products should include:
  - Any documentation control number that has been assigned
  - Any necessary disclaimers and use restrictions
  - A map legend
  - File path

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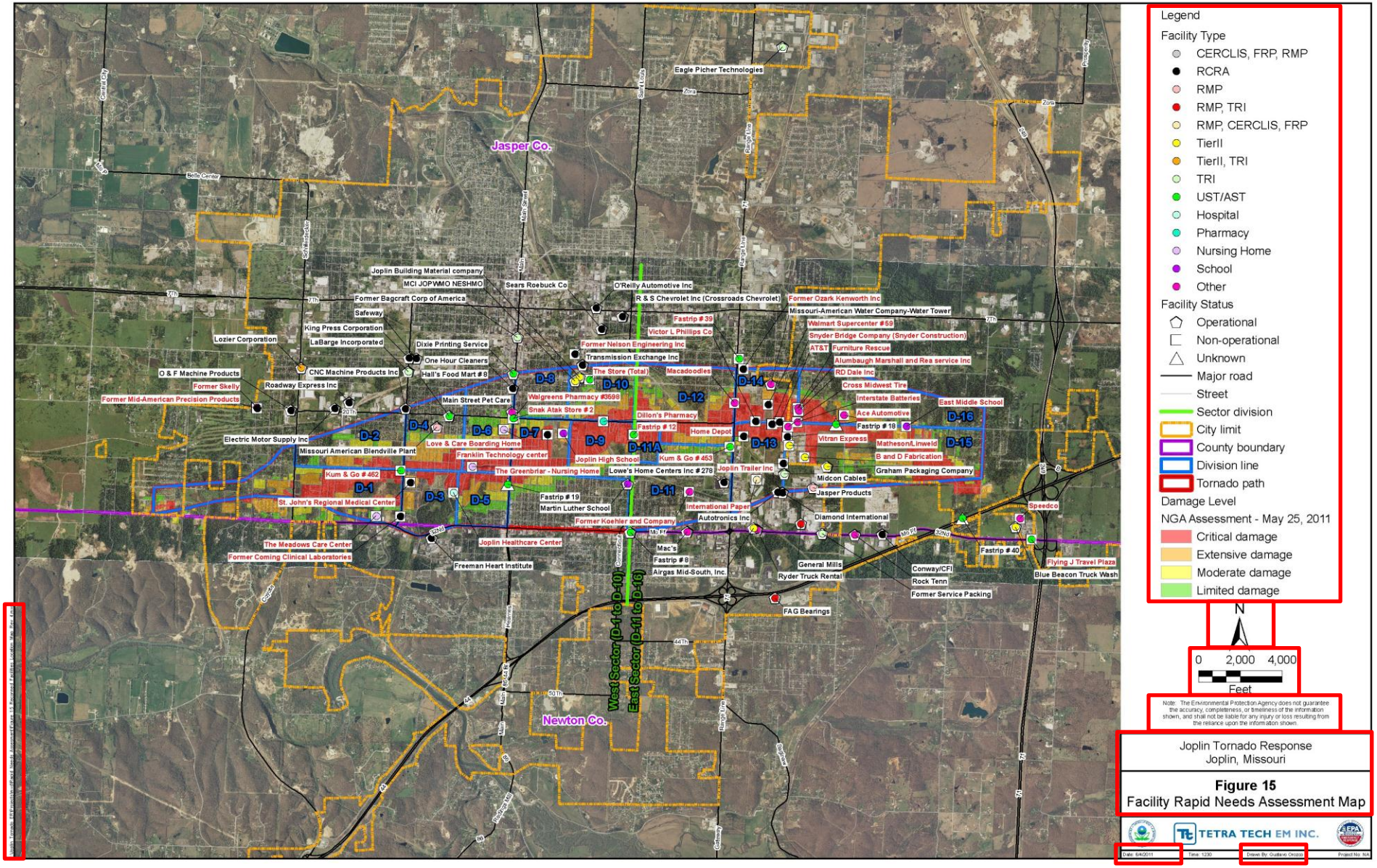
Map Standards



Map Templates

- Standard map templates are often utilized by GIS
  - They make map generation quicker and more efficient
  - They promote consistency in map products
- Incident-Specific map templates are usually generated for longer responses
- Template standards and availability vary by event, region, and agency
- Templates frequently change
- Templates for different map sizes and orientations
  - 8.5 X 11 – ANSI A
  - 11 X 17 – ANSI B
  - 17 X 22 – ANSI C
  - 22 X 34 – ANSI D
  - 34 X 44 – ANSI E

Map Templates

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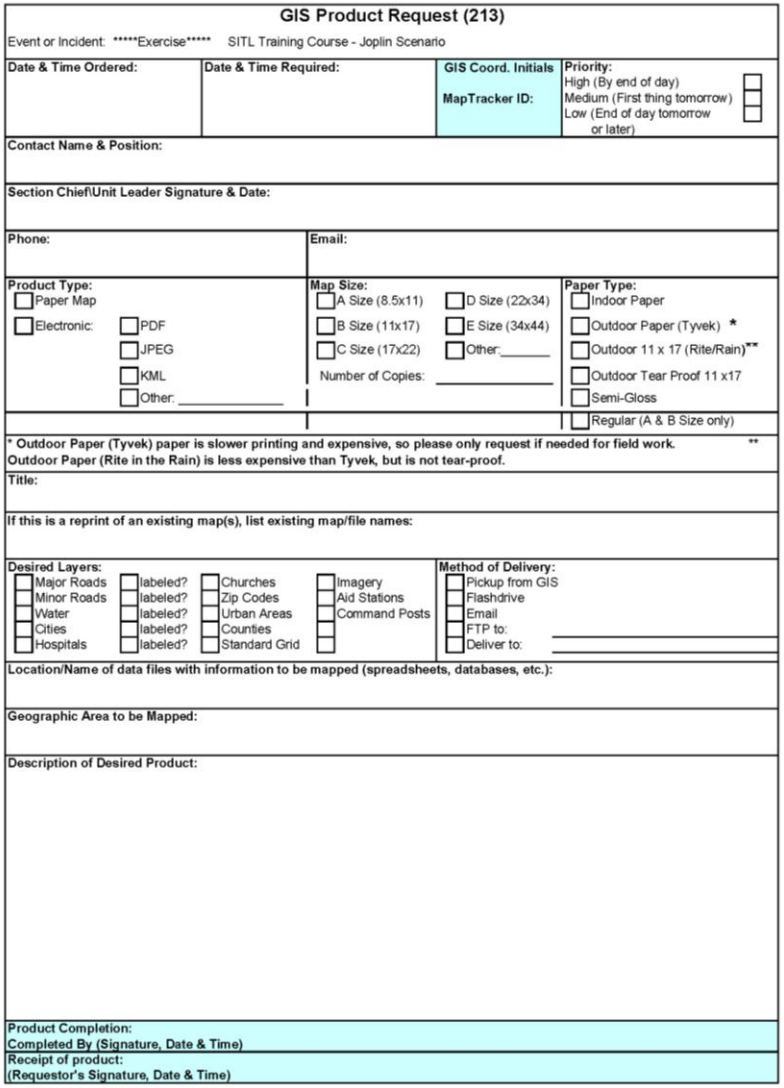
Geospatial Introduction

Map Request Process & Tracking

Map Requests

- Map requests
  - 213 form needs to be used for all GIS product and service requests
  - GIS Team needs to provide products when promised
- Map production tracking
  - MS Access
  - MS SharePoint
  - MS Excel
  - Google Docs



GIS Product Request (213)

Event or Incident: *****Exercise***** SITL Training Course - Joplin Scenario

Date & Time Ordered:	Date & Time Required:	GIS Coord. Initials MapTracker ID:	Priority: High (By end of day) ☐ Medium (First thing tomorrow) ☐ Low (End of day tomorrow or later) ☐

Contact Name & Position:

Section Chief\Unit Leader Signature & Date:

Phone:	Email:

Product Type:	Map Size:	Paper Type:
☐ Paper Map	☐ A Size (8.5x11) ☐ D Size (22x34)	☐ Indoor Paper
☐ Electronic: ☐ PDF	☐ B Size (11x17) ☐ E Size (34x44)	☐ Outdoor Paper (Tyvek) *
☐ JPEG	☐ C Size (17x22) ☐ Other:_____	☐ Outdoor 11 x 17 (Rite/Rain)**
☐ KML	Number of Copies: _____	☐ Outdoor Tear Proof 11 x17
☐ Other: _____		☐ Semi-Gloss
		☐ Regular (A & B Size only)

* Outdoor Paper (Tyvek) paper is slower printing and expensive, so please only request if needed for field work. ** Outdoor Paper (Rite in the Rain) is less expensive than Tyvek, but is not tear-proof.

Title:

If this is a reprint of an existing map(s), list existing map/file names:

Desired Layers:				Method of Delivery:
☐ Major Roads	☐ labeled?	☐ Churches	☐ Imagery	☐ Pickup from GIS
☐ Minor Roads	☐ labeled?	☐ Zip Codes	☐ Aid Stations	☐ Flashdrive
☐ Water	☐ labeled?	☐ Urban Areas	☐ Command Posts	☐ Email
☐ Cities	☐ labeled?	☐ Counties	☐	☐ FTP to: _____
☐ Hospitals	☐ labeled?	☐ Standard Grid	☐	☐ Deliver to: _____

Location/Name of data files with information to be mapped (spreadsheets, databases, etc.):

Geographic Area to be Mapped:

Description of Desired Product:

Product Completion:
Completed By (Signature, Date & Time)

Receipt of product:
(Requestor's Signature, Date & Time)

Processing Map Requests

1. Map request to SITL/GISM
2. GISM prioritizes the request and tasks GISS
3. If data necessary for request is not in house or is outdated, GISM makes appropriate contacts
4. Analyst generates map using the requirements from the map requests
5. The map is then sent to GISM to QA/QC
6. Map is sent to requestor for edits
7. After all edits are made, the map is sent back to the requestor
8. If the map request requires printing a large copy, GISS prints the map to the plotter using the appropriate dimensions

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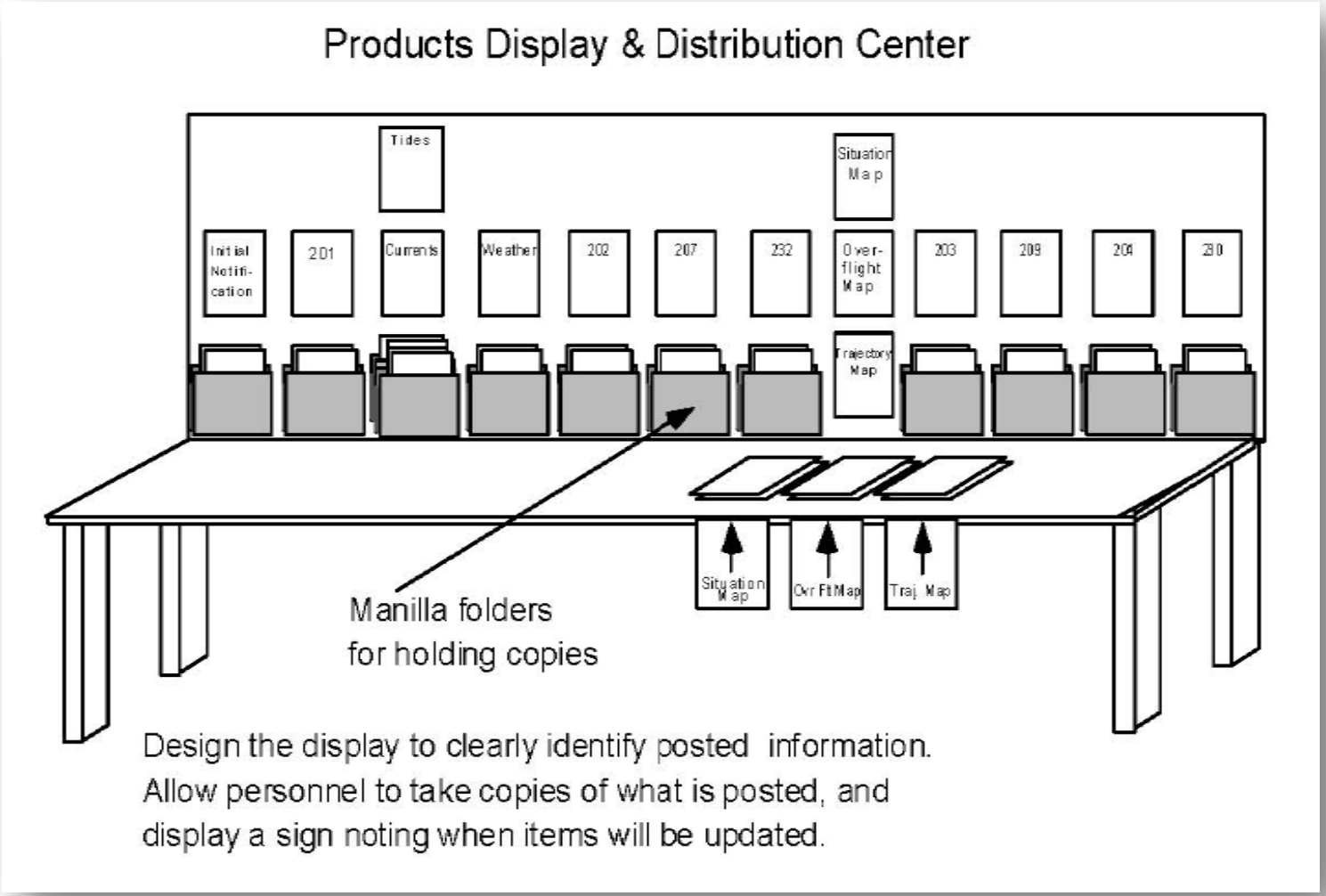
Geospatial Introduction

Distributing Products

Information Boards - Example



Information Boards - Documents

- Initial notification form – obtained from person initially reporting the incident
- Incident Briefing (ICS 201) – obtained from Incident Commander (IC)
- Weather forecasts – obtained from the SITL
- Response Objectives (ICS 202) – obtained from the Planning Section Chief (PSC)
- Organization Chart/List (ICS 207/203) – obtained from the Resources Unit Leader (RESL)
- Resources at Risk summary (ICS 232) – obtained from Technical Specialist

Information Boards - Documents

- Area Contingency Plan (ACP) Site Index (ICS 232a) – obtained from the SITL and posted next to the Situation Map
- Situation Report – obtained from SITL
- Daily Meetings Schedule (ICS 230) – obtained from the SITL

Information Boards - Maps

- Situation Map – obtained from GIS
- Over flight Maps – obtained from GIS
- Division Zone Maps – obtained from GIS
- Traffic Plan Maps – obtained from GIS, as necessary
- Command Post Map – obtained from GIS
- Facility Map - obtained from GIS
- Incident Action Plan map - obtained from GIS
- Resource Maps - obtained from GIS
- Trajectory Maps – obtained from the Environmental Unit (EU) or Technical Specialist
- Sensitive Environmental Resources Maps - obtained from EU or Technical Specialist
- Map of USA

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Information Boards - Maps

Web-based Distribution

- File Transfer Protocol (FTP)
  - FileZilla
  - SmartFTP
- MS SharePoint
- Google Drive
- Dropbox
- Browser-based GIS/Mapping
  - Can be a very effective way to share information
    - Data and application are centrally managed
    - User always has the most current information
    - User has some control over the output

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Geospatial Introduction

Data Collection Tools and Data Management Plans

Data Collection Tools

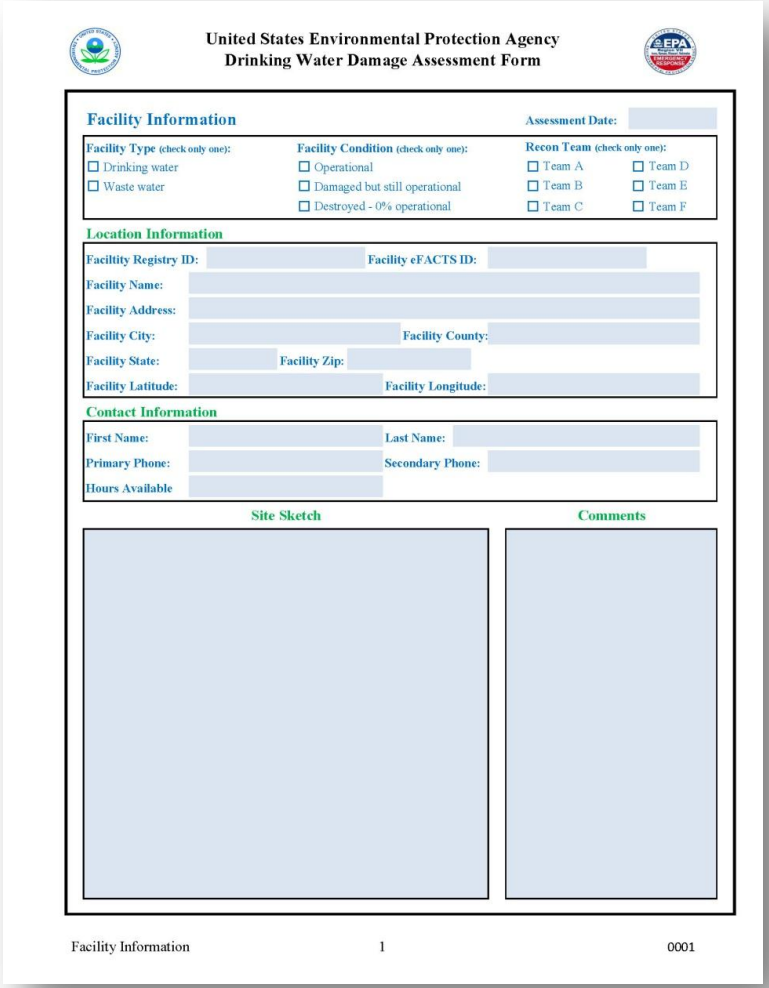
- The Benefits
  - Increased efficiency and accuracy
  - Decreased data processing time
  - Promotes standards in data collection and management
  - Allows for better collaboration
  - Allows for real / near – time data transmission

Data Collection Tools

- Technology
  - Field sheets – Old School / Tried and True
  - PDA based tools – Aging technology
  - Smartphone or tablet based tools – New and improved
  - Automated / remote systems - Newest in high tech gear
  - Hybrids

Data Collection Tools

- The Field Sheet
  - Regionally based or response specific
  - End of the world back-up
  - Tailored to capture all necessary information
  - Easily managed in the field
  - Creates bottleneck for data managers



United States Environmental Protection Agency
Drinking Water Damage Assessment Form

Facility Information — Assessment Date:

Facility Type (check only one):	Facility Condition (check only one):	Recon Team (check only one):	
☐ Drinking water	☐ Operational	☐ Team A	☐ Team D
☐ Waste water	☐ Damaged but still operational	☐ Team B	☐ Team E
	☐ Destroyed - 0% operational	☐ Team C	☐ Team F

Location Information

Facilltity Registry ID: Facility eFACTS ID:
Facility Name:
Facility Address:
Facility City: Facility County:
Facility State: Facility Zip:
Facility Latitude: Facility Longitude:

Contact Information

First Name: Last Name:
Primary Phone: Secondary Phone:
Hours Available

Site Sketch | Comments

Facility Information 1 0001

Data Management Plan

A data management plan (DMP) is a document constructed (usually at the onset of a large-scale response) to aid the Situation Unit and Environmental Unit with data management responsibilities. The plan is designed to help coordinate and document the collection, processing, and delivery of response related information.

- Workflows
- Methodologies
- SOPs and checklists
- Standardized procedures
- Data element dictionaries and valid values

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Siouxland Sub-Area Atlas Demonstration