Montana Spatial Data Infrastructure – Enhancing an All-Hazards Approach to Emergency Preparedness

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Montana Critical Structures Data Coordinator
Presentation Overview

- Montana Background & Homeland Security
- Montana Spatial Data Infrastructure
- Transportation & Cadastral Data Layers
- Critical Infrastructure & Structures Data Model
- Products and Applications
GIS Working Team of Montana DES

*Mission Statement:*

Promote the use of GIS with current and accurate geospatial data to facilitate effective and efficient emergency management and Homeland Security efforts within the State of Montana at the local, state and federal levels.

*Vision Statement:*

It is the vision of this subcommittee to incorporate GIS into all phases of emergency management in Montana.
Montana Background

- 2005 Estimated Population: 995,670
- Total Land Area: 145,552 square miles
- Length of Canada/US Border: 545 miles
- 15 Land Ports/5 Air Ports
- Population Density = 6.2 people/mi^2
- Largest city in population: Billings (~100,000)

Homeland Security Concerns

Natural Disaster Concerns
– Earthquake: 8 since 1925 > 4.2 R
– Flu Pandemic: 1918 outbreak

Human-Caused Disaster Concerns
Porosity of border
– Weapons of Mass Destruction
– Threats to Infrastructure
“Mind your Own Business” Culture

American Extremism Concerns
– Unabomber
– Freeman Standoff
Homeland Security Threats in Montana

- 563 miles of border with Canada
- Highly porous
- 15 Land Ports
- 5 Air Ports

- Major truck route (I-15)
- One of the only train routes
- 2 major Canadian cities (Calgary & Edmonton)
  - Immigrant populations with history of supporting terror organizations
  - Canada Intelligence Service estimates 56 terror groups
  - Periphery route for smuggling
  - Significant point of illegal entry

Source: http://www.customs.ustreas.gov
Extremism in Montana

Unabomber: aka Ted Kaczynski
- Domestic Terrorist
- Delivered 16 bombs
- Killed 3 people
- Injured 23 people
Extremism in Montana

Freeman Standoff
– Anti-Government
– 81 day standoff with FBI
– Reminiscent of Waco
– National attention
Federated GIS in Montana

• Centrification & maintenance of data from multiple users without confining standards
• In use since mid 90’s in Montana
• Effective development of State Framework layers (Montana Spatial Data Infrastructure)
• Maintainable databases
• Enterprise approach (persistent unique identifiers)
### Montana Spatial Data Infrastructure (MSDI)

<table>
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<tr>
<th>NSDI</th>
<th>Montana Developments to Date</th>
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<tr>
<td>• NSDI: technology, policies, criteria, standards and people</td>
<td>• Cadastral (land ownership)</td>
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<tr>
<td>• Multiple contiguous data layers</td>
<td>• Aerial Imagery</td>
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<td>• Purpose</td>
<td>• Stewardship Boundaries</td>
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<td>– Promote Data Sharing</td>
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<td>– Reduce Costs</td>
<td>• Transportation Framework</td>
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<td>– Reduce Redundancy</td>
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<td>– Ensure Compatibility</td>
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Montana Spatial Data Infrastructure (MSDI)

**Federal Framework Data**
- Land Ownership
- Transportation
- Surface Waters
- Boundaries
- Geodetic Control
- Elevation
- Aerial Imagery

**State Priority Data**
- Geology
- Hydro units
- Landcover
- Critical Infrastructure - structures, energy distribution, telecommunications, etc
- Soils
- Wetlands
Where Does Enterprise GIS Data Come From?

- Local Data Providers
- State Data Providers (ITS)
- Federal and Tribal Data Providers
- Private Data Providers

Statewide Road Centerline Framework

Applications:
- Emergency Services
- Addressing
- Routing
- Resource Management
Montana Transportation Framework

Multi-jurisdictional Roads
  – Federal, Tribal, State, County, and Local Roads

Approximately 235,000 line segments

Currently consists of 138,000 Miles

Currently over 50 data providers

Maintainable via Unique Identifiers and Change Detection

Based upon UNETRANS Data Model
Montana Cadastral Website

http://www.gis.mt.us/
Structures Data Model Background

Sub committee Objectives:

• Inventory existing data
• Ensure non-redundancy of efforts and encourage collaboration
• Determine needs of Emergency Management
• Encourage technology transfer of GIS to community
• Determine security concerns of distribution
• Prioritize data acquisition
Designing a useable geodatabase for DES begs the following questions:

- How responders identify & notify evacuees?
- What escape routes exist?
- Where are the facilities housing hazardous materials?
- What are the evacuation routes for schools?
- Which infrastructure is threatened by the failure of a dam?
Structures Data Model Background

Working Team determined to develop a structures database in 2004

- Data Repository
- Function at all scales
- Be highly portable – support other apps

“All Hazards”
Structures Data Model

Realities

• Data is dynamic
• Requires local buy-in
• Institutional Barriers
  – Emergency Management Community
    • Map on the hood
    • Computer phobic
• Solution must disseminate in multi media
Montana Critical Infrastructure and Structures Data Model

- Determination of Criticality (Operations)
  - Political divisions
  - Area of influence
  - Vulnerability status
  - Criticality rating
  - Criticality type
  - Status of record
  - Analysis detail supporting criticality for a given scenario

- Contact Information
  - Analyst determining criticality
  - Contact for structure
  - Contacts for function within structure

- Features, Function & Geometry
  - Supports a federated approach – external feature collections
  - Supports multiple functions per feature
  - Feature & Function
    - Relates structures to the function they serve
    - Crosswalk alternative classifications

- Supportive Data Models
  - Address model
  - Transportation model
  - Cadastral model
  - Base map

- Enterprise Tables
  - Table of Entities
  - Standard Dataset Identifiers

Persistent Unique Identifier Description
Spatial Domain Description
Critical Infrastructure & Structures Data Model by Geodata Services Inc.

Montana Critical Infrastructure and Structures Data Model
Annotated geodatabase schema diagram
(Version 2005.01.08.1)
Data Providers

Data Consumers
Critical Infrastructure & Structures Data Model

CISDM as Data Repository

Data Providers
- Fire, Police
- Emergency Operations
- Health & Human Resources
- Schools

Data Consumers
- Fire, Police
- Emergency Operations
- Health & Human Resources
- Schools
Feature Function Relationship

Police

Emergency Operations Center

Emergency Shelter
Critical Infrastructure & Structures Data Model

CISDM currently contains:
- Hospitals & Medical Care Facilities
- Police Stations
- Fire Stations
- Ambulance Facilities
- Emergency Operations Centers
- Emergency Shelters
- Nursing Homes
- Airports
Critical Infrastructure & Structures Data Model

CISDM Data Layers to come:
- Railroad lines
- Ports of Entry
- Influenza vaccine depots
- Morgues
- Churches
- Water storage facilities
- Blood banks
- Other abled transit locations
Critical Infrastructure & Structures Data Model

What about data security? Some data about critical structures should not be on the internet!

- Absolutely!
- Two copies of the data model
  - Public: available for dissemination to everyone, containing “non-sensitive” information
  - Private: available only to the DES Montana All Threat Intelligence Center (MATIC), containing “sensitive” information
CISDM Collaborations to date:

- Risk Management & Tort Defense: Digitized > 300 state structures valued over $1M
- Office Public Instruction: Carry all public schools, provided GIS feature class in return
- Dept. Natural Resource Conservation (DNRC): Commissioned digitization of inundation maps for 7 high hazard dams
- Commissioned creation of GIS template for use in Pre-Disaster Mitigation Plans (PDM’s)…standardize and cost savings
- Commissioned study & creation of a standardized symbology set to be useable by all disciplines
- Working with COOP/COG to ascertain criticality
- Intelligent Transportation Systems (ITS) from MDT
Critical Infrastructure & Structures Data Model - Applications

How can CISDM help with Emergency Preparedness?
Ask yourself: What happens during an actual event?
- Where is the event? What is threatened?
- Where are the contact data?
- Where are the closest responders?
- Where is the equipment? Infrastructure?
Montana Spatial Data Infrastructure Enhances the All Hazard Approach to Emergency Preparedness

The Critical Infrastructure layer is based upon the "All Hazards" approach to emergency preparedness. It is highly valuable and useful for local, state, and federal emergency responders (e.g., NIMS). The Critical Infrastructure Information Model (CIIM) production will support state and local models and enhance the analysis of critical infrastructure through an analytical framework for emergency planning.

The map below shows a coupling of the information Critical Infrastructure model that occurs in the city of Butte. The marked features shows an event perspective. Decreasing the density of events shows the density. Thus only a subset of the infrastructure is known, which includes infrastructure points, hospitals, schools, and transportation networks. A detailed feature of the CDEI is a "hub" that can support multiple information for a given feature. The map above can be used to identify critical infrastructure in Butte. The CIIM can also be used to identify infrastructure that is critical to the city. The ability to quickly see the critical infrastructure will support the visualization of infrastructure that is critical to the city.

The inclusion of Critical Infrastructure in the CIIM along with the Transportation, Critical, and other departmental layers in map infrastructure is a highly visible feature. Critical Infrastructure and other critical layers to reduce the potential of the cost of emergency response.

The Auditor

The undisputed name of the Berkeley Pit is the Auditor, a mongrel dog that called the mine site home for 16 years. This amazing canine survived in a coming sc冒险 in the Berkeley Pit. "Not a single blade of grass, not a tree, shrub or weed can survive underground," observed John Below, Animal's Yard. Resting in the shade and sun, this is the land of soil that eats men's boots. Let alone the rest of my normal dog," said the Auditor. The Montana Standard. Auditor, named for showing up when you least expect it, has since become a sort of mascot and symbol of the pit. The Auditor's presence on site is a reminder of the human impact at the Butte Hodge Mill.
Counties (5) With Reported Cases at 12:00PM on June 22, 2005

Legend
Potentially_Affected
- [all other values]
Reported_C
- 0
- 1; 7; 9; 13; 6
Montana Emergency Facilities
- [all other values]
TYPE
- Ambulance
- EOC
- ES
- Fire
- Police
roads
- [all other values]
TYPE
- Interstate
- Montana Ro
- Secondary
- U.S. Route
Montana Shaded Relief
RGB
- Red: Band_1
- Green: Band_2
- Blue: Band_3
User Interface
ArcGIS Server Web Application

- Digital Cartographic Model
- ArcGIS Server Application
- Extraction via Web Interface
  - Map Document (.mxd)
  - Personal GDB
  - Standardized Layers (.lyr)

- Data Feed from MSDI Layers
User-Interface Example
Base Map Product Example
ESRI Portal Toolkit

- Allow users to search/discover metadata
- Allow online mapping
- Chosen channel for CISDM data
- Organize user logins and profiles
Questions?

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