Extending GIS to the Field for Storm Damage Assessment

Jerry Warren
Dominion Resource Services
Hurricane Isabel
Supplies Used During Restoration Efforts

- More than 12,000 workers restoring power
- 10,705 poles
- 14,610 pole cross-arms
- 7,900 transformers
- Roughly 1,000 miles of new wire
- **More than 1.8 million customers affected**
Question?

1) How can we conduct a damage assessment survey over such a large geographic area?

2) What can we do with the data once it is collected?
APPLICATION OBJECTIVES

• Application must be able to collect hazard locations in relation to our existing electric facilities.
• Application must be light weight, easy to use
• Must have a way to exchange data between the field and the office.
• Development and implementation time must be kept to a minimum……2 weeks!
DID HE SAY IN 2 WEEKS?

YES!
DATA OBJECTIVES

- Hazard Data must maintain both spatial and non-spatial attributes
- Must be able to incorporate into Arc8 environment for analysis.
- Must be able to produce map products with data.
- Must be able to generate meaningful reports detailing hazards, status, material, etc.
Solution for Field Collection

• Mapframe’s FieldSmart Viewer (Dominion Viewer) will be utilized as a base map to place the hazard locations.
• Mapframe would provide a collection module with a predefined dialog for data entry.
• For each field user, a file is created with the username, date, and time in the filename to keep the files unique.
• Each time the user connects to the company MapFrame FTP site using fsupdate, the collect file will be placed in the \incoming ftp directory.
• A server process, scheduled to run on a pre-defined interval will check for these collect files in \incoming and process them by parsing the data and appending it to a master MSAccess file.
TYPES OF HAZARDS COLLECTED

- Cross Arm
- Joint Use
- Material Pickup
- Miscellaneous
- OH Devices
- OH Primary
- OH Secondary
- OH Service

- Pole
- Streetlight
- Switching
- Transformer
- Tree Condition
- UG Primary
- UG Secondary
- UG Service
DATA ENTRY FORM
HAZARD LOCATIONS PLACED IN DOMINION VIEWER
Log into Patrol Application
(Collect – User Login)

‘Find’ Circuit on Maps
(Find – Circuit)

Enter Hazards Found
(Collect – Hazards)

Create Upload File
(Collect – Export)

Upload Hazards
(File – Update Maps)
## Raw Data From Hazard Collect

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<th>X_Coordinates</th>
<th>Y_Coordinates</th>
<th>District</th>
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<th>Hazard_Mater</th>
<th>Condition1</th>
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DOMINION’S PROCESSING OF HAZARD DATA

- Dominion ran a nightly process to dump data from Mapframe’s master Microsoft Access database into temp tables in Oracle.
- An application was built to query, report, and assign work generated by hazard data.
- GIS process was developed to map hazard locations within Dominion’s GIS to perform further spatial analysis.
Process Flow

Create / Assign Patrol Packages

Patrol Circuits

Review / Modify Work

Create / Assign Work Packages
Distribution System Normalization Plan
Data Flow Diagram

Legend
- Business Process
- MapFrame Effort
- GIS Effort
- New Development
- B* = Primary Function
The Patrol
Data is
accessed
through Nfuse

Once in Nfuse
click on the
WMIS TEST
folder

The Distribution
Normalization Process
folder should now be
visible.

Click on this folder
Accessing Hazard Data

Assign patrollers and circuits

Review work generated from Hazard data

Generate reports
## Reporting Results

### Selected Office: CHESAPEAKE

Make assignments to the Orders here after selecting them in the List below.

### Crew: [ ] Assign Date: 03/26/2004

Assign the above Crew for the Selected Orders Below.

### Status: [ ]

Assign the above Status to Selected Orders Below.

### Priority: [ ]

Assign the above Priority to Selected Orders Below.

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- Manpower Report by Circuit - breaks down all PENDING work by circuit and type of work (OHLN, AUG, etc.)

- Manpower Report by Office - breaks down all PENDING work for all offices by circuit and type of work (OHLN, AUG, etc.)

- Material Report identifies major material items associated with all PENDING work for an office
Using ArcMap to Display Data

- The tabular Hazard Data in WMIS contained x,y coordinates of the Hazard location.
- Using ArcMap’s Add XY Event tool, we were able to map the Hazard Locations and overlay them with our existing facilities and landbase.
- A process was ran several times a day to facilitate the mapping of Hazard Locations.
Helpful Tools In ArcMap

• Add XY Event
• Flexibility of Symbolizing Data, especially by type
• Ability to show only features containing a certain criteria such as circuit, condition type, status, etc.
• Ability to produce meaningful maps easily.
• Spatial Selections
ArcMap Customization

- Print Tool was developed to produce Hazard Maps
- Automated process to convert Hazards data from tabular to a Personal Geodatabase.
- Very little customization was needed because ArcMap already provided many of the tools and functions we needed.
Spatial Analysis

- By mapping data in our GIS, supervisors were able to spatially analyze the data and assign jobs accordingly.
- Maps were created for routing and location.
- Maps were created to spatially track work completeness and track progress.
- Hazards locations that marked the replacement of a Joint Use Pole owned by another entity were used to help Dominion recover replacement cost.
Circuit Map
Project Conclusion

• Project was a success
• Development and implementation time was 2 weeks
• Over 23,000 hazard locations identified
• Several Hundred Thousand dollars was recovered from the ability to track non-Dominion owned joint use poles that Dominion replaced for restoration efforts.
• Success of project and proof of concept has initiated further investigation into creating a more sophisticated application such as the Storm Scouting proposal by Mapframe.
FUTURE OBJECTIVE

• To provide a more efficient and effective way to conduct a storm assessment survey and have the data integrate with existing systems such as WMIS, Outage Management, and GIS.
FUTURE PLANS

• Dominion is very interested in expanding the functionality of the Hazard Patrol Application.
• Mapframe has proposed the development of the Storm Scout Application initiated by Duke Energy.
• Mapframe is hoping to bring together a consortium of utilities to jointly develop the application in an attempt to decrease cost and increase synergy.
Questions?