Constructing a Regional GIS Database for First Responders
Montgomery County, Maryland

1.0 <u>Abstract of the Program</u>

The Montgomery County, Maryland Department of Technology Services - Geographic Information Systems (DTS-GIS) team has successfully constructed a regional GIS database for supporting the needs of first responders within the public safety agencies in the County. Unlike many regional efforts of constructing regional databases, which for the most part are still in pilot stages, following the tragic event of September 11, 2001, this regional database has been in operation since July 2003 and currently supports the daily operational needs of the public safety agencies. The databases have gone through multiple upgrades and are improving significantly as the maintenance programs are moving toward smooth operation.

2.0 <u>The Problem/Need for the Program</u>

Montgomery County's Department of Fire and Rescue Service (DFRS) maintains standing Mutual Aid agreements with surrounding jurisdictions. These agreements provide for DFRS to provide fire and rescue services to residents of neighboring jurisdictions within a specific distance from the common borders. For less developed areas (with sparse dwellings) along the border, the distance is 5 miles. This applies to the following Maryland counties: Frederick County, Carroll County and Howard County. For more developed areas (with dense dwellings) along the border, the distance is 3 miles. This applies to Maryland's Prince George's County, the District of Columbia and Virginia's Fairfax County. Similarly, if requested, these jurisdictions will render help to Montgomery County residents within 3 or 5 miles of the County border.

To support the mutual aid requirement on the County's new computer aided dispatching (CAD) system, the GIS data layers required by CAD needed to be expanded to include data relevant to neighboring jurisdictions around Montgomery County.

3.0 <u>Description of the Program</u>

This requirement resulted in a tremendous challenge to the DTS-GIS team - collecting and integrating needed GIS data layers from these neighboring jurisdictions (Figure 1). The County's GIS manager endeavored to visit or exchange e-mails with GIS managers or coordinators from these jurisdictions. Following the tragic events of September 11, 2001, there was an increased realization of the need for building a regional GIS database to support first responders and emergency response planners. For the most part, the requests for data were met with enthusiasm and cooperation.

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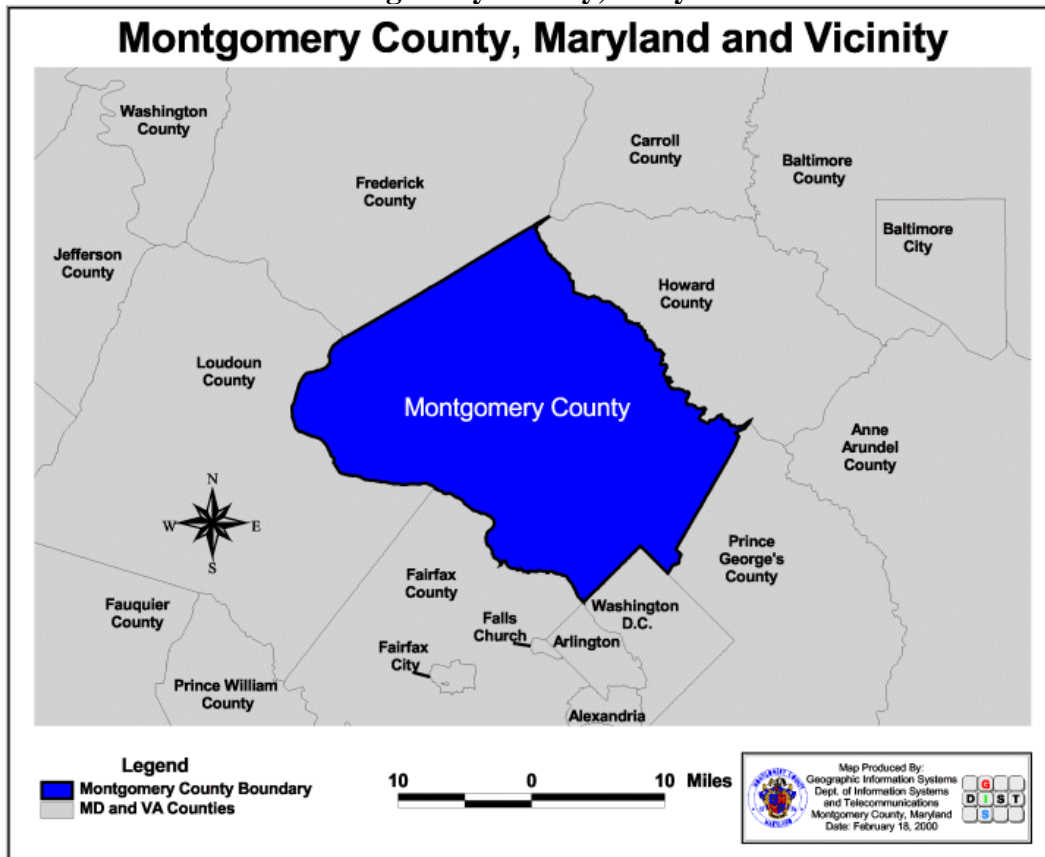## Montgomery County, Maryland

Figure 1. Montgomery County and its neighboring jurisdictions

Data Layers Requested

Using the in-county public safety GIS data layers specification as a guide, the following data layers were requested from each of the neighboring jurisdictions:

- Street centerlines with address ranges
- Building footprints
- Fire hydrants
- Points of interest
- Other water sources
- Orthophoto images

Data Uploading and Standardization

This task was somewhat simplified by the fact that all vector data layers were provided in the ESRI Shapefile format and the fact that all neighboring Maryland counties and the District of Columbia use Maryland State Plane coordinate system (in survey feet) based on NAD83 datum. Only the Fairfax data needed re-projection. Orthophoto images are in either TIFF or SID format.

The CAD dispatching, vehicle locating and map display functions all require that the underlying data layers to be for a single geographic extent. This led to the need to merge the in-county files with those of the neighboring jurisdictions. One basic requirement for the different jurisdiction's files to be

able to be merged together is that the attribute layouts need to be identical. Standardization entailed the adding, deleting or renaming of the attributes associated with each data layer received.

The CAD address verification system also requires that the interstates and ramps be named and attributed with artificial address ranges in a certain way. This necessitated editing work for I-95 in PG and Howard counties and for I-495 in PG County.

<u>Merging the Centerline Files</u>

Just like the Points (e.g. fire hydrants) and polygons (e.g. building footprints) data, the lines (i.e. street centerlines) data for in- and out-of-county need to be merged into one. An AML script was developed to automate the process by which in- and out-of-county centerlines are joined together. The biggest problem is selecting and moving the nodes to snap them together, as dangling nodes are handled differently by ArcEdit than pseudo-nodes (nodes that join two arcs). The AML will select all the boundary arcs only (by RECORD_ID) and move them a negligible amount (0 or 0.1 feet), causing the nodes to snap together. Once the corresponding nodes (in the in- and out-of-county files) are snapped together, street network connectivity is maintained and the CAD route recommendation function would work. Currently, the merged region-wide file represents 70,000 street segments - 41,000 in-county and 29,000 for the mutual aid areas. (Figure 2)
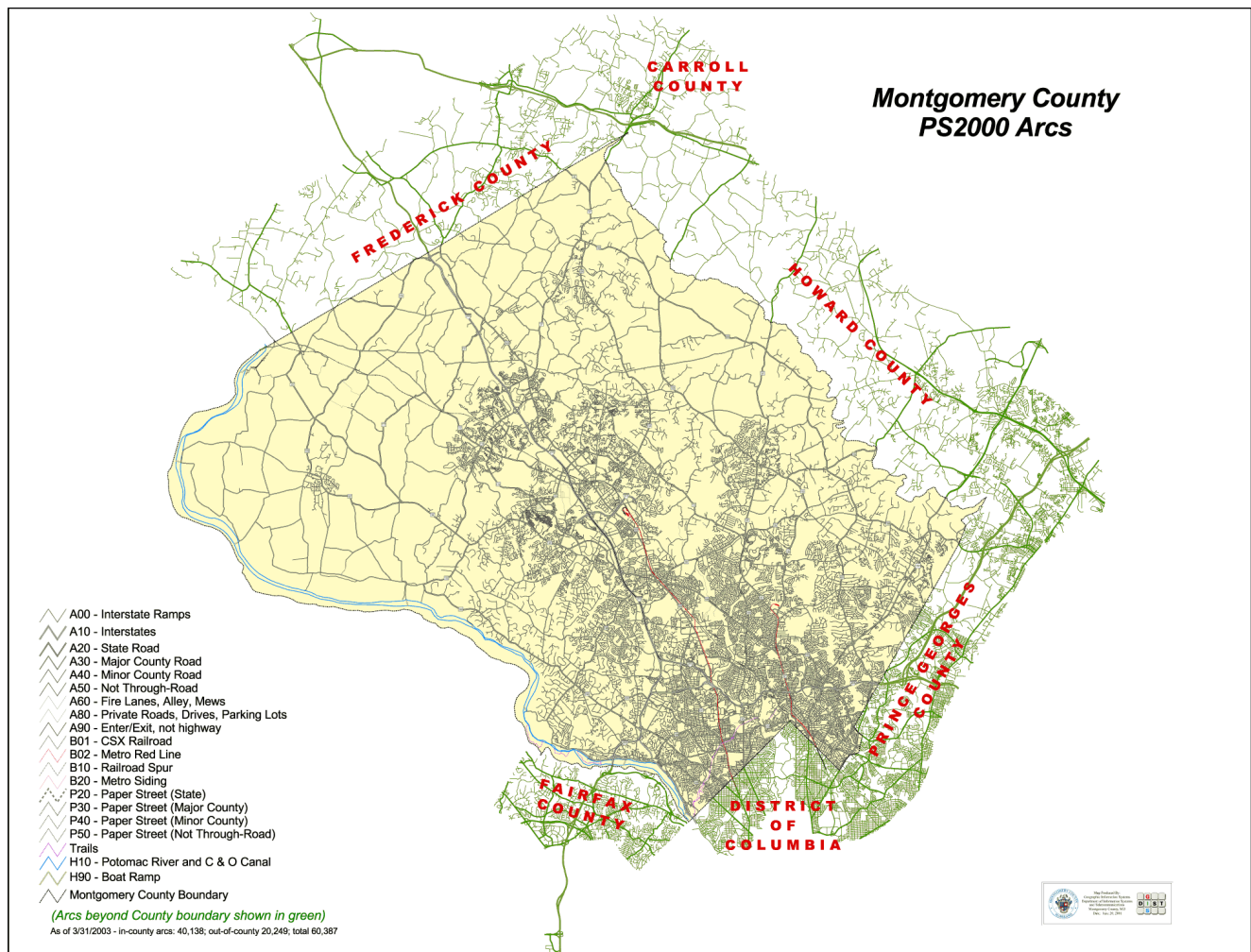

Figure 2. The Merged In- and Out-of-County Centerlines

Conversion of ESRI ArcInfo Coverages to CAD Files

Using the GIS PC workstations, the merged regional GIS data layers - with in- and out-of-county portions joined together - were then converted into the Public Safety CAD format. These converted files were then copied over the network into the Public Safety server (Figure 3). Such conversion and data upload is currently scheduled to occur four times a year.
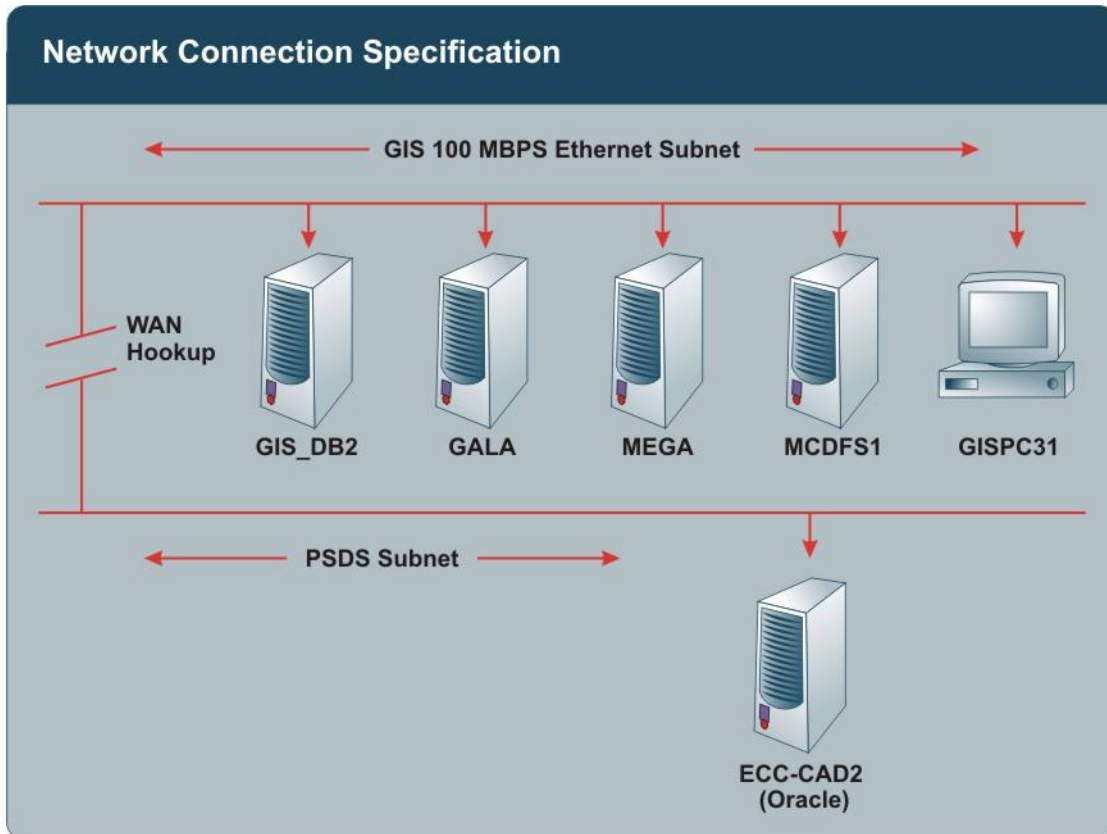

Figure 3. GIS File Server, Unix and PC Workstations, and the CAD Server

GIS Data Layers for the County Emergency Operations Center

In addition to the support of the new CAD system, the regional GIS data layers are also to be made available to the County's Emergency Operations Center (EOC), which is co-located within the County's Public Safety Communications Center (PSCC). This will be accomplished via the Web based GIS Map Viewer application and as Shapefiles residing on the GIS File Server.

4.0 Use of Technology

The maintenance of the GIS data layers is accomplished under the ESRI ArcInfo (Workstation GIS) running on Unix workstations. The GIS to CAD data conversion is handled by the CAD system vendor's Altaris Tools. The DFRS Preplans (building floor plans and/or site plans) were constructed

using scanning or Microsoft Visio drawing package and then converted to (Adobe) PDF format. ArcInfo AML scripting language was used to automate some of the data integration tasks.

5.0 The Cost of the Program

The GIS data from all of the neighboring jurisdictions were provided to the County free of charge. The existing GIS hardware and software were used for the integration and maintenance of the in- and out-of-county data layers; and the conversion of GIS data to CAD files. The DTS-GIS staff time spent on touching up the out-of-county files is estimated at 300 hours for a cost of about $9,000. This cost will be incurred three to four times a year. The effort for maintaining the in-county data layers is budgeted as on-going GIS data maintenance.

6.0 The Results/Success of the Program

The regional GIS database constructed under this program has served the needs of the Montgomery County Public Safety Communications System CAD since July, 2003. The CAD Geo data files are refreshed about four times a year. The database meets the needs of County first responders.

When needed, a true regional GIS database covering additional Virginia counties such as Arlington, Prince William and Loudon can be constructed to support the public safety needs of the metro DC region. An earlier version of the regional centerline database supported the public safety agencies in the region for the October 2002 sniper cases in the region. (Figure 4)
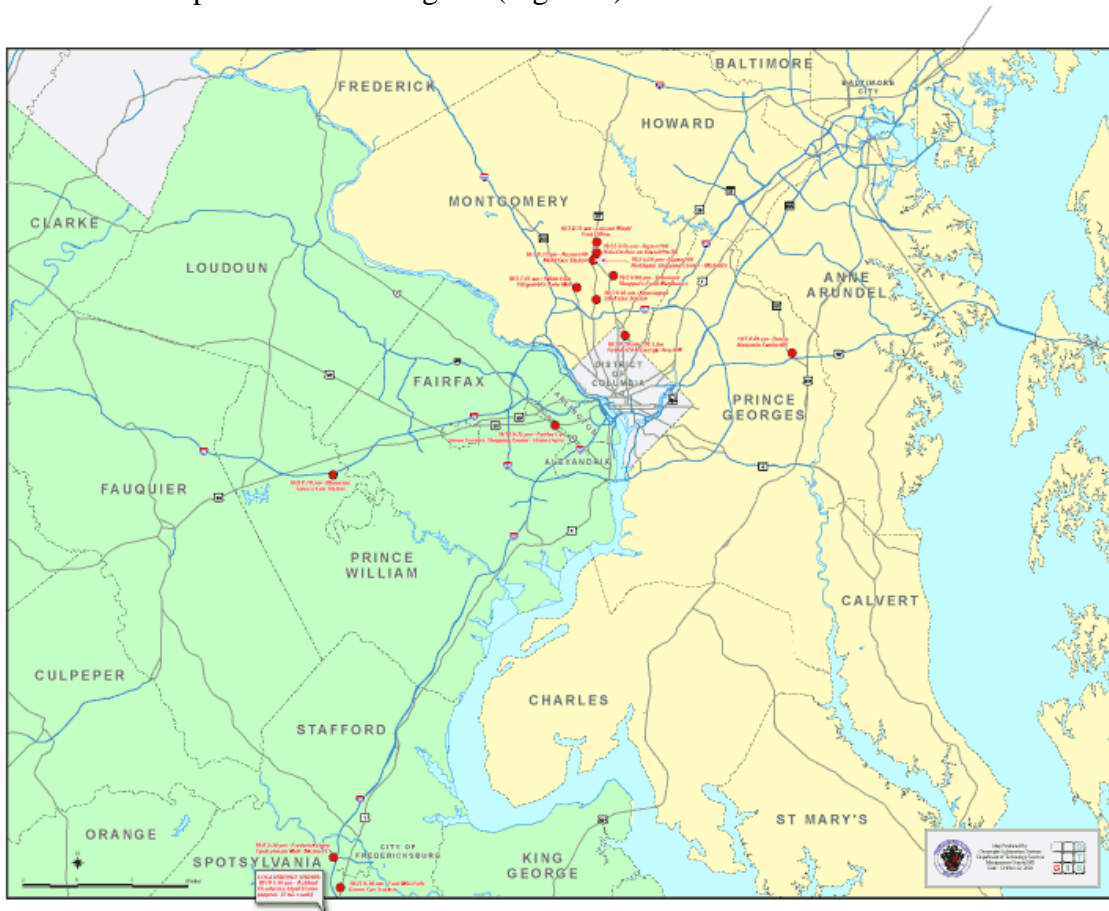

Figure 4. An earlier version of the regional GIS database supported the mapping needs of the various law enforcement agencies during the October 2002 sniper shootings.

7.0 <u>Worthiness of an Award</u>

Montgomery County's experience of constructing a regional GIS database for supporting the County's first responders represents one of the first such endeavors, thus far, in the nation. Many jurisdictions have attempted similar efforts with varying rates of success.

The pre-existing mutual aid agreements with neighboring jurisdictions and the improved atmosphere of cooperation following the events of September 11th, 2001 helped the data collection effort.

The data sharing and technical processing approaches employed in this project serve as a model for other counties or urban centers contemplating similar programs.