Building Inventory Application
Montgomery County, Maryland

1.0 Abstract of the Program

The Montgomery County Government, Department of Technology Services - Geographic Information Systems (DTS-GIS) team, in cooperation with the Department of Fire & Rescue Service (DFRS), developed an ArcView GIS based Building Inventory Application (BIA) to provide the Public Safety team from DFRS with useful geographic and attribute information and to improve Public Safety staff efficiency for adding building attributes and building footprints to the Montgomery County GIS buildings data layer.

The Building Inventory Application makes use of geographical and attribute information from over 10 County databases and also the State of Maryland's Department of Assessments and Taxation data listings, the County's road networks and Maryland-National Capital Park and Planning Commission (MNCPPC) property data listings and plat addresses. Staff need only call up the application for adding a new building footprint, adding an address, deleting a footprint that no longer exists or adding a Preplan PDF file name to a building footprint and updating the building inventory data layer. The geographic data presented in the BIA reflects information downloaded daily, weekly, or quarterly by a DTS-GIS staff member.

2.0 The Problem/Need for the Program

The fundamental requirement of the building footprints for supporting fire fighting is that ALL buildings (and their addresses) must be present on the fire fighters' computer monitors. The Montgomery County BIA was developed to improve DFRS staff efficiency and to provide useful geographic information to the participants in a Public Safety incident for display on 911's dispatch screen, or in an Automatic Vehicle Locator (AVL) terminal for dispatching and finding an incident. This application extends the ability of DFRS staff to quickly and efficiently access the geographic database information features.

Prior to the development of the application, there was no user friendly way to maintain and update geographic information for the location of new or existing buildings within Montgomery County. Consequently, DFRS asked DTS-GIS to create the application to reduce the complexity of creating the data and to provide a sophisticated, yet simple application, to allow DFRS staff to quickly update and maintain a current building footprint data layer for Montgomery County. As a result, DTS-GIS developed the BIA to enable staff to quickly find a Montgomery County building based on the input of an address or map tile number. The application was also created to add additional information about the building footprint, such as a floor plan (PDF file name) and address of the building footprint and to include a tool for displaying orthophotos, to be used to update and/or add new building footprints as necessary.

3.0 Description of the Program

The BIA was designed and tested on the ESRI GIS software ArcView. After a few tutorials and revisions, the BIA was approved by DFRS staff and is installed on a fire house desktop computer. The following sub-sections describe the process used to develop and maintain the BIA.

Building Inventory Application and Maintenance

Step 1: Establish functional requirements

Upon attending several DFRS meetings and brainstorming sessions, DTS-GIS was provided with functional requirements for the BIA in March of 2003. The application was to provide quick access to geographical data of the county and information for over 10 databases in Montgomery County's GIS Data Server. Some of these include the State of Maryland's Department of Assessments and Taxation, Park and Planning property lines and plat addresses, orthophotos, and base layer of building footprints in Montgomery County. In addition, DFRS staff was to be able to find a building footprint to update or add information to that location. GIS database attributes provided were, for example, URL name, the date the building was edited and the address of the building. The map layers needed for the project are listed in the Table of Contents panel of the application and can be turned on and off by a check mark.

The application is installed on one designated PC, a Montgomery County Fire Station 21 common area computer. The PC can be accessed remotely from the application administrator's PC using *PC Anywhere* software so that they can access the data live or have the most current data downloaded to the application on the local hard drive for ease and speed of use. The building footprints data provided by the BIA is to be downloaded weekly by a DTS-GIS staff member.

Step 2: Collect data, documents, and information

DTS-GIS is the clearing house for all the needed geographic and information data to operate the BIA. Geographic data is provided by DTS-GIS in two formats -- ArcInfo coverages and Shapefiles. The data items include, but are not limited to, State Department of Assessments and Taxation (SDAT) parcel point (i.e. centroid) records, Park and Planning Commission (MNCPPC) property polygons (i.e. land parcels) and plat address annotation, DTS-GIS building footprint polygons, street centerlines, private drives, DFRS fire station response area boundaries, site information, fire hydrants, knox boxes, connections and static water status. These data layers are updated at the various intervals by the responsible agencies and downloaded quarterly and then go through quality control checks. These GIS data layers are useful geographic references for the displaying, updating and maintaining of building inventory. Detailed BIA instructions and pictures were provided in hard copy format for easy reference. Tutorial classes will also be provided to DFRS staff by a DTS-GIS staff member.

Step 3: Programming and Creating the Building Inventory Application

The application was programmed with the Avenue scripting language using ESRI's ArcView software development environment. The geocoding capability was provided by ESRI's ArcView software. ESRI's ArcView software was used to export the final building data layer product to be used in a third party software for display. The application was initially tested on a Dell Optiplex GX300, pentium 3 PC with Microsoft Windows NT 4.0.

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The application interface is generated by functional dialog boxes and simple input boxes to enable DFRS staff to quickly and easily review the results of their editing (Figure 1).

An operator retrieves a building footprint at a time for editing its location and/or attributes. The retrieval of a building footprint is by address or map tile number.
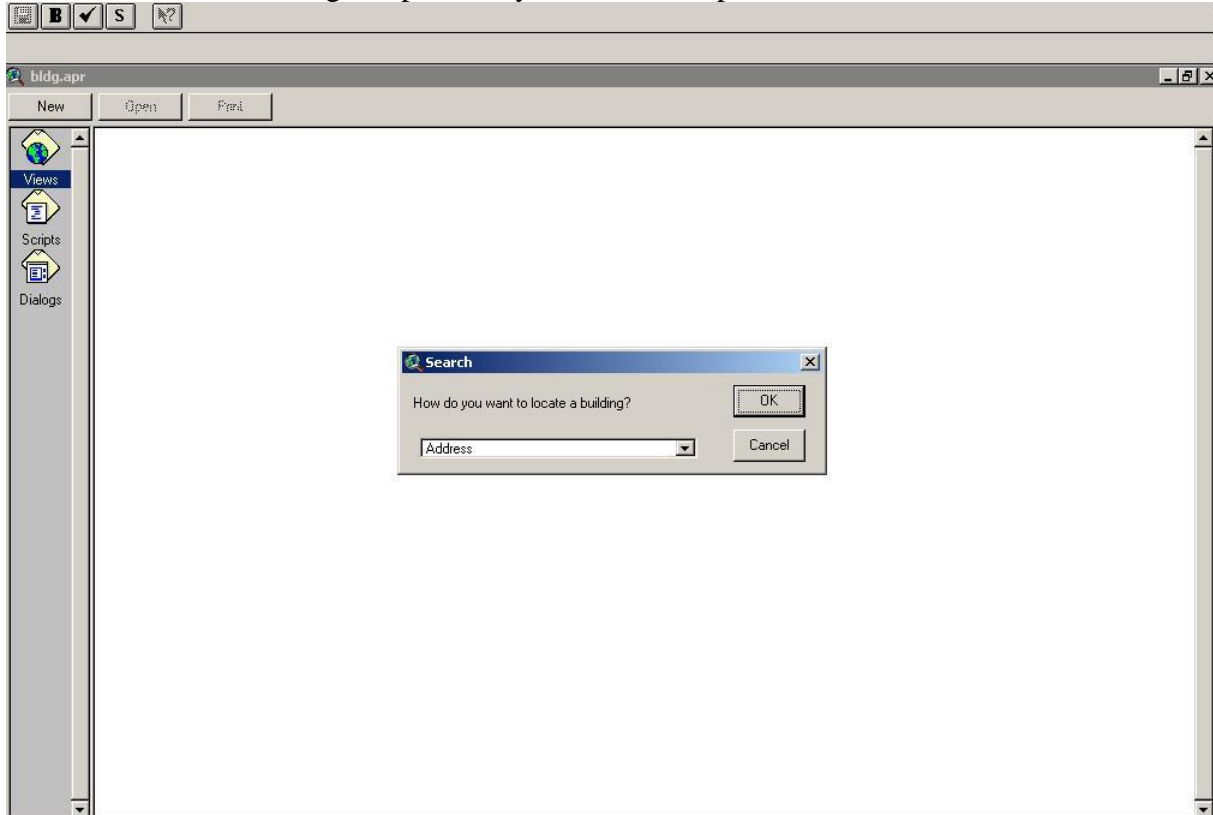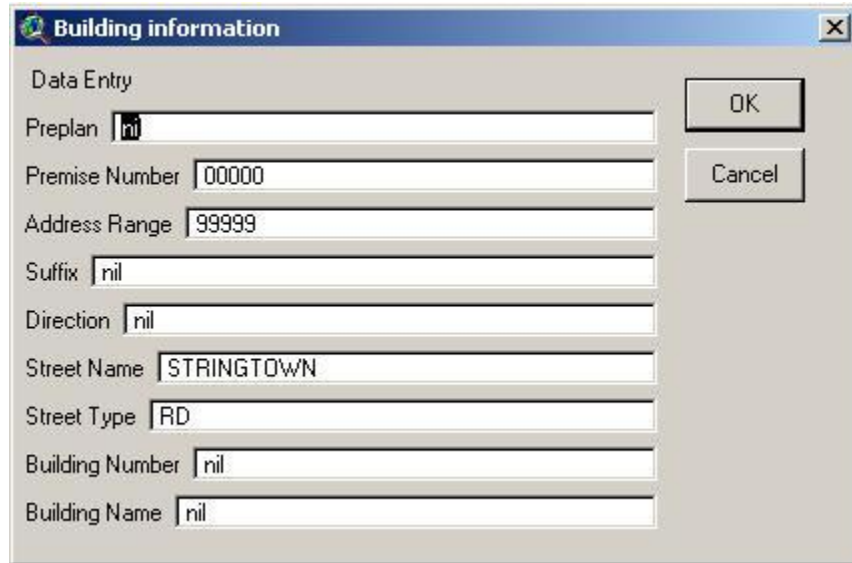

Figure 1: BIA Custom ArcView Environment Screen

The BIA was designed to enable users to quickly update and edit building footprint geography and attributes and then display their changes. The application includes displaying current orthophotos to show any new building footprints not yet shown on the building inventory layer. In addition, DFRS staff also has the option to conduct a more comprehensive search based on a query of address, map tile number or PDF file name to work in more specific areas of the county that are quickly building new construction. (Figure 2).

Table of Contents panel on the left shows GIS data layers Site Info, Static Water Status, Hydrants, MDP Parcel Points, Addresses, URL Attached, Buildings, Road Names, and Roads are all checked (i.e. turned on). "Edit Buildings" pop-up menu provides four selectable operations: Add File Name, Add Polygon, Delete Polygon, and Cancel. File Name refers to the Preplans (in PDF format) that are to be linked to the corresponding building footprints. Polygon refers to building footprint.

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Figure 2: BIA Interface

Another tool is the data entry dialog box, used to display current attribute data for one building at a time and then to allow staff to change the data to reflect new information. (Figure 3)

One or more of the building attributes can be updated by the operator while editing or adding a building footprint.

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Figure 3: Data Entry Dialog

The data change is then displayed in the BIA interface depicting geographic data with a different color (Figure 4).

Figure 4: Data Change Results

While the data layer is undergoing maintenance, the DTS-GIS staff backs up the building footprints data layer regularly. It is downloaded quarterly for conversion to a format acceptable to Public Safety Communication System's third party display software (AltarisView).

Step 4: Review and revise BIA

DFRS staff reviewed and provided improvement recommendations for the application between March and May of 2003. The recommendations were incorporated into the application by a DTS-GIS staff member and were approved by DFRS in May of 2003.

Step 5: Install BIA on the PC On Loan to Fire Station 21

The BIA has been installed on one high-end PC that was on loan to DFRS. The appropriate network drives have been connected to the PC so that the PC always accesses the latest GIS data layers stored on the Enterprise GIS Database Server.

Step 6: Maintain application content

The associated geographic data from MC and other sources, such as SDAT and MNCPPC, is downloaded by a DTS-GIS staff member on a quarterly basis. The data is then reviewed and prepared for input into the BIA by a DTS-GIS staff member. The application content including GIS shapefiles, building data and street centerlines will be updated quarterly by DTS-GIS staff. The system administration of the application is also provided by DTS-GIS.

4.0 Use of Technology

The application was created and tested on a Montgomery County Government DTS-GIS Pentium 3 PC with Microsoft Windows NT 4.0 1GB RAM running ESRI's ArcView. ESRI's ArcView programming language, *Avenue*, was used as the application development environment to design, program, and test scripts used to create the BIA.

5.0 The Cost of the Program

The total cost to develop the DFRS BIA including staff time (programming and data maintenance) and software/hardware equipment is approximately $7,000. Approximately 40 hours of staff time were invested into the development of the application at a cost of $1,250. The ArcView GIS software cost approximately $1,500. Maintenance cost will vary according to staff salary.

In order for the DFRS staff member to use the application, a high-end PC workstation with processor 2.8 GHz or better, 1 GB of RAM, and the high speed SCSI disk drive (15,000 RPM) is needed. Large capacity RAM will reduce caching and thus speed up the editing of a typically large building footprints data layer. High speed disk drive is vital for the adequate performance of the editing sessions. Such a high-end PC workstation would cost about $4,000. A standard county T1 connection to the Internet through Microsoft Internet Explorer should satisfy the needs of staff.

6.0 The Results/Success of the Program

This application grew out of a need to update and maintain the building inventory data layer in order to provide the Public Safety third party software a building data layer that

displays addresses and to have on hand a quick reference to PDF files of building floor plans. Thus, the need for auditing the application was evident. The performance of the DFRS BIA will be evaluated by using an Avenue script to date stamp the editing of buildings to gauge the number of times the application is accessed by the DFRS staff assigned to the project.

The positive results of this application consist of a simple and uncomplicated way for DFRS staff to maintain, update and edit the important geographic information needed for responding to an emergency. The application will help reduce the demand on DTS-GIS staff time in responding to the inquiries of the DFRS staff in connection to data maintenance. Thus, the DTS-GIS staff would have more time devoting to other application development.

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

The DFRS BIA provides DFRS staff with tools to search, display, edit or update geographic building information in seconds rather than hours for any building in a database with close to 300,000 buildings. The data links between Preplan PDF files and their corresponding building footprints, made possible by the BIA, allow the first responders to quickly retrieve the pertinent floor plans. Such floor plans tell the locations of such vital information such as standpipes, hydrants, stairwells, and fire escapes. Once fully deployed, this mode of data access will replace the need to manually flip through pages of Preplan binders for a particular building (in fire or under other forms of stress), thereby, resulting in a significant savings in first responders' time and minimizing the loss of life and property.

The BIA makes use of the latest orthophotos for updating the building footprints. This is an economic way of data maintenance. Traditional way of planimetric data updates using consultants' photogrammetrical procedures is a much longer process and is more costly.

Although there are other agencies that maintain this kind of geographic database, Montgomery County is one of the first few local governments to develop this kind of GIS data service for its DFRS. The DFRS BIA serves as a model for other counties and municipalities who provide geographic data and information to their public safety planners and operation supervisors or managers.