

Program Information: Montgomery County, Maryland
Program Title: Several Maps in One: Providing Multi-Layered PDF Maps to the Public
Program Category: # 14, Information Technology
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1. Abstract of the Program

The Montgomery County, Maryland, Department of Technology Services - Geographic Information Systems (DTS-GIS) team, has begun using the layer feature of PDF files to provide County residents with access to mapping data in a new way. Multi-layered PDF maps complement other services provided online by providing the user with an experience that is more interactive than an ordinary static map, but as intuitive to use as clicking on a link. A number of mapping themes which previously would have been displayed on multiple individual maps can now be grouped into a single PDF file, yet viewed or printed to the specifications of the user. Comparisons between related maps can be made with the click of a mouse.

2. The Problem / Need for the Program

For many years, DTS-GIS has provided a number of static maps for residents on its website (<http://www.montgomerycountymd.gov/gistmpl.asp>) in both screen-friendly (GIF/JPG) and print-friendly (PDF) formats. The print-friendly Adobe PDF format has given residents the capability to print their own copies of maps and other documents on their home PC's, thus reducing the need to distribute hard copies. By preserving the points, lines, polygons, and text of GIS data, this format duplicates GIS-created maps flawlessly for anyone with the free Acrobat Reader program and a printer, and even allows enlargement of the maps without pixelation.

However, some of the static maps displayed on the DTS-GIS website in PDF format show geographic information that complements other maps, and users may naturally wish to use these various maps together. For example, residents might be interested not only in a map of schools in their particular area of the County, but also the recreation facilities in their area, or other County services. In the past, such themes have been displayed on separate individual PDF maps, and residents would have to locate several different PDF files from the increasing number of maps in the online gallery to view the entire series.

The separate PDF maps also mean a larger number of files to maintain, each of which contains some of the same basic information. For example, all maps in a series may contain the exact same street centerline and other base-map data, with the only differences being one or two other map layers; one map might show police and fire stations on top of the base-map data, while another identical map would show school points on top of the exact same base-map data. As separate PDF files, this is not an efficient use of server disk space or user's Internet bandwidth.

3. Description of the Program

Layer capabilities introduced in version 6 of Adobe Acrobat allow a new approach. Using ArcGIS in combination with Adobe Illustrator and Adobe Acrobat Professional, DTS-GIS has begun making series of maps contained within a single PDF file. Users can click between map themes of the same geographic area within the PDF map by clicking on hyperlink "bookmarks" for each theme. Base-map layers remain, and other layers, titles, and legends are simply switched to provide the user with several maps in one file.

For example, a multi-layered PDF file might include several map themes for one area of the County. Users would be able to click on a link to show map features relating to just Public Safety, or on

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another link for Schools, or yet another link for Recreation facilities. Base-map and all alternating layer are contained within the same file and easily accessed by the user. The user can print any of the linked maps. It is even possible for more daring users to toggle visibility of layers independent of the presets, thereby converting a simple PDF file into a sort of low-end geographic information system of its own.

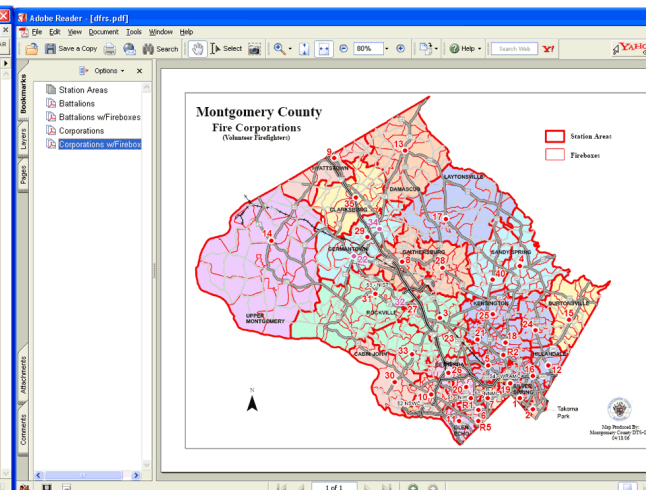
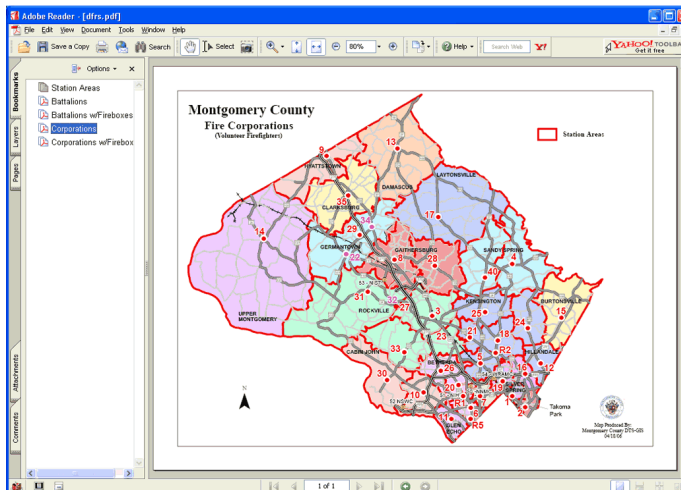
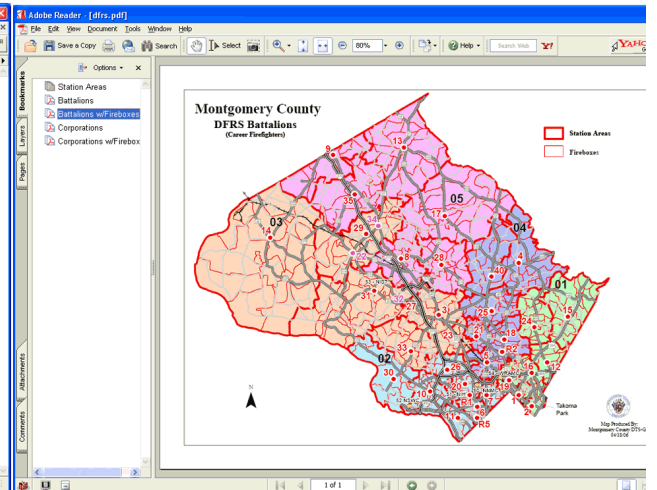
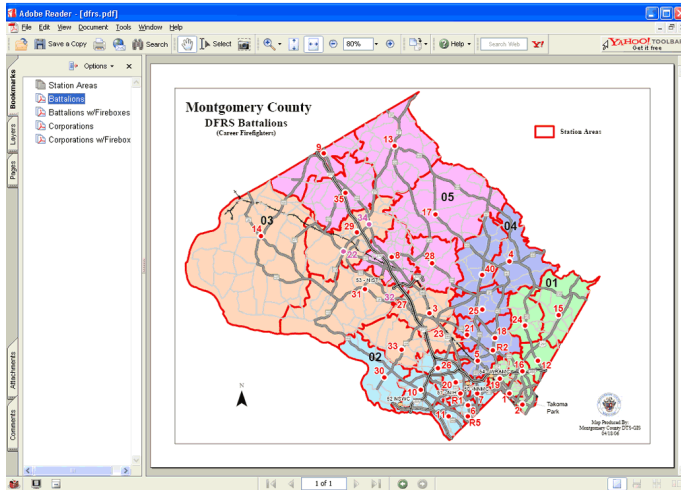
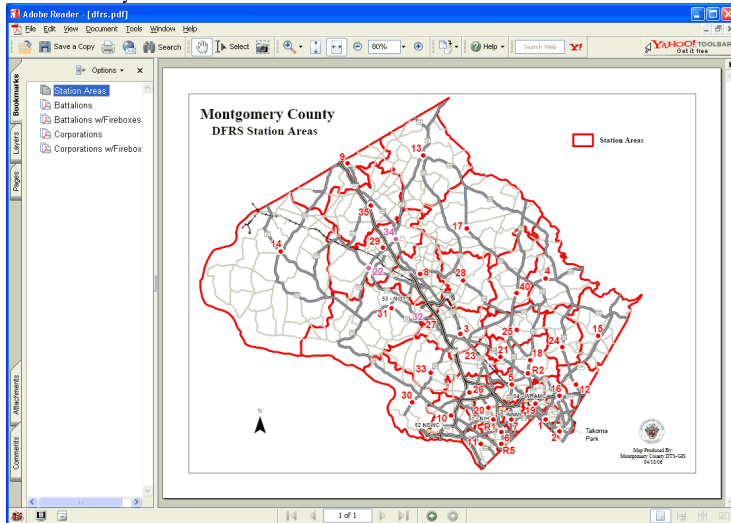
Creation of the multi-layered PDF maps begins in ArcGIS, where the GIS data can be accessed directly. It is in this first step within the GIS software that any data-driven processes - such as selecting or labeling features - must be done, as once the map is transferred to the graphics software there will no longer be any attribute data associated with the graphics. Also, it is important to determine the spatial extent to be covered on the map while in ArcGIS, because such adjustments are considerably more difficult without direct access to the GIS data. It is best not to work on creating an aesthetic map while in ArcGIS, but rather to make sure all of the necessary map layers have been added to the map. When all stages of map creation that depend on access to the data have been completed, the map can be exported to Adobe Illustrator format.

An important feature of ArcGIS' export to Adobe Illustrator format is that GIS data layers are preserved as graphic layers when opened in Illustrator. Thus, the graphics are already organized into layers that can be turned on and off in the graphics software to show the different maps in the series. Illustrator's robust graphics capabilities make this second stage of the multi-layered PDF process the best time for making aesthetic improvements to the map. The software also provides easy manipulation of layers, so that elements can be easily reorganized and new layers can be created. With a little effort, a title and legend can be created for each of the clickable states of the final map. Also, line and polygon symbols can be simplified to reduce the number of vertices with little effort; this is important because if the PDF is to be posted online, it is preferable to reduce the file size as much as possible. The "CS" version of Illustrator introduced the ability to export to a multi-layered PDF file.

In Acrobat Professional, finishing touches are made to the file. Adobe has always maintained that PDF is a "final product" format and recommends that all editing be done elsewhere. Therefore, after all graphic editing has been completed in Illustrator, all that's left to do in Acrobat is to set up the PDF document properties (such as what the user sees when the document is initially opened) and set up the "bookmark" links to the various map layer combinations.

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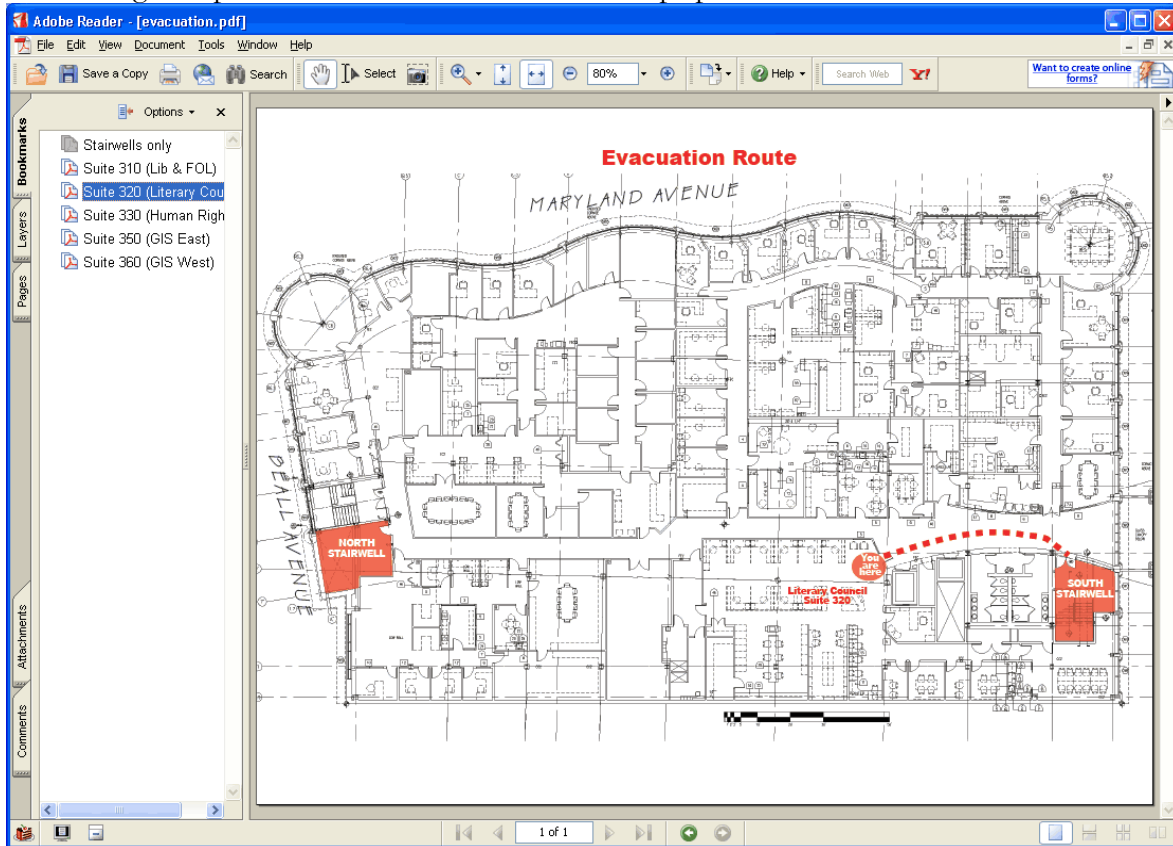
Below: Various maps showing Fire & Rescue boundaries in the County are easily comparable within a multi-layer PDF file.



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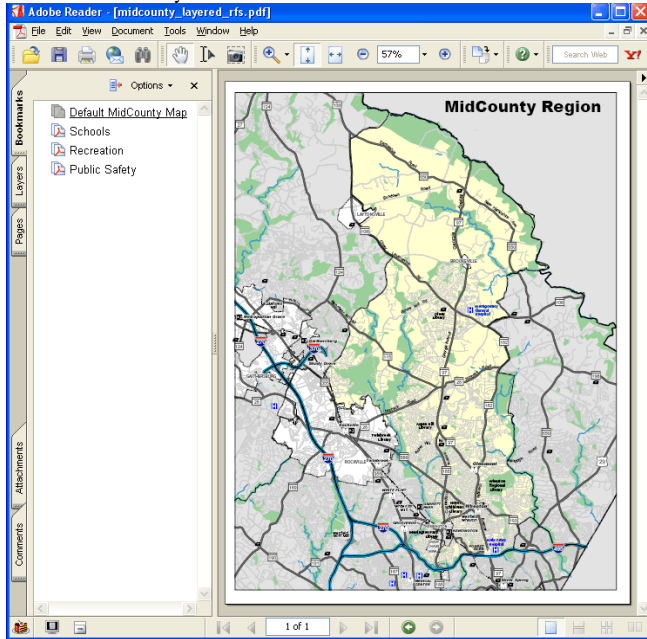
Below:

Conserving file space - a series of five evacuation maps printable from one 226 kb PDF file

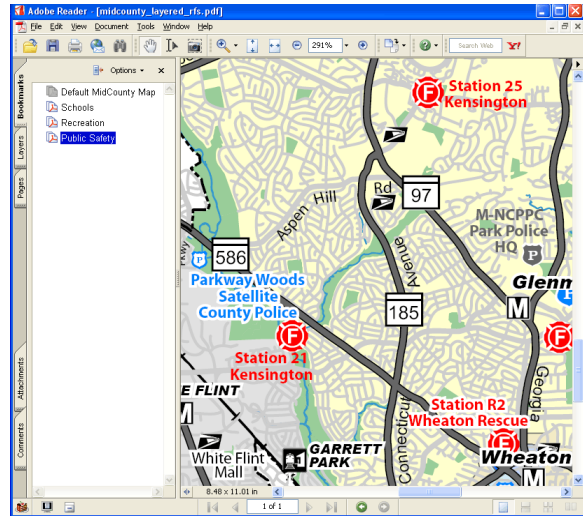


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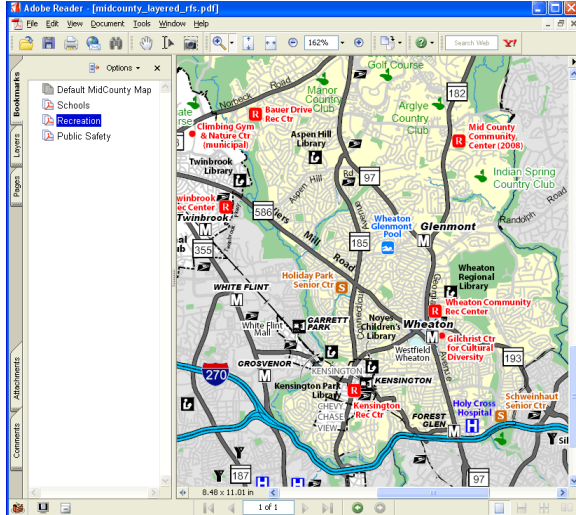
Below: a map series contained within a multi-layered PDF file can serve as an easy-to-use geographic information system for residents



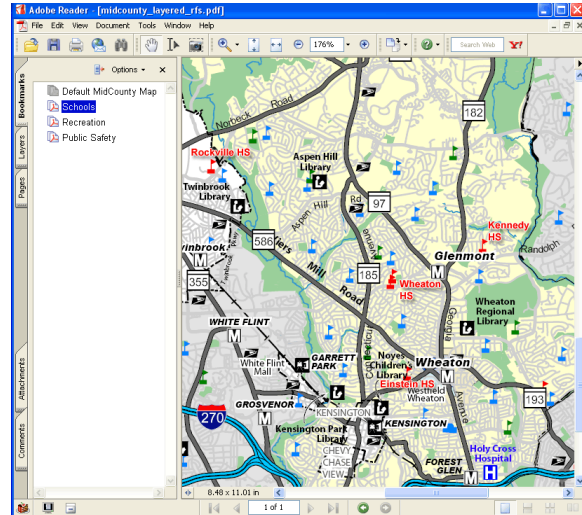
Initial view showing base-map only



Detail of Public Safety map



Detail of Recreation map



Detail of Schools map

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4. Use of Technology

As described above, three pieces of software are involved in the creation of multi-layered PDF maps from GIS data:

1. ArcGIS 9.1 – to access the GIS data and create the original map document
2. Adobe Illustrator CS – to edit for aesthetics and manipulate layers
3. Adobe Acrobat 6.0 Professional – to finalize the PDF for optimum ease of use

All three software components natively handle data layers, and the relatively smooth save/export commands of each software package allows the map to be processed between the programs in this order. All connection to the original GIS data – especially the attribute data – is lost in the first export from ArcGIS to the graphic Illustrator format.

Because layered PDF maps using this method are actually created in Illustrator, the lower priced “Standard” version of Acrobat would suffice for finalizing the PDF files. However, more robust control of layers is available in the “Professional” version.

It should be noted that, while ArcGIS does support direct export to PDF format, it does not support PDF layers. Therefore, even if one did not intend to make aesthetic improvements in Illustrator, it is a necessary intermediate step to bring the layers into the PDF file. Currently, Acrobat Professional imports layers from engineering applications AutoCAD and Visio to PDF, so it is not far fetched that similar support could be provided for ArcGIS layers in future versions.

5. The Cost of the Program

Data and software already owned by DTS-GIS are used to create multi-layered PDF maps. Currently, it is hard to imagine that any organization that maintains GIS data would not already have an ArcGIS license. Adobe’s Illustrator and Acrobat products are also commonly used by GIS users. When purchased new, the latest versions run at \$499 for Illustrator CS2 and \$299 for Acrobat 8 Standard, or \$449 for the more robust Acrobat 8 Professional.

Staff time required for completion of multi-layered PDF maps of course depends on the complexity of the particular map. It should be noted, however, that this time includes not only what would be required to make the bookmarked map views as individual PDF maps, but also in organizing the layers. There is a learning curve to this process, as the cartographer must think in terms of creating multiple maps at the same time.

6. The Results / Success of the Program

DTS-GIS published its first multi-layered PDF maps in May, 2006. Maps showing various election districts in the County that previously involved five separate maps at about 400 kb each were replaced by a single 492 kb PDF map, making various combinations of election geography accessible to residents with a single click. Additional multi-layered PDF maps have been posted allowing users to interact with Fire & Rescue geography and Police geography. Residents now only need to locate one map file within the online map gallery to view multiple map layers on a common theme. They can make geographic comparisons within the same map file, a task that previously would have involved either printing out several maps or juggling between several Acrobat windows.

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DTS-GIS is currently working on multi-layer PDF maps showing various County services by the County's five County Service Regions. Also, in the works for three commercial areas within the County, multi-layered PDF maps will allow users to display in various combinations the localized district boundaries such as the Central Business District, Arts and Entertainment District, and State Enterprise Zones.

7. Worthiness of an Award

By implementing multi-layered PDF maps, Montgomery County DTS-GIS is providing geographic information in a new, simpler way. County residents and staff benefit from this new technique by gaining access to maps that contain complex, disparate GIS data and information that previously spanned multiple maps.

The new format provides residents the ability to print their own copies of maps and other documents on their home PC's, which reduces the need of DTS-GIS to distribute hard copies of maps. By preserving the points, lines, polygons, and text of GIS data, this format duplicates GIS-created maps flawlessly for anyone with the free Acrobat Reader program and a printer, and even allows enlargement of the maps without compromising the clarity.

DTS-GIS implemented this new mapping technique in a cost-effective manner. Existing data continues to be leveraged to create the maps; new software and hardware costs related to this effort were minimal; and last, County staff learned and implemented the new process without the use of outside consultants, which further minimize the costs.