Using ArcGIS Tools for Rapid Updating of a County Atlas

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Abstract

Gallatin County, Montana's first atlas was published in 2000 using custom AML scripts in ArcInfo. With the advent of ArcGIS 8.x, new options in presentation, dynamic labeling, and workflow efficiency became available. Rapid growth in the County has necessitated a re-thinking of an acceptable update schedule for the atlas, as its primary use is by and for emergency services personnel. Transferring the atlas from ArcInfo Workstation to ArcGIS is an arduous process but will result in more timely updates. The transfer also allows enhancement of the atlas, making it more useful for emergency services personnel and the public while maintaining the look and feel of the existing atlas. Distribution via the internet using exported .pdf files or ArcIMS also becomes a possibility. The County's use of the ESRI's Map Book Developer Sample, dynamic labeling, ESRI's Maplex (when available), reference grids for indexing, and new export capabilities will be discussed.

Background

Gallatin County is a 2,600 square mile county in southwestern Montana with a population of about 70,000 people. Roughly 47 percent of the County is publicly owned. We are currently one of the fastest growing counties in Montana. The GIS Department is responsible for all of the rural addressing in the county, as well as supporting the e911 system with current road and structure data. To date, the County has mapped over 4,800 miles of roads and over 18,700 structures.

The County first acquired GIS in late 1996, and hired a GIS Coordinator in spring of 1997. Through a cooperative effort with the local University, the City of Bozeman and the U.S. Forest Service, all of the road centerlines were driven using GPS. Structure points were gathered over a 2 year time frame at a later date and new centerlines and structure points are now gathered on a quarterly basis.

The ArcGIS-based atlas is the third atlas created within the County. The first atlas was created and maintained by the County Road Department. The focus of the first atlas was addressing. Specifically, "where is the house in relation to the property boundary?" The atlas was manually drafted and last updated in 1995. At about the same time, growth in the County started to increase, and the Road Department abandoned updates likely because it became impossible to keep up with the changes using a manually oriented process.

The second atlas was created entirely within ArcInfo using custom Arc Macro Language (AML) scripts. All text was manually placed annotation and the atlas was finalized in late 2000. The primary focus of this atlas was, and continues to be, public safety— "where is the house and how do I get there?" This version of the atlas contained two levels of detail, the township (a 36 square mile area) and the section (a one square mile area, where necessary).

The Atlas Today

The atlas today is an extension of the version created in ArcInfo. It is a refinement of previous experiences and incorporates some of the wishes of our primary customer, the public safety community. The atlas also attempts to capitalize on the new tools and technology available with ArcGIS. See Figure 1 below. Some of those new features and enhancements include:

- Simplifying public ownership – the ArcInfo version thematically classified public ownership by Agency. In some cases the colors in the final print version became too light in color to be effective. The current atlas has one symbol to designate public ownership.

- Removal of shaded relief background – this, and simplifying the public ownership increased the usefulness of the atlas when produced as a black-and-white copy.

- Reference grid for road indexing – ArcGIS provides an easy way to create attractive reference grids for indexing feature layers.

- Latitude/Longitude grid for GPS users – ArcGIS also provides an easy way to create measured grids. Many of our fire personnel have asked for this feature in the atlas and now we are able to easily accommodate the request.

- Sub-section level detail pages – Increased density of growth in the County and the use of dynamic labeling in ArcMap have necessitated this level of detail.

Figure 1. Atlas page examples

Gallatin County's Solution

The Gallatin County GIS Department needed a new atlas process to support our on-going County-wide address standardization project, quarterly road and structure updates in support of 911/public safety agencies, shortened turn-around of providing public safety agencies with custom atlas updates, and new ways of distributing the atlas to public safety agencies and the public. ArcGIS is an integral part of our solution.

Our solution:

- Capitalize on the dynamic labeling features of ArcGIS 8.x and 9.x

- Leverage the features in the Map Book Developer Sample for managing the output of atlas pages

- Leverage existing sample code to produce page indexes supporting multiple versions of the atlas

- Leverage new export capabilities in ArcGIS 8.x and 9.x

Capitalize on Dynamic Labeling

One of the topics of debate for any map product such as an atlas is whether to use annotation or dynamic labeling. Gallatin County GIS was no exception. In the ArcInfo version of the atlas, all text was annotation, which took an extremely long time to edit for the final product. In light of our on-going address standardization project as well as adding new features on a quarterly basis it became clear that the time involved in making changes to the existing annotation would be inefficient at best. An additional concern was the fact that the County has not yet moved to the geodatabase and is still using the

coverage model for data storage. These concerns make dynamic labeling an attractive and logical option.

ArcGIS 8.x is a monumental leap forward from previous ESRI software in squeezing the most performance possible from the software's labeling engine. Through the use of advanced label expressions, advanced placement options, layer labeling priority, and conflict detection rules, the dynamic labeling engine can be customized to maximize the number of labels placed relative to the number of data layers presented and the spatial distribution of the features in those layers.

Advanced label expressions allow the user to have explicit control over what gets labeled and can be as simple as labeling only features having a certain attribute value or as complex as labeling features a certain way based on a set of values. ArcGIS also adds an easy to use set of dialogs that allow you to set various placement options for your labels. Using labeling priority levels, we are able to tell ArcGIS which labels and features are more important to us for labeling purposes, allowing ArcGIS to make decisions on label placement without user interaction.

Dynamic labeling is not without its faults, however. While the labeling engine does a wonderful job, there are situations where the engine decides not to place a label. At this point, manual placement of a label may be necessary if a feature must absolutely be identified. The labeling engine's ability to place adequate labels varies based on the spatial extent being labeled as well as the distribution of features within that extent. In short, as with any good cartographic product, a careful review is still required before final release.

The Map Book Developer Sample

The Map Book Developer Sample is an extension to ArcMap that contains a set of tools to create and manage map layouts with a consistent look and feel. While it was written with the creation of atlases in mind, the Map Book is useful for creating any type of map product where multiple pages or "tiles" are desired. The user supplies a page index layer (map grid), or the Map Book can create an index layer from scratch. The Map Book has the ability to create map grids for areas as well as strip map grids based on a linear feature such as a highway project.

When describing what the Map Book extension is, I like to think of it as "spatial bookmarks on steroids". ArcMap has the built-in ability to create spatial bookmarks, which allow the user to "jump" from one defined area of their dataset to another in a repeatable fashion. In order to create a series of map pages, the user would need to create a layout, use the spatial bookmarks to navigate to each book-marked extent, and manually change any text or other identifying elements on the layout based on the extent being displayed. The Map Book, in contrast, creates a set of spatial bookmarks automatically based on the page index layer specified. It contains a set of specialized tags and identifiers that update information on your layout based on the spatial extent (map page) being displayed. These specialized tags include a Title tag, Local and Global

Identifiers to display the map page relative to other pages in the series, and Index Layer Field tags that are updated based on information from an attribute field in the index layer. The user creates a layout, adding the specialized tags and identifiers in the appropriate places. When the user views a particular page in the series, the tags and identifiers automatically get updated based on the extent being displayed. No manual editing is required!

With its ability to automatically update titles and other information, the Map Book has the ability to print or export map pages in batch mode. The user can enable or disable pages in order to facilitate updates. Gallatin County's experience with this feature is positive. A recent update to our atlas required changing forty pages. Selecting those forty pages in the Map Book and batch exporting them took under 30 minutes. Manually exporting each page would have taken considerably longer. After batch exporting, we looked at each page to verify that everything we wanted to have labeled was indeed labeled. We edited the pages that needed manually placed labels, re-exported those pages and they were ready for distribution. All of the newly acquired roads and structures were incorporated into the relevant pages and labeled automatically. The turnaround for the update was a few days instead of more than a week.

Because the Map Book is a Developer Sample and therefore is not officially supported, it does have its quirks. Although the documentation implies that multiple map series can be created within one map document, that capability is not implemented. For our three levels of detail, we maintain three different map documents, each with its own map series. The source code is available online for you to modify if you do not like the way the Map Book does something, or it does not do something you would like.

Feature Indexes

The Gallatin County atlas utilizes a reference grid for indexing the roads on each page. The reference grid was created using the built-in features of ArcMap. Through version 8.3, the ability to index a feature layer against this reference grid was not built-in (Note: At the time of writing, we have not installed version 9.0, so the addition of this capability could not be verified). A bit of sample code demonstrating one way of indexing a feature layer with a reference grid was modified and a macro was created. This macro allows the user to select a reference grid and a feature layer to index, and a text file containing the resulting index is produced. The resulting index is then combined with other page indexes to produce custom road indexes for various versions of the atlas. The Map Book contains an indexing component; however, it only indexes to the map page and does not take into account any reference grids you may wish to utilize. Depending on the extent of your atlas pages, the included indexing component may be all that is needed. In Gallatin County's case, finding a particular road in a 36 square mile township can, at times, be impossible without utilizing a reference grid and a companion index.

Feature indexes have been the most problematic and time-consuming aspect of Gallatin County's atlas. We are attempting to balance the desire of an index that lists exactly the

pages where a particular road exists (a large index) with the reality that public safety agencies want the "best" page to find that particular road (a small index).

New Export Options

Before ArcGIS, exporting map layouts to Adobe Acrobat .pdf format entailed creating an image file and using the Adobe Acrobat distiller. ArcGIS allows direct export to .pdf format, allowing for a small document size without loss of visual quality.

Gallatin County GIS exports each map page to .pdf format for printing and distribution. This format will allow us to readily distribute our atlas via CD or the internet, as well as providing the ability to easily print the atlas page to a paper size different from the original, which is 11" x 17". This capability is important for many of the County's fire districts, which, in an emergency situation, may need extra copies of various pages and may only have a letter-size printer available.

The Future

The Gallatin County atlas is an evolutionary product. Even with the tools and features discussed here, the atlas will likely change due to technology and the desires of the public safety community. Gallatin County will continue to tweak the dynamic labeling options of ArcGIS to extract as much performance as possible. We will also explore the capabilities of the Maplex extension, as it's advanced text placement capabilities may help us reduce the number of atlas pages required, resulting in an easier to maintain atlas and less time spent manual labeling. Gallatin County will continue to enhance and automate the feature indexing aspect of the atlas to reduce the time and effort involved in producing custom indexes.

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