Fall 2010 - GIS 101: Oblique and Ortho and Stereo - Oh My!

By Randy Knippel

In simple terms, aerial photography comes from cameras placed above the Earth's surface, usually on an airplane or satellite. There are many ways in which it can be tailored, to fit a variety of uses. The most common use is to simply visualize things in ways not possible using any other means. An overhead view provides a much better overall understanding of our world. However, there are many specific uses for which different variations are better suited.

One common variation is the angle at which images are captured. Ortho images are captured with the camera pointed straight down (figure 1). Oblique images are captured with the camera pointed at an angle (figure 2).

Figure 1 - Ortho image

Stereo images use overlapping images to form a 3D view (figure 3), allowing detailed feature identification and precise measuring. Ortho images are usually stitched together to form a seamless image over a large area. Additional processing is required to remove distortion caused by terrain and to put many images together without noticeable edges at the seams. Oblique images are difficult to seam together and are provided in the form of libraries of many images, each tied to their locations for easy access.

Other variations of aerial photography are based on the time of year, or altitude of the camera, or the type of sensor. Spring and fall photography provides conditions where deciduous trees don't have their leaves and the ground is not covered by snow, while summer provides views of lush greenery. Low altitude photography is more expensive than high altitude photography, but provides increasing detail that can be used to identify signs, utilities, and cracks in pavement. Cameras can use different types of film or digital sensors to capture images in black and white, color, infrared, and variations between them. Finally, variations in aircraft, cameras, and GPS technology produce variations in the accuracy and resolution of the images.

With all these options, which are the best? It depends. It depends on who you ask and how they intend to use it. There is no such thing as one size fits all, or even one size fits most. The solution is to combine a few options that fit most and do it in a cost-effective way through cost-sharing partnerships.


Figure 2 - Oblique image

Dakota County, in partnership with its cities, acquired aerial photography from Pictometry International in 2006 and again in 2008. Pictometry provides low-altitude oblique and ortho images on a two-year cycle. Individual images are provided in a library, accessible through special software. The ortho images are also stitched together; however, some of the seams are visible and with 6-

inch pixels, the accuracy of +/- 7 feet is less than is usually expected for this kind of product.

This year, for half the price, the same partnership acquired ortho and stereo photography through an extended partnership with Scott County, the Metropolitan Council, the Minnesota Department of Natural Resources, the Minnesota Department of Transportation, and the United States Geological Survey. This project produced multiple resolutions over 10 counties in the metro and surrounding area using Surdex Corporation. The ortho photography will be provided as a seamless image, with 6-inch pixels, accurate to +/- 2 feet, meeting national mapping accuracy standards.

The stereo photography will be used to update the GIS basemap, including buildings, roads, and contours, across

Figure 3 - Stereo image (requires red/blue glasses)
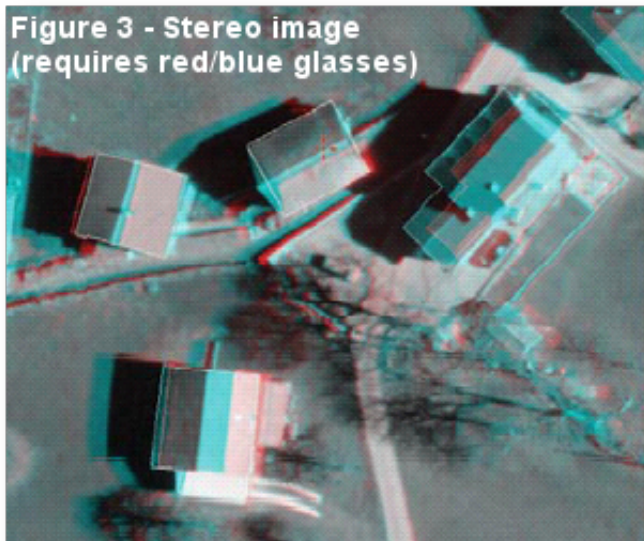
the entire county. This is usually accomplished by contracting for stereo photography in specific areas identified as having the most significant changes. However, the new photography will allow us to easily update any part of the basemap anywhere it is needed. Over the next two years, we will identify areas that need updating using several techniques, including building permits, Capital Improvement Projects, and personal knowledge. The same photography can also be used to analyze areas in 3D for other special projects.

As the demand for aerial photography continues to increase, we will be looking for ways to meet multiple technical requirements using a single vendor, and to reduce costs through strategic partnerships. The combination of technology improvements and the economic climate are causing vendors to find creative ways to help us by providing multiple products from a single project. We need to be equally creative in aligning our timelines and technical specifications to make the most use out of the aerial photography we acquire at the lowest cost.

Fall 2010 - Tech Talk: Editing Physical Features in Stereo Analyst for ArcGIS
By Joe Sapletal, GISP

Recently, using funds from the GIS Enterprise Fund, the Office of GIS purchased a replacement system for our existing photogrammetry system. We are now using Stereo Analyst for ArcGIS from ERDAS to collect physical features in stereo. The new system costs of fraction the original system, and it allows us to work in a familiar editing environment and a familiar database.

The GIS Enterprise Fund was created as a partnership between Dakota County, its cities and Dakota Electric Association to fund the creation and maintenance of the physical feature database. This database has been maintained by Dakota County staff since 1996 in an Intergraph environment. Now we are maintaining that data on a standard computer and in our ArcGIS database using Stereo Analyst for ArcGIS from ERDAS.

Stereo Analyst for ArcGIS is an extension for ArcMap and ArcCatalog that allows you to import photogrammetry project information (aerotriangulation) from Intergraph, SOCKET SET and Lieca aerotriangulation systems right into ArcMap. Those project files contain all the information about how many images there are in the project and the real world location of each of them, as well as how they relate to one another. Once the importing has completed, the operator is able to open a series of special toolbars for ArcMap, and a stereo window for viewing the stereo pairs that allow for data collection.

Portions of the editing environment are familiar to the operator, as they see the existing data and any new features they digitize in the ArcMap window. The actual editing takes place in a stereo window, where your mind's eye sees 3-D features. Put simply, one of your eyes sees one image of a stereo pair, and the other eye, the other image, and your mind sees buildings jutting up from a undulating earth's surface as if you were looking out the window of a low flying airplane. A more technical explanation would be that this system uses two video cards that display two images on two separate monitors simultaneously, using specialized hardware called a Planar Stereo/3D display. The Planar monitor system consists of two monitors mounted nearly perpendicular to one another with a StereoMirror intersecting them. When you use this system and special glasses with polarized lenses, your right eye sees the reflection of the top monitor on the surface of the StereoMirror, while your left eye

sees through the StereoMirror to the bottom monitor. Visit the Planar website for a more in-depth explanation of the [Planar monitors and stereoscopic viewing](#).

The actual editing and storage of features takes place in a geodatabase. The ultimate goal will be editing in the enterprise geodatabase to make the edits more immediately available. In the past we have been prioritizing on square mile areas and purchasing imagery for just those bounded areas. Prioritization of areas to edit will be different with the new system, due to the fact that, as part of a metro-wide ortho image acquisition, we were able to acquire stereo pairs for the whole county. With county-wide imagery we can prioritize based on clusters of construction activity, be it roads, housing or improvements to existing structures - essentially, editing without boundaries. If you have a special area that needs to be a higher priority for your project, email us and let us know.
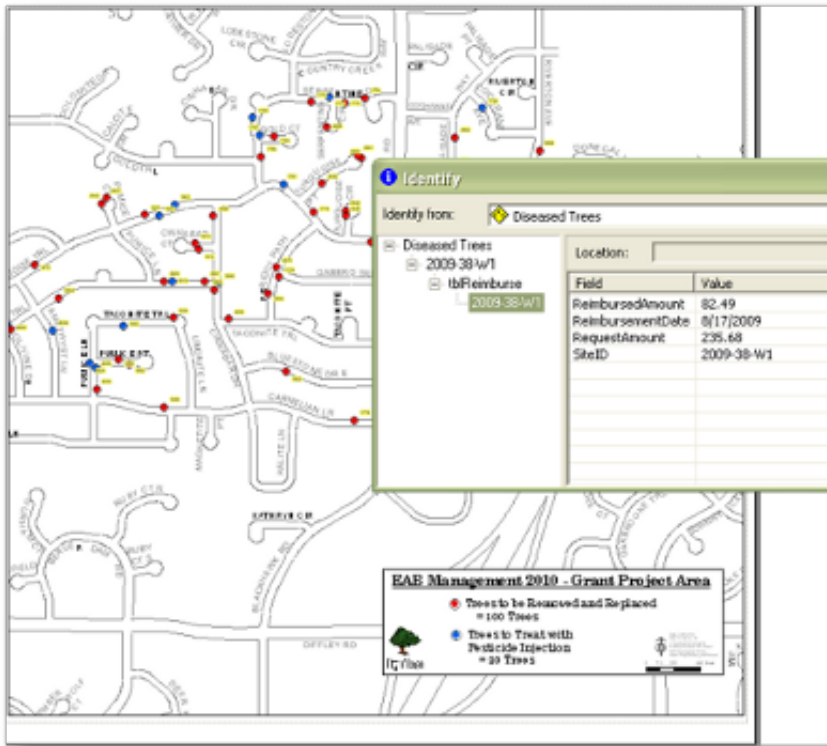
Fall 2010 - Department Spotlight: The City of Eagan Uses GIS to Help Track Diseased Tree Removal Grant Funds

By Tami Maddio, City of Eagan

The Emerald Ash Borer (EAB), a highly destructive pest of ash trees, has now been documented in St. Paul (May 2009), in Falcon Heights (November 2009), and in Minneapolis (Tower Hill Park, March 2010). Research indicates that it is very likely that EAB has infested many other ash trees in our area. This exotic beetle, introduced from Asia into the Great Lakes region in 2002, has the potential to devastate millions of ash trees in Minnesota. The City of Eagan is now proactively managing its ash tree resource to prepare for potential EAB.
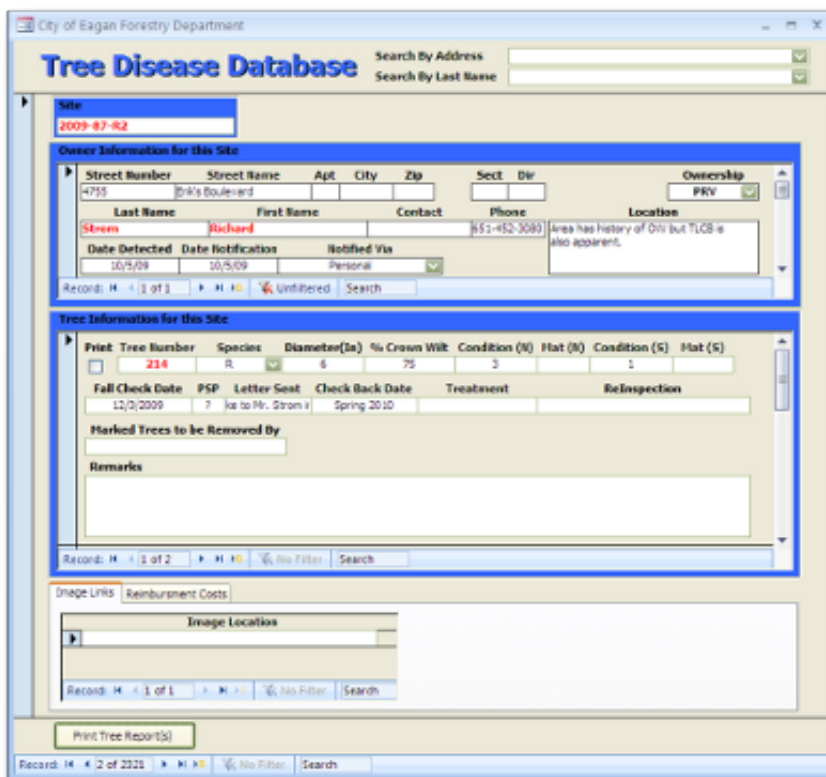
The City of Eagan estimates there are 4,377 Ash trees within the City boundary. Within weeks of the St. Paul documented EAB infestation, Eagan Forestry developed and adopted an EAB Management Plan. Basically, the plan lays out a variety of management activities to minimize negative impacts of inevitable EAB infestations. Management activities will include chemically protecting high value ash trees in parks and public places, removing poor quality and/or damaged ash trees in parks and public places, and replanting with non-ash tree species. In an effort to kick-start our EAB management, the city applied for and received a MDA 2010 Forest Protection Reserve – Planning and Preparedness Grant. Funds from this grant are being used for the Eagan Boulevard Tree EAB Project. There will be no cost to Eagan residents to conduct this project.

EAB Management 2010 - Grant Project Area
• Trees to be Removed and Replaced = 100 Trees
• Trees to Treat with Pesticide Injection = 39 Trees

The tree removal and treatment process and the grant funds are tracked using a database and GIS locations of the boulevard trees. Using ArcMap, Eagan City Forestry staff can click on a tree on a map and get information on individual trees and are also able to view treated trees by area within the City. Mapping grant money distributions has been helpful in tracking where the money is going and how best to use the City's remaining resources. The forestry staff is also able to produce reports and resident letters directly from the database. This resource has proved to be extremely valuable in the management of the EAB grant project. Using GIS helps visualize the EAB distribution and assists in the planning of staff resources. The integration of the EAB database and GIS allows City Forestry staff to use the same processes to track other diseased tree treatments as well as other forestry related projects.

Fall 2010 - Desktop GIS: Introducing Dakota County Property Information 1.0
By Mary Hagerman

Move over Real Estate Inquiry, there's a new property information application in town. The Office of GIS would like to introduce the latest addition to our GIS toolkit, Dakota County Property Information online, affectionately known as DCPI. DCPI is an easy to use property information lookup for the general public. It is built on new technology, has a more modern look and feel, and yes, it is slated to take the place of the Real Estate Inquiry.

The Real Estate Inquiry, which was originally released in 1998, is built on old, unsupported technology. Although performance is still excellent, and usage is still high, the user experience is somewhat diminished due to an outdated look and feel. Additionally, it may be only a matter of time before the application is no longer operational.
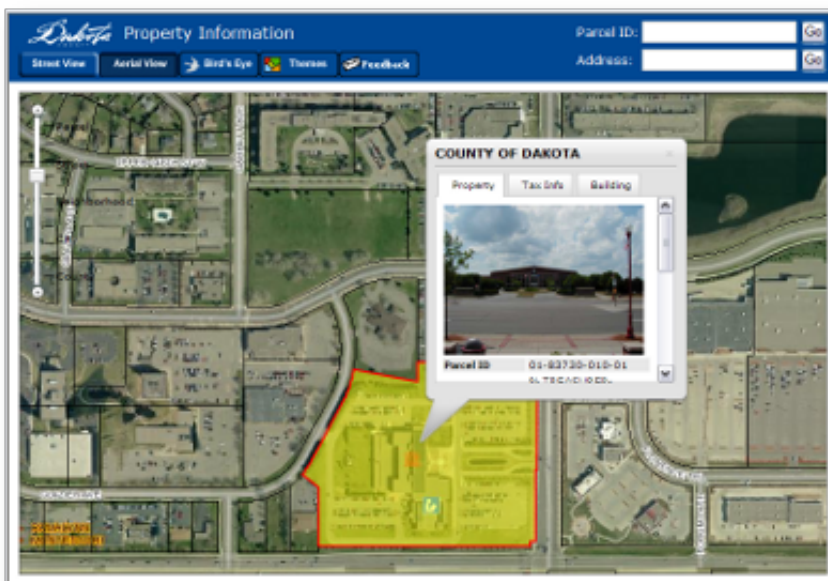
DCPI, which is built on ArcGIS Server technology, offers a more intuitive, Google-like user experience. The map area is large and cartographically pleasing, with streets, lakes, parks, and many labeled points of interest. You can easily switch back and forth between the standard street map and an aerial photo map. There is also a zoom in/out slider and mouse wheel navigation capabilities.

DCPI is primarily a property information lookup, so you can search for parcels by address or parcel ID. You can also use the map navigation tools to zoom in to an area first, and then click on a parcel to identify it. Available property information includes owner information, parcel description, property value, sale value, tax information, building type, year built, and much more. There are property photos, links to the plat drawings, and links to the tax statement and tax payment stub.

One nifty new feature available in DCPI is a printable property card. Property information about the selected parcel is formatted neatly, along with the property photo, on an 8.5 x 11 property card. The sharp looking property card is a PDF, so it can easily be saved or printed.

DCPI also sports a Bird's Eye tool. This tool allows you to link out to Bing maps to see oblique aerial photography for the property or area of interest. Oblique photography is taken at an angle, so you can see the sides of buildings, not just the roof tops. It gives a different perspective to the imagery, which can be very useful to have.

There is a comparable sales tool available in DCPI too. This tool returns a list of properties that sold in the last 18 months that have characteristics similar to the selected property. There is a map showing where the properties are located as well.

Dakota County created DCPI in collaboration with Carver and Scott counties. Staff from all three counties worked together to develop a common base map and user interface, so the applications for all three counties will look and function the same. Users will be able to visit the sites for each county, and enjoy a consistent experience from county to county. How great will that be for people who live near the border?

DCPI is available now on the Dakota County website. Just click on 'Property Info' under Home & Property, and then 'Property Information Online'. There is a Welcome screen to help you get started. There is also a Feedback button so you can send us your comments and questions. So what are you waiting for? Start using DCPI today!

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