Geographic Systems Benefit Dutchess County
Quality E9-1-1 addressing and maps are just the beginning
By Bob White

There are a lot of reasons for having a good, consistent addressing scheme. And, as a public safety professional, you probably know them all. Of course, implementing a good, consistent addressing scheme can also be a challenge. Take, for instance, Dutchess County, New York, where county officials have implemented an addressing plan that brings the county in-step with technology that creates a safer environment, better mail distribution, better planning tools, more accurate property tax maps, and more.

For hundreds of years, residents of this Hudson Valley county have relied primarily on local knowledge for directions in times of emergency. Road signs, landmarks, and people who knew the area were the mainstay of public safety responders. As one public safety official put it, "Finding somebody at two o'clock in the morning could be very difficult."

Geography and Demographics
Dutchess County New York is an 807-square mile region north of New York City that borders Putnam County to the south, the State of Connecticut to the east, the Hudson River to the west and Columbia County to the north. It has a growing population of 280,000-plus. Among the largest of 30 municipalities is Poughkeepsie, which has about 43,000 residents. While the county has experienced a steady increase in population since 1990, some areas in the southern portion are experiencing growth as high as 33 percent over the past 10 years.

Dutchess County has long been known as home to New York's rich and famous, who chose the county for elegance and charm. Names like Roosevelt, Astor and Vanderbilt established residences (Eleanor's famous Val-Kill retreat is here and so is the Franklin D. Roosevelt Library). Today, many stars of stage and screen live here, and guard their privacy.

Planning for E9-1-1
"When the County Legislature approved establishing an enhanced 9-1-1 program in 1990, we put together an oversight committee to determine the scope of what would need to be done," said John Murphy, assistant coordinator for Dutchess County Department of Emergency Response. "The committee—made up of police, fire, communications personnel, and others—determined early that a consistent mapping scheme for the entire county would be essential to our 9-1-1 program, as well as to other county departments."

In the early 1990s, the county had rural route addressing with no structure numbers in the less populated areas. The more urbanized areas had "fairly consistent" odd/even addressing.

In a region where roads and residences have existed for more than 300 years, the addressing plan needed to combine technology with good old-fashioned leg work. The committee outlined a proposal that used a combination of existing county maps, global positioning satellite (GPS) technology, and physical surveys by field crews literally knocking on doors. The geographic information system (GIS) data would be used to create a new digital map set with a digital master street address guide (MSAG).

"Our plan called for creating digital maps using GPS and then matching layers with all available resources," said Larry Brody, 9-1-1 GIS mapper for the Department of Emergency Response. "Although it took some unanticipated turns along the way, the end result of using GIS and leading-edge technology is now working extremely well for the County."

Addressing Criteria
The committee used NENA guidelines to establish addressing criteria for the County. They decided on using a consecutive numbering system based on one address per street-side, every 52.8 feet. This allowed for 200 addresses per mile.

The criteria also included a standard for creating new road names, whereas every driveway serving more than three addressable structures would become a new road. Road names would be the province of local municipalities. The County recommended that the suffix of new names indicate the secondary nature of the road such as Lane, or Way. The County also asked that the new name not contain the suffix Road or Street, so as not to be confused with a larger thoroughfare. The County standard ultimately created 800 new road names.

A request for proposal (RFP) was published specifying the criteria and a process for the mapping/addressing project. The process would prepare the county for its move to enhanced 9-1-1 service as well as wireless 9-1-1 Phase II location. One company was selected from a short list of four qualified firms. That firm began gathering data in autumn 1995.

"The County had the vision to see how a technically advanced addressing scheme could benefit multiple agencies," says Kevin Karn, project manager for Dutchess County. "From the beginning, we focused on putting the best technology available to work."

Putting GPS to Work
GPS technology uses a network of 24 Department of Defense satellites designed to provide US armed forces with accurate location information. For many years, the signals from the satellites were purposely distorted to deter unauthorized public use. GPS data collection required a post-processed differential correction to compensate for the "selective availability" imposed by the government. In 1998-1999, Congress decided to make the data more accurate for a wider range of users, including public safety.

Today, standard GPS receivers are accurate to within 20 meters. However, with a real-time differential correction using radio signals provided by a network of Coast Guard

stations, GPS points can be taken with sub-meter accuracy. Dutchess County used real-time differential correction in collecting GPS data. The GPS unit receives data beamed from the satellite at regular intervals. The data is then collected on a laptop computer and the points are used to pinpoint specific locations such as street centerlines, driveway entrances and land parcels. The points are then matched to the layers of the digital map, which can be edited accordingly. During the first phase of the Dutchess County project, this was all done in separate manual steps.

Data Collection
The data collection phase included as many as 15 two-man data collection teams using GPS receivers and laptop computers. The field teams visited each tax parcel in the County and "shot" GPS points from driveways and road centerlines.

"The teams matched existing parcel information on paper maps with what was physically there," says Brody. "GPS points were taken at driveways that supported addressable structures and from the center frontage portions of vacant parcels. We also took GPS points from street centerlines."

Challenges
One of the challenges early in the project was the number of manual processes that needed to be completed before addresses could be assigned. At first, road segments were defined with a measurement tool included in a mapping software program. Using calculators, technicians divided each segment's distance by 26.4 to determine the number of addresses in that particular segment. The information would then be transferred to the digital map.

"There were a lot of separate actions involved with the previous vendor's methodology and it was time consuming," said Brody.

Eventually, the county decided to issue a revised RFP. A second vendor was selected to complete the majority of tasks, along with the help of newly formed teams of county personnel.

Resolution
Florida-based DMSC (now part of Plant Equipment, Inc.) presented an advanced technical solution for gathering and applying the GPS data. In addition, the County geared up and trained staff to implement a permanent GIS program. The revised program had the benefit of real-time GPS (Trimble Aspen) and a map management program (ORION MapManager) designed specifically for matching an MSAG to a digital map.

"We went to a system and a tool set that did the entire process automatically," says Brody. "The action helped facilitate our needs and moved the project toward the goal at a much greater pace."

Connecting the Dots

One of the goals of the addressing project was to create a digital map that could be used by numerous public agencies. A base map was created from scanning Mylar tax maps and then overlaying adjusted street centerlines, making sure both were spatially accurate. Layers could then be added as needed. Layers, collected from a variety of sources, included tax parcel boundaries, emergency service zones, municipal boundaries, a hydrology layer and others. The layers were used to develop the County's digital map. MapManager was used to automatically add the GPS points to the map and plot addresses.

Using Ortho-Photography
Spatially corrected aerial photography, or ortho-photography, can enhance most any mapping or addressing program, but it can be expensive. Because the most accurate segment of photograph is in the center (heart), each aerial negative has to be altered for spatial accuracy. This process of cropping negatives and splicing them together is known as photogrammetry, and is usually contracted to a specialized vendor. Add that to the cost of flying the area and taking the photographs, and ortho-photography is a luxury for some addressing and mapping projects.

 "In researching our mapping resources, we discovered that the US Department of Agriculture had recently flown the County and taken aerial photographs in 1994 and 1995," said Brody. "This was fortunate for the County because flying the area and taking photographs was not in the budget. We acquired the photography for a relatively nominal fee, and then had it ortho-rectified."

The ortho-photography helped save time in confirming structure frontage and other physical characteristics such as how many structures were on a given parcel. It also helped in defining which deeded rights-of-way were actually being used (as opposed to just recorded on paper), and determining the correct address for a corner lot.

"Using the ortho-photography gave us added confidence that all our structures were addressed correctly and that our street centerlines were accurate," says Brody. "It also saved time in checking various physical characteristics such as hydrology and general topography."

Integrated GIS
The integration of GIS data with digital maps to create a layered mapping system meets the needs of not only public safety, but also those of planning, public works, environmental management and, of course, tax assessment needs as well.

"It was an involved process, but one that was well worth the effort," says Murphy. "We created 800 new road names, defined service areas and made the entire county a safer place to live."

The new addressing scheme may have also increased property tax revenues by better defining parcel locations. On one field encounter, a property owner asked the team members if they had included his daughter and son-in-law's new house. When they said

they hadn't, the man directed them to the newly built home. They followed the directions and discovered not one, but two, impressive new homes that were not on the county tax rolls.

A Few Surprises
Although the field teams caught some people a little off guard, the majority of residents were very cooperative and they had very few complaints. This is especially good for an area where many residents hold a high regard for privacy.

"We completed the whole process of addressing more than 100,000 parcels with very few complaints," says Murphy. "There were a few surprises along the way, but for the most part, everyone understood what we were doing and were helpful."

Ongoing Benefits
Today, the Dutchess County Department of Emergency Response continues to maintain the County's digital MSAG by continuously updating information and resolving any addressing conflicts. Dutchess is one of the fastest growing counties in New York State with new subdivisions being added on a regular basis.

Benefits of the project include: defined emergency service boundaries, accurate addressing, accurate street maps, and a digital map data set that can be shared by numerous county agencies. The system can be easily updated to include new roads, subdivisions and addresses. In addition, tool sets such as MapManager help produce collateral materials including map booklets for field use.

Prepared for the Future
The County is now prepared to add a mapping component to the communications centers in preparation for Phase II wireless location mandates. The county is also planning to implement an automatic vehicle location (AVL) system for emergency responders. Both of these additions will benefit from the addressing project and the GIS that was created in support of it.

"It may have taken us awhile to implement enhanced 9-1-1, but we believe we are now in better shape than many other counties in the United States," says Murphy. "The mapping element is the key to our future success as a public safety service agency."

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