

Cochise County GIS Analyst Ron Long (current owner of Trace Consulting) uses station "TIGER" (PID CG1159) for RTK observations.

## building a fully functioning COUNTY GIS in five years

ive years ago Cochise County, Arizona embarked on a comprehensive plan to install a practical Geographical Information System. Today 300 county employees use it regularly. We attended the Arizona Geographic Information Council's 2009 Education and Training Seminar in Tucson in early November. Walter Domann, GIS Coordinator for Cochise County, explained how it was done. It all started with a pledge of cooperation

from the county surveyor. While GIS professionals understand the importance of survey control, there are still some land surveyors who don't yet appreciate the value of a solid GIS.

Cochise County is nestled in the southeastern corner of Arizona and encompasses 6,220 square miles of mountains, yucca-speckled grasslands, and unique cities and towns. The incorporated areas of Sierra Vista, Huachuca City, Benson, Bisbee, Tombstone, Douglas and Willcox, along with the border community of Sonora, Mexico, foster a shared work-

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Cochise County GIS Technician Shannon Lawrence recovers PLSS corners.

force and enjoy cross-market commerce. The county has a population of 135,150 and a growth rate of 2.5%.

Three steps were involved in establishing their GIS: Geodetic Control, Establishing a Low Distortion Projection, and RTK GPS Precision Positioning.

To begin, the county surveyor's crew established 124 stations that are now Bluebooked with NGS. In addition to the survey crew, this was accomplished using a large number of volunteers from the county, other government agencies, and the private sector. All of the stations are included in the Arizona Height Modernization effort. The stations were placed near (not at) township corners and near the centers of each township. The criteria for the stations were stability and accessibility. Other secondary points are maintained as "GPS Check-in Stations".

The county decided to incorporate its own map projection, called a Low Distortion Projection (LDP). Using State Plane Coordinates for the projection would result in a distortion of about -1.5 feet per mile in areas of interest, mainly private land (negative distortion indicates grid distances are shorter than ground distances). Using the LDP they achieved distortion of +/- 0.2 foot per mile error in areas of interest, thus eliminating the mapping grid as a source of distortion. The LDP was designed by Michael Dennis of Geodetic Analysis, LLC. The GIS department outputs its information to the county departments in LDP coordinates.

Finally, with solid geodetic control points in place, together with a suitable projection, the county surveyor could make effective use of RTK GPS Precision Positioning of recovered PLSS corners.

Meanwhile, the GIS department began incorporating the other necessary elements of the GIS to serve the numerous other functions of the county such as address management, planning, emergency response, tax assessment, public health, voter registration, elections and public health to name a few. The GIS staff assisted the surveyors with GIS applications including up-to-date aerial imagery and GIS data layers relevant to their services (query and mapping).

County departments now query the integrated system, not separate projects. It's not "just coordinates" anymore–there is true geospatial content. The records include land records as well as imagery files. The GIS department has on file every survey, subdivision plat and other maps. The GIS staff made the effort to scan and index these documents.

Users can access records of survey, plats, mineral surveys, GLO plats, Railroad Right-of-way plats, ADOT plats and FEMA FIRM maps. One can look up a list of the documents using the GIS and access these documents.

The County GIS is now the "tree" for others to hang their hats on, for road construction, floodplain management,





**Above:** Cochise County GIS application Geodesy Avec used by survey staff for PLSS inventory, research and recovery operations.

**Right:** Set in 1910 by the GLO, the east 1/4 corner of Section 32, T18S R23E (GSB&M), was recovered in 2009 by survey technician Sheryl Records and GIS technician Shannon Lawrence.

rights-of-way, surveys, and utility locations. The entire effort is now guided by the Geospatial Service Group which consists of surveyors, engineers and geospatial professionals. This group provides critical input. Mr. Domann said the turning point was the willingness of county surveyor Dave Sutherland (at that time), to work with the GIS department.

In the question and answer period that followed, one participant asked how they ever got the blessing of the county fathers to start such and effort. Mr. Domann said they didn't *ask*-they just *did*. Now that the GIS is in place, its benefits are so extensive and obvious that everyone wants to be part of the team effort.

This new GIS has affected virtually every county department and made everyone's job easier. The county puts all



the projects on a single, consistent, Low Distortion Projection so they all easily relate projects to each other, now and in the future. If there is a need to translate coordinates into State Plane or UTM, it's done quickly with the touch of a button instead of a laborious calculation, removing the chance of error. Control monument information is available on the NGS website. It is easily accessible and includes any new adjustments or updates performed by NGS.

Most of the county is well represented with control. In some areas we could use more control. It is heaviest in the populated areas of the county. Section corner and quarter corner information is in the GIS.



Map provided to participants for static GPS observation sessions used to the expand County Control network and augment NGS Height Modernization.

The assessor's office is now able to plot parcel geometry with survey grade accuracy. The GIS benefits the recorder's office because records of surveys and subdivision plats tied to the system are easy to relate. The recorder's department is working now to get all the records available online. Planning and Zoning uses the system for its work. For example, they map out illegal dump sites that are easy to find again, which aids in cleaning up those sites. When the county had issues with the West Nile virus, the GIS was used to locate the mosquito hot spots.

In the words of Dale Jones, the current county surveyor, "Walter Domann, the GIS Director, and Dave Sutherland, the former County Surveyor, are visionaries; the County will be reaping the benefits for years to come." There are still issues related to older projects which came before the new projection, but they are becoming less problematic. The GIS has saved a lot of time. It is especially useful when we have to resurrect something that we worked on before and for whatever reason was dropped. Staff members can now quickly pick up from where they left off with much less review time.

Local surveyors working in the county still are not fully aware of the capabilities of the new GIS. The GIS Coordinator will make a presentation in May 2010 to the surveyors to the Arizona Professional Land Surveyors (APLS) southeastern Arizona chapter to get the word out about its capabilities. Life is especially good for local surveyors using the GIS data because of the large number of section corners and quarter corners that have been located and placed in the GIS. While it doesn't relieve the surveyor of the responsibility for doing his own work, it gives surveyors confidence when they know what they are looking for and when they get essentially the same measurement results.

This effort was accomplished with six personnel, three in the GIS department together with the county surveyor and two field technicians. A large number of volunteers (along with other county employees) also provided a critical contribution to the Height Modernization field surveys. Mr. Domann's summary of his efforts are detailed in an article in *Surface Matters*, the newsletter of the Arizona Geographic Information Council, available at http://agic.az.gov/ newsletter/agicnews\_17.pdf **A** 

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