Automation of Cadastral Data from Paper-based Records to Survey Fabric

Steven L. Hope
Bob Nagel

Abstract

As a response to Western Governors Association Policy Resolution 03-05, a partnership between Bureau of Land Management (BLM), State of Utah, and Rich County, is piloting a procedure to automate parcel boundary data for rural counties of Utah. The goals of the pilot are; provide seamless cadastral data across geo-political boundaries, convert land records from paper to digital, and perpetuate the cadastral infrastructure. The pilot utilized current BLM Geographic Coordinate Database/Public Land Survey System legacy software to construct a cadastral framework suitable for import as the survey fabric within Survey Analyst of ArcGis. A consensus resolution of such overarching issues as, identification of the limits of data custodianship where cadastral jurisdictions overlap and efficient data sharing between independent custodians, will constitute the benchmarks of success for the pilot.

Background

In March of 2000, the Western Governors Association (WGA) sponsored the Western Cadastral Data and Policy Forum in Salt Lake City, Utah. The purpose of the Forum was to characterize an ideal or target Western Cadastral Infrastructure as a vision statement, and assemble a set of recommendations for submission to the WGA and subsequent adoption as a WGA policy resolution. Federal, State, Tribal and Local government representatives dominated attendance at the forum. WGA Policy Resolution 00-05 was adopted in June of 2000. The recommendations crafted from the forum included; developing partnerships, promoting data sharing across jurisdictions, support increased funding for collection and maintenance of the cadastral infrastructure, and implementation of data standards nationwide.   In May of 2003, WGA Forum: Putting Land Records to Work, was an opportunity for specific disciplines, which require a cadastral infrastructure, to provide feedback regarding the WGA Policy " Public Lands Survey System and Ownership Database". The attendees

represented the disciplines of; realty and titling industry, energy, taxation, land planning, and disaster management. A minimally revised WGA Policy Resolution 03-05 was issued September 15,2003.   The Western Governors' Policy statement advocated the following:

1- A solid digital cadastral infrastructure requires a coordinated effort from Federal, State, Tribal, Local governments, and the private sector to develop standardized collection and maintenance practices, that will result in seamless land record modernization across the western states.

2- The support of the recommendations crafted from the Cadastral Data and Policy Forum.

3- The BLM, in conjunction with the Western Governors Geographic Council, will develop a comprehensive, unified plan for Geographic Coordinate Data Base (GCDB) implementation and maintenance across the west.

4- Call on Congress to provide the necessary funding for BLM to implement and maintain GCDB in coordination and partnership with the states.

In response to the WGA policy resolution, the BLM entered into an Assistance Agreement with the State of Utah, Automated Geographic Reference Center (AGRC), under the legal authority of <u>Federal Land Policy and Management Act of 1976</u> (43 U.S.C.§1737). The purpose of the assistance agreement is to support the creation of automated parcel data for county land record modernization. The assistance agreement directly supports the WGA recommendation to promote data sharing across jurisdictions. The portions of the Public Land Survey System (PLSS) which have shifted to local control will be rehabilitated and geospatially referenced. The BLM acts as the custodian of the PLSS official records (DOI, 1988), but the BLM has no authority over PLSS positions, which no longer control federal interest lands. The assistance agreement will facilitate a seamless interface between the PLSS controlling Federal Lands and the PLSS under local control.

The BLM, as lead agency for the National Spatial Data Infrastructure (NSDI) Cadastral Data Theme (OMB, 2002), initiated the Geographic Coordinate Data Base (GCDB) project to digitally portray the PLSS and nonPLSS boundaries of

federal interest. The GCDB solution utilized the above mentioned boundary lines as the spatial framework for a multi-purpose cadastre. The project developed a measurement based collection methodology using official cadastral survey records with associated geodetic ties to the National Spatial Reference System. The GCDB framework, as collected, is of sufficient granularity to discreetly portray the parcels upon which BLM land tenure activities occur. The 40 acre aliquot part or subdivision within the PLSS is the usual parcel size which the BLM tracks.   The BLM GCDB/PLSS legacy software easily creates survey record and subdivision templates, which adhere to the BLM Manual of Survey Instructions, 1973,to the aliquot parcel of 2.5 acres and non-rectangular (metes and bounds) parcels as well. The BLM is in the midst of developing the National Integrated Lands System (NILS). NILS a consortium of BLM, U.S. Forest Service (USFS), state and county government consultation, and ESRI, is developing customized modules to load and maintain the cadastral data and parcel records for a multipurpose cadastre. ESRI is providing COTS capabilities to meet the business needs of the BLM Cadastral Survey and Land Tenure activities. NILS customized modules are based upon core functionality found in the ArcGIS platform. The Survey Analyst extension of ArcGIS provides the software tools for collection and maintenance of the GCDB survey network. The GCDB/PLSS survey records as well as unsurveyed records will be collected and maintained as a network within the survey fabric and will be the template for generation of the legal description fabric.

County land record modernization efforts require parcel granularity smaller than the standard 40 acre aliquot parcel. In Utah, most parcels have been created through paper-based instruments or legal descriptions; rarely, was a field survey performed in conjunction with the creation of the instrument. Further, non-surveyors most often wrote the legal descriptions. The effort required by the county recorders office to bring harmony to the mosaic of legal descriptions within the original senior parcel can be daunting. The legal descriptions have been drafted onto tax plat sheets and each parcel has been assigned their respective tax parcel numbers for the fiscal purposes of assessment and taxation. Initial efforts to convert the paper-based tax plats to a GIS layer have been relatively successful for the rural counties of Utah. The GIS tax parcel overlay is

usually vertically integrated with the GCDB framework. Lee Rasmussen, from Emery County, Utah, developed a program allowing tabular entry of the arcs that determine each tax parcel found in paper-based tax plat books to create digital tables and subsequent graphical display of each page in ArcView 3.X. The tables are linked to known positions found in the GCDB framework or the local control framework; the result is a digital tax plat theme. The software was made available to other small rural counties in Utah. Many of the smaller counties took advantage and have been gradually building their digital tax plat book and page themes.

The counties are in a process of upgrading their GIS software to an ArcGIS platform and will require migrating the digital tax plats to a local geodatabase. With the migration, the opportunity to create a working data layer from the existing tax plat overlay emerged.   AGRC has developed a toolset for the migration. The toolset is a combination of custom VBA coding and existing ArcGIS tools. The VBA code searches through the tax plat book and page directory structure, and picks out shape files of the digital tax plat book and page, and joins them all together in a Personal Geodatabase. The toolset continues the routine as follows:

1.   Snap the proper corners of the feature class to the GCDB points.
2.   Run topology on the feature class and figure out what gaps are good and which are bad.
3.   Once verified, the data layer created can be moved into the ArcGIS map book extension, and plat maps are produced.
4.   The data is joined to the tax roll tables for labeling and printing.
5.   Currently, development is underway for a tool to pass any parcel splits from the GIS database (geography and change table) to the Tax Roll database in Access.

   While the migration with technical assistance from AGRC has gone smoothly, there was recognition by all that the existing tax plat conversion software was limited to ArcView 3.X softwares; a replacement software was required. The same toolset will also be used to continue the conversion process of paper-based tax plat to a working data layer in a personal geodatabase. The collection process utilizes the COTS tools found in ArcGIS to add to the existing tax plat data layer.

Migration to Survey Fabric

The parcels found on county tax plats are defined by legal description and/or field survey is a consensus fact. Ideally, those parcel boundaries should reside in the survey fabric along with the GCDB/PLSS survey network. Through the assistance agreement the BLM and AGRC will pilot a process to migrate tax parcel boundaries into the survey fabric. Treating the existing effort by AGRC as a springboard, the BLM is providing cadastral guidance for further development, to export a boundary record template file (GCDB raw file) from the tax parcel data layer for import into current GCDB legacy software and subsequent importation into the survey fabric. The elements of legal descriptions mirror survey plats of record when translated to tabular form. There is the linkage to the senior parcel/survey and subsequent distance and direction segments around the parcel.

The first challenge for AGRC will be translating the myriad of direction and distance expressions found in legal descriptions and survey plats, to a single standard unit of direction and of distance. For GCDB, direction unit of bearing as DDMMSS.SS with numerical quadrant and distance units of chains, are the desired units for import into GCDB/PLSS legacy software. The GCDB raw file has a field reserved for metadata with each segment of record information. The tax parcel number for each parcel will be inserted in the metadata field of every segment of the parcel. Exporting a survey record template file has quite specific requirements to function as a GCDB raw file in the legacy software, but future collection and maintenance of survey fabric within the geodatabase using Survey Analyst extension should allow a more generalized import function.

Another challenge to the conversion and subsequent GCDB raw file export is developing duplicate parcel recognition between tax parcels and existing GCDB framework. This is expected when aliquot subdivisions of the PLSS as collected in GCDB are identical to county tax parcels of aliquot description. The exported GCDB raw file is not expected to be 100% effective, but effective rates of 80-90% are anticipated. With the conversion process working and the GCDB raw file export enabled, the counties must make decisions as to the desired degree of granularity within the survey fabric. Rich, a small rural county participating in

the pilot, has a population of <2000, and approximately 8530 tax parcels to administer. The nature of the population and their parcels occupy extremes, with the majority of county land being agricultural, but the majority of parcels being recreational/residential. The parcels of recreational land are small lots within subdivisions. Tracking the agricultural use parcels is anticipated to mirror the existing GCDB/PLSS framework, but the subdivisions of recreational/residential parcels often are metes and bounds descriptions. Within the scope of the pilot there was agreement to export the subdivision boundaries to a GCDB raw file, but the individual lots would be delayed to a later date, if at all. This decision was based more upon anticipated workload, than technical feasibility.

Finally, the survey plats filed at the county recorders office will require collection and integration into the survey fabric. Since the state statute requiring all property boundary surveys, conducted by licensed land surveyors, be filed with the county recorder (Utah Code 17-23-17.5), was enacted within the last twenty years; there are a modest number of plats on file. They represent a very small fraction of the tax parcels found in the county and the AGRC application should accommodate collection and export to a GCDB raw file.

Issues of Jurisdiction

As the partnership between the BLM and AGRC progresses, the overarching issues, which create barriers to a seamless digital cadastral infrastructure, rise to the forefront of attention. The overlaps and gaps between custodial jurisdiction, stewardship, and data sharing must be addressed. The current pilot project has provided a first step toward resolving these issues in the state of Utah. Rich County has a significant amount of lands, which are of federal and state ownership. The distribution, of those government lands and private lands, is a mosaic. The mosaic creates PLSS corners under BLM authority that control both public and private lands; overlaps of custodial jurisdiction between the BLM and Rich County exist.   The solution proposed within the pilot is to assign shared stewardship of the federal/private interface to both the BLM and the county, which is contingent upon a responsive data sharing procedure. The data-sharing between Rich County and the BLM will be facilitated by AGRC

While the BLM is authorized to act as the lead for GCDB/PLSS portraying public

lands; such lands may be administered by separate agencies. Both, the BLM and the USFS, administer lands in Rich County. Stewardship responsibilities of USFS lands are anticipated to reside with the USFS. Along the boundaries between USFS and BLM lands, stewardship responsibilities will be shared by both agencies. The BLM is currently finalizing agency policy regarding coordination of stewardship, and data sharing of GCDB/PLSS. Once finalized, an Instructional Memorandum will be issued which will clarify the official BLM policy.

Conclusion

The efficiencies gained by using a complete, seamless, digital cadastral infrastructure for land records management are well worth the effort involved. Federal, State, Tribal and Local governments, as well as the private sector are solidly in support of the endeavor. As recommended by the WGA Policy Resolution 03-05, the cadastral framework should be standardized and maintainable. Further, partnerships are encouraged to take advantage of funding, technology, and information that the diverse stakeholders in western public land states can bring to the effort. The assistance agreement between the BLM and AGRC creates the opportunity for small counties with very limited budgets to convert their paper based land records activities to an automated system, with a maturing technology. The ArcGIS platform brings an opportunity to manage boundary records as a true underpinning of land records management and related fiscal activities. Migration of paper based legal descriptions, whether in text format or survey plat format, to the survey fabric will facilitate increased surety of land tenure for public and private properties. Finally, the partnerships recommended by the WGA policy resolution, imply a willingness by the stakeholders to achieve consensus resolution of the jurisdictional issues of custodianship, stewardship and access within a seamless digital cadastral infrastructure.

References

Bureau of Land Management, Manual of Surveying Instructions, U.S. Government Printing Office, Washington, D.C. (1973).
Department of Interior, Department Manual, 757 DM 2.7B(1), (1988).

Office of Management and Budget, <u>Circular No. A-16, Revised</u>, (August 19,2002).
Utah Code 17-23-17.5
WGA Policy Resolution 00-05, <u>Public Lands Survey System and Ownership Database</u>, (2000).
WGA Policy Resolution 05-03, <u>Public Lands Survey System and Ownership Database</u>, (2003).
43 U.S.C.§1737