

FEDERAL CONTRIBUTION TO LOCAL LEVEL
AND LAND INFORMATION SYSTEMS

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In the United States, the Federal contribution to the local level and land information system started over 200 ago years with the beginning of the rectangular survey system. With the majority of the land area of the country covered by the system, it is obvious that State and local governments would necessarily incorporate this township, range, and legal subdivision reference system into all functions requiring land descriptions. Presently, as survey and mapping data is updated, the information is available to all governmental entities and to the public.

It is precisely this need for the Federal Government to be responsive to the needs of both public and private users which critically demonstrates that a readily usable automated data bank of land information be developed. Because, while all of Federal Government land data and resource information is available to all users now, present operations for retrieving land data from Federal Government sources are principally on a manual basis. From both economic and service viewpoints, the Federal contribution to local land information systems is not where it should be.

There are varying degrees of land resource information accessibility in the Federal Government depending upon the agency and the type of data desired. The following discussions are directed principally toward activities inherent to the Bureau of Land Management (BLM). The BLM is the single largest administrator of land in the United States.

The BLM is well on its way toward developing the mechanics for automated retrieval graphics depictions for land ownership and resources. The Bureau is a latecomer in supplying a data base which will give realistic and valuable meaning to the "overlay" data. With the recent advent of advanced technology in surveying and mapping, the time is opportune for the integration of the vast amount of parameter data developed on an almost daily basis into the demands of land use/ownership graphics for accurate, adequate referencing.

With the data base need and problem identified, it became apparent to me that the development of a data base for Bureau use needed immediate attention. Accordingly, I directed one of the units in my organization, the Survey and Mapping Development Branch at the Denver Service Center to construct a prototype for a "plan to process, file, and publish geographic coordinates of the PLSS corners"

Subsequently, an advisory technical committee was formed composed of mapping, automatic data processing, and surveying experts from throughout the Bureau. This committee has held two meetings in 1982; the textual material which follows is mainly from the committee's interim report.

Critical domestic requirements for energy and mineral resources in recent times have resulted in abounding demands for accurate land descriptions. Coupled with the high priority of the Department of the Interior for increased energy and mineral production is the ever-constant pressure of all the various public land resource users for rapidly obtaining specific area geographic and status depictions and parameters. This paper proposes the continued development and

implementation of a Geographic Positioned Data Base for the Public Land Survey System (GPDB/PLSS) which, when implemented, will be the essential key to the creation of a bureauwide automated land information system necessary for the rapid adjudication of oil and gas leases and land ownership and use patterns.

The proposed Geographic Positioned Data Base/PLSS will perform two functions. First, it will provide for the collecting, processing, adjusting, storing, and disseminating of geographic coordinates of PLSS corner positions.

Second, it will serve as the foundation for developing the BLM Geographic Information Systems and the Automated Land and Mineral Records System, establishing a comprehensive Automated Land Information System, and it should

all other operational inventory-inquiry systems regardless of origin. The system data will be available to all surface and minerals management agencies. The system will unify several existing and proposed automated systems throughout the Government. Private industry and the using public will also have access to the valuable data base.

The objectives of the GPDB/PLSS are:

- Provide a uniform system for storage and retrieval of current cadastral monument positions and establish standardized data definitions and system compatibility bureauwide.
- Provide the foundation for implementation of a bureauwide Geographic Information System (GIS) which will integrate cadastral monument geographic positions and parcel identifiers in support of case adjudications.

- Utilize the positioned data base to improve the accuracy, efficiency, and accessibility of survey data used to support Bureau land title and use records.
- Utilize geographic positioning in survey project areas (past and present) to serve as the basis for network adjustments, closures, and accuracy evaluations.
- Provide a standardized reliability classification for accuracy of the PLSS.
- Provide rapid response to Bureau users, other agencies, and the public requesting geographic positions for cadastral survey monuments and GIS information.

At present, offices of the BLM are collecting limited numbers of geographic positions by one of two methods: (1) Cadastral Survey organizations are performing surveys of the public lands using state-of-the-art equipment and techniques. These surveys constitute a vast reservoir from which geographic positions can be generated; (2) Photogrammetric and Cartographic organizations are digitizing the public land survey net information from U.S. Geological Survey maps and other sources (a practice we discourage but have no immediate pipe line solution to offer in lieu thereof).

Pressing needs have led to the development and use of advanced three-dimensional surveying, photogrammetric, and cartographic equipment. Included are the Auto-Surveyor (inertial guidance system), satellite doppler positioning systems, global positioning systems, analog and

analytical photogrammetric systems, and other types of three-dimensional positioning equipment. These systems both collect and use geographic positions which are compatible with the proposed GPDB/PLSS.

Current procedures in the Bureau for storage and dissemination of geographic positions of the PLSS are not satisfactory to meet today's needs or technological requirements.

- Geographic positions for the PLSS are essentially nonexistent; the few that exist are neither official, identified as to reliability, or readily available to users.
- There is no interface between PLSS monument positions and land description records used in lands and minerals cases or title/use records.
- No automated mechanism exists for geographically relating the PLSS to land title, use areas, or natural resource data.
- No bureauwide procedures now exist to provide or update geographically positioned data.
- Geographic positions data exchange between agencies (U.S. Geological Survey, U.S. Forest Service, National Geodetic Survey, National Park Service, U.S. Fish and Wildlife, Minerals Management Service, etc.) is inadequate and results in a duplication of work.

The GPDB/PLSS will be an interactive multipurpose/multiuse information system for storage, retrieval, dissemination, and updating of geographically positioned monuments of the PLSS. Features and advantages of an interactive multipurpose/multiuse system are:

- Interface with and support of present Bureau Geographic Information Systems (ADS/MOSS, AHDS/MOSS, WAMS/MOSS, IDIMS, etc.)
- Standardization of computer formats for easy analysis of information by all Bureau users.
- Designed to insure that survey coordinates derived from either field survey or digital collection are integrated into the GPDB/PLSS.
- Selection and standardization of mathematical adjustment procedures of survey data for uniform coordinate accuracy.
- Establish and identify the accuracy and reliability of each geographic position.
- Data base updates upon completion of a survey unit.

The GPDB/PLSS will be the critical interface between the GIS system and the Automated Land and Minerals Record System. It also must have the capability of interfacing with other agencies (U.S. Geological Survey, U.S. Forest Service, U.S. Fish and Wildlife, Minerals Management Service, etc.) and the private sector.

The GPDB/PLSS, with the ability to interface to the Automated Land and Minerals Record System (ALMRS) and automated GIS, will generate information (concerning Cadastral Surveys, Land, Minerals, Case Adjudication, Resource Management, Programs, and Records) to all State, District, Region, and Area offices. Along with the Bureau as a major beneficiary of GPDB/PLSS, other surface and minerals management agencies (Minerals Management Services, U.S. Forest Service, Bureau of Indian Affairs, National Park Service, etc.) will also benefit from GPDB/PLSS, saving in the costly duplication of information. It is expected that many State and local governments, as well as private enterprise, will request GPDB/PLSS information.

The GPDB/PLSS will respond to user requests for geographic positions for the entire State, county, township, range, and meridian, latitude and longitude window, or by point identifier. As a result of user requests, GPDB/PLSS will produce various reports containing pertinent information (latitude, longitude, elevation, UTM coordinates, reliability, adjustment unit, etc.). The GPDB/PLSS will interface with the Automated Land and Minerals Record System and the GIS to produce specialized products graphically showing land, mineral, and resource data tied to the Public Land System. This capability would provide the basis for automation of the MTP/use plats.

Because of the importance of adjacency relationships in adjudication and automated analysis, it is imperative that the data be topologically structured, ie., spatial relationships between data elements be specified. Consequently, each position within the GPDB/PLSS will be identified by the following data elements:

- latitude
- longitude
- elevation
- source data - agency (BLM, NGS, USGS, State, County, etc.)
- acquisition method (survey, digitized, photogrammetric, etc.)
- source material (photography, maps, scale, and accuracy)
- date of acquisition
- point of identification - cross-referenced to parcel/aliquot part
- polygon (parcel) identifier (ties positions to a unique parcel in the Bureau Geographic Information System and Record System)
- Reliability Class (Standard Accuracy Classes)

User requests may be in a variety of output requirement formats, i.e., tabular, magnetic, and graphic plots. These requests will also run from the simple (1-3 positions) to extensive (total data base). System flexibility should allow retrieval by State, county, township, range, and meridian, latitude and longitude window, or by point identifier. The output report may vary by site depending upon sophistication of equipment. Further system capabilities will be evaluated during the design phase of the GPDB/PLSS.

With interface capability to all Bureau Geographic Information Systems, Resource or Land and Mineral Records System, the system will generate any type of report required by the user. Terminals might be located in State, district, and resource area offices for use by Bureau personnel, other government agencies (USGS, USFS, etc.) as well a private enterprise. The foregoing analysis by the PLSS Technical Committee is a starting point. The frame work for action has been joined.

In summary, the answer to the question of the Federal contribution to local level and land information systems is that land data now contained in various agency files is available. It is useful data, has served the majority of the United States extremely well for over 200 years, and many land resource/ownership functions could not be nearly as well maintained and operated without this contribution. However, in order to become responsive to both internal and public/private user needs to the degree that present technology permits and economic and service ethics dictate, automatic land retrieval systems are critical.

The ultimate goal of the Federal contribution to local land information should be the development of a model automated land records system which can be readily expanded for use by all levels of government, the private sector, and the public. The system should be capable of being readily responsive and available to the public's needs. It is hoped that the system developed will be so efficient, accurate, and applicable to universal requirements that the 3,000 county governments of the United States will want to incorporate its basic tenets.

BIO-SKETCH

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Mr. Hostrop began his surveying career in the Big Horn Mountains in 1952, after serving in the U.S. Air Force overseas. He is a civil engineering graduate of Michigan Tech and is a registered land surveyor in Wyoming and Alaska.

Mr. Hostrop has served in various official positions with the American Society of Civil Engineers and the American Congress on Surveying and Mapping. He is a fellow in both societies as well as a member of the National Society of Professional Engineers and has had published over 30 articles and reference books that deal with surveying and mapping topics. He is past President of the Land Information Assembly and is on the Board of Directors for the Institute for Land Information.