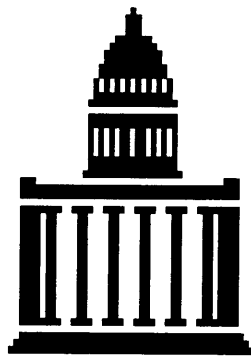


**REPORT OF THE 1990-91 INTERIM  
GIS/GPS TASK FORCE**



**PRESENTED TO**  
**THE LEGISLATIVE RESEARCH COMMISSION**  
**AND THE**  
**1992 REGULAR SESSION OF**  
**THE KENTUCKY GENERAL ASSEMBLY**  
**RESEARCH MEMORANDUM NO. 450**  
**October, 1991**



## LEGISLATIVE GIS/GPS TASK FORCE

### MEMBERS

Senator Fred Bradley, Chair  
Representative John Harper  
William Bowdy, Northern Kentucky Area Planning Commission  
Glenn Dempsey, Administrative Office of the Courts  
Andrew Kellie, Murray State University Remote Sensing Center  
Ray Leigh, Kentucky Association of Professional Surveyors  
George Neack, Kenton County Fiscal Court  
Michael Ritchie, Kentucky Section, American Society of Civil Engineers  
Bruce Seigle, Louisville & Jefferson Co. Metropolitan Sewer District

### NON-VOTING MEMBERS\*

Don Ecton, Kentucky Transportation Cabinet  
John Fulda, University of Louisville Urban Studies Center  
Dr. Donald Haney, Kentucky Geological Survey

\* *1990 SCR 112 provided that the Task Force to be comprised of 14 members:  
9 appointed by the Legislature, 5 appointed by the Governor. (See Appendix A)*

*The non-voting members represent three organizations named in 1990 SCR 112  
from which the Governor could make appointments, but subsequently did not.  
They therefore served in an advisory capacity.*

### LRC STAFF

Jim Monsour, Danny Jackson, and Kathy Ragland

## **LEGISLATIVE GIS/GPS TASK FORCE**

### **TASK FORCE JURISDICTION**

Pursuant to enactment of Senate Concurrent Resolution 112 by the 1990 General Assembly, the Task Force on GIS/GPS\* was created to study the coordination of automated mapping system (GIS) development in state and local government based on a geodetic reference network identified with satellite technology (GPS).

\* GIS/GPS = Geographic Information System/Global Positioning System

### **TASK FORCE ACTIVITY**

Beginning in April, 1991, the GIS/GPS Task Force met thirteen times during the Interim. Eleven meetings were held in Frankfort, one meeting was held at the Louisville and Jefferson County Metropolitan Sewer District office in Louisville, and one meeting was held at Kentucky Geological Survey offices at the University of Kentucky in Lexington.

The Task Force heard testimony on GIS-related issues from representatives of the following:

- American Cadastre Inc.
- Big Sandy Area Development District
- Kentucky Geological Survey
- Kentucky Information Systems Commission (KISC)
- Kentucky Natural Resources & Environmental Protection Cabinet
- Kentucky Transportation Cabinet
- Lexington-Fayette Urban-County Government
- Louisville/Jefferson County Information Consortium
- Louisville and Jefferson County Metropolitan Sewer District
- Murray State University, Mid-America Remote Sensing Center
- PlanGraphics Inc.
- University of Kentucky, Department of Geography

The Task Force heard testimony on GPS-related issues from representatives of the following:

- Kentucky Transportation Cabinet
- National Geodetic Survey
- Tennessee Department of Transportation
- Trimble Navigation, Inc.
- U. S. Army Corps of Engineers
- University of Kentucky, Department of Forestry
- Virginia Advisory Council on Mapping, Surveying and Land Information Systems

## **LEGISLATIVE GIS/GPS TASK FORCE**

### **FOCUS OF TASK FORCE MEETINGS**

- o **GIS Basics and Potential Uses;**
  
- o **GIS and Automated Mapping Applications Currently in Use in State and Local government;**
  
- o **Spatial Data Collection, Data Digitizing and Data Sharing;**
  
- o **Coordinated GIS Development in Other States;**
  
- o **GPS Basics and Potential Uses;**
  
- o **Geodetic Reference Points Providing the Base Layer for GIS Development Statewide;**
  
- o **GPS Surveying Technology and Processes.**

## LEGISLATIVE TASK GIS/GPS TASK FORCE

### APPENDICES\*

- o APPENDIX A - 1990 SCR 112, creating GIS/GPS Task Force
- o APPENDIX B - Recommendations for Coordinated GIS Development
- o APPENDIX C - Summaries of Recommended Legislation for 1992 Regular Session

92 RS BR 199, *AN ACT relating to Land Surveying*

92 RS BR 422, *AN ACT relating to the Natural Resources and  
Environmental Protection Cabinet*

\* Appendices follow page 15.

# LEGISLATIVE GIS/GPS TASK FORCE

## GIS Basics and Potential Uses

### Background

A Geographic Information System (GIS) is a specialized data management system designed for the entry, storage, analysis, management, and display of data that can be associated with physical locations on earth.

Issues related to environmental protection, natural resources management, transportation, political boundaries, emergency response, property ownership, and economic development are particularly suited to GIS applications.

The cost to implement a GIS application is considerable and includes the following:

- o data acquisition by field observation, aerial photography or maps;
- o preprocessing, including the digitizing of spatial data and identifying of the location of objects in a systematic way;
- o data management to provide consistent methods for data entry, update and retrieval;
- o data analysis to manipulate the data within the system;
- o product generation to provide hard copy maps, graphs, reports and soft copy images, tapes and disks.

Owing to application requirements, most GIS systems reside on a mainframe or mini-computer. Personal Computer GIS applications, however, are beginning to be available as reported in the computer literature, and have promising potential for smaller system users.

Presently, nevertheless, only those agencies that can afford application and ongoing costs of hundreds of thousands of dollars or more annually have GIS systems. There is consensus, therefore, that future GIS development should be coordinated to reduce the cost components above, and hence make GIS capabilities available statewide.

A GIS can be understood by comparing it to a conventional map with several transparent overlays. The first map, or the first layer of a GIS, may contain topographical features such as mountains and rivers. Additional overlays might depict highway networks, political boundaries, land parcels, property ownership, utilities sitings, and population densities.

## LEGISLATIVE GIS/GPS TASK FORCE

### GIS Basics and Potential Uses

A GIS can generate maps, graphs, and reports by manipulating and combining the data associated with each of its layers. However, the accuracy of the resulting maps is dependent, in part, on the geodetic reference points that allow the various layers to be tied together. Typically, such points are identified by traditional land surveying, aerial or satellite photography (remote sensing), or are associated with the corners of topographical quadrangle maps supplied by the U. S. Geological Survey. The scale for maps from these various sources varies with the area being mapped and the map's intended use. They range from 1:50 (1 inch to 50 feet) to 1:1,000,000 (1 inch to 1,000,000 feet). Reducing maps to a smaller scale affects their accuracy, with the precise location of objects on the map, and accurate distances between geodetic reference points diminishing as the scale is reduced.

#### Findings

- o *Current GIS users in Kentucky state and local agencies, by necessity, collect, digitize, and maintain spatial data specific to their respective applications;*
- o *One result is the collection of redundant data, such as population statistics. Another is the incompatibility in data formats from one system to another, with the use of GIS software from different vendors. A third is inconsistent mapping of the same area, owing to how the spatial data was collected. The net result is that a large sum of money is currently spent by a few agencies to generate maps of questionable accuracy with data that cannot be shared outside the generating agency.*
- o *The Natural Resources & Environmental Protection Cabinet, the Transportation Cabinet, the Kentucky General Assembly, the Office of Disaster and Emergency Services, the Revenue Cabinet, the Economic Development Cabinet, and other state and local government agencies have implemented, or plan to implement in the next biennium, GIS applications.*



## LEGISLATIVE GIS/GPS TASK FORCE

### Current Automated Mapping in State & Local Government

#### Background

To identify current automated mapping applications in state and local government, the Task Force reviewed:

- o A Survey of State Agency GIS, compiled by the GIS Task Force of the Kentucky Information Systems Commission (KISC), September, 1989;and
- o GPS Application Requirements Analysis: Status Report to the GIS/GPS Task Force, compiled by American Cadastre, Inc., August, 1991, for KISC.

In addition, testimony on currently operational mapping applications was received from the Natural Resources and Environmental Protection Cabinet, the Transportation Cabinet, the Louisville/Jefferson County Information Consortium, Lexington-Fayette Urban-County Government, the University of Kentucky, Murray State University, and the Kentucky Geological Survey.

#### Findings

- o *Most current applications provide countywide or regional coverage;*
- o *ARC/INFO software is used in most state, local and university applications;*
- o *Prints of standard map sheets are the most common output;*
- o *Few applications provide digital map output;*
- o *State agencies currently using automated mapping software plan to develop GIS databases;*
- o *Map products in scales of 1:100, 1:200, 1:1,000 and 1:2,000 are available for selected counties from various agencies, and in 1:24,000 scale for all counties from the Kentucky Geological Survey.*

## LEGISLATIVE GIS/GPS TASK FORCE

### Spatial Data Collection, Data Digitizing, and Digitized Data Standards

#### Background

Information on the collection and digitizing of spatial data was collected from the same sources listed on the previous page.

In addition, The Task Force reviewed and distributed to government GIS users the National Institute of Standards and Technology's (NIST) proposed Spatial Data Transfer Standard (SDTS). SDTS provides standards for digital data formats and requires accompanying data describing its attributes. Comments were received and a collective response forwarded to NIST in July.

#### Findings

- o *Most maps produced by automated mapping applications are not plotted from geodetic reference points, but digitized from USGS paper quadrangle maps, mylar maps, or aerial photography maps;*
- o *1:24,000 scale maps are most often used to provide digitized spatial data;*
- o *Such agencies as the Transportation Cabinet, the Kentucky Geological Survey, the Northern Kentucky Area Planning Commission, and the Louisville Metropolitan Sewer District digitize spatial data in-house;*
- o *Many state and local agencies rely on the private sector to provide digitized spatial data;*
- o *Highways, land use, demographics, property ownership and utilities data are spatial data most commonly used;*
- o *Aerial photography is used most often to update existing spatial data;*
- o *GIS user reaction to SDTS indicated that once formulated, SDTS could serve as the standard for GIS development in Kentucky;*
- o *Similar Digital Corp. VAX processors in use in the Department of Revenue and the Natural Resources and Transportation Cabinets provide the potential for data transfer between state government's largest GIS users.*

## LEGISLATIVE GIS/GPS TASK FORCE

### Coordinated GIS Development in Other States

#### Background

The Task Force reviewed GIS-related legislation, enacted or pending, in seven states - Florida, Iowa, Maine, Mississippi, Utah, Vermont and Virginia. These states were chosen to provide organizational and funding models for any GIS legislation proposed by the Task Force.

1990 GIS legislation enacted in Virginia was reviewed in depth, and after testimony from a Virginia representative of the Advisory Commission on Mapping, Surveying, and Land Information Systems, similar legislation (92 RS BR 422) was drafted. The Virginia legislation:

- o Created a Division of Mapping, Surveying, and Land Information Systems, with the director known as the "State Coordinator";
- o Made the Division responsible for technical assistance, the development of standards, the administration of land records, the coordination of mapping services, and the promotion of access to spatial data, relating to implementation and management of GIS by local government; and
- o Established an Advisory Commission on Mapping, Surveying, and Land Information Systems to assist the State Coordinator.

In addition, findings of the State Geographic Information Compendium, published by the Council of State Governments, were distributed to the members. The compendium identified the following "keys to success" regarding coordinated GIS development:

- o A leadership role of environmental and natural resources agencies in state government GIS development;
- o Quality direction, planning and management of information technology to maximize GIS development; and
- o Creation of interagency and interorganizational groups, or geographic information councils.

## LEGISLATIVE GIS/GPS TASK FORCE

### Coordinated GIS Development in Other States

#### Findings

- o *The Task Force subsequently modified 92 RS BR 422, after suggestions from affected state agencies were received. It provides for the creation of an Office of Geographic Information Systems in the Natural Resources and Environmental Protection Cabinet; names a GIS Advisory Commission to assist the Office in the implementation of GIS; and requires this commission to assist the Kentucky Information Systems Commission in the statewide planning and coordination of GIS.*
  
- o 92 RS BR 422 was adopted based on the following considerations:
  - *CSG findings of “keys to success” in states attempting to coordinate GIS system development;*
  - *Virginia GIS legislation enacted in 1990 serving as an organizational model;*
  - *Testimony in the course of the Interim indicating that the Natural Resources and Environmental Protection Cabinet could provide more GIS application implementation experience and expertise than any other state agency, and hence be a lead agency in coordinating GIS development; and*
  - *Rather than focusing on the development of a single GIS, focusing on the development of multiple systems, under the aegis of a coordinating agency, to allow users to access and select their GIS technology and data from existing resources, or ones likely to exist in the future.*

***The Task Force voted to prefile 92 RS BR 422 with an expression that it should pass.***  
A summary of 92 RS BR 422 is provided in Appendix C.

# LEGISLATIVE GIS/GPS TASK FORCE

## GPS Basics and Potential Uses

### Background

Global Positioning System (GPS) is satellite technology developed by the Department of Defense that can be used to determine the position of any point on the earth. GPS is based upon many of the principles of land surveying, but uses signals received from orbiting satellites to triangulate positions of interest.

There are currently 15 such satellites in orbit, allowing GPS observations, at selected times, for 19 hours per day. A constellation of 24 satellites will comprise GPS when fully implemented in 1993 and allow 24 hour per day observation. Four satellites must be in view to perform calculations (one is used to correct receiver timing errors). The distance between points is determined by measuring the time it takes for a radio signal to travel from a satellite to a GPS receiver on the ground. As changes in the satellite movements are recorded by GPS receivers, the precise position of the receiver, and thus a geodetic reference point, is determined.

The basic output of a GPS receiver is latitude/longitude coordinates, a format readily handled by GIS. GPS provides a contiguous and continuous set of geodetic reference points, which can serve as a control for aerial photography, and ground surveys, which in turn provide the base map that GIS applications can be built on.

The improved accuracy between geodetic points with GPS surveying allows more accurate description of land forms, boundaries and other spatial data when used in conjunction with computerized mapping systems.

### Findings

- o *Start up costs for GPS surveying are high compared to conventional surveying - GPS receivers cost from \$10,000 to \$60,000 each;*
- o *Surveying costs using GPS are lower long term, as a result of reduced time needed for recognizance, smaller survey crews and fewer surveying trips;*
- o *GPS surveying reduces reliance on traditional surveying and aerial photography for spatial data collection and improves the accuracy of each;*
- o *As GPS data can also be digitized in the field, the use of GPS technology can be expected to reduce costs associated with field survey and data conversion components of GIS.*

# LEGISLATIVE GIS/GPS TASK FORCE

## Geodetic Reference Points

### Background

The Task Force learned that accurate latitude and longitude land coordinates, called geodetic reference points, are not only the base on which different layers of geographic data are tied together in a GIS, but can also serve a multitude of GIS users developing systems simultaneously. Three concepts stressing the use of GPS technology to establish shared or common geodetic reference points for statewide use were studied:

- o The creation of a Statewide Geodetic Control Network;
- o The establishment of a Community-based GPS Reference System; and
- o Densification of the existing National Geodetic Reference System (NGRS) of some 1600 control points identified by traditional surveying techniques, with GPS measurements in those areas not covered by the network.

Representatives of the U. S. Army Corps of Engineers, National Geodetic Survey, and the Tennessee Department of Transportation spoke on behalf of establishing a statewide geodetic network from GPS measurements. Testimony indicated that the existing geodetic reference system (monuments that are either a steel rod driven into concrete or a metal cap in exposed bedrock) in the United States was created with surveying techniques used in the early 20th century, had been subject to forestation, flooding, and displacement by construction projects, and was of questionable accuracy. It was the consensus of these speakers that in lieu of relying on conventional land surveying to identify geodetic points usable in GIS application development, it was cheaper, faster and more accurate to establish a statewide geodetic control network with GPS technology. Once established, such a network was available for use in developing state, regional and local base maps for GIS.

Testimony revealed that networks of this type had been completed in eight states - Delaware, Florida, Maryland, New Mexico, Oregon, Tennessee, Washington and Wisconsin - and were being established in four others. Tennessee, a state comparable in size, topography and budget to Kentucky, established its network of 60 monuments, 50 kilometers apart, within a year, for approximately \$200,000.

A representative of the University of Kentucky faculty testified on behalf of a community-based GPS reference system that would consist of three continuously operating GPS receivers, one in Lexington serving as the main reference point (MRP), and two others located out in the state, serving as regional reference points (RRPs).

## LEGISLATIVE GIS/GPS TASK FORCE

### Geodetic Reference Points

Each site would be equipped with a personal computer and modem to facilitate GPS data transfers between the RRP's and MRP. The MRP would also be connected to the UK Computer Center.

Field receivers would collect GPS data and transfer it to the MRP via phone connection, where it could be processed, or uploaded to the Computer Center for future use. Public agencies and private users could request GPS data through phone connection of their PC to the Computer Center, or request stored data on magnetic tape or disks. Such a system would provide 24 hour GPS data, meet more than 80% of the GPS positioning reference needs in GIS applications, and could be implemented in 6-8 months for approximately \$111,000, excluding the salary of the MRP manager and GPS training.

The densification of the existing geodetic reference network (NGRS) was discussed by representatives of the National Geodetic Survey and the U. S. Army Corps of Engineers, as an alternative to the establishment of the high accuracy network based solely on GPS measurements. The cost to densify the existing network, however, is approximately the same as the statewide GPS network alternative, and would still yield measurements whose accuracies were more suitable to surveying applications than for use in the development of GIS base maps.

#### Findings

- o *The Kentucky Transportation Cabinet has submitted a budget request in the amount of \$185,000 to contract with an engineering firm to establish a high accuracy GPS network statewide to serve as the control in highway construction projects;*
- o *If funding is approved for the establishment of the GPS network above, the geodetic reference point data could be used as control for GIS base map development by other state and local agencies, as is done in Tennessee;*
- o *A geodetic control network using GPS measurements for all GIS applications would tie together disparate spatial data on geology, topography, utilities sitings and roads, and serve to integrate statewide mapping;*
- o *Until a GPS Geodetic Control Network is established, Kentucky should adopt the Kentucky Coordinate System of 1983, to improve accuracies between geodetic reference points defined by conventional land surveying. 92 RS BR 199 establishes the Kentucky Coordinate System of 1983 for this purpose. The Task Force voted to prefile 92 RS BR 199, with an expression that it should pass. A summary of 92 RS BR 199 is provided in Appendix C.*

# LEGISLATIVE GIS/GPS TASK FORCE

## GPS Surveying Technology and Processes

### Background

Representatives of Trimble Navigation, Inc., the U. S. Army Corps of Engineers and the University of Kentucky briefed the Task Force on GPS Surveying equipment and techniques. The Task Force learned that GPS technology is not only revolutionizing surveying, but also that GPS receivers are increasingly shrinking in size and price, while becoming more portable and compatible with data digitizers and personal computers. As a result, several surveying techniques are available for mapping applications, depending on the accuracy needed between geodetic control points.

Four GPS surveying techniques, or modes of observations, were described:

- o autonomous mode;
- o differential mode;
- o static differential mode; and
- o kinematic mode.

In autonomous (stand-alone) mode, with only one single-frequency, 2-channel GPS receiver in use, typical field observation accuracy is 12 to 15 meters horizontal when selective availability (Department of Defense encrypting signal) is off. Using the same receiver as above and a differential mode, the horizontal accuracy is 2 to 5 meters, if the data are averaged for 3 minutes or more.

In differential mode, two or more GPS units are used to receive signals from the same satellites at the same time. This observing period is called a session. The base station whose position is known (called the reference station) collects data at the same time as the remote station(s). After the recording session, the remote data is differentially corrected on a computer by using the post-processing software. The differential GPS survey will provide accurate distance measurement, regardless of terrain or distance between stations.

In the static (fixed) differential mode, one GPS unit is always positioned on a known point, with the other unit(s) on the unknown point(s). When the unknown point(s) in observing session 1 become(s) known, one unit remains at the reference station while the other(s) is "leap-frogged" to other unknown point(s) for session 2; etc. The observations are processed to obtain the components of the baseline vector between observing stations.



## LEGISLATIVE GIS/GPS TASK FORCE

### GPS Surveying Technology and Processes

The coordinate differences between the receiver at the known point and the receiver at the unknown point(s) can be determined to an accuracy of 1:100,000 or better.

A minimum of four satellites should be visible at the same time to do 3-dimensional measurements (3 for horizontal control). The number of points that can be established in a day is determined by the number of receivers used, the accuracy required, and the travel time between points. In general, the greater the number of receivers, the greater the productivity.

In the "kinematic" (in motion) differential mode (after initial baseline points are established), one unit stays static while the other units rove from point to point, without losing lock on at least 4 satellites. Twenty-five points an hour, using one roving receiver, is not uncommon with kinematic surveying.

#### Findings

- o *GPS surveying accuracy is primarily a function of the receiver and its associated software, and the mode of observation used for data acquisition;*
- o *Accuracy is generally increased by using a multi-channel receiver to track more satellites, by using dual-frequency observations, rather than single frequency surveys, by averaging multiple observations, and by using autonomous positioning methods;*
- o *GPS measurements provide accuracies of 1 to 5 centimeters between geodetic reference points up to 100 miles apart. Conventional surveying results in errors of 5 meters or greater over the same distance;*
- o *Static differential surveys should be used to establish a GPS control network;*
- o *With two people and two receivers, it takes an hour to set a geodetic control point using GPS.*



**LEGISLATIVE GIS/GPS TASK FORCE**

**APPENDIX A**

**1990 SCR 112**





## 1990 SCR 112

A CONCURRENT RESOLUTION to create task forces to study selected issues.

WHEREAS, in 1974 a water impoundment project of a tributary of the Salt River was first proposed by the United States Army Corps of Engineers to be located on the Washington and Nelson County line; and

WHEREAS, this project, known as Camp Ground Lake, was proposed to provide flood control, water supply, water quality control, general recreation and the preservation of fish and wildlife resources; and

WHEREAS, Congressman William Natcher, United States Representative of the people within Washington and Nelson Counties recognizing the need for flood protection and the preservation of future water resources for these counties, has requested federal money for the continued study of this issue;

NOW, THEREFORE,

Be it resolved by the Senate of the General Assembly of the Commonwealth of Kentucky, the House of Representatives concurring therein:

Section 1. That there is created the Camp Ground Lake Task Force. The task force shall study the potential for the proposed Camp Ground water impoundment to provide flood control, water supply, water quality control, general recreation and the preservation of fish and wildlife resources. The task force shall also study the effect of the proposed lake on economic development for the area and the overall level of community support for the Camp Ground Lake project. The task force also shall study the proposed lake in a manner which takes into account the efforts of Congressman Natcher.

Section 2. That the task force shall be composed of fourteen (14) members appointed by the Legislative Research Commission. The membership shall include the members of the Senate representing the fourteenth (14th), twentieth (20th), and twenty-second (22nd) legislative districts, the members of the House of Representatives representing the twenty-fourth (24th), the forty-ninth (49th), the fiftieth (50th), and the fifty-fifth (55th) legislative districts, the county judge/executives, of the counties of Anderson, Marion, Nelson, and Washington, or their representatives, a representative of the Lincoln Trail Area Development District, a representative of the Bluegrass Area Development District and a member appointed at large. The chairperson shall be appointed by the Legislative Research Commission.

Section 3. That the task force shall report the findings and recommendations of the study to the Legislative Research Commission by October 30, 1991.

Section 4. Staff services to be utilized in completing this study are estimated to cost twenty-five thousand dollars (\$25,000). These staff services shall be provided from the regular Commission budget and are subject to the limitations and other research responsibilities of the Commission.

**Section 5. (1) WHEREAS, there is a need for an improved land survey and mapping system which can aid land transfers, furnish a basis for more equitable taxation, and provide necessary information for resource management and environmental planning; and**

**WHEREAS, the Navstar Global Positioning system is being developed by the United States Department of Defense to utilize satellites to precisely locate objects on the surface of the earth; and**

**WHEREAS, to use the GPS effectively, the National Geodetic Survey stations throughout the Commonwealth must be reviewed to determine suitability with the Global Positioning System; and**

**WHEREAS, a highly accurate geographic information system (GIS) can result by the use of the global positioning system (GPS) technology for the benefit of the Commonwealth;**

**NOW, THEREFORE, the General Assembly of the Commonwealth of Kentucky declares:**

**(2) That the GIS/GPS Task Force is created to study a geographic information system and a global positioning system oriented geodetic reference system for the Commonwealth. The membership of the task force shall include:**

**(a) Two (2) members of the General Assembly chosen by the Legislative Research Commission and representative of the two (2) political parties polling the greatest number of votes in the state at general elections. The Legislative Research Commission shall appoint one of these members to serve as the chairperson of the task force;**

**(b) The Chief Justice of the Supreme Court of Kentucky or his designee; and**

**(c) Five (5) members appointed by the Governor and representing the following executive branch agencies:**

**1. A representative of the Transportation Cabinet office which regulates airports;**

2. A representative of the Transportation Cabinet office which regulates highways;
3. A representative of the Natural Resources and Environmental Protection Cabinet which regulates surface coal mining;
4. A representative of a state university who is knowledgeable about the use of satellites to conduct land surveys and geographic information systems; and
5. A representative of the Kentucky Geological Survey.

(d) In addition, the Legislative Research Commission shall appoint to the task force a representative from each of the following:

1. The largest organization in Kentucky representing land surveyors;
2. The largest organization in Kentucky representing professional engineers;
3. The largest organization in Kentucky representing professional planners;
4. The Mid-America Remote Sensing Center (MARC) of Murray State University;
5. A metropolitan sewer district from a county containing a city of the first class which has a geographic information system; and
6. A county containing a city of the second class which has a geographic information system.

(3) That the purpose of the task force shall be to study and make recommendations to the 1992 General Assembly of the Commonwealth of Kentucky on a proposal to establish a geographic information system and a geodetic reference system for Kentucky which can utilize the global positioning system.

(4) The recommendations of the task force shall be submitted to the Legislative Research Commission by September 1, 1991.

(5) The Kentucky Geological Survey shall designate staff to provide technical assistance to the task force. The Legislative Research Commission shall provide administrative support services to the task force.

(6) Legislative Research Commission staff services to be utilized in completing this study are estimated to cost \$10,000. These staff services shall be provided from the regular Commission budget and are subject to the limitations and other research responsibilities of the Commission.





**LEGISLATIVE GIS/GPS TASK FORCE**

**APPENDIX B**

**RECOMMENDATIONS FOR COORDINATED GIS DEVELOPMENT**



# **LEGISLATIVE GIS/GPS TASK FORCE**

## **RECOMMENDATIONS FOR COORDINATED GIS DEVELOPMENT IN KENTUCKY STATE GOVERNMENT**

**October, 1991**

- 1. A Geodetic Control Layer for GIS Base Maps using GPS technology should be established.**
- 2. 1:24,000 scale should be adopted as the statewide standard for Transportation Network Mapping and other statewide mapping.**
- 3. The Natural Resources and Environmental Protection Cabinet should assume the leadership role in the integration of GIS technology in other state programs through an Office of GIS.**
- 4. An Advisory Commission on Geographic Information Systems should function to assist the KY Information Systems Commission in planning for state use of GIS, and the Natural Resources and Environmental Protection Cabinet in implementing GIS strategies.**
- 5. State Level Technical Standards and Guidelines should be based on ARC/INFO import/export compatibility and the National Institute of Standards and Technology's standards on digital cartographic data, digital data exchange, and quality control and documentation.**

**RECOMMENDATIONS FOR COORDINATED GIS DEVELOPMENT  
IN KENTUCKY STATE GOVERNMENT  
October, 1991**

**1. Geodetic Control Needs.**

- o Geodetic control layers are the foundation for all other GIS applications.
- o Kentucky should complete the surveying and marking of a sufficient number of geodetic control monuments to provide the needed control layer for GIS.
- o Current estimates indicate that 60 control points suitable for GIS application development could be established using GPS technology.

**Action** - *The Kentucky Transportation Cabinet, with the assistance of the Advisory Commission on Geographic Information Systems, should prepare a detailed plan, specifications, standards, and an implementation schedule for the survey of the control points and completion of a statewide geodetic control system.*

It is estimated that the plan and implementation schedule can be done by a consultant engineering firm in 2-4 months, at an estimated cost of \$100,000 to \$185,000.

**Action** - *The Kentucky Transportation Cabinet should enlist the assistance of the National Geodetic Survey (NGS) in the establishment of a statewide geodetic control network. Transportation Cabinet GPS equipment and crews should work with the consultant engineer and NGS to tie GPS points into the existing National Geodetic Reference Network (NGRN) and in the placement of monuments. Schedules should take advantage of normal Transportation Cabinet operations. The Kentucky Transportation Cabinet should adopt the Federal Geodetic Control Committee's 1988 standards and specifications for use of a global positioning system.*

The cost of locating and placing each monument will be approximately \$500. The Transportation Cabinet should absorb the cost of the equipment and crews needed for monument placement, and adjustment with the NGRN. A permanent GPS surveying crew should be responsible for maintenance of the statewide network .

**RECOMMENDATIONS FOR COORDINATED GIS DEVELOPMENT  
IN KENTUCKY STATE GOVERNMENT  
October, 1991**

**2. Cartographic Features Needs.**

- o Between 60% and 80% of the total cost of GIS is incurred in collecting and maintaining geographic data.
- o This high cost can be significantly reduced through effective management, coordination and sharing of the information common to most GIS applications.
- o At the state level this includes the transportation networks, the political boundaries and the water bodies which are commonly referred to as cartographic information layers.
- o Most state agencies and institutions currently use the USGS quadrangle maps at the 1:24,000 scale as the base maps for their GIS applications, even though these maps are not currently available on a statewide basis in digital format.

**Action** - *The Kentucky Transportation Cabinet should adopt the 1:24,000 scale as their standard scale for statewide transportation network mapping, and should use the USGS quadrangle maps at that scale as their primary source maps for creating the initial base map information on Kentucky's transportation networks. To implement this standard, The Transportation Cabinet should continue to digitize data files on all of the roads, streets, water bodies and political jurisdictions contained on the 750 1:24,000 scale USGS quadrangle maps that cover Kentucky.*

**Action** - *The KY Geological Survey (KGS) should coordinate plans to convert the 1:24,000 scale quadrangle maps to digitized format for the use of other state agencies in automated statewide mapping applications. This task must specify data and map accuracy levels at no less than those required by the National Map Accuracy Standards for the 1:24,000 scale.*

KGS estimates that it will cost \$6.4 million to convert eight elements from the approximately 700 quadrangles remaining to be digitized. The U.S. Geological Survey has a 50% matching fund program for such a project. If Kentucky were to cooperate with the U.S. Geological Survey in this effort, its share would be \$3.2 million, or \$4,560 per quadrangle. Therefore, \$1,600,000 in state funds should be allocated for the 1992-94 biennium.

**RECOMMENDATIONS FOR COORDINATED GIS DEVELOPMENT  
IN KENTUCKY STATE GOVERNMENT  
October, 1991**

**3. *Geographic Information System Integration.***

- o Agencies involved in managing natural resources have much of the basic components of an integrated GIS technology in place today, and are also a repository of expertise in the application of the technology, which is not matched elsewhere in state government.
- o These agencies have developed a variety of means for pursuing informal cooperation, but lack a comprehensive plan for coordinating their activities and functions with other state and local government agencies.
- o An Office of GIS (OGIS) within the Natural Resources and Environmental Protection Cabinet should serve to coordinate state GIS application development.
- o An OGIS cannot meet the demands of state and local governments in mapping, map use and related technology applications without an appropriation for FYS 92-94.

**Action** - Given the current environment for GIS applications at the state level, it seems most appropriate for the state to focus its GIS policy-making responsibility in the office of the Secretary of Natural Resources. For state government today the pressing need for GIS use is in natural resources management and environmental protection. State agencies most experienced in the application of automated GIS technology are also concentrated in the natural resources area. It is therefore logical that the Secretary take the lead in assisting other state programs to implement GIS technology.

**Action** - *The Natural Resources and Environmental Protection Cabinet needs an appropriation of approximately \$100,000 for FYS 92-94 to establish and staff an OGIS.*

**RECOMMENDATIONS FOR COORDINATED GIS DEVELOPMENT  
IN KENTUCKY STATE GOVERNMENT  
October, 1991**

**4. *Role and Responsibility of the Advisory Commission on GIS.***

- o The OGIS is empowered to provide technical advice on mapping practices, standards and information sources, with particular focus on assisting local government.
- o The OGIS also is empowered to recommend ways of coordinating, consolidating and improving mapping services and programs being carried out by state government.
- o The GIS Commission serves to advise and monitor OGIS policies and functions.
- o The GIS Commission cannot operate without FYS 92-94 appropriations.

**Action** - The Natural Resources and Environmental Protection Cabinet needs an appropriation of approximately \$100,000 for FYS 92-94 to adequately staff OGIS. In addition, an appropriation of approximately \$100,000 for FYS 92-94 is needed to staff and operate the Advisory Commission on Geographic Information Systems.

**Action** - *In the next biennium, the Office of Geographic Information Systems should focus on its state and local government support role, and provide technical assistance. The GIS Commission should assist OGIS in the formulation of standards, and help design, in cooperation with the Kentucky Information Systems Commission, a long-term plan to integrate the state use of GIS.*

**RECOMMENDATIONS FOR COORDINATED GIS DEVELOPMENT  
IN KENTUCKY STATE GOVERNMENT  
October, 1991**

**5. State Level Technical Standards and Guidelines.**

- o ARC/INFO is a high-level software product which has become the de-facto standard for LIS/GIS use in the state, as it has at the federal level and in many other states and localities. Most current users of automated GIS use ARC/INFO or have selected this software for installation.

**Action** - The Advisory commission on GIS will develop technical standards or guidelines, as appropriate, to make effective use of the ARC/INFO GIS software, based on its commonality of use, resource sharing potential and the current levels of expertise available in state agencies and institutions of higher education. *The support of the ARC/INFO import/export (ASCII) format should be considered a minimum requirement for the selection of any high-level automated GIS software package.*

**Action** - During 1992-93, the GIS Commission will review the soon-to-be-released National Institute of Standards and Technology's standards on digital cartographic data, digital data exchange, and quality control and documentation for their applicability to Kentucky. Based on its findings, *the GIS Commission should consider recommending adopting the NIST standards, in whole or in part, for use in the Commonwealth.*



**LEGISLATIVE GIS/GPS TASK FORCE**

**APPENDIX C**

**SUMMARIES OF RECOMMENDED LEGISLATION  
1992 REGULAR SESSION**

- o 92 RS BR 199
- o 92 RS BR 422



**LEGISLATIVE GIS/GPS TASK FORCE  
92 RS BR 199**

**AN ACT relating to land surveying**

**Section 1. Creates a New Section of KRS Chapter 322**

- o Legislative Intent

**Section 2. Creates a New Section of KRS Chapter 322**

- o Adopts Kentucky Coordinate System of 1983 as defined by National Geodetic Survey
- o Defines Kentucky Coordinate System
- o Allows descriptions of survey locations based on the KY Coordinate System of 1983 to be considered legal

**LEGISLATIVE GIS/GPS TASK FORCE  
92 RS BR 422**

**AN ACT relating to the Natural Resources and  
Environmental Protection Cabinet**

**Section 1. Amends KRS 224.01-010**

- o Definitions

**Section 2. Creates a New Section of KRS Chapter 224**

- o Office of Geographic Information Systems Created
- o Director of Office to be State Coordinator
- o Office to Provide Technical Advice, Promote Access to Digital Data
- o Office to Develop Documentation, Indexing, and Mapping Standards
- o Office to Recommend Improved Mapping Services through Coordination with State Agencies

**Section 3. Creates a New Section of KRS Chapter 224**

- o Creates an Advisory Commission on Geographic Information Systems

## **LEGISLATIVE GIS/GPS TASK FORCE**

- o Advisory Commission to Assist State Coordinator in the Development of Standards and the KY Information Systems Commission in Strategic Planning for GIS Development
- o Advisory Commission Membership (13):
  - Secretary of the Finance & Administration Cabinet or designee
  - Secretary of the Transportation Cabinet or designee
  - Secretary of the NR & EP Cabinet or designee
  - Secretary of the Revenue Cabinet or designee
  - Chairman of the KY Info Systems Commission or designee
  - Director of Administrative Office of the Courts or designee
  - A Representative of the American Soc. of Photogrammetry
  - A Representative of the American Soc. of Civil Engineers
  - A Representative of the KY Assoc. of Professional Surveyors
  - A Representative of the KY Chapter of the Amer. Planning Assoc.
  - A Representative of the KY Assoc. of Counties
  - A Representative of the KY Municipal League

### **Section 4. Creates a New Section of KRS Chapter 224**

- o Advisory Commission to Meet Quarterly
- o Advisory Commissions Duties to Include:
  - Recommending and Reviewing Proposed Policies of the Office of Geographic Information Systems
  - Advising State Coordinator on Schedule of Fees for GIS Services
  - Coordinating GIS Training with Dept. of Info. Systems
  - Implementing Geodetic Network with Transportation Cabinet





