2003 INNOVATIONS AWARDS PROGRAM
Application Form

1. Program Name:
GeoStor

2. Administering Agency
Arkansas Geographic Information Office

3. Contact Person (Name & Title)
Shelby Johnson, Arkansas Geographic Information Coordinator

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8. Please provide a two-sentence description of the program.
GeoStor is the nation's first statewide, publicly-accessible, multi-vendor, enterprise-class geospatial information system. GeoStor enables GIS users across Arkansas to respond to numerous location based questions including: economic development request, city zoning issues, and disaster response needs in an efficient manner.

9. How long has this program been operational (month and year)?
GeoStor was made available to the public on January 18, 2001.

10. Why was the program created? (What problem[s] or issue[s] was it designed to address?)
Rapid access to high-quality geospatial data has become a key component of the activities of most local, regional, and state agencies as well as the public. Furthermore, the Arkansas 81st General Assembly of 1997 directed the Board to: pursue activities that result in coordinated, cost-effective programs for spatial data development and distribution; and to develop procedures for the inventory, storage, and distribution of spatial information (Arkansas Code 15-21-504).

The State Land Information Board recognized the need for a comprehensive mechanism that would facilitate geospatial data sharing and coordination. In 1998 the State Land

Information Board formed a subcommittee to define the technical objectives for a statewide GIS clearinghouse. Most of the members of this committee have contacts with other state GIS programs and decided to first review other plans instead of "re-inventing any wheels." As with Arkansas, many other states have either executive orders or legislation that recognizes the cumulative value of geospatial data and calls for the development of a well-organized clearinghouse of geospatial information. After looking at the plans of our surrounding states, and soliciting comments from those states who already have been through the process of strategic planning for statewide geospatial clearinghouse systems, the committee found that every plan reviewed had a common theme of serving the people of their state with a clearinghouse that:

- Encourages voluntary, cooperative efforts of government agencies at all levels, public and private organizations, and geographic data users
- Strives to identify common interests and foster development, use, and sharing of high quality geospatial data
- Recognizes the interdependence among entities in the development and maintenance of geospatial data
- Calls for processes to develop GIS standards that enable geographic data to be easily used and economically shared by all and to adopt metadata standards
- Provides mechanisms to follow to ensure data contained within the clearinghouse follows the adopted standards for overcoming the barriers of consistency in collecting, creating, maintaining, and sharing geospatial information
- Recognizes and incorporates the efforts at the national level by the Federal Geographic Data Committee (FGDC) and National Spatial Data Infrastructure (NSDI), in developing a framework that centers around common themes to help data producers locate their information in its correct position and provide a means to integrate this information with other geographically referenced data

Uncommon among state clearinghouses was the ability to deliver custom geographic extents and data in the format and projection required by the user.

In January of 2000, the Arkansas Geographic Information Office conducted a second generation Framework Data Survey, modeled after the first survey sponsored by the Federal Geographic Data Committee (FGDC) and the National States Geographic Information Council (NSGIC) (See http://www.gis.state.ar.us/Downloads/SLIC/Audit_results.pdf). The survey results demonstrated that a growing number of organizations in Arkansas were engaged in creating and using geospatial data; these users were operating in multiple software environments and developing multiple data sets. These users would benefit from a centralized clearinghouse that could deliver a custom geographic extent, in their format and their projection.

In determining how to respond to this motivation, it was recognized that, in the past, centralized warehouses of geospatial data were composed of collected files of geographic (map) data. Those wishing to use the data downloaded the files to their local computer and performed needed analyses. While such systems increased the accessibility of data, they had a number of limitations. File-based data required that users download an entire file and extract selected data even when they only need a limited amount of data. Frequently, the area of interest is at the boundary of one or more files, so that multiple files are downloaded. A second limitation of these systems was that the data is provided in a predefined format with respect to the particular software format (e.g. vendor) and map projection and datum. Map projections and datums are technical characteristics of mapping data and different users have different requirements. As a result, it was necessary to either insist that all data providers utilize similar specifications or convert the data provided. Requiring a one-size-fits-all approach has repeatedly proven to be ineffective as different data providers and consumers have different technical requirements – these requirements limit accessibility. On the other hand, conversions by the end-user place substantial and unneeded technical demands on that group. More significant, however, is that the timeliness of a file-based system is difficult to maintain. Changes to any single feature in a file-based system require that the entire file be replaced. As an example, suppose that a transportation agency closes a bridge. The change will not be reflected in the statewide system until a completely new file is provided and added to the system. If, for example, emergency responders are accessing the data from the file based system, they will be unaware of the closed bridge until the file has been updated. Additional limitations to these file based systems revolve around the difficulties they represent for multi-user access with differing levels of security control and similar well-known, basic multi-user information technology related issues.

A second concern was the massive duplication of data across agencies, municipalities, and the public. Because timely data was not easily accessible, each agency developed its own version of various standard data and added agency-specific data. For example, multiple agencies had developed their own versions of the statewide transportation data. With GeoStor, the Arkansas Highway and Transportation Department can immediately post any changes to the state's transportation infrastructure and all others have direct and instant access. The design of GeoStor is facilitating public-private sector collaboration. In one example, multiple agencies, communities, and private sector firms have collaborated to develop a single street-centerline data structure that will be implemented in GeoStor and will allow all the groups to collaboratively share the highest resolution data.

11. Describe the specific activities and operations of the program in chronological order.

1997 Q1-Q4: Arkansas State Land Information Board appointed by Governor Huckabee lacks the ability to effectively organize, manage and distribute its spatial data.

1998 Q3: Initial work began on planning the technical objectives to be accomplished by the system. This work was carried out by a subcommittee of the State Land Information Board. The resulting document described technical objectives required by the Board. A copy of the objectives can be found at http://www.gis.state.ar.us/Downloads/SLIC/pdf/asdi.pdf.

1998 Q1 – 2000 Q4: Center for Advanced Spatial Technologies (CAST) is granted the Governor's Telecommunications and Technology Infrastructure Fund for a research project entitled "Seamless Warehouse of Arkansas Geodata (SWAG)".

2000 Q1: Initial SWAG beta testing begins with membership of the Arkansas GIS Users Forum and K-12 schools in Arkansas.

2000 Q2: State Land Information Board adopts "GeoStor" as the formal name.

2000 Q2: Massive loading of geospatial data from Federal and State sources into the GeoStor database.

2000 Q4: Research produced from the SWAG project gives way to GeoStor vision promoted by the State Land Information Board.

2001 Q2: GeoStor defined as part of the Arkansas Spatial Data Infrastructure by 83rd Arkansas General Assembly in Arkansas Code 15-21-502.

2001 Q1- 2002 Q4: Users become increasingly reliant on spatial data to address issues facing Arkansas. GeoStor proves to be utilized by a broad group of users in and out of state.

2002 Q2- 2004 Q4: Arkansas Executive Chief Information Officer, the State Land Information Board, the Arkansas Geographic Information Office, the Department of Information Systems, and CAST pursue other grant funding sources to continue operating GeoStor. Several other applications that build on GeoStor are researched, utilizing federal and private contributions.

12. Why is the program a new and creative approach or method?
GeoStor was designed to serve as the "backend" data querying solution to a number of applications as well as a geospatial delivery system. In this way, the initial investment in the system could be leveraged to provide multiple applications. This was not only a cost savings, but it also ensured the different applications were working from a common database – one that could be dynamically updated. The spatially enabled database management system structure provides the infrastructure that allows multiple data providers to locally maintain their own internal information while electronically updating the enterprise system.

A number of other applications have been developed that build on the GeoStor research. This low continuing cost is due to the fact that, automated solutions are being created to deliver the needed spatial data products (e.g., RAPID, see below). With this approach ongoing operational costs to the state will be dramatically reduced. Linkages to existing "live" data sources (e.g., Arkansas soils data) means that no specialized data duplication/maintenance costs will be required. Costs going forward will consist of software maintenance, unless data sources not originally included are to be added as a direct result of agency/user demands.

GeoStor OGC Web Map Portal. GeoStor was designed to be standards compliant, particularly the geospatial standards under development by the Open GIS Consortium (OGC). In the summer of 2001, the FGDC funded CAST to extend the GeoStor architecture with OGC compliant Web Mapping Services. This project was completed in 2002, will also be adding GML (Geography Markup Language) server capabilities to GeoStor.

Arkansas On-Line Economic Atlas Project. With support from FGDC under their Community Demonstration Project, an on-line Web information system providing extensive economic development data for all communities and areas in Arkansas was developed. Comprehensive American Economic Development Council data sets can be downloaded for each community, county and commuter-shed in the state. This site enables prospective companies can quickly locate information on the best sites for new facilities or investments in the state.

RAPID-AmericaView. Under the AmericaView program USGS is working with states to increase the availability of satellite imagery and other spatial data products. This process generally involves the transfer of satellite imagery from the EROS Data Center to a server in the state where they are freely accessible via FTP. In Arkansas, this project is described as RAPID-AmericaView (Real-time Access and Processing of Image Data). Coordinated by the Arkansas Geographic Information Office for the State, developed an automated system that processes satellite imagery into a number of information products that are automatically placed into GeoStor. Potentially this project could benefit farmers, disaster management personnel, and foresters.

Each of these projects has enabled Arkansas to leverage federal dollars by forming partnerships between federal and state agencies. GeoStor has received both national and

international attention and continues to enable the state to explore new applications that streamline public and private sector workflow.

13. What were the program's start-up costs? (Provide detail about specific purchases for this program, staffing needs and other financial expenditures, as well as existing materials, technology and staff already in place.)

Arkansas Governor's Office
Contribution: The Governor's Telecommunications and Technology Infrastructure Fund was granted twice $298,985 (November 4, 1998) and $312,000 (January 11, 2000).

Arkansas State Highway and Transportation Department
Contribution: A number of spatial data layers.

Arkansas State Land Information Board.
Contribution: Overall GeoStor Coordination of educational events in and out of state, through the Arkansas Geographic Information Office.

ESRI
Contribution: Software with a commercial value in excess of $50,000.

Federal Geographic Data Committee
Contribution: Four grants of $26,000, $8,000, $70,000, and $20,000 as well as assistance with standards and metadata.

Intergraph
Contribution: Software with commercial value of more than $80,000.

MapInfo
Contribution: Software with a commercial value of more than $65,000.

Oracle
Contribution: Software with a commercial value of $1,500,000.

PCI
Contribution: Software with a commercial value of $150,000.

Safe
Contribution: Software with a commercial value of more than $45,000.

Sun
Contribution: Hardware with a commercial value of $1,200,000.

Four full time employees are required to maintain GeoStor in an operational environment.

14. What are the program's annual operational costs?
$375,000 is required for technical personnel, and hardware and software maintenance.

15. How is the program funded?
Grants and in-kind contributions

16. Did this program require the passage of legislation, executive order or regulations? If YES, please indicate the citation number.
This program did not require the passage of legislation, but reference is made to the system in Arkansas Code 15-21-501.

17. What equipment, technology and software are used to operate and administer this program?
Hardware:
Sun Enterprise 4500 server, a Sun StorEdge L3500 Tape Library and a Sun StorEdge A5200 RAID disk system. Windows 2000 Dell Server.

Software:
ArcIMS, MapXtreme – JAVA, MapMarker J with US dataset, PCI Geomatica Prime (UNIX), FME Oracle Suite, FME Enterprise for Solaris, Oracle8i/9i Enterprise Edition, Solaris.

18. To the best of your knowledge, did this program originate in your state? If YES, please indicate the innovator's name, present address and telephone number.
Yes- Arkansas State Land Information Board
124 West Capitol Suite 200
Little Rock, AR 72203
(870) 682-2767

19. Are you aware of similar programs in other states? If YES, which ones and how does this program differ?
A number of states have geospatial clearinghouses. GeoStor is unique in the way a user can define an area of interest, GIS format, and projection and receive the file in the pre-defined format. GeoStor does not just serve geospatial data to end users. GeoStor also acts as the "backend" of numerous applications (refer to question 12)

20. Has the program been fully implemented? If NO, what actions remain to be taken?
GeoStor has been available to the general public since January 2001.

21. Briefly evaluate (pro and con) the program's effectiveness in addressing the defined problem[s] or issue[s]. Provide tangible examples.
GeoStor is a Web-based solution, the "cost of ownership" for any user is minimal; all that is required is a standard browser and adequate network capacity. The system has been designed to operate over a 56K connection.

GeoStor has proven to be a first of its kind in several ways. Users can easily search for data, select any specified area of interest and extract data just from that area, reproject the data (raster and vector) and transfer it to their personal computer. GeoStor is designed to allow the data system to interface with multiple softwares. There are currently over 500 different spatial data layers in the system (http://www.cast.uark.edu/cast/geostor/data_available/index.htm). To create these 500 data layers, the GeoStor data development staff acquired more than 8,400 different data files from various federal and state sources, merged them into seamless, statewide sets and loaded them into GeoStor.

GeoStor data layers are accessible via the U.S. Geological Survey's Federal Geographic Data Committee (FGDC) Clearinghouse and all data layers have FGDC compliant metadata. GeoStor meets or exceeds all federal and state standards currently in place.
Major users of the data distribution system are state agencies and private sector companies, followed by universities, local communities, schools, and federal agencies. The economic development information systems impact all communities over 2,500 residents in the state (100 communities).

> "Fort Chaffee, Arkansas was one of the military bases decommissioned in the recent past. A Hatfield-McCoy feud brewed between the cities of Fort Smith and Barling regarding the surplus Fort Chaffee lands. During a two-day span, I was required to create some 20 different maps of various land-swap scenarios. This required compiling non-existent base information encompassing the immediate Fort Chaffee area and the City of Barling. In all, we needed twelve square miles of geodata we didn't have. Everything from transportation to hydrography COULD be used as a potential boundary and had to be incorporated to our existing system in a BIG hurry. Utilizing GeoStor, we had everything we needed in our coordinate system and projection in less than two hours. Without GeoStor, we were looking at a week by the time we tracked down the data and converted to our coordinate system and format. It was amazing to everyone, including the legal teams, that the Barling city limits were actually up-to-date and reflected their "annexation" of yet-to-be released Fort Chaffee land. It sure beat COGO-ing 23 pages of legal descriptions. Eventually, we will be replacing the GeoStor information with higher accuracy data. But for now, the GeoStor information is proving invaluable."
>
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"My name is Randy Everett and I serve as the GIS Supervisor for North Arkansas Electric Cooperative. The electric cooperative in which I work has already reaped benefits from GeoStor. The information that is now available on GeoStor is just a small portion of what can and will be offered. As a not-for-profit organization, our resources are somewhat limited and GeoStor is able to offer us information via the Web for free. The aerial photography and USGS topographic maps allow us to do some engineering work in-house that was previously contracted by outside engineering firms, which saves the cooperative money, which in turn saves the members money. Thank you."

Sincerely,
Randy Everett
GIS Supervisor
North Arkansas Electric Cooperative

22. How has the program grown and/or changed since its inception?

Modifications to the user interface were made after initial beta testing. Modifications to the underlying database structure were made to improve system performance. Additional data layers have been loaded into the system for public consumption. All of these modifications have been made to improve the efficiency and effective delivery of spatial data to the end user.

23. What limitations or obstacles might other states expect to encounter if they attempt to adopt this program?

GeoStor is a complex system built with a number of GIS and Web mapping softwares. The funding to purchase the hardware and software is the most significant obstacle other states should expect to encounter. Arkansas has overcome this obstacle by creating cooperative partnerships, grants, and providing “backend” solutions.