Bureau of Land Management

Geospatial Services Strategic Plan

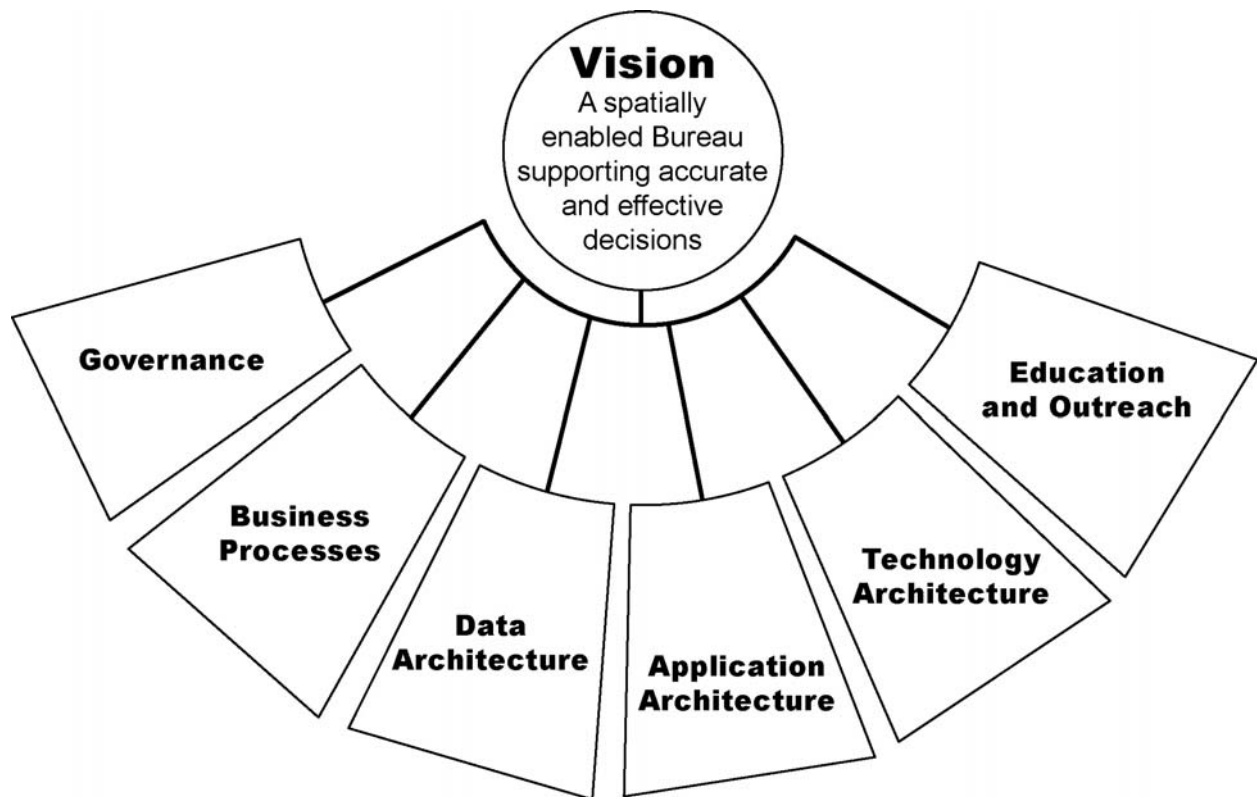# FY2008

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Executive Summary

Background and Context

Managers, resource specialists, analysts, researchers, and policymakers recognize that geospatial information is critical for managing the public lands—for understanding natural resource relationships, environmental interactions, social and economic impacts, and environmental performance. Data that identify the geographical spatial characteristics of natural or manmade features and boundaries, or geospatial data, are invaluable for most planning and decision-making activities at the Bureau of Land Management (BLM).

BLM responses to a recent information request by the Office of Management and Budget (OMB), the Geospatial Line of Business assessment (GLoB) completed in June 2006, indicate that upwards of $20 million a year is being spent on geospatial services and technologies. This is a conservative estimate of the actual annual costs that did not include the many smaller (less than $20 thousand) projects in the states and did not address the value of the geospatial services.

Geospatial assets and costs in the Bureau are difficult to manage and determine because the collection, storage, and use of geospatial data are deeply intertwined with many of the core mission systems, functions, and IT infrastructure within the BLM. Unlike traditional BLM programs (lines of business), there is no organizational or functional model that owns or manages "geospatial." It is a collection of data, content, standards, technology, staff (contractor and government), technology tools, services, and systems that directly or indirectly relate to more than 70 percent of BLM functional responsibilities.

While the value of geospatial technologies to support business requirements has been recognized at all organizational levels across the Bureau, several issues have limited the BLM's ability to optimize those investments already made. The issues include:

- establishing organizational approaches that enhance the leadership, coordination, and provision of geospatial services
- strengthening the data, applications, and technology architectures needed to support Bureau business processes
- promulgating BLM's data management policies and guidance for geospatial data
- referencing appropriate geospatial data to the Public Land Survey System (PLSS) and Geographic Coordinate Data Base (GCDB).

Many existing and potential BLM geospatial data and technology users and managers interviewed during the Department of the Interior (DOI) Geospatial Blueprint development effort and the GLoB noted frustration with:

- the difficulty of using, finding, and gaining access to data, tools, and applications
- the lack of availability of national data standards/databases
- the slow response times due to telecommunications capacity.

Managers interviewed indicated that these difficulties hindered the use of geospatial information in their respective programs and offices. Recognition of the importance of geographic services to the BLM and their extensive but uncoordinated use has led to the development of this Geospatial Services Strategic Plan (GSSP).

Proposed Integrated Geospatial Services Initiative

The GSSP was conceived and developed based on input and insights from personnel across the Bureau and supports a geospatial services initiative that will increase the value of geospatial investments for the BLM. Six major goals are outlined in the GSSP that support other key Bureauwide (and governmentwide) information management strategic planning efforts, including the Federal Geospatial Line of Business; DOI Geospatial Modernization Blueprint; BLM Assessment, Inventory, and Monitoring (AIM) Initiative; BLM Strategic Plan; and Enterprise Architecture efforts at the Federal, DOI, and Bureau levels. Implementing the strategic goals and actions of this strategy will result in geospatial services that provide coordinated discovery, acquisition, management, and deliver geospatial services that are faster, easier, and less costly for the Bureau's lines of business to access and utilize these services.

As a framework for geospatial services in the Bureau, the GSSP identifies roles and responsibilities, establishes priorities, and provides a governance structure for securing approvals from management that will lead to the Bureau's commitment of resources to enable implementation of this plan. The GSSP identifies future, tiered-down action plans that will require further analysis and work in order to identify the activities and timetables required to reach the stated goals. The GSSP contains the "What"; the action plans identify the operational and tactical "Hows" and "Whens."

Goals

The goals of the GSSP were specifically developed and organized based upon components of Federal, DOI, and Bureau Enterprise Architectures. The goals are defined here and supported by objectives and actions that are described in the body of this document.

Goal 1: Governance

Establish direction for the BLM; identify and prioritize geospatial needs; align BLM and Departmental strategies and activities; identify national partnership opportunities with high return on investment; and, provide policy and oversight to assure progress in achieving geospatial services goals.

Goal 2: Business Processes

Ensure common, unified, geospatial processes are in place to improve decision making and meet the business needs of the BLM.

Goal 3: Data Architecture

Provide BLM staff, partners, and the public with the standardized geospatial information needed to carry out BLM business processes and make informed decisions.

Goal 4: Application Architecture

Provide BLM staff, partners, and the public with standardized applications and Web services to collect, maintain, use, and publish geospatial data in support of the BLM's business requirements.

Goal 5: Technology Architecture

Design and implement a standard, enterprisewide technical infrastructure that supports the collection, maintenance, utilization, and publication of distributed geospatial data, applications, and Web services in a seamless manner.

Goal 6: Education and Outreach

Institute an effective education and outreach program to assist state and field office staff in using geospatial technology to efficiently support the BLM's business requirements.

First Steps—Establish and Align Leadership Structure for Geospatial Services

Charter and establish the Managing for Excellence Data Management Subcommittee (MEDS) as a sub-group of the Field Committee. The MEDS will:

- Identify, monitor, and address issues regarding the state of data management/geospatial activities.
- Maintain knowledge of, and contacts with, the Federal Geographic Data Committee (FGDC) and other Federal, tribal, state and local government geospatial information entities.
- Develop and make recommendations concerning data management and geospatial services initiative execution and resources needed to meet corporate requirements.
- Communicate observations, findings, and recommendations.
- Make recommendations concerning the establishment of additional working groups or the holding of meetings necessary to further BLM data management/geospatial goals.
- Make recommendations for inviting representatives of other Federal agencies, other governments, and non-governmental organizations to attend meetings and to participate in work groups when appropriate.

- ### *Next Steps—Implement an Effective Geospatial Services Initiative*

Several actions outlined in this GSSP have already been initiated. Personnel and managers from the Washington Office, the National Centers, all states, and key programs have been involved in the development of this document. Conversations with key information technology personnel responsible for the Enterprise Architecture and the DOI Geospatial Modernization Blueprint are ongoing. The actions outlined previously and described in more detail in the following pages represent the next major steps in implementing a robust and effective geospatial services initiative within the BLM. Details about the timing and sequencing for the various activities over the next several years are described. Initial schematics and proposals for the geospatial components of the overall Enterprise Architecture are contained in the appendixes of the document.

The MEDS will work with the Field Committee to prioritize and oversee the development and implementation of the action plans described in this document, establish milestones, measure progress, and communicate direction, accomplishments, and challenges to the BLM employees who both provide and benefit from the success of this Strategic Plan.

With a formalized plan in place, leadership support, and this document as a blueprint, the BLM can realize, within 5 years, the full benefits of developing a coordinated and integrated set of geospatial services.

Introduction

Managers, resource specialists, analysts, researchers, and policymakers recognize that geospatial information is critical for managing the public lands—for understanding natural resource relationships, environmental interactions, social and economic impacts, and environmental performance. In addition, Cadastral Survey information that identifies the geographical location of manmade features and boundaries is invaluable for most planning and decision-making activities at the Bureau of Land Management (BLM).

Responses to a recent information request by the Office of Management and Budget (OMB), the Geospatial Line of Business assessment (GLoB) completed in June 2006, indicate that upwards of $20 million a year is being spent by BLM on geospatial services and technologies. This is a conservative estimate of the actual annual costs that did not include the many smaller (less than $20 thousand) projects in the states and did not address the value of the geospatial services. In addition, a BLM study by the National Information Resources Management Center (NIRMC, August 2006) identified 2,800 individuals, in nearly all BLM field, district, state offices and centers, who use geospatial data and technologies to support key business operations. Many additional BLM personnel benefit from the geospatial products developed and services provided.

While the value of geospatial technologies to support business across the Bureau has been demonstrated, several issues have limited the BLM's ability to optimize the investments that have already been made. Investments in geospatial data and technologies are primarily made by individual BLM state offices, the National Operations Center (NOC), and the Enterprise Geographic Information System (EGIS) Project. There is some cross-Bureau coordination taking place between the states and the projects. However, geospatial data and tools developed in one office are difficult to share with another office, even when needs are similar. There is no recognized governance structure in place to ensure that the BLM's resources for, and investments in, integrated geospatial services are coordinated and managed efficiently. Many existing and potential BLM geospatial data and technology users and managers interviewed during the Department of the Interior (DOI) Geospatial Blueprint development effort and GLoB noted frustration with the difficulty of using, finding, and gaining access to data, tools, and applications; the lack of availability of national data standards/databases; and the slow response times due to telecommunications capacity. They indicated that these difficulties hindered their use of geospatial analyses in their operations.

Recognition of the importance of geospatial data and technologies to the BLM and their extensive but uncoordinated use has led to development of this Geospatial Services Strategic Plan (GSSP). The scope of geospatial services covered in the GSSP includes Cadastral Survey, Geographic Information Systems (GIS), remote sensing, photogrammetry, aerial photography, resource grade global positioning system data maintenance, cartography and engineering services. Services include technical integration of information systems, work processes, and databases, as well as dissemination of the data and services for use by all Federal, state, and local agencies, private industry, and the public.

Geospatial Technology in the BLM

Public land management requires knowledge regarding the location of the public lands and an understanding of the distribution and current conditions of natural resources. It also requires the ability to correlate the past, current, and future conditions of natural resources to land management activities and land use plan implementation. In addition, a wide variety of regulatory and permitting activities must also be supported. These functions all require correlating spatial locations against other variables and establishing relationships. Facilitating these connections is a primary function of geospatial applications.

Issues with Existing Use

While there are a wide variety of geospatial applications within the BLM, most users believe that the Bureau is not fully optimizing and leveraging how these applications are being used. At the Geographic Information Systems Managers Meeting in November 2005, a number of concerns were identified that affect the ability to leverage existing geospatial resources within the BLM. These include:

- Responsibility and accountability for geospatial services is divided between AD-200, AD-300, and AD-500
- Inequity between state, district and field offices in providing geospatial services
- Limited coordination and leadership, resulting in redundancy and an inability to leverage shared resources in support of BLM programs
- Current and complete geospatial data sets to support BLM business (program) requirements are unavailable
- Minimal existing quality control procedures to assure the development and documentation of quality BLM enterprise data
- Few resources funded or available to assist programs (lines of business) in identifying and developing shared (enterprise) data resources
- Performance latency, inadequate bandwidth and telecommunication functionality to support transfers of large enterprise data sets concurrent with other BLM business needs
- Lack of easy to use tools and applications to support BLM lines of business.

Benefits of Implementing the Geospatial Services Strategic Plan

The integrated geospatial services outlined in the GSSP will increase the effectiveness and efficiency of BLM programs in integrating natural resource data and administrative information for environmental assessment, emergency response, and regulatory/enforcement activities. Examples of the benefits achievable with an effective BLM geospatial services initiative include:

- Enhanced ability to develop and share information supporting the Healthy Lands Initiative, such as the extent of wetlands, condition of uplands, and ambient environmental conditions
- Improved ability to share information regarding the land use planning process, plan implementation, and monitoring
- Improved response to emergency situations involving wildland fire and hazardous materials
- Improved means to use, collect, report, analyze, and distribute information obtained during the course of regulatory reporting and permitting processes
- Enhanced access to and use of distributed data sources and tools both inside and outside the BLM through improved communication and Web services.

Components of the Geospatial Services Strategic Plan

This section of the GSSP presents the components necessary for efficiently integrating geospatial services into the Bureau's wide spectrum of business activities. The components are presented in the same framework as that of the Enterprise Architecture. Each of the enterprise components includes a major goal, several objectives, and action items. Timelines for accomplishing the activities necessary to meet the goals and objectives are noted. In addition, the Appendixes outline in detail the preliminary proposals for governance, data architecture, and technology architecture infrastructures for the Bureau. These proposals have been developed based on extensive discussion with staff and managers across the BLM. The Appendixes include:

- Principles for the BLM Geospatial Services Strategic Plan (Appendix A)
- Proposed BLM Geospatial Services Governance (Appendix B)
- Proposed BLM Geospatial Services Data Architecture (Appendix C)
- Proposed BLM Geospatial Services Technology Architecture Design (Appendix D).

Proposed Integrated Geospatial Services Initiative

The GSSP proposes integrated geospatial services that will support the Bureau's business requirements, improve efficiency, and maximize use of the tools and technology at the field office level within the BLM. The GSSP was conceived and developed based on input and insights from personnel across the Bureau and supports a geospatial services initiative that will increase the value of geospatial investments for the BLM. The GSSP outlines six major goals that support other key Bureauwide (and governmentwide) information management strategic planning efforts, including the Federal Geospatial Line of Business (GLoB); DOI Geospatial Modernization Blueprint; BLM Assessment, Inventory, and Monitoring (AIM) Initiative; BLM Strategic Plan; and Enterprise Architecture efforts at the Federal, DOI, and Bureau levels. Implementing the strategic goals and actions of this strategy will result in geospatial services that provide coordinated discovery, acquisition, and management, and deliver geospatial services that are faster, easier to use, and less costly for the Bureau's lines of business to access and utilize.

The GSSP serves as a framework for identifying roles and responsibilities, setting priorities, and securing approvals from management that will lead to the Bureau's commitment of resources to enable implementation of this plan. The GSSP identifies future, tiered-down action plans that will require further analysis and work in order to identify the activities and timetables required to reach the stated goals. The GSSP contains the "What"; the action plans identify the operational and tactical "Hows" and "Whens." Most action items will have an individual action plan. The implementation of the action plans will be tracked to measure overall progress in meeting these goals.

Vision

A spatially enabled Bureau supporting accurate and effective decisions means that the BLM must have data and processing capabilities available to support day-to-day business. Data can come from internal or external sources, and should be accessible electronically and, in most cases, on the Web.
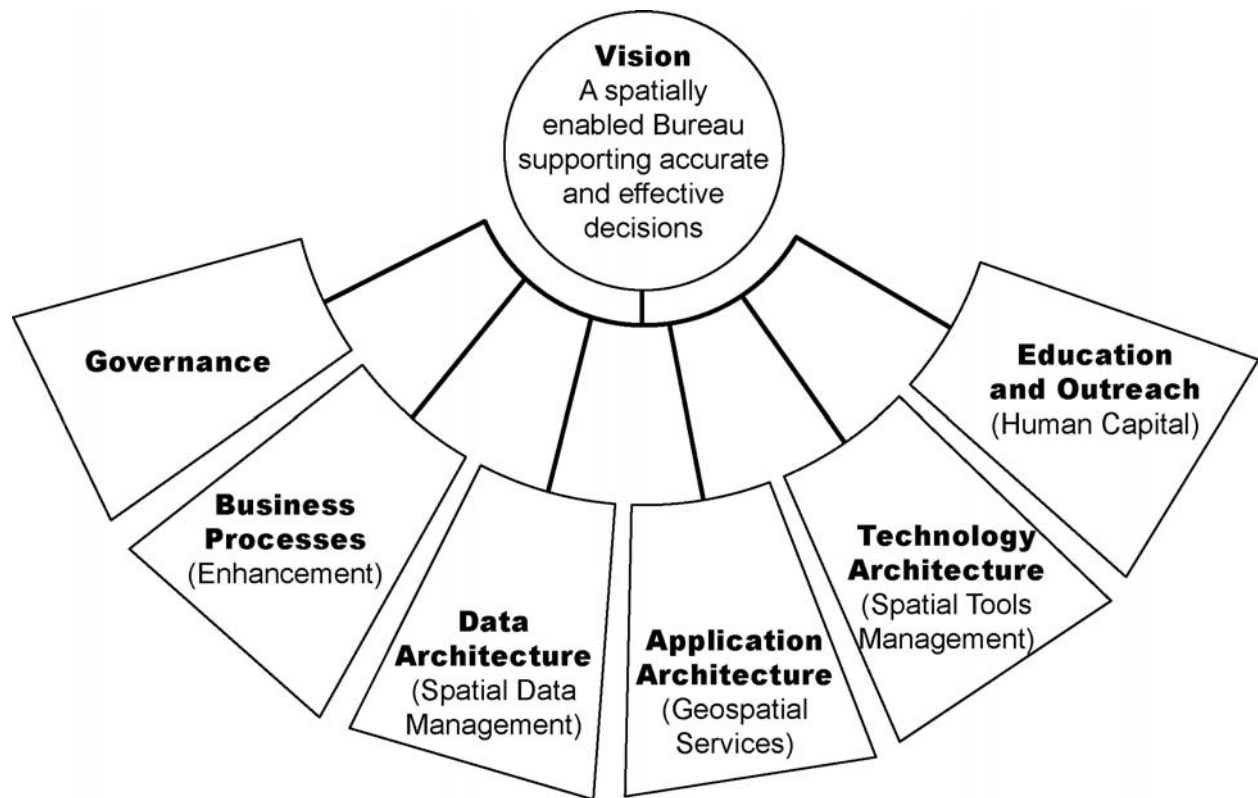
Goals

The time frame for accomplishing all of the goals and objectives is within the next 5 years. Various activities are already underway, while some activities are dependent on the completion of other tasks not specific to geospatial interests. The DOI and BLM Enterprise Architecture efforts, and in particular the documentation of business processes and information, and technology requirements to support those processes, are critical to understanding the role of geospatial data in the work of the BLM. The integrated geospatial services initiative will evolve and develop in concert with other information resources both inside and outside of the BLM, including network initiatives such as the DOI's Enterprise Network System and data sharing efforts such as The National Map and Geospatial One-Stop.

Table 1. Time Frames for Geospatial Initiative Activities.

ARCHITECTURE COMPONENT	CURRENT	SHORT TERM (6 MONTHS -1 YEAR)	LONG TERM (1 - 5 YEARS)
GOVERNANCE	Geospatial Services Governance Structure proposal under development	Geospatial Services Governance Structure adopted	Geospatial Services Governance Structure in place and functioning
	Fragmented coordination, divided sponsorship, inconsistent state and WO policy	Increased Bureauwide coordination and accountability through the governance body	Bureauwide coordination and accountability through the governance body
BUSINESS PROCESS	Mainly project specific, geospatial decision support in some key programs (business areas)	Increased involvement by lines of business (programs) in utilizing geospatial services	Lines of business (programs) realizing full benefit of geospatial services)
DATA	Multiple sources, inconsistent attribution	Authoritative data source identified	Authoritative data service implemented
	Acquired and integrated independently	Enterprise acquisition of core data sets	Enterprise acquisition and maintenance of core data sets
	Multiple versions of data resident in states	Core data in Enterprise repository	Enterprise version maintained
	Fragmented Metadata, BLM Metadata server unfunded	Metadata accessible via Geospatial One-Stop	Metadata accessible via Geospatial One-Stop
	State supported processes to generate and validate spatial information	Improved access to Web services and standard protocols for validating and maintaining spatial information	Continued improvement to Web services; additional standard protocols developed
APPLICATIONS	Generally state developed and supported applications	Increased support and use of "national" applications and geospatial services	Increased support and use of "national" applications and geospatial services
	Program specific geospatial applications	Increased involvement by programs in utilizing geospatial services	Programs realizing full benefit of geospatial services

	Mostly workstation based, limited centralized (Enterprise Geographic Information System (EGIS) architecture) with a few mobile/wireless applications	Additional centralized and mobile/wireless applications	Centralized and mobile/wireless applications supporting business requirements for analysis and data services
TECHNOLOGY	Many states using SDE DBMS with legacy coverage and shapefile systems abundant	Web enabling, additional states migrating to SDE DBMS	SDE DBMS implemented and supported Bureauwide
	Workstations, local servers, statewide application/data servers, national application/data servers	Enterprise network of linked state and national data/application servers	Enterprise Geospatial Services Bus supporting business requirements
EDUCATION	Many courses focused on "standalone" use of geospatial technology	Additional courses developed to support the integration of geospatial technology into Programs	Program specific courses include geospatial capability as a routine means of accomplishing work

Goal 1: Governance

Establish direction for the BLM; identify and prioritize geospatial needs; align BLM and DOI strategies and activities; identify national partnership opportunities with high return on investment; and provide policy and oversight to assure progress in achieving geospatial services goals.

Current Status

Geospatial technology is used widely in all BLM land management programs and in some support areas. Though many programs benefit, there is no executive sponsor for geospatial services, nor is there an effective coordination mechanism or organization to identify high-priority requirements or opportunities. In addition, standards for data are developed but not implemented uniformly across the Bureau, impeding data sharing and use across administrative boundaries. Also, existing coordination efforts tend to focus on technical solutions and information exchange, rather than Bureauwide requirements, management, or planning for future needs.

Presently, many decisions to invest in geospatial activities are made at the individual state, district, or field office level. The decisions involve data collection and maintenance, application development and use, equipment and software, and positions and skills. Many times these decisions are made individually, without knowledge of how the investments relate to national strategies and the investments of others. Some investments produce crucial mission support that could not have been achieved in any other way; others are largely ineffective.

Desired Outcome

Leadership will be clearly established under a single Assistant Director or equivalent, who will serve as the proponent and advocate for the geospatial initiative and coordinate with other directors and groups concerning national needs. A policy framework will be in place that clearly defines roles, responsibilities, and processes to manage and support the initiative, prioritize investments, and oversee progress toward strategic goals. BLM's geospatial strategy will be regularly updated to reflect evolving technology and programmatic needs. The costs and benefits of geospatial initiative elements will be identified and tracked.

Objectives and Action Items

1.1.   Establish and align the leadership structure for geospatial services.

- Action 1.1.1: Recommend the organizational structure for management of the geospatial initiative, including the responsible executive and National Operations Center (NOC) organizational unit. Recommend the required staffing level for national level initiative management. Identify roles and responsibilities for the executive, the NOC, and other BLM organizations to implement the actions in this strategy.
- Action 1.1.2: Charter and establish the Managing for Excellence Data Management Subcommittee (MEDS), sub-committee of the Field Committee, to provide direct communication between the executive and the field, advise on communication, policy, business, and customer needs regarding data management and geospatial activities.
- Action 1.1.3: Document the functions and responsibilities for geospatial services initiative management in the BLM at the Washington Office (WO), NOC and state level, including any updates to the Delegation of Authority BLM Manual 1203.

1.2.   Establish the investment management process for geospatial services.

- Action 1.2.1: Recommend the process to identify business requirements for geospatial data and infrastructure and to prioritize investment funding.
- Action 1.2.2: Recommend how BLM geospatial investments should be tracked individually and/or cumulatively to include new development work, operations and maintenance of existing data and infrastructure and technology refreshment.
- Action 1.2.3: Recommend links between geospatial investment management processes and existing organizations (e.g., Budget Strategy Team, Information Technology Investment Board).

1.3.   Pursue high-priority national and state partnership/data sharing/Service First needs and opportunities in the geospatial services initiative area.

- Action 1.3.1: Inventory existing partnerships and data sharing agreements, along with state and national needs.
- Action 1.3.2: Identify new required partnerships and recommend priorities to the Field Committee.

1.4.   Implement efficient management of BLM's existing geospatial investments (e.g., hardware, software licenses, data management, management processes, new technology).

- Action 1.4.1: Identify and prioritize opportunities to realize efficiencies in geospatial investments.

Note: Governance objectives and actions in the areas of geospatial data, technology, and applications are addressed under those specific goals.

Goal 2: Business Processes

Ensure common, unified, geospatial processes are in place, based on the PLSS where appropriate, to improve decision making and meet the business needs of the BLM.

Current Status

Many BLM programs, field, district, and state offices are reaping the benefits of using spatial information as an enterprise framework for their programs. In addition, several BLM state organizations have implemented state data standards, centralized GIS application servers, and geospatial technologies to integrate land management activities within administrative areas and across jurisdictions. The National Integrated Lands System (NILS) and the Enterprise Geographic Information System (EGIS) are two national projects that use geospatial information and PLSS as a framework for addressing almost all their information responsibilities. The EGIS project is also sponsoring a national spatial data server, which supports the development and provision of corporate geospatial data. The national spatial data server is also hosting key geospatial services and is currently being used by several states and programs for strategic decisions and local geospatial support. In addition, several states incorporate geospatial data extensively in their land management activities and have established their own spatial data centers and data management processes.

Desired Outcome

BLM Program leads and managers will understand how geospatial data, including cadastral survey information, applications, and technology can be meaningfully used to enhance their business operations. They will also recognize the value of a services-oriented architecture (e.g. range allotment boundaries are collected once and made available and easy to use in land use planning, weed control, wild horse and burro management, etc.). Geospatial information and applications improve the efficiency of programs and states with regard to information sharing and decision making. In addition, programs, managers, and resource specialists will have access to the geospatial services they need.

Objectives and Action Items

2.1.   Ensure BLM programs realize the benefit of integrated geospatial services.

- Action 2.1.1: Identify the current and potential role of spatial-based approaches in two to four key BLM Lines of Business annually and integrate geospatial services as appropriate. (NOC – begin 2nd quarter FY2008)
- Action 2.1.2: Identify Bureauwide requirements for geospatial data, analytical tools, and products through a biennial survey of BLM Programs, National Centers, field, district, and state offices. (NIFC, NOC, MEDS, WO, and state offices - 3rd/4th quarters FY2008)

2.2.   Identify costs and benefits of using geospatial services to address BLM Lines of Business requirements.

- Action 2.2.1: Conduct a geospatial services initiative cost benefit analysis in support of the FY2010 budget. (NIFC, NOC, MEDS, WO, and state offices - 3rd/4th quarters FY2008)
- Action 2.2.2: Provide templates to BLM programs and offices to help them examine and set priorities among investments in geospatial data, including the PLSS, tools/applications, and technologies. (BA Team - 4th quarter FY2008).

Goal 3: Data Architecture

Provide BLM staff, partners, and the public with the standardized geospatial information needed to carry out BLM business processes and make informed decisions.

Current Status

Geospatial data at BLM are often difficult to find, access, and use across administrative boundaries. Spatial information tends to be acquired and/or developed on a state-by-state basis (at best) and, in many instances, data collected for a program or project are different in neighboring field offices. The BLM does not have governance procedures for ensuring that spatial data are collected in a consistent and accurate manner. In some state organizations, field, district, and state offices maintain independent geospatial libraries that are not designed in such a way that they can be easily integrated. In addition, there are numerous national and regional initiatives involving BLM partners including: Service First, National States Geographic Information Committee, state-focused Geographic Information Committees, Western Governors Association and the Nature Conservancy. Each of these committees and groups has its own data sources, data collection protocols/standards and data sharing policies. Further complicating the situation, network access to geospatial data is difficult and the quality of the data is not well known or communicated since metadata are not always collected correctly or consistently.

Desired Outcome

All BLM offices, partners, and the public, will know the extent and quality of the geospatial data the BLM manages and maintains. They will be able to find the data and metadata they need using enterprisewide indices, registries, or catalogs. Data standards will be readily accessible, implemented, maintained, and where appropriate geospatial data will be referenced to the PLSS. Business data stewards will take ownership and responsibility for standards, quality, guidelines, and maintenance of their designated data. State and Headquarters offices will jointly maintain a repository so that duplicate data purchases and unnecessary storage requirements are eliminated. Managers and programs will have an effective process to annually identify data requirements. These data requirements will be considered by senior managers and addressed, as annual budgets are developed and allocated.

Objectives and Actions

3.1.   Ensure BLM's policies and guidance for geospatial data management support business requirements at all organizational levels.

- Action 3.1.1: Establish clear and appropriate guidance for use of BLM and external partners' spatial data for regional and national reporting requirements. (AIM, NIFC, NOC, WO-200, WO-300, WO-500 - FY2008).
- Action 3.1.2: Revise the BLM Spatial Data Policy to include requirements that spatial attributes and Federal Geographic Data Committee (FGDC)-compliant metadata be included with all geospatial data collected and/or acquired by the BLM. (NOC, CMAT, WO-500 – FY2008).
- Action 3.1.3: Develop options and an implementation plan for increasing the quality and accuracy (generated from PLSS/GCDB where appropriate) of the spatial data BLM is responsible for based on OMB Circular A-16 and other directives (NIFC, NOC, WO-200, WO-300, WO-500 - FY2008).
- Action 3.1.4: Conduct peer review of BLM's Data Management Strategy and Tactical Plan. Develop and finalize guidance regarding quality assurance project plans for geospatial data. (NIFC, NOC, WO-200, WO-300, WO-500 with Program Leads and state office staff – 1st quarter FY2008).

3.2.   Coordinate BLM's collection of geospatial data with internal and external partners based upon priority needs.

- Action 3.2.1: Use the Enterprise Architecture business process modeling as a starting point to identify opportunities to obtain spatial data during routine BLM business activities (e.g., inspections). (NIFC, NOC, WO-200, WO-300 - Ongoing).
- Action 3.2.2: Work with program managers, the AIM Initiative, and others to ensure key monitoring databases and other data sets (e.g., vegetation, National Hydrography Dataset, Fire Perimeters) contain spatial data adequate for their intended use and where appropriate are based on the PLSS. (NIFC, NOC, WO-200, WO-300 - Ongoing).

- ▪ Action 3.2.3: Continue to identify and assess the best mix of external and internal BLM solutions for accessing, acquiring, managing, distributing, and standardizing key geospatial data to meet the Bureau's business needs more effectively. (NIFC, NOC, WO-200, WO-300 with state, district, and field office staff - Ongoing quarterly updates, started 3rd quarter 2007).
- ▪ Action 3.2.4: Set priorities for acquiring data and entering into geospatial data acquisition, development, or exchange partnerships to ensure the availability of the geospatial data needed for BLM's business requirements, consistent with Department, Bureau and state initiatives and priorities (e.g. Healthy Lands Initiative, Assessment, Inventory and Monitoring, ePlanning, etc.) (NIFC, NOC – FY2008).

3.3.　　Maintain catalogs, indices, and registries to facilitate access and data sharing.

- ▪ Action 3.3.1: Establish Bureauwide policies and procedures to ensure that information about the availability of geospatial data is current, well organized, and well documented. (NIFC, NOC, WO-200, WO-300, WO-500 with state, district, and field office staff - FY2008).
- ▪ Action 3.3.2: Facilitate BLM program and state efforts to implement the FGDC metadata standard (CMAT, WO-500, WO-200, NIFC, NOC with BLM Program Leads and state office staff - Ongoing).
- ▪ Action 3.3.3: Examine needs for additional metadata (e.g., survey [PLSS], feature, transaction-based, or analysis model-based) and engage the Corporate Metadata Advisory Team and/or FGDC in considering the development of standards for such metadata (WO-300, WO-500, NOC, AIM Initiative - 2nd Quarter FY2008).
- ▪ Action 3.3.4: Develop a Bureauwide management plan for the Aerial Archive to ensure the sustained use and maintenance of this valuable BLM resource. (NOC - Ongoing).
- ▪ Action 3.3.5: Create and deploy an internal spatial index tool of BLM's satellite imagery archive. (NOC – FY2008).
- ▪ Action 3.3.6: Develop a Geospatial Data Index and integrate it with other efforts such as the Geospatial One-Stop Initiative, the BLM Data Dictionary, and the National Map. (NIFC, NOC - Ongoing).

3.4.　　Ensure processes exist to identify, develop, and implement data standards as required at all levels of the organization.

- ▪ Action 3.4.1: Increase participation in program-based efforts that promote the effective use, stewardship, and provision of geospatial data for land management decision making (NOC - Ongoing).
- ▪ Action 3.4.2: Participate in the development of standards processes with the BLM Data Management Group following the DOI Data Standardization Guidelines. (WO, NIFC, NOC - Ongoing).
- ▪ Action 3.4.3 : Clarify WO and NOC roles and responsibilities with respect to remote sensing and develop a strategy for enhancing the use of remote sensing within Bureau programs and projects. (WO, NOC, and AIM Initiative - FY2008).

3.5. Ensure capability exists for sharing geospatial data within multiple business applications and with external partners.

- Action 3.5.1: Initiate and guide efforts to develop national corporate databases and improve the quality and accessibility of geospatial data. (NIFC, NOC – FY2008).
- Action 3.5.2: Identify reusable data modules that can be shared and develop a data architecture to assist in sharing those modules. (NOC – 2nd quarter FY2008).
- Action 3.5.3: Clarify WO and NOC roles and responsibilities with respect to remote sensing and develop a strategy for enhancing the use of remote sensing within Bureau programs and projects. (WO, NOC, and AIM Initiative - FY2008).

Goal 4: Application Architecture

Provide BLM staff, partners, and the public with standardized applications and Web services to collect, maintain, use, and publish geospatial data in support of the BLM's business requirements.

Current Status

There are hundreds of geospatial applications in use throughout the Bureau; however, these applications are actively used by only about 2,400 of the 12,000 BLM employees. Many who could benefit from using geospatial analyses in their work do not because they do not know of their existence or find them too difficult to access and use without training. Many of the applications (e.g., CARAT) that currently exist have been created independently in different states and National Centers. Some duplication occurs because states have different requirements and time frames within which they are working or have significantly different geographic conditions. Duplication also exists because the Bureauwide policy for implementing and supporting national applications is so restrictive that it creates an environment where applications and slightly different tools are developed (without adequate documentation or support) to satisfy the implementation approach developed in specific states and offices. Additionally, requirement assessments for applications have not generally involved a broad cross section of programs and states. Where enterprise geospatial tools have been developed, they have often focused on supporting operations within an individual state or directorate rather than addressing the Bureau business requirements as an enterprise.

Desired Outcome

BLM staff, partners, and the public will be able to access and use Bureau geospatial applications to collect, maintain, use, and publish geospatial data. Software will be interoperable and based on open standards. Geospatial tools will be available through desktop, Web browsers, mobile, and wireless devices. Geospatial applications will be managed to eliminate duplication, minimize development costs, and promote efficient use. Geospatial applications will be developed with a business focus. The expectation is that most BLM employees will use geospatial technology routinely in some aspect of their work.

Objectives and Action Items

4.1. Ensure Bureau employees understand and use available geospatial applications to conduct BLM business.

- Action 4.1.1: Coordinate the development of enterprise geospatial applications that support BLM business activities. (NIFC, NOC and state offices - Ongoing).
- Action 4.1.2: Monitor the evolution of commercial and external geospatial web services for possible use by the BLM and provide recommendations to the MEDS on the use and/or responsibilities to support such services to enhance or facilitate BLM work. (NIFC, NOC and state offices - Ongoing).
- Action 4.1.3: Assess and establish Enterprise Licensing Agreements (ELAs) as appropriate to facilitate Bureauwide access to geospatial software. (NOC, WO-200 – Ongoing).
- Action 4.1.4: Enhance procedures and tools to document, inventory, and advertise all geospatial applications and services developed within the BLM. (NIFC, NOC and state offices - Ongoing).
- Action 4.1.5. Set Bureau priorities for acquiring or developing geospatial applications in annual budget and operating plan processes using results of the biennial survey process (see action 1.2.2). (MEDS with Programs and state offices - 2008, then ongoing).
- Action 4.1.6: Establish criteria for evaluating potential software acquisitions, including the ability of the product to meet BLM functional needs. Conduct benchmarking analyses as necessary. (Technical Review Board with NOC, state offices - 2008, then ongoing).

4.2. Ensure BLM geospatial tools and enterprise services are managed and implemented utilizing industry standard practices.

- Action 4.2.1: Design and implement effective means to access and use open source code for geospatial applications. (NOC, states - Ongoing).

4.3. Ensure geospatial applications are developed or acquired as determined by Bureau priorities.

4.4. Ensure processes are in place to evaluate emerging geospatial applications.

Goal 5: Technology Architecture

Design and implement a standard, enterprisewide technical infrastructure that supports the collection, maintenance, utilization, and publication of distributed geospatial data, applications, and Web services in a seamless manner.

Current Status

BLM's geospatial activities are currently supported by a diverse array of handheld devices, personal computers, servers, and networks, which were documented in the Geospatial Baseline (2001). BLM's technical infrastructure was originally designed to support individual and independent applications without considering needs for enterprisewide data exchange. While the current configuration supports many distributed users, BLM state and program offices often have difficulty accessing and sharing data due to limitations in both network configuration and capacity. In some cases, network bandwidth within offices is significantly less than between offices across the country, creating challenges for interstate and NOC data exchanges. In addition, BLM security concerns have created new challenges in sharing data with external partners. Use of Web tools and technologies to deliver GIS and other geospatial products is generally restricted to those offices with significant funding and the ability to navigate difficult technological and administrative hurdles.

Desired Outcome

BLM staff and programs will be able to access geospatial services whenever and wherever needed to accomplish their goals, including sharing data with BLM partners. The geospatial technology architecture is planned and maintained as part of the Bureau's enterprise architecture.

Objectives and Action Items

5.1.   Ensure BLM staff has the computing resources and network capacity to support geospatial services.

- Action 5.1.1: Work with the BLM Enterprise Architecture Team to ensure that geospatial user needs are addressed as the Bureau's technical infrastructure evolves. (NOC, ongoing).
- Action 5.1.2: Identify key needs of states, field offices, and national programs for desktops, servers, printers, plotters, remote/handheld units, and other devices based on required functionality and develop an acquisition strategy. (NOC, WO-500, and WO-200, 2008, then ongoing).
- Action 5.1.3: Identify and set priorities for IT infrastructure and investment based on BLM geospatial needs (NOC, 2008, then ongoing).
- Action 5.1.4: Work with National IRM staff to develop an acquisition and maintenance strategy for geospatially-enabled desktops, servers, printers, plotters, remote/handheld units, and other devices. (states, WO-500, ongoing).
- Action 5.1.5: Identify key network bandwidth and performance needs for both states and field offices (including remote locations) to support national data in the NOC Data Center as well as the level of technology required. (NOC, ongoing).

- Action 5.1.6: Ensure that all nodes within the BLM geospatial infrastructure and organization are properly supported and fully operational. (NOC, ongoing).
- Action 5.1.7: Provide access to equipment and training for on-the-ground staff to help them collect geospatial data in the course of their regulatory and monitoring activities. (NOC, ongoing).

5.2. Ensure BLM's geospatial services technology architecture is aligned with the Bureau's enterprise architecture and security policies.

- Action 5.2.1: Identify performance measures and conduct testing of various network/hardware configurations to ensure proper functioning in normal and emergency situations. (NOC, ongoing).
- Action 5.2.2: Work with National Configuration Management and the National Test Lab to ensure that new software, tools, and hardware configurations, including disconnected field use, are tested and approved in a timely manner. (NOC, ongoing).
- Action 5.2.3: Establish secure Web services to share BLM data and tools with external partners via the Internet and intranet. (NOC, 1st quarter FY2008, then ongoing).

5.3. Ensure BLM's geospatial is data accessible to partners and the public.

- Action 5.3.1: Establish network protocols to allow the exchange of geospatial data with external users, coordinating such efforts with the Bureau's and DOI's broader enterprise activities as appropriate. (NOC and DOI, FY2008)
- Action 5.3.2: Increase BLM participation in various industry and government standards efforts to ensure interoperability and openness to internal and external customers. (NOC, WO, state and field offices, ongoing).

5.4. Ensure processes are in place to evaluate emerging geospatial technology.

- Action 5.4.1: Upgrade the Bureau's desktop operating system and desktop applications to support Web-enabled geospatial services. (NOC, 3rd quarter FY2008, then ongoing).
- Action 5.4.2: Work with the BLM Enterprise Architecture group to ensure an architecture that can support imagery services. (NOC, FY2008, then ongoing).
- Action 5.4.3: Work with the BLM Enterprise Architecture group and national network and telecommunications staff to ensure support for unmanned aerial systems. (NOC, FY2008, then ongoing).

Goal 6: Education and Outreach

Institute an effective education and outreach program to assist state and field office staff in using geospatial technology to efficiently support the BLM's business requirements.

Current Status

Geospatial training emphasis is on the functionality of the software and hardware. Modest amounts of training are available on integrating geospatial tools into everyday business processes. Communications and outreach are generally oriented toward the technical community. Program managers and staff are often unaware of recent developments and advancements in the area of geospatial services.

Desired Outcome

BLM staff has access to training and assistance that focus on the use of geospatial information within programs. Managers have the information they require to build and maintain a workforce that is proficient in supporting geospatial applications. Mechanisms are in place to educate staff, partners, and the public in BLM's geospatial assets and how to use them.

Objectives and Action Items (all actions under Education and Outreach are ongoing and assigned to NTC unless otherwise noted)

6.1. Ensure that BLM employees have access to the training and support they require to optimize their use of geospatial services.

- Action 6.1.1: Identify employee training needed for various geospatial tools.
- Action 6.1.2: Revise the Geospatial Training and Workforce Development Plan.
- Action 6.1.3: Implement revised Geospatial Training and Workforce Development Plan.

6.2. Provide managers with the information they need to build and maintain a geospatial workforce.

- Action 6.2.1: Review standard GIS position descriptions and update if necessary.
- Action 6.2.2: Post position descriptions in easy to find locations.
- Action 6.2.3: Provide management guidance to assist states in structuring and deploying their geospatial workforce for maximum benefit.

6.3. Ensure partnerships and resources are in place to fulfill BLM's training needs.

- Action 6.3.1: Evaluate partnership opportunities to make training resources available.
- Action 6.3.2: Ensure existing training is available through NTC (e.g. BLM/FS collaboration in OR/WA).

6.4. Ensure intra- and inter-Bureau communication regarding geospatial services is efficient and effective.

- Action 6.4.1: Develop a plan for a Bureau geospatial internal and external website to provide one stop shopping for geospatial information.
- Action 6.4.2: Evaluate the possibility of expanding on existing Bureau websites.
- Action 6.4.3: Increase involvement in business area working groups (e.g., range, wildlife, energy) by participating in conference calls, attending planning meetings, and other activities.

Implementing an Effective Geospatial Services Initiative

Several actions outlined in this GSSP have already been initiated. Personnel and managers from the Washington Office, the National Centers, all states, and key programs have been involved in the development of this document. Conversations with key information technology personnel responsible for the Enterprise Architecture and the DOI Geospatial Modernization Blueprint are ongoing. The actions outlined previously represent the next major steps in implementing a robust and effective geospatial services initiative within the BLM. Initial schematics and proposals for the geospatial components of the overall Enterprise Architecture are contained in the appendixes of the document. With a formalized plan in place and leadership support of the GSSP, the BLM will realize, within 5 years, the full benefits of developing a coordinated and integrated set of geospatial services.

Please contact Bob Bewley at Bob_Bewley@blm.gov for more information.

Appendix A
Principles for the Geospatial Services Strategic Plan

- Respond to the business requirements and multiple skill levels of users throughout the Bureau and among partner organizations and customers.

- Invest in geospatial technologies and data that directly support BLM business needs, giving priority to those that will enhance productivity for the maximum number of stakeholders.

- Foster the cost-effective management of BLM geospatial data and technologies.

- Promote coordination within the BLM and DOI through adequate stakeholder representation in key decisions related to Bureau use of geospatial data and technologies.

- Provide access to the best available data of known origin and quality for decision making, whether produced by the BLM or external partners.

- Rely, as much as possible, on open, market-proven technologies, utilizing custom-developed tools only where necessary.

- Comply with Federal mandates, such as the Government Performance Reporting Act, Circular A-16, Executive Order 12906 (National Spatial Data Infrastructure), and the Clinger-Cohen Act.

- Facilitate the BLM's ability to capture and utilize accurate and documented spatial data during transactions, such as inspections and regulated industry reporting to the BLM.

- Monitor the performance and benefits derived from BLM's geospatial services initiative and manage resources to meet priority requirements.

Appendix B
Proposed Geospatial Services Governance

Participants in the development of the Geospatial Services Strategic Plan (GSSP) placed a high-priority on establishing a strong focal point for coordinating geospatial efforts Bureauwide and clarifying the roles and responsibilities of the WO, Programs, states, and National Centers. Ongoing discussions on roles and responsibilities are being held with members of the Geospatial Services Strategy Team, National Operations Center (NOC) Implementation Team, senior managers, and others. The current results of these interviews and sessions are summarized below.

Roles and Responsibilities

Field Committee

Serves as the permanent approval and management authority regarding geospatial services across the BLM.

- Ensures that the BLM's resources for, and investments in, the Bureau's geospatial services initiative are managed efficiently and effectively.
- Approves the Bureauwide geospatial services initiative budget.

Data Management sub-Committee

Provides advice, guidance, and recommendations to the Field Committee, Senior Geographer, and Chief Information Officer (CIO) on achieving the corporate vision for an enterprisewide geospatial environment.

- Supports BLM's business requirements by defining priorities for data management, enterprise geospatial data, and technology investments at all levels of the BLM.
- Coordinates with the Senior Geographer and NOC staff to develop annual business requirements for geospatial data and technologies.

    Areas covered include:
    - Strategic direction, priorities, and investments
    - Data development, management, and dissemination
    - Standards development, adoption, and administration
    - Applications development and implementation
    - Evaluation and acquisition of geospatial technologies
    - Technical support services
    - Training, outreach, and technology transfer

National Operations Center (NOC)

Provides background research and recommendations to the Data Management sub-Committee (MEDS) on training, business process enhancement, technical architecture, data, required application development, and/or maintenance.

- Tracks Bureau expenditures and identifies returns on geospatial investments
- Provides Bureauwide training for geospatial services (i.e., applications, data management)
- Coordinates the development of geospatial applications (services) to meet common user needs
- Provides a geospatial services help desk function
- Coordinates hardware and software acquisition
- Coordinates development of, and access to, national geospatial data sets
- Coordinates the provision of specialty services (3-D visualization) and image processing
- Implements data sharing agreements with other Federal agencies and the private sector
- Provides technical data modeling support, including logical design
- Provides structure and guidance for formal data efforts, such as facilitating business process review
- Models and develops data standards
- Implements standards (e.g., hardware, software, data) adopted by the BLM.

Senior Geographer

Provides overall coordination and support for BLM geospatial activities.

- Ensures that the work of the states and the NOC is coordinated and supports the Bureau's business requirements
- Promotes strategic thinking in the programs with regard to geospatial services and ensures integration of geospatial capabilities to meet business requirements
- Serves as a constituent of the Geospatial Advisory Subcommittee
- Secures financial support for enterprise geospatial activities in the BLM
- Identifies priority BLM geospatial requirements for Bureau lines of business, seeks input from the MEDS regarding resource needs, and tracks progress on Bureauwide geospatial services coordination issues
- Develops data sharing agreements with other Federal agencies and the private sector
- Represents the Bureau in external coordination activities regarding geospatial services.

Appendix C
Proposed Geospatial Services Data Architecture

Enterprise geospatial services data architecture stipulates data standardization and metadata documentation, allowing for shared use of these data throughout the BLM. These data and metadata are accessed via services that exist at various levels both within and outside the BLM.

Four levels represent a tiered approach to providing and acquiring geospatial data and metadata. At the highest levels are Geospatial One Stop (GOS) and OMB recognized Authoritative Data Sources (ADS). The second level represents BLM national data services and centrally managed metadata services. The third level is state data and metadata services, and the last level is field office data collection, development, utilization and metadata services.

The BLM has limited resources for data management and storage, and must use these resources efficiently. Currently, there are several ongoing efforts within the BLM and DOI that provide baseline assessments of geospatial systems and data. The following is a list of some of these efforts:

- ITIB directed base-lining of the national applications and of the IT infrastructure (WO - 200/300/500)
- EPlanning project design and development
- Data standards development from the National Data Management Team
- Oregon state data inventory and classification effort
- Assessment, Inventory, and Monitoring (AIM) Strategy Project
- Geospatial Blueprint (DOI-EGIM)
- Management Planning and NEPA Blueprint (DOI)
- WO-200 Vegetation Treatment Module (recommendation from base-line)
- DOI Authoritative Data Source Pilot with NILS/LR2000 (NOC)

Several of these efforts promote the vision of the Federal Enterprise Architecture and OMB Circular A-16 to assign authority of specific data layers and data types to individual federal agencies or bureaus. These agencies or bureaus are then referred to as the Authoritative Data Source (ADS). Each ADS is responsible for providing their data to other agencies and the public. The BLM is currently being designated as a pilot for this effort with the NILS/LR2000 system for cadastral data and land ownership data.

Several of these efforts provide a list of the geospatial data sets required to effectively support implementation of business operations Bureauwide. This list will be maintained and updated as needed by the Senior Geographer and MEDS. This list will be used in determining which specific BLM data layers should be promoted as "National Data Layers" and which should remain at the state or local level (while still meeting the national data standard).

The BLM will be able to access data from the ADS as directed by OMB Circular A-16, the DOI Geospatial Blueprint, and other guidance. For example, data and applications users can directly access the USGS master files for National Hydrography Dataset (NHD), National Elevation

Dataset (NED), National Land Cover Dataset (NLCD), and the National Watershed Boundary Dataset (NWBD). The governmentwide Geospatial One-Stop will support this type of access. BLM geospatial data sets will also be accessible to others (within security constraints) via Geospatial One-Stop.

The "true" ADS national data layers will be served from centralized data servers with direct connect access by all BLM geospatial data users and applications. These data layers are of interest to BLM business and used in applications that are served to the public, but are not high demand data layers for our partners or the public (e.g., Grazing Allotments, Field Office Boundaries, Wild Horse and Burro Herd Areas and Herd Management Areas, and Land Use Planning Boundaries)...

Some states (CA, ID, MT, OR, and UT) have implemented the EGIS data architecture and other states currently have efforts underway that are moving them toward the EGIS data architecture (AZ, CO and Eastern States [ES]). Lack of architecture technology and other support has hindered movement toward the data architecture for other states. National resource support will be focused on states making below-average progress toward standardization.

Data management policies of states that have moved to an enterprise data architecture will generally remain the same. However, if it is determined that data should be contributed to an ADS, process standards of sharing data at national level and beyond should be implemented.

Technology support from EGIS and other national-level resources will allow states to concentrate on data acquisition. The National Data Management Team can assist with data standardization and metadata documentation. Once these are addressed, data can be centrally located, allowing easy access from the state and field offices, and saving time and money for the BLM as a whole.

Appendix D
Proposed Geospatial Services Technology Architecture Design

The primary goal of the BLM Geospatial Services Technology Architecture design is to establish a single, optimum infrastructure strategy to support all geospatial services activities throughout the BLM. The main benefits are achieved through development of an optimum architecture solution (server consolidation, data consolidation, and optimized network utilization) based on geographic information system (GIS) architecture and IT best practices that will reduce hardware, software, and system administration costs, while optimizing GIS user productivity. This overall objective can only be met through an integrated planning perspective, including an overview of comprehensive GIS user requirements from an enterprise BLM-infrastructure perspective.

The BLM geospatial services technology architecture is designed to support field-, state-, and national-level business operations throughout the BLM, as well as support integration with other Department of the Interior (DOI) business operations and services through the Geospatial One-Stop, the United States Geological Survey (USGS), the USDA Forest Service, and the National Map Web-based mapping services. Many of these Web-based interagency deployments are in their conceptual implementation phases, and these projects, along with Federal organizational initiatives and rapid hardware and software technology change, will impact the geospatial services technology architecture in the future. For this reason, the Technology Architecture plan is established as a dynamic document, with the primary purpose of providing clear direction, with scheduled annual updates, to support the BLM in establishing a hardware and network infrastructure that will best support geospatial services user requirements throughout the BLM enterprise environment.

Legacy GIS architecture is illustrated in Figure A-1. This is the traditional GIS architecture in the BLM. Every field office has an independent installation of GIS applications and maintains an independent data store. This implies:

- large, exclusive workstations for every field GIS user
- large, expensive data storage hardware at every field office
- staff at every field office with system and database administration skills, or require constant travel to field offices for state or district IT staff
- separately maintained data at different field offices will inevitably grow misaligned, out of sync, and inconsistent
- sharing data between field offices will consume large amounts of network bandwidth
- inevitably, each office will have a slightly different hardware and software configuration, making it harder to isolate problems and adding to the expense of user support
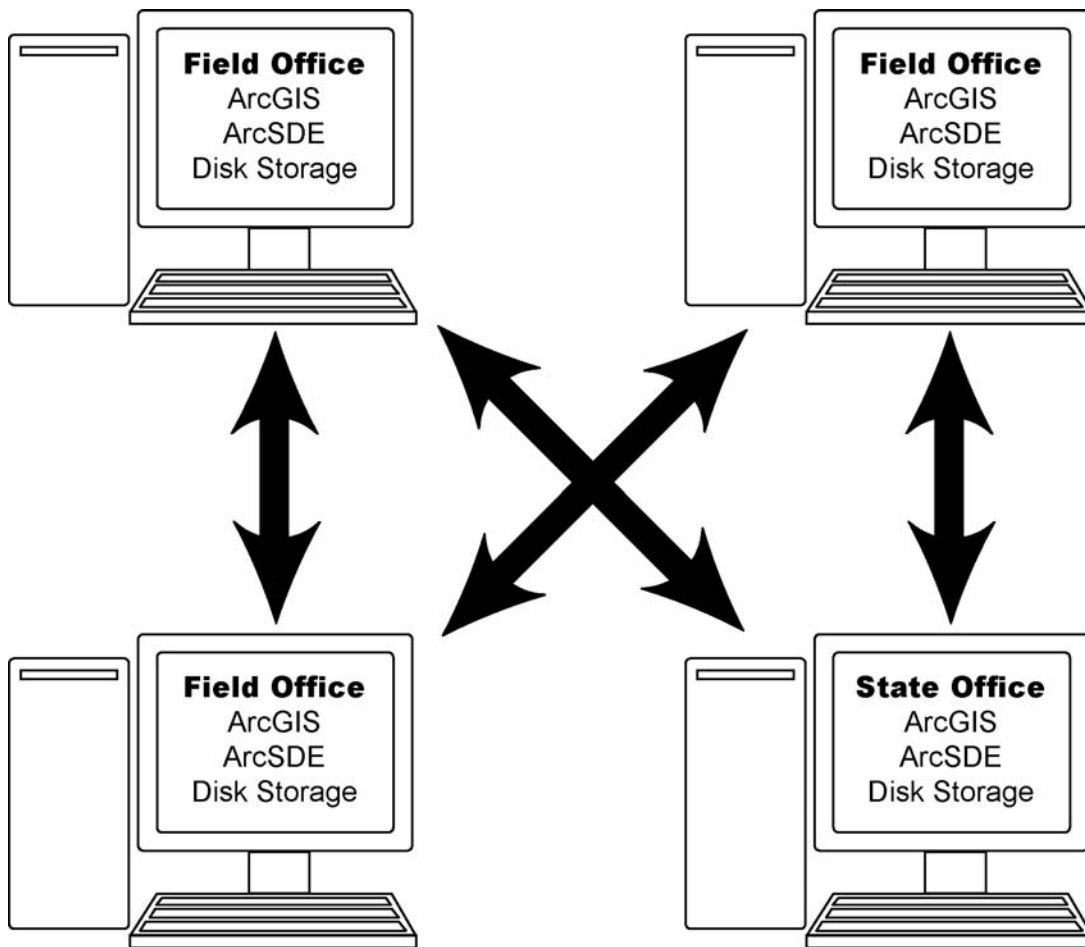
Figure A-1. Legacy GIS Architecture

The target geospatial services architecture is illustrated in Figure A-2. This is a multi-tiered architecture with application and database servers located in a national or regional center.   Field users connect to a Windows Terminal (Citrix) server over a lightweight, low-bandwidth connection. The advantages of this architecture include:

- Field GIS users can use low-price commodity workstations with a long refresh cycle.
- Field offices do not need separate data storage facilities apart from their local hard drives
- GIS software and database software is not installed in field offices. The Bureau only needs to maintain specialized IT staff at a few central locations. These locations are in urban areas with a larger talent pool, and consolidation makes it possible to hire a smaller number of staff with higher skill levels.
- IT staff only maintain applications at a few centralized locations, making it easier to keep up with new software patches and releases.
- Security patches can be quickly and easily implemented.
- Data can be backed up in a frequent, regular, and consistent manner.
- Software and hardware configurations are consistent throughout the agency, enabling configuration management and volume buying.
- Geographic data are pooled and centrally stored and maintained, and remain consistent throughout the agency. Field offices can maintain authoritative data for their area of responsibility through a checkin-checkout procedure.
- Separate BLM offices do not need to send data to each other. In most cases, the data are resident and visible to all users via a lightweight, low-bandwidth connection.
- An authoritative single source of data can be served to partner agencies and the public via a Web server housed near the database.
- If the Bureau needs to change its data standards or software configuration to meet DOI or other Federal Government standards, such changes can be readily and quickly implemented.
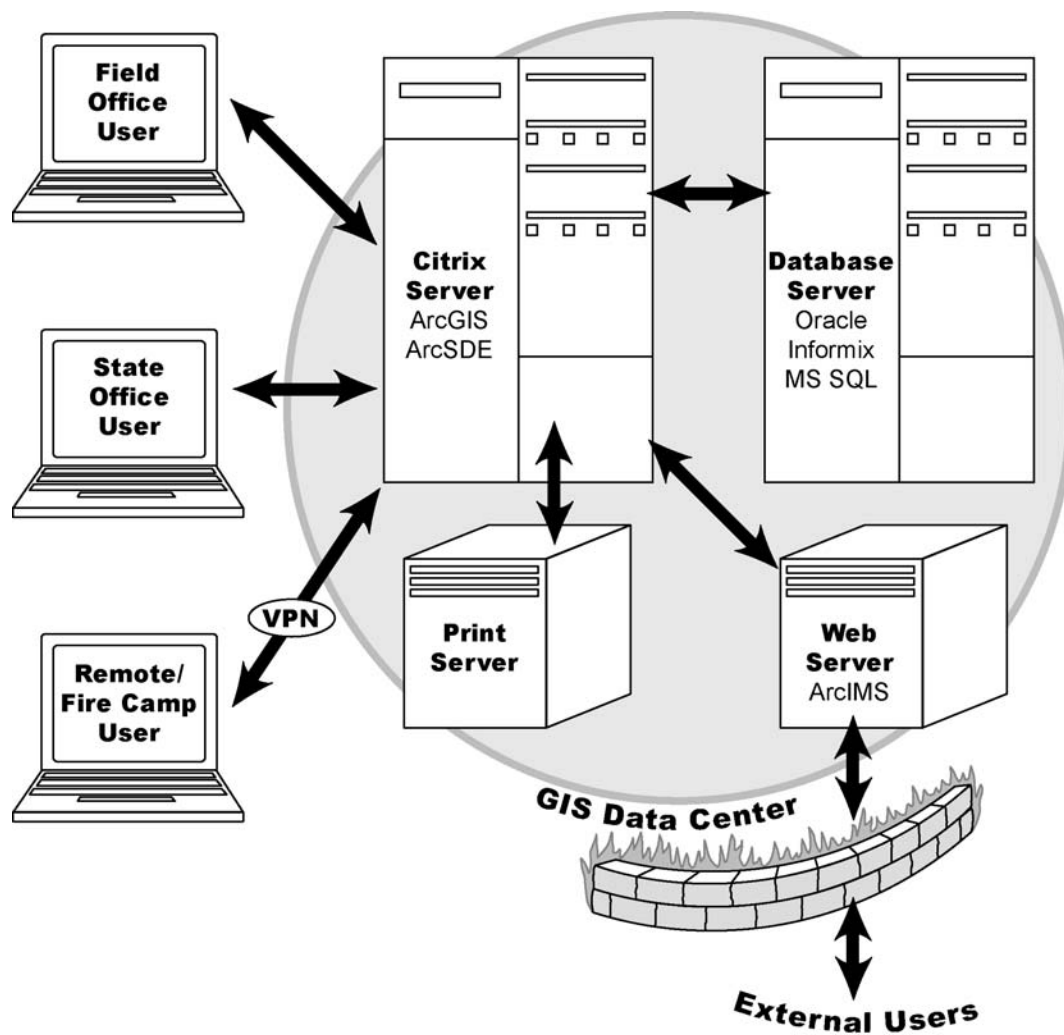
Figure A-2. Target Geospatial Services Architecture

Although the architecture illustrated in Figure A-2 is a desirable long-term goal for the Bureau, several factors preclude its immediate adoption:

- A national data center requires a shift in field office Bureau culture, which still favors local control and ownership of data.
- A fully functional national data center will require substantial changes in the Bureau's organizational structure and budget allocations.

A regional/state geospatial services architecture option is illustrated in Figure A-3. This is a transitional architecture between the status quo (Figure A-1) and the full national data center (Figure A-2). It is a multi-tiered architecture with applications and database servers located in national and state centers. Field users in states with no data center can connect to Windows Terminal (Citrix®) servers located in national or state centers over lightweight, low-bandwidth connections. National data sets are stored in the national center with child replicas at state centers for use and maintenance by field personnel. All data are kept up to date with automatic two-way data synchronization technology. Edits occurring at state centers are automatically posted to the national data sets, and edits occurring at the national centers are posted to replicas at state centers.

The regional geospatial services architecture shares, at least in part, most of the advantages of the national data center. In addition:

- It utilizes existing investment in applications, data, personnel and training.
- It maintains existing partnerships and customer relationships. Retains in-house GIS expertise and oversight.
- It causes less interruption to BLM's core business activities.
- Because it models the current Bureau organizational structure, it can be implemented relatively quickly.
- It provides a smooth transition path to implementation of the target architecture.
- It gives Bureau field staff a margin of comfort during the transition period; they would work with state IT staff already known to them. At the same time, it would begin building precedents for remote storage and administration of data.
- It would allow IT staffs a period of time to work out technical problems involved in database replication, remote administration, etc.
- When the time comes for a full national implementation, the Bureau would have a sound foundation of experience on which to base intelligent decisions about the design details.
- By providing for incremental, rather than radical change, it lowers the overall risk of failure.
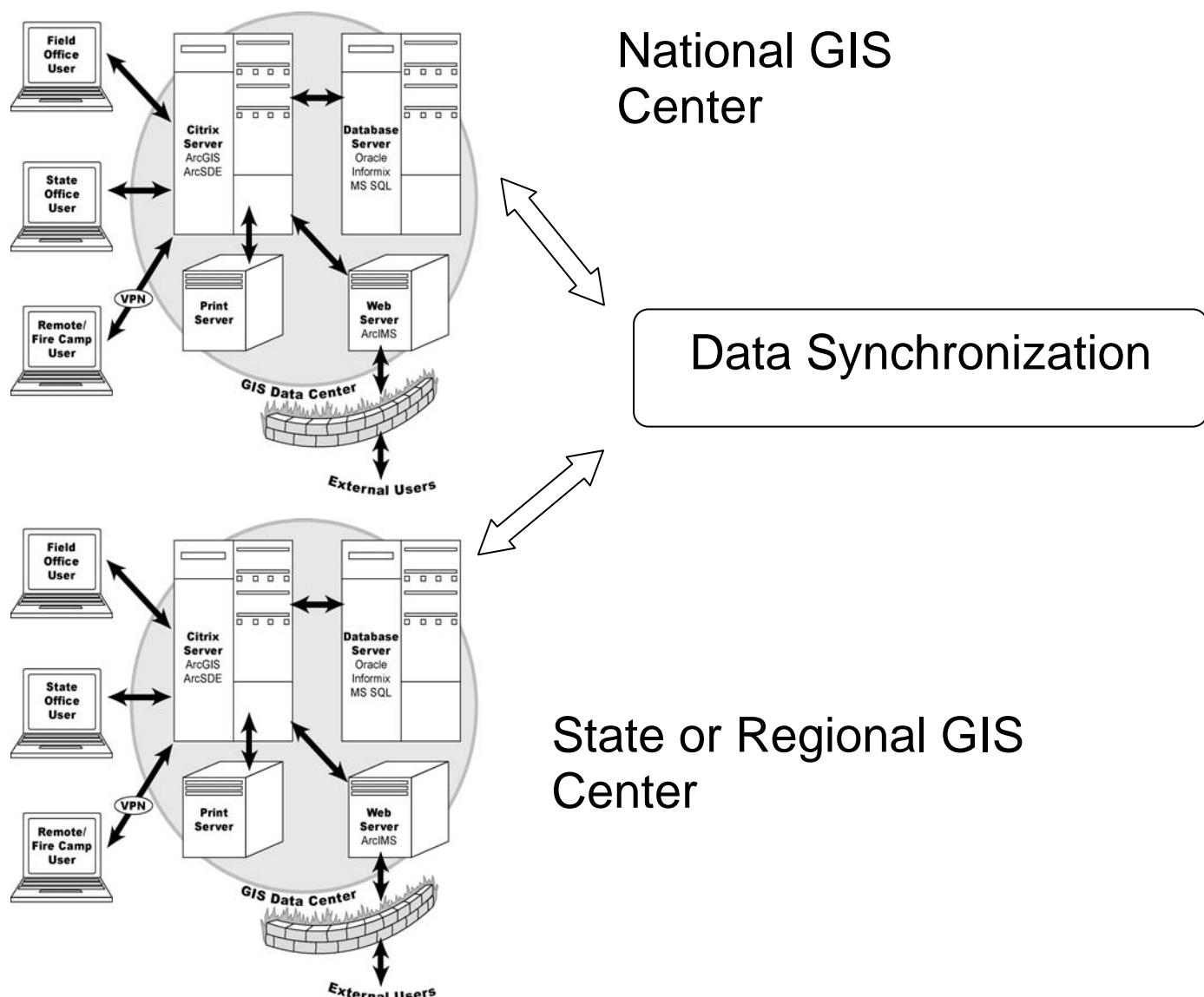
Figure A-3. Regional/State Geospatial Services Architecture