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Department of Energy
Enterprise Architecture

Geospatial Science Segment Architecture

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Geospatial Science Segment Architecture

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Executive Summary

The overarching mission of the Department of Energy (DOE) is to discover the solutions to power and secure America's future. The five strategic themes which serve as a roadmap to achieving this mission are energy security, nuclear security, scientific discovery, environmental responsibility, and management excellence. Each of DOE's strategic themes is supported by geospatial science resources – people, processes, data and technology that collect, analyze, and communicate information that are spatially referenced. The Department is advancing geospatial science as an enterprise services segment architecture within its Enterprise Architecture Transition Plan because it is cross-cutting and there are existing opportunities to leverage work through intra- and inter-agency coordination.

Historically DOE's application of geospatial science has been performed and funded tactically, with a focus on meeting short-term project requirements without consistent Department-wide management and investment oversight. The challenges facing DOE's geospatial science segment are:

- Limited collaboration across the DOE complex
- Lack of strategic coordination of geospatial science research and development
- Lack of institutionally guided and managed financial resources for key activities
- Limited awareness and outreach to build an understanding of the potential for geospatial science

To address these challenges, DOE established the Geospatial Science Program (GSP) as the business owner to provide governance and oversight of DOE geospatial science and contribute to inter-agency coordination. The GSP is chaired with voting representation from the Office of Environmental Management, Office of Science, and the National Nuclear Security Administration; and technical, operational, administrative and financial support from the Office of the Chief Information Officer (OCIO). The GSP guides the efficient use of geospatial science resources across DOE in order to realize and maximize programmatic benefits with the implementation of priority programs. The GSP participates in the inter-agency Geospatial Line of Business to ensure that DOE's requirements and strengths are incorporated, and that DOE can take advantage of any Common Solutions as they emerge.

The Department has identified key mission, business, technology, and legislative drivers applicable to the geospatial science segment. Most notable are the need for a broader strategic approach to addressing long-term, cross-departmental requirements, and improved management of geospatial science data as a primary business asset. The Department has performed a comprehensive review of activities and investments. It has expressed a vision with intended outcomes for a successful implementation that leverages current resources (people, processes, data, and technology) and builds upon the many innovative and effective business and IT

initiatives in which DOE has already invested. The target state encompasses outcomes that cross mission and business lines as well as those that are unique to one or more individual offices and programs.

The GSP is managing segment architecture development and operating with a multi-year perspective that continues to improve the vision for geospatial science within DOE. The geospatial science segment will continue to advance by identifying and implementing projects to move toward the vision, overseeing cross-cutting and inter-agency opportunities, and leveraging the enterprise architecture framework. This effort is laying the groundwork for improved mission support and investment decision-making for geospatial science and technology across DOE.

Geospatial Science Segment Architecture

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1 Segment Definition and Analysis

1.1 Segment Scope

The Department of Energy's overarching mission is to discover the solutions to power and secure America's future. The five strategic themes which serve as a roadmap to achieving this mission are:

- Energy Security: promoting America's energy security through reliable, clean, and affordable energy
- Nuclear Security: ensuring America's nuclear security
- Scientific Discovery and Innovation: strengthening scientific discovery, economic competitiveness, and improving quality of life through innovations in science and technology
- Environmental Responsibility: protecting the environment by providing a responsible resolution to the environmental legacy of nuclear weapons production
- Management Excellence: enabling the mission through sound management

Each of these themes is supported by the application of geospatial science. Figure 1 presents a few recent examples that demonstrate the variety, complexity, and breadth of these applications in support of these themes.

Figure 1. Department of Energy Geospatial Science Examples

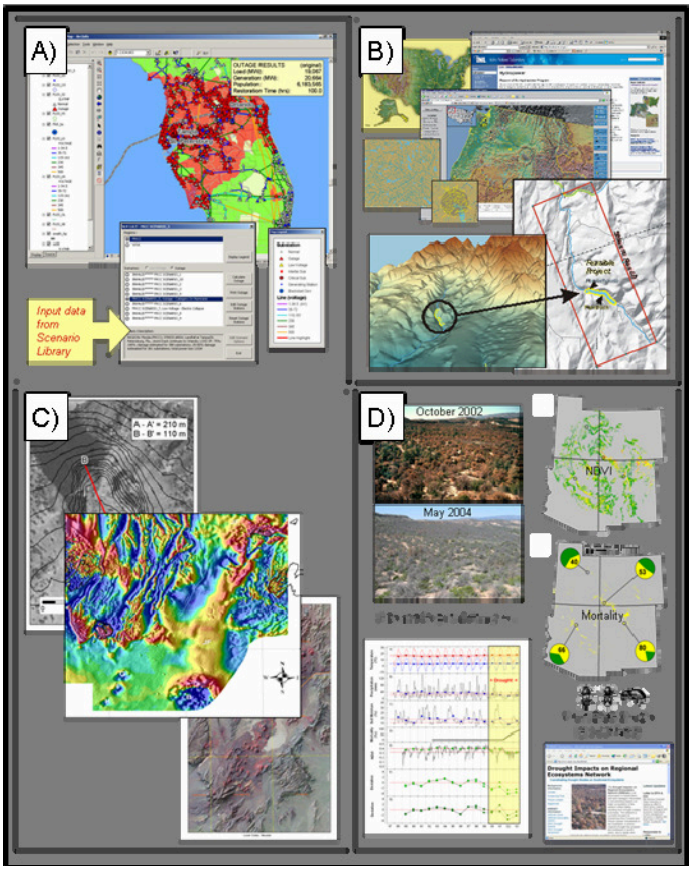


Figure 1. Examples of geospatial science applications in four DOE mission areas: national security, energy sustainability, environmental stewardship, and basic science. A) The Scenario Library Visualizer enables rapid evaluation of regional electric and gas outage scenarios, such as those that occur during hurricanes and other natural and human-induced emergencies. B) The Virtual Hydropower Prospector assists in locating and assessing hydropower potential and feasibility. C) Geospatial analysis and visualization are used to assess long-term risks of high-level waste storage at Yucca Mountain. D) Geospatial and remote sensing technologies are used to evaluate local and regional patterns of tree die-off due to drought, in the context of understanding cross-scale consequences of extreme weather events.

In its *Information Resource Management Strategic Plan 2007-2009*, DOE defines its information technology (IT) vision to ensure the sound use of information technology to:

- Revitalize cyber security
- Use information technology to reduce the cost of accomplishing the mission
- Enable the mission through sound management of IT

Geospatial science applications are reliant on IT investments throughout DOE. Effective and improved coordination of geospatial science to optimize these investments is necessary to support DOE's IT vision.

In its enterprise architecture (EA) transition planning approach, DOE evaluated activities based on a comparative analysis of mission impact, financial impact, feasibility, and the extent to which an activity builds on work in progress or serves as a prerequisite for another critical activity. Because of geospatial science's cross-cutting mission services, potential financial benefits from cost avoidance, and opportunities to leverage work in process for intra- and inter-agency coordination, its development within the segment architecture framework was identified as a priority within DOE's FY06 *Enterprise Architecture Transition Plan*.

The Department's application of geospatial science comprises an enterprise segment; the underlying geographic information systems are a cross-cutting technology that supports users performing a variety of functions and meeting mission needs. The segment architecture development activity is building a future vision for geospatial science within DOE, identifying implementation plans to move toward the vision, within the context of the overall EA. This effort is laying the groundwork for informed investment decision-making for geospatial science across DOE.

The Department established the Geospatial Science Program (GSP) as the business owner to provide governance and oversight of geospatial science applications. The GSP guides the efficient use of geospatial science resources (people, process, data, and technology) across the complex in order to realize and maximize programmatic benefits with the implementation of priorities. The GSP participates in inter-agency efforts to improve collaboration for applications and investments across all sectors and levels of government.

1.2 Geospatial Science Defined

The term 'geospatial science' is used to encompass both the concepts of geographic information science and geographic information systems. Geographic information science is the study of spatially-referenced data, including geographic theory, technological design, and analytical algorithms. Geographic information systems (GIS) are specialized software and hardware used to manage, manipulate, query, and visualize spatially-referenced data. Table 1 presents examples of geospatial science capabilities.

Table 1. Examples of Geospatial Science Capabilities

Capability	Description
Cartography	Graphical representation of spatial data as map products (paper or digital)
Data capture and conversion	Digitizing, data import/export, transformation
Data Management	Geospatial data archive, documentation, quality control, management, delivery, and update
Geospatial Modeling	Automation of spatial processes include physics, engineering, system dynamics, atmospheric and hydrologic transport
Global Positioning System (GPS)	Hardware & software that assists in determining spatial location for navigation use or capturing field data for integration with other spatial data
Internet GIS	Web-based mapping services
Network Analysis	Network data model (paths, connections, restrictions) and methods for evaluating routing (closest facility, service area, travel times) and hydrologic systems
Remote Sensing Processing/Analysis	Data collection, image processing, fusion with GIS, classification, spatial analysis
Spatial Analysis and Geoprocessing	Measurement, intersection, union, proximity, neighborhood, map algebra
Spatial Decision Support Systems	Data/model/visualization integration with custom interfaces to support a specific process
Statistical Analysis	Kriging, spatial auto-correlation, spatial descriptive statistics (mean, max, min of an attribute over space)
Surface Analysis	Analysis of earth surface properties such as slope, aspect, watershed/catchment, visibility
Three-Dimensional GIS	Surface generation, topography, volume analyses, spatial relations
Visualization	Creation of images, maps, charts, and diagrams; static and rotating; 2-D, 3-D, time series (4-D), animations

Within DOE there exists a community of practitioners who perform geographic information science research and who apply geographic information systems to support DOE operations including facilities management, site operations, emergency management and response, and environmental remediation. Historically DOE's application of geospatial science has been performed and funded tactically, with a focus on meeting short-term project requirements. Commercial GIS has typically been inadequate to solve many of the unique and complex problems faced by DOE. While DOE practitioners use commercial off-the-shelf GIS to capture data, perform basic spatial analysis, and develop visualizations, much effort is spent developing specialized processes to integrate spatial data with complex models in support of DOE's mission. In 2001, the Office of the Chief Information Officer established the Geospatial Science Steering Committee (GSSC) as a collaborative working group made up of representatives from DOE's practitioner community. The GSSC working group supports the GSP in a technical advisory capacity to further advance the goals and objectives of the GSP.

1.3 Change Drivers

The improvements in departmental support and coordination for the geospatial science segment are being planned in alignment with mission, business, technology, and legislative drivers.

Mission drivers influence how geospatial science supports DOE's vision to discover the solutions to power and secure America's future. The segment's governance is structured to provide appropriate programmatic representation for central coordination of the application of geospatial science. The GSP represents three of the largest programs with an interest in geospatial science, the Office of Science, the Office of Environmental Management, and the National Nuclear Security Administration. It receives technical advice from numerous laboratories and practitioners supporting many of DOE's mission and business areas. The governance structure roles and responsibilities ensure alignment to mission focus for energy security, nuclear security, science discovery, and environmental responsibility.

The segment is responding to an opportunity to promote a broader strategic approach to meet long-term, cross-departmental geospatial science needs. The GSP provides the enterprise business framework to foster DOE complex-wide use of geospatial resources. Operating in an enterprise business climate will result in a reduction of waste, redundancy, and duplication of efforts. Creation of the geospatial science segment within the EA framework provides for a more effective, efficient decision-making process for determining priorities and investments.

The segment is aligning with business drivers supporting departmental initiatives. The two key business drivers are data management and geospatial science resource management improvement.

Geospatial science data is the primary business asset that results from activities, and a key resource for conducting accurate geospatial analysis. Improved adherence to federal geospatial data standards will reduce rework due to inconsistent and nonstandard data acquisition, modification, and dissemination efforts. Improved management practices are essential to ensure accessibility. The development of a life cycle data management approach will provide DOE the ability to establish requirements, perform and inventory spatial data holdings, prioritize acquisitions, process and distribute data uniformly, and store and dispose data as a collective enterprise investment. These practices will not only better coordinate geospatial science resources for current users, but also allow other organizational components access to information resources that were previously unknown to them.

The Department's current commercial GIS licensing practices are not coordinated across the complex, resulting in administrative inefficiencies, less-than-optimal pricing, and potentially redundant investments. Management of software licenses and development of enterprise license agreements will satisfy a departmental business need. The GSP and the OCIO are evaluating geospatial software usage and maintenance requirements. The implementation of a coordinated software procurement approach will in turn support a coordinated investment approach.

To promote improved use of technology resources, the GSP will analyze software and hardware practices to support comprehensive and efficient access to geospatial data sets across DOE. Various data management and replication strategies will be assessed to address critical issues of

data availability for emergency management and response and long-term access to historical data used in decision making for cleanup and remediation activities.

Federal legislative and executive initiatives require departmental attention and can impact DOE's application of geospatial science. The Department actively participates in the coordination efforts of the federal government in support of:

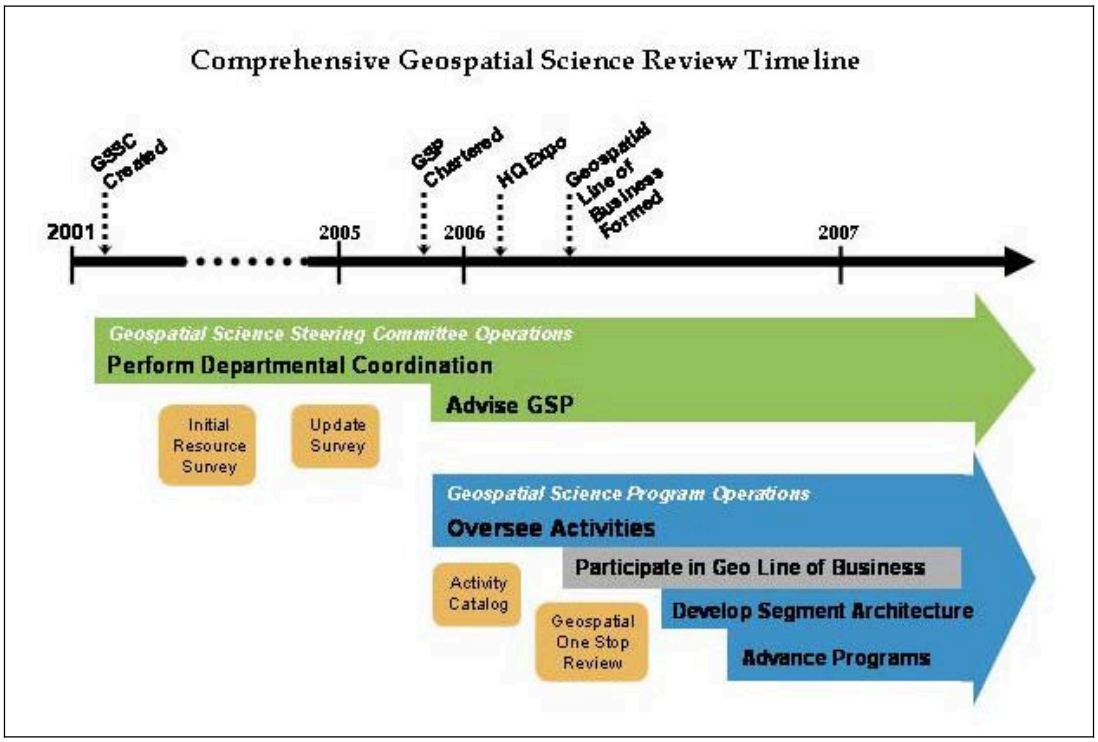
- OMB Circular A-16 (Coordination of Geographic Information and Related Spatial Data Activities)
- Executive Order 12906 (Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure)
- The Presidential Initiatives for the Geospatial One-Stop and Geospatial Line of Business

The establishment of the GSP as the governance body for the geospatial science segment is ensuring improved cross-departmental communication of federal policy directives concerning geospatial information as well as increased representation in inter-agency coordination activities.

1.4 Current State

The Department has compiled a comprehensive review of the geospatial science resources and investments. This review is the result of efforts by the Geospatial Science Steering Committee and the Geospatial Science Program over several years, as awareness of the need for improved coordination grew and oversight was established. Figure 2 illustrates the review process.

Figure 2. Comprehensive Geospatial Science Review Timeline



In 2003, a survey requesting information on a variety of business, data, services, technology, investments, and personnel information and was completed by geospatial practitioners across DOE. The specific survey topics included:

- Organization function
- Organizational roles, responsibilities, and personnel background
- Organizational use of GIS (i.e., cartography, analysis, modeling)
- Types and number of software licenses
- Types and number of hardware (i.e., desktop, server platforms)
- Types of data (geodetic control, orthoimagery, elevation and bathymetry, transportation)
- Status of metadata (percentage of data layers in compliance with Circular A-16)
- Budget and funding sources
- Database products used

In 2005, a supplemental survey and analysis was conducted to validate and update the 2003 information and collect additional business and performance data. The goal of this analysis was to derive the geospatial science investments for each laboratory/facility, including: personnel, hardware, software, and data; amount of available metadata; sources and cost of commercial data; estimated cost of the investment in data, and estimated cost to standardize data assets.

In early 2006, a Geospatial Science Expo was held at DOE Headquarters where examples of recent geospatial science applications were presented to the Secretary of Energy and other DOE leadership. Preparations for the Expo yielded information about the breadth and complexity of geospatial science applied in support of DOE's mission and other agencies.

Also in 2006, information was collected in response to multiple OMB data requests. These responses provided additional insight into the range of geospatial science applied across DOE. The data requests included:

- Commercial GIS licensing summary
- Announcement of Planned Data Acquisitions on the Geospatial One-Stop
- Summary of contributions to the Geospatial One-Stop
- Geospatial Investment Report

The result of this multi-year, multi-faceted analysis is a comprehensive baseline architecture for the segment.

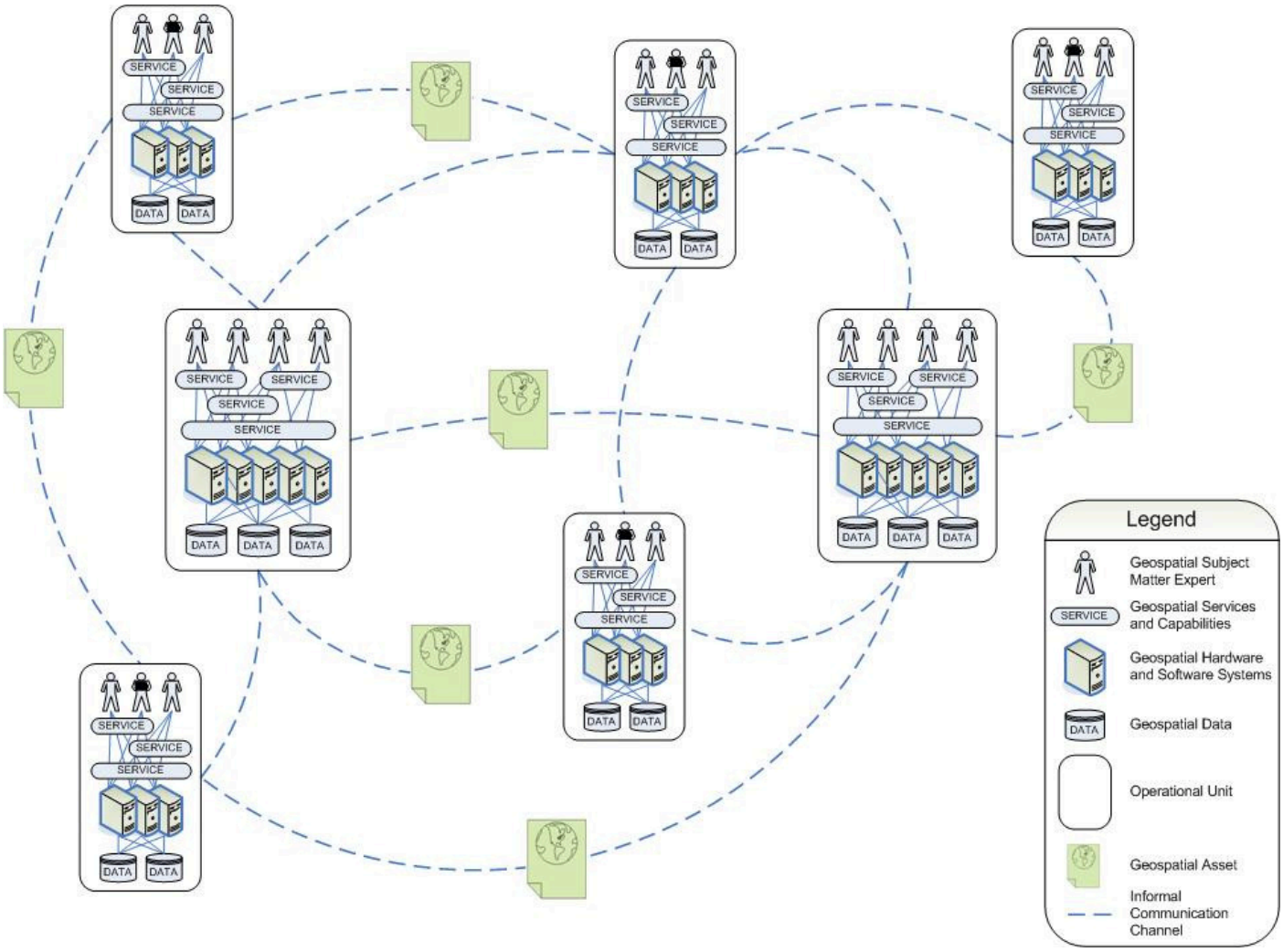
1.5 Conceptual Operating Changes

The challenges facing DOE's geospatial science segment are:

- Limited collaboration across DOE
- Lack of strategic coordination of geospatial science research and development
- Lack of institutionally guided and managed financial resources for key activities
- Limited awareness and outreach to build an understanding of the potential for geospatial science

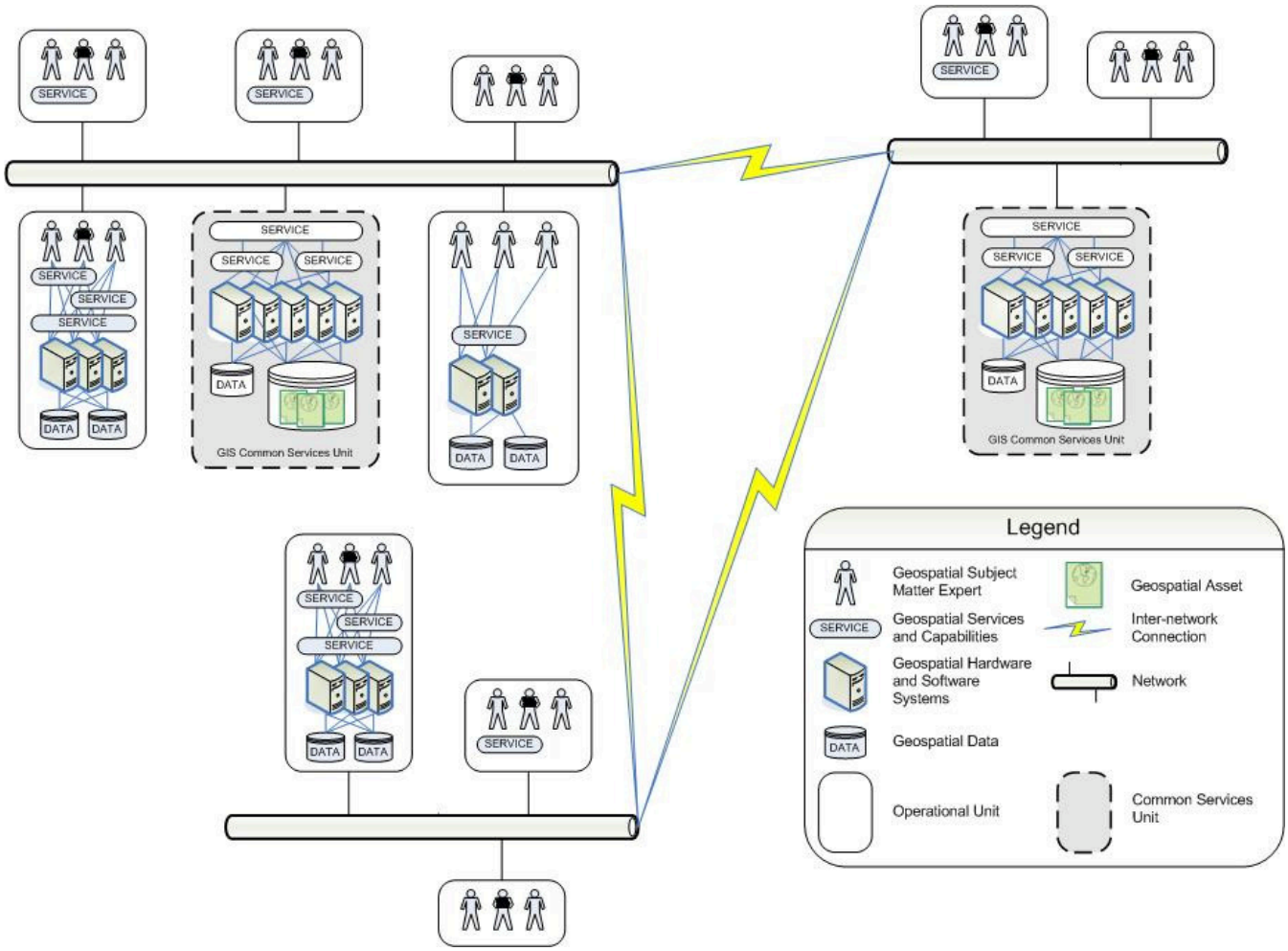
The establishment of the Geospatial Science Program governance and application of a segment architecture approach is designed to address these challenges through a coordinated oversight of geospatial investment and resource coordination.

Figure 3. Notional As-Is Department of Energy Geospatial Science Resource Framework



In the current project driven environment, autonomous geospatial science operational units composed of subject matter experts, services, technology and data perform activities to meet a specific mission and business need. Infrastructure connectivity across units rarely exists; the key geospatial assets (maps, analysis, and data) are shared in an ad hoc fashion. There are no central repositories of data or shared departmental services supporting common geospatial science capabilities.

Figure 4. Notional To-Be Department of Energy Geospatial Science Resource Framework



In the mission and business led environment, coordinated departmental resources are provided through geospatial science common services units (composed of geospatial services, technology and data) as shared services available through interconnected networks. Subject matter experts in some operational units can perform their activities entirely leveraging the shared services from the common services units. Common services units are defined and implemented based on detailed analysis of Program Office needs and requirements, incorporating input from geospatial practitioners and all customers and stakeholders to identify the appropriate resources and approach for deployment. Common services units are optimized resource investments that reduce and improve administration of technology to (A.) enable geospatial science practitioners to focus on innovative applications to meet mission needs and (B.) allow other organizational components access to information resources that were previously unknown to them. Some operational units will manage specialized geospatial services, technology or data as needed to meet specific needs. Key geospatial assets are managed with a lifecycle approach within the common service units.

2 Segment Target Vision

2.1 Purpose & Intent

The purpose and intended benefit of a coordinated geospatial science segment is to identify opportunities to maximize DOE's investment in geospatial technology as it supports its core mission. Employing a segment architecture approach provides the framework to define the requirements for geospatial capabilities, implement appropriate solutions, and manage an integrated geospatial science technology capability over time. The opportunities to meet this goal and the potential outcomes will continue to evolve as the technology and related capabilities continue to grow.

2.2 Envisioned Outcomes

Currently, the envisioned outcomes of the successful geospatial segment architecture implementation are:

- Support to the President's E-Government Management Agenda as it relates to geospatial technologies - contributing to the Geospatial One-Stop, leveraging licensing opportunities, and participating in the Geospatial Line of Business
- Secure access to standard geospatial data for use internally to support DOE mission and business processes
- Establishment of processes and infrastructure for sharing of DOE developed geospatial data to support enhanced government efficiency through data accessibility to all levels of government and the public
- Reduced vulnerability of loss of DOE's investment in legacy geospatial data through metadata development, cataloging and archiving, to ensure data is available for re-use and future management needs
- Reduced redundancy, duplication, waste and inefficiency through increased collaboration, data sharing, and compliance with federal geospatial data standards
- Standardization, modernization, interoperability and assured availability to a common geospatial technology across DOE facilities, creating efficiencies in management and consistent services to internal and external stakeholders
- Standardization and management of DOE facility geospatial data to support improved Homeland Security and resource protection
- Improved decision support using geospatial capabilities for emergency management and response mission requirements and business functions
- Increased departmental collaboration on geospatial capabilities to support national defense, basic and applied research, and homeland security issues
- Cost efficiencies through corporate licensing of software and critical privately-vended regional, national, and international datasets
- Improved relationships with software and data vendors to influence product enhancements for DOE benefit

The geospatial science segment can leverage current resources (people, processes, data, and technology) and build upon the many innovative and effective business and IT initiatives in

which DOE has already invested to realize programmatic benefit. The vision for the target state for DOE's geospatial segment encompasses outcomes that cross mission and business lines as well as those that are unique to one or more individual offices and programs. As DOE moves forward with the implementation of the geospatial segment architecture, detailed analysis of Program Office needs and requirements, incorporating input from geospatial practitioners and all customers and stakeholders, will be assessed before any decision to aggregate to a common solution is advanced.

2.3 Agency Technology Standards

The geospatial science segment technology architecture is being developed in alignment with DOE's Energy Information Technical Architecture (EITA). Segment analysis, visioning and development are advancing collaboratively with the EA and EITA efforts. This collaboration is ensuring the capture of information about current geospatial components, requirements, best components in the marketplace, and approaches for going forward. It is also raising awareness within the geospatial community of interest of DOE guidance provided by the EITA. As the geospatial science segment continues to mature, EITA will continue to assist by guiding geospatial technology procurement and the use of standards or services.

2.4 Data Architecture

Within the geospatial science segment architecture, data is the primary business asset that results from activities. The GSP has identified a priority need to articulate a geospatial data strategy to support the sharing, reuse, and maintenance of DOE's investment in geospatial data. The geospatial science community will be an early participant in DOE's upcoming data architecture efforts and will work collaboratively within the EA program to develop its geospatial data architecture, improving the way data is acquired and used across the department, and continue to identify opportunities for increased data efficiency and effectiveness.

The Department and the broader federal community recognize that geospatial data is complex. Government wide standards for categorizing, characterizing, describing, and sharing are being defined and advanced by inter-agency working groups focusing on specific themes and functions. The Department will continue to participate in the inter-agency efforts. The geospatial data architecture will adopt standards, specifications, and best practices as they continue to emerge.

2.5 Performance Goals and Metrics

The geospatial science segment's success depends on the ability of the GSP leadership to align the desired outcomes and implementations to both the segment's goals and DOE's strategic goals. Analysis of the segment in an EA framework resulted in the identification of relevant success metrics from the Performance Reference Model as defined in Table 2 below.

The applicability of these measurement areas and categories varies across the priority programs. This is appropriate given the cross-cutting nature of geospatial science where specialized data and processes support core mission areas and common data and processes support numerous mission areas and business services. As each segment program is advanced, it will be aligned to the performance reference model based on its scope and intended outcomes and to establish specific measures of success. This nested approach is intended to ensure that the segment

establishes meaningful performance baselines, sets performance targets, and can measure performance towards meeting the goals of each program, the segment overall, and the Department.

Table 2. Geospatial Segment Alignment to Performance Reference Model

Applicable DOE Geospatial Segment Measurement Area	Applicable DOE Geospatial Segment Measurement Category
Mission and Business Results	Planning & Resource Allocation
	Controls & Oversight
	Disaster Management
	General Science and Innovation
	Energy
	Environmental Management
Technology	Information & Data
	Financial
	Effectiveness
	Quality
Processes and Activities	Management & Innovation
Customer Results	Service Accessibility

Several overall performance measurement areas, categories and indicators address the envisioned outcomes related to numerous mission areas and business services:

- Mission and Business Results / Controls and Oversight / Program Evaluation: the number of program offices, laboratories, and DOE affiliates with representation in the Geospatial Science Program (GSP and GSSC)
- Technology / Information & Data / External Data Sharing: the number of metadata on Geospatial One-Stop
- Technology / Financial / Licensing Costs: the number of licensing vehicles
- Technology / Quality / Compliance & Deviations: the number of in-use software product platforms at or above standard

2.6 Investment & Funding Strategy

The discrete geospatial science activities undertaken by DOE are supported as components within numerous separate investments across DOE's portfolio. A review of investments conducted in 2006 identified geospatial-related activities. While some activities were identifiable through the business cases and capital investments, by virtue of an alignment to the Geospatial Components of the Service Reference Model, DOE relied on the GSSC's knowledge and connection to the practitioners to identify unaligned activities. Table 3 below presents a summary of the investment report; Appendix A presents the complete Geospatial Investment Report.

An Exhibit 300 presenting an Initial Concept Business Case for an overarching Geospatial Science Program Management Office was submitted in 2005, for Fiscal Year 2007. This business case identified priority programs and associated capital requirements. The capital

investment was not established, but efforts to advance the analysis and vision for the coordinated program continued with funding support by the OCIO.

Table 3. Summary of DOE's Geospatial Investment Report (All $ in Millions)

Type of Investment	FY 2005	FY 2006	FY 2007
Services	$15.898	$15.953	$16.139
Hardware	$0.716	$0.676	$0.676
Software	$0.465	$0.465	$0.465
Data	$0.265	$0.285	$0.309
Totals	**$17.344**	**$17.379**	**$17.589**
Amount aligned to Geospatial Components of the Service Reference Model	$3.630	$3.789	$4.052

The GSP leadership continues to consider establishing direct funding for implementation of the geospatial science segment architecture in out-years. The GSP, with support from capital planning leadership, plans a review of the original Business Case in light of progress since the 2005 Exhibit 300 submission. Advances that inform the capital planning process include official establishment of the Geospatial Science Program governance, additional analysis of current state and target vision with input from business managers and geospatial practitioners, and incorporation into DOE's EA framework. The review will also consider coordinated efforts planned across the federal community under the Geospatial Line of Business. The GSP will determine whether an update and re-submission of a Business Case is appropriate.

The GSP leadership has a role in identifying and evaluating alternative funding opportunities and approaches. The GSP promotes the envisioned outcomes and justifications of priorities to program office leadership and gains buy-in from the stakeholder community. The GSP works with stakeholders to explore use of program discretionary funds, consolidation of existing resources, or synchronization of previously independent program office efforts as a leveraging strategy. Candidate investments and efforts derive benefit from collaboration and provide mission and business improvements within their business domain.

3 Segment Transition Plan

3.1 Governance & Operating Activities

The strategic direction, mission alignment, communication, and resource coordination for the geospatial science segment architecture is governed by the Geospatial Science Program (GSP), which was established in October 2005. The charter defines the GSP's mission to "coordinate and optimize [DOE's] investments in geospatial science and technology as they support the core missions of the Department." The GSP guides the efficient deployment of geospatial science resources (people, process, data, and technology) across DOE in order to realize and maximize programmatic benefits with the implementation of priority programs as directed by the GSP leadership. The objectives for segment operation are:

- Optimize geospatial resource allocations
- Encourage cross-complex and inter-agency technology sharing to enable and enhance program goals and objective
- Align geospatial science infrastructure requirements with DOE's EA
- Ensure appropriate security measures are established to protect geospatial science and technology investments
- Enhance emergency management to minimize risk to departmental assets
- Establish a legacy geospatial data records management strategy
- Support geospatial science and technology development relevant to DOE's mission
- Contribute to federal geospatial standards, guidance, and E-Government initiatives
- Provide inter-agency coordination and communication on geospatial science and technology

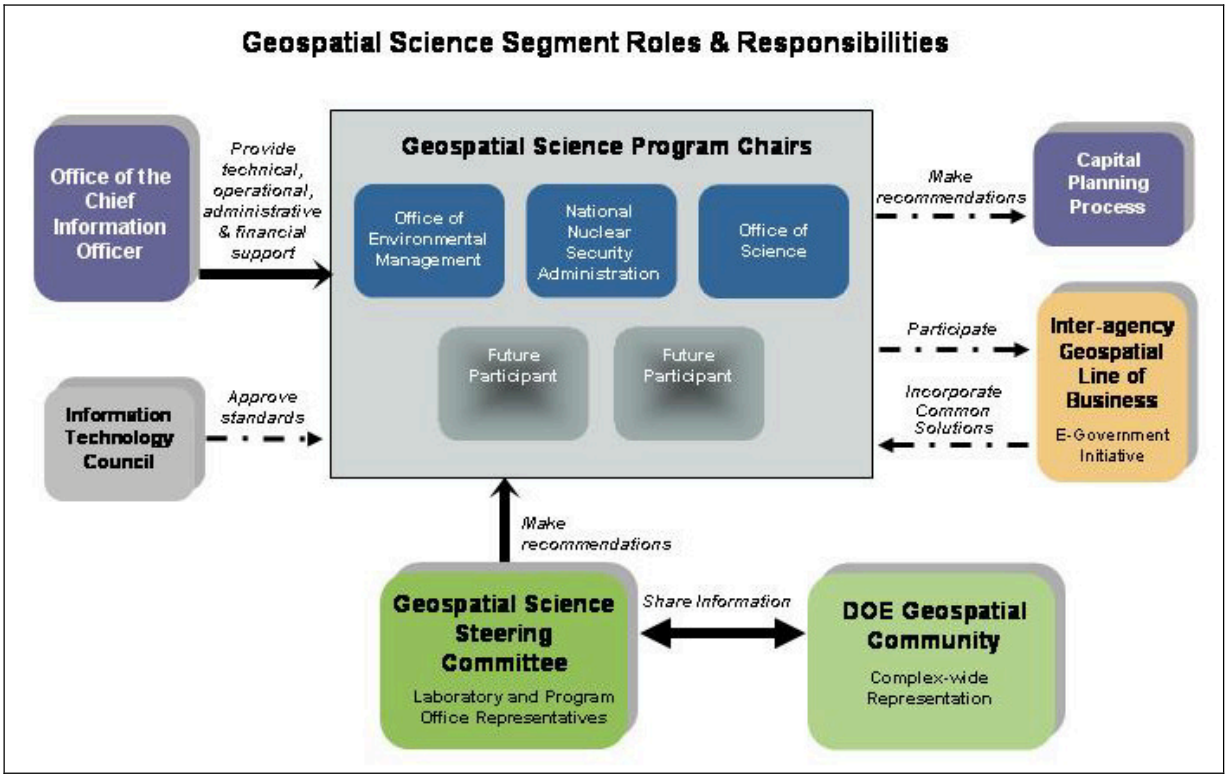
The GSP is currently Tri-Chaired with representation from the Office of Science, Office of Environmental Management, and the National Nuclear Security Administration. The Office of the Chief Information Officer, serving as a nonvoting member, provides technical, operational, administrative, and financial support as well as external coordination in support of DOE's geospatial science and technology requirements.

The GSP communicates with DOE's Information Technology Council and may request input from the Council on related information technology, architecture, and infrastructure areas of interest that may impact Geospatial Science Program programs and operations. Figure 5 depicts the organizational governance framework of DOE's Geospatial Science Program.

The Geospatial Science Steering Committee (GSSC), formally recognized by the OCIO in 2001, consists of geospatial subject matter experts from national laboratories, facilities and Program Offices. The GSSC is a nonvoting GSP member providing technical advice and recommendations in the assessment, implementation, and operation of GSP directives.

The GSP Charter identified the establishment of Integrated Project Teams (IPT) as a strategy to advance the GSP goals. Current funding constraints limit the ability to undertake the IPTs that would be needed to effect improvements. The approach for the creation of IPTs is being evaluated by the GSP.

Figure 5. Geospatial Science Segment Governance



Since its inception, the GSP leadership team has met regularly to discuss strategic and tactical drivers and areas of interest, evaluate the merits of potential programs, prioritize high-impact efforts, and address the requirements of E-Government activities related to the geospatial science segment. The GSP leadership anticipates a 3 to 5 year operating window to reach implementation milestones and performance improvements.

Program management, in the form of regular meetings and continued DOE and inter-agency coordination, will continue as a baseline function of the segment. This enables the identification of new or revised business and information requirements, the continuing implementation of solutions, and the evaluation of performance improvements. Participation in the inter-agency Geospatial Line of Business is key to ensuring that DOE's requirements and strengths are incorporated, and that DOE can take advantage of any Common Solutions as they emerge (see Section 5.3 for more information on the Line of Business).

3.2 Project Sequencing Plan

Decisions about the sequencing of projects to achieve the geospatial science segment target vision are based on four criteria:

- Mission goals and objectives of DOE
- The recommendations of the GSSC as the subject matter experts with critical knowledge of gaps, risks, and opportunities

- Technology drivers, including DOE IT goals, business manager and stakeholder requirements, and geospatial technology advances
- Opportunities to coordinate Program Office and laboratory projects and develop strategic alliances to achieve broader departmental goals

Given the limited funding in FY 2007, strategic alliances are particularly important for achieving segment performance improvements. The GSP is working to leverage the segment's baseline support with various Program Office efforts to incrementally address high-impact areas.

3.2.1 Work Accomplished

In its first year of operation (FY 2006) the GSP focused on developing its operating approach, performing outreach across DOE to determine the segment scope, contributing to inter-agency coordination, and meeting legislative requirements:

- Conducted regular meetings of the GSP leadership team and the GSSC to build cross-complex geospatial science coordination, identify gaps, and explore approaches for eliminating duplication, inefficiency, and waste
- Organized the Headquarters Geospatial Science Expo, where numerous examples of the application of geospatial science in support of DOE's mission were on display in the Forrestal Building lobby. Members of the GSSC presented to Secretary of Energy Samuel Bodman and Program Office leadership to raise awareness of geospatial science
- Developed a catalog of DOE geospatial science applications, with high-level summaries of recent efforts undertaken by more than a dozen responding laboratories and Program Offices
- Selected Emergency Management & Response and Legacy Data Management as high priority programs for analysis and project planning
- Collected additional baseline information with the review of Geospatial One-Stop participation and development of a Geospatial Investment Report
- Participated in the Geospatial Line of Business, a component of the President's Management Agenda for cross-agency optimization, standardization, and consolidation of common geospatial functions, services, and processes
- Initiated segment architecture development with the analysis of the multi-year information collection activities to describe the current state

3.2.2 Work Planned

The GSP will continue to perform outreach, contribute to inter-agency initiatives, and meet legislative requirements.

Specific FY 2007 plans include:

- Based on the task progress of the Geospatial Line of Business Common Solutions/Technical Architecture, assess impacts, incorporate recommendations, and revise planning and investment strategies of DOE's geospatial science segment
- Initiate improvements in geospatial science applied to Emergency Management and Response
- Initiate improvements in Legacy Geospatial Data Management

- Develop an enterprise acquisition strategy for commercial GIS licensing improvements
- Increase DOE stakeholder participation in the GSP and the GSSC
- Continue segment architecture development with improvement of the target vision and performance metrics, alignment with DOE EA Transition Plan, and establishment of program performance monitoring
- Evaluate the development and submission of an Exhibit 300 Capital Investment Plan to support the transition to the target segment architecture

Specific FY 2008 plans include:

- Based on the task progress of the Geospatial Line of Business Common Solutions/Technical Architecture, assess impacts, incorporate recommendations, and revise planning and investment strategies of DOE's geospatial science segment
- Initiate definition and implementation of a comprehensive geospatial data strategy
- Develop a "best fit" solution for ensuring compliance with federal metadata standards for all DOE-authored geospatial data
- Continue improvements in geospatial science applied to Emergency Management and Response
- Continue improvements in Legacy Geospatial Data Management
- Implement the enterprise acquisition strategy for commercial GIS licensing improvements
- Maintain segment architecture with the review of change drivers and new business and information requirements, assessing the impact on segment architecture management plan

Out-year plans include:

- Based on the task progress of the Geospatial Line of Business Common Solutions/Technical Architecture, assess impacts, incorporate recommendations, and revise planning and investment strategies of DOE's geospatial science segment
- Manage and monitor success of the enterprise acquisition strategy for ESRI software
- Analyze and evaluate the feasibility of a DOE enterprise GIS to enable cross-complex access to key geospatial data and services

4 Segment Programs and Projects

4.1 Overview

Progress towards achieving the segment's envisioned outcomes is being made through a series of programs. Segment programs involve the implementation of plans and projects to address specific priorities of the segment. Programs are scoped based on well-defined business or enterprise service areas that relate to a specific set of requirements, stakeholders, and customers. Each program and its projects are planned to incorporate cross-cutting concerns such as security, data requirements and standardization, technology and EA.

The current portfolio of geospatial segment programs includes:

- Emergency Management & Response
- Legacy Data Management
- Commercial GIS Licensing
- Commercial Data Licensing
- Life Cycle Geospatial Data Strategy

Projects within a program are undertaken to meet a specific goal or respond to an opportunity while still supporting broad segment goals. The segment benefits overall by applying any lessons learned on successive projects, by making incremental progress on a broader data strategy, and by incremental improvements in its investment approach. Currently, the segment is supporting projects for its Emergency Management and Response program, and is developing project plans for Legacy Data Management and Commercial GIS Licensing programs.

4.2 Emergency Management & Response Program

The value of geospatial science to emergency management and response (EM&R) is its robust capabilities to integrate, analyze and communicate a broad range of data (which for EM&R is often of a spatial nature) to the objectives of protecting life, property and the environment. The Department's geospatial science capabilities were critical tools in the response to recent emergencies such as the Cerro Grande fire which threatened Los Alamos National Laboratory, and Hurricane Katrina which effected the energy resources and infrastructure for a large area of the United States. The After Action analysis of these and other emergencies has highlighted gaps, risks and opportunities in the provision of geospatial EM&R capabilities across DOE. The GSP has identified improvements in geospatial EM&R capabilities as a priority for the segment.

The goals of improved support for emergency management and response include:

- Distributed access to critical infrastructure data
- Timely situation analysis support
- Enhanced analysis for prediction of effects and planning of response alternatives

The GSP identified a need to evaluate geospatial EM&R capabilities across DOE and determine an approach to delivery of shared services. The National Nuclear Security Administration's

(NNSA) Office of Emergency Operations Support (NA-44) is a key stakeholder because of its mission to provide DOE/NNSA and other customers with reliable, secure emergency communications for information exchange. The GSP and NA-44 have established a strategic alliance that would leverage the evaluation of EM&R shared services with NA-44's plans to upgrade and standardize its Emergency Communications Network technology infrastructure and integrate its decentralized geospatial capabilities.

4.2.1 Shared Services for EM&R Project

4.2.1.1 Overview

This FY 2007 project addresses the GSP priority to improve the use of geospatial capabilities in emergency management & response activities. Its goal is to address current gaps in sharing of geospatial data and services, application of standards for geospatial data, technology infrastructure and management, and inefficiencies in performing situation awareness as they support emergency management and response efforts.

In early FY 2007, the GSP approved a project to evaluate the feasibility of leveraging NNSA's Emergency Communications Network (ECN) as a launch-point for a federated delivery of geospatial EM&R shared services. The OCIO is championing this effort; the strategic alliance with NA-44 ensures coordination and visibility of ECN's architecture needs and targets. The project is scoped to consider all aspects of geospatial science resources (people, process, data and technology) as they support EM&R requirements.

4.2.1.2 Scope and Approach

A review of recent geospatial science applications identified 16 that are related to EM&R. The GSP anticipates that there are additional geospatial EM&R capabilities at the more than twenty site Emergency Operations Centers (EOC), the power administrations, and other Program Offices and laboratories that were not captured in the survey. Each capability has its own set of data, processes, and visualizations to support a specific information and decision need for EM&R. The scope of this project is to identify and develop collaborations with the diverse stakeholders and customers, capture requirements, capabilities, and challenges, and develop a Service Enhancement Plan to identify desired improvements and how to achieve them.

Project tasks include:

- Detailed profiling of ECN resources, to capture current and target people, process, data and technology requirements
- Cataloging EM&R geospatial capabilities to collect information on their mission functions, technology platforms, stewardship/customer/stakeholder community, and data requirements
- Prioritizing the capabilities based on breadth of utility, complexity, uniqueness, function maturity, data dependencies and other factors
- Detailed profiling of the resources related to top priority capabilities, to capture current and target people, process, data and technology
- Assessment of profiled capabilities considering alignment with DOE EA and segment architecture requirements, any gaps, weaknesses or challenges to federation within the ECN framework, and approaches to address

Progress to date involves initial profiling of the ECN and visibility of their plans to enhance infrastructure and geospatial services. As distributed EM&R capabilities are identified and profiled, their requirements and processes will be compared against the ECN platform to assess the feasibility of federation within the ECN environment.

4.2.1.3 Task One: Emergency Communications Network (ECN) Profile

4.2.1.3.1 Overview

The ECN is a stand-alone network that connects DOE EOCs for video conferencing, data transmission, e-mail, provides the backbone for intranet applications for emergency management. In the event of an emergency, ECN provides network connections between DOE/NNSA field elements, select national laboratories, NNSA support facilities, and select government incident response support centers to DOE/NNSA Headquarters. The ECN is managed and directed by NA-44, has representation on the GSSC and participates in DOE geospatial science coordination activities.

The ECN team provides NNSA and DOE leadership and other customers with specialized geospatial databases, network and system administration, scientific and technical analysis, and data acquisition, interpretation and classification. The ECN operations are supported from several locations that have historically operated independently. The ECN leadership (NA-44) is working towards integrating the current disparate networks to provide a better, faster, and more complete picture of field operations.

The ECN's plans to improve the integration of its geospatial capabilities for improved response to emergencies is in line with NNSA's overall strategic vision, as outlined by NNSA's 2004 Strategic Plan (see Table 4).

Table 4. Alignment of NNSA Vision and ECN Integration

NNSA Strategic Vision	Geospatial EM&R Integration
Better and faster analysis of real-time data	Utilize modernized geospatial internet mapping technologies to provide a dynamic, interactive geospatial solution for EM&R scenarios
Enhanced response time of the assets through regionalizing assets and partnerships	Infrastructure modernization, data structure and content standardization standardization providing for improved, time sensitive geospatial products and solutions
Greater efficiency in the use of the assets	Integration of existing geospatial EM&R capabilities to provide a uniform geospatial asset solution
Cutting-edge application of advances in technology, encompassing both improved detection and analysis	Infrastructure modernization, data structure and content standardization providing for improved geospatial capabilities
An ever-evolving state-of-the-art communication system	Utilizing the modernization efforts of the overall ECN to facilitate geospatial data and product dissemination

4.2.1.3.2 Current State

The ECN geospatial capabilities provide analysis and mapping support for the Forrestal Operation Center, DOE Alternate Operations Center, and other fixed site ECN users. The ECN provides a wide range of geospatial products including DOE facility site data, maintenance of various geospatial datasets, mapping products, aerial photograph overlays and emergency response datasets used in emergency management scenarios.

An inventory of workstations, laptops, servers and peripheral equipment utilized in current ECN activities was developed to inform the planning process. A data inventory identified all geospatial datasets in use, including data owners, users, providers, descriptions and costs.

4.2.1.3.3 Target State Vision

The ECN's strategic vision is to improve its overall infrastructure, utilize ECN as the lead coordinating agent for geospatial support of EM&R, and enhance its geospatial capabilities. As presented in their FY 2007 Solutions planning documents, the ECN team is integrating its current disparate geospatial science resources into a coordinated geospatial solution that utilizes ECN architecture as the primary vehicle for all DOE/NNSA EM&R geospatial applications to reduce redundancy and provide a more streamlined geospatial response to emergency situations. Consolidating DOE/NNSA resources through ECN will allow for a critical nexus between DOE/NNSA national assets, Headquarters programmatic leadership and field elements to facilitate a seamless transfer of uniform, time-sensitive geospatial data and products.

4.2.1.3.4 Transition Requirements

The successful integration of existing ECN assets will maintain the integrity of individual mission requirements, leverage human capital and infrastructure resources, promote product and data dissemination and standardization, and comply with security procedures and policies. Progress towards this vision is in alignment with and will facilitate progress in the overarching geospatial science segment. The ECN team has identified both short and long term solutions to transition to its target state vision.

Short-Term ECN Solutions:

- Creation and modification of internal procedures to allow for geospatial data and products to be readily shared between field support activities and ECN

Long-Term ECN Solutions:

- Secure interconnection between networks
- Clientless VPN
- Establish extranet connection between network firewalls
- Integration of existing geospatial data, application and web servers
- Server design integration
- Infrastructure modernization and standardization
- Implementation of single operating systems, database systems and datasets

Table 5. Emergency Communications Network Planned Milestones

FY	Goal	Description
2007-08	Extranet - Security, Investment, Cost Savings	A private network that uses protocols and network connectivity to securely share geospatial data, products and information
2007-08	Data Structure	A standardized method of storing geospatial data to ensure maximum efficiency in data analysis, distribution and maintenance
2007-08	Current Cost of Infrastructure- Life Cycle	Total investment in program networks, hardware, software and peripheral equipment and the estimated costs associated with modernization as the current infrastructure becomes obsolete
2007-08	Mission Requirements	Observance with strategic goals of the EM&R programs, ECN, NNSA and DOE
2008-09	ECN Network Configuration	Align current disparate networks with the modernization effort of the overall ECN
2008-09	ARC Server	Utilize modernized geospatial internet mapping technologies to provide a dynamic, interactive geospatial solution for EM&R scenarios

4.2.1.3.5 ECN Data Strategy

The ECN's data strategy directs the integration of existing geospatial data resources from the current, separate ECN operating units into a robust geospatial data repository to reduce redundant processes and maintenance for data creation and purchasing.

The anticipated contents for this centralized data repository include commercially purchased as well as federally provided datasets. The ECN envisions facilitating coordination with commercial data providers and leveraging of additional existing data from other federal agencies to increase the quantity and variety of geospatial data available for use. The ECN also envisions central support for a managed complex-wide site dataset, standardized derivative products and aggressive data mining activities.

The ECN is evaluating adoption of federally accepted geospatial information standards, such as the Homeland Security Data Model for geospatial data, as an approach to improve geospatial data standardization and facilitate data analyses and data distribution both across DOE and in inter-agency support activities/needs.

4.3 Legacy Data Management Program

Geospatial science is an important technology service supporting DOE's mission to complete the safe cleanup of the environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research. Geospatial capabilities are broadly applied in all phases of the remediation processes including condition assessment, design

of solutions, monitoring of actions, evaluation of outcomes, and development of long-term stewardship approaches and institutional controls. These processes rely on and create geospatial data that manages and tracks operations and aids in decision-making. These 'legacy data' represent a significant DOE investment, capturing both scientific research and validation that operations were conducted properly to guarantee the health and safety of surrounding populations, thereby justifying closure and property transfer.

The goals of improved management of legacy geospatial data include:

- Distributed access to a significant scientific and management data collection
- Efficiencies in data development, metadata archiving and advocacy of "best practices"
- Ensuring long-term access to critical information that offers DOE a defense against closure challenges

In recent years DOE has completed cleanup at several major sites, and is on target towards additional remediation and site closures in the next five years. A coordinated and consistent approach to the management of the related legacy geospatial data is critical for efficient and successful transfer of ownership of remediated legacy sites from the Office of Environmental Management to the Office of Legacy Management. Identification of best practices for data use and management, compliance with Federal Geographic Data Committee geospatial data standards, and the establishment of a configuration management approach for long-term archival and access to this data investment are needed.

In FY 2007, the GSP leadership is evaluating projects to advance this initiative. The GSP Tri-Chair for Environmental Management is championing this effort. Recent focus is on identifying and developing collaboration with key stakeholders and partners, and defining Program Office projects for a leveraged funding opportunity.

4.4 Department-Wide Programs

4.4.1 Life Cycle Geospatial Data Management Plan

The Department, through the direction of the GSP, will institute a life cycle geospatial data management plan to effectively and efficiently guide the investment of geospatial information resources and related activities. By organizing geospatial data in a life cycle approach, where each of the phases of the cycle are defined with a common understanding from both a data producer and user standpoint, commonalities can be identified and opportunities for coordination established. The spatial data management plan will be aligned with the principles of OMB Circular A-130 data life cycle approach. In addition and in keeping with the OMB Geospatial Line of Business, the life cycle should be applied not only to data but also to all geospatial assets – to include services and the human resources required to provide a sustainable and accessible set of resources for DOE geospatial community. The interpretation of the A-130 life cycle can also be extended to include 'publish' and 'find' capabilities that are especially critical in the identification and sharing of geospatial data resources.

For the purposes of planning the development of DOE's Geospatial Life Cycle Data Management Plan, the data life-cycle will leverage the current OMB Geospatial Line of Business initiative defining the 'life cycle' as follows:

- Requirements Definition - Users must first define their needs in terms of data, services, and infrastructure based on business-driven requirements
- Identification or Find - Once the requirements are defined, the user searches DOE's assets or inventory to discover the available information resources (e.g., data and services) required using requirements defined in prior step
- Acquire or Create - If assets exist and are immediately available, then they are accessed in real-time through order, download, or via web services. If assets are not available, they need to be acquired or created
- Publish – Data and service providers or integrators should make their assets known to the community by documenting them and making them searchable such that they may be applied to a suitable purpose
- Disseminate - Geospatial assets that have been published are then made available for access
- Process – When new geospatial features are collected, or as existing ones change or no longer exist, the data provider should process and make public data updates
- Maintain - Data, services, and personnel are maintained to provide suitable content, maximum utility, and accuracy to support the requirements of the community
- Store and Manage - Data and services are stored and managed with availability appropriate to the balanced needs of the community
- Use - The geospatial assets are applied to solve a problem
- Disposition – The archival or data resources based upon the original definition requirements

The Department will participate on and contribute to the OMB Geospatial Line of Business and Federal Geographic Data Committee's efforts proposed within the Common Solution and Technical Architecture, to implement a life cycle approach to geospatial information resources investment. The GSP will leverage these efforts to support and supplement the internal development of DOE's Spatial Data Management Plan.

4.4.2 Commercial GIS Licensing

The Department's geospatial science segment leverages commercial geographic information systems (GIS) to support many of its mission and business service activities. The Department's usage of this software has achieved a level where a more comprehensive enterprise license agreement approach would leverage purchase volume discounts.

The goals of coordinated commercial GIS licensing include:

- Improved buying power and reduced total cost of ownership by attaining optimal pricing through aggregation
- Uniform pricing on commonly used geospatial software
- Increased contract administration efficiencies through consolidation of legacy contracts into enterprise license agreements;
- Streamlined geospatial software acquisition and license management

- Improved knowledge-sharing of IT acquisition best practices
- Coordinated source of information for geospatial science segment commercial software usage

The Department's current method for acquisition and maintenance of GIS software licenses has resulted in independent procurements to meet specific programmatic and application needs. The geospatial science surveys conducted in 2003 and 2005 showed that DOE program offices and laboratories were consistently purchasing GIS from ESRI, one of the major industry vendors. In 2005 DOE collected ESRI software usage information in support of the GSA SmartBuy analysis (ESRI is a major commercial software vendor of geographic information systems); results are summarized in Table 6.

Table 6. Department of Energy ESRI Software Usage and Annual Maintenance Costs

License Status	# of Licenses	License Cost	Maintenance Cost
Current (Supported)	1,145	$4,103,420	$980,972
Current (Not Supported)	1,079	$1,501,319	$0
Total	**2,224**	**$5,604,739**	**$980,972**

In FY 2007, the GSP leadership is evaluating geospatial software usage and maintenance requirements to determine the cost / benefit for the use of a coordinated and/or consolidated procurement process. The goals and approach for this effort are aligned with, and will be advanced through, the OCIO's Enterprise Licensing Agreement (ELA) Program. Efforts this year include further analysis and strategy development related to enterprise licensing options for ESRI or other appropriate GIS products. It is anticipated that any roll out will be executed as a phased approach in order to take advantage of near-term vendor incentives while continuing to identify and expand licensing improvements. The GSP, working with the ELA program, will provide communications, identify and engage stakeholders, develop analysis, approve recommendations, and establish metrics for measuring licensing performance improvements.

4.4.3 Commercial Data Licensing

The Department is a charter member of the Federal Geographic Data Committee, as established by OMB Circular A-16 and Executive Order 12906. However, DOE is neither a framework data layer steward nor a primary data producer as defined by the A-16. The Department is a geospatial data consumer and as such has a vested interest in the efficient and effective production of federal geospatial information resources to meet its mission goals and objectives. For those data not produced or available from government sources, DOE will assess commercial data licensing opportunities to meet their data requirements. Commercial data licensing is one method to meet the "acquire or create" phase of the life cycle geospatial data management plan as described in 4.4.1. Once requirements are defined, available data resources will need to be identified and acquired. The acquisition strategy will include a volume based approach in order to leverage existing investment to provide broader access and availability to DOE's geospatial practitioner community.

5 Supplemental Activities

5.1 Senior Agency Official for Geospatial Information (SAOGI)

OMB Memorandum M-06-07: *Designation of Senior Agency Officials for Geospatial Information* (March 2006), established DOE's Chief Information Officer as DOE's primary point of contact for the federal coordination of geospatial science activities. The roles and responsibilities of the SAOGI include:

- Representative on the Federal Geographic Data Committee (FGDC) Steering Committee
- Oversees coordination of geospatial information activities
- Appoints the agency representative to serve on the FGDC Coordination Group
- Appoints representatives to FGDC Subcommittees and/or Working Groups
- Knowledgeable about its agency's geospatial investments
- Collaborates with the agency CIO (if not the CIO) to implement geospatial information initiatives

The Department of Energy is a charter member of the FGDC as established by OMB Circular A-16, and as such the SAOGI oversees, coordinates, and facilitates DOE's implementation of the geospatial-related policies, directives, requirements, and activities. The SAOGI is DOE's representative responsible for involvement in all geospatial coordination and E-Government activities across the federal government including Geospatial Line of Business, Geospatial One-Stop, Federal Enterprise Architecture Geospatial Profile v1.1, SmartBuy and the Subcommittee/Working Groups of the FGDC. The OCIO provides the coordination and technical/operational support to the FGDC and DOE's Geospatial Science Program respectively, and as such ensures a consistent and comprehensive focal point for DOE to be aware of and engaged in activities that influence and benefit DOE's implementation of the geospatial science segment architecture.

5.2 Federal Geographic Data Committee (FGDC)

OMB Circular A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, revised August 2002, describes the management and reporting requirements of federal agencies in the acquisition, maintenance, distribution, use, and preservation of spatial data for the establishment of a National Spatial Data Infrastructure (NSDI) as managed by the by the federal government.

The Circular establishes the FGDC as the inter-agency coordinating body for NSDI-related activities, and forms an executive Steering Committee as the policy-level inter-agency group responsible for overseeing all related activities and implementation NSDI. The Steering Committee's central focus is to provide the executive leadership for the coordination of federal geospatial activities between, among, and within agencies by establishing policy and providing guidance and direction to the member agencies.

The Department SAOGI serves as the charter member of the FGDC Steering Committee and as such is DOE's policy-level oversight of federal geospatial programs and inter-agency

coordination and providing direction for the implementation of the NSDI. The responsibilities of DOE's SAOGI on the Steering Committee members include:

- Overseeing coordination of the member agency's acquisition, management, development, maintenance, documentation, and dissemination of geospatial data using the National Spatial Data Clearinghouse and Geospatial One-Stop portal
- Overseeing coordination of geospatial investment management
- Voting on the adoption of FGDC standards and policies
- Promoting agency compliance with FGDC policies, standards and requirements
- Promoting the allocation of agency resources to fulfill the responsibilities of effective spatial data collection, production, and stewardship
- Ensuring the communication of key national geospatial activities within the agency and with the greater FGDC Community
- Partnering with the agency Chief Information Officer to ensure the agency leverages its cumulative geospatial information investments to benefit agency-wide business processes

5.3 OMB Geospatial Line of Business (GLoB)

The Geospatial Line of Business (GLoB) enables geospatial work and investments across federal programs. Through such cooperation, federal programs can enhance their capacity for understanding and using information in terms of its relevant geography. Optimal use of geographic data and geo-analytics can significantly improve the way that governments plan their strategies; manage their organizations, and offer goods and services to the public. The GLoB recommends a set of common government-wide solutions that serve the Nation's interests, and the core missions of federal agencies and their partners, through more effective and efficient development, provisioning, and interoperability of geospatial data and services. This federal operational framework will result in a more coordinated, collaborative, and leveraged approach to produce, maintain, and use geospatial data and services. Future cost savings, and greater satisfaction of customer and business needs will be realized by optimizing; and where appropriate, consolidating geospatial assets and activities through enhanced performance accountability and compliance mechanisms and coordinated budget planning and cost avoidance strategies.

The GLoB will be managed as a national investment, with oversight provided by the FGDC Steering Committee leadership directed by the SAOGIs. Initial key activities will include:

- Transition Plan
- Business Requirements
- Geo-Enabled Business Practices
- Common Services and Activities
- Budget Coding Structure
- Budget Data Request/Data Call Standardization

5.3.1 Common Solution and Technical Architecture (CS/TA)

The GLoB Common Solutions and Target Architecture (CS/TA) lays out an initial six-year plan with the preferred alternative including the establishment of a GLoB Program Management Office beginning in FY 2007. The elements of the CS/TA include:

- *Common Solutions* – Identifies how the common solutions interact with each other, the drivers, milestones and desired outcomes, specific support tasks, roles and responsibilities, and benefits and risks
- *Conceptual Target Architecture* – Describes how the implementation of common solutions, enabled by a target architecture aligned with the Performance, Business, Technical, Service and Data Reference models that comprise the Federal Enterprise Architecture, and managed processes for information exchange among agencies

The anticipated benefits to the federal agencies include:

- *Enhanced Governance* - Development of a stakeholder centric governance model and robust performance, evaluation, accountability, and reporting mechanisms required to operationalize the NSDI
- *Improved Planning and Investment Strategy* - Incorporate coordinated requirements analyses, planning and budgeting efforts, standardized budget coding to allow automated evaluation and tracking of federal geospatial assets and expenditures, and a common acquisition strategy that includes shared acquisition vehicles and services to reduce or avoid unnecessary costs
- *Optimized and Standardized Geospatial Data and Services* - Utilize known best practices and open standards to establish widespread, shared and re-useable geospatial asset discovery, access/delivery, analysis, training, and brokering services. It also includes mechanisms to standardize agency approaches to geospatial business, technology, services, and data

5.3.2 OMB Geospatial Investment Request

On April 21, 2006, OMB prepared and released guidelines for agencies to report all major and non-major geospatial investments back to OMB by June 15, 2006. This budget guidance directed all departments and agencies to identify and report to OMB their geospatial investments and activities as defined by OMB Circular A-16. The Department provided a cross-complex response to the Data Call classify each identified investment as hardware, software, services (professional), data or other. This coordinated response from the Geospatial Science Program through the OCIO provided further support to the establishment of a geospatial segment architecture for DOE. The report is presented as Appendix A.

Appendix A. Dept. of Energy Geospatial Investments Report, June 2006

DEPARTMENT OF ENERGY GEOSPATIAL INVESTMENTS AND ACTIVITIES

						PY (FY2005)			CY (FY2006)			BY (FY2007)			
Investment Name	Description	UPI Code (IT only)	Type of Investment	Capability provided by Investment	Data Theme managed by Investment	DME	SS	Non-IT	DME	SS	Non-IT	DME	SS	Non-IT	If Cost is Estimated, Provide Rationale
Geospatial One-Stop (e-Gov)	Annual Department support fee to DME of GOS	019-60-01-99-04-0120-24-404-142	Services	Geospatial Information Broker		0.1000			0.1000				0.000		
Geospatial Science Program Management Office	Departmental investment to establish a Geospatial Sciences Program Management Office to maximize the complexwide investment in geospatial activities as they support the DOE mission.	019-60-01-99-02-0120-24-111-034	Services	Specialized Geospatial Business Components (Various)								0.200			Estimated based on expected FTE costs to consolidate agency-wide priority geospatial data .
Geospatial Science Program (GSP)	Department of Energy scientists and engineers across the complex use geospatial technologies as an enabling function applied to mission-specific applications and research. The Geospatial Science Program provides a framework to assess, coordinate, manage, and implement an integrated geospatial science and technology capability to optimize DOE's investments (services/FTEs, hardware, software) in geospatial science and technology activities. (Servers)	Infrastructure 300 UPI - 019-60-02-00-01-5000-00-404-139	Hardware	Specialized Geospatial Business Components (Various)			0.290			0.290			0.290		Based on estimated average maintenance costs for existing investment in hardware supporting geospatial activities.
Geospatial Science Program (GSP)	Department of Energy scientists and engineers across the complex use geospatial technologies as an enabling function applied to mission-specific applications and research. The Geospatial Science Program provides a framework to assess, coordinate, manage, and implement an integrated geospatial science and technology capability to optimize DOE's investments (services/FTEs, hardware, software) in geospatial science and technology activities. (Workstations)	Infrastructure 300 UPI - 019-60-02-00-01-5000-00-404-139	Hardware	Specialized Geospatial Business Components (Various)			0.366			0.366			0.366		Based on estimated average maintenance costs for existing investment in hardware supporting geospatial activities.
Savannah River (SR) Mission Support Systems	Process Control & Support Sub-Element. The SRS Environmental Geographic Information System provides all environmental and infrastructure data sets to the site-wide population. This is done through a centralized server and software distribution system. Limited data is collected through outside resources IE aerial photography every three years and occasional LIDAR.	019-10-01-15-01-1058-00-404-142	Hardware	GIS Server		0.051	0.009		0.017	0.003		0.017	0.003		
Geospatial Sience Program (GSP)	Dept. of Energy scientists and engineers across the complex use geospatial technologies as an enabling function applied to mission-specific applications and research. The Geospatial Science Program provides a framework to assess, coordinate, manage, and implement an integrated geospatial science and technology capability to optimize DOE's investments (services/FTEs, hardware, software) in geospatial science and technology activities. (Licenses)	Infrastructure 300 UPI - 019-60-02-00-01-5000-00-404-139	Software	Specialized Geospatial Business Components (Various)			0.366			0.366			0.366		Based on estimated average maintenance costs for existing investment in software supporting geospatial activities.
Savannah River (SR) Mission Support Systems	Process Control & Support Sub-Element. The SRS Environmental Geographic Information System provides all environmental and infrastructure data sets to the site-wide population. This is done through a centralized server and software distribution system. Limited data is collected through outside resources IE aerial photography every three years and occasional LIDAR.	019-10-01-15-01-1058-00-404-142	Software	Geographical Information System		0.068	0.012		0.068	0.012		0.068	0.012		
National Atmospheric Release Advisory Center (NARAC)	Supported by NNSA and DHS, NARAC provides to the Federal government tools and services that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere. NARAC is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological, and natural emissions. NARAC uses geospatial technologies for model calculations, health effects predictions using population distribution, and dispersion pattern mapping for display/analysis with other data. (Specialized Software Licensing/Object FX)		Software	Geographical Information System				0.018			0.018			0.018	
PNNL EMSL Molecular Science Computing Facility	The MSCF is dedicated to addressing Grand Challenge computational problems in environmental science at the molecular level. Part of the Environmental Molecular Sciences Laboratory (a National Scientific User Facility), the MSCF provides integrated experimental and computational resources for technological innovation in the environmental molecular sciences to support the needs of DOE and the Nation. MCSF provides to its researcher community a commercially licencsed geospatial visualization tool.	019-20-01-21-01-1026-00-109-026	Software	Geographical Information System			0.0007			0.0007			0.0007		
National Atmospheric Release Advisory Center (NARAC)	Supported by NNSA and DHS, NARAC provides to the Federal government tools and services that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere. NARAC is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological, and natural emissions. NARAC uses geospatial technologies for model calculations, health effects predictions using population distribution, and dispersion pattern mapping for display/analysis with other data. (Specialized Data Licensing/TeleAtlas)		Data Acquisition		Buildings and Facilities			0.040			0.040			0.040	

Investment Name	Description	UPI Code (IT only)	Type of Investment	Capability provided by Investment	Data Theme managed by Investment	DME	SS	Non-IT	DME	SS	Non-IT	DME	SS	Non-IT	If Cost is Estimated, Provide Rationale
National Atmospheric Release Advisory Center (NARAC)	Supported by NNSA and DHS, NARAC provides to the Federal government tools and services that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere. NARAC is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological, and natural emissions. NARAC uses geospatial technologies for model calculations, health effects predictions using population distribution, and dispersion pattern mapping for display/analysis with other data. (Specialized Service Licensing/Globe Explorer)		Data Acquisition		Digital Ortho Imagery			0.009			0.009			0.009	
National Renewable Energy Lab's Dynamic Maps, GIS Data & Analysis Tools	As part of its renewable energy mission, DOE's NREL provides a Dynamic Maps, GIS Data and Analysis Tools website. This site supports information transfer on renewable energy sources with access to spatial data of renewable energy resources for energy technologies that are viable solutions in national and international regions. This site also provides access to an FTP site for downloading data and Geospatial Toolkits. Platt (PowerMap and PowerDat) Data Licensing - Energy Infrastructure data		Data Acquisition		Buildings and Facilities			0.056			0.056			0.060	
Office of Transportation Program Transportation Routing Analysis GIS (TRAGIS)	DOE's Office of Transportation Program (formerly NTP) has responsibility for all non-classified shipments of hazardous materials, including radioactive, mixed wastes, and other commodities in support of environmental site clean-up activities. To plan and execute this responsibility, NTP sponsors the development and maintenance of TRAGIS, a GIS-based database and modeling tool for transportation routing. TRAGIS offers numerous options for route calculation utilizing uniquely value added network databases for highway, rail, and waterway infrastructures in the continental US.	019-10-01-15-01-1050-00-404-142	Data Collection		Transportation			0.160			0.180			0.200	
Geospatial Science Program (GSP)	Dept. of Energy scientists and engineers across the complex use geospatial technologies as an enabling function applied to mission-specific applications and research. The Geospatial Science Program provides a framework to assess, coordinate, manage, and implement an integrated geospatial science and technology capability to optimize DOE's investments (e.g. services/FTEs: hardware; software) in geospatial science and technology activities. (Services/FTEs)		Services	Specialized Geospatial Business Components (Various)				12.706			12.582			12.725	Based on an estimated average FTE cost for agency-wide personnel engaged in mission based geospatial science activities.
Savannah River (SR) Mission Support Systems	Process Control & Support Sub-Element. The SRS Environmental Geographic Information System provides all environmental and infrastructure data sets to the site-wide population. This is done through a centralized server and software distribution system. Limited data is collected through outside resources IE aerial photography every three years and occasional LIDAR.	019-10-01-15-01-1058-00-404-142	Services	Specialized Geospatial Business Components (Various)		0.935	0.165		1.020	0.179		1.063	0.188		
National Renewable Energy Lab's Dynamic Maps, GIS Data & Analysis Tools	As part of its renewable energy mission, DOE's NREL provides a Dynamic Maps, GIS Data and Analysis Tools website. This site supports information transfer on renewable energy sources with access to spatial data of renewable energy resources for energy technologies that are viable solutions in national and international regions. This site also provides access to an FTP site for downloading data and Geospatial Toolkits.		Services	Specialized Geospatial Business Components (Various)				0.400			0.400			0.425	
Office of Transportation Program Transportation Routing Analysis GIS (TRAGIS)	DOE's Office of Transportation Program (formerly NTP) has responsibility for all non-classified shipments of hazardous materials, including radioactive, mixed wastes, and other commodities in support of environmental site clean-up activities. To plan and execute this responsibility, NTP sponsors the development and maintenance of TRAGIS, a GIS-based database and modeling tool for transportation routing. TRAGIS offers numerous options for route calculation utilizing uniquely value added network databases for highway, rail, and waterway infrastructures in the continental US.	019-10-01-15-01-1050-00-404-142	Services	Specialized Geospatial Business Components (Various)				0.040			0.065			0.070	
Low Head / Low Power Water Energy Resources	As part of its mission to identify energy opportunities, DOE scientists leveraged GIS to assess low head/low power water energy resources in the US. Research results are shared through a web-enabled GIS application that displays the locations of U.S. natural stream water energy resources and their gross power potential as determined by the analytical process. It also shows the locations of feasible potential hydropower projects which have been determined using a set of feasibility criteria.		Services	Specialized Geospatial Business Components (Various)				0.075			0.075				
Scenario Library Visualizer (SLV)	DOE and DHS support a variety of initiatives for critical infrastructure disruption/vulnerability modeling to help Federal agencies create and evaluate emergency response plans and contingency action plans. SLV is one such initiative focused on electical energy delivery. SLV is a sofware package that consists of a catalog of presolved scenarios that can be modified to analyze and visualize blackouts during an unfolding natural or man-made disaster. SVL uses geospatial technology to support assessment and visualization of impacts.		Services	Specialized Geospatial Business Components (Various)				0.200			0.200			0.200	

Investment Name	Description	UPI Code (IT only)	Type of Investment	Capability provided by Investment	Data Theme managed by Investment	DME	SS	Non-IT	DME	SS	Non-IT	DME	SS	Non-IT	If Cost is Estimated, Provide Rationale
National Atmospheric Release Advisory Center (NARAC)	Supported by NNSA and DHS, NARAC provides to the Federal government tools and services that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere. NARAC is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological, and natural emissions. NARAC uses geospatial technologies for model calculations, health effects predictions using population distribution, and dispersion pattern mapping for display/analysis with other data. (Services/FTEs)		Services	Specialized Geospatial Business Components (Various)				0.060			0.060			0.060	
Computer Assisted Resource Analysis Tool (CARAT)	DOE's Office of Fossil Energy partnered with the Bureau of Land Management under the Federal Lands Technology Partnership to increase access to federal lands for energy development.One initiative is the development of CARAT, a GIS-based decision support system for land use planning activities that would assist the BLM in streamlining reviews of land use applications. The system will provide field office staff easy access to specialized geospatial data to facilitate the review of oil and gas permits.		Services	Specialized Geospatial Business Components (Various)				0.150			0.150				
NNSA STA Transportation Command & Control System	The mission of this system is to aid in the tracking and communication of the safe and secure transportation of nuclear weapons, components and special nuclear materials.	019-05-01-11-01-1040-00-401-119	Services	Specialized Geospatial Business Components (Various)			0.250			0.285			0.200		GIS is subcompnent of larger program. Allocation to geospatial activities were estimated by staff.
INL Environmental Restoration Information System	The ERIS provides database management system, GIS graphics, and related data management services to the Remediation Program. The subcompnent ICP Geospatial System provides the display capabilities.	019-10-01-15-02-5233-00-404-138	Services	Specialized Geospatial Business Components (Various)			0.428			0.428			0.428		
LM LTS&M SEEPro, GEMS, & Environmental Systems Support	LM Long Term Surveillance & Maintenance Mission. SEEPro, GEMS, and Environmental Systems Support operation, maintenance, and update services for Environmental Monitoring and GIS systems. The Geospatial Environmental Mapping System (GEMS) provides dynamic mapping and environmental monitoring data display for sites managed by the U.S. Department of Energy (DOE) Office of Legacy Management.	019-60-01-31-02-3407-00-404-142	Services	Specialized Geospatial Business Components (Various)			0.389			0.409			0.580		Based on an equal proration of the total investment across the three systems.

Appendix B. Acronyms and Abbreviations

CPIC	Capital Planning and Investment Control
CS/TA	Common Solutions and Technical Architecture
DOE	Department of Energy
EA	Enterprise Architecture
ECN	Emergency Communications Network
ELA	Enterprise Licensing Agreement
EM&R	Emergency Management and Response
EOC	Emergency Operations Center
FGDC	Federal Geographic Data Committee
FY	Fiscal Year
GIS	Geographic Information Systems
GLoB	Geospatial Line of Business
GPS	Global Positioning System
GSA	General Services Administration
GSP	Geospatial Science Program
GSSC	Geospatial Science Steering Committee
IPT	Integrated Project Team
IT	Information Technology
NA-44	NNSA Office of Emergency Operations Support
NNSA	National Nuclear Security Administration
NSDI	National Spatial Data Infrastructure
OCIO	Office of the Chief Information Officer
OMB	Office of Management and Budget
SAOGI	Senior Agency Official for Geospatial Information