Geospatial Line of Business Common Solutions and Target Architecture

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1.0 PART I: LINE OF BUSINESS BACKGROUND INFORMATION

1.1 Overview

The Geospatial Line of Business (LoB) addresses data and services that are or can be associated with a location on earth[1]. Internet services, like Google Earth, MapQuest and many newer offerings are popularizing location-enabled services that used to be only accessible to high tech and geography professionals. With these types of services, we can now see that 80 to 90 percent of all data have a locational or geospatial component that could enable a visual representation or mapping of information. This is not an arcane interest of a few Federal agencies. Information and knowledge derived from geospatial data and services are vital to scores of business functions that span all Federal agencies and other levels of government (international, state, local and tribal). In addition, geospatial information serves critical needs of private citizens and commercial businesses in far-ranging ways. For example:

- In Hurricane Katrina, citizens and emergency responders needed to know the nature, magnitude, and timing of anticipated storm destruction in different areas, the location of victims and emergency facilities, the best and nearest evacuation routes, and the actual patterns of damage by location after the storm passed

- Businesses need to know how much the consumer price index is rising in their operating area in order to fairly establish annual salary increases or the geographic growth patterns of new consumer markets to properly plan business investments

- Military veterans need to know what medical services are available in their community and where they can obtain more specialized care

- Farmers can use the measured spatial and temporal trends in climate to help make prudent decisions on future crop selections and irrigation needs

- Citizens and legislators need to know the changing demographics in their community as a result of immigration to guide wise decisions about where tax dollars must provide social services and private investments should fund future development

- Citizens and businesses have a vested interest in whether income tax laws and regulations are being equitably enforced in different regions of the country, e.g., how does the likelihood of being audited vary

Today, there are numerous geospatial efforts being conducted independently across Federal agencies, resulting in disparate data silos and services and investment opportunity losses. It is estimated that hundreds of millions of dollars are spent annually by Federal Agencies and their partners on geospatial data, services, technology and expertise to support their internal business

[1] Geospatial data is information that identifies the geographic location and characteristics of natural or constructed features and boundaries on the Earth. This information may be derived from, among other things, remote sensing, mapping, and surveying technologies.

operations and enhance service to citizens. Advances in technology and the use of geospatial information have outpaced the ability of Federal agencies and their partners to fully benefit from, manage, and share these assets. Contributing factors may include a lack of funding for continuous and targeted training/hiring and university/government partnerships and the continuing need for innovation in organizations, leadership, and management.

The Geospatial LoB has set forth ambitious and transformational goals to better serve the Nation's interests. Building on the policy foundation of the Office of Management and Budget (OMB) Circular A-16[2] ("*Coordination of Geographic Information and Related Spatial Data Activities*") and the President's Management Agenda, the Geospatial LoB will establish a new and more citizen-centric collaborative model for geospatial-related activities and investments. This will create a framework for sustainable participation from non-Federal partners, and create a more coordinated and leveraged approach to producing, maintaining, and using 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. Provisioning the Nation with easy to use geospatial capabilities will promote cheaper, smarter and more efficient government business, services and information.

OMB and the Geospatial LoB are focused on business-driven, common solutions(s) aligned with the Federal Enterprise Architecture (FEA)[3] and guided by the FEA Geospatial Profile[4] and the National Spatial Data Infrastructure (NSDI)[5] in order to support operations across the Nation and beyond. This approach leverages the global information platform (and the growing power of its functional and architectural capabilities) while adhering to privacy, security and other federal regulations. These web-based services will be managed and delivered through trustworthy providers (Federal or commercial) where the following characteristics are present:

- High quality and timely geospatial data and services are easy to find and use by all levels of government, the private sector, and communities of interest (COIs)
- Enterprise business needs and agency core mission requirements can be identified, planned, budgeted and exploited in a geospatial context
- Long term costs of geo-information delivery and access, are reduced and duplicative development efforts are minimized
- Business processes are optimized and knowledge management capabilities exist for locating geospatial data and obtaining services

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[2] http://www.whitehouse.gov/omb/circulars/a016/a016_rev.html

[3] http://www.whitehouse.gov/omb/egov/a-1-fea.html

[4] http://www.cio.gov/documents/FEA_Geospatial_Profile_v1-1.pdf

[5] http://www.fgdc.gov/nsdi/nsdi.html

- Effective, yet less costly COTS systems and contractual business support operations can replace legacy geospatial applications

- Collaborative management of geospatial investments can be made more adaptable, proactive and inclusive

1.2 Guide to the Document

The results of our Geospatial LoB efforts are described in six major sections. Each section is summarized as follows:

LoB Background Information – Includes an overview of the LoB, including a problem statement, and states the vision, goals, and objectives of the LoB.

Concept of Operations (ConOps) – Explains future business processes and activities.

Common Solutions – Identifies the Geospatial LoB common solutions; 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 requires an enabling target architecture that is aligned with the Performance, Business, Technical, Service and Data Reference models that compose the FEA, augmented by the managed processes for information exchange among agencies.

Baseline Architecture – Describes the current state that the target transition strategy must transform to the target architecture and the enabled common solutions.

Target Transition Strategy – Sets forth a time-phased plan for implementing the elements of the proposed common solutions consistent with an orderly transition to the target architecture.

Figure 1 summarizes the relationships between these sections.

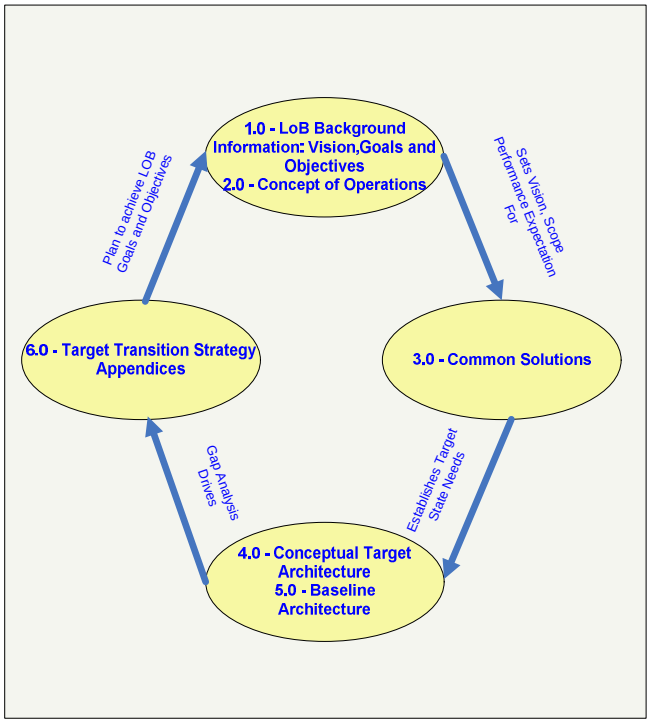

Figure 1: Geospatial LoB Common Solutions and Target Architecture Document Guide

1.3 Problem Statement

Current geospatial efforts are largely conducted independently across Federal agencies based on limited geospatial business requirements definition[6]. There are limited efforts for increasing internal and enterprise effectiveness and efficiency or creating new geospatial resources and services. This inability to better coordinate, organize, and manage business needs yields a situation where:

- Disenfranchised stakeholders perceive that their business requirements are not met and have little incentive to partner financially or share their geospatial assets with the Federal government
- Disparate efforts are underway to complete the National Spatial Data Infrastructure (NSDI) which has delayed its completions and inflated its cost
- Independent geospatial data, services and applications have been developed multiple times to support the same or similar business processes
- Multiple licenses and contracts for the same product or service are in place across the government, reducing the opportunities for economies of scale and increasing the overall cost to the government

[6] Geospatial Information: Better Coordination Needed to Identify and Reduce Duplicative Investments, Government Accountability Office (GAO), GAO-04-703 (June 23, 2004), http://www.gao.gov/new.items/d04703.pdf

- Operational data and services used to support mission specific business functions have not been "geo-referenced" or "geospatially enabled", decreasing their value and use

- Wide disparities in geospatial capabilities exist across Federal agencies resulting in many programs not taking advantage of innovative technologies that are available

1.4 Vision, Goals, Objectives

Vision

The Nation's interests are served, and the core missions of Federal agencies and their partners are met, through the effective and efficient development, provision, and interoperability of geospatial data and services.

Goals and Objectives

Goal 1 - Productive intergovernmental collaboration for geospatial-related activities and investments across all sectors and levels of government.

Objectives -

- To improve governance processes and results in alignment with common geospatial solutions

- To identify, evaluate and implement common geospatial services, processes and best practices

- To enhance coordination across geospatial community stakeholders

Goal 2 - Optimized and standardized common geospatial functions, services, and processes that are responsive to customers

Objectives -

- To implement guidance provided through the FEA Geospatial Profile

- To adopt, deploy and promote effective use of geospatial interoperability standards

- To establish an LoB-wide business architecture for common functions associated with geospatial information

Goal 3 - Cost efficient acquisition, processing, and access to geospatial data and information

Objectives -

- To coordinate geospatial requirements and capabilities

- To identify opportunities and consolidate geospatial acquisition activities when cost-effective and when all essential agency requirements are met

- To enhance LoB-wide portfolio management
- To develop and implement geospatial requirements language for Federal grants and contracts

2.0 PART II: CONCEPT OF OPERATIONS

2.1 High Level ConOps Overview

The high level ConOps identifies the future operating environment, in which participating organizations, stakeholders, partners, and individuals will interact and manage geospatial assets to support business-driven requirements. It is within this context that the proposed Common Solutions, described in Part III will be deployed. Figure 2 provides a high-level view of the geospatial community that is to be engaged in the realization of this Line of Business. Various stakeholder roles are shown in an inclusive governance process to broaden access to geospatial assets. Geospatial assets include services, mission or business data and related information, and human capital that support knowledge management.

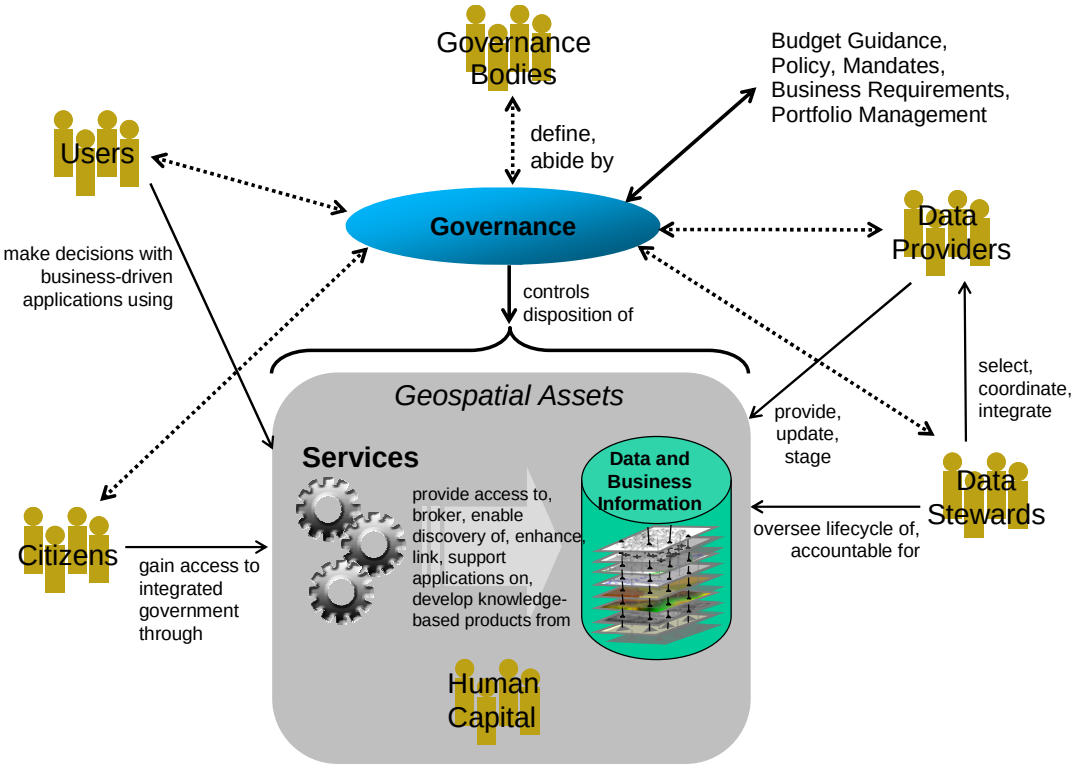

Figure 2: High-Level Concept of Operations Overview

Key stakeholders in the realization of the LoB include:

- ***Users*** who discover, evaluate, and use geospatial assets in the support of decision-making
- ***Citizens*** who gain benefit from geospatially enabled services to citizens through maps and location-aware applications and technologies (e.g. cell phones, PDAs, and GPS)
- ***Data Providers*** who develop, apply quality assurance/quality control, update, and stage geospatial assets

- ***Data Stewards*** who oversee the lifecycle of specific geospatial assets, select, coordinate, and integrate common geospatial assets, and are accountable for their availability in support of community business requirements

- ***Governance Bodies*** where roles and responsibilities are defined based on the role of the participant. There are several requirements to be addressed in the governance of the geospatial community for various stakeholder affiliations

The scope of participation in the Geospatial LoB is inclusive of organizations that produce, coordinate, and consume geospatial data and services. Because one of the primary interests of the LoB is the sharing and reuse of geospatial resources, the main activities under the governance of the LoB include access to sustained, mission-critical information resources and access points for exchange between agencies. The LoB incorporates and respects agency mission responsibilities and promotes reusability through effective and efficient access to geospatial data and services. The precise definition of roles and responsibilities will need to be adjudicated through the proposed governance bodies for the LoB. Although the focus is on the federal government, key non-federal stakeholders will have critical roles to play within the broader geospatial community.

2.2 ConOps Workflow

A workflow diagram that addresses the life cycle of geospatial assets from the perspectives of the provider and the consumer is provided in Figure 3. Both notional data flows (dotted lines) and governance or workflows (solid lines) are depicted in this figure.

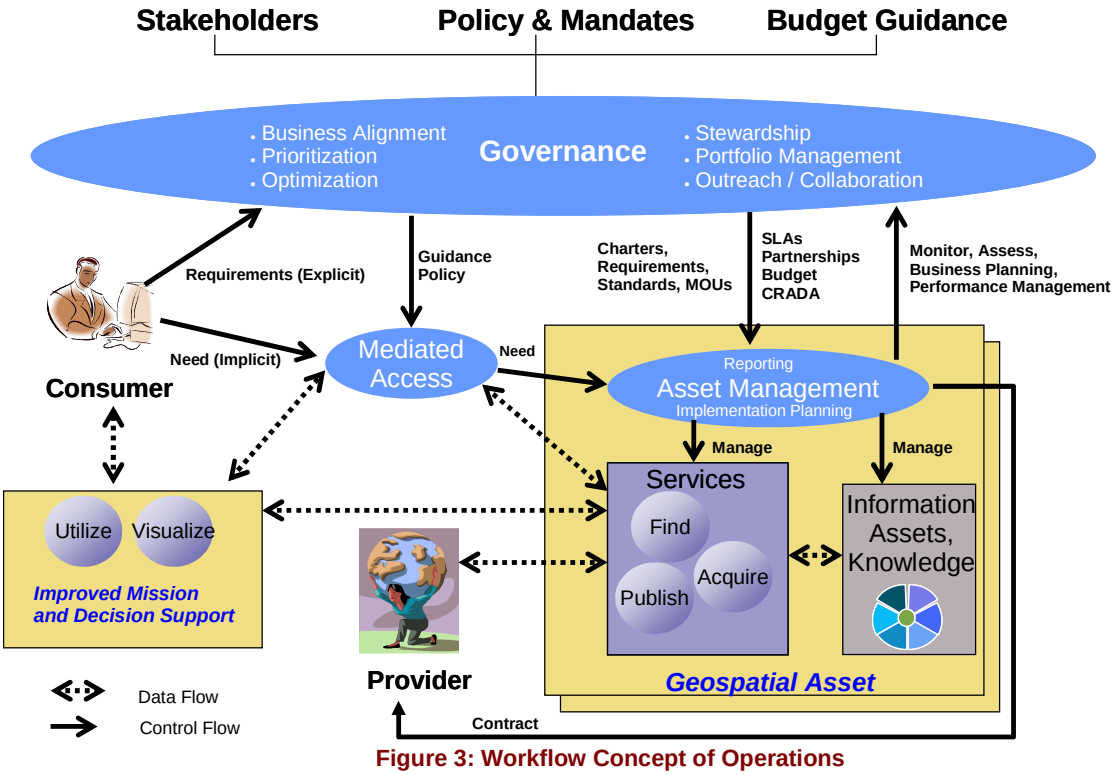

Figure 3: Workflow Concept of Operations

Providers publish their assets as discoverable resources (assets) that consumers, through their decision support environments, would use. Consumers use decision support applications that allow them to discover, visualize, and use geospatial data and their mapped representation. Mediated access, sometimes known as brokering, helps bridge the heterogeneity problem between data producers and consumers through applications for processing, translating, aggregating and integrating data. Asset management is required for both geospatial services and the information assets (data and knowledge). Direct access to assets is also supported for applications to perform routine interactions with geospatial data and services.

2.3 Requirements and Capabilities

In the context of this geospatial community, functional requirements are most readily aligned with the existing principles of OMB Circular A-130 data lifecycle. In the development of the Geospatial LoB, it was recognized that the lifecycle should be applied not only to data, but also to all geospatial assets – to include data, services, and the human resources required to provide a sustainable and accessible set of resources for the community. The interpretation of the A-130 lifecycle was similarly extended to include ***publish*** and ***find*** capabilities that are especially critical in asset awareness across multiple organizations (Figure 4).

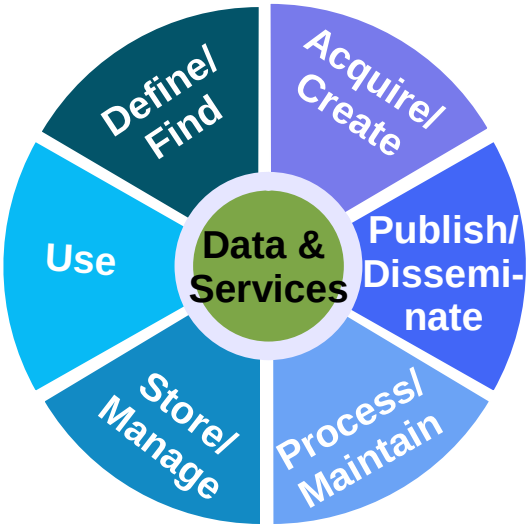

Figure 4: Modified A-130 Asset Lifecycle Elements

The following generic scenarios illustrate the functional requirements and capabilities that are exercised through the lifecycle by the participants in the geospatial community. Key aspects of the inset use scenarios include a citizen user oriented scenario, a scientific publishing scenario that is not time sensitive but knowledge sensitive, and an emergency scenario for immediate access. There are many roles depicted in Figure 3 - Workflow ConOps that are key to successful uptake of geospatial practices. These roles may exist within all sectors of participation – commercial, government, citizen, etc. Each numbered lifecycle element, below, may not be exercised in every scenario by all role types.

Citizen User Scenario:

1.A citizen accesses a government portal to ***find*** what grant or other assistance opportunities are available to them.

2.Portal requests information about the type of assistance required and the location of residence for the citizen.

3.Citizen enters location and other requested information into the portal.

4.Portal interacts with several government grant and assistance programs in different agencies that have been "location-enabled". Portal compares the characteristics of the citizen with the programs, including eligibility by location, and returns eligible program information.

5.Citizen is presented with an integrated listing of eligible programs customized to his/her location ***(use)***.

1. **Define** – In the context of solving a problem, a user must first define their needs in terms of data, services, and infrastructure based on business-driven requirements. Key elements of this step include:

- Categorize requirements - Define data features, properties, quality, reliability, source, standards, etc.
- Refine Requirements - Consider other similar requirements based on common business interests
- Discover – Using Implicit Knowledge Model, suitable real-time data and services can be marshaled in support of a problem (i.e. "I don't know what data I need" or "I don't know how to ask for it). See also "Find"
- Revisit Requirements – Apply governance principles

2. **Find** – Once the requirements are defined, the user searches the community assets as described through data and services metadata using requirements defined in prior step. Key elements include:

- Discover available assets
- Evaluate existing assets (internal and external) against requirements
- Perform gap analysis (if gaps exist, see also "Acquire")
- Revisit in accordance with requirements ("Is the data still useful today?")

Publisher Scenario:

1.A scientists develops a flooding simulation model for a river basin, based on many geographic parameters. The model is made accessible through a web application to support interaction by the public and decision makers. The scientist ***stores*** and ***manages*** the model, the data, and the map.

2.The scientist develops descriptions for the model as an application, the data used, the output data developed, and the map service that allows it's visibility with other maps. The data and services are ***disseminated*** via the web.

3.The scientist registers to ***publish*** the geospatial information . Descriptions of his/her data and applications are made searchable in the Geospatial One-Stop catalog.

4.Potential users may now ***find***, evaluate and otherwise use the scientific data and model to support their business needs.

3. **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 created. Key elements include:

- Data may be created on request but not available in real-time as developed products
- Data or services are created to meet requirements using appropriate collaboration and acquisition methods (contract, agreements, purchase, collection)

4. **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. Key elements include:

- Describe the geospatial assets of all types using standardized metadata including documentation of content, quality, and accessibility

- Post metadata as publicly available for search

5. **Disseminate** —Geospatial assets that have been published are then made available for access. Key elements of this task are:

- Establish role-based secure access to resources
- Support bandwidth, concurrency, time-sensitive and device-sensitive requirements on access
- Make resources available using pull (download, service-based) and push (notification, status/alert) all, personalization, new, updated, and deprecated or deleted resources

Emergency Scenario:

1.An emergency response decision maker with access to the internet and desktop GIS software needs to identify potential routes for evacuation from a coastal area. Current, detailed road information, elevation, and population data are ***requirements.***

2.User consults the Geospatial One-Stop catalog to ***find*** geospatial data with the parameters needed for analysis. Descriptions (metadata) of geospatial data and services are examined and several data sources are selected that cover the topical and geographic area of interest.

3.Some data is ***downloaded*** in real time, other data requires e-Authentication services for ***access*** to restricted content. Maps or live data are made available via web services.

4.Selected information is brought into the desktop GIS application where query and analysis are performed to identify potential evacuation routes based on accurate road conditions (***use***). A map and table are generated as products for distribution to emergency evacuation planners.

6. **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. Key issues:

- Changes to content are solicited from the community and accepted for update
- New, changed, or removed resources and their properties are processed for access
- Use personalization capabilities to keep Community informed

7. **Maintain** – Data, services, and personnel are maintained to provide suitable content, maximum utility, and accuracy to support the requirements of the community, Key elements are:

- Provide accessibility to geospatial resources for broad user base with many conditions and contingencies
- Promote the development and maintenance of employee geospatial skills and introduce geospatial analysis into supporting the solution of traditional business problems
- Educational resources are available online to keep skills current and appropriate to diverse business needs

8. **Store and Manage** – Data and services are stored and managed with availability appropriate to the balanced needs of the community. Key elements of this are:

- Appropriate asset availability is managed and provided for geospatial resources
- Address requirements for critical areas of interest, high-availability areas, real-time, 24x7, historical information
- Plan for extreme access conditions to support full availability (redundancy, replication, bandwidth, cache)
- Support backup/restore/records and archival/disposition requirements

9. **Use** – The geospatial assets are applied to solve a problem. Key elements of this are:

- Apply the geospatial resource in mission applications to support business processes
- Align applications using common or shared geospatial services
- Insert geospatial capabilities into implementation of business processes

3.0 PART III: COMMON SOLUTIONS

3.1 Approach

The Geospatial LoB Task Force, comprising government-wide business leaders and subject matter experts used the approach depicted in Figure 5 to develop a business driven common solution and supporting architecture to enable the Geospatial LoB ConOps.

Geospatial LoB vision, goals and objectives served as the strategic guiding principles for the effort. Using these, the Task Force incorporated the existing geospatial community, organizational entities, and policy arrangements to build a foundation for developing the ConOps. Chief among these are:

- OMB Circulars A-16 (identifying Federal geospatial data theme leads), and A-130 (Data Lifecycle and Dissemination)
- The National Spatial Data Infrastructure (NSDI) and its enabling Executive Order 12906 as implemented by the Federal Geographic Data Committee (FGDC)

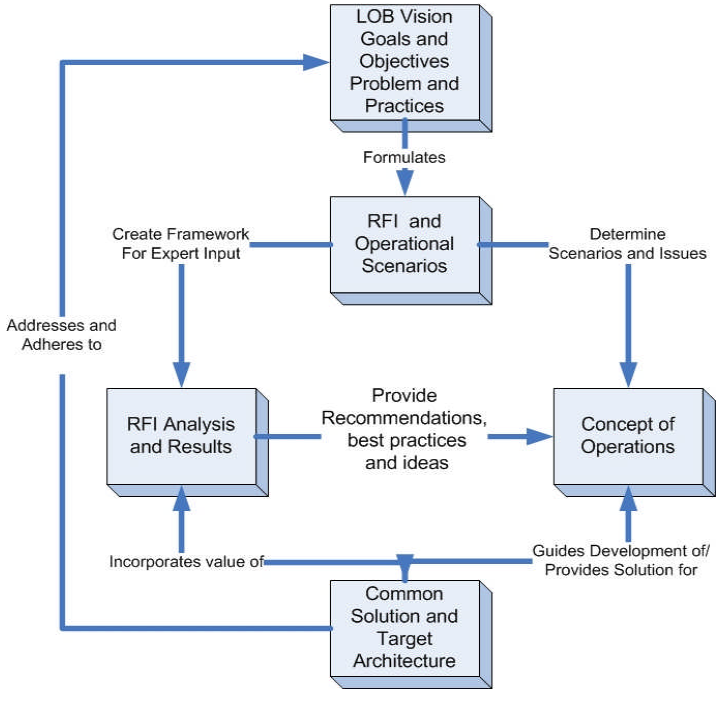

Figure 5: Development Approach

- The Geospatial One-Stop initiative and its geodata.gov portal
- The FEA Geospatial Profile that provides guidance on the introduction of geospatial capabilities into all aspects of agency enterprise architecture

The existing organizational context, institutional knowledge, industry trends, and best practices were assessed and enhanced to create a 5–10 year operational vision for the LoB. This operational vision was informed by and validated against operational scenarios in the areas of science, emergency management, administration, and mission operations.

Three common solution tracks were identified based on high-level requirements articulated by the Geospatial Task Force and from analysis of the following:

- Responses from the Geospatial LoB Request for Information (RFI)
- Proposals in the June 2004 report " NSDI Future Directions Initiative-Towards a National Geospatial Strategy and Implementation Plan"
- Recommendations in the June 2004 GAO document "GEOSPATIAL INFORMATION-Better Coordination Needed to Identify and Reduce Duplicative Investments"
- Input from subject matters experts associated with multiple Federal agencies and agents of those agencies

As common solutions and associated tasks were identified, they were mapped back to the goals and objectives for the LoB (see Appendix B) to ensure a valid line of sight. Tactical implementation details will be finalized and presented to the FGDC Steering Committee by the FGDC Secretariat with support from the Geospatial LoB Program Management Office (PMO) and the FGDC Coordination Group members. Only the most critical common solution implementation elements are described in this section. The descriptions of the detailed solutions, tasks, and outcomes focus on those FY 2007 activities necessary to prepare for the fully operational phase of the Geospatial LoB and key tasks slated for FY 2008 and beyond. The full array solution elements and activities are described in the Transition Activity Table contained in Section 6 of this document.

3.2 Common Solutions Defined

As depicted in Figure 6, the common solution consists of three solution tracks. This solution framework collectively ensures timely, accessible, and quality geospatial data, services, and products that meet citizen and government business requirements in the most cost effective manner. Each solution track plays a critical role in supporting the vision, goals, and objectives of the Geospatial LoB.

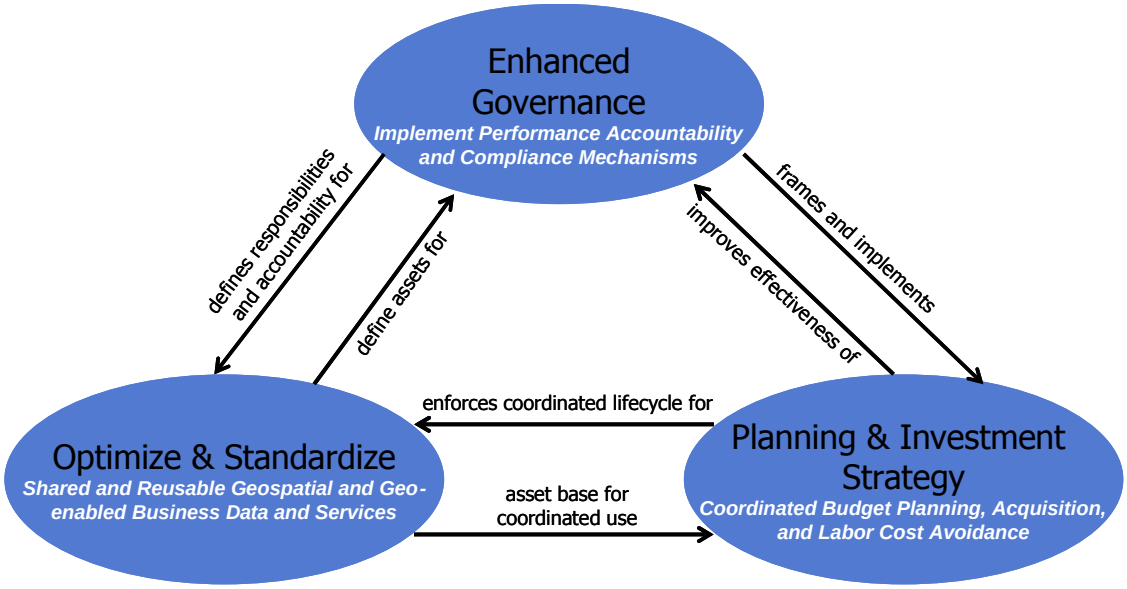

Figure 6: Common Solutions Framework Diagram

Enhanced Governance -

Includes the development of a stakeholder centric governance model and robust performance, evaluation, accountability, and reporting mechanisms required to make the NSDI operational, and improve Federal Agency geospatial program coordination and performance.

Planning and Investment Strategy -

Incorporates, coordinated requirements analyses, planning and budgeting efforts across LoBs, 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.

Optimize and Standardize Geospatial Data and Services -

Utilizes 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.

3.3 Enhanced Governance

Outcome –

Enhanced performance accountability and compliance mechanisms

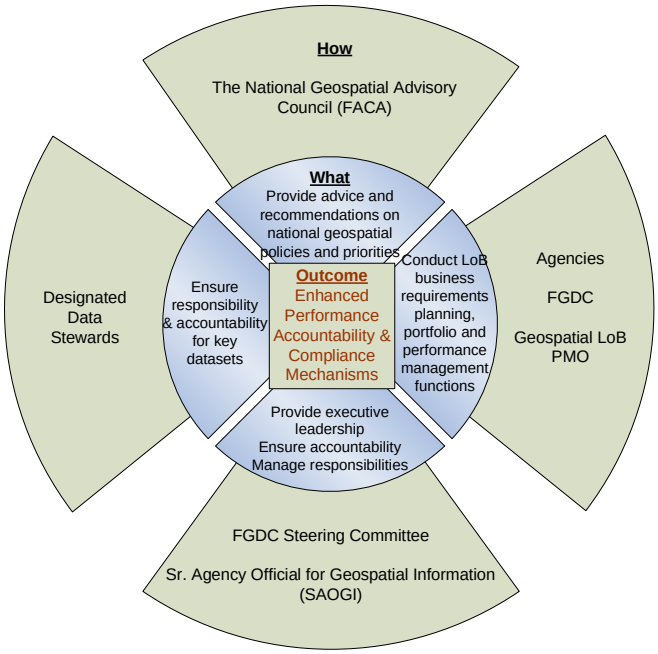

Figure 7: Enhanced Governance Components

The purpose of this solution is to provide an effective and representative governance structure to achieve the goals and objectives of the Geospatial LoB. The current governance model addresses data standards and select enterprise capabilities, but falls short of addressing cross-agency geospatial business and information requirements planning and creating performance accountability. Without a transformation in the governance model and supporting business functions and processes, the Geospatial LoB will not effectively reduce the financial and human resources that are currently necessary to manage nationally significant geospatial assets and provide common cross cutting solutions to improving business performance. As illustrated by Figure 7, the enhanced governance solution provides a forum and mechanisms to provide executive level advice and recommendations on national geospatial policies and priorities, to provide business driven common requirements identification, to facilitate the management of geospatial investments as a national portfolio, and to establish performance based responsibility and accountability for Federal geospatial activities.

Key to the enhanced government solution is agency representation in the Federal decision-making process, and both Federal and non-Federal participation in all other activities. Figure 8 on page 18 depicts the proposed target governance structure.

It is important to note that important components of the Enhanced Governance common solution track include activities, such as the establishment of the National Geospatial Advisory Council (NGAC), that extends beyond the scope of the Geospatial LoB. All external to federal activities identified in Figure 7 will be facilitated by the Department of Interior (DOI) in their role as Chair of the FGDC. The roles and responsibilities are described below:

FGDC Steering Committee:

The Geospatial LoB will be implemented, managed, and sustained by the FGDC as a national investment of its members. The FGDC Steering Committee is the policy-level interagency authority responsible for providing leadership and direction in support of the OMB Circular A-16 related activities, the development of the National Spatial Data Infrastructure (NSDI), and the Geospatial LoB. The FGDC Steering Committee is comprised of the member agency's designated Senior Agency Official for Geospatial Information (SAOGI) who is responsible for internal and external federal agency coordination for the effective and efficient execution of the

OMB A-16 and Geospatial LoB activities. The FGDC Steering Committee will serve as a review and decision-making board for the Geospatial LoB tasks and milestones, with equal voting representation for the oversight and strategic direction of the Geospatial LoB national investment.

The FGDC Steering Committee is chaired by the Secretary of the Department of the Interior. The Deputy Director for Management, OMB, serves as Vice-Chair. Current Steering Committee member agencies are:

Department of Agriculture
Department of Commerce
Department of Defense
Department of Energy
Department of Health and Human Services
Department of Homeland Security
Department of Housing and Urban Development
Department of the Interior
Department of Justice
Department of State
Department of Transportation
Environmental Protection Agency
Federal Communications Commission*
General Services Administration
Library of Congress
National Archives and Records Administration
National Aeronautics and Space Administration
National Capital Planning Commission*
National Science Foundation
Office of Management and Budget
Tennessee Valley Authority
(*Non-voting members)

Departments or agencies that are not members of the FGDC but have significant activities in geographic information or spatial data collection or use, identified by and contributing to the funding strategy for the Geospatial LoB will be requested to become a non-voting Participating Member, and may request voting membership in writing to the Chair of the FGDC. Upon acceptance, they assume the same responsibilities and privileges as other members of the FGDC.

FGDC Coordination Group:
The FGDC Coordination Group is accountable to, and reports to the FGDC Steering Committee and serves as a coordination board for the operational-level interagency management authority responsible for facilitating OMB Circular A-16 related activities, the implementation of the NSDI, and the execution of the Geospatial LoB. Coordination Group member representation and alternate are appointed by each FGDC Steering Committee member. The Coordination Group is chaired and co-chaired by agency members on a rotating annual basis. The Coordination Group shall serve as the operational management oversight body for the effective and efficient prioritization, execution, and administration of the Geospatial LoB, its tasks, milestones, and

deliverables as directed and approved by the FGDC Steering Committee. The Coordination Group will provide management direction to the FGDC Secretariat for the execution of the Geospatial LoB.

FGDC Secretariat:

The FGDC Secretariat Director and staff are accountable and report to the FGDC Steering Committee and Coordination Group. The FGDC Secretariat administers the daily operation oversight and execution of the OMB A-16 related activities and the Geospatial LoB as directed by the FGDC Steering Committee and Coordination Group. The Secretariat is responsible for the effective and efficient execution of Geospatial LoB tasks, milestones, and deliverables. Additionally, the FGDC Secretariat provides the Program Management Office (PMO) contractor support staff direction and contract management oversight. The Department of the Interior provides administrative support to the FGDC Secretariat.

FGDC Program Management Office:

The FGDC PMO provides contractor staff support to the FGDC Secretariat for task execution of the Geospatial LoB as directed by the FGDC Coordination Group and the FGDC Steering Committee. The PMO is responsible for the daily execution of Geospatial LoB tasks, milestones, and deliverables. The PMO contractor staff requirements will be defined based upon individual Geospatial LoB task requirements for Subject Matter Expertise to successfully accomplish the tasks outcomes and deliverables. The scheduled tasks not assigned to the PMO will be completed by government FTE.

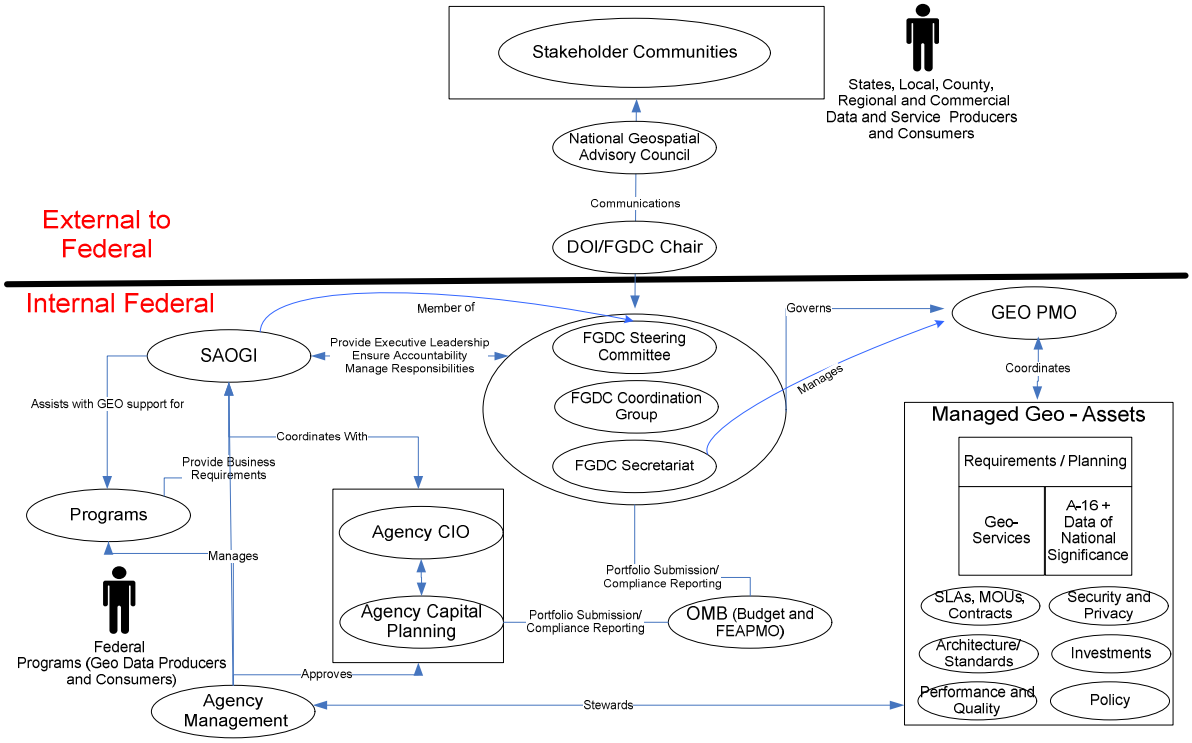

Figure 8: Federal Geo LoB Governance Model (To-Be)

Senior Agency Officials for Geospatial Information (SAOGI), as established by the OMB Memorandum M-06-07, shall provide executive decision-making capability for the Federal stakeholders. Executive agencies, agencies that are part of the Executive Branch, must participate in the governance and execution of the Geospatial LoB to achieve government-wide benefits. Their duties and membership must be reconciled to ensure that they meet evolving roles of the FGDC Steering Committee under this new Geospatial Line of Business.

A means to involve maximum participation by non-Federal partners within this community is also recognized. Governance recommendations from the FGDC Future Directions efforts were also addressed during the development of this LOB.

Key responsibilities of these Officials include:

- Must have authority to modify critical business processes and allocate requisite budgetary resources to ensure their organizations geospatial training, information, technology and service requirements are established in a timely manner

- Represent their agency in the management and decision-making with respect to mission specific and the larger community-wide geospatial assets

- Participate in an open and transparent prioritization process to ensure optimal cost benefit to the government

- Interface with existing agency architecture and investment governance models to ensure the Federal Geospatial Portfolio is used and integrated into the business planning, architecture, capital planning and portfolio maturity efforts

- Coordinate the Federal requirements gathering process with those of the state, local and tribal government geospatial management activities to identify the cost sharing and data reuse opportunities

Data Stewards roles and responsibilities for data themes and other data assets of national significance, as defined by NSDI are assigned to Federal agencies in OMB Circular A-16, but responsibilities regarding geospatial services and related activities, performance expectations and ways to measure them, and establishment of milestones for NSDI goals have not been clearly defined and accountability is lacking.

Current Data Steward Agency responsibilities, listed below, relate to leadership, planning, and development of data and standards and will require updating and modification.

- Assert leadership in the convening of a Community of Interest for a given theme within a formal national standards process to develop data content standards for data exchange and access in support of multi-mission business requirements

- Identify and pursue the most effective and efficient means for data acquisition and update within the community, then marshal those resources to develop data themes from Federal, state, local, tribal, NGO, academic, and commercial sources

- Assure the online availability of geospatial information for data download (exchange) and access using web services and interoperability standards for data content, syntax, and service interfaces

Critical Solution Objectives -

In order to achieve the desired outcome, critical solution objectives are identified as follows:

- A governance model must be established that ensures active stakeholder participation in the management of nationally significant geospatial assets

- Performance measures and service level agreements (SLAs) must be established and monitored for Data Stewards to improve service to citizens and government agencies

- A Federal government-wide geospatial investment tracking process and LoB investment strategy is implemented to facilitate collaboration of planning, development and acquisitions of geospatial assets

- Consistent integration of geospatial capabilities into Federal agencies enterprise architectures wherever appropriate

Critical Solution Tasks -

In order to achieve the critical solution objectives, tasks are identified as follows:

Task 1: Complete the designation of a Senior Agency Official for Geospatial Information (SAOGI) at every Department and independent agency. Develop a formal functional description for the SAOGI that reflects the roles and responsibilities necessary to implement the common solutions of the Geospatial LoB.

Task 2: Update the FGDC Steering Committee and Coordination Group charters to reflect the roles and responsibilities necessary to implement the common solutions of the Geospatial LoB.

Task 3: Establish a Geospatial LoB Program Management Office (Geo PMO) to facilitate agency implementation of the common solutions. Annual work plans will be coordinated/approved with partner agencies.

Task 4: Review and solidify the roles and responsibilities of the Data Stewards for the A-16+ nationally significant geospatial data sets and alter designations as necessary.

Task 5: Establish the National Geospatial Advisory Council (NGAC), based on the Federal Advisory Committee Act (FACA), to provide executive level advice and recommendations on national geospatial policy and priorities.

Task 6: Develop a common set of Federal geospatial investment definitions and budget codes to enable the consistent tracking of Federal geospatial investments and identify opportunities for cost savings.

Benefits -

Solution benefits include institutionalizing a governance model that increases buy-in of all stakeholders in decisions related to the development of the NSDI as well as expedited and more coordinated completion of nationally significant data sets. The solution will also clarify performance responsibilities and ensure performance accountability while garnering greater participation from dependent organizations and other stakeholders.

Risks -

Solution risks include the potential for reduced resource commitment from non-Federal members of the National Geospatial Advisory Council for inter-governmental common solution elements, because FACA committee models allow non-Federal members only an advisory role in

significant governance activities of planning and budgeting. State, local and tribal government counterparts may not be collaborating due to time and budget constraints. Other risks include overcoming existing cultural and organizational barriers, legacy thinking, resistance to changing business processes and current funding model challenges. There is likely to be difficulty in getting agencies to adopt detailed geospatial definitions and budget coding, because they fear loosing budget flexibility. This may cause the milestone for adopting this solution to be delayed.

3.4 Planning and Investment Strategy

Outcome –

Coordinated acquisition, budget planning, and labor cost avoidance

As depicted in Figure 9, the purpose of the Planning and Investment Strategy solution is to develop a series of transformative business processes and supporting mechanisms to improve government-wide business requirements planning and portfolio management capabilities in order to better coordinate acquisition and track geospatial investment performance. Today, the civilian Federal government's limited capability to define, evaluate and track cross agency geospatial investments, including contracts, grants and cooperative agreements has hindered coordination of shared investments for cross-cutting services. This is often because the geospatial community's services are embedded in other, large scale IT investments, making the geospatial component difficult to track and assess for value and performance. A well developed planning and investment strategy addresses these issues by creating a portfolio of managed assets and supporting management control, but needs to be coupled with the enhanced governance solution, as governance provides the decision making and prioritization framework necessary to focus and execute the strategy. This solution provides the supporting business processes to aggregate demand for data and services requirements. Pre-budget submission knowledge of these requirements is critical to providing for economies of scale purchasing and licensing agreements, as well as simplification of administrative support functions, and are requisite inputs to a robust governance solution. The standardization and aggregation of geospatial business requirements will place the Geospatial LoB managers in a position to achieve economies of scale on technology and to provide improved cost management and budget planning. Government FTEs will participate in the coordinated acquisition, budget planning for the Geospatial LoB. For further details of the government FTE skill set

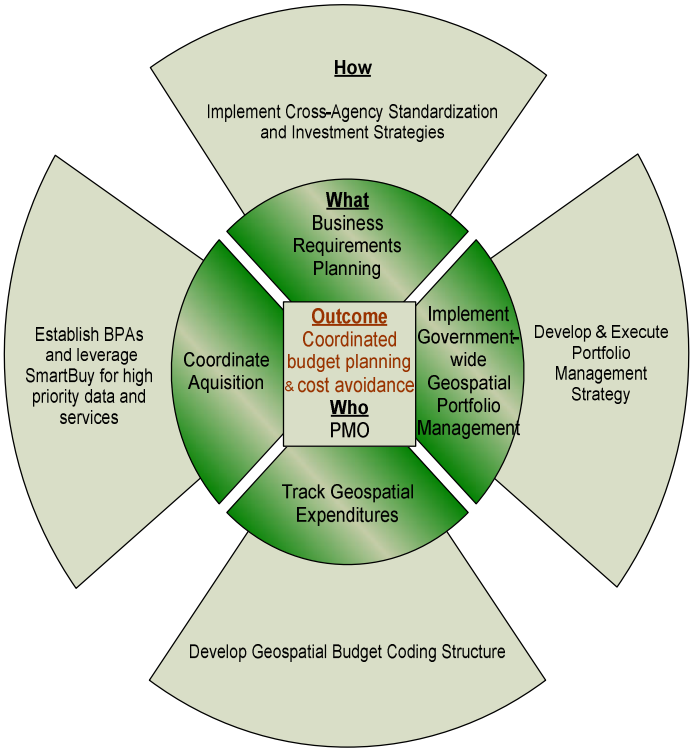

Figure 9: Planning and Investment Strategy Components

profile, see appendix C.

Other Considerations
This Exhibit 300 funding strategy only covers FY 2007 and FY 2008. Another objective is to conduct a better investment data call so that possible duplication and real savings will be identified. In subsequent years, the funding strategy will evolve toward relying more on agency partnerships for specific data or projects and fee-for-service.

The PMO will conduct a survey of the status and accessibility of A16 layers so that agencies can save funds on data development and systems. In addition, the overall cost can be reduced by leveraging shared services such as the eAuthentication service, Business Gateway, IT Security LOB, IT Infrastructure LOB, and perhaps grants.gov, Recreation One-Stop, USA Services, Disaster Management, SAFECOM, E-Training, E-Travel, E-Records Management and other eGov projects as well. New technologies and processes may benefit further the provision of data in less costly and more efficient ways.

Critical Solution Objectives –

In order to achieve the desired outcome, critical solution objectives are identified as follows:

- Develop a government-wide acquisition strategy for geospatial investments
- Manage nationally significant geospatial assets as a Federal-wide common capital asset within a Federal portfolio
- Competitively source geospatial data and services delivery wherever possible

Critical Solution Tasks –

In order to achieve the critical solution objectives, tasks are identified as follows:

Task 1: Develop and apply criteria to promote competitive third-party hosting of data and services both within the government and within the private sector.

Task 2: Prioritize and track investments with geospatial budget codes to foster collaboration with state, local, and tribal government counterparts to identify unnecessarily duplicative collection or application development activities. Define and optimize geo-resource requirements during the budget planning to create opportunities for shared resource utilization in a planned and predictive manner.

Task 3: Investigate and develop appropriate Federal or government-wide acquisition vehicles for geospatial data and technologies such as cross-agency licensing, Smart-Buy, subscription to data or services, working capital funds, and grant mechanisms as well as arrangement such as MOUs and cooperative agreements.

Task 4: Recognize the 34 data sets listed in OMB A-16 as nationally significant data as a Federal-wide, common capital asset and manage them as a Federal portfolio as opposed to individual data sets funded at the discretion of agency managers.

Benefits-

Solution benefits include the establishment of reproducible and more effective methods for doing business and increased optimization of assets for reuse across Federal, state and local governments by institutionalizing governance and enterprise portfolio management processes resulting in improved performance of geospatial investments from both a multi-mission delivery and cost and labor savings perspective. In addition, these tasks will garner greater participation from dependent organizations and other stakeholders to maximize buy-in to common solution development activities.

Risks-

Solution risks include the time it might take to implement this solution due to organizational culture and administrative barriers that need to be overcome within the contracting and budgeting arenas of individual agencies. Many agencies are likely to be reluctant to support third party hosting if they perceive internal resources or positions are threatened even if in the long term there may be significant cost avoidance. Agreement to common grant and budget terminology has proven difficult in efforts already underway and consensus may take more time than anticipated. These barriers can be addressed by using incentive-based funding strategies within the JBC Exhibit 300, policy directives, and strategic communications from OMB or the CIO Council.

3.5 Optimize and Standardize Data and Services

Outcome -

Widespread adoption of shared and reusable geospatial and geo-enabled business data and services

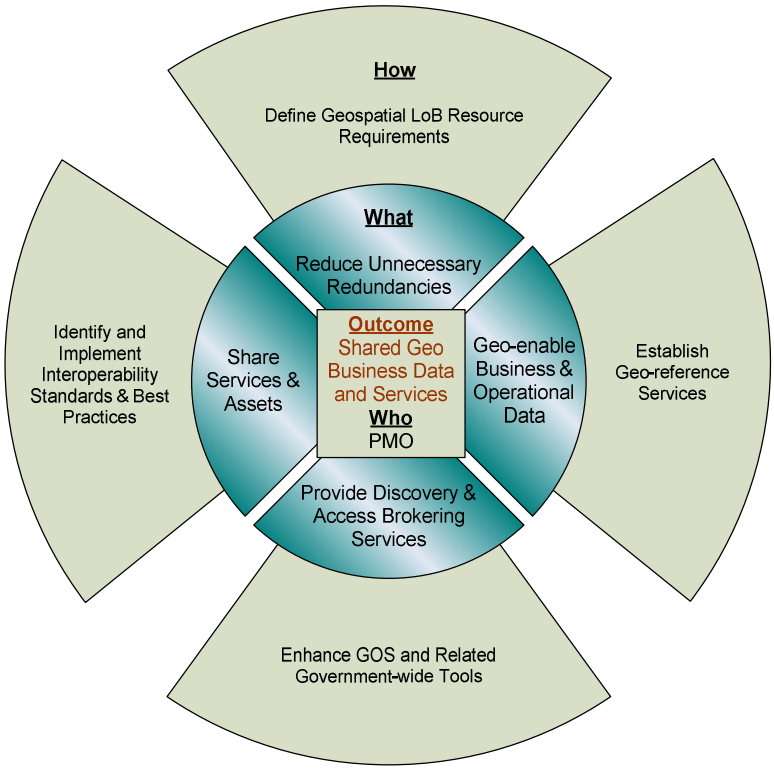

Figure 10: Optimize and Standardize Components

As depicted in Figure 10, the purpose of this solution is to make geospatial data and services more available and to institutionalize the widespread adoption of shared and reusable geospatial and geo-enabled business data and services. Current practices have not yielded consistent data collection and deployment, leading to variable gaps in the availability of current and relevant geospatial data for multiple business purposes. The establishment of standardized web-based data services, likewise, has been slow although a few trusted service arrangements are being established to assure multi-agency access to data for mission use. This condition is equally applicable to A-16 data themes and geospatial mission support data. The means to discover, describe, model, publish, and serve all geospatial data is required to optimize access to and reuse of geospatial solutions across the community. As these data are identified and managed, they will be treated as "National" assets and be subjected to very similar, if not the same, expectations of data management as A-16 information.

This solution includes community tasks that will enhance reliable access to geospatial information through the design and deployment of common, secure enterprise geospatial services correlated with established authoritative data sources. The information access and delivery model is a set of universal services that are required for a wide variety of producers and consumers of geospatial information (individuals, systems, workflow engines). The services provide a flexible, reusable and non-intrusive mechanism to integrate with a wide variety of mission areas without full knowledge of all the local mission requirements. By correlating services to enterprise authoritative information, supported by robust SLAs, the LoB will be removing significant cultural and political barriers currently inhibiting successful geo-interoperability. As new assets mature and are approved by the geo-governance process, these services and supporting authoritative information will be promoted to an enterprise service. Items that are promoted to enterprise service will become elements of the enterprise investment portfolio and will be managed accordingly. The business processes that would support the establishment of enterprise authoritative data can be coordinated to achieve production and integration economies of scale.

Workforce proficiency in geospatial technologies is a key factor in successful uptake of the information and services. Education, outreach, and accommodating technology refresh within the community are critical in the adoption of geospatial capabilities.

Government FTEs will play a major role in communicating the adoption of shared and reusable geospatial and geo-enabled business data and services to their respective agencies.

Critical Solution Objectives –

In order to achieve the desired outcome, critical solution objectives are identified as follows:

- Provide discovery, access, delivery, and brokering services for nationally significant geospatial data
- Near-real-time data and services are available to derive custom products for a variety of uses
- Enhance awareness of geospatial capabilities and their appropriate usage through training and outreach

Critical Solution Tasks –

In order to achieve the critical solution objectives, tasks are identified as follows:

Task 1: Establish effective and efficient geospatial information lifecycle services to enhance decision making using open standards.

Task 2: Initiate implementation of practices and capabilities to extract and link business data with their geographic location for use with other data.

Task 3: Initiate work to establish enhanced training and outreach for the community workforce to ensure uptake, sustainability, integration, and applicability of geospatial capabilities.

Task 4: Implement application and human interfaces that are easy-to-use and are adaptable towards use and re-use by different types of users, including direct and mediated services.

Benefits -

Solution benefits include greater and more immediate access to geospatial information, improved data quality and reliability, reduction in overall IT infrastructure expenditures and labor costs, improved support of business and workflow processes and efficiencies. This will also lead to improved productivity, improved mission delivery, and increased service to citizens. Geospatially enabling traditional business data will improve business process efficiency, allow for geographically based work planning and investment processes, assist in infrastructure asset tracking, improve mission delivery, and promote use of business intelligence in decision support systems.

Risks -

Solution risks include resistance to changing business practices, adoption of new or cutting-edge technology, costs for service deployment, establishment of trust arrangements in support of multiple mission activities, delayed design and implementation costs, and potentially unforeseen architectural transition costs.

3.6 Solution(s) Applicability Analysis, Benefits Estimate and Value Proposition

An initial applicability analysis was done to determine how well the proposed common solutions supported the Geospatial LoB goals and objectives developed by the Geospatial LoB Task force Members.

4.0 PART IV: CONCEPTUAL TARGET ARCHITECTURE

4.1 Purpose

This section presents the Conceptual Target Architecture (CTA) for the common solutions described previously. The purpose of this section is to describe the target "to-be" state towards which the Federal government's geospatial asset investment strategy should be driving. Each agency will be monitored and assessed for progress towards achieving the CTA within the transition framework outlined in Section 6.

Agencies should use this section to architect their individual solutions within their own enterprise architecture, aligning with Federal and agency investment strategies for geospatial assets, and finally implementation utilizing existing standards and guidance provided within this document.

4.2 Target Architecture Approach

The CTA has been derived from analyzing the material presented earlier. Specifically, the vision, goals, and objectives provided the high-level business requirements; the ConOps provides the business process framework for the CTA; the common solutions partitions the CTA into technology-driven, data-driven, and people-driven aspects; the RFI responses provided stakeholder perspectives on driving requirements and architecture principles; and the scenarios described in the RFI provide a validation framework.

The three common solution tracks for the Geospatial LoB present distinctly different aspects of the ConOps. *"Enhanced Governance"* and *"Planning and Investment Strategy"* common solution tracks focus on the processes needed to manage the organizational and data acquisition aspects of the ConOps. Whereas the *"Optimize and Standardize Geospatial Data and Services"* common solution track is focused on the provisioning of data services through technology. For this reason, all three common solution tracks will be addressed from a performance and business layer perspective, but only the *"Optimize and Standardize Geospatial Data and Services"* common solution track will be addressed from the service, technology and data layer perspectives. As information becomes available in the operational phase, additional and necessary architecture development activities will be addressed.

4.3 Target Performance Architecture

The purpose of the Performance Architecture is to establish a set of measures and indicators to determine how successful the implementation of the common solution will be. Based upon the vision, goals and objectives and the ConOps of the Geospatial LoB, performance analysis has established an initial set of FEA Performance Reference Model (PRM) measures and indicators. These are depicted in Appendix A, Table 1. These measures and indicators have been developed to provide guidance to the other layers of the Target Architecture and to inform the Joint Business Case (JBC) development. This information provides comprehensive coverage of key benefit areas of the LoB and ensures an appropriate breadth of indicators to support the requirements of the Capital Planning Investment Control (CPIC) process. In addition, once the recommendations from the common solution are implemented, this information will provide the means to monitor the success of the JBC stated benefits to its actual achieved performance.

4.3.1 Performance Layer Approach

The ConOps and LoB goals strongly recommend a common requirements planning model to identify potential resource savings early in the budget cycle, and a governed approach to reusable geospatial data and services to provide a foundation to support many LoBs with similar needs. These strategies and thoughts guided the evaluation of the complete set of FEA PRM measurement indicators. Special attention was given to the measurement categories related to services, customer-benefits, data sharing and finance. A future enterprise services paradigm requires a strong trusted and transparent relationship between the customers (LoB) and the service providers to facilitate transformation. An emphasis was put on ensuring a high degree of customer benefits-oriented measures to ensure the visibility to the LoBs. The LoBs will require a transparent and focused insight into the management and performance of the service providers. The services themselves will be metered for coverage, availability and quality. The Information Sharing category analysis led to establishing indicators for data sharing, standardization and exchange, which are intended to start to account for measured improvements in the reuse of critical national data assets among the LoBs and stakeholder communities. Financial measures have been established at the portfolio, service, technology and requirements planning level.

As a result, not only are the LoBs the direct beneficiaries of the service improvements, citizens become an indirect beneficiary of this approach when we provide common reusable capabilities to multiple mission areas of the Federal government. These mission areas, in turn, will provide more efficient and effective products and services for citizens. In addition to these internal service improvements, there will be opportunities to improve direct citizen interaction where the Return On Investment (ROI) warrants it. In the past, public data catalogs such as Geospatial One Stop (GOS) have been such an opportunity. Subsequent JBC performance analysis shall validate these preliminary concepts, finalize the measures, and establish the baseline values and the monitoring frequency. The approved performance model will be maintained within a governed portfolio of geospatial assets.

4.4 Target Business Architecture

4.4.1 Common Target Business Process Layer Mappings to FEA Reference Models

The three common solution tracks, developed of themselves, do not directly implement any given agency's business, but the solutions as a whole greatly enhance most agencies' business. Analysis of the 2007 OMB Exhibit 300 submissions demonstrated a very broad applicability of geospatial data services across many business functions and sub functions. Some 50% of the Business Reference Model (BRM) mappings reported by the Federal government have the potential for business enhancement through geospatial data services. However, the individual processes that implement geospatial services belong to the individual agencies, and are numerous. Therefore, although we have identified the business processes associated with each common solution, we have adopted the approach of aligning with the FEA BRM at the common solution level.

The purpose of this section is to help Enterprise Architects map LoB and agency geospatial investments to business activities (functions, sub-functions and processes). This will enable

individual investments (whether, within an agency, cross-agency, of LoB-wide) to be assessed or aligned with business needs.

The business processes associated with each common solution are provided in Appendix A, Table 2.

Appendix A, Tables 3 and 4 provide two views on the mapping of the BRM to the Target Business Architecture. Geospatial assets are pervasive across Federal business. However, it is useful to make a distinction between those activities that service citizens, and therefore require a single responsible Federal agency, versus those activities that are crosscutting and require inter-agency coordination. It is worth noting that many "service for citizens" applications are the culmination of a number of internal business processes. Some of which will require crosscutting coordination.

When agencies are looking to align their Enterprise Architectures with this document they should do so by mapping their business lines to the processes defined in Appendix A, Table 2 through the mappings provided in Appendix A, Tables 3 and 4.

The remainder of the Conceptual Target Architecture is applicable for business needs that align with capabilities from the *"Geospatial Data & Services"* common solution track only.

4.4.2 LoB Goal Alignment

Appendix A, Table 5 illustrates how each common solution and associated business processes address the LoB goals and objectives.

4.4.3 PRM Alignment

Appendix A, Table 6 illustrates targeted business processes mapped to the high-level PRM category, areas, and indicators.

4.5 Target Service Component Architecture

Many of the underlying capabilities for achieving geospatial data and service interoperability have been developed over recent years. What has been missing is the organizing principal that describes how these capabilities fit into interoperable service architecture and can be leveraged within current and legacy environments. It is the purpose of this section to provide that organizing framework.

4.5.1 Service Layer Approach

The Target Service Component Architecture has been derived from Appendix F of the FEA Geospatial Profile (Version 1.1) and the Geospatial Interoperability Reference Model (Version 1.1)[7]. Both these references are focused on documenting traditional geospatial service types and capabilities. Additionally, it should be recognized that geospatial function can be derived from traditionally non-geospatial information resources – data that happen to include fields that could be geo-referenced (i.e. address, census or FIPS code, Public Land Survey, or coordinate pair). One of the goals of this LoB is to 'geo-enable' business data that have not been typically used in geospatial analysis such that they may be more readily used in a geographic context for business purposes. Wherever, the LoB seeks express geospatial services as "special methods" under existing FEA SRM components, as opposed to consolidating geospatial functions into new geospatial SRM components. The benefits of this approach are two-fold:

1) It permits agencies to express their geospatial investments more accurately as elements of a business focused service implementation rather than as a separate geospatial service component outside of the business context, and to cluster those services into a capability appropriate for their application.
2) The de-emphasis of geospatial context means that the Technology Target Architecture will focus the implementation stack of standards in the right order i.e. geospatial standards will have to be supported within the framework of the more general IT standards framework (e.g. SOAP). This will encourage the integration of geospatial services into business process, and provide ready adoption as new applications are identified.

To confirm completeness of this approach, the service components were tested against the scenarios used during the RFI process and the ConOps development.

4.5.2 Service Components

Figure 11 provides the Service Component Target Architecture. Overall, geospatial capability is provided by special geospatial methods within existing FEA Service Components. The exceptions are two new components identified as Geographic Analysis and Imagery Analysis under the Analysis & Statistics Service Type.

[7] Insert link to GIRM ver 1.1

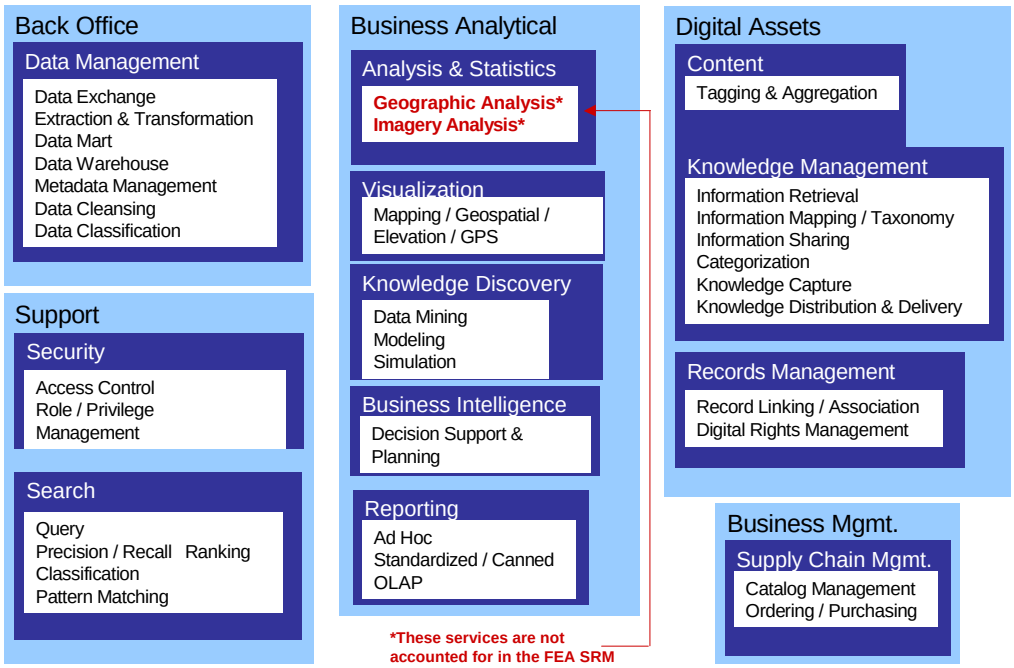

Figure 11: Target Service Component Architecture

Geographic Analysis - A general-purpose set of capabilities for analyzing and processing geospatial data. This service includes general Geographic Information Systems (GIS) services as well as general analytical capabilities such as geocoding, geolocation, navigation & routing, monitoring and tracking, and specific decision applications.

Image Analysis - A general purpose set of capabilities for analyzing and processing geospatial imagery and related metadata. Capabilities in this service area include, image manipulation and processing, feature identification and extraction, image merging (compositing).

Appendix A, Table A7 maps service requirements to capabilities. The table provides a complete description of the service components and the geospatial methods that apply within each of the service components. Architects will be able to identify how to map unique geospatial functions to the FEA Service Components Reference Model thus enabling service component level alignment of geospatial capability within the agency's enterprise architecture.

Appendix A, Table A8 provides a mapping of the service components to the common processes defined in the ConOps. This completes the mapping process by providing the linkage between geospatial capability expressed in the Geospatial Functions column of Appendix A, Table A7 and geospatial services need as expressed by the activities identified in the ConOps.

4.6 Target Technology Architecture

Appendix A, Table A9 maps the functions of the ConOps to the FEA Technical Reference Model (TRM). In addition to this general mapping, this table indicates in the "Technology Comments" column, those specific standards (where relevant) that support the implementation of geospatial methods within the mapped service standard.

4.7 Target Data Architecture

This section outlines a Conceptual Target Architecture that will enable the widespread adoption of shared and reusable geospatial and geo-enabled business data and services. This data architecture will be further elaborated during the operational phase of the Geospatial LoB initiative. This section does not recommend a specific data taxonomy or data schema. Rather, it sets forth principles by which various data sets are stewarded and utilized by the Nation. Data should be defined, structured, and documented to facilitate efficient discovery, sharing, and reuse of geospatial and geo-enabled business data. Specific data schemas shall be documented by lead Federal agencies responsible for nationally significant framework themes and by COIs responsible for thematically or regionally specific data.

Several challenges have been identified that limit the Nation's ability to discover, share, and reuse geospatial data. Nationally significant geospatial data – as defined in OMB Circular A-16 – are not complete and are not shared effectively. A significant amount of Federal data assets are not associated with location (i.e., not "geo-referenced"), thereby limiting the utility of those data as they cannot be visualized or analyzed in a spatial context. Additionally, existing geospatial data assets are not formally aligned with business functions and the taxonomies and data schemas are not adequately documented in a fashion enabling efficient discovery, sharing, and re-use. The Geospatial LoB RFI findings show that citizens and organizations would benefit from interoperability, and that common or interoperable data standards would enable that interoperability. The Target Data Architecture sets forth principles and guidelines for rectifying these issues.

This section is organized by the FEA Data Reference Model (DRM) version 2.0. Figure 12 provides an illustrative overview of the Geospatial LoB Target Data Architecture.

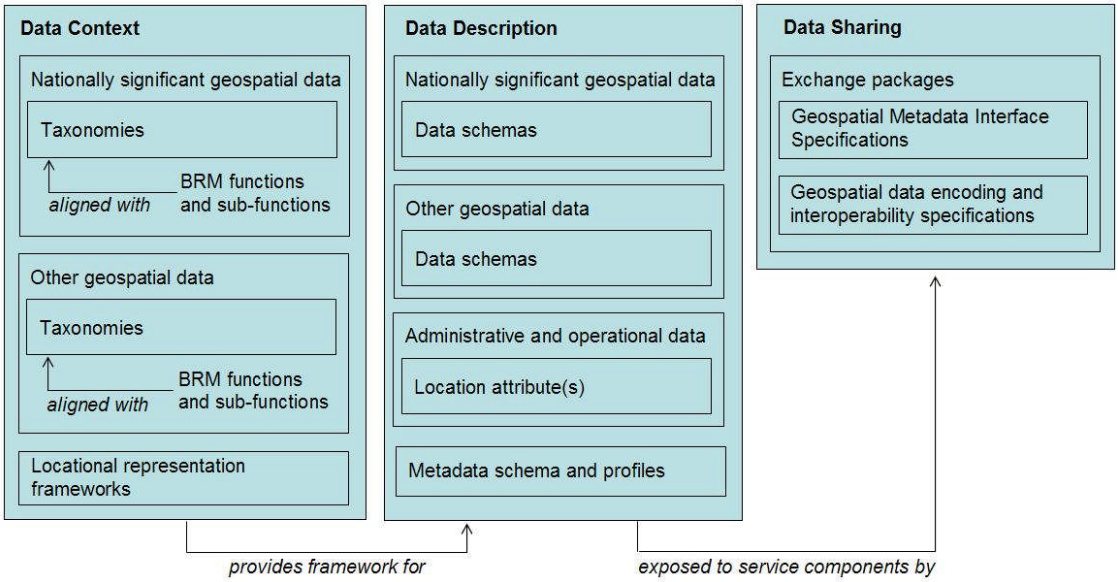

Figure 12: Geospatial LoB Target Data Architecture Framework

4.7.1 Defining Geospatial Data Assets

For the purposes of defining a Target Data Architecture (Figure 14), data assets are categorized as follows:

- **Nationally Significant Geospatial Data** –

  Geospatial data themes of national significance and coverage providing the core, most commonly used set of base data, referred to as "National Spatial Data Infrastructure (NSDI) framework themes" in OMB Circular A-16. These nationally significant geospatial data serve as the foundation of national and regional use and into which other geospatial data (locally oriented, thematically specialized, more detailed) may be "nested". Nationally significant data are stewarded by lead Federal agencies identified in OMB Circular A-16. Lead Federal agencies must establish and maintain data taxonomies and data schemas for nationally significant geospatial data as described in DRM version 2.0.

- **Other Geospatial Data** –

  Other geospatial data include those geospatial data with national or regional coverage that do not fit into the context of the NSDI framework themes set forth in OMB Circular A-16 and state, local, or tribal data that can be "nested" into the nationally significant geospatial data framework themes. Some other geospatial data might be stewarded by COIs with participation by key stakeholders. These COIs may be internal to Federal departments and agencies or can be intra-agency where particular business functions or requirement warrant. COIs should include state, local, and tribal participation as appropriate. Other geospatial data must have their context, taxonomies, and data schemas formally defined, DRM version 2.0 defines the role of

COIs in defining geospatial data context and establishing and documenting data schemas for these data, respectively.

- **Administrative and Operational Data** –

Administrative and operational data are those business data maintained and used by Federal departments and agencies that are specialized or more dynamic in nature used for specific events or analytic purposes. These data are typically non-spatial in nature but include one or more locational attributes (address, etc.) that enables geo-referencing to facilitate fusion with nationally significant and other geospatial data to support specific visualization or analysis needs. Communities of interest may identify the business need (context) warranting the geo-referencing of administrative and operational data.

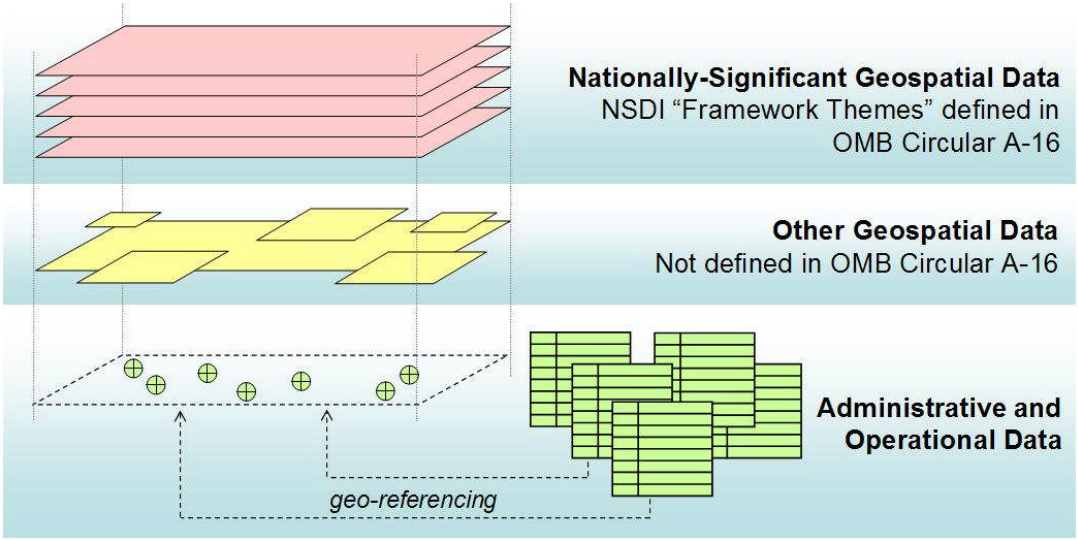

Figure 13: Geospatial Data Asset Categories

4.7.2 Data Context

The FEA DRM Data Context area provides a standard approach to representing taxonomies that data stewards use to categorize data. Taxonomies are important for all data – including geospatial data – to ensure a consistent understanding of how data are organized and how data 'model' the real world. The FEA DRM Data Context also enables the business context of data to be well understood, which enables the ability to track and align geospatial investments by LoB and the ability to establish business- and mission-oriented taxonomies for geospatial data.

4.7.2.1 Defining Taxonomies and Business Context for Geospatial Data

- **Identifying Business Context for Geospatial Data -**

Section 4.1.1 recommends that the common solutions rather than the target architecture be aligned with the FEA BRM. However, Section 4.1.1 also states that

specific LoB and agency geospatial investments should be formally aligned with BRM functions and sub-functions. In accordance with this approach, geospatial *data assets* should be associated with BRM functions and associated functions and sub-functions to formally associate LoB and agency geospatial portfolios to Federal business functions defined in the BRM. This association should be performed by appropriate lead Federal agencies or COIs responsible for stewarding specific data resources.

Nationally significant and other Federally stewarded geospatial data shall be explicitly associated with one or more FEA BRM business functions or sub-functions[8]. The BRM functions and sub-functions with which geospatial data are associated should be recorded in the metadata (see Section 4.7.3.2) describing each data object and in Exhibit 300 submittals as described in Section 3, Common Solutions.

- **Defining Taxonomies for Geospatial Data -**

Taxonomies contain a hierarchy topics and relationships between topics, which in turn define specific data assets. Data assets provide the management context for structured data resources. Once data assets are identified for a given taxonomy, logical data models can be developed to guide physical instantiation and implementation of specific data objects. This framework, described in the FEA DRM version 2.0, should apply to all nationally significant and other Federally stewarded geospatial data.

Taxonomies describing nationally significant and other Federally stewarded geospatial data should be documented using Web Ontology Language (OWL) and the Resource Description Framework (RDF). Taxonomies describing geospatial data can then be made accessible via services defined in the Service Component Target architecture to facilitate efficient search, discovery, and data translation capabilities and to facilitate development of more detailed data schemas and logical data models as described in Section 4.7.3.

Geospatial data schemas should be associated with existing business-oriented taxonomies (i.e., those taxonomies defined by and aligned with the FEA BRM) where possible. This will enable synchronization of geospatial data schemas with business language and processes and better facilitate the integration of geospatial data with departmental and agency-specific enterprise architectures (EAs).

In some cases, taxonomies have been developed describing specific FEA BRM LoBs, functions, and sub-functions, but no explicit reference is made to geospatial representation of data assets. These taxonomies typically describe non-spatial operational and administrative data as described in Section 4.7.1. To facilitate geo-

[8] It is recognized that many geospatial data are cross-cutting and may support several BRM functions or sub-functions. Therefore, it is appropriate to associate geospatial data with multiple BRM functions.

referencing of operational and administrative data, COI's may choose to identify those data assets resulting from the taxonomy that should or could have a geospatial representation and then develop geospatially oriented data schemas to organize geospatial representations of those data.

4.7.2.2 Locational Representation Frameworks

Nationally significant and other geospatial data are inherently geospatial in nature; i.e., they are represented using spatial geometries. Other operational and administrative data are typically non-spatial in nature but can be geo-referenced by rendering spatial objects (points, lines, areas) using locational attributes associated with operational and administrative data objects.

Several frameworks exist for representing location, and are summarized here. The FEA Geospatial Profile provides more information on the international (ISO) and national (ANSI/NISO) standards that govern the representation of location using these frameworks:

- **Spatial Referencing by Coordinates ("Absolute Location") -**

Geographic objects (points, lines, areas) can be represented by one-, two-, or three-dimensional coordinates and coordinate reference systems. nationally significant geospatial data and other Federally stewarded geospatial data should be referenced using absolute location.

Any number of coordinate systems, horizontal and vertical datums, and projections may be applied by different geospatial data. The Geospatial LoB Target Data Architecture does not dictate use of a single, common coordinate reference system, horizontal or vertical datum, or projection. Rather, the metadata describing geospatial data objects shall comprehensively and accurately describe these parameters to enable real-time fusion with other disparate geospatial data and to enable extract, transform, and load (ETL) operations.

- **Spatial Referencing by Geographic Identifiers ("Relative Location") -**

Geospatial data can also be referenced using relative location. Relative location is established by use of geographic identifiers that do not provide precise, explicit coordinate locations for a given data asset. Relative location is typically appropriate when geo-referencing non-spatial administrative and operational data, but can also be associated with geographic objects (points, lines, areas) as attributes. Methods for representing relative location include:

- **Addressing –**

  Addresses specify location by reference to a thoroughfare, landmark or a point of postal delivery. The FGDC is currently coordinating a national addressing standard, to be stewarded by the U.S. Census Bureau upon publication.

- **Linear Referencing –**

  Linear referencing specifies location along a linear feature using a measurement from a known point, such as highway mile-markers.

- **Place Name and Identifier –**

  The U.S. Board of Geographic Names approves the official names of over twenty different types of named locations in the United States, its Territories, and Possessions. The U.S. Geological Survey manages the authoritative place names, identifiers, and their geographic location in the Geographic Names Information System (GNIS). The use of GNIS Identifiers (GNIS-ID) is recommended as a key to unique, officially recognized locations in the U.S.

- **Federal Information Processing (FIPS) Codes**[9] **–**

  ANSI/NISO standard codes ensuring uniform identification of geographic entities in the United States and territories. Relevant FIPS codes include:

  - FIPS Pub 5-2, Codes for the identification of U.S. states
  - FIPS Pub 6-4, Counties and equivalent entities
  - FIPS Pub 8-6, Metropolitan areas (MSAs, CMSAs, PMSAs, and NECMAs)
  - FIPS Pub 9-1, Congressional districts
  - FIPS Pub 55-3, Named populated places, primary county divisions, etc.

- **U.S. Public Land Survey System –**

  Location reference system for western states that reference Meridian, Township, Range, Section and Partitioning for land and resource management

- **U.S. National Grid (USNG) –**

  A hierarchical spatial reference system presenting Universal Transverse Mercator (UTM) coordinates via a scalable grid reference system at various levels of precision[10].

The FEA Geospatial Profile provides a more thorough discussion of the standards and code lists enabling geo-referencing using relative location.

[9] These FIPS Standards are being deprecated and all FIPS codes will be moved to and managed within the GNIS system, described above, and will be nominated as an American National Standard (ANS).

[10] USNG is primarily used to define a 'grid' position for a point or small rectangular area; it is not intended to be used as a coordinate reference system.

4.7.3 Data Description

The FEA DRM Data Description area guides the uniform description of data to enable data discovery, reuse, harmonization, sharing, and exchange. Data Description is based on taxonomies developed under the FEA DRM Context area and result in the development of data schemas that define entities, attributes, associated data types, and the formal relationships between entities. Properly documented, data schemas can then be exposed to the broad user community to enable discovery and understanding of the structure of data assets and to implement physical (operational) data models. The Geospatial LoB Target Data Architecture establishes guidelines for developing and documenting geospatial data schemas and documenting geospatial data resources using metadata.

4.7.3.1 Geospatial Data Schemas

Data schemas define how geospatial data are organized, how geospatial objects relate to each other, and the attributes associated with each object. For maximum interoperability, these schemas must be based standards identified by lead Federal agencies or COIs for logical (abstract/database design) and physical (encoding/exchange) applications. For data that have not been standardized, data schemas should be documented using logical data models with sufficient detail to enable physical data models and development of geospatial data objects. Logical data models are vendor-neutral and are independent of physical data storage devices, but may be used to define data transfer encodings.

Logical data models should be documented using international (ISO) and national (ANSI/NISO) standards including:

- Unified Modeling Language (UML)
- Entity-Relational (E-R) diagrams
- XML schemas

- **Modeling Nationally Significant and Other Geospatial Data**

All nationally significant geospatial data (NSDI framework themes) and Federally stewarded other geospatial data shall have established logical data models. These logical data models shall govern physical implementation (operationalization) of geospatial data.

Logical data models shall be developed by lead Federal agencies responsible for NSDI framework themes – as per OMB Circular A-16 – and by COIs for other Federally stewarded geospatial data.

- **Modeling Administrative and Operational Data**

Taxonomies and logical data models for non-spatial administrative and operational data are expected to be developed by appropriate COIs. Once a decision is made to geo-reference a specific non-spatial data resource, the Geospatial LoB would collaborate with

the authoritative data steward (or COI) to extend those data models to facilitate consistent geospatial representation of those data resources.

4.7.3.2 Geospatial Metadata

All nationally significant and other Federally stewarded geospatial data shall be documented with descriptive metadata to enable discovery, assessment of fitness-of-use, and sharing of geospatial data resources. Geospatial metadata should be organized by a common schema to be applied across the Federal sector that would:

- Be organized in accordance with ISO metadata specifications (ISO 19115 and ISO 19139), thereby documenting key properties of geospatial data resources including but not limited to:
    - **Identification information** including context/topic, search keywords, data set title, etc.
    - **Data quality information** including positional accuracy and precision, adherence to data accuracy standards, completeness, etc.
    - **Spatial representation and reference system information** including geometry properties, coordinate systems, projections, datums, etc.
    - Maintenance frequency, data steward (POC) information, content description, distribution protocol and constraints, etc.
- Contain, to the maximum extent possible, normalized and well-defined metadata descriptive attributes ("pick-lists") to enable efficient discovery; "free-text" metadata tags should be kept to a minimum
- Utilize ISO 19115 Topic Categories to categorize data to facilitate keyword searches and structured query. ISO 19115 topic categories should be mapped to FEA BRM functions and sub-functions to enable the linkage between geospatial data resources and the FEA BRM
- Explicitly define distribution rights and restrictions, to enable role-based access implemented through Federal e-Authentication initiatives and strategy

The common metadata schema should be documented using international (ISO) and national (ANSI/NISO) standards including:

- Unified Modeling Language (UML)
- Entity-Relational (E-R) diagrams
- XML schemas

Lead Federal agencies and COIs stewarding specific data resources may establish targeted profiles that extent the common metadata schema to accommodate descriptive requirements for a particular mission or problem set.

The FGDC is currently developing North American Profile of ISO 19115/19139 metadata standards. This profile will act as the next generation of a government-wide

geospatial metadata schema and, when finalized, will provide the discovery capabilities and meet the objectives of the FEA DRM and DRM XML schema. ISO Metadata supports the collection and management of feature-level, dataset-level (like the current FGDC metadata standard), and collection-level metadata.

Until this profile has been completed and properly vetted, Federal departments and agencies should continue to document all existing geospatial data resources using the Content Standards for Digital Geospatial Metadata (CSDGM) v2.0, 1998 as maintained by the FGDC.

4.7.4 Data Sharing

The FEA DRM Data Sharing area provides an architectural pattern for the sharing and exchange of data through a services-oriented strategy, such as that recommended by the Geospatial LoB. Geospatial data should be encoded using appropriate interface standards and specifications to enable data exchange (fixed recurring transactions between data suppliers and consumers) and less structured requests for data access. This section identifies the key interface standards and specifications to enable geospatial data sharing.

4.7.4.1 Supplier-to-Consumer Matrix

The FEA DRM recommends development of a supplier-to-consumer matrix (or "user"-to-"data provider" matrix as per Figure 3 in Section 2.0, Concept of Operations) to identify organizational (or COI-oriented) information exchange requirements to guide development of service components and information exchange packages. The number of potential consumers of Federal geospatial data assets is too large to warrant an explicit data supplier-to-consumer matrix as recommended by the DRM. The Geospatial LoB Target Architecture will enable any number of consumers to discover availability and fitness-of-use of relevant geospatial data and provide an effective means to connect consumers with authoritative geospatial data through service-oriented discovery, brokering, and access. The service components defined in Section 4.5 will provide broad, cross-cutting capabilities that can be exploited by the full range of potential consumers of Federal geospatial data resources.

4.7.4.2 Geospatial Data Interoperability Standards

Once consumers request access to geospatial data resources (upon performing necessary discovery as described above), these data must be encoded in a fashion by which interoperable service components can access and deliver the data. Geospatial data encoding standards should:

- Be open and vendor-neutral to enable exploitation by a broad range of technology solutions
- Be based on ISO and ANSI/NISO standards

The Geospatial LoB recommends use of the Open Geospatial Consortium (OGC) family of specifications as they are based on and adhere to the two fundamental requirements

listed above. Geospatial data should be encoded and exposed to services using OGC encoding standards including but not limited to:

- Web Map Service (WMS)
- Web Feature Service (WFS)
- Web Coverage Service (WCS)
- Geography Markup Language (GML)
- Style Layer Descriptor (SLD)

The FEA Geospatial Profile provides a more exhaustive list of ISO, ANSI, and OGC geospatial standards and specifications.

4.7.5 Target Data Architecture Summary

In summary, geospatial data should:

- ✓ Be stewarded by formally chartered communities of interest (COI)
- ✓ Be aligned with business functions and sub-functions defined in the FEA BRM and as defined in departmental and agency EAs
- ✓ Have taxonomies defined and documented
- ✓ Have data structures defined and documented
- ✓ Comply with and utilize relevant Federal and international standards
- ✓ Be described using metadata
- ✓ Shared/exchanged using open, vendor-neutral interoperability standards
- ✓ Exposed through services documented in the Service Component Target Architecture outlined in Section 4.5.

In turn, this will:

- ❖ Facilitate the translation and exchange between national and local data resources organized by disparate standards and schemas
- ❖ Improve the ability to fuse disparate data and provide a more comprehensive and holistic view of a particular problem set
- ❖ Improve the ability to make connections and relationships based on location and spatial relationships
- ❖ Increase interoperability, communication and collaboration
- ❖ Reduce redundancy by making existing data discoverable and accessible – and improving access to government information resources – via query and catalog services as described in Section 4.5.

4.8 Integration

The pervasive, cross-cutting nature of embedded and explicit geospatial capabilities in government leads to potential benefits and coordination with many of the existing recognized Federal e-Government initiatives and LoBs. Table 1 shows the results of an initial review of initiatives for which there is a suggested potential integration point with the common solution initiatives of the Geospatial LoB. Initiatives with a higher potential for integration benefit are shown with a double diamond relative to that common solution.

Table 1 - Cross-governmental activities with geospatial benefits

	Common Solutions		
E-Government Initiatives	**Enhanced Governance**	**Planning & Investment Strategy**	**Optimize & Standardize Data & Services**
Government to Citizen			
Recreation One-Stop			♦♦
GovBenefits.gov			♦
E-Loans		♦	♦
Government to Business			
Federal Asset Sales		♦	♦
International Trade Process Streamlining			♦
Consolidated Health Informatics			♦♦
Government to Government			
Grants.gov	♦	♦♦	♦♦
Geospatial One-Stop	♦♦	♦♦	♦♦
Disaster Management		♦♦	♦♦
E-Vital			♦
Internal Efficiency & Effectiveness			
Recruitment One-Stop			♦
Enterprise Human Resources Integration		♦	♦
Integrated Acquisition Environment		♦	
E-Records Management			♦

	Common Solutions		
E-Government Initiatives	**Enhanced Governance**	**Planning & Investment Strategy**	**Optimize & Standardize Data & Services**
E-Authentication			
E-Authentication			♦
HSPD-12			♦
OMB-recognized Lines of Business			
Financial Management		♦	♦
Grants Management		♦	♦
Human Resources Management		♦	♦
Federal Health Architecture			♦♦
IT Security			♦
Infrastructure		♦	♦♦

The prominent initiatives that have the highest potential or need to integrate/coordinate with the Geospatial LoB are in the government-to-government category, where direct sharing of government mission data is supportive of decision-making. The wider availability of all geospatial assets for multiple use, the definition of participant roles and responsibilities backed by performance and accountability measures, the ability to place business data into a geographic context, and coordinated investments – all these stand to provide significant benefit to other initiatives. The strongest category of support is the Optimize and Standardize Data and Services common solution track, which is the provision of access to geospatial and services for use by many applications in many domains.

The Geospatial One-Stop (GOS) initiative was specifically intended to provide improved access, governance, and geospatial data availability. It has resulted in an operational catalog of community data and services descriptions accessible through a portal. The GOS portal may provide a future implementation vehicle for the solution architectures to be defined by the Geospatial LoB.

4.9 Proposed Changes to the FEA Reference Models

The development of the Conceptual Target Architecture has highlighted the need for some additions to the Service Component Reference Model. While we were able to map

the majority of the services on geospatial data to existing Service Components, new services were identified in the ***Analysis & Statistics*** Service Type. Analysis and statistics is a central service area for geospatial data. Many geospatial applications are focused on the detailed analysis of geographic or imagery data. For this reason, the CTA proposes the following service components be added to this Service Type.

Geographic Analysis - A general-purpose set of capabilities for analyzing and processing geospatial data. This service includes general Geographic Information Systems (GIS) services as well as general analytical capabilities such as geocoding, geolocation, navigation & routing, monitoring and tracking, and specific decision applications.

Image Analysis - A general-purpose set of capabilities for analyzing and processing geospatial imagery and related metadata. Capabilities in this service area include, image manipulation and processing, feature identification and extraction, image merging (compositing).

5.0 PART V: BASELINE ARCHITECTURE

5.1 Overview and Purpose

This section is a preliminary, high-level narrative describing the current business practices data, services, and technology environments encompassed within the scope of the Geospatial LoB.

5.2 Baseline Business Architecture

The common solutions outlined in Section 3 reflect the consensus of Agency participants that the largest barriers to optimizing the use of geospatial data and technologies in government business functions are related to insufficient business modeling, governance, policy, and targeted resources. This section summarizes key issues identified with these areas.

5.2.1 Business Process

The business processes of most Federal agencies are oriented around places, therefore geospatial data and capabilities can serve as a strong integrating force in many LoBs and their associated business functions. An analysis by the Geospatial LoB Task Force of the 2007 OMB Exhibit 300 submissions identified a very broad applicability of geospatial data services across many business functions and sub functions. An assessment by the authors of the Geospatial Profile (January 2006) determined that all 39 LoBs delineated within the FEA BRM can benefit from location based approaches to some extent. They identified twenty lines of business (63%) as having primary geospatial elements. In the “Services for Citizens” lines of business, 74% had geospatial components as a primary element. (see Table 2).

Table 2 - Lines of Business that Have Geospatial Elements (per Geo Profile)

Business Area	Lines of Business	Primary or Secondary Element
Services for Citizens	Homeland Security, Intelligence Operations, Defense & National Security, International Affairs and Commerce, Disaster Management, Law Enforcement, Education, Energy, Environmental Management, Health, Natural Resources, Community and Social Services, Economic Development, Transportation	Primary
	General Science and Innovation, Correctional Activities, Litigation and Judicial Activities, Income Security, Workforce Management	Secondary
Support Delivery of Services	Revenue Collection, Internal Risk Management and Mitigation, Controls & Oversight, General Government	Primary
	Legislative Relations, Regulatory Development, Public Affairs, Planning and Resource Allocation	Secondary
Manage Government Resources	Admin Management, Supply Chain Management	Primary
	Financial Management ,Human Resource/ Resource Management , Information and Technology Management	Secondary

Although "geospatially enabling" agency business activities can significantly improve the services provided to citizens and management of government resources, most agencies have not built geospatial requirements management into their business process modeling. When modeling occurs, it is often on an ad hoc basis at a project level versus at the enterprise level, hindering the expansion of geospatial capabilities across all business processes of an agency. Therefore, geospatial data and technology, while currently embedded in numerous different business functions is still not maximized to the extent that it could be to improve decision making. There is a trend for agencies to incorporate geospatial components into their enterprise architecture and agencies including DOI, USDA and EPA are using EA efforts to identify the geospatial aspects of their business functions. The Geospatial Profile released in January 2006 provides a framework for identifying which business processes to "geo-enable."

There is an increasing interest across Federal agencies to share data and collaborate to solve common issues with Federal, State and local government, yet cross agency deployment of application solutions for the same or similar business processes is still not common. This increases the likelihood that independent geospatial applications are being

developed multiple times across the Federal government to support the same or similar business processes. For example, there are the geospatially enabled targeting tools developed used by numerous agencies for environmental impact assessments under the National Environmental Protection Act. This situation is compounded because few policies are in place to encourage cross business function planning and geospatial data and applications are often managed and maintained on a project-by-project basis.

5.2.2 Cost Savings

Federal agencies collectively acquire millions of dollars of geospatial assets. OMB, individual Federal agencies, and cross-government committees and initiatives have each taken actions to coordinate the government's geospatial investments. Many examples of data acquisition partnerships exist. For example, the Department of Agriculture and Department of Interior have collaborated on a land management system. Over 1700 counties have been updated using state, county, tribal, or local geospatial files for the Census Bureau's TIGER Modernization program. The National Digital Orthophotography Program (NDOP) was chartered in 1993 as a consortium of Federal agencies with the purpose of developing and maintaining national orthoimagery coverage in the public domain by establishing partnerships with Federal, State, local, tribal, and private organizations. NDOP has allowed many agencies to acquire much needed imagery by leveraging their collective dollars.

Although the GOS Marketplace is a good starting point for helping ensure that the same data is not acquired more than once, one can not easily ascertain if the same data provider is being used to provide the same data to other Federal agencies or to leverage across agencies to get a price reduction due to the data volume being captured. In addition, many Federal agencies still do not register intended geospatial data collection and acquisition on the Geospatial One-Stop (GOS) Marketplace, stating the intent to spend dollars for geospatial data that could be leveraged to meet all stakeholder needs over the same piece of ground. Where cost data is collected it is not collected consistently which is compounded by the lack of a consistent budget coding structure for geospatial assets.

5.3 Baseline Service Component Architecture

There is a growing number of web mapping and locator services that are helping more business entities understand the benefits of geospatial data and services. However, the current framework for providing consistent reusable geospatial services is fairly fragmented so these services are not always coordinated or optimized. There is a wide range of geospatial capability across government agencies. Some agencies are leaders in geospatial technical innovation, while others still rely primarily on manual processes. Some have implemented service-oriented architectures (SOA), while others are just beginning to explore the potential for its use.

The evolving web service standards and the SOA approach help organizations attain interoperability among services. To date there are few geospatial applications built using multi-source services and a broader use of applications using multiple services will not advance rapidly unless organizations comply with interoperability standards. The

development of shared services through data centers is also limited in the Federal government.

The Geospatial One-Stop portal provides a mechanism to organize, discover, and interact with geospatial resources from all sectors. It is currently configured as a catalog service that enables human negotiation among geospatial resources, but does not currently provide functionality for transparent brokering of service requests to back-end contributors. Enhancing GOS to provide this type of functionality would help to improve its utility as a service provider for end-users. The move from human negotiation among services to automated peer-to-peer, service-to-service negotiated requests with different back-end providers would be an important step toward interagency interoperability.

5.4 Baseline Technology Architecture

This section will be completed after the information from the OMB geospatial investment reporting data call is analyzed (estimated 1Q07).

5.5 Baseline Data Architecture

While the FGDC efforts have resulted in increased use of standards across the Federal government, it is still uncommon to observe consistent implementation of standards across an organization's business processes. At many civil agencies, much of the geospatial data in use across the agency is obtained from different state or local sources. An attempt to observe geospatial data use and patterns across an agency often requires a large amount of up-front work to simply determine which data layers are similar across the various offices. Standards within data sets (attributes, naming conventions, etc) are even more wide-ranging. In many cases, even when standards are applied, it is difficult to ensure rigorous adherence. Discrepancies across data sets from different sources make utilization of disparate data sets challenging, especially during times of heightened pressure, such as an emergency response. The current governance structure does not support the development of policies to enforce the adoption of standards. Thus, there is no guarantee that resources are being spent effectively and that the data or products generated can be reused to realize the full return on investment. There is a greater need for changes in policies to enable geospatial data and services coordination between the defense and intelligence communities and civilian agencies. The use of different standards, protocols and access restrictions has made it difficult to share and then use data, particularly in emergency responses.

Because the current governance structure does not approach the development of priority data sets as a common capital asset, the development of policies to enforce the adoption of standards is lacking. Thus, there is no guarantee that resources are being spent effectively and the data or products generated can be reused to realize the full return on investment.

6.0 PART VI: TARGET TRANSITION STRATEGY

6.1 Redundancy and Gap Analysis

When the data call information from the Federal agencies is received, all reported items will be matched to the target state to identify gaps and redundancies. Taxonomy and ontology will be considered to determine if data truly are redundant or missing. Prioritization will be applied as gaps are further researched against the RFI universe to determine whether existing solutions are available. Redundancies will be closely regarded to determine if any of the current state data collection, processing, services or technologies can be consolidated.

6.2 Feasibility and Alternatives Analysis

As discussed in Section 3.3 Solution Applicability Analysis, the common solution initiatives will be evaluated for cost/benefit analysis, risk analysis, and valuation, as a part of the feasibility and alternatives analysis pending results of the June 2006 data call. Upon completion of the feasibility and alternatives selection, the appropriate transition strategy and plan can be crafted and will be addressed the Geospatial LoB JBC.

6.3 Transition Strategy and Plan

The Federal Transition Framework (FTF) is a single information source for cross-agency IT initiatives. It is developed and maintained by the Office of Management and Budget (OMB) and is an important part of efforts to fulfill government-wide policy objectives. Content related to the initiatives will be placed into the FTF Catalog. The content describes information using a standard series of layers mapped to the Federal Enterprise Architecture (FEA) Reference Models. These layers are illustrated in Figure 16 below.

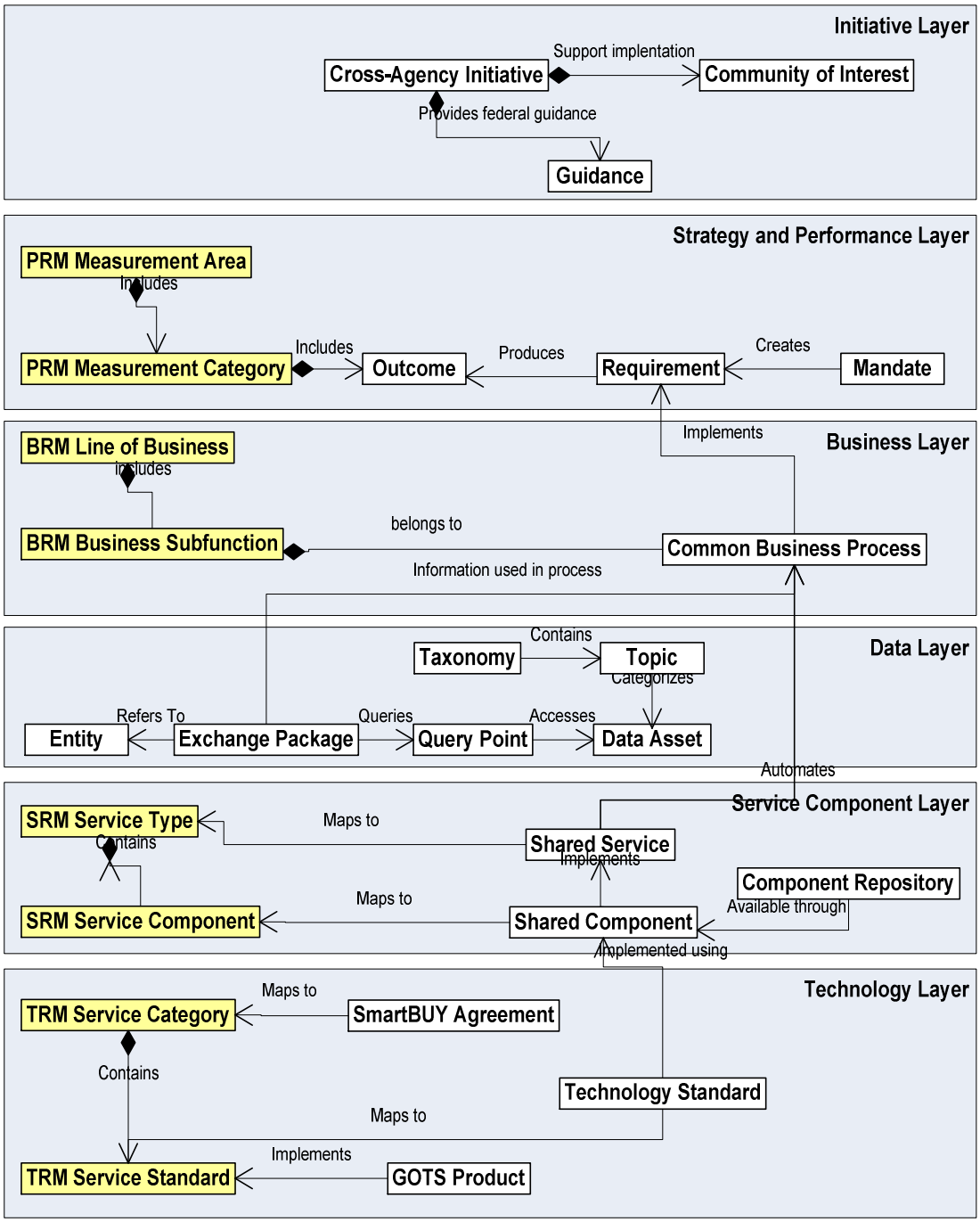

Figure 14: Federal Transition Framework Metamodel

Content related to the Geospatial LoB will be placed into the FTF Catalog. The FTF Catalog will be published in September.

By publishing information about the Geospatial LoB into the FTF Catalog, agencies will:

- Receive more consistent, complete and detailed information about the LoB initiative to inform agency enterprise architecture, capital planning, and implementation activities
- Use information about the LoB to make better informed decisions about agency investments
- Improve the effectiveness and efficiency of IT investments to realize service improvements and cost savings.

In turn, government overall will benefit from:

- More consistent, complete and detailed information about the LoB and be able to more efficiently communicate to a broad audience
- Increased level and speed of adoption of the LoB initiatives
- Improved overall effectiveness and efficiency of IT investments related to the LoB.

In summary, the information published in the FTF Catalog will support the following goals:

- Increase the alignment of agency enterprise architectures with federal IT policy decisions or other forms of official guidance
- Increase sharing and reuse of common, cross-agency processes, services components and technology standards
- Increase collaboration through agency participation in cross-agency communities of practice.

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APPENDIX A: CONCEPTUAL TARGET ARCHITECTURE MAPPINGS TO FEA REFERENCE MODELS

Table A1 represents the performance analysis of Geospatial LoB goals and objectives mapped to the PRM.

Table A 1: Performance Analysis for the Geospatial LoB

Geo LoB Sub-Objectives	FEA Measurement Area	Measurement Category	FEA Generic Measurement Indicator
Goal 1 - Productive intergovernmental collaboration for geospatial-related activities and investments across all sectors and levels of government.			
To enhance coordination across geospatial community stakeholders	Customer Results	Customer Benefit	Customer Satisfaction (% of subscribed customers who are satisfied with service level agreements)
	Customer Results	Service Coverage	New Customers & Market Penetration (% change in the number of new subscribers –end users and applications)
To identify, evaluate and implement common geospatial services, processes and best practices	Technology	Efficiency	Accessibility (change in the number of accesses moving from manual to automated)
To improve governance processes and results in alignment with common geospatial solutions	Process and Activities	Management and Innovation	Innovation and Improvement (measure of the number of LoB, program actively participating in GEO LoB)
Goal 2 - Optimized and standardized common geospatial functions, services, and processes that are responsive to customers			
To establish an LoB-wide business architecture for common functions associated with geospatial information	Customer Results	Service Accessibility	Availability (% of day service is available – work day to be defined)
	Mission and Business Results	Planning and Resource Allocation	Budget Formulation (shared costs)
	Customer Results	Service Quality	Accuracy of Service or Product Delivered (% of products delivered according to specification)
	Mission and Business Results	All LoBs (To Be Assessed)	(labor savings)

Geo LoB Sub-Objectives	FEA Measurement Area	Measurement Category	FEA Generic Measurement Indicator
	Process and Activities	Productivity and Efficiency	Efficiency (for service: measured improvement in time to perform specified task)
	Process and Activities	Management and Innovation	Participation (% of LoB using standard services and authoritative data sources)
	Technology	Information and Data	External Data Sharing (number of formal external data sharing partners)
	Technology	Information and Data	Data Standardization (number of data standards approved and implemented into authoritative data assets using governance model)
	Process and Activities	Quality	Complaints (% change in number of complaints)
	Technology	Efficiency	Interoperability (For each service: time to wait for service from system/app interaction)
	Customer Results	Timeliness & Responsiveness	Delivery Time Response Time (time from request to product delivery)
	Technology	Reliability and Availability	Availability (number of failed bus. Operations due to lack of availability)
Goal 3 - Cost efficient acquisition, processing, and access to geospatial data and information			
To coordinate geospatial requirements and capabilities	Process and Activities	Management and Innovation	Knowledge Management (number of shared requirements consolidated for cost savings)
To enhance LoB-wide portfolio management	Technology	Financial	Costs (% reduction in cost of providing service/customer)
To identify opportunities and consolidate geospatial acquisition activities	Technology	Financial	Licensing Costs (cost / seat)

Geo LoB Sub-Objectives	FEA Measurement Area	Measurement Category	FEA Generic Measurement Indicator
To identify opportunities and consolidate geospatial acquisition activities - To develop and implement geospatial requirements language for Federal grants and contracts - To implement guidance provided through the FEA Geospatial Profile	Process and Activities	Financial	Savings & Cost Avoidance (portfolio aggregated costs / customer) (total cost avoidance/customer)

Table A2 provides the business processes associated with each common solution. This helps identify which processes are important in the management of geospatial asset lifecycle. Note that for "*Optimize and Standardize Geospatial Data & Services*" the business processes identified map back to the capability areas discussed in the ConOps.

Table A 2: Common Solution Business Processes

Common Solution	Process/Capability	Description
Enhanced Governance - Enhance performance accountability and compliance mechanisms	Stakeholder Management	The activities a business enterprise initiates to manage the relationships with its stakeholders. These activities include partnering, consulting, information and controlling depending on the importance of the stakeholder to the enterprise.
	Portfolio Management	The processes, practices and specific activities to perform continuous and consistent evaluation, prioritization, budgeting, and finally selection of investments that provides the greatest value and contribution to the strategic interest of the organization.
	Capital Planning	A decision-making process for ensuring that investments integrate strategic planning, budgeting, procurement, and management of the asset (IT, construction, etc.) in support of agency missions and business needs.
	Enterprise Architecture	The explicit description and documentation of the current and desired relationships among business and management processes and information technology.
	Strategic Planning	Planning which focuses on longer range objectives and goals.
	Governance	The people, policies and processes that provide the framework within which managers make decisions and take actions to optimize outcomes related to their spheres of responsibility.
	Budget Planning	Tactical/ operational financial planning
	Asset Life-cycle Management	The management of an asset (both Data & Services assets) covering all phases of acquisition, operation, and logistics support of an item, beginning with concept definition and continuing through disposal of the asset.
Planning & Investment Strategy - Coordinated acquisition, budget planning, labor cost avoidance	Relationship Management	The management of relationships formed by two or more organizations that share, participate in joint investments, and develop linked and common processes to increase the performance of both organizations.
	Acquisition Planning	The process by which all acquisition-related disciplines of an acquisition program are developed, coordinated, and integrated into a comprehensive plan for executing the program and meeting the stated requirements within the cost and schedule boundaries.

Common Solution	Process/Capability	Description
	Requirements Management & Planning	Concerned with understanding the goals of the organization and its customers and the transformation of these goals into potential functions and constraints
	Requirements Prioritization	The strategic organization of requirements to address business priorities
	Requirements Optimization	The tactical organization of requirements to maximize ROI
Optimized and Standardized Geospatial Data & Services - Widespread adoption of shared and reusable geospatial and geo-enabled business data and services	Define business-driven requirements	Identification of data and services need
	Find data and services	Discovery, Evaluation, and assessment of suitability of geospatial assets
	Acquire	Delivery, purchase, or generation of a geospatial data asset
	Publish	Make known to the public, announce availability
	Disseminate	Distribute or provision geospatial assets
	Update resource content	Change content of a published asset
	Resource maintenance	Provide Level of Service against assets
	Store and manage resources	Host geospatial Assets
	Use	Employ geospatial assets

Table A3 shows how the external or citizen facing services map to the LoB common solutions. These services are consumers of services provided under the common solution for the benefit of the citizen. The contents of the table were deduced using the GEA Profile in the evaluating of each business sub-function and determining if geospatial could help the business effectiveness. The result illustrates the pervasive nature of a geospatial capability. Columns marked "TBD" (To Be Determined) are inadequately described in the OMB FEA BRM to determine the relevance of geospatial capabilities to the sub-function. Future efforts in describing the business value of geospatial capabilities should strive to prioritize the business lines and sub-functions based on potential value/impact and/or cost savings.

Table A 3: BRM to Common Solutions (External)

Line of Business (FEA)	Sub Function (FEA)	Governance	Planning & Investment	Geospatial Data & Services
Services for Citizens				
Natural Resources	Agricultural Innovation and Services	X	X	X
	Water Resource Management	X	X	X
	Conservation, Marine and Land Management	X	X	X
	Recreational Resource Management and Tourism	X	X	X
Energy	Energy Resource Management	X	X	X
	Energy Conservation and Preparedness	X	X	X
	Energy Supply	X	X	X
	Energy Production	X	X	X
Environmental Management	Pollution Prevention and Control	X	X	X
	Environmental Remediation	X	X	X
	Environmental Monitoring and Forecasting	X	X	X
Law Enforcement	Criminal Apprehension	X	X	X
	Citizen Protection	X	X	X
	Crime Prevention	X	X	X
	Property Protection	X	X	X
	Substance Control	X	X	X
	Leadership Protection	X	X	X
	Criminal Investigation and Surveillance	X	X	X
Economic Development	Business and Industry Development	X	X	X
	Financial Sector Oversight	X	X	X
	Industry Sector Income Stabilization	TBD	TBD	TBD
	Intellectual Property Protection	TBD	TBD	TBD
Community and	Community and Regional Development	X	X	X

Line of Business (FEA)	Sub Function (FEA)	Governance	Planning & Investment	Geospatial Data & Services
Services for Citizens				
Social Services	Home Ownership Promotion	X	X	X
	Postal Service	X	X	X
	Social Services	X	X	X
Disaster Management	Emergency Response	X	X	X
	Disaster Preparedness and Planning	X	X	X
	Disaster Repair and Restore	X	X	X
	Disaster Monitoring and Prediction	X	X	X
Health	Consumer Health and Safety	X	X	X
	Health Care Services	X	X	X
	Access to Care	X	X	X
	Population Health Management	X	X	X
	Health Advancement	X	X	X
Homeland Security	Border and Transportation Security	X	X	X
	Key Asset and Critical Infrastructure Protection	X	X	X
	Catastrophic Defense	X	X	X
Education	Higher Education	X	X	X
	Cultural and Historic Exhibition	X	X	X
	Cultural and Historic Preservation	X	X	X
	Elementary, Secondary, and Vocational Education	X	X	X
Transportation	Ground Transportation	X	X	X
	Air Transportation	X	X	X
	Space Operations	X	X	X
	Water Transportation	X	X	X
Workforce Management	Worker Safety	X	X	X
	Training and Employment	X	X	X
	Labor Rights Management	TBD	TBD	TBD
Litigation and Judicial Activities	Judicial Hearings	TBD	TBD	TBD
	Resolution Facilitation	TBD	TBD	TBD
	Legal Defense	TBD	TBD	TBD
	Legal Investigation	X	X	X

Line of Business (FEA)	Sub Function (FEA)	Governance	Planning & Investment	Geospatial Data & Services
Services for Citizens				
	Legal Prosecution and Litigation	X	X	X
General Science and Innovation	Space Exploration and Innovation	X	X	X
	Scientific and Technological Research and Innovation	X	X	X
Correctional Activities	Criminal Incarceration	X	X	X
	Criminal Rehabilitation	X	X	X
Defense and National Security	Operational Defense	X	X	X
	Strategic National and Theater Defense	X	X	X
	Tactical Defense	X	X	X
Income Security	Food and Nutrition Assistance	X	X	X
	Housing Assistance	X	X	X
	Survivor Compensation	TBD	TBD	TBD
	Unemployment Compensation	TBD	TBD	TBD
	General Retirement and Disability	TBD	TBD	TBD
Intelligence Operations	Intelligence Planning and Direction/Needs	X	X	X
	Intelligence Collection	X	X	X
	Intelligence Analysis and Production	X	X	X
	Dissemination	X	X	X
International Affairs and Commerce	Foreign Affairs	X	X	X
	Global Trade	X	X	X
	International Development and Humanitarian Aid	X	X	X

Table A4 shows how the internal or cross agency services map. These services can also be consumers for internal agency business processes, but are more likely to be providers of services for the coordination of the common solution processes, which are then consumed by other agencies in the provisioning of their own citizen services.

Table A 4: BRM to Common Solutions (Internal)

Line of Business (FEA)	Sub Function (FEA)	Governance	Planning & Investment	Geospatial Data & Services
Management of Government Resources (Cross-Agency)				
Financial Management (Cross-Agency)	Reporting and Information (Cross-Agency)	X	X	X
Administrative Management (Cross-Agency)	Help Desk Services (Cross-Agency)			X
Human Resource Management (Cross-Agency)	Training Management (Cross-Agency)		X	
Information and Technology Management (Cross-Agency)	Information Management (Cross-Agency)	X	X	X
	IT Infrastructure Maintenance (Cross-Agency)	X	X	X
	IT Security (Cross-Agency)	X	X	X
	Lifecycle-Change Management (Cross-Agency)	X		X
	Record Retention (Cross-Agency)			X
	System Development (Cross-Agency)			X
	Systems Maintenance (Cross-Agency)			X
Supply Chain Management (Cross-Agency)	Goods Acquisition (Cross-Agency)		X	
	Services Acquisition (Cross-Agency)	X	X	X
Mode of Delivery - Financial Vehicles				
Federal Financial Assistance	Federal Grants (Non-State)	X	X	
Transfers to State & Local Governments	Earmarked Grants	X	X	
Knowledge Creation and Management	Knowledge Dissemination			X
Knowledge Creation and Management	Research & Development		X	
Public Goods Creation & Management	Information Infrastructure Management			X
Regulatory Compliance and Enforcement	Standard Setting/Reporting Guideline Development	X		
Support Delivery of Services (Cross-Agency)				

Line of Business (FEA)	Sub Function (FEA)	Governance	Planning & Investment	Geospatial Data & Services
Internal Risk Management and Mitigation (Cross-Agency)	Contingency Planning (Cross-Agency)			**X**
	Continuity of Operations (Cross-Agency)			**X**
	Service Recovery (Cross-Agency)			**X**
Planning and Resource Allocation (Cross-Agency)	Budget Execution (Cross-Agency)			**X**
	Capital Planning (Cross-Agency)	**X**	**X**	
	Enterprise Architecture (Cross-Agency)	**X**		
	Management Improvement (Cross-Agency)	**X**		
	Strategic Planning (Cross-Agency)	**X**		
Public Affairs (Cross-Agency)	Official Information Dissemination (Cross-Agency)	**X**		**X**
	Product Outreach (Cross-Agency)			**X**
Regulatory Development (Cross-Agency)	Policy and Guidance Development (Cross-Agency)	**X**		
	Public Comment Tracking (Cross-Agency)	**X**		
Revenue Collection (Cross-Agency)	User Fee Collection (Cross-Agency)			**X**

Table A5 illustrates how each common solution and associated business processes address the LoB goals and objectives.

Table A 5: LoB Goal Alignment

Enhanced Governance									Planning & Investment Strategy					Optimize and Standardize
Stakeholder Management	Portfolio Management	Capital Planning	Enterprise Architecture	Strategic Planning	Governance	Program Management	Budget Planning	Asset Lifecycle Management	Relationship Management	Acquisition Planning	Requirements Management and Planning	Requirements Prioritization	Requirements Optimization	All Capabilities
Goal 1 - Productive intergovernmental collaboration for geospatial-related activities and investments across all sectors and levels of government.														
To enhance coordination across geospatial community stakeholders														
X					X			X	X		X			
To identify, evaluate and implement common geospatial services, processes and best practices														
X														X
To improve governance processes and results in alignment with common geospatial solutions														
X					X									
Goal 2 - Optimized and standardized common geospatial functions, services, and processes that are responsive to customers														
To establish an LoB-wide business architecture for common functions associated with geospatial information														
X	X			X	X			X	X	X	X	X	X	
To adopt, deploy and promote effective use of geospatial interoperability standards														
X								X	X	X				X
To implement guidance provided through the FEA Geospatial Profile														
X		X	X				X			X	X	X	X	X
Goal 3 - Cost efficient acquisition, processing, and access to geospatial data and information														
To coordinate geospatial requirements and capabilities														
X			X					X	X					

Enhanced Governance									Planning & Investment Strategy					Optimize and Standardize
Stakeholder Management	Portfolio Management	Capital Planning	Enterprise Architecture	Strategic Planning	Governance	Program Management	Budget Planning	Asset Lifecycle Management	Relationship Management	Acquisition Planning	Requirements Management and Planning	Requirements Prioritization	Requirements Optimization	All Capabilities
To enhance LoB-wide portfolio management														
X		X				X	X							
To identify opportunities and consolidate geospatial acquisition activities														
X		X					X			X	X	X	X	
To develop and implement geospatial requirements language for Federal grants and contracts														
X		X					X			X	X	X	X	

Table A6 illustrates targeted business processes mapped to the high-level PRM category, areas, and indicators.

Table A 6: LoB PRM Alignment

			Enhanced Governance									Planning & Investment Strategy					Optimize and Standardize
FEA Measurement Area	**Measurement Category**	**FEA Generic Measurement Indicator**	**Stakeholder Management**	**Portfolio Management**	**Capital Planning**	**Enterprise Architecture**	**Strategic Planning**	**Governance**	**Program Management**	**Budget Planning**	**Asset Lifecycle Management**	**Relationship Management**	**Acquisition Planning**	**Requirements Management and Planning**	**Requirements Prioritization**	**Requirements Optimization**	**All Capabilities**
Customer Results	Customer Results	Service Coverage									X	X		X			
Customer Results	Service Coverage	New Customers & Market Penetration	X					X				X		X			
Technology	Efficiency	Accessibility															X
Process and Activities	Management and Innovation	Policies	X					X									
Customer Results	Customer Benefit	Customer Satisfaction	X					X				X					
Customer Results	Service Quality	Accuracy of Service or Product Delivered		X			X				X						
Mission and Business Results	All LoBs (To Be Assessed)		X														
Process and	Processes	Productivity and															

			Enhanced Governance									Planning & Investment Strategy					Optimize and Standardize
FEA Measurement Area	Measurement Category	FEA Generic Measurement Indicator	Stakeholder Management	Portfolio Management	Capital Planning	Enterprise Architecture	Strategic Planning	Governance	Program Management	Budget Planning	Asset Lifecycle Management	Relationship Management	Acquisition Planning	Requirements Management and Planning	Requirements Prioritization	Requirements Optimization	All Capabilities
Activities	and Activities	Efficiency															
Process and Activities	Processes and Activities	Management and Innovation	X				X	X					X	X	X	X	
Technology	Information and Data	External Data Sharing	X					X									X
Technology	Information and Data	Data Reliability & Quality									X						X
Process and Activities	Quality	Complaints									X	X	X				
Technology	Efficiency	Interoperability															X
Technology	Reliability and Availability	Availability															X
Process and Activities	Management and Innovation	Knowledge Management									X	X					
Technology	Financial	Costs			X					X							X
Technology	Financial	Licensing Costs	X		X					X			X	X	X	X	X
Process and Activities	Financial	Savings & Cost Avoidance	X		X					X			X	X	X	X	

Table A7 maps service requirements to capabilities.

Table A 7: Geospatial Service Component

Service Domain	Domain Description			
	Service Type	Type Description		
		Service Component	Component Description	Geospatial Function(s)
Back office	***Defines the set of capabilities that support the management of enterprise planning and transactional-based functions***			
	Data Management	*Provide for the usage, processing and general administration of unstructured information.*		
		Data Exchange	Support the interchange of information between multiple systems or applications; includes verification that transmitted data was received unaltered	Imagery Product (multi-file) exchange services Brokering Services
		Extraction & Transformation	Support the manipulation and change of data	coordinate transformation, resampling, subsetting, reprojection
		Data Mart	Support a subset of a data warehouse for a single department or function within an organization	Location specific subset
		Data Warehouse	Support the archiving and storage of large volumes of data	Geospatial context data storage
		Metadata Management	Support the maintenance and administration of data that describes data	FGDC compliance tests, spatial processing on ingest
		Data Cleansing	Support the removal of incorrect or unnecessary characters and data from a data source	Geospatial data cleansing (e.g. Gazetteers, address reconciliation)
		Data Classification	Allow the classification of data	Spatial Classification
Business Analytical Services	***Defines the set of capabilities supporting the extraction, aggregation, and presentation of information to facilitate decision analysis and business evaluation.***			
	Analysis &	*Examine business issues, problems and their solutions.*		

Service Domain	Domain Description			
	Service Type	Type Description		
		Service Component	Component Description	Geospatial Function(s)
	Statistics	***Geographic Analysis****	A general purpose set of capabilities for analyzing and processing geospatial data.	GIS, Navigation, Tracking Weather, etc.
		Imagery Analysis*	A general purpose set of capabilities for analyzing and processing geospatial imagery and related metadata.	Feature extraction, edge detection, neural networks etc.
	Visualization	*Convert data into graphical or picture form.*		
		Mapping / Geospatial / Elevation / GPS	Provide for the representation of position information through the use of attributes such as elevation, latitude, and longitude coordinates	Mapping Client, Coverage Client Etc.
	Knowledge Discovery	*Facilitate the identification of useful information from data.*		
		Data Mining	Provide for the efficient discovery of non-obvious, valuable patterns and relationships within a large collection of data	Geospatial Mining Algorithms
		Modeling	Develop descriptions to adequately explain relevant data for the purpose of prediction, pattern detection, exploration or general organization of data	Geospatial Modeling
		Simulation	Utilize models to mimic real world processes	Geospatial Simulations
	Business Intelligence	*Provide information that pertains to the history, current status or future projections of an organization.*		
		Decision Support & Planning	Support the analyze information and predict the impact of decisions before they are made	Geospatial Decision Support
	Reporting	*Organize data into useful information.*		

Service Domain	Domain Description			
	Service Type	Type Description		
		Service Component	Component Description	Geospatial Function(s)
		Ad Hoc	Support the use of dynamic reports on an as needed basis	Geospatial based reporting
		Standardized / Canned	Support the use of pre-conceived or pre-written reports	Geospatial based reporting
		OLAP	Support the analysis of information that has been summarized into multidimensional views and hierarchies	Geospatial analysis
Digital Asset Services	***Defines the set of capabilities that support the generation, management, and distribution of intellectual capital and electronic media across the business and extended enterprise.***			
	Content Management	*Manage the storage, maintenance and retrieval of documents and information of a system or website.*		
		Tagging & Aggregation	Support the identification of specific content within a larger set of content for collection and summarization	Geospatial Tagging & Aggregation
	Knowledge Management	*Identify, gather and transform documents, reports and other sources into meaningful information.*		
		Information Retrieval	Allow access to data and information for use by an organization and its stakeholders	Location based information retrieval
		Information Mapping / Taxonomy	Support the creation and maintenance of relationships between data entities, naming standards and categorization	Geospatial Ontology mediation
		Information Sharing	Support the use of documents and data in a multi-user environment for use by an organization and its stakeholders	Location based information sharing
		Categorization	Allow classification of data and information into specific layers or types to support an organization	Geospatial data categorization
		Knowledge Capture	Facilitate collection of data and information	Geospatial Knowledge Capture

Service Domain	Domain Description			
	Service Type	Type Description		
		Service Component	Component Description	Geospatial Function(s)
		Knowledge Distribution and Delivery	Support the transfer of knowledge to the end customer.	Geospatial Knowledge Distribution
	Records Management	*Schedule, appraise, store, protect, classify, retire and preserve geospatial data and information.*		
		Record Linking / Association	Support the correlation between logical data and information sets	Geospatial association
		Digital Rights Management	Support the claim and ownership of intellectual capital and artifacts belonging to an organization	Geospatially constrained digital rights.
Business Management Services	***Defines the set of capabilities that support the management of business functions and organizational activities that maintain continuity across the business and value-chain participants. The Business Management Services Domain represents those capabilities and services that are necessary for projects, programs and planning within a business operation to successfully be managed.***			
	Supply Chain Management	*Plan, schedule and control a supply chain and the sequence of organizations and functions that mine, make or assemble materials and products from manufacturer to wholesaler to retailer to consumer.*		
		Catalog Management	Support the listing of available products or services that an organization offers	Feature update, Coverage Update, Gazetteer Update Resource Catalog Update
		Ordering / Purchasing	Allow the placement of request for a product	Geospatial data order
Support Services	***Defines the set of cross-functional capabilities that can be leveraged independent of Service Domain objective and/or mission.***			
	Security Services	*Protect an organization's hardware/software and related assets.*		
		Access Control	Support the management of permissions for logging onto a computer or network	Location based access control
		Role / Privilege Management	Support the granting of abilities to users or groups of users of a computer, application or network	Location based Role / Privilege management
	Search	*Provide for the probing and lookup of specific data from a data source.*		

Service Domain	Domain Description			
	Service Type	Type Description		
		Service Component	Component Description	Geospatial Function(s)
		Query	Support retrieval of records that satisfy specific query selection criteria	Geospatial Query
		Precision / Recall Ranking	Support selection and retrieval of records ranked to optimize precision against recall	Geospatial optimization
		Classification	Support selection and retrieval of records organized by shared characteristics in content or context	Geospatial Context Classifiers
		Pattern Matching	Support retrieval of records generated from a data source by imputing characteristics based on patterns in the content or context	Geospatial Pattern Matching

Table A8 provides a mapping of the service components to ConOps common processes.

Table A 8: Service Component to ConOps Process Mapping

Service Domain	Service Type	Service Component	Define	Find	Acquire	Publish	Disseminate	Update	Maintain	Store	Use
Back office	*Data Management*	Data Exchange			X		X	X		X	X
		Extraction & Transformation			X		X	X		X	X
		Data Mart			X			X	X	X	X
		Data Warehouse			X			X	X		X
		Metadata Management			X	X		X	X		
		Data Cleansing			X			X			
		Data Classification			X			X			
Business Analytical Services	*Analysis & Statistics*	***Geographic Analysis****	***X***			***X***		***X***			***X***
		Imagery Analysis*	***X***			***X***		***X***			***X***
	Visualization	Mapping / Geospatial / Elevation / GPS									X
	Knowledge Discovery	Data Mining	X	X				X		X	X
		Modeling	X	X						X	X
		Simulation	X	X						X	X
	Business Intelligence	Decision Support & Planning	X	X			X	X			X
	Reporting	Ad Hoc									X
		Standardized / Canned									X
		OLAP									X

Service Domain	Service Type	Service Component	Define	Find	Acquire	Publish	Disseminate	Update	Maintain	Store	Use
Digital Asset Services	*Content Management*	Tagging & Aggregation				X		X			X
	Knowledge Management	Information Retrieval					X				X
		Information Mapping / Taxonomy				X	X		X		X
		Information Sharing					X				X
		Categorization			X	X		X			
		Knowledge Capture			X					X	
		Knowledge Distribution and Delivery					X				X
	Records Management	Record Linking / Association						X	X		
		Digital Rights Management					X				
Business Management Services	*Supply Chain Management*	Catalog Management						X	X		
		Ordering / Purchasing					X				
Support Services	*Security Services*	Access Control	X	X	X	X	X	X	X	X	X
		Role / Privilege Management	X	X	X	X	X	X	X	X	X
	Search	Query	X	X							
		Precision / Recall Ranking	X	X							
		Classification	X	X							
		Pattern Matching	X	X							

Bold Italics represent new service components

Table A9 maps the functions of the ConOps to the FEA TRM.

Table A 9: TRM to Concept of Operations Mapping

Service Areas	Service Category	Service Standard	Technology Comments	Define	Find	Acquire	Publish	Disseminate	Update	Maintain	Store	Use
Service Access and Delivery	Access Channels	Web Browser	HTML/HTTP	X	X							X
		Wireless/PDA	Various	X	X	X						X
		Collaboration / Communications	email	X		X						X
		Other Electronic Channels	Web Services		X	X	X	X	X			X
	Delivery Channels	Internet			X		X	X	X			
		Intranet			X		X	X	X			
		Extranet			X		X	X	X			
		Peer-to-peer			X		X	X	X			
		VPN			X		X	X	X			
	Service Requirements	Legislative Compliance	OMB A-16, Section 508,	X	X	X	X	X	X	X	X	
		Authentication/ Single Sign-on	eAuthentication, HSPD-12		X	X	X	X	X			
		Hosting					X	X	X	X	X	
	Service Transport	Supporting Network Services			X	X	X	X	X	X	X	
		Service Transport			X	X	X	X	X	X	X	

Service Areas	Service Category	Service Standard	Technology Comments	Define	Find	Acquire	Publish	Disseminate	Update	Maintain	Store	Use
Service Platform and Infrastructure	Support Platforms	Wireless/Mobile			X	X			X			X
		Platform-independent			X	X	X	X	X	X	X	
	Delivery Servers	Web servers			X		X	X	X	X		X
		Application servers		X		X		X	X	X	X	X
		Portal servers			X		X				X	
	Software Engineering	Software Configuration Management					X	X	X	X	X	
		Test Management					X	X	X	X	X	
	Database/ Storage	Database	*Geospatial format, indexing, and processing (OGC SF-SQL)*		X				X	X	X	X
		Storage								X	X	
	Hardware/ Infrastructure	Servers/Computers		X	X	X	X	X	X	X	X	X
		Wide-Area Network (WAN)	There a need to match bandwidth requirements across the data services enterprise.	X	X	X	X	X	X			X
		Local Area Network (LAN)	There a need to match bandwidth	X	X	X	X	X	X	X	X	X

Service Areas	Service Category	Service Standard	Technology Comments	Define	Find	Acquire	Publish	Disseminate	Update	Maintain	Store	Use
			requirements across the data services enterprise.									
Component Framework	Security	Certificates / Digital Signature			X	X	X		X			
		Supporting Security Services			X	X	X	X	X			
	Presentation/ Interface	Static Display		X	X	X	X	X				X
		Dynamic Server-side Display	OGC Web Map Server, ISO 19128					X		X		X
		Content Rendering	OGC Style Layer Descriptor					X				X
			OGC Web Map Server, ISO 19128					X				X
		Wireless/Mobile	OGC OpenLocation Services 1.0		X		X	X				X
	Data Interchange	Data Exchange	OGC Web Feature Service, ISO 19142			X		X	X	X		X
			OGC Web Coverage Service			X		X		X		X
			OGC Filter Encoding, ISO 19143 (Filter)		X	X						

Service Areas	Service Category	Service Standard	Technology Comments	Define	Find	Acquire	Publish	Disseminate	Update	Maintain	Store	Use
			Spatial Data Transfer Standard, ANSI INCITS 320					X				X
			OGC GML 3.1.1, ISO 19136					X				X
	Data Management	Database Connectivity							X	X	X	
		Reporting and Analysis			X	X	X	X	X	X	X	
Service Interface and Integration	Integration	Middleware	SQL-Multi-Media (Spatial Extensions) ISO 13249-3:2003;						X	X		X
			ISO 23950		X		X		X	X		X
			OGC SimpleFeatures SQL						X	X		X
		Enterprise Application Integration			X	X		X	X	X	X	
	Interoperability	Data Format/ Classification	OGC Web Map Context									X
			OGC GML, ISO 19136					X				X
			HDF, HDF EOS, net-CDF			X		X				X
		Data	FGDC CSDGM	X	X		X					X

Service Areas	Service Category	Service Standard	Technology Comments	Define	Find	Acquire	Publish	Disseminate	Update	Maintain	Store	Use
		Types/Validation										
			ISO Metadata 19115/19139	X	X		X					
			ANSI INCITS Framework Data Standards (Draft)			X		X				X
		Data Transformation	OGC Coordinate Transformation Service					X				X
			OGC Web Map Service ISO 19128					X		X		X
	Interface	Service Discovery	OGC Catalogue Service	X	X		X				X	X
			UDDI	X	X		X			X		X
		Service Description/ Interface	OGC OWS Common									X
			Web Service Description Language (WSDL)				X					X