

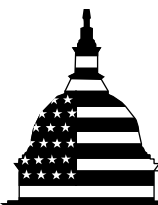
GAO

Report to the Committee on Homeland
Security and Governmental Affairs,
U.S. Senate

November 2012

GEOSPATIAL INFORMATION

OMB and Agencies Need to Make Coordination a Priority to Reduce Duplication



G A O

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Highlights of [GAO-13-94](#), a report to the Committee on Homeland Security and Governmental Affairs, U.S. Senate

Why GAO Did This Study

The federal government collects, maintains, and uses geospatial information—information linked to specific geographic locations—to support many functions, including national security and disaster response. In 2012, the Department of the Interior (Interior) estimated that the federal government invests billions of dollars on geospatial data annually, and that duplication is common. GAO was asked to determine the extent to which the federal government has established and effectively implemented policies and procedures for coordinating its geospatial investments and avoiding duplication.

To do so, GAO focused on FGDC coordination activities; efforts within the departments of Commerce, the Interior, and Transportation; and OMB oversight. GAO reviewed FGDC and department documentation, such as policies, procedures, and strategic plans; OMB guidance and an executive order; and reports concerning duplicative investments.

What GAO Recommends

GAO is making recommendations aimed at improving coordination and reducing duplication, to include FGDC developing a national strategy for coordinating geospatial investments; federal agencies following federal guidance for managing geospatial investments; and OMB developing a mechanism to identify and report on geospatial investments. Two agencies and OMB generally agreed with GAO's recommendations and one agency neither agreed nor disagreed.

View [GAO-13-94](#). For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov.

GEOSPATIAL INFORMATION

OMB and Agencies Need to Make Coordination a Priority to Reduce Duplication

What GAO Found

While the President and the Office of Management and Budget (OMB) have established policies and procedures for coordinating investments in geospatial data, governmentwide committees and federal departments and agencies have not effectively implemented them. The committee that was established to promote the coordination of geospatial data nationwide—the Federal Geographic Data Committee (FGDC)—has developed and endorsed key standards—including a metadata standard that includes descriptive information about a particular set of geospatial data—and established a clearinghouse of metadata; however, the clearinghouse is not being used by agencies to identify planned geospatial investments to promote coordination and reduce duplication. The FGDC has not yet planned or implemented an approach to manage geospatial data as related groups of investments to allow agencies to more effectively plan geospatial data collection efforts and minimize duplicative investments; and its strategic plan is missing key elements, such as performance measures for many of its defined objectives. Further, none of the three federal departments in GAO's review have fully implemented important activities for coordinating geospatial data, such as preparing and implementing a strategy for advancing geospatial activities within their respective departments (see table).

Status of Federal Departments' Implementation of Geospatial Activities

Activity	Commerce	Interior	Transportation
Designate a senior official	◐	●	◐
Prepare and implement a strategy	○	○	○
Develop a policy for metadata	◐	○	○
Make metadata available on clearinghouse	●	●	●
Adopt procedures for accessing clearinghouse	○	○	○

● = Fully met ◐ = Partially met ○ = Not met

Source: GAO analysis of department documentation.

Further, the three agencies in GAO's review responsible for governmentwide management of specific geospatial data have implemented some but not all important activities for coordinating the national coverage of specific geospatial data. For example, only one agency has developed a plan for the nationwide population of the datasets under its responsibility, and none of the agencies have developed a plan to develop standards that facilitate the collection and sharing of geospatial data. Finally, while OMB has oversight responsibilities for geospatial data, OMB staff members acknowledged that OMB does not have complete and reliable information to identify potentially duplicative geospatial investments.

FGDC, federal departments and agencies, and OMB have not yet fully implemented policies and procedures for coordinating geospatial investments because these efforts have not been a priority. As a result, efforts to acquire data are uncoordinated and the federal government is acquiring duplicative geospatial data. For example, three agencies are independently acquiring road data, which is reported to have resulted in millions of wasted taxpayers' dollars. Unless OMB, the FGDC, and federal departments and agencies decide that coordinating geospatial investments is a priority, this situation will likely continue.

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Abbreviations

BTS	Bureau of Transportation Statistics
Commerce	Department of Commerce
FGDC	Federal Geographic Data Committee
GIS	geographic information systems
Interior	Department of the Interior
IT	information technology
NOAA	National Oceanic and Atmospheric Administration
NSDI	National Spatial Data Infrastructure
OMB	Office of Management and Budget
TIGER	Topologically Integrated Geographic Encoding and Referencing
Transportation	Department of Transportation
USGS	U.S. Geological Survey

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Accountability * Integrity * Reliability

United States Government Accountability Office
Washington, DC 20548

November 26, 2012

The Honorable Joseph I. Lieberman
Chairman
The Honorable Susan M. Collins
Ranking Member
Committee on Homeland Security
and Governmental Affairs
United States Senate

The federal government collects, maintains, and uses geospatial information—information linked to specific geographic locations—to help in decision making and to support many functions, including national security, law enforcement, health care, environmental protection, and natural resources conservation. Among the many activities that can depend on critical analysis of geospatial information are maintaining roads and other critical transportation infrastructure and quickly responding to natural disasters, such as floods, hurricanes, and fires.

Multiple federal agencies may provide services at the same geographic locations and may independently collect similar geospatial information about those locations, thus raising the question of how well the nation's investments in geospatial data are coordinated. Moreover, the Department of the Interior (Interior) has recently estimated that the federal government invests billions of dollars in geospatial data annually, and reported that duplication among investments is common.¹

Over the past 2 years, we issued two comprehensive reports that identified federal programs or functional areas where duplication,² overlap, or fragmentation exists; the actions needed to address such

¹Department of the Interior, *Geospatial Line of Business Capital Asset Summary*, Aug. 14, 2012.

²Duplication occurs when two or more agencies or programs are engaged in the same activities or provide the same services to the same beneficiaries.

conditions; and the potential financial and other benefits of doing so.³ For this review, you asked us to determine the extent to which the federal government has established and effectively implemented policies and procedures for coordinating its investments in geospatial data and avoiding duplication.

To address our objective, we focused on governmentwide activities to implement the National Spatial Data Infrastructure (NSDI)—an infrastructure to facilitate the efficient collection, sharing, and dissemination of geospatial data among all levels of government, and public and private sectors—as well as efforts of the Federal Geographic Data Committee (FGDC)—the federal committee established to promote the coordinated use, sharing, and dissemination of geospatial data nationwide. Additionally, we focused on activities within three selected departments: Department of Commerce (Commerce), Department of the Interior (Interior), and Department of Transportation (Transportation); and within three selected agencies responsible for managing data themes:⁴ the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), and the Bureau of Transportation Statistics (BTS). The themes in our review are geodetic control⁵—(NOAA), hydrography⁶—(USGS), and transportation⁷—(BTS). We reviewed and assessed FGDC and department documentation, such as policies, procedures, strategic plans, meeting minutes, and budget documentation; the Office of Management and Budget (OMB) data call results and guidance; and recent reports discussing duplicative geospatial

³GAO, *2012 Annual Report: Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings, and Enhance Revenue*, [GAO-12-342SP](#) (Washington, D.C.: Feb. 28, 2012); and *Opportunities to Reduce Potential Duplication in Government Programs, Save Tax Dollars, and Enhance Revenue*, [GAO-11-318SP](#) (Washington, D.C.: Mar. 1, 2011).

⁴Data themes are comprised of one or more sets of geospatial data that have national significance, as established by federal guidance, such as hydrography (i.e., surface water features, such as lakes, ponds, streams, and rivers).

⁵The data collected as part of the geodetic control theme are used to establish the precise location of geospatial data.

⁶This theme includes surface water features, such as lakes, ponds, streams, rivers, canals, oceans, and coastlines.

⁷This theme includes both physical and nonphysical components representing all modes of travel that allow the movement of goods and people between locations.

investments; and interviewed FGDC and department officials, and staff members from the OMB Office of E-Government.

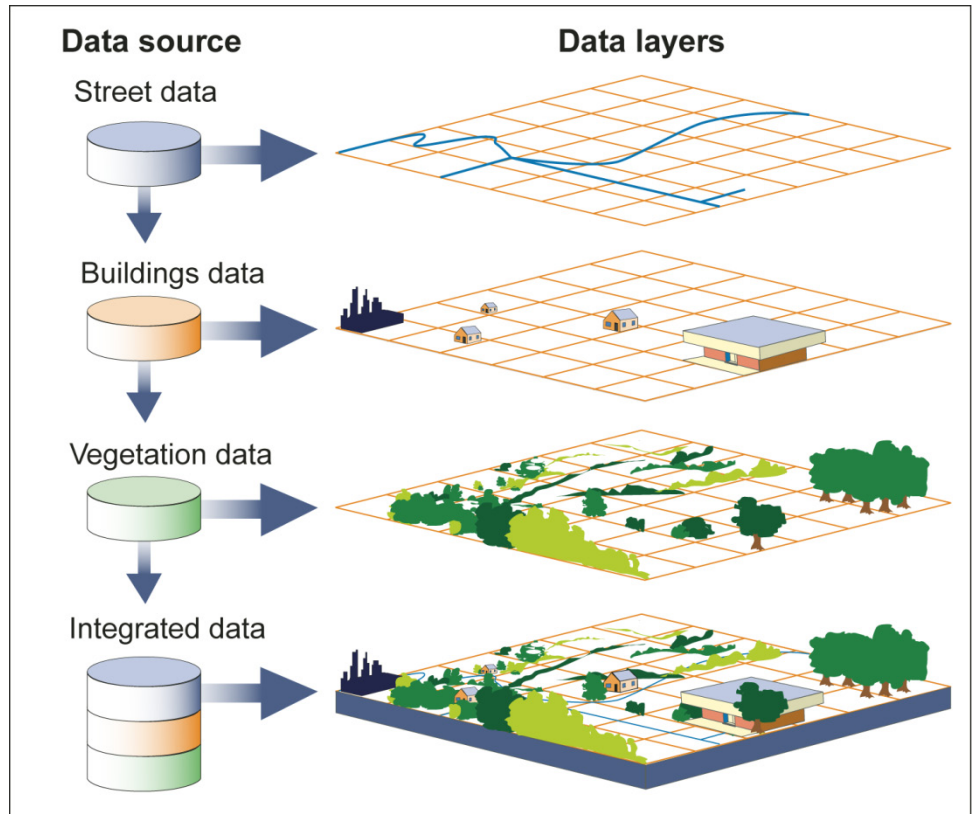
We conducted this performance audit from November 2011 to November 2012, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective. Details of our objective, scope, and methodology are contained in appendix I.

Background

Geospatial information describes entities or phenomena that can be referenced to specific locations relative to the Earth's surface. For example, entities, such as buildings, rivers, road intersections, power plants, and national parks can all be identified by their locations. In addition, phenomena, such as wildfires, the spread of the West Nile virus, and the thinning of trees due to acid rain can also be identified by their geographic locations.

Users can analyze that data in geographic information systems (GIS)—systems of computer software, hardware, and data used to capture, store, manipulate, analyze, and graphically present a potentially wide array of geospatial information. The primary function of a GIS is to link multiple sets of geospatial data and display the combined information as maps with different layers of information. Assuming that all of the information is at the same scale and has been formatted according to the same geospatial standards, users can potentially overlay geospatial information about any number of specific topics to examine how the data in the various layers interrelate. Each layer of a GIS map typically represents a single theme comprised of one or more sets of data, each of which could be derived from a source completely different from the others. Figure 1 portrays the concept of visual representation of geospatial data themes in a GIS.

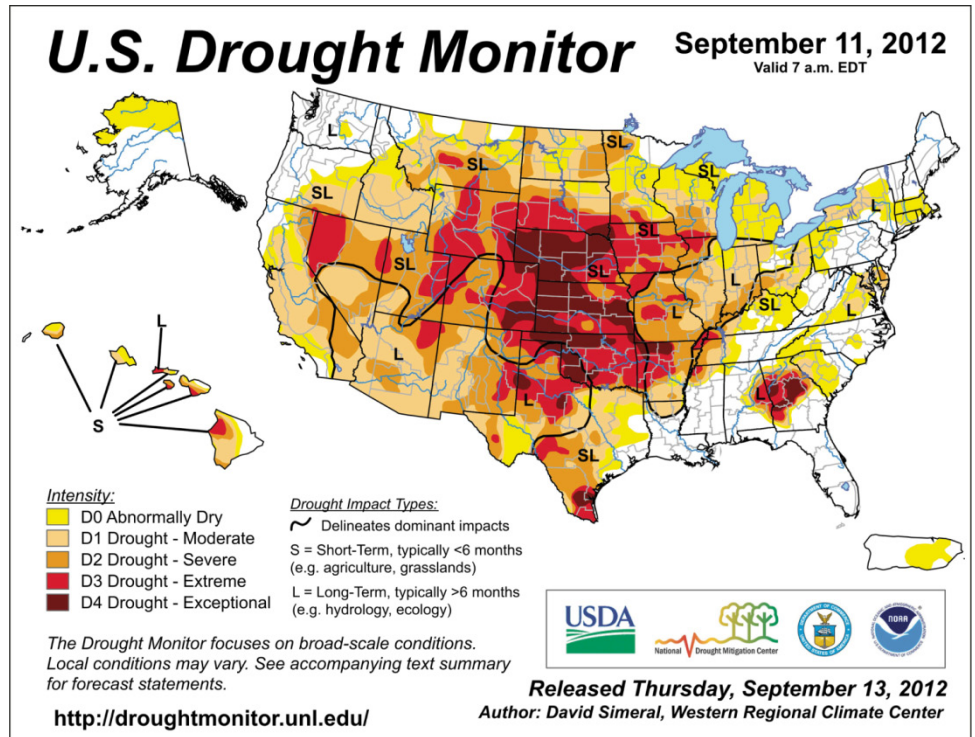
Figure 1: Visual Representation of Themes in a GIS



Source: GAO.

Examples of geospatial data applications are provided in figures 2 and 3. Figure 2 demonstrates the usefulness of GIS in showing the scope, severity, and duration of the effects of the recent drought in the United States, which could be used to make drought relief and agricultural support activities more effective.

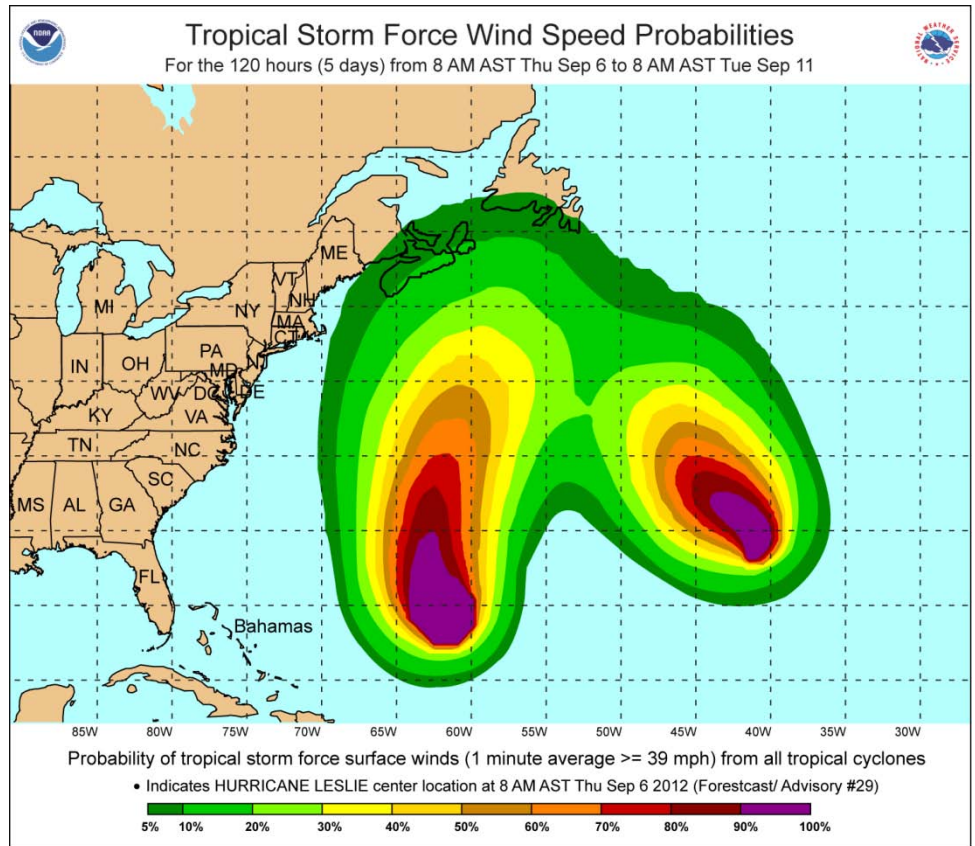
Figure 2: Monitoring Drought Conditions across the United States



Source: The National Drought Mitigation Center at the University of Nebraska-Lincoln. The U.S. Drought Monitor is a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration.

Another use for GIS is tracking and responding to natural disasters, such as wildfires and hurricanes. Figure 3 demonstrates the usefulness of GIS in tracking the direction and estimated strength of an impending hurricane. The timely delivery of these data can be used to provide for orderly evacuation of people from affected areas, and lessen the impact of the storm on facilities, such as sewage treatment plants, hospitals, and nursing homes.

Figure 3: Hurricane Leslie Wind Speed Predictions



Source: National Oceanic and Atmospheric Administration.

Coordination of Federal Geospatial Activities

For many years, the federal government has taken steps to coordinate geospatial activities both within and outside the federal government. In 1953, the Bureau of the Budget⁸ first issued Circular A-16, encouraging expeditious surveying and mapping activities across all levels of government and avoidance of duplicative efforts. In 1990, OMB revised Circular A-16 to, among other things, establish the FGDC within Interior to promote the coordinated use, sharing, and dissemination of geospatial data nationwide. Building on that guidance, in 1994 the President issued Executive Order 12906 for the purpose of addressing wasteful duplication

⁸The Bureau of the Budget became OMB in 1970.

and incompatibility of geospatial information, and assigned the FGDC the responsibility to coordinate the development of the NSDI.⁹ In 2002, OMB again revised Circular A-16 to further describe the components of the NSDI; clearly define agency responsibilities for acquiring, maintaining, distributing, using, and preserving geospatial data; and to reaffirm the FGDC's role as the interagency coordinating body for NSDI-related activities.¹⁰ The circular established the following five components of the NSDI and described how these components were to be implemented.

- **Data themes.** Data themes are topics of national significance, such as transportation, which includes all modes of travel (e.g., road and rail data). OMB Circular A-16 currently identifies 34 data themes and identifies the “lead” agency or agencies for each theme. Each data theme is to be comprised of one or more electronic data records, known as datasets. Of the 34 themes, 9 are identified as “framework” themes¹¹—that is, themes identified in Circular A-16 as critical for many geospatial applications.
- **Standards.** Geospatial standards provide common and repeatable rules or guidelines for the development, documentation, and exchange of geospatial datasets.
- **Metadata.** Metadata are information about datasets, such as content, source, accuracy, method of collection, and point-of-contact. Metadata are used to facilitate the search of and access to datasets within a data library or clearinghouse, and enable potential users to determine the data's applicability for their use.
- **National Spatial Data Clearinghouse.** The clearinghouse is intended to be a centralized geospatial metadata repository that contains geospatial metadata records from federal agencies, state and local governments, and academic and private sector organizations that can be searched to determine whether needed geospatial data exist and can be shared. Federal agencies are required to identify their existing

⁹Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

¹⁰OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, Aug. 19, 2002.

¹¹According to FGDC officials, there are seven framework themes, with two of the themes having two parts.

and planned geospatial investments in the clearinghouse, and search the clearinghouse for cost-saving opportunities before acquiring geospatial data. In 2003, the FGDC created the Geospatial One-Stop to provide “one-stop” access to geospatial metadata from a centralized database and search function. In October 2011, the Geospatial One-Stop was retired, and the FGDC initiated a pilot project, known as the Geospatial Platform, which is envisioned to provide shared and trusted geospatial data, services, and applications for use by government agencies, their partners, and the public.¹² According to Interior officials, Interior is the managing partner of the Geospatial Platform. As of August 2012, there were approximately 835,000 geospatial metadata records in the central repository, of which about 373,000 were from federal sources. Users can search the metadata repository through two primary portals: geo.data.gov¹³ and the Geospatial Platform.¹⁴ The General Services Administration is responsible for managing the clearinghouse database and the associated web portal geo.data.gov.

- **Partnerships.** Partnerships are efforts aimed at involving all stakeholders (e.g., federal, tribal, state, local government, and academic institutions) in the development of the NSDI.

In November 2010, OMB issued supplemental guidance specifically regarding how agencies are to manage data themes.¹⁵ This supplemental guidance expands upon and clarifies some of the language and responsibilities contained in OMB Circular A-16 in order to facilitate the adoption and implementation of a geospatial asset management capability.

To fulfill its responsibilities, the FGDC is governed by a steering committee—an interagency decision making body that provides

¹²<http://www.geoplatform.gov>.

¹³<http://geo.data.gov/geoportal/catalog/main/home.page>.

¹⁴The repository can also be searched using data.gov; however, the site automatically redirects the user to geo.data.gov. [Data.gov](http://data.gov) was initially launched in May 2009 to encourage open government by increasing access to official sources of federal data and facilitating the use and development of tools to manipulate the data by all levels of government as well as academia and the private sector.

¹⁵OMB, M-11-03, *Issuance of OMB Circular A-16 Supplemental Guidance*, Nov. 10, 2010.

leadership and policy direction in support of the development of the NSDI. The Secretary of the Interior chairs the committee; the Vice-Chair is the Deputy Director for Management of OMB.¹⁶ All departments or agencies responsible for geospatial data themes or that have activities in geographic information or geospatial data collection or use are required to be members of the FGDC. Thirty-two agencies¹⁷ are currently members of the Steering Committee and are to be represented by their senior agency officials for geospatial information.¹⁸ These senior agency officials are responsible for overseeing, coordinating, and facilitating their respective agency's implementation of geospatial requirements, policies, and activities. The FGDC is supported by an Office of the Secretariat that consists of about 10 people located in USGS who do the day-to-day work of supporting, managing, and coordinating the activities of the FGDC.

In addition, in December 2007, the Secretary of the Interior created the National Geospatial Advisory Committee¹⁹ to provide the department and the FGDC with advice and recommendations related to the management of federal and national geospatial programs, development of the NSDI, and the implementation of related federal guidance. Members of the

¹⁶The chair and vice-chair may select designees to serve on their behalf. The Secretary of the Interior has delegated the committee chair responsibility to the Assistant Secretary for Water and Science. The Deputy Director for Management of OMB has delegated the committee vice-chair responsibility to the Federal Deputy Chief Information Officer.

¹⁷The 32 agency members of the Steering Committee are: Interior, OMB, U. S. Department of Agriculture, Commerce, Department of Defense, U.S. Army Corp of Engineers (non-voting member), Department of Education, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of Housing and Urban Development, Department of Justice, Department of Labor, Department of State, Transportation, Department of the Treasury, Department of Veterans Affairs, Environmental Protection Agency, Federal Communications Commission (non-voting member), General Services Administration, Library of Congress, National Aeronautics and Space Administration, National Archives and Records Administration, National Capital Planning Commission (non-voting member), National Science Foundation, U.S. Nuclear Regulatory Commission, Office of Personnel Management, Small Business Administration, Smithsonian Institution, Social Security Administration, Tennessee Valley Authority, and U.S. Agency for International Development.

¹⁸OMB, M-06-07, *Designation of a Senior Agency Official for Geospatial Information*, Mar. 3, 2006, calls for select agencies to appoint to the Steering Committee policy-level officials—a chief information officer or a senior official at the assistant secretary level.

¹⁹The Secretary created the committee as a federal advisory committee under the Federal Advisory Committee Act.

committee include approximately 30 officials from federal, state, local, and tribal governments, the private sector, and academia.

OMB's Roles and Responsibilities for Overseeing IT Investments

OMB has specific oversight responsibilities for federal information technology (IT) systems and acquisition activities—including GIS—to help ensure their efficient and effective use. Two key laws that outline these responsibilities are the Clinger-Cohen Act of 1996²⁰ and the E-Government Act of 2002.²¹

- The Clinger-Cohen Act of 1996—The act requires OMB to establish processes to analyze, track, and evaluate the risks and results of major capital investments in information systems made by federal agencies and report to Congress on the net program performance benefits achieved as a result of these investments.
- The E-Government Act of 2002—The act establishes an e-government initiative, which encourages the use of web-based Internet applications to enhance the access to and delivery of government information and service to citizens, to business partners, to employees, and among all levels of government. The act also requires OMB to report annually to Congress on the status of e-government initiatives. In these reports, OMB is to describe the administration's use of e-government principles to improve government performance and the delivery of information and services to the public.

OMB subsequently began initiatives to fulfill the requirements established by these laws:

- In February 2002, OMB established the Federal Enterprise Architecture, which is intended to facilitate governmentwide improvement through cross-agency analysis and identification of duplicative investments, gaps, and opportunities for collaboration, interoperability, and integration within and across agency programs. The Federal Enterprise Architecture is composed of five “reference models” describing the federal government's (1) business (or mission)

²⁰40 U.S.C § 11101 et seq.

²¹Pub. L. No. 107-347 (Dec. 17, 2002).

processes and functions, independent of the agencies that perform them; (2) performance goals and outcome measures; (3) means of service delivery; (4) information and data definitions; and (5) technology standards.

- In March 2004, OMB established multiple “lines of business” to consolidate redundant IT investments and business processes across the federal government. Later, in March 2006, OMB established the Geospatial Line of Business. Each line of business is led by an individual agency and supported by other relevant agencies. Interior is the managing partner for the Geospatial Line of Business and the FGDC Secretariat provides project management support. OMB reports to Congress each year on the costs and benefits of these initiatives.

In carrying out its responsibilities, OMB uses several data collection mechanisms to oversee federal IT spending during the annual budget formulation process. Specifically, OMB requires federal departments and agencies to provide information related to their IT investments (called exhibit 53s) and capital asset plans and business cases (called exhibit 300s).

- Exhibit 53. The purpose of the exhibit 53 is to identify all IT investments—both major and nonmajor—and their associated costs within a federal organization. Information included in agency exhibit 53s is designed, in part, to help OMB better understand agencies’ spending on IT investments. OMB guidance for the fiscal years 2013 and 2014 budget formulation instructs agencies to identify their geospatial investments in the exhibit 53 using Federal Enterprise Architecture codes for specific functions (e.g., geospatial services, financial management, and acquisition management).
- Exhibit 300. The purpose of the exhibit 300 is to provide a business case for each major IT investment and to allow OMB to monitor IT investments once they are funded. Agencies are required to provide information on each major investment’s cost, schedule, and performance.

GAO Has Previously Recommended Improvements in the Management of Geospatial Information and OMB Guidance

In June 2004, we reported that OMB, individual federal agencies, and cross-government committees and initiatives, such as the FGDC and the Geospatial One-Stop project, had taken actions to coordinate the government's geospatial investments across agencies and with state and local governments.²² However, we noted that these efforts had not been fully successful in reducing duplication in geospatial investments for several reasons:

- a complete and up-to-date strategic plan for doing so was not in place;
- agencies had not consistently complied with OMB guidance that seeks to identify and reduce duplication; and
- OMB's oversight of federal geospatial activities had not been effective because its methods—the annual budget review process, the federal enterprise architecture effort, and the FGDC's reporting process—were insufficiently developed and had not produced consistent and complete information.

We reported that, as a result of these shortcomings, federal agencies were still independently acquiring and maintaining potentially duplicative and costly datasets and systems. Accordingly, we recommended that the Director of OMB and the Secretary of the Interior direct the development of a national geospatial strategic plan, and recommended that the Director of OMB develop criteria for assessing interagency coordination on proposals for potential geospatial investments, and strengthen its oversight of geospatial projects. OMB and Interior generally agreed with our recommendations. In response, between 2004 and 2008, OMB, Interior, and the FGDC created a number of documents that addressed the development of a national geospatial strategic plan, including a strategic plan for NSDI development and a business case for the development of the Geospatial Line of Business. Furthermore, in 2004 and 2006, OMB issued guidance designed to increase the amount of budget information available on geospatial investments, and improve oversight of agencies' implementation of geospatial-related requirements, policies, and activities.

²²GAO, *Geospatial Information: Better Coordination Needed to Identify and Reduce Duplicative Investments*, [GAO-04-703](#) (Washington, D.C.: June 23, 2004).

In September 2011, we reported that OMB's guidance to agencies for reporting their IT investments did not ensure complete reporting or facilitate the identification of duplicative investments.²³ Specifically, agencies differed on what investments they included as an IT investment. We further reported that OMB's guidance to federal agencies to categorize IT investments did not go far enough to allow for the identification of potentially duplicative investments. In particular, OMB's guidance required that each investment be mapped to a single Federal Enterprise Architecture functional code; however, IT investments could fit into more than one functional code.

Accordingly, we recommended that OMB clarify its guidance on reporting IT investments to specify whether certain types of systems—such as space systems—are to be included; allow agencies to place their IT investments into more than one Federal Enterprise Architecture functional code in order to reduce potentially duplicative investments; and direct agencies to report the overall steps that they take to ensure that their IT investments are not duplicative as part of their annual budget and IT investment submissions. OMB did not agree that further efforts were needed to clarify reporting in regard to the types of systems; but it agreed with our recommendations regarding the categorization of investments and reporting of steps taken to reduce duplication. OMB's fiscal year 2014 budget formulation guidance allows agencies to identify up to five Federal Enterprise Architecture functional codes with each investment.

²³GAO, *Information Technology: OMB Needs to Improve Its Guidance on IT Investments*, [GAO-11-826](#) (Washington, D.C.: Sept. 29, 2011).

Implementing Established Policies Is Not a Federal Priority, Resulting in Duplicative Investments

While the President and OMB have established policies and procedures for managing and coordinating investments in geospatial data, the FGDC, federal departments and theme-lead agencies, and OMB itself have not effectively implemented them. This has resulted in uncoordinated and duplicative investments in areas of national interest, such as road and address data.

- While the FGDC has developed and endorsed several standards, it has not yet planned for or implemented an approach to manage data themes and their associated key datasets²⁴ as related groups of investments designed to allow agencies to more effectively plan geospatial data collection efforts and minimize duplicative investments. Additionally, planned geospatial data acquisitions are not identified in the clearinghouse and the FGDC does not have a current strategic plan to guide its efforts.
- None of the three federal departments in our review have fully implemented important activities for coordinating geospatial data and assets, such as developing and implementing a strategy for advancing geospatial activities within the department.
- The three theme-lead agencies in our review have implemented some but not all important activities to ensure the national coverage and stewardship of geospatial data themes.
- OMB's annual budget reporting mechanisms have not provided complete and reliable information to identify duplicative geospatial investments.

The primary cause for why the FGDC, federal departments and theme-lead agencies, and OMB have not yet fully implemented established policies and procedures for coordinating geospatial investments is because, according to OMB staff members and agency officials, they have been focusing on other priorities. Because federal agencies have yet to fully implement important activities and practices for coordinating and managing geospatial data and facilitating the development of the

²⁴According to OMB, a key geospatial dataset is (1) used by multiple agencies or with agency partners such as state, tribal, and local governments; (2) applied to achieve presidential priorities as expressed by OMB; (3) needed to meet shared mission goals of multiple federal agencies; or (4) expressly required by statutory mandate.

NSDI, and OMB is limited in its ability to oversee agencies' geospatial investments, agencies continue to acquire duplicative geospatial data.

FGDC Has Developed Geospatial Standards, but Has Not Fully Implemented Key Activities for Coordinating Geospatial Data

According to federal guidance,²⁵ the FGDC is to serve as the lead federal executive body charged with the leadership, development, implementation, and review of geospatial data standards.

To its credit, the FGDC has developed and endorsed several standards. In particular, it developed a metadata standard that includes descriptive information about a dataset—such as who created and published it, the related theme keyword, and the geographic coordinates that bound the dataset—and facilitates the identification and sharing of geospatial data.²⁶ The FGDC has also developed standards associated with each of the framework themes and endorsed several other standards developed by external standards bodies, such as the International Organization for Standardization's tracking and navigation standard for web services.²⁷

FGDC Has Not Yet Fully Planned or Implemented a Portfolio Management Approach

OMB guidance²⁸ from November 2010 calls for the immediate use of an approach to manage the NSDI data themes and their associated key datasets as related groups of investments, known as portfolio management. A portfolio management approach establishes a framework for governmentwide management of themes and datasets to allow agencies to more effectively plan geospatial data collection efforts and minimize duplicative investments. It includes establishing goals and performance measures, as well as processes for reviewing the health and status of datasets across the government in order to maximize the value of the data. OMB further directs the FGDC to provide guidance, within a year of issuance, about how to implement the portfolio management approach.

²⁵OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, Aug. 19, 2002; and Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

²⁶FGDC, *FGDC-STD-001-1998: Content Standard for Digital Geospatial Metadata*, 1998.

²⁷The International Organization for Standardization is an international standards body that develops voluntary standards through global consensus.

²⁸OMB, M-11-03, *Issuance of OMB Circular A-16 Supplemental Guidance*, Nov. 10, 2010.

While the FGDC has initiated activities that Secretariat officials say are first needed to establish a portfolio of datasets, it has not yet fully planned for or implemented a portfolio management approach. Specifically, the FGDC evaluated the 34 data themes identified in OMB Circular A-16 to determine whether any changes were needed; in August 2011, the Steering Committee proposed consolidating the 34 data themes into 17 themes; Secretariat officials subsequently stated that the FGDC agencies are proposing to eliminate 1 more theme for a total of 16. (See app. II for a comparison of the 34 themes and the newly proposed 16 themes.) These officials further stated that, as of August 2012, lead agencies have been identified for each of the 16 themes and said that they plan to discuss the revised lists of themes and lead agencies at the Steering Committee's September 2012 meeting. Once the Steering Committee approves the revised themes and lead agencies, the FGDC plans to send them to OMB for its approval. Additionally, the FGDC has identified 221 key datasets associated with the proposed data themes.²⁹

However, the data themes, lead agencies, and datasets have neither been finalized nor approved, and the FGDC has yet to provide guidance to agencies about how to implement the portfolio management approach. While Secretariat officials stated that they had developed a draft implementation plan in November 2011, it has not been finalized or approved, and FGDC Secretariat officials were unable, on behalf of FGDC agencies, to provide a time frame for doing so.

FGDC Secretariat officials stated that completion of the activities needed to fully implement the portfolio management approach has not been accomplished due to competing priorities, such as the Geospatial Platform. Until the implementation plan is completed; and the themes, lead agencies, and associated datasets are identified and approved, the agencies cannot effectively begin to implement a coordinated geospatial asset management capability that was, according to the OMB guidance, designed to provide a mechanism for agencies to plan more effectively in advance of data collection efforts to identify partnership opportunities, and to minimize duplicative investments.

²⁹According to Interior officials, the actual number of datasets varies over time based on, for example, new technologies, new data collection, data integration, and data disposition.

FGDC Has Established a Clearinghouse, but Planned Acquisitions Are Not Identified and Shared

According to federal guidance,³⁰ the FGDC is to develop a clearinghouse with the functionality to allow federal departments and agencies to (1) determine whether the geospatial data they are seeking already exist and (2) identify planned acquisitions of geospatial data and opportunities to jointly acquire the data in order to improve efficiencies in geospatial data collection and to reduce potential redundancies and duplication. Additionally, federal guidance requires agencies to identify their planned investments in the clearinghouse.³¹

The FGDC has developed a clearinghouse that allows users to determine whether the data they are seeking exist. As noted previously, the clearinghouse consists of a centralized repository that contains geospatial metadata³² records from federal agencies, state and local governments, and academic and private-sector organizations; and multiple web-based portals from which the metadata can be searched. The two primary portals are geo.data.gov and the Geospatial Platform. As of August 2012, there were approximately 835,000 geospatial metadata records in the centralized repository, of which about 373,000 were from federal sources.

Although the clearinghouse allows agencies to identify their planned investments, federal agencies are not doing so. According to the Geospatial Platform managing partner representative, the platform was modified in May 2012 to include a site for agencies to identify their planned acquisitions and potential cooperative efforts to acquire data. However, as of September 2012, federal agencies have not identified any planned geospatial investments. The Geospatial Platform managing partner representative stated that agencies are not identifying their planned investments because the FGDC has not completed and shared guidance with federal agencies that describes what information is to be shared and how agencies are to identify the planned investments in the

³⁰OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, Aug. 19, 2002; and Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

³¹OMB, Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, section 25, Aug. 3, 2012; and Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

³²As previously noted, metadata are information about datasets, such as content, source, accuracy, method of collection, and point of contact.

FGDC Lacks an Up-to-Date and Complete Strategic Plan to Coordinate Its Activities

platform. This official acknowledged that until the guidance is completed and implemented, agencies are not likely to add their planned acquisitions to the platform and identify potential cooperative efforts to acquire geospatial data and minimize potential redundancies and duplicative efforts.³³

According to Secretariat officials, they have not yet finalized the guidance for placing planned acquisitions on the platform because the primary focus of the FGDC has been on the development of the Geospatial Platform's Business Plan and the initial release of the Geospatial Platform's core capabilities, applications, and tools. However, without the ability to identify planned geospatial data acquisitions, agencies will likely miss opportunities to reuse or cooperatively acquire geospatial data, thus resulting in the acquisition of potentially duplicative geospatial data and needless expenditure of limited resources.

OMB requires FGDC to prepare and maintain a strategic plan for the development and implementation of the NSDI.³⁴ Foundational elements of strategic planning, as recognized by federal legislation³⁵ and OMB guidance,³⁶ include, among other things, (1) a vision statement; (2) outcome-oriented goals and objectives; (3) a description of how the goals and objectives are to be achieved—including the resources needed and a description of the working relationships with other agencies; (4) a description of how performance goals contribute to the general goals and objectives of the strategic plan; and (5) the identification of external factors that could significantly affect the achievement of the general goals and objectives. Such a plan could help to facilitate coordination among the many geospatial activities that are underway within the federal government and with other stakeholders, and provide a mechanism to

³³According to an FGDC Secretariat official, the Geospatial One-Stop had previously included the ability for agencies to identify their planned acquisitions. This official told us that during the time the Geospatial One-Stop was available, there were approximately 4,000 instances of organizations notifying the geospatial community, through the One-Stop, of planned data acquisitions.

³⁴OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, Aug. 19, 2002.

³⁵5 U.S.C. § 306(a)(1), (2), (4), (6), and (7).

³⁶OMB, Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, section 210, Aug. 3, 2012.

measure progress in coordinating geospatial activities and reducing duplication.

FGDC has prepared a strategic plan; however, it is missing key components and has not been kept up-to-date. FGDC's current strategic plan was issued in 2004 and includes (1) a vision statement, (2) three outcome-oriented goals and 13 objectives to be accomplished between 2005 and 2008, and (3) a high-level description of how all but 1 of the 13 objectives are to be achieved. However, its high-level description of the objectives does not include a description of the resources needed to achieve the goals and objectives, or explicitly how the FGDC agencies are to work together to achieve the goals. In addition, the plan does not identify performance measures (such as the percent of the nation for which a given type and standard of data is available) for 9 of the 13 objectives and it does not describe external factors that could affect the achievement of the general goals and objectives, such as the risk of theme-lead agencies not meeting their NSDI development milestones, or limited funding for geospatial investments.

Moreover, the plan does not reflect significant initiatives that the FGDC Steering Committee has engaged in—such as the Geospatial Platform, which did not exist in 2004—and the time frames for FGDC's goals are outdated. For example, the latest time frame associated with the goals in the plan is the year 2007. According to the FGDC Office of the Secretariat Executive Director, the plan needs to be updated; however, he could not provide a time frame, on behalf of the FGDC agencies, for doing so.

The FGDC Office of the Secretariat Executive Director stated that the FGDC has created other strategic planning documents, such as a technical architecture document from 2006 and, more recently, Geospatial Platform planning documents from 2011 and 2012. Individually, these documents contain several foundational elements of strategic planning (e.g., a vision statement, goals and objectives, and discussion of external risks). However, cumulatively they do not represent a comprehensive strategic plan that addresses all aspects of the NSDI for the same unified future time frame.

The Executive Director attributed the lack of a comprehensive strategic plan to competing priorities set by OMB and the FGDC's Steering Committee. Until a comprehensive strategic plan, with meaningful and measurable performance goals, is in place to guide the federal government's geospatial efforts, it is more difficult to achieve the NSDI

vision and to hold the FGDC and federal agencies accountable for its development.

Departments and Theme-lead Agencies Have Not Fully Implemented Important Activities for Coordinating and Managing Geospatial Data

OMB has issued guidance, which was followed by an executive order, to federal departments and agencies for effectively coordinating and managing geospatial data to help ensure that they wisely use federal resources in developing the NSDI.³⁷ According to OMB guidance and the executive order, federal departments and agencies that handle geospatial data are to:

- designate a senior agency official for geospatial information that has departmentwide responsibility, accountability, and authority for geospatial information issues;
- prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial data activities appropriate to their mission, and in support of the NSDI strategy;
- develop a policy that requires them to make their geospatial metadata available on the clearinghouse;
- make all metadata associated with geospatial data available on the clearinghouse, and use the metadata standard; and
- adopt internal procedures to ensure that they access the NSDI clearinghouse before they expend funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others, or (2) whether cooperative efforts to obtain the data are possible.

As shown in table 1, none of the three federal departments in our review have fully implemented the important activities needed for effectively coordinating and managing geospatial activities within their respective departments.

³⁷OMB, M-06-07, *Designation of a Senior Agency Official for Geospatial Information*, Mar. 3, 2006; OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, Aug. 19, 2002; and Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

Table 1: Status of Federal Departments' Implementation of Geospatial Activities

Activity	Commerce	Interior	Transportation
Designate a senior official with departmentwide responsibility	◐	●	◐
Prepare and implement a strategy	○	○	○
Develop a policy for metadata	◐	○	○
Make metadata available on clearinghouse	●	●	●
Adopt procedures for accessing the clearinghouse	○	○	○

Key

- =Fully met—the department provided evidence that addressed the criteria.
- ◐=Partially met—the department provided evidence that addressed about half or a large portion of the criteria.
- =Not met—the department did not provide evidence that addressed the criteria or provided evidence that minimally addressed the criteria.

Source: GAO analysis of department documentation.

- **Designate a senior official with departmentwide responsibility.** Only one department—Interior—has designated a senior official with departmentwide responsibility, accountability, and authority. Specifically, in a memo issued in August 2012, the Assistant Secretary for Policy, Management and Budget designated a senior official with departmentwide responsibility, accountability, and authority for geospatial information investments, and for overseeing, coordinating, and facilitating implementation of the department's geospatial-related requirements, policies, activities, and issues. According to NOAA's Chief Information Officer, he has been designated as Commerce's senior official for geospatial information, but acknowledged that he does not have responsibility and authority for other Commerce geospatial investments, such as those of the Census Bureau. Finally, Transportation has designated a senior official for geospatial information, but this individual does not have departmentwide responsibility, accountability, or authority for geospatial information, as she does not have any insight into, or control over, geospatial activities conducted by the Federal Aviation Administration, one of Transportation's major agencies.
- **Prepare and implement a strategy.** None of the departments have prepared and implemented a strategy for advancing geographic information and related geospatial data activities appropriate to their

mission. According to Interior's Deputy Assistant Secretary for Technology, Information, and Business Services, the *Geospatial Modernization Blueprint Recommendations and Architectures* from 2007 is the department's internal geospatial strategy;³⁸ however, it has not been approved or implemented.

- **Develop a policy for metadata.** None of the departments in our review have established a departmentwide clearinghouse metadata policy. In lieu of a departmentwide policy, two of Commerce's agencies, NOAA and the Census Bureau, have developed policies. Specifically, NOAA's *Data Documentation Procedural Directive* requires metadata for NOAA environmental data, information, and services to be published to certain national and international clearinghouse portals, and references data.gov.³⁹ The Census Bureau's metadata policy also mentions the importance of posting metadata to the clearinghouse.⁴⁰
- **Make metadata available on the clearinghouse.** All three departments have made their metadata available on the clearinghouse.

Most metadata records in the clearinghouse are owned by three federal agencies. Specifically, our analysis of the 441,343 federal records in the centralized geospatial metadata repository, as of February 2012,⁴¹ showed that over 99 percent of these records were populated by three agencies: Census Bureau, USGS, and NOAA. See table 2 for the total number of geospatial metadata records by agency.

³⁸Department of the Interior, *Geospatial Modernization Blueprint Recommendations and Architectures*, Version 1.0, December 2007.

³⁹National Oceanic and Atmospheric Administration, Environmental Data Management Committee, *Data Documentation Procedural Directive*, Oct. 28, 2011.

⁴⁰Census Bureau, National State Geographic Partnerships Branch, *Geospatial Product Metadata Standard*, Version 5.0, Jan. 28, 2010.

⁴¹The number of federal records in the clearinghouse as of February 2012 (441,343) is higher than the total number of federal records in the clearinghouse as of August 2012 (372,986) because, according to the General Services Administration, who is responsible for managing the clearinghouse database, it has taken steps to remove duplicative records or records no longer owned by federal agencies.

Table 2: Total Number of Federal Geospatial Metadata Records by Agency

Agency	Number of records	Percentage of total records
Census Bureau	283,855	64.3%
USGS	132,792	30.1
NOAA	23,904	5.4
Other	792	0.2
Total	441,343	100

Source: GAO analysis of General Services Administration data.

Our analysis of the 29 mandatory fields⁴² in the 441,343 federal metadata records shows that the metadata records from the three agencies with the majority of geospatial metadata records are largely complete, as shown in table 3. Specifically, nearly all of Census Bureau records had between 24 and 27 mandatory fields completed. In addition, over 95 percent of USGS's and NOAA's records had 28 or 29 of the mandatory fields completed. Finally, the small number of records associated with all other agencies had between 24 and 29 of the mandatory fields completed for virtually all of the records.

Table 3: Percentage of Metadata Records with Range of Mandatory Fields Completed By Agency

Range of mandatory fields	All agencies	Census Bureau	USGS	NOAA	Other agencies
0 – 18	0%	0%	0%	0.3%	0.1%
19 – 23	0.9	0 ^a	2.9	0	0.1
24 – 27	64.9	100	1.2	2.0	49.2
28 – 29	34.2	0	95.9	97.7	50.6
Total	100	100	100	100	100

Source: GAO analysis of General Services Administration data.

^aOur table is rounded to the nearest tenth of a percent. We found that of the 283,855 Census Bureau records, only 50 records, approximately .018 percent, had fewer than 24 of the mandatory fields completed.

⁴²According to the FGDC, *Content Standard for Digital Geospatial Metadata Workbook*, May 1, 2000, there are 29 mandatory fields that are to be completed for all metadata records.

Theme-lead Agencies Are Not Effectively Managing Data Themes

- **Adopt procedures for accessing the clearinghouse.** None of the departments have established procedures for searching the clearinghouse before expending funds to acquire or produce geospatial data. While Interior does not have procedures for accessing the clearinghouse, the department's Deputy Assistant Secretary for Technology, Information, and Business Services said that it is commonly practiced and noted that the department usually confers internally with its committees on elevation and orthoimagery⁴³ prior to acquiring geospatial data.

Department officials attribute the lack of progress in implementing important coordination and management activities to a lack of priority, competing department resources, and in some cases, a lack of awareness. Until the departments implement these activities, they risk acquiring potentially duplicative and costly geospatial data, resulting in the inefficient use of already limited resources.

According to OMB,⁴⁴ in order to effectively manage geospatial data and provide the leadership necessary to ensure the national coverage and stewardship of specific geospatial data themes, NSDI-designated theme-lead agencies are to:

- designate a point of contact who is responsible for the development, maintenance, coordination, and dissemination of data using the clearinghouse;
- prepare goals relating to the theme that support the NSDI strategy, and as needed, collect and analyze information from user needs and include those needs in the theme-related goals;
- develop and implement a plan for the nationwide population of the data theme that includes (1) the development of partnership programs with states, tribes, academia, the private sector, other federal agencies, and localities that meet the needs of users; (2) human and financial resource needs; (3) standards, metadata, and the

⁴³Elevation data provide three-dimensional models of the Earth's surface. Orthoimagery data provide images of the Earth's surface collected by aerial photography or satellites.

⁴⁴OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, Aug. 19, 2002.

clearinghouse needs; and (4) a timetable for the development for the theme; and

- create a plan to develop and implement theme standards.

As shown in table 4, the three theme-lead agencies in our review have implemented some but not all important geospatial activities.

Table 4: Status of Theme-lead Agencies' Implementation of Geospatial Activities

Activity	NOAA	USGS	BTS
Designate a theme point of contact	●	●	●
Prepare goals and analyze user needs	●	◐	◐
Develop a plan for theme population	●	◐	◐
Develop a standards plan	○	○	○

Key

●=Fully met—the agency provided evidence that addressed the criteria.

◐=Partially met—the agency provided evidence that addressed about half or a large portion of the criteria.

○=Not met—the agency did not provide evidence that addressed the criteria or provided evidence that minimally addressed the criteria.

Source: GAO analysis of agency documentation.

- **Designate a theme point of contact.** All three agencies have designated a point of contact.
- **Prepare goals and analyze user needs.** One agency has developed goals that recognize and consider user needs for all key datasets in its theme and two agencies have developed goals based on user needs for the major datasets that comprise their themes. Specifically, NOAA's *National Geodetic Survey Ten-Year Plan* includes goals for furthering all of the key datasets in the geodetic control theme.⁴⁵ For example, the plan highlights the goals to modernize geometric (horizontal) datum⁴⁶ and to modernize the geopotential (vertical)

⁴⁵Department of Commerce, National Oceanic and Atmospheric Administration, *The National Geodetic Survey Ten-Year Plan: Mission, Vision, and Strategy 2008-2018*, 2008.

⁴⁶The geometric datum, also known as the horizontal datum, is the horizontal frame of reference used by all civilian agencies. It is essentially the x and y axis on a horizontal plane, similar to longitude and latitude.

datum,⁴⁷ and identifies user needs and why they are important. NOAA has also developed other short-term goals, such as continue education, outreach, development of transition tools and applications, and capacity-building activities to prepare users for the transition to new geometric and geopotential datum; and identify common objectives and find opportunities for cooperative projects and tasks related to standardization and updates to vertical datum. USGS has developed goals for the maintenance of the National Hydrography Dataset and for the Watershed Boundaries Dataset, such as ensuring that datasets continue to meet user needs; however, these two datasets do not include all datasets within the hydrography theme. Similarly, BTS has developed goals for the development of a comprehensive road centerline⁴⁸ dataset; however, the goals do not address all other modes of transportation covered by the data theme, such as railroads, waterways, and virtual airways. The goals recognize differences in user needs for road centerline data, such as basic geometry and naming, support for addressing, and enhanced cartographic displays.

- **Develop a plan for theme population.** One agency has developed a plan that addresses all of the key elements for developing a nationwide plan; one has taken actions consistent with most of the key elements for some of the datasets associated with the theme, but has not integrated all the activities into a single plan that covers the entire theme; and one has developed a plan that addresses some of the key elements, but for only one of the major datasets in the theme. NOAA has developed a plan, its *National Geodetic Survey Ten-Year Plan*, which provides a strategy for how NOAA intends to modernize and populate its data theme. The plan includes the development of partnership programs with states, academia, federal agencies, and other stakeholders; identifies the need to address human and financial resource needs; identifies needs for standards, metadata, and the clearinghouse; and advances a timetable for the development of the theme. In contrast, USGS does not have a plan for the population of the hydrography theme; however, it has taken actions to (1) develop

⁴⁷The geopotential datum, also known as the vertical datum, is the vertical frame of reference used by all civilian agencies. It is essentially the z axis in a three-dimensional model, similar to altitude.

⁴⁸Road centerlines are vector line data that represent the geographic center of road rights-of-way on transportation networks.

partnerships; (2) address human and financial resources; and (3) identify needs for standards, metadata, and the clearinghouse for the National Hydrography Dataset, which is one dataset within the hydrography theme. BTS has developed a strategic plan for the development of a nationwide road centerline dataset. However, this plan does not address all other modes of transportation covered by the data theme, such as railroads, waterways, and virtual airways. These officials stated that a strategic plan for connecting all of the transportation datasets in an intermodal manner is needed; however, there are no plans to create such a plan in the immediate future.

- **Develop a standards plan.** None of the agencies have developed a plan to develop and implement standards; while NOAA recognized the need for a plan, both USGS and BTS stated that such a plan was not needed for their themes—USGS because of the maturity of their existing datasets, and BTS because they collect data from states and counties in various formats, and then standardize the data themselves. However, without a plan to maintain existing standards or anticipate new standards, these agencies risk potential future difficulties exchanging and sharing geospatial datasets.

Theme-lead agency officials attribute the lack of progress in implementing these activities to competing priorities, limited resources, and the perceived lack of need for some plans. Until agencies implement these activities, they will be challenged to effectively manage important geospatial activities, wisely use limited resources, and risk engaging in potential duplicative geospatial acquisition efforts.

OMB Does Not Have Complete and Reliable Information to Identify Duplicative Geospatial Investments

OMB has oversight responsibilities for federal IT systems and acquisition activities—including GIS—to help ensure their efficient and effective use. According to OMB Office of E-Government staff members, OMB relies primarily on the annual budget process to identify potentially duplicative geospatial investments; specifically, the exhibit 53s and 300s.

However, OMB’s Office of E-Government staff members acknowledged that these two sources may not in all cases provide the necessary information to allow OMB to identify potentially duplicative investments or accurately quantify the amount of federal dollars spent on geospatial datasets for three primary reasons. First, these staff members stated that some federal agencies may not classify investments in geospatial data as “information technology” (such as satellites), meaning that they would not be captured in exhibit 53s. OMB staff members stated that agencies are

to determine what qualifies as an IT investment and stated that there are variations in the way that agencies interpret the definition of IT. Second, agencies do not always appropriately classify geospatial investments as “geospatial services” using the Federal Enterprise Architecture codes. Our analysis of the fiscal year 2013 exhibit 53s for the three departments that we reviewed showed that only 5 of their 24 key datasets⁴⁹—1 of NOAA’s 6 geodetic control datasets,⁵⁰ and 4 of USGS’s 7 hydrography datasets⁵¹—were included in the departments’ exhibit 53s. Further, only 1 of these investments⁵² was identified with the geospatial services code, as required by OMB’s fiscal year 2013 budget formulation guidance.⁵³ Third, given that the geospatial data may be only one component of an IT investment or capital asset, even if it were included in the agencies’ exhibit 53s or 300s, OMB would have difficulties in identifying the geospatial component, and the associated dollars, without having a detailed discussion with individuals responsible for each investment.

OMB staff members stated that they do not have a complete picture of how much money is being spent on geospatial investments across the federal government because, as noted above, what is being reported may not capture all geospatial spending, and the data have not been reliable. In 2006 and 2007, OMB made two data calls directly to federal agencies to determine federal agencies’ spending on geospatial investments. However, according to OMB, neither of these data calls provided the agency with complete and reliable information—largely because agencies either provided incomplete information, or did not respond at all. Although the data may not be complete, those agencies that did respond reported that they planned to spend about \$1.89 billion in geospatial data and services between fiscal years 2007 and 2009, of which about \$1.53 billion, or about 81 percent, was to be on geospatial data. OMB staff

⁴⁹The FGDC Secretariat provided a list of key datasets associated with the three themes in our sample as of August 2012.

⁵⁰The key dataset was the Continuously Operating Reference Stations.

⁵¹The key datasets were National Hydrography Dataset, National Water Information System-Stream Gage Locations, National Water Information System-Water Quality Monitoring Stations Locations, and National Wetlands Inventory.

⁵²The key dataset was the National Hydrography Dataset.

⁵³As of August 2012, NOAA officials stated that they had requested a modification to its exhibit 53 to identify the Continuously Operating Reference Stations dataset as geospatial services.

members stated that OMB has not made any additional data collections outside of the IT reporting process (i.e., exhibit 53s and 300s) for geospatial data investments since 2007, and as of September 2012, has no current plans for any new collections.

OMB staff members stated that, although eliminating duplication in geospatial investments is important, OMB's recent efforts have focused on other commodity IT areas with higher spending and cyber security ramifications, such as reducing the numbers of federal data centers and internet connections maintained by the government. However, without complete and reliable information on the federal government's investments in geospatial data, including the amount of federal dollars spent, OMB does not have the necessary information to make a fact-based decision about the potential priority of geospatial information in relation to other activities.

Federal Agencies Have Coordinated Specific Investments, but Duplicative Geospatial Data Exists

According to FGDC Secretariat officials, departments and agencies have taken steps to coordinate geospatial data related to their respective data themes.

- Interior participates in several efforts aimed at coordinating one of its themes, orthoimagery. For example, in conjunction with the U.S. Department of Agriculture, Interior participates in the National Agricultural Imagery Program, which was developed to obtain one-meter resolution, "leaf-on" imagery⁵⁴ for the 48 continental states on a 3-year cycle. In addition, Interior, in conjunction with the Department of Defense, participates in the Urban Area Imagery Program. The goal of this program is to acquire one-foot resolution, "leaf-off" imagery⁵⁵ for 133 of the nation's largest or most important urban areas (such as state capitals) on a 2-to-4-year cycle. According to FGDC Secretariat officials, for both of these programs, members acquire the imagery, assure the quality of the imagery, and distribute it to the participants in the program. Each participant in these programs benefits from the imagery acquired, as do all other federal, state, and local agencies,

⁵⁴"Leaf-on" imagery refers to the time of year in which imagery data are being acquired during which there is foliage on certain tree and shrub species.

⁵⁵"Leaf-off" imagery refers to the time of year in which imagery data are being acquired during which there is no foliage or a reduced amount of foliage on certain tree and shrub species.

the private sector (such as companies that provide mapping services on the Internet), nonprofit organizations, and members of the public interested in this type of imagery.

- Interior also participates in a program for another theme, elevation. Specifically, in conjunction with other departments, Interior participates in the National Digital Elevation Program, which is intended to acquire detailed elevation data using advanced technologies to support various programmatic needs, such as USGS's Coastal and Marine Geology program, the U.S. Department of Agriculture's Natural Resources Conservation Service (which supports precision farming), and the Department of Homeland Security's Federal Emergency Management Agency's Risk Mapping, Assessment, and Planning program. The participating agencies seek other federal agency and state and local government participation in elevation acquisition projects as part of their program design. According to Secretariat officials, agencies generally coordinate their plans and funding, and execute the projects independently. In addition, the data acquired by projects are available to others.
- USGS further coordinated the elevation theme when, in conjunction with its partners, it sponsored the National Enhanced Elevation Assessment. According to USGS officials, the assessment was conducted to investigate the potential to obtain greater benefits and efficiencies from the growing interest in using data from advanced technologies, and concluded that moving to a coordinated national program has the potential to produce new benefits in excess of \$1 billion annually. USGS and its federal partners intend to use the recommendations from the assessment to improve on the current coordination-based approach among federal agencies and nonfederal organizations.
- As the theme-lead agency of the hydrography theme, USGS has led efforts to coordinate the population of the hydrography theme. According to USGS officials, it created a partnership for the development of two separate datasets associated with hydrography: the National Hydrography Dataset and the Watershed Boundaries Dataset. These datasets were created by pooling funding and resources from several federal, state, and local agencies into a single effort. This partnership supports the missions of several federal agencies: USGS and the U.S. Forest Service for mapping and analysis projects, the Environmental Protection Agency and the Department of Homeland Security for analysis projects, and the Census Bureau for mapping. Numerous state agencies also

participate in order to meet reporting requirements of the Federal Water Pollution Control Act. This partnership also has data stewardship agreements in place between USGS and 35 states. This data stewardship activity is based on the input of local organizations knowledgeable about hydrography in their immediate area.

While agencies have taken actions to coordinate geospatial data investments, recent reports, as well as officials from state and local associations and the FGDC Advisory Committee have all stated that duplicative geospatial data investments continue across all levels of government. For example, according to Transportation's *Transportation for the Nation Strategic Plan*, dated May 2011, duplication exists in the acquisition of nationwide road centerline data across federal agencies and other levels of government, resulting in millions of wasted taxpayer dollars.⁵⁶ The report identified several initiatives that are currently independently acquiring road centerline data:

- Census Bureau's Topologically Integrated Geographic Encoding and Referencing (TIGER) system, which uses data procured from local sources for census enumeration and demographic applications. These data were built and are maintained by the Census Bureau.
- USGS's National Map website, which uses licensed data from a commercial provider to create viewable maps on the National Map. These data are managed by USGS.⁵⁷
- The Department of Defense's Homeland Security Infrastructure Program, which uses licensed commercial data procured by the National Geospatial-Intelligence Agency for emergency management.

In addition, a subcommittee of the National Geospatial Advisory Committee has, at the request of the FGDC, been evaluating the need for a national address database, assessing potential concerns with such a database, and identifying possible approaches for its development. According to a National Geospatial Advisory Committee official, several federal agencies collect, purchase, or lease address information in a

⁵⁶Department of Transportation, *Transportation for the Nation Strategic Plan*, May 2011.

⁵⁷According to Interior officials, the Census Bureau and USGS have formed a working group to determine if the accuracy of the TIGER data can be improved sufficiently to allow them to be used on the National Map website, as opposed to the licensed data.

noncoordinated fashion. This subcommittee is in the process of finalizing a report⁵⁸ for the full committee that would assess, among other things, the benefits, potential savings, and efficiencies that could be realized from the development of a national address database.

Further, in a report on land parcel data, the National Academy of Sciences⁵⁹ stated that the lack of nationally integrated land parcel data has led to duplication of effort among various levels of government and between the public and private sector, such as the Department of Housing and Urban Development, the U. S. Forest Service, insurance companies, and private companies that list home values and sell parcel maps.⁶⁰ In addition, a National Geospatial Advisory Committee representative stated that a commercial provider leases the same proprietary parcel data to six federal agencies: the Department of Housing and Urban Development, the Department of Homeland Security, the Federal Bureau of Investigation, the Small Business Administration, the Federal Deposit Insurance Corporation, and the Federal Reserve. In recent reports, the Congressional Research Service found that a coordinated approach to federally managed parcel data still did not exist and that the best method for obtaining an accurate tally of federal lands is to contact each land management agency directly.⁶¹

Representatives from the National States Geographic Information Council⁶² stated that federal agencies are investing in geospatial data that exist at the state and local level, noting that duplicative data continue to

⁵⁸The report is tentatively scheduled for approval by the National Geospatial Advisory Committee by December 2012.

⁵⁹Founded by congressional charter, the National Academy of the Sciences is a private, nonprofit organization that serves as advisors to the nation on issues of science and technology that frequently affect policy decisions.

⁶⁰National Academy of Sciences, *National Land Parcel Data: A Vision for the Future*, 2007.

⁶¹Congressional Research Service, *Issues and Challenges for Federal Geospatial Information*, Apr. 27, 2012; and *Issues Regarding a National Land Parcel Database*, May 13, 2011.

⁶²The National States Geographic Information Council has two missions: (1) to promote the coordination of statewide geospatial activities in all states and (2) to advocate for the states in national geospatial policy initiatives to help enable the NSDI. Members of the council include senior state GIS managers and coordinators as well as others from all levels of government, academia, and the private sector. See <http://www.nsgic.org/>.

be procured in such areas as imagery, elevation, road centerlines, and address points.

Conclusions

The long-standing problem of effectively coordinating federal geospatial investments to reduce redundancies has yet to be resolved. In particular, the FGDC has not established a framework for governmentwide management of themes and datasets; provided geospatial information users with the means to identify planned data acquisitions; and developed and maintained a national strategy to guide the development of the NSDI, with associated metrics to measure progress and ensure accountability. Similarly, federal departments and agencies have not yet implemented long-standing OMB guidance intended to ensure the efficient use of limited federal resources and the effective stewardship of geospatial data themes, including developing and implementing a strategy for advancing geospatial activities related to their mission; and implementing policies, procedures, and plans for effectively coordinating and managing geospatial data, standards, and the clearinghouse. Moreover, OMB has not established an effective mechanism to identify the amount of the federal budget being spent on geospatial investments as well as potentially duplicative geospatial investments.

The FGDC, federal agencies, and OMB have each indicated that the lack of progress in implementing these important coordination activities is because they have been focusing on other priorities. However, while the extent of duplication in geospatial investments is unknown, it is estimated that billions of dollars are being spent across the federal government on geospatial investments. Further, many mission-critical applications, such as those used to respond to natural disasters—floods, hurricanes, and fires—depend on geospatial information to protect lives and property. Thus, it is important that the data acquired to support these critical functions be done in a timely and coordinated manner, with minimal duplication.

Until a comprehensive national strategy is in place, the FGDC develops and implements guidance and tools to effectively coordinate governmentwide geospatial activities, and federal agencies establish and implement the policies, procedures, and plans to coordinate their geospatial activities, the vision of the NSDI to improve the coordination and use of geospatial information will likely not be fully realized and duplicative investments will likely continue. Further, until OMB establishes a way to obtain reliable information about federal geospatial investments, OMB will not be able to identify potentially duplicative geospatial

investments. Unless the FGDC, federal departments and agencies, and OMB decide that investments in geospatial information are a priority, these investments will remain uncoordinated, and although the extent of duplication is unknown, the federal government will continue to acquire duplicative geospatial information and waste taxpayer dollars.

Recommendations for Executive Action

To better facilitate the coordination of—and accountability for—the estimated billions of dollars in federal geospatial investments, and to reduce duplication, we recommend that the Secretary of the Interior, as the FGDC Chair, direct the FGDC Steering Committee to take the following three actions.

- Establish a time frame for completing a plan to facilitate the implementation of OMB's portfolio management guidance, and develop and implement the plan within the established time frame. The plan, at a minimum, should include goals and performance measures, and the FGDC should report annually to OMB on the progress made on efforts to improve coordination and reduce duplication among themes.
- Develop and implement guidance for identifying planned geospatial investments using the Geospatial Platform, and establish a time frame for doing so.
- Establish a time frame for creating and updating a strategic plan to improve coordination and reduce duplication, and create and implement the plan within the established time frame. The plan, at a minimum, should include (1) a vision statement for the NSDI; (2) outcome-oriented goals and objectives that address all aspects of the NSDI; (3) a description of how the goals and objectives are to be achieved, including a description of the resources needed to achieve the goals and objectives and how the FGDC is to work with other agencies to achieve them; (4) performance measures for achieving the stated goals; and (5) external factors that could affect the achievement of the goals and objectives.

To help ensure the success of department's efforts to improve geospatial coordination and reduce duplication, we recommend that the Secretary of Commerce designate a senior agency official who has departmentwide responsibility, accountability, and authority for geospatial information issues. We further recommend that the Secretary of Commerce direct the

designated senior official for geospatial information to take the following three actions.

- Prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial data activities appropriate to its mission.
- Develop a policy that requires the department to make its geospatial metadata available on the clearinghouse.
- Develop and implement internal procedures to ensure that it accesses the NSDI clearinghouse before it expends funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.

Further, to improve the department's management of its geodetic control theme, we recommend that the Secretary of Commerce direct the geodetic control theme point of contact to create and implement a plan to develop and implement geodetic control theme standards.

We recommend that the Secretary of the Interior direct the designated senior official for geospatial information to take the following three actions.

- Prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial data activities appropriate to its mission.
- Develop a policy that requires the department to make its geospatial metadata available on the clearinghouse.
- Develop and implement internal procedures to ensure that it accesses the NSDI clearinghouse before it expends funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.

We further recommend that the Secretary of the Interior direct the hydrography theme point of contact to take the following three actions.

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- Prepare goals relating to all datasets within the hydrography theme that support the NSDI, and as needed, collect and analyze information from user needs and include those needs in the theme-related goals.
 - Develop and implement a plan for the nationwide population of the hydrography theme that addresses all datasets within the theme; and that includes (1) the development of partnership programs with states, tribes, academia, the private sector, other federal agencies, and localities that meet the needs of users; (2) human and financial resource needs; (3) standards, metadata, and the clearinghouse needs; and (4) a timetable for the development for the theme.
 - Create and implement a plan to develop and implement hydrography theme standards.

We recommend that the Secretary of Transportation designate a senior agency official who has departmentwide responsibility, accountability, and authority for geospatial information issues. We further recommend that the Secretary of Transportation direct the designated senior official for geospatial information to take the following three actions.

- Prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial data activities appropriate to its mission.
- Develop a policy that requires the department to make its geospatial metadata available on the clearinghouse.
- Develop and implement internal procedures to ensure that it accesses the NSDI clearinghouse before it expends funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.

We further recommend that the Secretary of Transportation direct the transportation theme point of contact to take the following three actions.

- Prepare goals relating to all datasets within the transportation theme that support the NSDI, and as needed, collect and analyze information from user needs and include those needs in the theme-related goals.
- Develop and implement a plan for the nationwide population of the transportation theme that addresses all datasets within the theme; and that includes (1) the development of partnership programs with

states, tribes, academia, the private sector, other federal agencies, and localities that meet the needs of users; (2) human and financial resource needs; (3) standards, metadata, and the clearinghouse needs; and (4) a timetable for the development for the theme.

- Create and implement a plan to develop and implement transportation theme standards.

Further, to improve OMB oversight of geospatial information and assets, and minimize duplication of federal geospatial investments, we recommend that the Director of OMB develop a mechanism, or modify existing mechanisms, to identify and report annually on all geospatial-related investments, including dollars invested and the nature of the investment.

Agency Comments and Our Evaluation

We received written, e-mail, or oral responses on a draft of this report from Interior, Commerce, Transportation, as well as OMB and the General Services Administration. These responses are summarized below.

In written comments, signed by the Assistant Secretary for Policy, Management and Budget, and reprinted in appendix III, Interior generally agreed with our recommendations. The department stated that it recognizes the need to more fully implement the portfolio management requirements described in the OMB Circular A-16 supplemental guidance and is already actively working to develop tools that will help agencies identify planned geospatial investments in the Geospatial Platform. With respect to our recommendations aimed at improving Interior's management of its geospatial investments, the department stated that it is beginning to take actions to implement our recommendations, including developing an Geospatial Advisory Committee for the department—which is intended to provide leadership and direction for the development of a comprehensive geospatial technical strategy for the department—as well as developing procedures for making metadata available on the clearinghouse. The department further stated that it is committed to working with OMB and its partner agencies to address our recommendations in a timely manner.

In addition, the department stated that its efforts to lead and coordinate activities of the FGDC and the Geospatial Platform continue to accrue great benefits to the federal community and U.S. citizens. In particular, Interior stated that through these efforts, it will be able to implement the

supplemental guidance to OMB Circular A-16, and realize the tremendous potential of the Geospatial Platform. We support the department's efforts as evidenced by our recommendations to the department aimed at furthering agencies' implementation of the supplemental guidance and use of the Geospatial Platform to identify planned geospatial investments. Interior also provided technical comments, which we have incorporated in the report as appropriate.

In written comments, signed by the Acting Secretary of Commerce, and reprinted in appendix IV, Commerce stated that the department and NOAA agree with our recommendations, and described actions planned to implement them. Commerce also stated that it appreciates the work that we have done to improve coordination in managing geospatial investments.

In oral comments, Transportation officials, including the department's Geospatial Information Officer/BTS Director of Geospatial Information Systems, neither agreed nor disagreed with our recommendations, and provided two comments on our draft report. First, Transportation officials stated that, as of October 2012, the department's metadata files are available on the geoplatform.gov and the geo.data.gov sites, and provided supporting evidence. As a result, we revised our report to acknowledge that the department has made its metadata associated with geospatial data available on the clearinghouse, and removed the recommendation that it does so. Second, Transportation officials stated that they believed that the department should have received partial credit for having prepared, maintained, published, and implemented a strategy for advancing geographic information and related geospatial data activities appropriate to the department's mission, and in support of the NSDI strategy. Specifically, Transportation officials stated that the department's *Transportation for the Nation Strategic Plan* partially satisfies these criteria because it includes a strategy for collecting and maintaining road centerline data, which represents the vast majority of travel in terms of both passengers and freight. We agree that transportation by road is a major component of the transportation data theme. In fact, our assessment of this plan was the basis for the partial rating for two of the criteria related to BTS's (the theme-lead agency) management of the transportation data theme: "prepared goals and analyzed user needs," and "developed a plan for theme population." However, the strategic plan does not include a strategy for advancing all the department's geographic information and related geospatial data activities, nor does it describe how the department and its agencies are to coordinate their geospatial efforts to support the department's mission. In

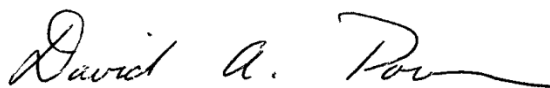
particular, the plan does not address geospatial themes other than transportation—including elevation and imagery—in which Federal Aviation Administration officials stated that their agency also makes investments. Therefore, we believe that the department's *Transportation for the Nation Strategic Plan* does not constitute a departmentwide geospatial plan. In addition, Transportation officials provided a technical comment, which we incorporated into the draft.

In comments provided via e-mail, a paralegal specialist in OMB's Office of General Counsel, on behalf of OMB, stated that OMB concurs with the need for improved collection of geospatial-related investments, but believes that it should only be achieved through improvements to broader reporting mechanisms for IT investments and data assets, and not by developing new and separate mechanisms specifically for geospatial-related assets. OMB further noted that it would be helpful if we clarified our recommendation to acknowledge that a new process is not required or expected. The decision as to whether OMB should develop a new mechanism, or improve an existing mechanism, should be made based on whichever option will be most successful in collecting the necessary information. We modified our recommendation to reflect this. OMB also provided technical comments, which we incorporated as appropriate.

In e-mail comments provided by a Management and Program Analyst in the GAO/IG (Inspector General) Response Audit Division, the General Services Administration stated that it had no formal comments on the draft report.

We are sending copies of this report to interested congressional committees; the Chair and Vice-Chair of the Federal Geographic Data Committee; the Director of the Office of Management and Budget; the Secretaries of the Departments of Commerce, the Interior, and Transportation; and the Administrator of the General Services Administration. This report will also be available at no charge on our website at <http://www.gao.gov>.

If you or your staffs have any questions on matters discussed in this report, please contact me at (202) 512-9286 or pownerd@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix V.



David A. Powner
Director
Information Technology Management Issues

Appendix I: Objective, Scope, and Methodology

Our objective was to determine the extent to which the federal government has established and effectively implemented policies and procedures for coordinating its investments in geospatial data and avoiding duplication. To address this objective, we focused on governmentwide activities to implement the National Spatial Data Infrastructure (NSDI), including efforts of the Federal Geographic Data Committee (FGDC), as well as those within selected departments.

To evaluate federal departments' efforts to implement the NSDI, we first identified the nine framework themes,¹ as identified in Office of Management and Budget (OMB) Circular A-16. These framework themes are cadastral, cadastral (offshore), digital orthoimagery, elevation bathymetric, elevation terrestrial, geodetic control, government units, hydrography, and transportation; and are described in appendix II. From those nine themes, we then randomly selected three themes and identified the federal departments and agencies responsible for managing the themes. The three departments, theme-lead agencies, and selected themes are:

- Department of Commerce (Commerce)—National Oceanic and Atmospheric Administration (NOAA)—Geodetic Control;
- Department of the Interior (Interior)—U. S. Geological Survey (USGS)—Hydrography; and
- Department of Transportation (Transportation)—Bureau of Transportation Statistics (BTS)—Transportation.

We then reviewed FGDC and federal department documentation, such as policies, procedures, strategic plans, implementation plans, technical documentation of standards and metadata, committee charters and meeting minutes, and budget documentation. We assessed this information against responsibilities identified in Executive Order 12906,²

¹The FGDC considers there to be seven framework themes, with two of the themes having two parts. Specifically, FGDC considers cadastral and cadastral (offshore) to be one theme and elevation bathymetric and elevation terrestrial to be one theme.

²Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

OMB Circular A-16,³ OMB M-06-07,⁴ and OMB M-11-03;⁵ identified any discrepancies, and discussed them with the relevant agency officials.

To determine the completeness of the federal agency metadata records in the clearinghouse and to determine which agencies contributed records to geo.data.gov, we obtained an extract of the contents of geo.data.gov as of February 22, 2012. We then recreated a database of the metadata records. We reviewed FGDC guidance⁶ to identify what are considered to be the mandatory data elements, which total 29. For each record in the database, we determined if the metadata value for each of the 29 mandatory data fields had information or was blank. In addition, we used the metadata records to determine what agencies contributed records by examining the data fields that indicated the origin and publisher of the data.

In order to assess the reliability of the clearinghouse data that we analyzed, we reviewed FGDC documentation, the General Services Administration's written responses to questions, and interviewed officials familiar with the clearinghouse data in order to gain an understanding of the controls around the creation and maintenance of the clearinghouse data. We determined that our recreation of the database had no material effect on our analysis and that the database, as recreated, was sufficiently reliable for our purposes.

To determine whether OMB had complete and reliable information to identify duplicative geospatial investments, we reviewed OMB's most recent data calls for geospatial data from 2006 and 2007, OMB Circular A-11,⁷ and department budget submissions. We compared the list of key datasets for the themes in our sample to budget documentation available

³OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities*, Aug. 19, 2002.

⁴OMB, M-06-07, *Designation of a Senior Agency Official for Geospatial Information*, Mar. 3, 2006.

⁵OMB, M-11-03, *Issuance of OMB Circular A-16 Supplemental Guidance*, Nov. 10, 2010.

⁶FGDC, *FGDC-STD-001-1998: Content Standard for Digital Geospatial Metadata*, 1998; and *Content Standard for Digital Geospatial Metadata Workbook*, May 1, 2000.

⁷OMB, Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, August 2011; and Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, August 2012.

in OMB's fiscal year 2013 exhibit 53 to determine the extent to which the agencies identified these datasets as investments in information technology (IT) and geospatial services. To determine the reliability of the data on the IT Dashboard, we reviewed recent GAO reports that identified issues with the accuracy and reliability of agency data on the IT Dashboard. We determined that the data were sufficiently reliable for the purpose of this report, which is to determine the extent to which departments' key datasets were included as IT investments and coded as geospatial services in the departments' respective exhibit 53s for fiscal year 2013.

To identify potential duplicative geospatial investments, we reviewed recent reports⁸ from the FGDC, Transportation, the Congressional Research Service, the National Geospatial Advisory Committee,⁹ and the National Academy of Sciences,¹⁰ and spoke with FGDC and the National States Geographic Information Council officials.¹¹

We also interviewed FGDC officials, including the Chair and Vice-Chair of the FGDC; the Executive Director of the FGDC Office of the Secretariat; the representative for the Managing Partner of the Geospatial Platform; OMB Office of E-Government staff members; department and agency officials responsible for coordinating geospatial investments within their respective agencies as well as theme-lead points of contact within those agencies; General Services Administration officials responsible for managing the geospatial clearinghouse; the Chair of the National

⁸See, for example: Department of Transportation, *Transportation for the Nation Strategic Plan*, May 2011; National Geospatial Advisory Committee, *National Addresses Databases Background Paper - DRAFT*, prepared by Gene Trobia, Apr. 3, 2012; National Academy of Sciences, *National Land Parcel Data: A Vision for the Future*, 2007; Congressional Research Service, *Issues and Challenges for Federal Geospatial Information*, Apr. 27, 2012; and Congressional Research Service, *Issues Regarding a National Land Parcel Database*, May 13, 2011.

⁹The committee is a federal advisory committee sponsored by Interior under the Federal Advisory Committee Act. It reports to the Chair of the FGDC.

¹⁰Established by congressional charter, the National Academy of Sciences is a private, nonprofit organization that serves as advisors to the nation on issues of science and technology that frequently affect policy decisions.

¹¹The National States Geographic Information Council is made up of senior state geographic information system managers and coordinators. Other members include representatives from federal agencies, local government, the private sector, academia, and other professional organizations.

Geospatial Advisory Committee; and the President and Washington Liaison of the National States Geographic Information Council.

We conducted this performance audit from November 2011 to November 2012 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

Appendix II: Comparison between Proposed Themes and Existing Themes

FGDC proposed theme and description	Corresponding A-16 existing theme and description
<p>Biota—Biota pertain to, or describe the dynamic processes, interactions, distributions, and relationships between and among organisms and their environments.</p>	<p>Biological Resources—This dataset includes data pertaining to or descriptive of (nonhuman) biological resources and their distributions and habitats, including data at the suborganismal (genetics, physiology, anatomy, etc.), organismal (subspecies, species, systematics), and ecological (populations, communities, ecosystems, biomes, etc.) levels.</p> <p>Vegetation—Vegetation data describe a collection of plants or plant communities with distinguishable characteristics that occupy an area of interest.</p>
<p>Cadastre—This theme describes past, current, and future rights and interests in real property, including the spatial information necessary to describe geographic extents. Rights and interests are benefits or enjoyment in real property that can be conveyed, transferred, or otherwise allocated to another for economic remuneration. Rights and interests are recorded in land record documents.</p> <p>The spatial information necessary to describe geographic extents includes surveys and legal description frameworks, such as the Public Land Survey System, as well as parcel-by-parcel surveys and descriptions. This theme does not include federal government or military facilities.</p>	<p>Cadastral^a—Cadastral data describe the geographic extent of past, current, and future rights, title, and interests in real property, and the framework to support the description of that geographic extent. The geographic extent includes survey and description frameworks, such as the Public Land Survey System, as well as parcel-by-parcel surveys and descriptions.</p> <p>Cadastral (Offshore)^a—Offshore cadastre is the land management system used on the Outer Continental Shelf. It extends from the baseline to the extent of U.S. jurisdiction. Existing coverage is currently limited to the conterminous United States and portions of Alaska.</p> <p>Public Land Conveyance (patent) Records—Public land conveyance data are the records that describe all past, current, and future rights, title, and interests in real property. This is a system of storage, retrieval, and dissemination of documents describing the rights, title, and interests of parcels.</p> <p>Federal Land Ownership Status—Federal land ownership status includes the establishment and maintenance of a system for the storage and dissemination of information describing all title, estates, or interests of the federal government parcels of real and mineral property. The ownership status system is the portrayal of title for all such federal estates or interests in land.</p>
<p>Climate and Weather—Climate and weather describes meteorological conditions, including temperature, precipitation, and wind, that characteristically prevail in a particular region over a long period of time. Weather is the state of the atmosphere at a given time and place, with respect to variables, such as temperature, moisture, wind velocity, and barometric pressure.</p>	<p>Climate—Climate data describe the spatial and temporal characteristics of the Earth’s atmosphere, hydrosphere, and land surface system. These data represent both model-generated and observed environmental information, which can be summarized to describe surface, near surface, and atmospheric conditions over a range of scales.</p>
<p>Cultural Resources—This theme describes features and characteristics of a collection of places of significance in history, architecture, engineering, or society. It includes national monuments and icons.</p>	<p>Cultural Resources—The cultural resources theme includes historic places, such as districts, sites, buildings, and structures of significance in history, architecture, engineering, or culture. Cultural resources also encompass prehistoric features as well as historic landscapes.</p> <p>Geographic Names—This dataset contains data or information on geographic place names deemed official for federal use by the U.S. Board on Geographic Names as pursuant to 80 Cong. Ch. 330. Geographic Names information includes both the official place name (current, historical, and aliases) and direct (i.e., geographic coordinates) and indirect (i.e., state and county where place is located) geospatial identifiers. This information is categorized as populated places, schools, reservoirs, parks, streams, valleys, and ridges.</p>

Appendix II: Comparison between Proposed Themes and Existing Themes

FGDC proposed theme and description	Corresponding A-16 existing theme and description
<p>Elevation—Elevation is the measured vertical position of the Earth surface and other landscape or bathymetric features relative to a reference datum typically related to sea level. These points normally describe bare Earth positions but may also describe the top surface of buildings and other objects, vegetation structure, or submerged objects.</p> <p>Elevation data can be stored as a three-dimensional array or as a continuous surface, such as a raster, triangulated irregular network, or contours. Elevation data may also be represented in other derivative forms, such as slope, aspect, ridge and drainage lines, and shaded relief.</p>	<p>Elevation Bathymetric^a—The bathymetric data for Inland and Intercoastal waterways is highly accurate bathymetric (i.e., the measurement of water depths) sounding information collected to ensure that federal navigation channels are maintained to their authorized depths. Bathymetric survey activities support the nation’s critical nautical charting program. These data are also used to create Electronic Navigational Charts.</p> <p>Elevation Terrestrial^a—These data contain georeferenced digital representations of terrestrial surfaces, natural or manmade, that describe vertical position above or below a datum surface.</p>
<p>Geodetic Control—This theme includes a collection of control points that provide a common reference system for establishing coordinates for geographic data.</p>	<p>Geodetic Control^a—Geodetic control provides a common reference system for establishing coordinates for all geographic data. All NSDI framework data and users’ applications data require geodetic control to accurately register spatial data. The National Spatial Reference System is the fundamental geodetic control for the United States.</p>
<p>Geology—Geology is geographically-referenced data pertaining to the origin, history, composition, structure, features, and processes of the solid Earth, both onshore and offshore.</p> <p>It includes geologic, geophysical, and geochemical maps, stratigraphy, paleontology, geochronology, mineral and energy resources, and natural hazards, such as earthquakes, volcanic eruptions, coastal erosion, and landslides. The theme does not include soils.</p>	<p>Geologic—The geologic spatial data theme includes all geologic mapping information and related geoscience spatial data (including associated geophysical, geochemical, geochronologic, and paleontologic data) that can contribute to the National Geologic Map Database as pursuant to Public Law 106-148.</p> <p>Offshore Minerals—Offshore minerals include minerals occurring in submerged lands. Examples of marine minerals include oil, gas, sulfur, gold, sand and gravel, and manganese.</p>
<p>Governmental Units—This theme includes data that describe political, governmental, and administrative (management) type boundaries that are used to manage people and resources. It includes geopolitical boundaries (county, parish, state, city, etc.), tribal boundaries, federal land boundaries, federal regions, international boundaries, and governmental administrative units, such as congressional districts, international lines of separation, limits, zones, enclaves, exclaves, special areas between states and dependencies, and all jurisdictional offshore limits within U.S. sovereignty. Boundaries associated with natural resources, demography, and cultural entities are excluded and can be found in the appropriate subject themes.</p>	<p>Governmental Units^a—These data describe, by a consistent set of rules and semantic definitions, the official boundaries of federal, state, local, and tribal governments as reported/certified to the U.S. Census Bureau by responsible officials of each government for purposes of reporting the nation’s official statistics.</p> <p>International Boundaries—International boundary data include both textual information to describe, and geographic information system (GIS) digital cartographic data to depict, both land and maritime international boundaries, other lines of separation, limits, zones, enclaves, exclaves, and special areas between states and dependencies.</p> <p>Marine Boundaries—Marine boundaries depict offshore waters and seabeds over which the United States has sovereignty and jurisdiction.</p>

Appendix II: Comparison between Proposed Themes and Existing Themes

FGDC proposed theme and description	Corresponding A-16 existing theme and description
<p>Imagery—The imagery theme includes georeferenced images of the Earth’s surface that have been collected using aerial photography or satellite data. Orthoimagery is prepared through a geometric correction process known as orthorectification to remove image displacements due to relief and sensor characteristics. This process allows for their use as base maps for digital mapping and analyses in a GIS. Specific imagery data sets created through image interpretation and classification, such as a land cover image, can be found under themes specific to the subject matter. This theme includes imagery, such as Landsat, National Agriculture Imagery Program, and Digital Orthophoto Quarter Quadrangle.</p>	<p>Digital Ortho Imagery^a—This dataset contains georeferenced images of the Earth’s surface where object displacement has been removed for sensor distortions and orientation, and terrain relief. Digital orthoimages have the geometric characteristics of a map and image qualities of a photograph.</p>
<p>Land Use/Land Cover—This theme refers collectively to natural and man-made surface features that cover the land (Land Cover) and to the primary ways in which land cover is used by humans (Land Use). Examples of Land Cover may be grass, asphalt, trees, bare ground, and water. Examples of Land Use may be urban, agricultural, ranges, and forest areas.</p>	<p>Earth Cover—The Earth cover theme uses a hierarchical classification system based on observable form and structure, as opposed to function or use. This system transitions from generalized to more specific and detailed class divisions, and provides a framework within which multiple land cover and land use classification systems can be cross-referenced. This system is applicable everywhere on the surface of the Earth. This theme differs from the Vegetation and Wetlands themes, which provide additional detail.</p>
<p>Real Property—The real property theme includes data that describes the spatial representation (location) of real property entities, typically consisting of one or more of the following: unimproved land, a building, a structure, site improvements, and the underlying land. Complex real property entities (i.e., facilities) are used for a broad spectrum of functions or missions. This theme focuses on spatial representation of real property assets only and does not seek to describe special purpose functions of real property, such as those found in the Cultural Resources, Transportation, or Utilities themes.</p>	<p>Buildings and Facilities—The facility theme includes federal sites or entities with a geospatial location deliberately established for designated activities; a facility database might describe a factory, military base, college, hospital, power plant, fishery, national park, office building, space command center, or prison.</p> <p>Housing—This theme includes geographic data on homeownership rates, including many attributes such as the Department of Housing and Urban Development’s revitalization zones, location of various forms of housing assistance, first-time homebuyers, underserved areas, and race.</p>
<p>Soils—This theme includes data that depict the geography and attributes of the many kinds of soils found in the landscape at both large and small map scales. A living dynamic resource providing a natural medium for plant growth and habitat for living organisms, soil recycles nutrients and wastes, stores carbon, and purifies water supplies. Soil has distinct layers (called “horizons”) that, in contrast to underlying geologic material, are altered by the interactions of climate, landscape features, and living organisms over time.</p>	<p>Soils—Soil data consist of georeferenced digital map data describing the spatial distribution of the various soils that cover the Earth’s surface, and attribute data describing the proportionate extent of the various soils as well as the physical and chemical characteristics of those soils. The physical and chemical properties are based on observed and measured values, as well as model-generated values. This theme also includes model-generated assessments of the suitability or limitations of the soils to various land uses.</p>

Appendix II: Comparison between Proposed Themes and Existing Themes

FGDC proposed theme and description	Corresponding A-16 existing theme and description
<p>Transportation—Transportation data describe means and aids for conveying persons and goods. The transportation system includes both physical and nonphysical components related to all modes of travel that allow the movement of goods and people between locations.</p>	<p>Transportation^a—Transportation data are used to model the geographic locations, interconnectedness, and characteristics of the transportation system within the United States. The transportation system includes both physical and nonphysical components representing all modes of travel that allow the movement of goods and people between locations.</p> <p>Transportation (Marine)—The Navigation Channel Framework consists of highly accurate dimensions (geographic coordinates for channel sides, centerlines, wideners, turning basins, and river mile markers) for every federal navigation channel maintained by the U.S. Army Corps of Engineers. The navigation framework will provide the basis for the marine transportation theme of the geospatial data framework.</p>
<p>Utilities—This theme includes the means, aids, and usage of facilities for producing, conveying, distributing, processing, and disposing of public and private commodities, including power, energy, communications, natural gas, and water. It includes subthemes for Energy and Communications.</p>	<p>There are not any corresponding existing themes.</p>
<p>Water—Inland—The Water—Inland theme describes interior hydrologic features and characteristics, including classification, measurements, location, and extent. It includes aquifers, watersheds, wetlands, navigation, water quality, water quantity, and groundwater information.</p>	<p>Hydrography^a—This data theme includes surface water features, such as lakes, ponds, streams and rivers, canals, oceans, and coastlines.</p> <p>Watershed Boundaries—This data theme encodes hydrologic, watershed boundaries into topographically defined sets of drainage areas that are organized in a nested hierarchy by size, and based on a standard hydrologic unit coding system.</p> <p>Flood Hazards/Flood Plain—This theme includes documentation of the boundaries and elevations of the 1 percent annual chance (100-year) flood for communities across the country. The National Flood Insurance Program has prepared flood hazard data for approximately 18,000 communities. The primary information prepared for these communities is for the 1 percent annual chance (100-year) flood, and includes documentation of the boundaries and elevations of that flood.</p> <p>Wetlands—The wetlands data layer provides the classification, location, and extent of wetlands and deepwater habitats.</p>
<p>Water—Oceans and Coasts—This theme includes datasets that describe features and characteristics of salt water bodies (tides, tidal waves, coastal information, reefs) and features and characteristics that represent the intersection of the land with the water surface (shorelines), the lines from which the territorial sea and other maritime zones are measured (baseline maritime), and lands covered by water at any stage of the tide (outer continental shelf), as distinguished from tidelands, which are attached to the mainland or an island and cover and uncover with the tide.</p>	<p>Baseline/Maritime Zones—Baseline represents the line from which maritime zones and limits are measured. Examples of these limits include the territorial sea, contiguous zone, and exclusive economic zone.</p> <p>Outer Continental Shelf Submerged Lands—These data include lands covered by water at any stage of the tide, as distinguished from tidelands, which are attached to the mainland or an island and cover and uncover with the tide. Tidelands presuppose a high-water line as the upper boundary, whereas submerged lands do not.</p> <p>Shoreline—Shorelines represent the intersection of the land with the water surface. The shoreline shown on NOAA's charts represents the line of contact between the land and a selected water elevation.</p>

Appendix II: Comparison between Proposed Themes and Existing Themes

FGDC proposed theme and description	Corresponding A-16 existing theme and description
<p>These existing themes are proposed to be removed because, according to the FGDC, the data associated with them are primarily statistical.</p>	<p>Cultural and Demographic Statistics—These geospatially referenced data describe the characteristics of people, the nature of the structures in which they live and work; the economic and other activities they pursue; the facilities they use to support their health, recreational, and other needs; the environmental consequences of their presence; and the boundaries, names, and numeric codes of geographic entities used to report the information collected.</p> <p>Law Enforcement Statistics—Law enforcement statistics describe the occurrence of events (including incidences, offenses, and arrests) geospatially located, related to ordinance and statutory violations and the individuals involved in those occurrences. This theme also includes data related to deployment of law enforcement resources and performance measures.</p> <p>Public Health—Public health themes relate to the protection, improvement, and promotion of the health and safety of all people. For example, public health databases include spatial data on mortality and natality events, infectious and notifiable diseases, incident cancer cases, behavioral risk factor and tuberculosis surveillance, hazardous substance releases and health effects, hospital statistics, and other similar data.</p>

Source: OMB and FGDC documentation.

^aDesignates a framework theme identified in OMB Circular No. A-16 as critical for many geospatial applications.

Appendix III: Comments from the Department of the Interior



United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

NOV 13 2012

Mr. David Powner
Director, Information Technology Management Issues
Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Powner:

Thank you for the opportunity to review and comment on the Government Accountability Office (GAO) draft report entitled, *Geospatial Information: OMB and Agencies Need to Make Coordination a Priority to Reduce Duplication* (GAO-13-94). We appreciate your work and share your interest in ensuring that the federal government continues to efficiently and effectively deploy geospatial technology in support of its diverse and important mission.

The Department of the Interior (DOI) generally agrees with the overall recommendations made in the report as they relate to DOI. We recognize the need to complete the implementation of portfolio management requirements described in the Office of Management and Budget Circular A-16 *Supplemental Guidance*. And as per the recommendations made in the draft report, DOI is already actively working to develop tools that will help agencies identify planned geospatial investments in the Geospatial Platform.

In addition, we are already beginning to take actions to implement the specific recommendations made in the report that pertain to the Department. This includes the establishment of the DOI Geospatial Advisory Committee, a body that will provide leadership and direction for the development of a comprehensive geospatial technology strategy for the Department, along with associated procedures for making our metadata available on the national clearinghouse. These actions will be of great benefit to the Department in helping to further our many mission areas that depend on geospatial information, and we appreciate the recommendations made by GAO that will help us direct these activities in the coming months.

We do, however, feel that this is also an opportunity to describe the benefits and value of efforts underway by the Department to lead and coordinate the activities of the Federal Geographic Data Committee and the Geospatial Platform. Over the past several years, there has been a substantial amount of activity in these areas that continues to accrue great benefits to the Federal community and the citizens we serve and we are accelerating these efforts. Through the substantial interagency coordination that is ongoing, we will be able to implement the *Supplemental Guidance*, and realize the tremendous potential of the Geospatial Platform as we prepare to release the next iteration of these capabilities.

Perhaps most importantly, we share GAO's desire of eliminating any and all unnecessary duplication in the development and utilization of geospatial technology across the Federal government. The Department's efforts to coordinate the activities of the Federal Geographic Data Committee are of tremendous significance in this regard. We believe our efforts to lead the Federal Geographic Data Committee give us an opportunity to reduce duplication across the Federal geospatial enterprise, and to help DOI and its partners leverage efforts by all Federal agencies.

The Department is committed to working with OMB and our partner agencies to address the recommendations made in this report in a timely manner. In addition to this letter, DOI has provided extensive technical comments to the GAO team working on this report. If you have any questions regarding these materials, please contact Jerry Johnston, DOI Geospatial Information Officer at (202) 208-4262 or jerry_johnston@ios.doi.gov.

Sincerely,



Rhea Suh
Assistant Secretary
Policy, Management and Budget

Appendix IV: Comments from the Department of Commerce



UNITED STATES DEPARTMENT OF COMMERCE
The Secretary of Commerce
Washington, D.C. 20230

November 6, 2012

Mr. David Powner
Director, Information Technology Issues
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Powner:

Thank you for the opportunity to review and comment on the U.S. Government Accountability Office's (GAO) draft report entitled "Geospatial Information: OMB and Agencies Need to Make Coordination a Priority to Reduce Duplication" (GAO-13-94).

We appreciate the work that GAO has done to improve coordination in managing geospatial investments. The Department of Commerce (Department) agrees with the five recommendations for the Department. As noted in the draft report, the Department has partially implemented the first recommendation. We plan to take steps to fully implement all of the recommendations. The enclosed comments from the National Oceanic and Atmospheric Administration provide additional information.

If you have any questions, please contact Simon Szykman, Chief Information Officer, at (202) 482-4797.

Sincerely,

A handwritten signature in cursive script that reads "Rebecca Blank".

Rebecca M. Blank
Acting Secretary of Commerce

Enclosure

Department of Commerce
National Oceanic and Atmospheric Administration
Comments to the Draft GAO Report Entitled
“Geospatial Information: OMB and Agencies Need to Make Coordination a Priority to
Reduce Duplication”
(GAO-13-94, October 2012)

General Comments

The Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA) appreciates the opportunity to review the U.S. Government Accountability Office’s (GAO) draft report on geospatial information.

NOAA Response to GAO Recommendations

The draft GAO report identifies the following five recommendations for the Department of Commerce (Department):

Recommendation 1: “To help ensure the success of department’s efforts to improve geospatial coordination and reduce duplication, we recommend the Secretary of Commerce designate a senior agency official who has departmentwide responsibility, accountability and authority for geospatial information issues.”

NOAA Response: NOAA agrees with this recommendation. As indicated in the table on page 22, the Department has ‘partially met’ the requirement to designate a Senior Agency Official for Geospatial Information (SAOGI). NOAA will work with Office of Management and Budget (OMB), Federal Geographic Data Committee (FGDC), and Department staff to take the necessary actions to meet this requirement fully.

Recommendation 2: “Prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial data activities appropriate to its mission.”

NOAA Response: NOAA agrees with this recommendation. NOAA will work collaboratively with the other Department Bureaus, as well as the FGDC, to develop a Department-wide strategy for geospatial activities.

Recommendation 3: “Develop a policy that requires the department to make its geospatial metadata available on the clearinghouse.”

NOAA Response: NOAA agrees with this recommendation. NOAA will work collaboratively with the other Department Bureaus, as well as the FGDC, to develop a Department-wide policy for publishing metadata to the NSDI clearinghouse.

Recommendation 4: “Develop and implement internal procedures to ensure that it accesses the NSDI clearinghouse before it expends funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.”

NOAA Response: NOAA agrees with this recommendation. NOAA will work collaboratively with the other Department Bureaus, as well as the FGDC, to develop a Department-wide approach for accessing the NSDI clearinghouse prior to new data acquisitions.

Recommendation 5: “Further, to improve the department’s management of its geodetic control theme, we recommend that the Commerce Secretary direct the geodetic control theme point of contact to create and implement a plan to develop and implement geodetic control theme standards.”

NOAA Response: NOAA agrees with this recommendation. NOAA National Geodetic Survey (NGS) staff will work with the membership of the FGDC Geodetic Control Subcommittee to develop a plan for geodetic control theme standards. NGS will work with the FGDC Secretariat staff to obtain additional information on other FGDC-approved standards, including who is the audience for the standards as well as example use cases, to inform the development of the geodetic control theme standards.

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

David A. Powner, (202) 512-9286 or pownerd@gao.gov

Staff Acknowledgments

In addition to the contact name above, individuals making contributions to this report included Deborah A. Davis (Assistant Director), Shaun T. Byrnes, Eric Costello, Rebecca Eyler, Kaelin P. Kuhn, John Mingus, Jamelyn Payan, Scott Pettis, and Andrew Stavisky.

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