Mapping Data Collection and Integration Subactivity

Subactivity	FY 2000 Estimate	Uncontrol. & Related Changes	Program Changes	FY 2001 Budget Request	Change From FY 2000
Mapping Data Collection and Integration	**56,330**	**+228**	**[(1)]+10,769**	**67,327**	**+10,997**
Earth Science Information Management and Delivery	34,270	+641	+2,000	36,911	+2,641
Geographic Research and Applications	36,117	+727	+14,200	51,044	+14,927
Total Requirements $000	126,717	+1,596	+26,969	155,282	+28,565

[1] See Program Change section for details on Community/Federal Information Partnership (+$10,000), Decision Support for Resource Management (+$400), Landsat (+$5,000), and programmatic decreases (-$4,631).

Current Program Highlights

Base Geospatial Data

Base geospatial data describe the most essential aspects of the earth's surface by identifying the geographic location and characteristics of specific features and boundaries. Some examples include features such as roads, railroads, streams, and lakes; position values for elevation data and geodetic control points; and the locations of government boundaries. When combined into nationwide databases in standardized formats, base geospatial data create a common foundation for computer-aided spatial analysis.

The technical advancements of the "Information Age" provide the possibility of more widely available and more current information that can be used to solve the increasingly difficult, interdependent, and changing problems of modern society. When complemented by computer-assisted geographic information systems and the growing use of spatially oriented information (geospatial data), the science of geography becomes an even more capable perspective for enhancing organizational processes and outcomes in government as well as in business. Place-based discourse and analyses can facilitate mutual understanding, collaborative research, and integrated decision making throughout various levels and agencies of government; a geographic perspective can improve the effective management of services and programs and help reduce costs. As a key element of its goal to use technical advancements to strengthen the geographical perspective, the USGS will expand its capabilities to provide geospatial data with an integrated land resource observation program that enhances collection and access to remote sensing data.

The USGS Mapping Data Collection and Integration Subactivity ensures the development and maintenance of permanent, long-term, national, geospatial databases for the Nation. The public benefits supported by this subactivity are, by design, expansive – they apply nationwide – and are diffusely distributed – they involve several types of data that are used by diverse customers at many levels of government, in business, and in the general public.

Geospatial Data Types and Applications

Digital Ortho-Imagery

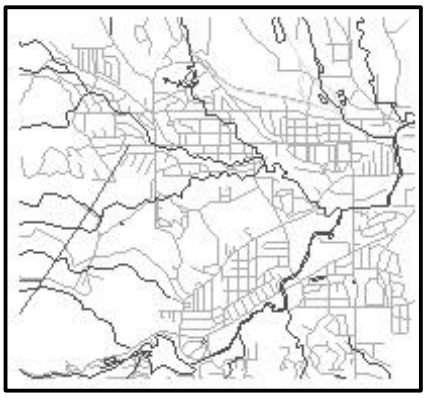
Computer-generated images of aerial photographs (or other remotely sensed data) that combine the image characteristics of a photograph with the geometric qualities of a map. Rectangular sections of digital ortho-imagery are called digital orthophoto quadrangles (DOQs).

Applications: DOQs are used for field references for earth science investigations and analyses. Firefighters, farmers, and environmental scientists use DOQs to assess vegetation conditions. The digital orthophoto serves as a data layer in geographic information systems and as a source of information for revising digital line graphs and topographic maps.

Elevation Data

Information about the elevation of the Earth's surface relative to sea level. A standard format for elevation data is the digital elevation model (DEM). DEMs may be combined with other types of digital data to create a three-dimensional effect.

Applications: Elevation data are vital for hydrologic applications, environmental management, engineering studies, flood zone mapping, public works projects, and zoning considerations. They are needed to produce DOQs.

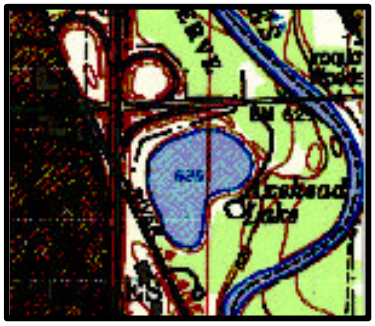


Vector Data

Digital files of basic linear data, such as transportation networks, boundaries, streams and other water data. These are referred to as digital line graphs (see also DOQs).

Applications: Users, such as state highway departments, land managers, and utility companies, can rapidly calculate related attributes of the data; for example, the number of miles of unpaved roads in neighboring counties and the proximity of certain roads to power lines. Vector data are needed to digitally revise graphic products.

Graphics



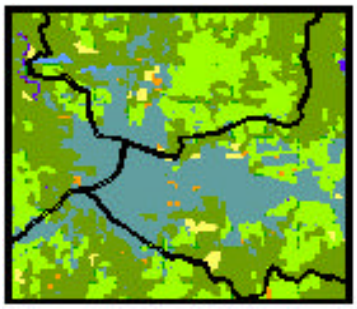
Printed topographic maps depicting base cartographic data, such as transportation networks, streams and other water data, boundaries, constructed features, elevation contours, surface information, such as vegetation, surface mining, and coastal land forms.

Applications: Hikers, fishermen, Scouts, engineers, realtors, geologists, and surveyors use printed maps in the field, in the office, and at home.

Digital Raster Graphic

A computer-readable image of a topographic map. DRGs are frequently used as a backdrop for other data layers in a geographic information system.

Applications: DRGs are used as a backdrop for thematic data in a GIS setting and for revising topographic maps. The private sector uses DRGs in the production of regional maps on CD-ROMs of national parks and recreation areas.

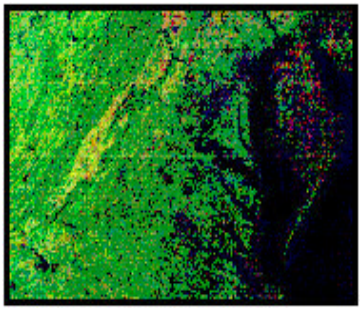


Land Cover Characterization

Classifications of the Earth's surface by type of feature, such as grasslands, forests, barren lands, or urban areas.

Applications: Foresters, environmental specialists, and public officials use these data to investigate the effects of drought on vegetation, indications of climate change, and the growth of urban areas.

Remotely Sensed Imagery



High-altitude photographs and satellite images of the Earth's surface, fundamental to many other geospatial data and cartographic products.

Applications: Satellite images provide a unique perspective of the Earth over time and are used in many earth science applications, such as identifying human-induced environmental changes. Aerial photographs are the basic source of data to produce DOQs.

USGS activities minimize duplication of efforts and costs for multipurpose data and improve the Nation's information base for resolving complex issues related to resource management, hazards mitigation, and improving the environment. The USGS (1) coordinates and oversees the fulfilling of broad national needs for base geospatial data and cartographic products, (2) provides leadership and support for the development and maintenance of geospatial data standards, (3) manages private sector contracts for the production of those data and products, and (4) reviews and evaluates map data produced by many organizations across the Nation. The USGS minimizes its mapping costs through cooperative arrangements with Federal, State, and local governments and private firms.

State Applications of USGS Products

The USGS Innovative Partnership (IP) with the State of Texas has completed its first-phase goal of statewide coverage of digital orthophoto quadrangles (DOQs). This IP, called the Texas Orthoimage Program, began in 1997 as a multi-year, cost-sharing initiative because a project of this size and complexity (over 16,000 DOQs) would have been too costly for any single entity to finance. The second phase of the partnership, called StratMap, is currently developing digital geographic data layers that document land features such as soils, elevation, hydrography, roadways, and political boundaries. Applications include mapping soil types and crop suitability, monitoring watercourse changes, identifying non-point pollution sources, documenting land-use changes, developing improved emergency response plans, and guiding natural disaster mitigation efforts.

Private Sector Services — The USGS Mapping Data Collection and Integration Subactivity generates business opportunities for private sector firms in two ways. First, within the USGS, the production of base geospatial data (e.g., ortho-imagery, elevation, vector, graphic revision) is accomplished largely by private sector firms. Second, the availability of consistent base geospatial data on a national scale encourages a wide range of commercial enterprises that utilize these data in varying degrees. The USGS has used private sector services since the early 1970's at the EROS Data Center where a substantial contractor workforce is managed by a relatively small government management staff. Beginning in the early 1980's, private sector services have served as a valuable option for achieving program objectives. For the past several years, the USGS has been working with Congress, particularly the Appropriations Committees in both the Senate and the House, to ensure that data production activities and related services conform with Congressional expectations for the use of private sector services by Federal agencies.

Data Collection (Production)

The data collection component ensures the development and maintenance of permanent, long-term, national databases of base geospatial data. Contributing to the National Spatial Data Infrastructure (NSDI), these databases form a common foundation for computer-aided spatial analysis across the Nation. This component also revises topographic maps, generates special-purpose maps, and includes the routine collection and processing of Landsat 7 imagery of the Earth’s land masses. Finally, this subactivity will provide support to the Hazard Support System (HSS), which implements a national wildland fire detection capability, including volcanic eruption and ash cloud monitoring activities.

DOI High-Priority Digital Data Base Program — A major element of the data collection component is the USGS responsibility for satisfying the highest priority geospatial data needs of Department of the Interior bureaus. The USGS provides this service through the DOI High-Priority Digital Base Data Program. Working together, the DOI bureaus annually assess the

geospatial data needs that will satisfy the highest priority program activities of the Department. Each year a percentage of program projects are completed and funding is directed to the highest priority data requirements. Although the funding for this program directly supports data collection for the Department, the DOI data needs often coincide with the needs of other users, and the data are incorporated into the long-term, national, geospatial databases available to all users. Thus Federal data collection redundancies are greatly reduced. In fact, for FY 1999, cooperatively funded DOI Program projects were developed with a number of Federal and State agencies including the Environmental Protection Agency, the Farm Service Agency, the Natural Resources Conservation Service, and the Texas Water Development Board. Cost-sharing with these agencies has allowed an additional $2.9 million of revised hydrography and orthoimagery data requirements to be addressed in 9 of the 22 areas on the FY 1999 DOI Program plan.

High-Performance Computing and Communication — For the first time, the USGS is receiving and processing high-volume satellite data and delivering them, using an ultra-high speed communication link, to the customer within hours after each satellite pass. A consortium of academic institutions in the State of Ohio, called the OhioView Consortium, in turn provides these data to land managers, researchers, educators, and the private sector throughout the State, making current near-real-time data available to these users and others. These data are being used to develop special sets of K-12 teaching materials in the areas of geography and science, improve undergraduate lecture notes for remote sensing classes, support a study of land use and land cover change in Ohio, support Master and Ph.D. research at OhioView universities, initiate a farmland loss project, and develop a NASA Glenn Research Center outreach project for Native Americans.

Key National Data Bases — The USGS mission goal for the Environment and Natural Resources GPRA Program Activity provides science for a changing world in response to present and anticipated needs to expand our understanding of environmental and natural resource issues on regional, national, and global scales and enhance predictive and forecast modeling capabilities. The long-term goal is to ensure the continued availability of environmental and natural resource information and systematic analysis and investigations needed by customers. The National Mapping Program is developing and maintaining the following critical, large-scale data bases to ensure the collection, preservation, and dissemination of natural science data, including support for the development of national infrastructures for the management and sharing of the these data at all levels of government.

Selected Core Data Bases	**FY 1998**	**FY 1999**
National Hydrologic Dataset (Cataloging units, 1:100,000-scale)	0	1,800
National Elevation Dataset (7.5-min quads)		
(30-meter post spaced)	45,100	46,250
(10-meter post spaced)	4,500	7,750
National Digital Ortho Imagery (DOQ)		
(1st time coverage)	86,000	146,000
(2nd time coverage)	0	96
National Land Cover Dataset (Scenes)	149	420
National Topographic Map Series (1:24,000-scale quads revised)	1,146	1,141
National Satellite Land Remote Sensing Data (Scenes processed)	2,162,000	2,304,000

- **National Hydrography Dataset (NHD) —** NHD data at 100,000-scale is available for most of the United States. High-resolution NHD data will be maintained by Federal, State, and local governmental organizations, archived in seamless formats, and retrievable by watershed or other unit.

- **National Elevation Dataset (NED) —** Thirty-meter (or equivalent) elevation data are available for the entire United States. Higher resolution elevation data will be maintained from a variety of collection devices and sources including State and local governments and the private sector, archived in a seamless format, and retrievable by watershed or other unit.

- **National Digital Orthophoto Program (NDOP) —** As initial coverage of 1-meter resolution DOQ imagery is completed for the United States, requirements are increasing for second time coverage. It is likely that higher resolution imagery from State and local governments will be a primary source of orthoimagery, particularly in urban areas. Also, the private sector will play a more prominent role as imagery from commercial high-resolution satellites becomes available. As data sources and resolutions vary, the formats may vary from the more traditional 1:12,000-scale, quarter-quad format.

- **National Land Cover Dataset —** Land cover data, produced from Landsat multispectral data, are available for the entire United States. The data were compiled as regional datasets. In the future, land cover data will continue to be compiled as regional datasets, archived in a seamless format, and retrievable by watersheds or other units.

- **National Topographic Map Series —** The USGS has completed large-scale map coverage for the United States. A more efficient and cost effective maintenance program for the valuable resource represented by these products is being defined and implemented. This new program will include the use of existing data, innovative cooperative arrangements, and possible changes to and redefining of the current products.

- **National Satellite Land Remote Sensing Data Archive —** This activity provides global land image data used by scientists, land resource managers, commercial firms, local and regional government planners, and individual citizens. Core data sets include worldwide Landsat digital and film images, declassified intelligence satellite photos, and digital land scenes captured by NOAA meteorological satellites, Landsat 7, and NASA's TERRA satellite.

USGS Partners with EPA on National Land Cover Data Set

The USGS Land Cover Characterization Program has teamed with the U.S. Environmental Protection Agency (EPA) to develop a National Land Cover Dataset (NLCD) based on 30-meter resolution Landsat-5 Thematic Mapper satellite data. Users, delighted with the quality, detail, and applicability of the dataset, are repeating the effort by remapping the entire United States starting in FY2001. These land cover data record the natural and man-made changes to the land surface and provide a framework for inventory, modeling, monitoring, and management. USGS and EPA both require detailed land cover data to accomplish their missions. These applications include environmental inventory, landscape monitoring, environmental law enforcement, watershed analysis, and surface- and ground-water quality analysis. The NLCD also has been used in more than 100 applications ranging from vector-borne disease analysis to the determination of surface roughness for wind damage potential.

Data Coordination and Standards

Through this component, the USGS provides (1) policy, guidance, and support for the development of partnerships with Federal, State, local, and private organizations for data sharing and maintenance and (2) leadership for the development, maintenance, and promulgation of national standards for the consistent collection and description of all types of base geospatial data.

Coordination of Partnerships — The national demand for base geospatial data is enormous and increasing. To help meet the demand, the USGS leverages its resources by forming strategic alliances with other organizations that produce or utilize geospatial data to support their own mapping needs. This partnership-based approach affords not only a greater return on the USGS investment, but also minimizes duplication of effort, advances the NSDI, and reduces taxpayer costs in securing these crucial national databases. One of the primary activities under the Mapping Data Collection and Integration Subactivity, therefore, is to encourage the development of long-term, flexible partnerships that can be easily adapted to meet changing customer requirements over time.

The USGS actively engages both public and private sector partners in the effort to build and maintain national geospatial databases. To foster relationships with partners, the USGS sponsors 27 National Mapping Program (NMP) partner liaisons. Presently, 13 of the 27 liaisons are based in offices local to their area of responsibility (e.g., Alaska, Florida, Minnesota, Texas). The USGS intends to shift another ten liaisons to local offices over the next 3 to 4 years. A more regionally distributed NMP presence will enable greater interaction and better communication with partners, and increase discovery of new partnering opportunities.

The USGS encourages Federal, State, and local efforts to establish consortia of geospatial data users, producers, and providers. Through these consortia, common geospatial data requirements and natural partnering opportunities are identified. The Interior Geographic Data Committee, which works to advance the DOI High-Priority Digital Base Data Program, is a successful example at the Federal level of one such consortium. The USGS is transferring the knowledge gained through that experience broadly throughout the geospatial data community. The efforts of many States to establish geographic information councils are advanced as a result.

Development and Maintenance of Data Standards — The USGS, through its leadership of the FGDC Subcommittee on Base Cartographic Data, is responsible for developing, maintaining, and promulgating standards for the consistent collection and the origin description (metadata) of all types of geospatial data. The USGS establishes digital cartographic and geospatial data standards as well as quality control procedures for collecting data in a form that meets these standards. Once collected, the standardized data become part of the NSDI. To date, the USGS has led the development of FGDC data standards for orthoimagery and elevation data, as well as standards for metadata, data accuracy, and data transfer standards.

The USGS is also pursuing standards development through expert technical participation in the work of national and international standards development organizations such as the American National Standards Institute (ANSI), the International Organization for Standardization (ISO), and the OpenGIS Consortium (OGC). Further, in OGC, the USGS is taking a leadership management role. The OGC is developing specifications that will allow diverse geospatial databases and systems to work together, and provide a solid foundation for geoprocessing interoperability integrated into the mainstream of general computing.

Recent Accomplishments

Near-Real-Time Satellite Data for the OhioView Consortium — In FY 1999 the USGS accepted delivery of a high-performance computing system that processes data from the Landsat 7 satellite. This system produces the products that will be delivered in near-real-time over networks to members of the OhioView Consortium and reduces delivery time from hours to minutes. The USGS also installed a new information access system, called EarthExplorer, that allows natural science data users to easily access and order data through the Internet as part of the NSDI network. The objectives of these new systems and the pilot project with the OhioView Consortium were to demonstrate near-real-time delivery of natural science data to university and K-12 educators; Federal, State, and local governments; and private industry. The broad applications of these data have the potential to benefit a wide range of public and private uses such as disaster and economic analyses, environmental monitoring, climate change research, geographic analyses and modeling, and natural resource management.

Landsat 7 Era Begins — The USGS, in partnership with NASA, began a new era of data collection for global change science with the launch of the Landsat 7 satellite in April 1999. For the first time in the 30-year history of the Landsat Program, entire global land-surface data sets will be collected seasonally, giving global change scientists unprecedented access to vast amounts of inexpensive, high-quality temporal data, with no restrictions on further use or distribution of data obtained from the USGS. The USGS operates the U.S. ground station for collecting, processing, archiving, and distributing Landsat 7 data acquired either by direct downlink of sensor data when the satellite is within range of the USGS EROS Data Center antenna near Sioux Falls, South Dakota, or by periodic downloads from the satellite's onboard solid-state recorder. Before the end of October 1999, well over 30,000 Landsat 7 scenes were already available from EROS, and collection of the first global Landsat 7 data set was nearly complete. Web site: **http://landsat7.usgs.gov**.

DOI High Priority Data Program Accomplishments — Digital base cartographic data were provided to DOI bureaus in response to their high priority science requirements. Some noteworthy examples of these applications include the development of an integrated data base for noxious weed species inventorying and monitoring in the Blackfoot Valley/Missouri Basin of Montana; a program to support the restoration and protection of living resources including finfish, shellfish, and other aquatic life and wildlife in the Chesapeake Bay; resource investigations and ecosystem studies in the Greater Yellowstone; ecosystem and refuge management and watershed restoration and protection for the Lower Klamath and Trinity River basins and the President’s Forest Plan in Oregon; and the development of a spatial data infrastructure to support public and private sector applications of geospatial data in such areas as emergency response, environmental protection, land management, law enforcement, community development, transportation, and agriculture along the US/Mexico border.

National Hydrography Dataset — The initial release of the National Hydrography Dataset (NHD) is now available for public access on the Internet. A joint effort by the USGS and EPA, the NHD provides comprehensive hydrologic data essential for resource assessment, planning and management by Federal and State agencies, local governments and the private sector. The NHD represents a concerted effort by two Federal agencies to combine their data resources into a single comprehensive, standardized package that can be used, and developed further, by a variety of users. Cooperating agencies in Georgia, Texas, Utah, Kentucky**,** Kansas, Missouri**,** and Montana were active partners with the USGS and EPA during early development of the NHD. Additional States will be joining in the growth of the NHD in the near future. Web site: **http://nhd.usgs.gov/**.

U.S. Coverage Completed for Digital Elevation Models — After more than 2 decades of work, complete Digital Elevation Model (DEM) coverage of the United States has been achieved. Through the cooperative efforts of USGS and its State and Federal partners, over 58,000 individual files of regularly spaced elevation points are now available to the public. At 30-meter or finer ground spacing, this data set represents over **10 billion** elevation points covering the Nation. Since the web site of free, downloadable DEMs (**http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html**) premiered in April 1998, more than 4 million files have been downloaded, making this the most popular of all geospatial data that USGS provides on the Internet. Files can also be ordered on 8-mm tape or CD media at **http://edcwww.cr.usgs.gov/webglis/**. DEMs can be combined with other geospatial data, such as imagery or vectors, to produce three-dimensional data. Scientific and commercial applications of DEM's include flood modeling, perspective views, and fly-through animations.

DEM Statewide Coverage

Digital elevation models (DEMs) covering the State of Texas are now available in a seamless dataset that is being used by USGS, Texas State agencies, and the University of Texas to predict and mitigate flood risks for the Guadalupe river basin and other threatened areas. The Texas dataset is being used with National Weather Service NEXRAD Doppler radar to help predict storm effects on river levels. Pennsylvania is cooperating with USGS to construct a similar dataset at 10-meter resolution. A seamless national elevation database constructed from DEMs, complete with user-definable "clip-and-ship" options, is anticipated for public access in the near future.

This remarkable image represents a 20-year effort to collect and integrate elevation data into a seamless data set for the Nation.

The OpenGIS Project — To open up the Nation's geospatial data and geoprocessing resources to wide and easy use, USGS is participating in, and helping to guide the work of the OpenGIS Consortium (OGC). OGC, a not-for-profit organization of industry, government and academic members worldwide, is developing interoperability specifications that will allow geospatial databases and systems to work together. In FY 1999, two significant specifications, the OpenGIS Grid Coverage Specification, addressing satellite images, aerial photos, digital elevation data, and other kinds of "gridded" data, and the OpenGIS Catalog Services Specification, enabling geospatial data "clearinghouses," were adopted. In addition, the first OpenGIS Interoperability Initiative, the Web Mapping Testbed (WMT), demonstrated how the OGC can prototype and "fast-track" new specifications. In FY 1999, the WMT successfully prototyped and demonstrated fundamental interfaces for open web-based map communication.