

The U.S. Geological Survey Recent Highlights—Innovative Scientific Information Management



U.S. Department of the Interior

U.S. Geological Survey

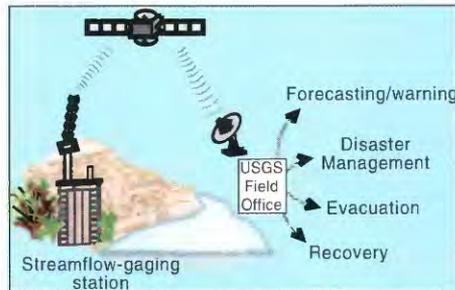
Introduction

The U.S. Geological Survey (USGS) provides real-time data during a major flood or earthquake, delivers more than 100,000 pages of earth and biological science information through the Internet, promotes standards for data sharing, and preserves massive archives of earth systems information for long-term research and monitoring in the areas of hazards, resources, and the environment. This fact sheet provides a glimpse of how the USGS manages data and information in terms of electronic information dissemination, discovery tools, and archiving. Also highlighted are examples of partnerships formed to jointly develop innovative information technology and products. The 1996 merger of the USGS with the National Biological Service and the minerals information component of the former Bureau of Mines is noteworthy; the new USGS has vastly more information and interdisciplinary scientific capability than ever before.

Data Collection and Rapid Dissemination

The USGS collects and disseminates a huge array of hydrologic, geologic, cartographic, and biologic information and analyses. For example, the USGS stream gaging network provides data for purposes ranging from flood forecasting to detection of changes in stream flow caused by human activities or global climate change.

From the establishment of the first stream-gaging station operated by the USGS in 1889, the stream-gaging network has grown to include more than 7,000 active stations. By using satellite communications and the World Wide Web, the public, the news media, private industry, emergency management officials, and government agencies can access real-time stream flow data for more than 3,000 stations. Real-time stream flow information from the USGS was the basis for dozens of decisions regarding the evacuation of people and property throughout Oregon and



Forecasters and emergency officials receive real-time flood data via satellite.



Whitewater enthusiasts and others request real-time flow data for every State. (Photo by Carter Hearn, USGS.)

Washington during the record flooding in February 1996. In Oregon's Willamette Valley alone, the partnership between the USGS and other Federal and State agencies saved the lives of many Oregonians as well as an estimated \$2.7 billion dollars. Throughout the Nation, the National Weather Service relies on USGS real-time stream flow data to forecast the timing and size of flood peaks and to alert emergency managers to possible hazards.

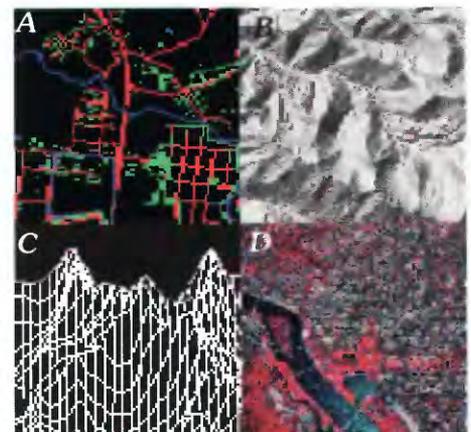
Boaters and anglers planning recreational activities have made real-time stream flow one of the USGS's most popular World Wide Web offerings. Real-time hydro-logic information is available at <URL: <http://water.usgs.gov/public/realtime.html>>

Information Discovery

The year 1996 witnessed rapidly expanding customer interest in Internet access to the USGS World Wide Web. The monthly tally of individuals accessing the main USGS server doubled in 1996 to a total of more than 150,000 users. The server organizes USGS information

by discipline (water, geology, mapping, biology) or by public issues, such as environment, hazards, resources, and information access. The server also provides news releases and information on events such as the Pacific Northwest flooding in January 1997, as well as key contacts at the USGS. The main server is one of more than 150 USGS servers nationwide.

The USGS has developed online product search and order tools so that any time of the day or night the public can access catalogs containing an array of digital image and map products. The Global Land Information System (GLIS) allows users to customize queries from personal computers or workstations anywhere in the world. Users can find the exact products that meet their needs and, in many cases, can view a sample of the product right on their PC screen. Since GLIS added its World Wide Web interface in 1996, the number of self-service online searches has increased from 4,000 per month to 17,000 per month. Also in 1996, GLIS searchable product inventories became available for more than 860,000 declassified intelligence satellite photos and all USGS digital elevation and cartographic data. GLIS is accessible at <URL: <http://edcwww.cr.usgs.gov/webglis>>



Samples of online images: A, Digital line graph, B, Shaded relief, C, Digital elevation model, and D, Digital orthophotoquad.

Creative Partnerships

The USGS has formed partnerships with an array of Federal, State, and private sector partners to develop innovative information technology and products.

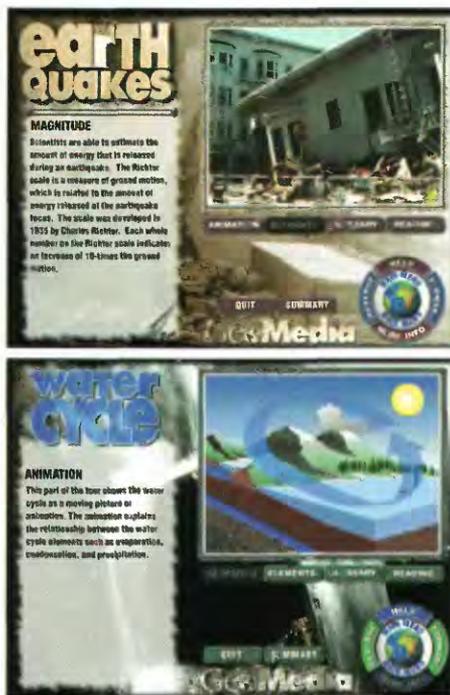
On-Demand Map Distribution Technology

As the Nation's largest civilian mapping agency, the USGS has more than 74,000 map titles in stock and distributes more than 6 million maps annually to people around the world. To better serve these customers, the USGS has entered into partnership agreements with the private sector to develop technology for rapid customized product dissemination. The USGS and 3M of St. Paul, Minn., signed a cooperative research and development agreement (CRADA) in 1996 to develop on-demand map printing and for 3M to develop a series of commercial instant map-printing systems. The 3M engineers will be working with USGS cartographers to develop a system allowing USGS customers to print a specific topographic map in a matter of minutes. Cost savings result from decreasing the USGS printed map inventory while customers gain rapid access to all USGS map products.

Under another CRADA, the USGS and Sprint Corporation are exploring the use of advanced, high-speed wide-area networks to remotely archive, access, and deliver image data sets that exceed 1 billion bytes. In 1996, the system was tested when the USGS transferred digital imagery to NASA's Goddard Space Flight Center at an average speed of 1.12 million bytes per second. Target communication speeds of up to 1 billion bits per second will greatly enhance the USGS's ability to provide timely and complete scientific and technical information to the public, while Sprint benefits from the transfer of cooperatively developed technology for high-speed communication.

Educational Products

The USGS provides educators and students with tools to understand earth science. For example, GeoMedia™, an educational CD-ROM for students between the ages of 10 and 14, uses interactive multimedia technology to give students exciting new possibilities for navigating through multiple layers of information. The goal of GeoMedia™ is to instill in children a sense of wonder, an understanding of scale, and the



InterNetwork Media, Inc., and the USGS have created a CD-ROM called GeoMedia™ to help students experience the wonder and power of the Earth and its cycles of change.

knowledge to use scientific fact-finding methods to develop solutions. Using GeoMedia™, children are more apt to comprehend a concept by interacting with information that sparks their curiosity.

GeoMedia™ was developed jointly with InterNetwork Media, Inc., under a CRADA to stimulate innovative technological approaches to teaching science. GeoMedia™ is a component of the USGS Learning Web, a part of the USGS home page on the World Wide Web dedicated to K-12 education, exploration, and life-long learning. The Learning Web is a collection of educational resources and teaching activities that can be used in the classroom to teach earth science concepts. Please explore educational resources at
<URL: <http://www.usgs.gov/education>>

Electronic National Atlas

In 1970, the USGS published its first and only National Atlas of the United States of America. It was a 400-page, oversize, 12-pound volume. Work has begun on a new National Atlas that will be produced with three innovative differences. First, the new Atlas will be primarily an electronic product. Second, the audience for this Atlas will encompass home computer users. And finally, the new Atlas will exploit information access and delivery

technologies that did not exist in 1970. In addition to having high-quality, small-scale maps, the Atlas will include authoritative geographic and statistical data sets on CD-ROM. These data will be collected and integrated under a consistent set of standards. The Atlas will also include easy-to-use software for data display, query, and customized map making. The product will include hot links to certified Atlas sites on the World Wide Web, allowing access to related real-time and regional data. Descriptive information, products, and software programs will also be delivered through the Internet.

New customers will be served by the Atlas. In the early 1970's, the National Atlas was typically found in the reference collections of libraries across the United States. Educators and government organizations were also primary customers for the original Atlas. Because it sold for \$100, not many Americans added the Atlas to their home libraries. The new National Atlas is crafted for individuals who own home computers, thus extending the value of USGS science into the American home. The USGS is forming strategic alliances with private sector partners to gather and analyze customer information and to assess the market for the National Atlas. Efforts in 1997 will concentrate on clarifying customer needs and expectations and then using this information to enhance product development.

The new Atlas will provide a graphical interface to the enormous spatial data holdings of the Federal Government. It will provide authoritative views of scientific, societal, and historical information with easy-to-use tools to display, manipulate, and query Atlas data so that customers can produce their own relevant information. The Atlas will make information more accessible to individual Americans and provide links to current and real-time events. The new Atlas will weigh less than 12 pounds; far less!

Information Sharing

The USGS leads in the cooperative development of standards for information exchange. The USGS is a key partner in developing the National Spatial Data Infrastructure (NSDI). The NSDI is a 1994 Presidential initiative that reaches out to the entire community of individuals and organizations who use geographic



data. The NSDI involves Federal, State, local, and tribal governments, academia, and the private sector in making current and accurate geographic information readily available to aid in decisions about economic growth, the environment, and social progress. Examples include solving location-based problems, such as where to build roads and schools, how to manage utilities, and how to protect drinking water. These basic human issues can be addressed by using geographic information systems (GIS), computer systems that collect, store, analyze, and display geographic data. In 1996, progress included developing an electronic network to aid in accessing and sharing geographic data, preparing high-priority data content standards, implementing a Federal Geographic Data Committee standard for documenting data, and developing technology partnerships with the private sector. To learn more about the NSDI please visit <URL: <http://nsdi.usgs.gov/nsdi/>>

The USGS is leading in the development of the National Biological Information Infrastructure (NBII), a broad cooperative effort to establish a distributed electronic federation of biological information. A complement to the NSDI, the NBII includes information resulting from USGS biological science activities and important biological data maintained by other Federal agencies, State agencies, natural history collections and herbaria, and non-government organiza-

tions (such as The Nature Conservancy). Through the NBII, users anywhere can find and retrieve the biological information they need, integrate or combine information from different sources, and apply it to make better resource management decisions. In 1996, progress was made in incorporating several significant new biological data sources within the NBII federation, developing comprehensive directories of biological data sources in State agencies and natural history museums, and working on cooperative projects with NASA and the National Science Foundation.

Work is ongoing to identify and incorporate additional biological data sources, to support efforts of cooperators and partners to document their data and make it accessible electronically, and to develop or adapt tools and technologies to assist in supporting the infrastructure. The NBII is operational and available at <URL: <http://www.nbs.gov/nbii>>

Information Archives

The USGS stores and preserves dozens of large earth and biological science data bases. The examples that follow include innovative technologies for archiving and searching digital imagery, traditional library collections, newly acquired collections, and data rescued from outside sources.

Satellite Imagery and Digital Data

The USGS Earth Resources Observation Systems (EROS) Data Center (EDC) archives and distributes more than 15 million photographs taken from both airplanes and satellites. The archive was augmented with 860,000 recently declassified images, which provide a historical perspective on landscape change. The EDC's growing base of earth science information—the world's largest—is used by scientists in the private sector and at government institutions and universities around the globe. By law, EDC is home to the National Satellite Land Remote Sensing Data Archive, an immense storehouse of images of land surface phenomena dating back three decades. The EDC is also the archive center for images of land processes collected as part of NASA's Mission to Planet Earth. The EDC is designated a World Data Center—one of a global system of centers that have agreed to hold and share Earth observational data in compliance with international data exchange standards. With elaborate computer systems, the EDC delivers massive amounts of data over the Internet and is a world leader in information management as well as in earth science. EDC's home page can be found at <URL: <http://edcwww.cr.usgs.gov/eros-home.html>>

The USGS Library

The USGS Library is one of the largest earth science libraries in the world. Established in 1882, the library serves the research needs of USGS scientists and other organizations and individuals in the areas of geology, hydrology, cartography, and related fields. The library holds over 1 million books, serials, maps, and microforms. Materials include USGS publications as well as those produced by State and foreign geological surveys, scientific societies, academic institutions, and government scientific agencies.

In 1996, the new electronic library catalog became available for use at the main library in Reston, Va., and the branch libraries in Denver, Co., Menlo Park, Calif., and Flagstaff, Ariz. The system is based on the latest technology and national standards, and the graphic displays have been designed to assist library users in locating scientific

information. The system supports sophisticated queries and makes it possible to view recently added titles, to move directly from one list of citations to related titles, and to print search results or save them to a file. Soon it will be possible for anyone to access the online catalog using the World Wide Web. In addition to having the online catalog, each library now has public workstations with network access to a variety of CD-ROM data bases and the Internet.

With the integration of the former Bureau of Mines and the National Biological Service into the USGS, the libraries of these organizations are now part of the Survey's information resources. Minerals and mining information is available from the USGS Library in Reston and Denver, and within the next year the electronic records of the Minerals Information Collection will be merged into the online library catalog. Biological information is available from 12 research center libraries located in various parts of the country; as electronic catalogs are developed by the libraries, they will be searchable on the Internet.

New Biological and Minerals Data

The USGS National Wetlands Research Center (NWRC) in Louisiana maintains one of the largest collections of geographic data bases relating to the natural resources in the southeastern United States. These geographic data bases cover many different topics, including coastal ecosystems, wetland trends, waterfowl populations and distribution patterns, forested ecosystems, neotropical migratory birds, hydrology, vegetation, and more. The Center is currently undergoing a complete inventory of data sets in preparing to provide access to the data by means of workstations connected to state-of-the-art optical disc jukeboxes. The data sets will then be available online through the Internet. Please visit NWRC at <URL: <http://www.nwrc.nbs.gov/>>

Each year the Environmental Monitoring Technical Center (EMTC) in Wisconsin acquires color-infrared aerial photos of key reaches of the Upper Mississippi and Illinois Rivers, collectively referred to as the Upper Mississippi River System (UMRS). The entire UMRS, 1,300 river miles, is photographed every 5 years. To

serve the needs of river managers and researchers involved in floodplain research and management, archived photos and index maps are available through the Internet. Users can now see what images are available and download them to their computers for use in reports or plotting. Scanned photos and index maps compiled from 1994 aerial photos are now available for the entire UMRS. To access these images, you may browse the aerial photo server at <URL: <http://www.emtc.nbs.gov>>

Statistics and information on the worldwide supply of, demand for, and flow of minerals and materials are essential to the U.S. economy, the national security, and protection of the environment. The USGS now maintains a reservoir of worldwide data in the form of data bases, reports, CD-ROM's, fax-on-demand documents, and products such as the Mineral Industry Surveys, Mineral Commodity Summaries, and the annual Minerals Yearbook.

Rescuing Geophysical Data

Numerous invaluable data sets collected by other organizations have been rescued by the USGS. The USGS formed the National Energy Research Seismic Library (NERSL) in 1989 to collect and preserve seismic and related geophysical data that were at risk for disposal. The amount originally spent to acquire and process the seismic data now in the NERSL exceeded 1 billion dollars. The Government's cost to rescue and store these data on a permanent, distributable medium is about one tenth of 1 percent of the original acquisition cost. These data, now available to scientists and the public, would have otherwise been lost forever.

The NERSL seismic data archive, which is largely on magnetic tape, is being converted to CD-ROM. For example, NERSL is transferring seismic data from the National Petroleum Reserve in Alaska (NPRA), including more than 8,000 magnetic tapes, from tape and paper storage to CD-ROM. A CD-ROM is best suited for archiving because it allows diverse digital data types and scanned documentation to be captured on a compact, permanent, random access medium having no special storage requirements beyond normal office conditions. CD-ROM discs have made

seismic data available to users of personal computers equipped with CD-ROM readers.

The capture and rescue of the NPRA data is a multiyear endeavor. In 1996, NERSL highlights included converting 182 NPRA magnetic tapes to CD-ROM, producing distribution copies of the unprocessed NPRA seismic data CD-ROM library, and producing a special CD-ROM in response to industry requests for a specific NPRA data set containing processed seismic data, velocity data, gravity data, and display software. The CD-ROM library consists of both unprocessed and processed seismic data. The unprocessed seismic data consist of 1,970 line-miles of seismic data, including thousands of scanned pages of documentation, on 15 CD-ROM's. The processed data consist of 3,500 line miles of seismic data on 5 CD-ROM's. The data captured by the NERSL are loaned to the public on request. In 1996, NERSL handled data requests from private industry involving hundreds of magnetic tapes, thousands of pages of documentation, and many of the archive CD-ROM's.

Information

For information on these and other USGS products and services, call 1-800-USA-MAPS, fax 703-648-5548, or e-mail: esicmail@usgs.gov.

Receive information from the EARTHFAX fax-on-demand system, which is available 24 hours a day at 703-648-4888.

The address for the USGS home page is <URL: <http://www.usgs.gov/>>

The address for the Information Management Theme home page is <URL: <http://www.usgs.gov/themes/info.html>>