THE 1994 PLAN FOR THE NATIONAL SPATIAL DATA INFRASTRUCTURE

Building the Foundation of an Information Based Society

EXECUTIVE SUMMARY

The National Spatial Data Infrastructure (NSDI) is conceived to be an umbrella of policies, standard, and procedure which organizations and technologies interact to foster more efficient use, management, and production of geospatial data. The NSDI requires and will facilitate cooperation and interacrion among various levels of government, the private sector, and academia. The major components of the NSDI currently under development include a basic framework of digital geospatial data to act as a foundation for numerous other data collection activities; known quality thematic data sets of facilitate data collecrtion, documentation, access, and transfer, and the means to search, query, find, access, and use geospatial data. Strategies to build the NSDI include establishing forums for communication, facilitating access to data, build the NSDI include establishing forums for communication, facilitating access to data, building framework and thematic data sets, developing educational and training programs, and fostering partnerships for data sharing. Key actions underway are develcping and implementing standards for franework and thematic data : procucing framework and thematic data ; implementing standards for geospatial data documentation and transfer; establishing procedures to use electronic networks to serch for, access, and use geospatial data; and cooperating in the development of state and regional councils and private sector agreements to accomplish these actions. The Clinton Administration has tasked the Federal Geographic Data Committee (FGDC) to provide the federal leadership for evolving the NSDI in cooperation with state and local governments and the private sector. The success of the NSDI will hinge upon the ability to build and maintain partnerships among these entities to carry out the actions of this plan.

BACKGROUND

Evolution of technology

Information technoloy is rapidly shanging the way that governments and the private sector conduct business. A growing reliance on the use of computerw for processing infornation is dramatically increasing demands for electronic data. In no area is this more true than in the use of technology to

collect, analyze, manage, and disseminate geographic information. Geospatial data, or data tied to a location on the earth, are critical to solving today's complex environmental, economic, and social problems. The use of geographical information system (GIS) thecnologies for digitally analyzing spatial problems has become pervasive and in the process, created a demand for vast amount of digital geospatial data.

Increasingry complex analytical needs are resulting in requirements for digital geospatial data that defines the characterristics of geographic space, are current, and are of known quality. These dta must be easily accessible and have the ability to be intergrated, generalized, and manipulated with known or predictable results. Meeting all of these requirement is not possible today. The intent of the National Spatial Data Infrastructure is to create the environment to respond to today's requirements for geospatial data.

Concurrent with the evolution of GIS technologies has been a revolution in communications and electrronic networking. Incresingly, individuals are using electronic networks to communicate with others both within and outside of their own organizations. Computing capability has evolved from primarily centralized mainframe processing, to within-agency distributed processing, to a current state of multi-nation, multi-organization "virtual" processing. The evolution of networking capabilities is changing forms of communication and the nature of working relationships. These changes are likely to have profound effects on current organizational structures.

Discussion lists involving a few to thousands of individuals are rapidly developing to share ideas and information on topics of common interest. The community of geospatial data users has established several communication forums on the global Internet network, including discussion lists such as GIS-L and MAPS-L. The continued develooment of the National Information Infrastructure will provide the backbone and capacity for communicating among millions of individuals, interacting with multiple distributed data sets, and electronically transferring vast amount of data. Many organizations anticipate using the network to distribute digital geospatial data.

Organizations and Personnel

The technology revolution is enabling many organizations to collect and intergrate digital geospatial data independently, rather than relying on broadly dissminating, and sharing digital geospatial data. A recent Office of Management and Budget data call estimates that federal agencies aloneare spending $3 billion annually to collect and manage domestic geospatial data, and an additional $1 billion annually on global geospatial data activities. However, few agencies have the mission or neccesary resources to collect all data required to support GIS activities. Many data collectors and technology users have little knowledge about geospatial data or about standards for data collection. Often times new data are generated with little understanding of accuracy or attribution requirments.

Mechanisms, procedure, and technologiesthat stimulate

sharing high-quality digital geospatial data have become essential. In the federal government, the Office of Management and budget (OMB) has created the Federal Geographic Data Committe (FGDC) through Circular A-16 and charged the

FGDC with the responsibility to coordinate various surveying, mapping, and spatial data activities, which invlves establishing standards and prividing wider access to geospatial data. The FGDC also has been charged with coordinating geospatial data related activities with other levels of government and other sectors.

The rapid evolution from paper maps to digital analysis of geospatial data for solving complex spatial problems has created a knowledge void. Many public and private sector agencies are discovering they do not have skilled workers who understand how to use the tecnology or what may be required for analyses. The pace of technology implementation in many organizations is constrained by a lack of trained personnel.

THE NATIONAL SPATIAL DATA INFRASTRUCTURE

The Mapping Science Committee (MSC) of the National Research Council has defined the NSDI as the "means to assemble geographic information that describes the arrangement and attributes of features and phenomena on the Earth. The infrastructure includes the materials, tecnology, and people necessary to acquire, process, store, and distribute such information to meet a wide variety of needs."

The FGDC has described the NSDI as an umbrella under which organizations and technology interact to foster more efficient use, management, and producrion of geospatial data. The NSDI consists of policies, standards, agreements, and partnerships among a variety of sectors and disciplines that will promote more cost-efficient production, ready availability, and greater use of high quality geospatial data. The NSDI also consists of a framework of basic digital geospatial data required

for registering and analyzing most other geospatial data, as well as thematic digital geospatial data sets of national interest.

The major objectives of the NSDI is to foster enhanced use of grospatial data through better management of existing geospatial data and through more efficient collection and production of new geospatial data in ways that maximize data usefulness for multiple data users. The NSDI will promote development and maintenance of and access to data sets that are needed for national, regional, state, and local analyses.

The NSDI currently exists in an hoc way, with standards and partnerships in various stages of development, large volumes of analog geospatial data (paper maps), and numerous collections of non-standardized, incomplete, often out-of-date digital data.

Recently, the Clinton Administration identified creation of the NSDI as one of the initiatives necessary to "reinvent government." Within vice President Gore's National Performance Review report, the development of the NSDI , based on partnerships with non-federal sectors, was recognized as key to minimizing redundnacy in the creation of geospatial data and facilitating means of access to these data for solving critical problems. The FGDC was recognized as the federal entity responsibile for helping to guide development of the NSDI. The president is expected to sign an Executive Order to help further efforts to develop the NSDI in the near future. The plan is addresses a variety of activities that must be carrued out by the FGDC, by federal, state, and local government agencies, and by members of the non-public sectors to fully develop the NSDI.

RECOMMENDATIONS

To achive the vision of efficient production, easy access, and shared use of vast stores of accurate geospatial data requires coordinated action on the part of organizations, associations, companies, and individuals.

A. Identify, establish, and/or utilize various forums to facilitate discussions, interactions, and actions necessary to evolve the NSDI.

Forums for communication may be formally strctured activities such as in conferences, councils, committees, or other organizations; or less formal as in conferences, workshops, and task forces. These forums must provide an environment to debate issues and establish agreed upon procedures, policies, and standards to facilitate geospatial data sharing, production, and use.

ACTION	DATE	RESPONSIBLE PARTY
1. Form or strengthen existing state GIS or gerspatial data coordinating councils.	Ongoing	State and local government agencies, National States Geographic Information Council, National Governer's Association, other state and local organizations.
2. Establish lines of communication between state councils and the FGDC and identify responsibilities.	Dec 94	State organizations and the FGDC
3. Develop a report outlining options for and costs in the formation of a national council, allience, or other organization to facilitate NSDI activities. Detail responsibilities.	March 95	FGDC sponsored contact
4. Conduct open discussions about NSDI activities at national, state, and local GIS and other spatial data meetings.	Ongoing	FGDC Secretariat, FGDC members, Subcommittee and Working Group Chairs, other participants in NSDI activities
5. Establish guidelines and criteria for the formation of or interaction with regional councils (eg. multiple states, ecosystems	June 94	FGDC Coordination Group, FGDC Steering Committee

encourage communication and data sharing and to promulgate standards. Identify means to formalize interactions with such groups.

6. Establish regional councils according to FGDC guidelines.	Ongoing	Representative of federal, state, and local governments and other sectors
7. Establish electronic lists on the Internet to conduct discussions, and sites to provide information access relation to NSDI. (see Appendix C)	Mar 94	FGDC Secretariat
8. Plan a May 1995 GeoData Forum to review NSDI development and to highlight NSDI partnership opportunties	Ongoing	FGDC, GIS/LIS

B. **Ensure effective means for finding, accessing, sharing, and using geospatial data.**
The evolving National Information Infrastructure (NII) provides a critical means for sharing information electronically. The geospatial data community will take adventage of the NII to communicate about the availability of geospatial data and ro identify potential partners for data development. Both the NII and NSDI are based onthe concept of a "distributed" approach to information management that relies on data procucers and suppliers to document and make known the availablility of the network will have access to geospatial data through stes such as the Earth Science Information Centers (1-800-USA-MAPS).

1. Complete work on the Spatial Metadata Standard to provide a consistent approach to documentation of geospatial data

a. Officially endorse Saptial Metadata Standard	Spring 94	FGDC Chairman
b. Develop guide and templates for use of the Spatial Metadata Standard.	Begin March 94, ongoing	FGDC Secretariat and Contract for support services
c. Conduct training seminars to foster use of Spatial Metadata Standard.	Ongoing	FGDC Secretariat and Contractor(s)
d. Submit the Spatial Metadata Standard to the National Institute of Standards and Technology for potential FIPS approval.	Spring 94	FGDC Secreteriat

2. Create a National Geoapatial Data Clesringhouse to allow for quering, searching, and accessing geospatial metadata across electronic networks.

a. Evaluate the Clearinghouse prototype and alternative approches for data access.

April 94

Clearinghouse Working Group, prototype participants, ather interested parties.

b. Conduct training and education activities to foster learinghouse use.

Ongoing

FGDC Secretariat, Contractor.

c. Establish Internet access for major geospatial data producing programs to privide access to docmentation and/or inventories of geospatial data.

August 94
Ongoing

Federal agencies All partiicipants

d. Establish procedures and policies to ensure that new data collected are documented using the Spatail Metadata Standard and made available to the Clearinghouse.

August 94

Federal agencies

e. Implement procedures to begin documenting new data.

Dec 94

Federal agencies

f. Establish means for public access to geospatial data through the clearinghouse

Feb 95

Federal agencies, FGDC, all participants

g. Develop a schedule and plan for documentation of existing data.

March 95

Federal agencies, FGDC

h. Establish polishies and procedures to ensure that the Clearinghouse is searched prior to new data collection activities.

March 95

Federal agencies

i. Continue expansion of clearinghouse activities and policies to non-federal geospatial data procedures and users.

Ongoing

All participants

j. Conduct research into optimal approaches to use and indexing of information within the Information Infrastructure.

Ongoing

FGDC Contracts, NSF, NCGIA, research community

3. Establish means to interoperate electronically against multiple format databases in a distributed applications context.

a. Complete a draft specification of a geodata interoperability standard and submit to the FGDC Coordination Group as part of the FGDC Standards Process.	Sept 94	Open GIS Foundation (OGF)
b. Implement the Geodata Interoperability standard.	Ongoing	Software vendors, FGDC, OGF.

C. **Through partnerships and based on standards, produce a framework of national digital geospatial data from which other data sets may be derived or to which other data sets can be referenced, both on and off-shore.**
These framework data are likely to include digital ortho imagery, geographic and cadastral reference systems, and spatial representations of giographic features such as transportation and hydrologic networks, terrain (elevation), and administrative and sociopolitical boundaries such as counties. These data are required and produced at different levels of accuracy and resolution in different geographic areas.
Applications and available budgets affect data collection accuracy and the levels of attribution.

1. Formulate a plan to establish a national network of global positioning system (GPS) differential base stations that agencies at all levels of government will cooperate in maintaining and using.	June 94	Federal Geodetic Control Subcommittee.
2. Working with the Community of data users and procucers, define basic framework content for national and local applications. (see Appendix F)	Oct 94	Framework Working Group
3. Identify needed standards for producing framework geospatial data sets	Oct 94	Framework Working Group
4. Recommend priorities for framework data production.	Oct 94	Users, Framework Working Group
5. Identify responsibilities for and contributions from various sectors for development to national standards of framework data sets.	Oct 94	Framework Working Group, major data producers

6. To aid the collection of the 2000 Census, complete the initial production of the transportation, hydrology, and boundary elements of the national degital geospatial data framework.	Jan 1998	Data producing agencies and cooperators
7. Recommend comprehensive schedules for the continuous update and disposition of framework data in the NSDI, including purging data that are no longer current, and retaining, archiving, and ensuring access to all data having continuing value.	Oct 94	Framework Working Group

D. **Develop thematic data sets that meet critical national needs.**
  Although certain geospatial data traditionally are not used to develop other data sets (such as the framework data), they are critical to answering questions of national significance. Examples include wetlands, soils, geology, land cover, and socioeconomic data.

1. Identify requirements for specific themes of data	Dec 94	FGDC Coordination Group, Subcommittees.
2. Prioritize data collection activites for themes of data.	Jan 95	FGDC Subcommittees.
3. Establish standards for collection and production of thematic data.	Ongoing	FGDC Subcommittees
4. Identify mechanisms for funding thematic data development based on cooperative partnerships and incentives	Dec 94	FGDC Coordination Group.
5. Produce key thematic data layers for the nation.	Ongoing	Data producing agencies and cooperators.

E. **Develop an education curriculum and training programs that ensure the availability of sufficient trained personnel for geospatial data activities in the future.**
  Programs to explain the concepts of geospatial relationships and the use of technology for analyzing and managies data about the Earth will begin in grades K through 12 and continue throughout professional development.

1. Promote the development of education and training programs on geospatial data concepts and technology for multiple levels of instruction.	Ongoing	Academic Institutions, NCGIA, Federal agencies.

F. **Identify options for fostering productive partnerships among all sectors for coordination of geospatial data collection, management, and use.**

Many ideas for developing the NSDI have been discussed and offered by experts in all sectors. Much of the disscussion has taken place at the meetings of professional associations and in "town meetings." These have been extremely useful in starting dialogues within the broad geospatial data user community. The next steps will involvefuther collaborative actions to effect and implement partnerships.

Oppertunities must be exploed and acted upon for pooling knowledge, resources, and research capabilities for geospatial data production, management, and use to benefit all sectors.

1. Explore opportunities for Cooperative Research and Development Agreements (CRADA) and other innovative parnerships with the private sector to develop cost-effective approaches to geospatial data production and maintenance.	Ongoing	Federal agencies, private sector
2. Identify federal assistance programs (grants, cost-sharing, technology transfer, and work-share) related ro geospatial data that are available to non-federal agencies. Examine means to coordinate these programs.	Jan 95	FGDC Contract
3. Initiate Competitive Cooperative Agreements Program to foster creative partnerships.	March 94	FGDC Secretariat
4. Develop a document outlining strategies for maximizing participation of non-federal sectors in the NSDI.	March 95	FGDC, Non-Federal cooperators.
5. Develop a document identifying organizations nationally and intenationally with responsibilities and authorities for goespatial and global change data standards. Identify strategies for encouraging coordination as feasible.	Sept 94	FGDC Standards Working Group, Interagency Working Group on Data Management for Global Change.

SIDE BAR

CHALLENGES

The global information revolution has created an unprecedented demand for access ro digital data. Optimizing the ability to use geospatial data requires action to address the following challenges:

- Digital geospatial data do not exist at needed levels of accuracy or currentness for large areas of the nation and globe.
- Requirements for posotional accuracy, information content, and geographic coverage of goespatial data vary significantly among users.
- Geospatial data often are not collected or auronated to standards that would make the data useful in multiple applications. Local, national, and international standards are are often in conflict.
- New techniques for collecting and technologies for managing digital geospatial data are changing the requiremerts for and uses of data.
- Existing geospatial data often are difficult to find. Adequate indexes and directories are not available.

- Geospatial data often are documented poorly and inconsistently.
- Where geospatial data sets do exist, they sometimes are difficult to use because of how they are packaged or formatted, and difficult to intergrate due to varing extents, positional accuracies, referencing systems, and classifications.
- Process for updating digital geospatial data sets, for conducting transactions, and for managing historical records are pooly defined or do not exist.
- Demands for digital geospatial data are increasing much faster than budgets for data collection and management.
- In some organizations, digital geospatial data are being teated as a commodity, raising many questions about public access, data fees, copyrights, liability, right-to-know, and appropriate use.
- The number of personnel educated and trained to make use of digital geospatial data is inadequate to meet the demand. Relatively few programs exist to provide appropriate education and training.

PARTNERSHIPS

Many states have recognized the value of coordinating geospatial data use, production, and management activities within their boundaries. Requirements and resources for developing geospatial data vary significantly across states and among state, local, and federal governments. A recent report[2] by nine national state and local government public interest groups, recommends that each state form a "coordinating council" of state, local, regional, and federal government represntatives, as well as academic and private sector interests. These councils, particularly if recognized formally by the governor or state legisualture, and adress issues of coordinated funding for data development, standards, data sharing policies, and data maintenance responsibilities on a statewide basis. Several of these councils are currently coordinating activites

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[2] "Statement by the Workgroup on State and Local Partnership with the Federal Geographic Data Committee", 1993. Advisory Commission on Intergovernmental Relations.

with the FGDC. Some states, such as Wisconsin, are making use of real estate transsaction fees to supprot development and coordination of geospatial data at the local government level. These locally developed data comply with standards and can be aggregated for use resionally or statewide.

There is great diversity in approaches to developing and using geospatial data within local governments. These requirements for data accuracy may vary significantly from state or nationwide needs. Means for funding data activities are a major concern, with many local agencies turning to the sale of data and GIS services to finance system development and maintenance. Some local governments have established strategic partnerships with private companies or utilities to develop basic parcel level data bases.

The state, local, and federal government agencies that form intra- and inter-agency committees and intergovernmental councils and task forces often share an interest in common, geography. Other organizations, such as the Inteligent Vehicle Highway System (IVHS) of American Congress on Surveying and Mapping, the American Society of Photogrammetry and Remote Sensing, and the Urban and Regional Information Systems Association have interests in specific data themes, types of analyses, or sectors of users of GIS. Private hardware and software vendors have other concerns related to the availability of data for use their tecnologies. All of these entities have roles to play in fostering the use of. creating, and desseminating geospatial data. A major challenge is identifying means for building partnerships among these entities to help collect, maintain, and share geospatial data.

The United States also functons as part of a global information inftrastructure, and increasingly, because of the need for understanding global processes, activities related to geospatial data must be coordinated in a large context. Activities of the FGDC and state and local governments must be conducted in consonance with organizations, such as the International Standards Organization (ISO), the International Cartographic Association, the Internatial Hydrographic Organization, the International Geographical Union, and others must be kept informed of U.S. activities. Conversly, agenceies and organizations in this nation must be aware of and consider the need for addressing international standards.

Partnership to foster coorperative responsibilities for data production, maintenance, intergration, and dissemination must be cultivated for the overall good of local and global communities. Agree upon policies and standards for creating digital data that can be widely used, for protecting privacy and for providing access to data are needed within the community to enhance the use of geospatial data for intelligent decision-making. These partnerships, procedures, standards, polices, and the framework and various themes of required digital geospatial data comprise the National Spatial Data Infrastructure.

FGDC STANDARDS PROCESS
(Steps 7-10 may be iterative.)

1. Define the need for, scope, and applicability of a standard (FGDC Coordination Group/Subcommittee/ Working Group, or other appropriate organization[3]). Document the applicability, purpose, and scope of the standard.

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[3] Needed standards may be suggested to an FGDC component by any member or organization within the spatial data community

2. Identify existing related standards and assess their adequacy and shortcomings (FGDC Coordination Group / Subcommittee / Working Group, or other appropriate organization).

3. Propose adoption of the existing standard, adaptation of an existing standard, or development of a new draft standard, including identification of the organization responsible for maintaining[4] the standard (FGDC Coordination Group / Subcommittee / Working Group, or other appropriate organization). Propose the target authorizing body(ies), such as the FGDC, National Institute for Standards and Technology, American National Standards Institute, or International Standards Organization.

4. Submit the propose draft standard to the FGDC Secretatiat for distribution to the FGDC Coordination Group and for discussion at the next Coordination Group meeting (FGDC Coordination Group / Subcommittee / Working Group, or other aoorioriate organization).

5. Review the propose standard and return it to the submitting organization for additional action or submit it to the FGDC Secretariat for announcement (FGDC Coordination Group).

6. Announce intent and a request for comments in the Federal Register, in professional jouranls, and on the Internet (FGDC Secretatiat).

7. Conduct presentations about the standard at public meetings and conferences, including those involving state and lical givernments, and the private sector (FGDC Coordination Group / Subcommittee / Working Group, Secretatiat,

or other appropriate organization).

8. Incorporate comments on the standard (FGDC Coordination Group / Subcommittee / Working Group, or other appropriate organization). Prepare a provision version of the standard.

9. Test the provisional standard (FGDC Coordination Group/Subcommittee/Working Group, or other appropriate organization oversee testing process, but the standard should be tested in as many sectors as possible).

10. Revise the standard as needed based on tests and prototypes, prepare a final version, and submit it to the FGDC Secretariat (FGDC Coordination Group / Subcommittee / Working Goup, or other appropriate organization).

11. Submit the fianl proposed standard to the FGDC Coordination Group for discussion and concurrence (FGDC Secretariat). As appropriate, formally submit the standard to external authorizing bodies.

12. Review the final proposed standard and return it to the submitting organization for additinal action or recommend adoption based on a majority vote to the FGDC Steering Committee (FGDC Coordination Group).

13. Submit proposed fianl standard to the FGDC Steering Committee with a recommendation for adoption (FGDC Secretariate).

14. Approve as an FGDC Standard based on a majority vote of the FGDC Steering Committee, with signature by the FGDC Chair.

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[4] The organization that becomes the "maintenance authority" promulgates the standard, and provides resources for education, assistance, impiementation, and maintenance of the standard, and aligns the standard with existing related standards as appropriate

Workshops and Presentations on the
National Geospatial Data Clearinghouse &
Content Standards for Spatial Metadata
as of March 1994

9th Annual GRASS GIS user's Conference and Exhibition

March 16, 1994, 8:30am-12pm and 1:30-5:00pm - Reston, Virginia - Clearinghouse/Metadata Workshops

Montana GIS Conference

April 6, 1994, 9:30-11:00am - Kalispell, Montana -NSDI/Clearinghouse Presentation

April 7, 1994, TBD - Kalispell, Montana - Clearinghouse/Metadata Workshop

Geographical Information Systems for Transportation Symposium '94

Aprill 11-13, 1994, TBD - Norfolk, Virginia - Clearinghouse Presentation [as part of Ground Transportation Subcommittee Meeting]

U.S. Hydrographic Conference '94

April 18, 1994, 1:00-5:00pm - Norfolk, Virginia - Clearinghouse Presentation [as part of Marine GIS Workshop

1994 ASPRS/ACSM Annual Convention and Exposition

April 28, 1994, 8:30-4:00pm - Reno, Nevada -

Clearinghouse/Metadata Workshop

Mid-America GIS Symposium

May 2, 9:00am-12:00pm - Kansas City, Missouri - Clearinghouse/Metadata Workshop

14th Annual ESRI User Conference

May 23-27, 1994, TBD - Parm Springs, California - Clearinghouse/Metadata Workshop

GIS in buisiness '94

June 5-8, 1994, TBD - San Francisco, California - FGDC Exhibition with Clearinghouse Demonstration

Urban and Resional Information Systems Association (URISA) '94

August 7-14, 1994, TBD - Milwaukee, Wisconsin - Clearinghouse/Metadata Workshops

Federal Geographic Technology '94

September 26-28, 1994, TBD - Washington, D.C. - FGDC Exhibit with Clearinghouse Demonstration

GIS/LIS '94

October 23-24, 1994, TBD - Phoenix, Arizona - Clearinghouse/Metadata Workshop