OGC's parts of

GEOWORLD'S FEBRUARY 2001 WEB MAPPING SPECIAL SECTION

(in association with the Open GIS Consortium and the University of Arkansas Center for Advanced Spatial Technologies)

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SECTION 1: Introduction

We have come a long way since maps were first scrawled in the sand. Explorers, merchants, and empire builders on water and land supported those who went ahead of us in the geography business as navigators, cartographers, surveyors, and map publishers. A century of flight and science and engineering gave us remote sensing and incredibly precise means for measuring the earth and earth phenomena. Fifty years of rapid advancement in digital technology provided a vehicle for the powerful disciplines of GIS, digital remote sensing, automated mapping and facilities management, and GPS. Now we are in the Internet Age. Now on wired and wireless streams of bits arranged in ever more clever protocols and packets we see the "Spatial Web" being spun for us, all around us.

Those who use the Web to provide or use spatial data and spatial processing are participating in the growth of the *Spatial Web* -- and that includes most of us. But in the midst of our rapid adoption of this set of technologies, there is, inevitably, confusion. This special *GEOWorld* Web Mapping section aims to provide some clarity and guidance. Web Mapping is delivered mainly via the commercial offerings of companies whose expert technologists and business people understand this field. These commercial offerings are described in detail in the second part of this section. 2001 will be the year that many readers of this magazine do business with Web mapping software vendors in order to more easily conduct business on the Web with people who need their spatial data and services. In this special GEOWorld section, we provide a broad look at the phenomenon of Web mapping and we also provide detailed product information to help you choose the software that is right for your Web mapping project.

With growth in the market we see a growing dialog between the users and providers of Web mapping technology. The vendors listed on page _____ can help you, but they are also looking for feedback. It's a time of rapid change and great possibilities, and what you can tell them about your application can help them focus their offering.

SECTION 2: Web Mapping Today

In summary, what we see happening in the world of Web mapping is this:

-- As the Spatial Web grows, there are more online spatial resources available. And while these resources are getting simpler to use, there is increasing potential for extended capability and complexity in web mapping applications.

-- As Web sites become richer in processing resources, you, the user, need to own less software and your sessions on the web will become more interactive.

-- Web mapping takes us beyond maps: you might get, instead of a map, the answer that a map would have provided. This will be particularly true as Location Services come to wireless Internet devices.

Consumer-directed applications of Web mapping will attract a lot of attention in the coming year, but equally important is the growing use of Web mapping to improve services provided by government. For example, EPA, the National Park Service, USDA Forestry Service, the Department of Defense, Department of Energy, Department of Interior, NASA and other federal agencies and their contractors, as well as their state, local, corporate and non-profit partners are major collectors, users and suppliers of environmental monitoring information. If data sharing between these institutions was good in theory but difficult in practice up until now, with Web mapping it becomes an imperative. Interoperability is becoming a requirement in federal Web mapping programs. (See *Industry Initiatives* on page __.)

Below we look at Web mapping trends in more detail.

It's getting bigger: Every day, more and more people use the Web to get geospatial information. GEOWorld's list of Web mapping Web sites grows longer every month (see http://www.geoplace.com.) Almost all of the "old" geoprocessing software vendors are now on the list of Web mapping software vendors in the tables on page ___, and some aspect of Web mapping is the focus of virtually all of the many new geoprocessing software vendors. Also, the list of sites serving maps through OpenGIS Web Map Server-conformant servers grows longer every month. The US Army Corps of Engineers Web Mapping site (http://www.webmapping.org/onlinedemos.html), for example, has links to a number of the clients and servers that implement the OpenGIS Web Map Server interface. The European JRC project for web mapping (World Wide Fire Web is an objective), uses OGC specifications to power several servers on their network -- see http://opengis.jrc.it/. The Digital Earth Viewer is available at www.digitalearth.gov. Information on the Minnesota Map Server is located at: http://clearinghouse3.fgdc.gov/wmswrapper.html. This application is driving the FGDC NSDI Clearinghouse. Keep in mind that many of these sites are part of limited duration projects and development efforts, so there is no guarantee that they will be up and running when you try to access them.

It's getting simpler: The chore of downloading, converting and merging spatial data and is becoming increasingly unnecessary. As each geoprocessing software vendor grows, their base of Web mapping server customers grows, as does the universe of accessible data for customers who use that vendor's Web mapping client software. OpenGIS Web Map Server interfaces take this one step further (see Column __ in Table 1) to enable a user to access maps from multiple map servers (from many different vendors) in a single session. These interfaces provide what is needed to automatically convert, fuse and display spatial information from multiple sources on the Internet to the same scale and the same coordinate reference system.. And the client is a simple Web browser! Thus every Web user's universe of readily accessible spatial data expands with every vendor's implementation of the OpenGIS Web Map Server that goes online. It's getting easier for users to *get* and make maps via the Web, and it's also getting easier for spatial information providers to set up servers that *serve* maps to those users.

While It's getting Easier for Users, it's getting more complicated for developers: The richness of today's product offerings enables system developers to build more complex applications. For example, organizations are beginning to deploy applications that support enterprise-wide use of spatial information. Usually this involves middleware that gives diverse spatial client applications access to general purpose enterprise database software. Here complexity arises in the use of multiple types of spatial information to support multiple workers' tasks.

Other complexity arises from the need to weave multiple online service providers together to serve consumers with diverse needs. The Web computing model provides powerful capabilities for linking together resources without regard to physical location or types of technologies used. Web users already hop (often without knowing it) from one Web site to another simply by clicking a button that activates a link. This ease of chaining of diverse services enables site owners to offer broader benefits to users without developing or purchasing software. It also creates incentives for improving interoperability between service providers. Web standards are necessary to make this work well, and Web mapping standards are necessary if this is to work well in our geospatial domain.

The software providers' delivery model is changing: Instead of downloading data and processing the data using software applications on our PCs, many of us will begin using a new approach: the Application Service Provider (ASP) model. This Internet distributed computing model allows users to not only access data over the Web, but also to run applications over the Web. The applications may run on a remote server or they may download and run transiently as Java "applets" on the user's computer. A user may use a single ASP provider who provides a full set of resources, or the resources may be chained from multiple providers. ASPs are beginning to appear in the geospatial realm. Downloading and installing software and data is the old way. The new way is using remote software and data via the Web.

There are economy-of-scale benefits to this model. Service providers can invest heavily in software and yet make a profit because they can collect from many pay-per-use users. Or, the remote resources may be a free piece of a larger offering from the company or agency providing the service. The user has access to potentially very sophisticated geospatial analysis tools, but avoids the costs of buying, installing and maintaining the software locally. Users also benefit from having ready access to up-to-date geospatial data, without the worry of storing it, backing it up, and maintaining its currency.

In the future, it is likely that custodians of geospatial data, especially in the public sector, will adopt an ASP model for providing access to both their data and the applications necessary for using it for particular purposes. Providing application services in this manner increases the value of their data.

Web mapping is getting more interactive: The pictures -- and maps -- we are accustomed to seeing on Web sites are GIF and JPEG images. They are “dumb” images, not “smart” data. In these simple images, a geographic feature such as a road or lake cannot be selected to query it for information, move it, edit it, change its styling (such as color of interstate highways), click on a point to get point-related information, or zoom in on it to see more detail. In many vendors’ Web-based GIS systems, such operations are possible, but the methods and data formats are usually proprietary.

Geography Mark Up Language (GML) provides a standard way of sharing intelligent spatial information (features and pixels with attributes) through encoding of geospatial data in XML, based on OpenGIS standards. GML and its supporting OpenGIS standards provide a standard, vendor-neutral way of encoding 1) virtually any kind of geospatial data and 2) virtually any method for processing and displaying such data. It makes it possible for geodata providers to become geospatial service providers, delivering real GIS, facilities management, and remote sensing services over the Web for use by anyone with a recent version (XML-capable) Web browser. One drawback: XML files, and thus GML files, are all ASCII, so proprietary solutions with more efficient file formats will outperform GML solutions when bandwidth is limited.

The Spatial Web includes a hot new domain: Location Services: Wireless Internet devices are being made position-aware through calculations of signal power from multiple nearby cellular communications transmitting antennas in some cases, and through built-in GPS or other location-determining technologies in other cases. By October 2001, U.S. phone carriers will be required by law to be able to identify the location of cell phone callers. Location services will help you shop, avoid traffic jams, get help in emergencies, find nearby jobs or yard sales, and keep track of your children and pets. Police, firefighters, excavators, surveyors, delivery people, and many others will employ special Location Services in their work. The Location Services market is predicted by the Strategis Group to grow to US $3.9 billion by 2004. The market is new, and the various service providers are struggling to make their market positions clear and struggling to form the right alliances with new and established Internet, telecom, platform, and mobile device players. In October, 2000, OGC launched an Open Location Services Initiative focused on providing this new domain with spatial standards. With spatial standards, the Location Services market can grow more rapidly, grow larger, and be more broadly useful, because Location Services will thus be able to interoperate with an extensive and growing open network of online geodata and geoprocessing resources.

In presentation, Web mapping won’t be only maps: Through increasing conformance to standards, the pieces of the spatial Web are beginning to work together. Buyers and users of Web-based mapping software are building a vast network of digital spatial data. Is it really a network of maps? Certainly it can be thought of and presented as a dense layering of thematic maps over the surface of the earth, maps that will seem to always be in the same scale and projection system, maps that can be panned, zoomed, overlaid, combined, synthesized, and otherwise utilized by anyone with an Internet-connected device, wired or wireless. But often this virtual map storehouse will be queried automatically by services programmed to simply tell us whether there is a photocopier dealer in a particular town, or to tell us that the car is at Sean's house, or to tell us the likely driving time between two addresses.

Compared to traditional applications of GIS, Remote Sensing, and Facilities Management, most Location Services applications (and Web mapping applications in general) won't require the user to understand or use very much data. Most Location Services will depend on specialized online servers to handle almost all of the processing, and only small amounts of data will be delivered to the mobile devices, where users will merely receive the information, or interact in limited ways. Information services will mainly use spatial data to automatically generate specific kinds of information. Looking at the Information Technology industry broadly, a primary goal of many software projects in this age of "info-glut" is to transform vast quantities of data into small, often transitory, nuggets of useful information. This will be true for spatial data and spatial processing.

W3C, the standards organization that sets Web standards, is remaking the Web (through XML, particularly) so that a single Web site can offer "presentation" that makes sense not only on a desktop computer screen, but also on a cell phone screen or through phones or car computers that interface with people via voice. It has become easier for developers to integrate spatial capabilities into solutions for non-experts, and the increasingly device-independent Web makes it possible to deliver such solutions to many kinds of users via many kinds of devices.

In content, Web mapping won't be only maps: When we think of spatial data we usually think of maps, but many kinds of place-related information are not categorized as "spatial". Video, photographs, and text documents, for example, could conceivably be stored and indexed in ways that would enable people to discover this information in spatial searches. "Fusing" such disparate kinds of data into one spatial framework has huge commercial potential and social value. Imagine a service to help the fireman shoveling snow to find the hydrant: location of fireman's personal device, location fused with map backdrop, fused with hydrant database, fused with photograph of immediate neighborhood of the hydrant, etc. GML, because it is XML-based, provides a straightforward way to integrate spatial data with other XML information types.

"Islands of Web Mapping" is still a problem, but the industry is embracing standards: On the Web, there are many lists of Web sites that offer spatial data -- some commercial, some with a shopping cart approach, others offered by researchers and academicians. While these sites are growing in number and the range of data they offer, they also show that the Spatial Web is still mostly comprised of unconnected "islands". In many cases data cannot be viewed online, and is offered only as downloadable or CD ROM based information. In other cases, metadata is non-standard or not accessible to standards based automated catalogs designed to assist in spatial data discovery. And much of the data that is viewable online at one site cannot be viewed or manipulated by another client..

However incomplete the current picture, the movement to standards is irreversible. Almost all the geospatial software vendors are now involved to some degree in promulgating the standards that enable the elements of this network to connect. (See "Web Mapping Initiatives" on page ___, and see the OpenGIS columns in Table 1.) Federal agencies are beginning to require OpenGIS conformance and FGDC-standard metadata. Others will follow suit, just because it makes sense from every user's perspective to have one big Spatial Web, not many small ones.

SECTION 3: Web Mapping Initiatives

Building the Spatial Web offers unprecedented market opportunity for the geotechnology industry, and, once in operation, the Spatial Web offers unprecedented benefits for society. But success depends on standards that support interoperability. Below we profile efforts to reach consensus on the interoperability initiatives that are facilitating easy discovery and widespread access to the world's geoprocessing resources and spatial information.

First, it is important to understand what kinds of standards are important, because this picture has changed dramatically. Six years ago, cities, states, federal agencies, and major corporations were still debating internally and with their data sharing partners about standardizing on particular vendors' GIS software platforms; particular data formats, and particular operating systems. Now, those issues are much less important. Today's task is much easier. Today, it is important, within and between organizations, to agree on two things: OpenGIS Interface Specifications and FGDC Metadata Standards. *Access* to heterogeneous spatial data and spatial processing resources is what the OpenGIS software interface specifications enable. *Discovery* of these resources (in the way that search engines and Web site keywords provide discovery of Web sites) depends on the OpenGIS Catalog Interface spec and on the resource owners' publishing of standard metadata for their data and processing resources.

Understanding interoperability requires understanding two terms: *open interfaces* and *standard metadata schemas.*

Open interfaces: An *interface*, in software terms, is software that enables independent systems to act on each other or communicate with each other. Historically, software vendors usually hid the interfaces that enabled communication between the independent systems of their product lines. But the general trend in the last decade has been to get away from closed interfaces, to publish the interface specifications so that software from diverse vendors can be made to work together. Good management of open interfaces is one key to the success of most major software vendors. **OGC** (the Open GIS Consortium, Inc.), a not-for-profit, began in 1994 to enlist vendors of GIS software (and other organizations) in a process to reach consensus on open interfaces that would enable their systems to communicate over networks. This effort has proceeded in coordination with the relevant committees in the International Organization for Standardization (ISO). OGC's members overcame complex technical and business issues to make this a success. It is a success, but there is still much to do.

Standard metadata schemas: Metadata is "data about data." Finding and sharing spatial data repositories and their individual spatial data files require that those repositories and files be accompanied by a considerable amount of information: When and how was the data collected? What geographic area is covered? What kind of data is it? (Raster, vector, TIN, etc.) What is the scale? What is the coordinate reference system? What geographic features are included? How are those features defined? Metadata files are typically hundreds of lines long. A metadata *schema* (or *profile*) establishes a specific sequencing, vocabulary, and format for such data. If multiple data repositories use the same metadata schema, it is possible to automate searches of the repositories. Such automation offers important social and economic benefits, just as search engines on the Web offer important social and economic benefits. Unfortunately but understandably, because so many people have collected spatial data for so many different purposes over so many years, there are many different and incompatible metadata schemas. The Federal Geographic Data Committee (**FGDC**) was created ten years ago to coordinate the development of the National Spatial Data Infrastructure (NSDI). One of its main tasks has been to coordinate the federal agencies' development of standard metadata schemas. This effort has proceeded in coordination with the relevant committees in the International Organization for Standardization (ISO). FGDC has overcome complex technical and organizational issues to achieve this goal. It is a success, but there is still much to do.

OGC's Web Mapping Initiative

OGC's work began before the Web became the dominant network computing platform that it is today. A great deal of progress had been made in the OGC Technical Committee before the OpenGIS Web Map Server Interface was created in a "rapid prototyping" process in OGC's 1999 Web Mapping Testbed. Much of the earlier specification work will be incorporated into future OpenGIS specifications that take open Web mapping beyond today's simple overlay capabilities. Future specifications will enable diverse client applications to take advantage of the capabilities of sophisticated GIS and remote sensing servers.

The highly successful Web Mapping Testbed led OGC to make the testbed method the consortium's main method for developing specifications. This method is fast and it creates a well-tested working prototype that is easy for developers to build into their software. See Sidebar 2 (page ___) for a summary of OGC's Interoperability Program accomplishments and agenda.

The US Federal Government leads in the charge to move to open discovery and access: Adoption of OpenGIS conformant products and FGDC Framework Metadata Standards is now proceeding rapidly in the US Federal government. Following the lead of USGS, NASA, and NIMA, and with FGDC support, all the US agencies that are big users and providers of spatial data are beginning to move in the direction that procurements for spatial data and technologies must require conformance with established international and commercial standards including ISO and OGC. This reflects the agencies' understanding of how interoperability helps agencies save money and improve their effectiveness in fulfilling missions to serve the nation's needs for disaster management, environmental protection, defense, housing, water supply, transportation, agriculture, etc. Missions that are served by serving maps on the Web are best served if those maps are viewable from any Web browser and automatically overlayable in the browser with maps from other servers. OGC's Louis Hecht believes that thousands of local governments will follow this trend in 2001 as they begin to use the Web to organize better access to local data.

In the private sector, adoption of standards is proceeding more slowly, but enterprises and to-the-consumer businesses have much to gain from joining in the movement toward adoption of standards. Services like those provided by MapQuest and DeLorme are very useful to millions of people, and before the Internet revolution could only have been delivered by proprietary systems. By increasing the use of standards, these and other services will be easily able to offer a richly expanded ability to access and leverage other spatial information and services on the web. Adoption of OGC specifications will provide users access to many other kinds of local information, overlaid or on the same page as their well-known Web-delivered road maps.

OGC's progress can be measured by the number of software products that implement the OpenGIS Specifications. Users have an important role to play in ensuring this progress. At the same time the vendors invest in building the OpenGIS Specifications, they have understandable business reasons not to open their products before their competitors do. Users, on the other hand, have much to gain, and should "vote with their pocketbooks" to encourage vendors to implement the specifications.

Web Mapping and FGDC's Metadata Initiatives

The Federal Geographic Data Committee is a US federal interagency committee promoting policies, standards, and procedures that help organizations cooperatively produce and share geographic data. The 17 federal agencies represented in the FGDC worked in committees to develop the Content Standard for Digital Geospatial Metadata, which was approved in 1998. Elements of this standard continue to be developed, reviewed, and approved in FGDC
Among its many NSDI-promoting activities, FGDC has developed boilerplate procurement language to help agencies write procurement documents that require purchase of products that implement interoperability standards. FGDC promotes interoperable Web mapping because it is the perfect solution to a wide range of data

publishing and data sharing problems that have bedeviled agencies at all levels of government ever since digital spatial data began to be created and used.

The rise of the Web had an effect on FGDC's programs just as it had an effect on OGC. The NSDI Clearinghouse, a Z39.50 directory of data sources whose metadata conform to the Content Standard, underwent a basic architectural change to accommodate the web. The new Clearinghouse was developed in cooperation with OGC, and this effort led to an OpenGIS Catalog Specification that is consistent with both OGC's architecture and the Z39.50 Government Information Locator Service approach. The end result for users is a capability for Web-based spatial data discovery that is much like the Web's capability for discovering web sites with search engines that search for particular key words. As explained above, sites' geodata and geoprocessing resources can be discoverable only if the sites are equipped with metadata that conforms to the standard profile, or schema, developed by the FGDC.

FGDC is involved in other NSDI initiatives that relate to the promotion of open Web mapping:

A major report on financing options the NSDI was prepared for the FGDC by Urban Logic, a New York City not-for-profit organization. That report identified ways to invest in sharable spatial information by 1) organizing spatial data consortia, 2) making OpenGIS and FGDC standards a key investment criteria, and 3) by examining the potential data redundancy being created by the many data mandates required for government programs.. The Report is available online at <http://www.fgdc.gov/whatsnew/whatsnew.html#financing>.

The FGDC emphasized Web Mapping as a major area of concentration for its FY2001 Cooperative Agreements Program of grants to communities seeking to implement NSDI practices and principles. Five grants [check this on the site] were awarded to implement Web Mapping specifications into community operations.

Sidebar 1: Technologies of Web Mapping

- XML (Xtensible Mark-up Language) has been adopted by the Worldwide Web Consortium (W3C) as the path that takes the Web beyond the limitations of HTML. XML's extended capabilities enable, among other things, easy conveyance of voice, music, video, 3D graphics, software, and, of particular interest to us, geospatial information. Unlike HTML, XML explicitly separates information content from how it is presented. XML is a simple and powerful way of describing arbitrary information by means of mark-up schemes. XML enables a client device to interpret diverse XML files' diverse encoding schemes. Presentation of an XML file is left to the client device. If the client device is a Web browser, then it will know how to display document-type XML files. Indeed, most users couldn't tell a Web page produced from an XML file from one produced from an HTML file. However, unlike HTML, XML files can be received and easily interpreted by non-browser devices, such as client software applications and XML-enabled PDAs, cell phones and car navigation systems.

- GML (Geography Mark-up Language) takes advantage of XML's flexibility. GML is simply a standard way of encoding geospatial data in XML, based on the OpenGIS standards for representation of geospatial features. Ironically, OGC's approach historically has been to develop software interface standards, as opposed to "yet another data standard," and yet GML is a data standard that is likely to be used widely as a general export format for GISs. But export formats are becoming virtually unnecessary. GML's advantages over previous data formats are (a) it is extensible, (b) it can easily be linked to any kind of non-spatial XML data and (c) it can be displayed as a map on a Web browser with negligible effort. (Web browsers are *much* more common than systems using the same GIS package you use.)

- Java and Jini: Java is an open object-oriented language that can be used to deliver client- and server-side Web applications. Jini is a scheme for indexing and identifying the capabilities of any kind of device on the Web. "Geojava" is a Java implementation of OpenGIS Specifications. Geojava provides an effective way to deliver geoprocessing capabilities that operate on GML-encoded data. This allows for client- and server-side geoprocessing, or a combination of both. Virtually every Java-enabled mobile Internet device could use this technology to efficiently deliver geospatial services to users. Jini will provide servers with the client device information they need to tailor services to the capabilities of the client device.

- HTML: Today's Web is based on HTML (Hypertext Mark-up Language). In *hypertext*, selected words form links to other files: text, images, or any digital file. Hypertext's great power was unleashed when standards were established to enable links to files on remote Internet-networked computers. A *mark-up language* is a system of codes embedded in text data that specify how the data is to be presented. When you look at a Web page's "source" you see the embedded HTML codes. HTML gave us the Web as we first knew it in the early 90s, an Internet-delivered cornucopia of flexibly formatted text, simple images, browsers, search engines and easy-to-format screens of information called *Web pages*. HTML primarily addresses formatting on a page, but now "mark-up" refers also to codes for handling voice and other media that are not necessarily page based.

- Z39.50. Z39.50 is a distributed digital library search protocol used in the Government Information Locator Service, or GILS. GILS is a decentralized collection of agency-based information locators and associated information services that identify and describe public information resources throughout the U.S. Federal Government. Early versions of FGDC's NSDI Clearinghouse were based on Z39.50. The current NSDI Clearinghouse supports Z39.50 while also supporting XML and other Web-based technologies that meet the geodata and geoservices discovery needs of the Spatial Web.

- SVG, VML, and X3D. Several XML-based specifications for describing vector graphic elements have been developed, including Scalable Vector Graphics (SVG), Vector Markup Language (VML), and X3D, the XML incarnation of the syntax and behavior of VRML (Virtual Reality Markup Language). The purpose of these specifications is to define how graphical elements (such as points, lines, polygons and arcs) are presented. They cover properties such as position, color, line weight, transparency, and size. These standards arose from the general Web publishing domain and have nothing to do with geospatial data. Their job is simply to draw collections of graphical elements (which happen, in our case, to represent maps). To view an SVG, VML or X3D data file, it is necessary to have a suitable graphical data viewer. In the case of VML this is built into Internet Explorer 5.0. In the case of SVG, Adobe has developed a Web browser plug-in, and IBM and several other companies have developed SVG viewers and supporting graphics libraries. Several Java SVG viewers are also available. To draw an SVG, VML or X3D map from GML data you need to transform the GML into one of these graphical vector data formats. This is done by associating a graphical "style" (e.g., symbol, color, size) to each feature in a GML file. When the styles are painted on the screen, you end up with a map that represents the GML features.

[End Sidebar 1: Technologies of Web Mapping]

<u>Sidebar 2: OGC's Interoperability Program</u>

1999
Completed the first phase of the Web Mapping Testbed, which resulted in the OpenGIS Web Map Server Specification.

2000
Completed the Upper Susquehanna-Lackawanna Pilot Project, applying OpenGIS Web Map Server technology in an operational flood control project.

Began a second phase of the Web Mapping Testbed, to be completed early in 2001. This will address: Legend, Style Sheet and S.S. Catalog, Stylized Layer Descriptor, Symbol Library, GML Extensions, Coverage, and Basic Service Model.

Began Phase 1 of a Geospatial Fusion Testbed (GFS). GFS, in both its phases, will address Gazetteer, WFS, Web Coverage Server, GeoLink, Geoparse, Geocode, Location Identifer Folder, GML/XML Schema, Thesaurus, and Type Dictionary. It will complete this early in 2001.

2001
OGC will begin: Decision Support Testbed, 4D Testbed, Information Community Enablement Testbed, Location Services Testbed, Military Pilot Project Testbed, Web Mapping Testbed Phase 3, and Geospatial Fusion Testbed Phase 2.

Other 2001 business includes communicating and coordinating with: IETF (Internet Engineering Task Force), The Open Group, MAGIC, E-gov, Digital Earth, Location Identifier Folder, WSC, and SEDRIS. OGC will also establish a Web mapping resources called OpenGIS.net, and ramp up activity in its European Programs.

[End Sidebar 2: OGC's Interoperability Program]

Sidebar 3: OpenGIS Specifications

The OpenGIS Specifications are software interface specifications which provide a common software syntax and semantics for system-to-system requests in distributed geospatial computing environments. They provide the foundation for making Web mapping as open as the Web itself. Some of the completed specifications and specification topics are listed below:

The **OpenGIS Web Map Server Specification** specifies the request and response protocols for open Web-based client/mapserver interaction. It addresses basic Web-based image and vector data access, display, and manipulation capabilities.

The **OpenGIS Simple Features Specification** describes "vector" geodata (e.g., streets, land use zones, property lines, watersheds, etc.) as points, lines, arcs and polygons.

The **OpenGIS Grid Coverages Specification** addresses satellite images, aerial photos, digital elevation data, and other kinds of "gridded" data.

The **OpenGIS Catalog Services Specification** describes the services of "clearinghouses," providing a common architecture for online automated directories of Web-based geospatial data and geoprocessing services, rather like "spatial search engines."

Technical standards developed in OGC also include:

- A standard scheme for automated coordinate transformation that frees us from worrying anymore about the dozens of dissimilar earth coordinate systems and map projection systems that have both intrigued and plagued geographers throughout the history of geography.

- Standards for gazetteers and geocoding that turn computer-speak earth coordinates into human understandable names.

- A catch-all standard scheme for yellow page services, routing services, information searching and data mining, style descriptors, etc.

[End Sidebar 3: OpenGIS Specifications]