

United States Geographic Information Standards: International, National, and Federal

Norman C. Andersen - Chair, INCITS L1

Julie Maitra – Vice Chair INCITS L1, Coordinator FGDC Standards Working Group

Dr. Charles Roswell – International Representative INCITS L1

Introduction

This paper describes what geospatial standards are and why they matter and discusses major standards activities at the international, national, and Federal government levels.

What are Standards?

ISO (www.iso.org) defines standards as "documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, procedures, and services are fit for their purpose." Further, "standards contribute to making life simpler, and to increasing the reliability and effectiveness of the goods and services we use."

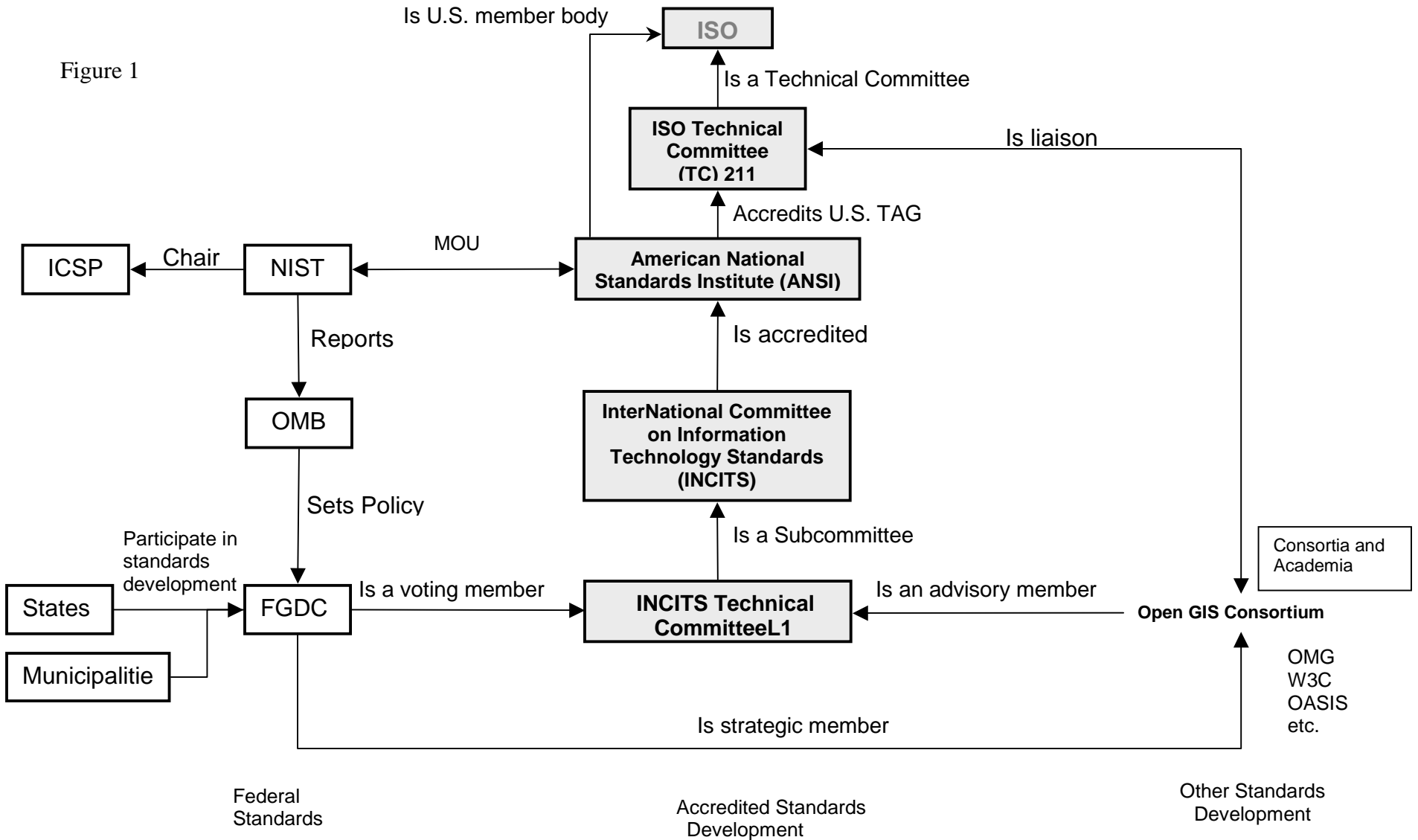
Geographic Information Systems is a distinct class of information systems because of its unique requirements for collecting, converting, sorting, retrieving, processing, analyzing, creating, and displaying geographic data. The purpose of geospatial standards is to facilitate data sharing and increase interoperability among automated geospatial information systems.

Need for Geospatial Standards in Today's World

With Global Positioning System (GPS) receivers in the hands of the average person, there has been an explosion of interest in and utilization of geographic information. Use ranges from hand held GPS receivers to automated location-based mobile systems in automobiles and emergency vehicles to tracking our complex transportation, communications, and utilities networks to mapping, modeling, and simulating the world in all its thematic glory. At the same time, there has been an exponential increase in the number of public and private decisions involving some form of geographic information. It is estimated that 80% of all data has a locational component. Linking this data together through relevant geospatial standards should now be considered a priority national goal.

Figure 1 shows the relationships among International, National, and Federal organizations that are involved in geospatial standardization activities. This paper will focus on standards development through the Federal government and ANSI and ISO.

Figure 1



Other organizations shown in Figure 1 also play a role in standardization, although they will not be the focus of this paper.

The OpenGIS Consortium (OGC, www.opengis.org) is aimed at growing interoperability for technologies involving spatial information and location through the development of interface specifications. Other organizations that are involved in activities that support geospatial interoperability include the Object Management Group (OMG, www.omg.org) for the Unified Modeling Language (UML) and the World Wide Web Consortium (www.w3c.org) for eXtensible Markup Language (XML).

Characteristics of Standards:

The Federal Geographic Data Committee (FGDC) Standards Reference Model (<http://www.fgdc.gov/standards/refmod97.pdf>) provides expectations for FGDC standards, many of which are applicable to other geospatial standards:

- *Within Scope* - Geospatial Standards must relate to geospatial data, cover appropriate topical areas, and standardize either data or processes to advance data sharing and minimize duplication of effort.
- *Future Focused* - They are intended to remove impedance to data sharing. They are being developed to promote new and enhanced interaction with existing Governmental and private industry coordinating mechanisms that have interest in the generation, collection, use, and transfer of spatial data.
- *Structured* - These standards need to be developed and presented in a structured manner that will lead to understandability and usability by consumers. Therefore these standards provide minimal guidelines for development and documentation of systems...
- *Technology Independent* - These Standards will not constrain technology development. They do not limit the use of new and emerging technologies. Nor will they be written or implemented in a way that limits any vendor or technology to maximize the use of the use of their own systems.
- *Integrated* - These Standards will be integrated with one another and with related standards. This means there will not be overlapping definitions, authorities, or procedures. Standards development will be coordinated to eliminate duplicate efforts and to maximize the efforts of the volunteers contributing to and implementing standards
- *Evolving* - They will evolve as technology and institutional mandates change. The standards will be written to allow for evolution and will accommodate backward compatibility for information gathered under previously known standards. There will be known update and maintenance procedures that are timely and responsive to changes. The procedures will be documented as a part of FGDC Standards.

- *Supportable* - These Standards must be supportable by the geospatial vendor community. They will be developed in a manner that is supportable by known or emerging technology.
- *Publicly Available* - These Standards will have a broadly based public notice of their availability...
- *Complete and Consistent* - These Standards will be complete in terms of the standards components and methodology described in this reference model. They will have a consistent form and format.

ANSI's National Standards Strategy for the United States notes that standards developed through successful standards process have the following characteristics:

- Standards are *relevant*, meeting agreed criteria and satisfying real needs by providing added value.
- Standards are *responsive* to the real world; they use available, current technology and do not unnecessarily invalidate existing products or processes.
- Standards are *performance-based*, specifying essential characteristics rather than detailed designs.

International Standards

ISO Technical Committee 211, Geographic information/Geomatics

ISO Technical Committee 211, Geographic information/Geomatics, supports development of Spatial Data Infrastructures (SDIs) around the world through international standardization in geographic information. International standardization promotes data sharing at the global, continental, regional, national, and local levels.

ISO/TC211 aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth. These standards may specify methods, tools and services for data management of geographic information (including definition and description) and acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/electronic form among different users, systems and locations. These standards will link to appropriate standards for information technology and data where possible, and provide a framework for the development of sector-specific applications using geographic data.

ISO/TC 211 has been developing the ISO 19100 series of geographic information standards. There are over forty standards projects listed in the ISO/TC 211 program of work. Many of the standards being developed by ISO/TC 211 are in advanced stages in

development, and work is underway to implement these standards in the SDIs of various countries. Many of these standards will be approved as International Standards by the end 2003.

Currently, 29 nations are participating members (P-members) of ISO/TC 211, with voting privileges on standards documents produced through ISO/TC 211. Twenty-seven other nations are observing members (O-members) that can access ISO/TC 211 standards documents and participate in technical development, but do not have voting privileges.

ISO/TC 211 Working Groups/ Advisory Groups

- Working Group 4 Geospatial Services
 - Working Group 6 Imagery
 - Working Group 7 Information Communities
 - Working Group 8 Location Base Services
 - Working Group 9 Information Management
 - Advisory Group on strategy
 - Advisory Group on outreach
 - Terminology Maintenance Group
 - Harmonized Model Maintenance Group
 - ISO/TC 211/Joint Advisory Group (JAG)
 - ISO/TC 204/TC 211 task group
- ISO/TC 211 Liaisons Internal/External (see TC 211 Below)

American National Standards

INCITS Technical Committee L1, Geographic Information Systems

The American National Standards Institute (ANSI), the U.S. member body of International Organization for Standardization (ISO), has accredited the InterNational Committee for Information Technology Standards (INCITS) to develop standards for Information and Communications Technologies (ICT). INCITS is comprised of many technical committees that develop standards in specific topic areas of ICT. Among these technical committees is INCITS Technical Committee L1 (INCITS/L1), Geographic Information Systems (GIS).

The work of INCITS/L1 consists of adopting or adapting information technology standards and developing standards used in creating, defining, describing, and processing digital geographic data.

INCITS/L1 represents the US as the US Technical Advisory Group (TAG) for ISO Technical Committee 211 (ISO/TC 211), Geographic information/Geomatics. INCITS/L1 has supported work on 40 ISO/TC211 projects: most of the standards generated by those projects will eventually be adopted as American National Standards (ANSs) through INCITS.

Liaison Activities

The following are the current L1 liaison activities:

- INCITS/H2, Database
- INCITS/L8, Metadata
- INCITS/H3 - Computer Graphics & Image Processing
- Standards Development Board (SDB)

US Metadata Study

INCITS/L1 is conducting this study in order to determine what actions need to be taken to amend and/or extend ISO 19115, Geographic information - Metadata once it has been formally adopted by ANSI. The study will also take into account the impact of two other ISO/TC 211 Metadata Projects (ISO 19139 and ISO 19115-2) and Federal Geographic Data Committee (FGDC) standards on metadata.

Standards Outreach

The purpose of the Standards Outreach Program is to provide information about current standards and the standards development process to users of geographic information. One goal of the outreach program is to involve as many GIS professionals in the development process as possible.

Membership

INCITS/L1 seeks members from all sectors of the geospatial community. INCITS/L1 membership includes Federal agencies, academia, professional societies, software vendors, and systems integrators.

To join INCITS/L1, an organization or individual must submit an application to INCITS. Information on membership is found at www.incits.org/meminfo.

FGDC Standards

Introduction to FGDC Standards

The Federal Geographic Data Committee (FGDC) is tasked to develop geospatial data standards that enable the sharing of spatial data among producers and users and support the National Spatial Data Infrastructure (NSDI). Acting under the Office and Management Budget (OMB) Circular A-16 and Executive Order 12906, FGDC subcommittees and working groups develop standards for the content, quality, and transferability of geospatial data, in consultation and cooperation with state, local, tribal, private, academic, and international communities.

FGDC standards are developed through a structured, open consensus process; integrated with one another and with voluntary consensus standards, as defined by OMB Circular A-119, to the extent possible; are supportable by the current vendor community but are independent of specific technologies so they may evolve as technology and institutional requirements change; and they are publicly available.

To date, the FGDC has formally endorsed twenty geospatial data standards. They include the *Spatial Data Transfer Standard (SDTS)*, *Content Standard for Digital Geospatial Metadata*, *Cadastral Data Content Standard*, *Content Standard for Digital Orthoimagery*, and *Geospatial Positioning Accuracy Standards*. Another eighteen standards are in various stages of development.

FGDC Standards Working Group

The primary responsibility of the FGDC Standards Working Group (SWG) is to support the various FGDC standards activities. The SWG provides guidance on FGDC standards policy and procedures and coordinates standards activities within the FGDC and between the FGDC and other standards bodies. The SWG reviews and approves all standards proposals submitted to the FGDC and reviews all draft standards for compliance to FGDC policy and procedures. Development of standards mostly occurs in the subcommittees and working groups of the FGDC, but the SWG may sponsor the development of standards when there is merit for having an FGDC standard but there is no appropriate FGDC Subcommittee or Working Group to develop the standard.

FGDC Standards Reference Model

The *FGDC Standards Reference Model* provides the guiding principles for the FGDC standards program. It defines the expectations of FGDC standards, describes the different types of geospatial standards, and documents the FGDC standards process, including the role of the SWG. Additional guidelines are given through a set of Directives that document specific procedures within the many areas of standards development.

Standards Development and Approval Process

FGDC standards follow a five stage development and approval process to ensure that they are created in an open and consensus driven manner, with the widest possible participation by the non-federal community, and that they are integrated with other FGDC standards. At the **Proposal Stage** the SWG reviews and approves proposals submitted by any FGDC or other organization to adopt or adapt an existing or create a new standard. During the **Project Stage** a development work group is formed and the development methodology and schedule are established. During the **Draft Stage** a working draft and then a committee draft for public review are produced. At this stage, input is received from as many affected parties as possible. The **Review Stage** consists of a series of reviews of the standard by the SWG, the FGDC Coordination Group, and then the public. The standard undergoes revisions based on these reviews and the document is

prepared for final approval. In the **Final Stage**, the FGDC Steering Committee formally endorses the standard.

Commitment To Voluntary Consensus Standards

OMB Circular A-119 directs Federal agencies to consult with, and participate, in voluntary consensus standards bodies. To that end, the FGDC and individual member agencies are members of the InterNational Committee for Information Technology Standards (INCITS) Technical Committee L1, Geographic Information Systems.

For more information

ISO Technical Committee 211, www.isotc21.org

American National Standards Institute (ANSI), www.ansi.org

InterNational Committee on Information Technology Standards (INCITS),
www.incits.org

INCITS Technical Committee L1, Geographic Information Systems, www.incits-l1.org

FGDC, www.fgdc.gov