



National Spatial Data Infrastructure

# Draft Geospatial Positioning Accuracy Standards Part 1: Reporting Methodology

Federal Geodetic Control Subcommittee  
Federal Geographic Data Committee

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Federal Geographic Data Committee

Department of Agriculture • Department of Commerce • Department of Defense • Department of Energy  
Department of Housing and Urban Development • Department of the Interior • Department of State  
Department of Transportation • Environmental Protection Agency  
Federal Emergency Management Agency • Library of Congress  
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## 1 INTRODUCTION

### 1.1 Explanation

This document provides a common methodology for reporting the accuracy of horizontal coordinate values and vertical coordinate values for clearly defined features where the location is represented by a single point coordinate: examples are survey monuments, such as brass disks and rod marks; prominent landmarks, such as church spires, standpipes, radio towers, tall chimneys, and mountain peaks; and targeted photogrammetric control points. It provides a means to directly compare positional accuracy obtained by one method (e.g., a cartographically-derived value) with that obtained by another method (e.g., a Global Positioning System (GPS) geodetic network survey) for the same point. It is increasingly important for users to not only know the coordinate values, but also the accuracy of those values, so users can decide which numerical values represent the "best" estimate of the "true" value for their applications.

Activities which collect or produce data coordinates include geodetic network and crustal motion surveys; national, regional, state, and county topographic mapping; bathymetric mapping and nautical charting; engineering, construction, and facilities management mapping and drawing; cadastral and boundary surveying; etc. These activities support geospatial data applications in areas such as transportation, community development, agriculture, emergency response, environmental management, and information technology.

This document is being developed in parts to address various activities. Each data activity will apply the same general accuracy standard to develop a reporting classification scheme for its particular data. The following parts have been submitted to date:

Part 2, STANDARDS FOR GEODETIC NETWORKS. Geodetic control surveys are usually performed to establish a basic control network (framework) from which supplemental surveying and mapping work, covered in other parts of this document, are performed. Geodetic network surveys are distinguished by use of redundant, interconnected, permanently monumented control points that comprise the framework for the National Spatial Reference System (NSRS) or are often incorporated into the NSRS. These surveys must be performed to far more rigorous accuracy and quality assurance standards than those for control surveys for general engineering, construction, topographic mapping, or cadastral purposes. Geodetic network surveys included in NSRS must be performed to meet automated data recording, submittal, project review, and least squares adjustment requirements established by the National Geodetic Survey (NGS). The lead agency is the

Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, NGS; the responsible FGDC unit is the Federal Geodetic Control Subcommittee.

Part 3, NATIONAL STANDARD FOR SPATIAL DATA ACCURACY. The National Standard for Spatial Data Accuracy (NSSDA) implements a well-defined statistic and testing methodology for positional accuracy of base geospatial data in digital or graphic form, derived from sources such as aerial photographs, satellite imagery, or maps. The NSSDA does not recommend a level of accuracy, because it applies to diverse geospatial data products. Ultimately, data users must identify acceptable accuracies for their applications. Data and map producers must determine what accuracy exists or is achievable for their data. The National Spatial Reference System (NSRS) may be used to reference mapping project control surveys to a common georeference system. The accuracy of geospatial data derived from project control surveys is expressed using the NSSDA. The NSSDA also may be related to the NSRS by using NSRS points as check points to test accuracy of geospatial data derived from aerial photographs, satellite imagery, maps, and other secondary sources. The lead agency is the Department of the Interior, U.S. Geological Survey, National Mapping Division. The responsible FGDC unit is the Subcommittee on Base Cartographic Data.

In addition, two other parts have been identified for inclusion in this document and are under development:

Part 4, ENGINEERING, CONSTRUCTION, AND FACILITIES MANAGEMENT. This part will provide accuracy standards for engineering surveys and maps used to support planning, design, construction, operation, maintenance, and management of facilities, installations, structures, transportation systems, and related projects. It will apply the NSSDA to architectural, engineering, and construction (A/E/C) maps. It will provide guidance in developing specifications for geospatial data used in engineering documents such as architectural and engineering drawings, construction site plans, regional master planning maps, and related Geographical Information Systems (GIS), Computer-Aided Drafting and Design (CADD), and Automated Mapping/Facility Management (AM/FM) products. The lead agency is the Department of Defense, U.S. Army Corps of Engineers. The responsible FGDC unit is the Facilities Working Group.

Part 5, NAVIGATION CHARTS AND HYDROGRAPHIC SURVEYS. This part will specify minimum standards for hydrographic surveys so that hydrographic data are sufficiently accurate and spatial uncertainty is adequately quantified for safe use by mariners. It will provide a common framework to evaluate and assess hydrographic data for a range of applications through a standard statistical approach. This part will be based

on the recently revised International Hydrographic Organization (IHO) Standard for Hydrographic Surveys, which is in the final stages of review by the international community. Potential users of Part 4 are agencies that conduct surveys of the marine waters, including the high seas, coastal and estuarine waters, and inland lakes and rivers. The lead agency is Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service. The responsible FGDC subcommittee is the Bathymetric and Nautical Chart Subcommittee.

## 1.2 Justification

As stated in Executive Order 12906, dated April 13, 1994, FGDC will coordinate the Federal Government's development of the National Spatial Data Infrastructure (NSDI). The Executive Order is intended to strengthen and enhance the general policies described in OMB Circular No. A-16. This standard supports the development of the NSDI by providing a consistent means to directly compare positional accuracies of spatial data obtained by different methods for the same point and thereby facilitating interoperability of spatial data. This standard also meets the general FGDC responsibility stated in OMB Circular No. A-119 for developing standards for implementing the NSDI, in consultation and cooperation with State, local, and tribal governments, private and academic sectors, and, where feasible, the international community. It also meets the responsibilities stated in OMB Circular No. A-16 and in E.O. 12906, Section 4, Data Standards Activities, to develop standards through FGDC to ensure that the spatial data produced by all agencies are compatible.

## 1.3 Relationship with Other Standards

### 1.3.1 Relationship with FGDC Standards

The Spatial Data Transfer Standard (SDTS) specifies that a data quality report accompany the data in a standard transfer. Because the quality report will function in the assessment for fitness of use, it must also be obtainable in its entirety and separately from the actual data. The quality report consists of five portions: lineage, **positional accuracy**, attribute accuracy, logical consistency, and completeness. Positional accuracy reported according to Geospatial Positioning Accuracy Standards will be included in the data quality report.

Part 2, Data Quality Information, of Content Standards for Digital Geospatial Metadata adopts the five elements of data quality specified by SDTS. Consequently, positional accuracy reported according to

Geospatial Positioning Accuracy Standards will be encoded in Metadata.

### 1.3.2 Relationship with ISO Standards

The ISO/TC 211 Working Draft Standard, Geographic Information - Quality, defines these data quality elements: completeness, logical consistency, **positional accuracy**, temporal accuracy, and thematic accuracy. It provides a means of measuring how well the data set maps geospatial phenomena for its product specification.

### 1.4 Maintenance

The U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), National Geodetic Survey maintains Part 1, Reporting Methodology, Geospatial Positioning Accuracy Standard for the Federal Geographic Data Committee. Address questions concerning Part 1 to Director, National Geodetic Survey, NOAA/NOS, 1315 East-West Highway, Silver Spring MD 20190.

### 1.5 Standards Development Procedures

Part 2, Standards for Geodetic Networks and Part 3, National Standard for Spatial Data Accuracy (NSSDA) were originally developed independently. Following the first public review of the NSSDA, in its previous draft as National Cartographic Standards for Spatial Accuracy, the NSSDA was aligned with emerging standards from the Federal Geodetic Control Subcommittee (FGCS). The FGCS has broad participation from various Federal agencies. Noting how individual FGDC subcommittees and working groups were developing accuracy standards, the FGCS membership agreed to sponsor an FGDC project to compile the various accuracy standards into one document. The FGDC Standards Working Group has endorsed this approach. This is the first FGDC standards project to integrate standards for various data themes and applications.

### 1.6 Accuracy Standard

All spatial data activities should develop a classification scheme following the standard given below. The standard for reporting positional accuracy is defined in two components: horizontal and vertical.

Horizontal: The reporting standard in the horizontal component is the radius of a circle of uncertainty, such that the true or theoretical location of the point falls within that circle 95-percent of the time.

Vertical: The reporting standard in the vertical component is a linear uncertainty value, such that the true or theoretical location of the point falls within +/- of that linear uncertainty value 95-percent of the time. The reporting accuracy standard should be defined in metric (International System of Units, SI) units. However, accuracy will be reported in English (inch-pound) units where the point coordinates or elevations are reported in English units.

The method used to determine accuracy should be defined. Examples include: statistical testing, least squares adjustment results, comparison with values of higher accuracy, repeat measurements, estimation, etc. The accuracy standard for point data in each part of the document will identify the type of application and if applicable, the accuracy level recommended for that application.

Coordinate values should be in the National coordinate systems. Horizontal coordinate values should be in the North American Datum of 1983 (NAD 83). Vertical coordinate values should be in the North American Vertical Datum of 1988 (NAVD 88) or the National Geodetic Vertical Datum of 1929 (NGVD 29). If coordinate values are not referenced to the National coordinate system, identify the local coordinate system used and its relationship to the National coordinate system. If the relationship between the local coordinate system and the National coordinate system is unknown, identify the local coordinate system, but state that the relationship is "UNKNOWN."

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#### BIBLIOGRAPHIC REFERENCES

Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, D.C., Department of Commerce, National Institute of Standards and Technology

Federal Geographic Data Committee, 1994, Content Standards for Digital Geospatial Metadata: Washington, D.C., Federal Geographic Data Committee, 66 p.

Morrison, J.M., 1996, Geographic Information - Quality, version 2.0 *Working Draft Standard*: Washington, D.C., ISO/Technical Committee 211, Working Group 3 - Geospatial Data Administration, 32 p.