
Geographic information — Functional standards

Information géographique — Normes fonctionnelles

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Contents

	Page
1 Scope	1
2 References	1
3 Terms and definitions	2
4 Abbreviated terms	2
5 Review of functional standards	4
6 Use of profiles to map functional standards to ISO 19100 base standards	9

Annexes

A ISO 19104, Geographic information — Terminology.....	16
A.1 Summary of functional standards characteristics	16
A.2 Key issues to be addressed	16
B ISO 19106, Geographic information — Profiles.....	17
B.1 Summary of functional standards characteristics	17
B.2 Key issues to be addressed	17
C ISO 19107, Geographic information — Spatial schema	18
C.1 Summary of functional standards characteristics	18
C.2 Key issues to be addressed	18
C.3 Response from project team	20
D ISO 19108, Geographic information — Temporal schema	21
D.1 Summary of functional standards characteristics	21
D.2 Key issues to be addressed	21
E ISO 19109, Geographic information — Rules for application schema	22
E.1 Summary of functional standards characteristics	22
E.2 Key issues to be addressed	22
F ISO 19110, Geographic information — Feature cataloguing methodology	23
F.1 Summary of functional standards characteristics	23
F.2 Key issues to be addressed	23
F.3 Response from project team	23
G ISO 19111, Geographic information — Spatial referencing by coordinates	24
G.1 Summary of functional standards characteristics	24
G.2 Key issues to be addressed	24
H ISO 19112, Geographic information — Spatial referencing by geographic identifiers	25
I ISO 19113, Geographic information — Quality principles	26
I.1 Summary of functional standards characteristics	26
I.2 Key issues to be addressed	26
I.3 Response from project team	26
J ISO 19114, Geographic information — Quality evaluation procedures	27
J.1 Summary of functional standards characteristics	27
J.2 Key issues to be addressed	27

K	ISO 19115, Geographic information — Metadata	28
K.1	Summary of functional standards characteristics	28
K.2	Key issues to be addressed	28
K.3	Response from project team	28
L	ISO 19116, Geographic information — Positioning services.....	29
L.1	Summary of functional standards characteristics	29
L.2	Key issues to be addressed	29
L.3	Response from project team	29
M	ISO 19117, Geographic information — Portrayal	30
M.1	Summary of functional standards characteristics	30
M.2	Key issues to be addressed	30
M.3	Response from project team	30
N	ISO 19118, Geographic information — Encoding	31
N.1	Summary of functional standards characteristics	31
N.2	Issues to be addressed	31
O	ISO 19119, Geographic information — Services	32
O.1	Summary of functional standards characteristics	32
O.2	Issues to be addressed	32

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this Technical Report may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 19120 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

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Introduction

The ISO 19100 series of geographic information standards under development within ISO/TC 211 provides a framework for the development of geographic information standards. There are a number of existing functional standards in use within the international community that would seek to achieve compliance with the emerging ISO 19100 series of standards.

The availability of a common frame of reference, as provided by the ISO 19100 series, may also present an opportunity for harmonization between the functional standards to the extent that such harmonization supports the primary goal of harmonization of the functional standards with the ISO 19100 series, but harmonization between functional standards is not the subject of this report. This Technical Report seeks to identify how functional standards can be developed as profiles of the ISO 19100 series of standards and how this profiling process can promote harmonization between these functional standards.

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Geographic information — Functional standards

1 Scope

Within the context of this Technical Report, a functional standard has been identified as an existing geographic information standard, in active use within the international community. National standards have not been considered within this report.

This Technical Report seeks to identify the components of those recognized functional standards and to identify elements that can be harmonized between these standards and with the ISO/TC 211 base standards. This Technical Report provides a starting point for a feedback cycle between the functional standards communities and the ISO 19100 series component project teams.

2 References

ISO/IEC 8211:1994, *Information technology — Specification for a data descriptive file for information interchange*

ISO/IEC 8824 (all parts):1998, *Information technology — Abstract Syntax Notation One (ASN.1)*

ISO/IEC TR 10000-1:1998, *Information technology — Framework and taxonomy of International Standardized Profiles — Part 1: General principles and documentation framework*

ISO 19101:—¹⁾, *Geographic information — Reference model*

ISO 19102:—¹⁾, *Geographic information — Overview*

ISO/TS 19103:—¹⁾, *Geographic information — Conceptual schema language*

ISO 19104:—¹⁾, *Geographic information — Terminology*

ISO 19105:2000, *Geographic information — Conformance and testing*

ISO 19106:—¹⁾, *Geographic information — Profiles*

ISO 19107:—¹⁾, *Geographic information — Spatial schema*

ISO 19108:—¹⁾, *Geographic information — Temporal schema*

ISO 19109:—¹⁾, *Geographic information — Rules for application schema*

ISO 19110:—¹⁾, *Geographic information — Feature cataloguing methodology*

ISO 19111:—¹⁾, *Geographic information — Spatial referencing by coordinates*

ISO 19112:—¹⁾, *Geographic information — Spatial referencing by geographic identifiers*

ISO 19113:—¹⁾, *Geographic information — Quality principles*

ISO 19114:—¹⁾, *Geographic information — Quality evaluation procedures*

¹⁾ To be published.

ISO 19115:—¹⁾, *Geographic information — Metadata*

ISO 19116:—¹⁾, *Geographic information — Positioning services*

ISO 19117:—¹⁾, *Geographic information — Portrayal*

ISO 19118:—¹⁾, *Geographic information — Encoding*

ISO 19119:—¹⁾, *Geographic information — Services*

ISO/TR 14825, *Geographic Data Files (GDF)*

CEN ENV 14825, *Geographic Data Files (GDF)*

Digital Geographic Exchange Standard (DIGEST). Digital Geographic Information Working Group — Edition 2.0 June 1997

International Hydrographic Organization (IHO) Transfer Standard S-57, Edition 3.0

3 Terms and definitions

For the purposes of this Technical Report, the following terms and definitions apply.

3.1

encapsulation

collection of specified data content in a well-defined coding structure or the process by which it is done

3.2

functional standard

existing geographic information exchange standard, developed specifically for transfer of data between entities in different nations, and currently used for that purpose

3.3

module

predefined set of elements in a base standard that may be used to construct a profile

3.4

profile

set of one or more base standards and - where applicable - the identification of chosen clauses, classes, subsets, options and parameters of those base standards that are necessary for accomplishing a particular function

[ISO/IEC TR 10000-1:1998]

3.5

product specification

description of the universe of discourse and a specification for mapping the universe of discourse to a dataset

4 Abbreviated terms

BIIF	Binary Image Intechange Format
CHRIS	Committee on Hydrographic Requirements for Information Systems (IHO)
CHS	Canadian Hydrographic Service
DBWG	Data Base Working Group, now called TSMADWG (IHO)

DIGEST	Standard for the exchange of digital geographic information. Supports the exchange of DGI required to support military operations
DGI	Digital geographic information
DGIWG	Digital Geographic Information Working Group
DNC	Digital Nautical Chart (DIGEST)
ECDIS	Electronic Chart Display Information System (S-57)
ENC	Electronic Nautical Chart (S-57)
FACC	Feature and Attribute Coding Catalogue (DIGEST)
FRS	Feature Representation Scheme (GDF)
GDF	Geographic Data Files (CEN/ISO), standard for definition and exchange of digital road databases with a focus on navigation applications
HO	Hydrographic Office
HWP	Harmonization Working Party (joint DGIWG/IHO)
ICD	Interface Control Document (DGIWG/IHO HWP)
IHB	International Hydrographic Bureau (secretariat of the IHO) https://standards.iteh.ai/catalog/standards/sist/e1f51a4c-4d38-471c-8143-bef5e9521b5/iso-tr-19120-2001
IHO	International Hydrographic Organization
IIF	Image Interchange Format
IMO	International Maritime Organization
MD	Maintenance Document (refers to S-57, published by TSMADWG)
NATO	North Atlantic Treaty Organization
OGC	Open GIS Consortium, Inc.
OGIS	Open GIS
S-57	IHO Transfer Standard; standard for the exchange of digital hydrographic data between national Hydrographic Offices, and for the distribution of such data to manufacturers, mariners and other users
STANAG	Standardization Agreement (NATO)
TSMAD	Transfer Standard Maintenance and Applications Development Working Group (IHO)
USOC	Use of the Object Catalogue for ENC (S-57)
VRF	Vector Relational Format (DIGEST encapsulation)

5 Review of functional standards

5.1 General

This Technical Report reviews a selection of functional standards currently in use within the international digital geographic information community. The standards selected are not intended to represent an exhaustive review of all the de-facto international geographic data standards currently in existence. Such work has been carried out by other organizations; rather than duplicating their effort, this Technical Report addresses a number of existing standards in wide use at the current time.

The experience gained in considering the activities required to develop these functional standards into profiles of the ISO 19100 series of standards is valuable to any developer or data producer considering the use of profiles as a mechanism for achieving compliance with the ISO 19100 series.

The review of the functional standards in parallel with the development of the ISO 19100 series of standards, has identified the need for liaison between the International Standard developers and the functional standard community.

- The “sequential” development of International Standards should be cyclically linked to the external functional standards communities. This provides for a “sanity check” on the emerging international standards by providing real test cases.
- Once the component base standards have reached International Standard status, they still may not be adequate to handle all requirements of the functional standards. These outstanding requirements may prompt future versions of the standard to be developed.

Three functional standards are considered within this Technical Report. They are as follows.

- DIGEST (Digital Geographic Exchange Standard): In use to support the military DGI requirements amongst NATO nations. The standard is maintained by the Digital Geographic Working Group (DGIWG).
- GDF (Geographic Data Files): In use to define and exchange digital road databases, with a particular emphasis on navigation applications.
- S-57: In use to support the exchange of digital hydrographic data between national Hydrographic Offices and for distribution to manufacturers, mariners, and other data users.

Each of the functional standards considered within this Technical Report comes from a different user community, and as such brings a unique perspective to the profiling activity. Each of the standards and their intended audience are summarized in the following sections.

5.2 The Digital Geographic Information Working Group (DGIWG) DIGEST Standard

5.2.1 Introduction

The Digital Geographic Information Working Group (DGIWG) was established in 1983 to support the exchange of Digital Geographic Information (DGI) among the military of NATO nations. The DGIWG membership includes Belgium, Canada, Denmark, France, Germany, Italy, Netherlands, Norway, Spain, the UK and the US. Four countries have observer status: Australia, Portugal, Greece and New Zealand.

The DGIWG is not an official NATO body; however, the DGIWG's standardization work has been recognized and welcomed by the NATO Geographic Conference (NGC). The DGIWG developed and maintains DIGEST as an exchange standard to facilitate the exchange of DGI to support interoperability within and between the military components of NATO nations, and to promote burden sharing of digital data production. The scope of this activity includes dataset specification development and harmonization of standards.

The DIGEST standard has been subject to continual evolution, in order to satisfy the requirements of the defence user community, and has evolved beyond its initial conception as an exchange standard, and now forms a true geospatial standard, addressing quality, data modelling and feature cataloguing in addition to data exchange formats.

In the future, defence data providers will be required to support multinational forces with global coverage of geographic data. This data will need to be produced accurately and provided quickly in order to support the needs of the forces. Thus the need to burden share and to interoperate is critical. The DGIWG seeks to meet this objective by developing DIGEST in order to provide a common core of data standards and processes to support interoperability.

DIGEST has become a NATO standardization agreement (STANAG 7074) and the latest version of DIGEST, edition 2.0, was released in June 1997.

5.2.2 Contents

DIGEST supports the exchange of raster, matrix, imagery and vector DGI (and associated text) among producers and users. DIGEST supports a range of vector topological structures:

- Level 0 topology - “Spaghetti”
- Level 1 topology - “Chain-Node”
- Level 2 topology - “Planar Graph”
- Level 3 topology - “Planar Graph with Face”

The standard describes a variety of encapsulations, which are in effect profiles, for the various data models supported by DIGEST. These encapsulations are defined in a series of Annexes to the standard. DIGEST also includes the Feature and Attribute Coding Catalogue (FACC), which forms a comprehensive coding scheme for features, their attributes and attribute values.

The structure of the DIGEST document is as follows:

- a) Part 1: General Description
- b) Part 2: Theoretical Model, Exchange Structure and Encapsulation Specifications
 - Annex A: ISO/IEC 8211 Encapsulation Specifications
 - Annex B: ISO/IEC 8824 Encapsulation Specifications
 - Annex C: Vector Relational Format (VRF) Encapsulation Specification

DIGEST VRF encapsulation describes the vector format supported by the DIGEST standard. VRF supports multiple levels of vector topology, and also supports application level relationships between features, such as “connected to”, “stacked on” and “stacked under”.

- Annex D: Image Interchange Format (IIF) Encapsulation

IIF complies with the Binary Image Interchange Format (BIIF).

- Annex E: ASCII Encapsulation

Table of contents when the transmittal is non-standard (due to more than one kind of data structure or encapsulation)

- c) Part 3: Codes and Parameters
- d) Part 4: Feature and Attribute Coding Catalogue.

FACC is a data dictionary of feature and attribute definitions and coding schemes used across the DIGEST family of products.

A number of products have been developed to the DIGEST standard, and are in active use. These include:

ASRP ARC standard raster product

DTED Digital Terrain Elevation Data

DNC Digital Nautical Chart

VMAP Vector map - A family of vector mapping products derived from high, medium and low scale sources

WVS World Vector Shoreline

Further information is available from the DIGEST web site <http://www.digest.org>

5.2.3 Maintenance

DIGEST is maintained by the DGIWG. A number of working parties have been set up to address technical issues associated with the standard. These working parties are directed by, and report to the DGIWG Technical Committee, which in turn reports to the DGIWG Steering Committee.

The working parties address issues arising from the current edition of DIGEST, and also seek to develop DIGEST to meet the emerging requirements of the DGIWG user community.

Currently the DGIWG is planning development of DIGEST edition 3.0. Edition 3.0 will be developed making use of the ISO 19100 series of standards.

5.3 The International Hydrographic Organization (IHO) S-57 Transfer Standard

5.3.1 Introduction

The International Hydrographic Bureau (IHB) in Monaco (founded in 1926) is the Secretariat of the International Hydrographic Organization (IHO). The IHO is an international organization based upon an intergovernmental convention that came into force in 1970. IHO presently comprises 67 Member States represented by their Hydrographic Offices (HOs). Additionally, application for IHO membership by approximately 10 states is pending. Most of the major coastal states are members of the IHO.

The IHO Transfer Standard S-57 is intended to be used for the exchange of digital hydrographic data between national Hydrographic Offices and for distribution to manufacturers, mariners, and other data users. S-57 was adopted as the official IHO standard by the XIVth International Hydrographic Conference, Monaco, 4-15 May 1992. It supports the exchange of vector (and later raster and matrix) hydrographic data. It comprises a theoretical data model, on which the standard has been based, a description of the data structure, and a catalogue of objects and attributes. In the data structure, provision has been made for the encoding of chart updates.

Additionally, S-57 includes a product specification for Electronic Nautical Chart (ENC). Edition 3.0 of S-57 was published in November 1996, and use of S-57 is specified in the IMO Performance Standards for ECDIS (IMO Resolution A/817 (19), December 1995).

S-57 has been frozen for four years, from November 1996, with a view to allowing HOs to produce ENC data conforming to Edition 3.0, and ECDIS manufacturers to market their systems.

It is currently available in both digital and paper formats. The printed version includes only a selection of the pages from the Object Catalogue.

5.3.2 Contents

The ISO Transfer Standard S-57 has the following contents.

- Part 1: General Introduction
- Part 2: Theoretical Data Model
- Part 3: Data Structure
 - Annex A: ISO/IEC Summary & Examples
 - Annex B: Alternate Character Sets

- Appendix A: IHO Object Catalogue
 - Chapter 1: Object Classes
 - Chapter 2: Attributes
 - Annex A: IHO Codes for Producing Agencies
 - Annex B: Attributes/Object Classes Cross-reference
- Appendix B: Product Specifications
 - Appendix B1: ENC Product Specification
 - Annex A: Use of the Object Catalogue for ENC
 - Annex B: CRC Code
- Appendix B2: Data Dictionary Product Specification

5.3.3 Maintenance

The IHO Transfer Standard, S-57 Edition 3.0, is maintained by means of “Maintenance Documents” (MD). These MDs are produced by the IHO TSMAD, through an agreed maintenance mechanism.

Each MD contains three sections: Clarifications, Corrections and Extensions. Each of these is explained in its respective Introduction section. Each time that the Transfer Standard Maintenance and Applications Development Working Group (TSMAD) meets and produces any changes, clarifications or extensions to the Standard, a new MD is produced.

Within a Maintenance Document, each item is assigned a unique Identifier. This Identifier takes the following form:

MD.SS.NNN

where MD = the MD Number, SS = the Section Title (Cl: Clarifications, Co: Correction, Ex: Extension), and NNN = the Item's sequential number within a section. For example, 11Co.12 is the 12th item in the Corrections Section for MD 1. All items within a section are presented in the same order as the sections of the Standard.

MDs are made available from the IHO Website <http://www.iho.shom.fr>

S-57 MD No. 1 and S-57 MD No. 2 were released in November 1997 and June 1998 respectively.

In addition, Annex A to S-57 Appendix B1 “Use of the Object Catalogue for ENC” (USOC) is maintained by means of new editions, as this document may be subject to frequent changes. These new editions are also produced by the IHO TSMAD. Edition 1.2 of the USOC was released in June 1998 and it has been posted on the IHO Website.

5.4 The GDF standard

5.4.1 Introduction

GDF (Geographic Data Files) is a standard for the definition and exchange of digital road databases with a focus on navigation applications. Often GDF is seen as just an exchange standard, but it is more than that. It provides, in the first place a common framework for the production of digital road map databases for in-vehicle navigation systems and other applications.

GDF development started in 1984 in the Demeter project, was continued in several other European projects, and was taken up by CEN/TC 278 (Road Transport and Traffic Telematics - RTTT) in 1994. GDF reached a status of provisional completion in the document of 12 October 1995, describing GDF version 3.0, which was adopted by the CEN/TC 278 Plenary as an ENV (European pre-standard) in 1996. The completion is provisional, because in 1995 ISO/TC 204 started to contribute to GDF development in order to create a global GDF. In 1996 ISO adopted the CEN document as the primary input to this process. This work is expected to be completed in early 1999.