INTERNATIONAL STANDARD

ISO 19379

First edition
2003-09-01

Ships and marine technology — ECS databases — Content, quality, updating and testing

Navires et technologie maritime — Bases de données ECS — Contenu, qualité, mise à jour et essais

Reference number
ISO 19379:2003(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 2.

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.

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

ISO 19379 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation*.

Introduction

This International Standard covers the content, quality, updating and testing of an Electronic Charting System (ECS) Database. This International Standard does not cover the system (hardware and operating software) on which the ECS Database is used. Its purpose is to clearly define the *minimum* acceptable requirements for electronic chart data to support a system of electronic charts with maximum safety, efficiency and convenience. The three requirements, contents, quality and updating, seriously impact the safety of navigation. Hence the provisions of this International Standard that define these requirements are made with care, consistent with concerns for navigational safety. All three of the requirements lend themselves to precise description, definition and measurement. Hence it is reasonable to rely on a Standard to assure a major contribution to navigation safety when using a compliant electronic chart.

ECS are Electronic Chart Systems that electronically display the real-time vessel position and relevant nautical chart data and information from the ECS Database on a display screen, but do not meet all of the IMO requirements for ECDIS and are not intended to satisfy the SOLAS Chapter V requirement to carry a navigational chart.

National regulatory authorities may wish to require compliance with this International Standard for data used in ECS or other electronic navigation systems regulated by their countries.

Ships and marine technology — ECS databases — Content, quality, updating and testing

1 Scope

This International Standard contains the requirements and test methods for the production of an ECS Database. It addresses the elements of the database relevant to safety of navigation including content, quality and updating.

This International Standard provides guidance on production and testing of an ECS Database. It does not provide detailed coverage of the methods and techniques required for database design and development, nor does it address specifc quality management procedures.

The main users of this International Standard will be ECS Database producers. ECS manufacturers and national regulatory authorities may find the guidance in this International Standard relevant.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9000:2000 (all parts), *Quality management and quality assurance standards*

3 Terms and definitions

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

3.1
Electronic Chart Display and Information System
ECDIS
navigation information system which is defined in the IMO Performance Standard for ECDIS (IMO Resolution A.817(19), as amended)

3.2
Electronic Chart System
ECS
navigation information system that electronically displays vessel position and relevant nautical chart data and information from the ECS Database on a display screen, but does not meet all the IMO requirements for ECDIS and is not intended to satisfy the SOLAS Chapter V requirement to carry a navigational chart

3.3
ECS Database
database, standardized as to content, quality and updating, issued for use with an ECS

3.4
vector data presentation
method of representing individual chart features digitally by points, lines and polygons and text given through their coordinates, attributes and appropriate code(s)

3.5
raster data presentation
method of representing all, or part, of a chart digitally by a matrix-like scheme of pixels or grid points

3.6
Nautical Chart or Nautical Publication
special-purpose map or book, or a specially compiled database from which such a map or book is derived, that is issued officially by or on the authority of a Government-authorized Hydrographic Office or other relevant government institution and is designed to meet the requirements of marine navigation

3.7
working database
database, separate from or in addition to the ECS Database, containing additions, changes and updates to the ECS Database

3.8
conspicuous features
objects, either natural or artificial, that are distinctly and notably visible

3.9
source document
any material, in printed (i.e. paper) or electronic (i.e. digital) form, used as a source of information for compiling the ECS Database

3.10
resolution
size (at the scale of the source document) of the smallest unit used to store positions

NOTE For vector data, resolution corresponds to the size of the smallest coordinate unit or sub-unit. For raster data, resolution corresponds to the size of the pixels that comprise the raster image. In either case, resolution indicates the size of the smallest spatial feature that can be discriminated, or the minimum distance between two spatial features collected as separate entities

3.11
reproduction accuracy
true distance (at the scale of the source document) between the geographic position of a given feature, as provided by the source, and the position of the corresponding entity as reproduced in the ECS Database

3.12
encoding error
discrepancy between the ECS Database and the source document (or documents) from which it is compiled, including all Notices to Mariners applied to the ECS Database in the form of updates

4 Requirements

4.1 ECS Database contents

4.1.1 Contents in general

4.1.1.1 The ECS Database shall contain, at a minimum, the same level of data and information relevant to the safety of navigation that is available from the latest edition of the Nautical Chart.

4.1.1.2 The ECS Database may be compiled from multiple sources.

4.1.1.3 Data and information derived from the Nautical Chart may be integrated with data from other sources, provided that such integration does not degrade the data or information from the Nautical Chart and the ECS Database is identified as using data or information not derived from the Nautical Chart.

4.1.1.4 The ECS Database producer shall maintain a traceable record of source documents used.

4.1.1.5 The ECS Database producer may include a generalization of the ECS Database, provided that the generalised Database cannot be used separate from the non-generalized portion of the ECS Database, i.e. the ECS user can always zoom in to check best detail.

4.1.2 Details of contents

See 5.3.2 and 5.3.5 for test provisions related to the contents of the ECS Database.

At a minimum, the ECS Database shall contain the following elements when available from Nautical Charts:

4.1.2.1 Information above and below the high water line

a) All depth contours up to and including a depth of 50 m.

b) All spot soundings up to and including a depth of 50 m.

c) Indication and details of all isolated dangers with a depth less than 50 m (or with depth unknown, when considered dangerous to surface navigation), for example: wrecks, rocks, obstructions, offshore platforms, breakers, etc.

d) Navigable canals, navigable rivers.

e) Boundaries, for example: fairways, channels, dredged areas and swept areas.

f) Drying lines.

g) Coastline, shoreline constructions and man-made flow-control structures, such as dams, locks, weirs and dykes.

h) Bridges, overhead pipelines and cables with horizontal and vertical clearances over navigable water.

4.1.2.2 Navigation aids

a) Indication and details of all fixed and floating aids to navigation including navigation markings and numbers.

b) Navigation lines.

c) Traffic routing systems and separation schemes.

d) Recommended routes.

e) Conspicuous features.

4.1.2.3 Other features

a) Submarine cables and pipelines.

b) Areas for which special conditions exist such as:

   1) anchorage areas and anchorage prohibited areas;

   2) restricted areas, for example: cautionary areas, prohibited areas, fishing prohibited areas, areas to be avoided;

   3) regulated areas, for example: fishing grounds, offshore production areas, dumping areas;

   4) military practice areas;

5) international boundaries and national limits.

c) Ferry routes.

d) Nature of the seabed, for example: sand, mud, rocks, sponge, etc.

e) Distance marks.

4.1.2.4 Textual information

a) Indication and contents of cautionary notes relating to safety of navigation.

b) Place names.

4.1.2.5 Metadata

a) ECS Database producer and identification of the source Nautical Chart.

All parts of the ECS Database compiled from sources other than the Nautical Chart or from other official government sources shall contain information in the metadata that the ECS manufacturer may use to generate an appropriate warning to the user.

b) Date the ECS Database is current through.

If the database is produced from multiple Nautical Charts, then the date the ECS Database is current through should be the date associated with the latest update to the least up-to-date Nautical Chart.

c) Horizontal geodetic datum and offset to WGS-84, if any.

The horizontal geodetic datum of a vector format ECS Database shall be WGS-84. The horizontal geodetic datum of a raster format ECS Database should be WGS-84, but it may be produced in its source datum provided the offset to WGS-84 is provided in the metadata. If the ECS Database includes an area for which the datum is unknown, an indication shall be provided in the metadata.

d) Sounding datum and vertical datum.

e) Scale boundaries or database resolution boundaries, if different.

f) An indication of the suitability of the ECS Database for a specific intended navigational purpose, based upon the scale and positional accuracy of the source data and the reproduction accuracy, that may be used by the ECS manufacturer to notify the user that the ECS Database is suitable for use in conjunction with a continuous positioning system of an accuracy consistent with the requirements of safe navigation, according to Table 1.

Table 1 — Suitability of the ECS Database for navigational purposes

Navigational purpose	Scale of source data	Horizontal tolerance of ECS Database m
Can be used in restricted waters	$\geqslant$ 1:20 000	$\leqslant$ 10
Can be used to approach a harbour	$\geqslant$ 1:50 000	$\leqslant$ 50
Can be used for coastal navigation	$\geqslant$ 1:100 000	$\leqslant$ 100
Should not be used in conjunction with a continuous positioning system		$>$ 100

4.1.2.6 Other information

The ECS Database should include other information necessary for the ECS manufacturer to work with the ECS Database, such as horizontal and vertical units of measurement, etc.

4.2 ECS Database quality

The concept of database quality incorporates the process by which the ECS Database is produced, the source materials, the resolution and reproduction accuracy of chart features, and the correctness and completeness of data. These items shall be incorporated in the producer's program of quality management.

4.2.1 Product specification

The producer of the ECS Database shall generate and maintain a product specification for the ECS Database, describing

a) the compliance with any industrial, governmental or International Standard and regulation, when applicable,

b) the type-approval or classification certificates issued for the product, when applicable,

c) the data structure of the ECS Database such as vector, raster, both vector and raster, or other,

d) the properties of the ECS Database, for example: resolution, maximum allowable errors in reproduction accuracy, maximum allowable error in completeness of encoding,

e) the packaging of the ECS Database, including how the various parts, sections or units that the ECS Database consists of are assembled into individual products,

f) the way in which the ECS Database can be updated, and

g) any known limitation in the use of the ECS Database.

4.2.2 Process control

The ECS Database producer shall have in place a quality management system meeting recognized standards, for example: ISO 9000 series. Within the producer's quality management system, there shall be procedures to assure that the ECS Database complies with the producer's product specification and with the requirements of this International Standard, including the following:

a) written procedures for selection, purchasing, inspection and acceptance of source materials;

b) written procedures for all critical phases of the process, including registration of source materials, geo-referencing, geo-rectification, conversion to digital format (raster or vector), and compilation into final product;

c) written procedures for internal quality management for both intermediate and final products, including handling of non-conformities, preventive and corrective actions;

d) encoding specifications providing rules describing which information is captured from source documents and how it is classified in the form of features and geometric primitives in the ECS Database.

NOTE Encoding specifications only apply to an ECS Database containing vector data.

4.2.3 Source documents

4.2.3.1 In the context of this International Standard, a source document is any material, in analogue (paper) or digital (electronic) form, used as a source of information for compiling the ECS Database. Typical source documents include, but are not limited to, the following:

a) Nautical Charts;

b) Nautical Publications and notices (e.g., List of Lights and Radio Signals, Sailing Directions, Notice to Mariners);

c) hydrographic surveys;

d) topographic surveys;

e) imagery.

4.2.3.2 Source documents can be issued by governmental agencies (e.g., Hydrographic Offices, Maritime Administrations, Port Authorities) or private organizations. Source documents used for compiling the ECS Database shall contain the following information, when applicable:

a) horizontal geodetic datum and offset to WGS-84, if any;

b) sounding datum;

c) vertical datum;

d) scale;

e) minimum and maximum coordinates of the area covered;

f) all elements needed for geo-referencing (e.g., borders with marks, gridlines, projection).

NOTE Exceptions to the above list are only permitted for documents representing the sole available source of navigational information in a given area.

4.2.3.3 The producer of the ECS Database shall maintain a log of all source documents used for the ECS Database, reflecting the sources actually used for each edition, version, or subset of the ECS Database. The record for each source document shall include as a minimum the following information:

a) issuing body (e.g., agency, organization, or company);

b) identification according to the issuing body (e.g., catalogue number);

c) edition, reprint or re-issue number and date.

Alternatively, the above can be encoded in the ECS Database itself, in a form that allows its querying, retrieval and display by appropriate means (e.g., as parameters for logical storage units of the ECS Database, or as meta-data).

4.2.4 Resolution

See 5.3.3 for test provisions relating to resolution of the ECS Database.

4.2.4.1 Resolution of the ECS Database is a quantity depending on digitizing hardware and software, encoding procedures, etc. In general, it is the size (at the scale of the source document) of the smallest unit used to store positions. For vector data, it corresponds to the size of the smallest coordinate unit or sub-unit; for raster data, to the size of the pixels that the bitmap consists of. In both cases, the resolution indicates the size of the smallest spatial feature that can be discriminated, or the minimum distance between two spatial features collected as separate entities.

4.2.4.2 Resolution of the ECS Database shall be such as to ensure that the ECS may generate a detailed, truthful and comprehensible representation of the information derived from source documents, when the ECS Database is displayed at the same scale as the source. In any case, resolution shall be not coarser than 0,2 mm at scale 1:1, or (0,2 multiplied by N) mm at scale 1:N on the source.

Table 2 — Example of resolution of an ECS Database

Scale	Database ground resolution m
1:1 000	$\leqslant$ 0,2
1:10 000	$\leqslant$ 2,0
1:50 000	$\leqslant$ 10,0

4.2.5 Reproduction accuracy

See 5.3.4 for test provisions relating to reproduction accuracy of the ECS Database.

4.2.5.1 Reproduction accuracy is defined as the true distance (at the scale of the source document) between the geographic position of a given feature as provided by the source and the position of the corresponding entity as reproduced in the ECS Database.

4.2.5.2 Reproduction accuracy of any element of the ECS Database shall be not worse than 0,5 mm at scale 1:1, or (0,5 multiplied by N) mm at scale 1:N on the source.

4.2.6 Correctness and completeness of encoding

See 5.3.2 and 5.3.5 for test provisions relating to completeness of encoding.

4.2.6.1 Correctness and completeness of encoding shall be in accordance with the encoding specifications implemented by the producer of the ECS Database, and at a minimum, shall comply with the following:

a) The ECS Database shall not contain any encoding error that might endanger safety of navigation. These errors, referred to as critical encoding errors, are listed in Table 3.

b) Any other encoding error is classified as non-critical. The number of features affected by non-critical encoding errors shall not exceed 1 every 200 features encoded in the ECS Database (corresponding to an acceptance criterion of 99,50 %).

Table 3 — Critical encoding errors

Feature(s)	Critical encoding error(s)
Depth contours up to and including a depth of 50 m	Missing feature Wrong or missing depth value
Spot soundings up to and including a depth of 50 m	Missing feature Wrong or missing depth value
Indication and details of isolated dangers with a depth less than 50 m (or with depth unknown, when considered dangerous to surface navigation)	Missing feature Attribution to the wrong feature class (e.g. rock instead of wreck) Wrong or missing depth value Wrong or missing indication of water level (e.g. emerged instead of underwater)
Navigable canals, navigable rivers	Missing feature Wrong depth value
Boundaries	Missing feature Wrong or missing depth value Wrong or missing year of dredging
Drying lines	Missing feature
Coastline	Missing feature
Shoreline constructions and man-made flow-control structures, such as dams, locks, weirs and dykes	Missing feature Wrong or missing indication of water level
Bridges, overhead pipelines and cables with horizontal and vertical clearances over navigable water	Missing feature Wrong or missing horizontal or vertical clearance
Indication and details of fixed and floating aids to navigation	Missing feature For all IALA marks: wrong or missing attribution to IALA class (e.g. cardinal instead of lateral) or sub-class (e.g. port instead of starboard); wrong or missing encoding of functional characteristics (e.g. wrong colour, shape, number) For all marine or aeronautical lights: wrong or missing colour(s), characteristics (e.g. fixed instead of flashing), signal period, signal group (e.g. Fl instead of Fl(3)), range and sector limits
Navigation lines	Missing feature
Traffic routing systems and separation schemes	Missing feature Attribution to wrong feature class (e.g. recommended traffic lane instead of traffic-separation-scheme lane) Wrong or missing orientation of traffic-separation-scheme lanes Wrong or missing traffic indication (e.g. one-way instead of two ways) Wrong or missing depth value of deep water routes

Table 3 — Critical encoding errors (*continued*)

Feature(s)	Critical encoding error(s)
Recommended routes	Missing feature Wrong or missing traffic indication (e.g. one-way instead of two ways)
Conspicuous features	Missing feature Wrong description, or attribution to wrong feature class (e.g. chimney instead of mast)
Submarine cables and pipelines	Missing feature
Areas for which special conditions exist	Missing feature Wrong or missing encoding of the prohibition, restriction, regulation, function or caution relevant to the area
Ferry routes	Missing feature
Nature of the seabed	Missing feature Wrong encoding of the nature of the seabed
Distance marks	Missing feature Wrong or missing distance values
Indication and contents of cautionary notes relating to safety of navigation	Missing feature Wrong encoding of the cautionary note, when this alters the significance of the information, excluding typos, (e.g., exclusion of cautionary notes outside the "neatline" of the paper Nautical Chart in the raster database)
Metadata	Missing encoding of the ECS Database producer Missing or wrong encoding of the source Nautical Chart Missing or wrong encoding of the date the ECS Database is current through Missing or wrong encoding of the horizontal geodetic datum or offset to WGS-84 Missing or wrong encoding of the sounding datum Missing or wrong encoding of the vertical datum Missing or wrong encoding of scale boundaries or database resolution boundaries Missing or wrong encoding of the navigational purpose Missing or wrong encoding of the database suitability

4.2.6.2 In the context of this International Standard, an encoding error (either critical or non-critical) is defined as a discrepancy between the ECS Database and the source (or sources) from which it is compiled, including all Notices to Mariners applied to the ECS Database in the form of updates.

4.2.6.3 The definitions of critical encoding errors are based on the assumption that the relevant information is provided by the source (or sources) from which the ECS Database is compiled.

4.3 ECS Database updating

See 5.3.6 for test provisions relating to updating the ECS Database.

The producer of the ECS Database shall be responsible for regularly acquiring and making available to his customers, updating data that is to be applied to the customers' database.

NOTE It will be necessary for the producer to provide evidence of an existing procedure currently available to his customers that meets this requirement for updating.

4.3.1 The database, when made available by the producer, shall be at least as current and up-to-date as the Nautical Charts for the area, with timeliness compliant with the standards set herein.

4.3.2 The ECS Database producer shall publish a list of current updates to each ECS Database and the dates that they were issued, and make it available at least once per month.

4.3.3 The ECS Database producer shall publish updates to the ECS Database and make them available at least once per month. The updates shall contain all Notices to Mariners relevant to the Nautical Charts contained in the ECS Database and received by the producer (or made openly available by, for example, publication on the Internet) before the 15th day of the preceding month. In those areas where updates to the Nautical Charts are less frequent than monthly, updates to the ECS Database may have the same frequency as the updates to the Nautical Charts.

NOTE 4.3.2 and 4.3.3 may be satisfied by replacing the entire ECS Database.

4.3.4 When a new edition of a Nautical Chart or a new Nautical Chart is published that affects the ECS Database, the ECS Database producer shall publish an update to the ECS Database, containing the new edition or the new chart, and make it available within the shortest possible time, in accordance with its production process, the time when the relevant source document(s) are received from the producing Agency, and the total number of new editions and new charts to be processed at the same moment.

4.3.5 In case that, upon receipt of a Notice to Mariners by which a new edition or chart is announced, the ECS Database producer is unable to include the new edition or chart in the next update as mentioned in 4.3.4, the ECS Database producer shall include in the update a note that the affected Nautical Chart (with a reference to the chart number and description of the chart), contained in the ECS Database, is no longer current.

5 Test methods

5.1 General

These methods of testing may be used by the ECS Database producers, national regulatory authorities and designated testing agencies or organizations.

5.2 Testing of the production process

5.2.1 Product specification

Verify that a formal product specification exists, which includes a description of the data structure, the database properties, details of packaging and updating, and specifics of any known limitation for use of the product.

5.2.2 Process control

Verify that a formal recognized quality system exists, which includes written procedures for verification of all elements of the ECS Database, in accordance with the requirements of 4.2.

5.2.3 Source documents

Verify the accuracy of the log of source documents, and that it complies with the requirements of 4.2.3.

5.3 Testing of the ECS Database

This subclause contains descriptions of the minimum recommended tests to be conducted to determine if the ECS Database complies with this International Standard.

5.3.1 Testing tools

5.3.1.1 Testing is performed through use of an ECS Database Testing Device. This is a device, consisting of an ECS, or a dedicated software program, capable of performing the following operations:

a) checking that the resolution of the raster image is not coarser than the coarsest value allowed by this International Standard when a raster image has been used as the source;

b) loading the ECS Database in its native format (i.e., the same format in which it is distributed to customers);

c) displaying the ECS Database using colours and symbols to permit the testing specified by this International Standard;

d) displaying a selected geographic position;

e) changing the display scale;

f) providing information about the scale of display;

g) moving a cursor on the representation of the ECS Database, and displaying the geographic coordinates at each specific position of the cursor;

h) measuring the distance between two positions;

i) providing the following information read from the ECS Database itself:

   1) reference to the source document(s);

   2) horizontal geodetic datum, parameters for converting to/from WGS-84 if the horizontal datum is different from WGS-84, or the information that the horizontal datum is unknown, when applicable;

   3) sounding datum;

   4) vertical datum;

   5) intended display scale;

   6) date to which the ECS Database is updated.

5.3.1.2 The ECS Database producer shall maintain an ECS Test Database produced using Chart INT 3 (from IHO M-4) as the source Nautical Chart.

5.3.2 Cartographic framework

Check that the all metadata listed in 4.1.2.5 is included in the ECS Database.

5.3.3 Resolution

See 4.2.4 for requirements relating to resolution.

5.3.3.1 Vector data

a) When a raster image has been used as the source, check that the resolution of the raster image is not coarser than the coarsest value allowed by this International Standard.

b) Check the resolution of the ECS Database, by observing the position of point objects, or of vertexes along lines or polygons, and ensure that they are placed on a grid not coarser than the coarsest resolution allowed by this International Standard.

5.3.3.2 Raster data

Check that the resolution of the raster image is not coarser than the coarsest value allowed by this International Standard.

5.3.4 Reproduction accuracy

See 4.2.5 for requirements relating to reproduction accuracy.

Testing of reproduction accuracy for raster databases shall be based on comparing positions on the source document(s) with the corresponding positions in the ECS Database. This test shall not be conducted by overlaying a printed output form of the ECS Database on the source when the source is paper.

In order to check reproduction accuracy of the ECS Database by comparing its coordinates with coordinates in the source document(s), positions shall be referred to a common horizontal datum. If the ECS Database has positions referred to a different horizontal datum, the shift values (as stored in the ECS Database) shall be taken into account.

The following methods should be applied for testing reproduction accuracy.

5.3.4.1 Vector format ECS Database

5.3.4.1.1 Introduction

Testing reproduction accuracy for vector databases shall be based on conspicuous features, other than intersections of parallels with meridians, whose position can be unequivocally identified such as:

a) point features represented in both the source document(s) and in the ECS Database by symbols marking their exact position, such as lighthouses, buoys and beacons;

b) conspicuous vertexes of line/area features, such as sharp corners along man-made shorelines, or corners of restricted/regulated areas.

The actual testing procedure depends on the process by which the ECS Database is produced. In most cases, the process can be categorized as either of the following types:

5.3.4.1.2 Paper-to-vector conversion

Reproduction accuracy shall be tested by comparing the geographic coordinates of conspicuous features (see 5.3.4.2.2), measured on the source document, with the coordinates of the corresponding features as encoded in the ECS Database.

For each such feature, using the function provided by the ECS Database Testing Device, verify that the distance between the position on the source and the position on the ECS Database is equal to or less than (0,5 multiplied by N) mm, where 1:N is the scale of the source.

NOTE In paper-to-vector conversion, the paper chart is converted to digital vector format by mean of a digitizing table, with no intermediate step.

5.3.4.1.3 Raster-to-vector conversion

Reproduction accuracy can be tested using the same procedure as above, or (more conveniently) verifying the reproduction accuracy of the raster image, then comparing the geographic coordinates of conspicuous features (see 5.3.4.2.2), measured on the raster chart, with the coordinates of the corresponding features as encoded in the ECS Database.

The following procedure can be used.

a) Verify the reproduction accuracy of the raster chart, using the same procedure described for an ECS Database in raster format by dedicated equipment, on which the raster chart can be loaded, and all operations necessary for its verification performed.

b) For each such feature, using the function provided by the ECS Database Testing Device, verify that the distance between the position on the source, and the position on the ECS Database is equal to or less than (0,5 multiplied by N) mm, where 1:N is the scale of the source.

NOTE In raster-to-vector conversion (or head-up digitizing), the paper chart is first converted to digital raster format by means of a scanner, or a Raster Nautical Chart is used as a source, and the raster image vectorized on a CAD workstation.

5.3.4.1.4 Vector-to-vector conversion

Reproduction accuracy can be tested by comparing the geographic coordinates of conspicuous features (see 5.3.4.2.2), measured on the source data, with the coordinates of the corresponding features as encoded in the ECS Database.

For each such feature, verify that the distance between the position on the source and the position on the ECS Database is equal to or less than (0,5 multiplied by N) mm, where 1:N is the scale of the source.

NOTE In vector-to-vector conversion, a source vector-format chart database is converted to a different vector format.

5.3.4.2 Raster-format ECS Database

5.3.4.2.1 Reproduction accuracy shall be tested at intersections of parallels with meridians visible on the source document(s). Points along the chart border (and in particular, the chart's four corners) shall not be tested for reproduction accuracy.

5.3.4.2.2 Verify that the reproduction accuracy at intersections results in accuracy equal to or better than the limit set in this International Standard.

5.3.4.2.3 Using the function provided by the ECS Database Testing Device, verify that the distance between the position from the source and the position from the ECS Database at each intersection is equal to or less than (0,5 multiplied by N) mm, where 1:N is the scale at which the ECS Database is currently displayed by the equipment.

5.3.5 Details of ECS Database contents

Compare the details of the contents of the ECS Database, as required in 4.1.2, with the contents of the source data and verify for correctness and completeness as specified in 4.2.6.

5.3.6 Updating the ECS Database

Verify that the ECS Database and its updates comply with the requirements of 4.3.1, 4.3.2 and 4.3.3.

Bibliography

[1] IHO Chart INT-3, *Use of symbols and abbreviations*

[2] IHO M-4:2001, *Regulations of the IHO for international charts and chart specifications of the IHO*

[3] IHO S-57:1996, *IHO Transfer Standard for Digital Hydrographic Data*

[4] IMO A.817(19):1995, *Performance standards for electronic chart display and information systems (ECDIS)*

[5] IMO MSC.64(67):1996 (Annex 5), *Amendment to the performance standards for ECDIS*

[6] IMO MSC.86(70):1998 (Annex 4), *Amendments to the performance standards for ECDIS*

ICS 47.020.70

Price based on 14 pages