

INTERNATIONAL STANDARD

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1999-04

Maritime navigation and radiocommunication equipment and systems – Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results

*Matériels et systèmes de navigation et de
radiocommunication maritimes –
Systèmes intégrés de passerelle –
Exigences d'exploitation et de fonctionnement,
méthodes d'essai et résultats d'essai exigés*



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –****Integrated bridge systems (IBS) –
Operational and performance requirements,
methods of testing and required test results**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61209 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

The text of this standard is based on the following documents:

FDIS	Report on voting
80/199/FDIS	80/221/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annexes A and D form an integral part of this standard.

Annexes B, C and E are for information only.

A bilingual version of this standard may be issued at a later date.

INTRODUCTION

In 1991, the International Electrotechnical Commission (IEC) technical committee 80 (TC 80) observed that, while considerable work was progressing to develop standards for the individual systems or subsystems of a modern ship's bridge, no international organization had yet assigned the task of integrating these individual systems or co-ordinating the individual standards.

The normal progression would be the development of an International Maritime Organization (IMO) safety-related circular or assembly resolution, to be followed by assignment for the development of the IEC standard to a TC working group (WG).

IEC TC 80 felt that the development of an integrated bridge system was so important that they should not wait any longer before embarking on the development of this International Standard. They therefore assigned the task to TC 80, WG 9, Integrated bridge systems (IBS) for ships, and informed IMO of this work programme.

WG 9 co-ordinated their work closely with similar activity within the IMO subcommittees on Safety of Navigation (NAV), Design and Equipment, Radiocommunications, Search and Rescue, and other working groups of TC 80, the activities of the International Association of Classification Societies (IACS), as well as individual classification societies, and national initiatives. Many of the working group members actively participated in one or more of these other groups.

IEC TC 80 submitted the material contained in the requirements section of this standard to IMO with a proposal that it could provide the basis for an international agreement on the subject of integrated bridges. The IMO Maritime Safety Committee (MSC), at its 67th session, agreed to the essence of this proposal and adopted resolution MSC.64(67), annex 1, performance standards for integrated bridge systems (IBS).

The aims of this standard are to provide recommendations for the design, manufacture, integration and testing of:

- stand-alone equipment;
- networks;
- integration units; and
- multifunction displays

in connection with the aspect of interaction (integration) within a bridge.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Integrated bridge systems (IBS) – Operational and performance requirements, methods of testing and required test results

1 Scope

This International Standard specifies the minimum requirements for the design, manufacture, integration and testing of integrated bridge systems (IBS) to comply with IMO resolution MSC.64(67), annex 1, of the International Maritime Organization (IMO), and other relevant IMO performance standards, in order to meet the functional requirements contained in applicable IMO instruments, not precluding multiple usage of equipment and modules or the need for duplication.

Reference is made, where appropriate, to IMO resolution MSC.64(67) annex 1, and text in this standard, the meaning of which is identical to that in the IMO resolution, is printed in *italics* and identified by the resolution paragraph numbers in brackets.

This standard aims to increase safe and efficient ship management by suitably qualified personnel taking care of, *inter alia*, uninterrupted functional availability of systems, and of human factors.

Operation of the IBS may conflict with the requirements for individual equipment. Such conflicts may imply modification to, or deviation from, individual equipment standards or the carriage of additional equipment. This standard highlights those deviations as well as their justification. Existing standards for individual equipment are not addressed.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, these publications do not apply. However parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative documents referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60945:1996, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61162 (all parts), *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*

ISO 8468:1990, *Ship's bridge layout and associated equipment – Requirements and guidelines*

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

ISO 9001:1994, *Quality systems – Model for quality assurance in design, development, production, installation and servicing*

ISO 9002:1994, *Quality systems – Model for quality assurance in production, installation and servicing*

IMO International Convention for the Safety of Life at Sea (SOLAS):1997, Consolidated edition

IMO A.686:1991, *Code on alarms and indicators*

IMO A.823:1995, *Performance standards for automatic radar plotting aids (ARPAs)*

IMO A.830:1995, *Code on alarms and indicators* (amendments to IMO 686: 1991)

IMO A.694:1991, *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO MSC.64(67):1996, Annex 1 – *Performance standards for integrated bridge systems (IBS)*

IMO MSC.64(67):1996, Annex 4 – Amendments to A.477:1981, *Performance standards for radar equipment*

IMO MSC/Circular 566:1991, *Provisional guidelines on the conduct of trials in which the officer of the navigational watch acts as the sole look-out in periods of darkness*

IACS UR N1:1992, *Unified requirements for one man bridge operated (OMBO) ships*

NOTE – Additional IMO requirements which may be applicable to IBS are listed in annex A.

3 Definitions and abbreviations

3.1 Definitions

For the purpose of this standard, the following definitions apply.

3.1.1

configuration of complete system

all operational functions of the IBS as installed

3.1.2

configuration available

operation(s) allocated to and available at each workstation

3.1.3

configuration in use

operation(s) and task(s) currently in use at each workstation

3.1.4

connectivity

a complete data link and the presence of valid data

3.1.5

essential functions

functions related to determination, execution and maintenance of safe course, speed and position of the ship in relation to the waters, traffic and weather conditions (passage execution)

Such functions normally include, but are not limited to,

- route planning;
- navigation;
- collision avoidance;
- manoeuvring;
- docking;
- monitoring of internal safety systems;
- external and internal communication related to safety in bridge operation and distress situations;
- ship stability

3.1.6

essential information

that information which is necessary for the monitoring and control of essential functions

3.1.7

functionality

ability to perform an intended function. The performance of a function normally involves a system of displays, controls and instrumentation

3.1.8

IMO requirements

IMO conventions, regulations, resolutions, codes, recommendations, guidelines, circulars and related ISO and IEC standards

3.1.9

(1.1, 2) integrated bridge system (IBS)

any combination of systems which are interconnected in order to allow centralized access to sensor information or command/control from workstations to perform two or more of the following operations:

- *passage execution;*
- *communications;*
- *machinery control;*
- *loading, discharging and cargo control;*
- *safety and security.*

Management operations may also be performed within the IBS (see annex C).

3.1.10

integrity

ability of a system to provide users with accurate, timely, complete and unambiguous information and warnings within a specified time when the system shall not be used

3.1.11

latency

time interval between an event and the resulting information, including time for processing, transmission and reception

3.1.12

multifunction display

a single visual display unit which can present, either simultaneously or through a series of selectable pages, information from more than one operation of an IBS

3.1.13

part

an individual subsystem, equipment or module

3.1.14

performance check

a representative selection of short qualitative tests, to confirm correct operation of essential functions of the IBS

3.1.15

sensor

a device which provides information to or is controlled or monitored by the IBS

A compilation of definitions of integration related terms is contained in annex E.

3.2 Abbreviations

Abbreviations used in this standard:

ARPA	Automatic radar plotting aid
GMDSS	Global maritime distress and safety system
IACS	International Association of Classification Societies
IBS	Integrated bridge system
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
ISO	International Organization for Standardization
MMI	Man-machine-interface
MSC	IMO Maritime Safety Committee
NAV	IMO Subcommittee on Safety of Navigation
SOLAS	(International Convention for the) Safety of Life at Sea
SSD	System specification document
VDU	Visual display unit

Additional relevant abbreviations are found in annex B.

4 General requirements

4.1 (3.1) **General**

4.1.1 (3.1.1) *The IBS shall comply with all applicable IMO requirements as contained in clause 2 and annex A of this standard. Parts executing multiple operations shall meet the requirements specified for each individual function they can control, monitor or perform. By complying with the provisions of this standard, all essential functions remain available in the event of a single failure. Therefore, means for operation independent of the IBS shall not be required.*

4.1.2 (3.1.2) *Each part of an IBS shall meet the relevant requirements of IMO resolution A.694(17) as detailed in IEC 60945. In consequence the IBS is in compliance with these requirements without further environmental testing to IEC 60945.*

4.1.3 Where implemented, passage execution shall not be interfered with by other operations.

4.1.4 (3.1.3) *A failure of one part shall not affect the functionality of other parts except for those functions directly dependent upon the information from the defective part.*

4.2 (3.2) Integration

The IBS shall provide functional integration meeting the following requirements.

4.2.1 (3.2.1) *The functionality of the IBS shall ensure that operations are at least as effective as with stand-alone equipment.*

4.2.2 (3.2.2) *Continuously displayed information shall be reduced to the minimum necessary for safe operation of the ship. Supplementary information shall be readily accessible.*

4.2.3 Integrated display and control functions shall adopt a consistent man-machine-interface (MMI) philosophy and implementation. Particular consideration shall be paid to

- symbols;
- colours;
- controls;
- information priorities;
- layout.

4.2.4 (3.2.3) *Where multifunction displays and controls are used to perform functions necessary for safe operation of the ship they shall be duplicated and interchangeable.*

4.2.5 (3.2.4) *It shall be possible to display the complete system configuration, the available configuration and the configuration in use.*

4.2.6 Any unintentional change of a configuration shall be brought to the immediate attention of the user. An unintentional change of the configuration in use shall, in addition, activate an audible and visual alarm.

4.2.7 (3.2.5) *Each part to be integrated shall provide details of its operational status and the latency and validity of essential information. Means shall be provided within the IBS to make use of this information.*

4.2.8 (3.2.6) *An alternative means of operation shall be provided for essential functions.*

4.2.9 For integrated machinery control, it shall be possible for all machinery essential for the safe operation of the ship to be controlled from a local position.

4.2.10 (3.2.7) *An alternative source of essential information shall be provided. The IBS shall identify loss of either source.*

4.2.11 (3.2.8) *The source of information (sensor, result of calculation or manual input) shall be displayed continuously or on request.*

4.3 (3.3) Data exchange

4.3.1 (3.3.1) *Interfacing within the IBS and to an IBS shall comply with IEC 61162, as applicable.*

4.3.2 (3.3.2) *Data exchange shall be consistent with safe operation of the ship. The manufacturer shall specify in the system specification document (SSD) the maximum permissible latency for each function, considering the use of fast control loop, normal control loop, essential information and other information.*

4.3.3 Corrupted data shall not be accepted by the IBS. Corrupted or missing data shall not affect functions which are not dependent on this data.

4.3.4 (3.3.3) *The integrity of data flowing on the network shall be ensured.*

4.3.5 The network shall be such that in the event of a single fault between nodes there shall be an indication, and the sensors and displays on the network shall continue to operate and data transmission between them shall be maintained.

4.3.6 (3.3.4) *A failure in the connectivity shall not affect independent functionality.*

4.4 (3.4) **Failure analysis**

(3.4.1) A failure analysis shall be performed, documented and be acceptable.

4.4.1 Parts, functions and connectivity shall be identified.

4.4.2 Possible failures of parts and connectivity associated with essential functions and information shall be identified.

4.4.3 Consequences of failures with respect to operation, function or status of the IBS shall be identified.

4.4.4 Each failure shall be classified with respect to its impact on the IBS taking into account relevant characteristics, such as detectability, diagnosability, testability, replaceability and compensating and operating provisions.

4.4.5 The results of the failure analysis shall confirm the possibility for continued safe operation of the ship.

4.5 **Quality assurance**

The IBS shall be designed, developed, produced, installed and serviced by companies certified to ISO 9001 or ISO 9002, as applicable.

5 (4) **Operational requirements**

5.1 (4.1) **Human factors**

5.1.1 (4.1.1) *The IBS shall be capable of being operated by personnel holding appropriate certificates.*

5.1.2 (4.1.2) *The MMI shall be designed to be easily understood and in a consistent style for all integrated functions.*

5.1.3 Operational information shall be presented in a format readily understandable without need to transpose, compute or translate.

5.1.4 Indications, which may be accompanied by a short low-intensity audible signal, shall occur when

- an attempt is made to execute an invalid function;
- an attempt is made to use invalid information.

5.1.5 If an input error is detected by the system, it shall require the operator to correct the error immediately. Messages actuated by an input error shall guide the correct responses, for example

do not use: Invalid entry

but use: Invalid entry: re-enter set point between 0 and 10.

5.1.6 Layered menus shall be presented in a way which minimizes the added workload to find and return from the desired functions.

5.1.7 An overview shall be easily available to assist the operator in the use of a multiple page system. Each page shall have a unique identifier.

5.1.8 (4.1.3) *Where multifunction displays are used, they shall be in colour. Continuously displayed information and functional areas, for example menus, shall be presented in a consistent manner.*

5.1.9 (4.1.4) *For actions which may cause unintended results, the IBS shall request confirmation from the operator.¹⁾*

5.1.10 Functions requested by the operator shall be acknowledged or clearly indicated by the IBS on completion.

5.1.11 Default values, where applicable, shall be indicated by the IBS when requesting operator input.

5.1.12 For bridge operation by one person, special consideration shall be given to the technical requirements in IMO MSC/Circular 566, paragraphs 10 to 32.

5.2 (4.2) Functionality

5.2.1 (4.2.1) *It shall always be clear from where essential functions may be performed.*

5.2.2 (4.2.2) *The system management shall ensure, that one user only has the control of an input or function at the same time. If so, all other users shall be informed about that by the IBS.*

5.3 Training

5.3.1 Manufacturers of integrated bridge systems shall provide training possibilities for the ship's crew. This training shall take place ashore or on board and shall be carried out by means of suitable material and methods to cover the following topics.

5.3.2 General understanding and operation of the system:

- knowledge and understanding of the system's configuration and application;
- reading and understanding of the operating manual;
- usage and understanding of brief descriptions and instructions provided on the bridge;
- usage and understanding of electronic "HELP" functions, if provided in the system;
- familiarization with the system using safe trial modes.

¹⁾ Examples of such actions are

- attempting to change position of next waypoint while in track mode steering;
- attempting to switch on bow thruster when insufficient electrical power is available.

5.3.3 Mastering of uncommon conditions in the system:

- detecting and locating of failures;
- resetting the system to safe default values and modes;
- operating safely without certain sensor data or parts;
- possibilities for on-board repair;
- identifying the potential for unintended results.

5.3.4 Methods and support for providing the above-mentioned training may be, for example

- printed material;
- training courses;
- video films;
- computer-based learning programmes;
- simulation of different situations or data, respectively;
- recorded speech.

6 (5) *Technical requirements*

6.1 (5.1) *Sensors*

In order to ensure an adequate system functionality, the sensors employed shall meet the following requirements, as applicable:

6.1.1 *ensure communication compatibility in accordance with the relevant international marine interface standard, IEC 61162; and provide information about their operational status and about the latency and validity of essential information;*

6.1.2 *respond to a command with minimal latency, and indicate receipt of invalid commands, when remote control is employed;*

6.1.3 *have the capability to silence and re-establish the audible portion of the local alarm;*

6.1.4 *have information documented about deterministic and stochastic errors and how they are handled, insofar as signals are pre-processed locally, for example plausibility check.*

6.2 (5.2) *Alarm management*

6.2.1 (5.2.1) *The IBS alarm management as a minimum shall comply with the requirements of the Code on Alarms and Indicators, 1995 (IMO Resolution A.830(19)) (see also IMO A.686).*

6.2.2 (5.2.2) *Appropriate alarm management on priority levels (see 6.2.5) and grouping of alarms¹⁾ based on operations and tasks (see annex C) shall be provided within the IBS.*

¹⁾ The purpose of grouping alarms is to achieve the following:

- to reduce the variety in type and number of audible and visual alarms and indicators so as to provide quick and unambiguous information to the personnel responsible for the safe operation of the ship;
- to readily identify any abnormal situation requiring action to maintain the safe operation of the ship;
- to avoid distraction by alarms which require attention but do not require immediate action to restore or maintain the safe operation of the ship.

6.2.3 (5.2.3) *The number of alarms shall be kept as low as possible by providing indications for information of lower importance.*

6.2.4 (5.2.4) *Alarms shall be displayed so that the alarm reason and the resulting functional restrictions can be easily understood. Indications shall be self-explanatory.*

6.2.5 Alarms shall be prioritized as follows:

a) Emergency alarms

Alarms which indicate that immediate danger to human life or to the ship and its machinery exists, and that immediate action shall be taken.

b) Distress, urgency and safety alarms

Alarms which indicate that a mobile unit or a person is in distress, or the calling station has a very urgent message concerning the safety of a mobile unit or a person, or has an important warning to transmit.

c) Primary alarms

Alarms which indicate a condition that requires prompt attention to prevent an emergency condition as specified in statutory and classification rules and regulations.

d) Secondary alarms

Alarms which are not included above.

6.3 Human factors

6.3.1 A multifunction display, if used, shall be a colour display.

6.3.2 The size, colour and density of text and graphic information presented on a display shall be such that it may be easily read from the normal operator position under all operational lighting conditions²⁾.

6.3.3 Symbols used in mimic diagrams shall be standardized throughout the system displays.

6.3.4 All information shall be presented on a background providing high contrast and emit as little light as possible by night.

6.4 (5.3) Power interruptions and shut-down

6.4.1 (5.3.1) *If subjected to an orderly shut-down, the IBS shall, upon turn-on come to an initial default state.*

6.4.2 (5.3.2) *After a power interruption full functionality of the IBS shall be available after recovery of all subsystems. The IBS shall not increase the recovery time of individual subsystem functions after power restoration.*

6.4.3 (5.3.3) *If subjected to a power interruption the IBS shall upon restoration of power maintain the configuration in use and continue automated operation as far as practicable. Safety related automatic functions, for example automated steering control shall only be restored upon confirmation by the operator.*

²⁾ (See 6.2.3 of ISO 8468.)

6.5 (5.4) Power supply

6.5.1 General power supply requirements are summarized in annex D.

6.5.2 (5.4.1) *Power supply requirements applying to parts of the IBS as a result of other IMO requirements shall remain applicable.*

6.5.3 (5.4.2) *The IBS shall be supplied*

- *from the main and emergency source of power with automated changeover through a local distribution board with provision to preclude inadvertent shut-down;*
- *from a transitional source of power for a duration of not less than 1 min; and*
- *where required in annex D, parts of the IBS shall also be supplied from a reserve source of power.*

7 Methods of testing and required results

7.1 Introduction

7.1.1 The testing proposed as part of this standard is intended to supplement, and not replace, testing of parts that is required to meet the relevant IMO performance standards. The intention is to ensure that when parts are integrated there is no degradation of their individual functionality and the overall system meets the requirements contained in clauses 4 to 6.

7.1.2 In all instances, the performance standards for parts will form the minimum test requirement for an integrated system. Parts previously type-approved will not require re-testing. Bridge-mounted parts for which no IMO performance standard exists shall be tested to the requirements of IEC 60945. Integration aspects of the IBS shall require testing to ensure compliance with requirements contained in clauses 4 to 6.

7.1.3 The test strategy shall demonstrate that the IBS, when operated by suitably trained personnel, shall increase safe and efficient management of the ship (clause 1).

7.2 General requirements (clause 4)

7.2.1 The manufacturer shall state the operations intended to be performed by the IBS.

7.2.2 Since each IBS may integrate an individual set of operations and parts, it is not possible to define in advance which IMO requirements apply. Therefore, the following steps shall be taken with each individual IBS being considered.

7.2.2.1 Produce a matrix of the applicable IMO requirements from annex A:

- collect IMO requirements referring generally to IBS (for example SOLAS Chapter V and Code on Alarms and Indicators (A. 686 and A.830);
- collect IMO requirements applicable to the operations stated in 7.2.1 (for example if a radar/ARPA is integrated, collect IMO MSC.64(67), annex 4 and A.823);
- identify the individual parts of the IBS and their interfaces;
- identify parts executing multiple operations;
- identify functions necessary to perform the operations stated in 7.2.1;
- identify power supply requirements for the individual parts of the IBS from annex D.

7.2.2.2 Verify the validity of the appropriate type-approval certificates (4.1.1).

7.2.2.3 Verify that all functions identified in 7.2.2.1 are performed (4.1.1).

7.2.3 Confirm compliance with IEC 60945 by one of the following:

- a valid type-approval certificate;
- a test certificate issued by an appropriate body;
- successful completion of appropriate tests (4.1.2).

7.2.4 Confirm by examination of the SSD that operational functions in addition to passage execution are implemented on a non-interference basis (4.1.3).

7.2.5 Independently disable each part identified in 7.2.2.1 and determine by a test that only those functions dependent on the disabled part are affected (4.1.4).

7.2.6 Confirm by examination that only minimum information necessary for the safe operation of the ship and as applicable to the configuration in use is continuously displayed, and that supplementary information is readily accessible (4.2.2).

7.2.7 Where IMO requirements governing the symbols, colours, controls, information priorities and layout of the integrated display and control functions exist, confirm compliance by examination. Where no such requirements exist, confirm by examination that the use of symbols, colours, controls, information priorities and layout is consistent (4.2.3).

7.2.8 Where used, confirm by examination that there are at least two identical and interchangeable multifunction displays and controls (4.2.4).

7.2.9 Confirm by examination that it is possible to display the configuration of the complete system, the configuration available and the configuration in use (4.2.5).

7.2.10 Disable a part of the configuration in use and confirm that an audible and visual alarm is activated immediately (4.2.6).

7.2.11 Confirm by examination of relevant certificates and documentation that each part integrated in the IBS provides details of its operational status, latency and validity of essential information. Confirm by a performance check that changes in status of the parts and of the latency and validity of information is used by the IBS in a safe and unambiguous manner (4.2.8).

7.2.12 Confirm by examination of the SSD that there is an alternative means of performing each applicable essential function (4.2.8).

7.2.13 Confirm by examination of the SSD that, for integrated machinery control, it is possible for all machinery essential for the safe operation of the ship to be controlled from a local position (4.2.9).

7.2.14 Confirm by examination that there is an alternative source of essential information. Confirm by a performance check that loss of essential information is recognized by the IBS (4.2.10).

7.2.15 Confirm by examination that the source of information is displayed continuously or on request (4.2.11).

7.2.16 Confirm by examination of relevant certificates and documentation that interfacing complies with IEC 61162, as applicable (4.3.1).

7.2.17 Confirm by examination of the SSD that the stated latencies are appropriate to all intended operations. Confirm by examination of the manufacturer's SSD that the stated latencies are achieved while the network is loaded to its maximum expected loading (4.3.2).

7.2.18 Confirm by a performance check that corrupted data is not accepted by the IBS and that corrupted and missing data does not affect functions which are not dependent on this data (4.3.3).

7.2.19 Confirm by examination of the manufacturer's SSD that, as a minimum, data includes a checksum in accordance with IEC 61162, and that, in addition, limits checking is applied to essential data (4.3.4).

7.2.20 Create a representative number of single faults between network nodes and confirm that there is an indication of the fault and the displays and sensors continue to operate and data transmission is maintained (4.3.5).

7.2.21 Identify the system connectivity by examination of the SSD. Independently interrupt each connection and determine by a performance check that only those functions dependent on the connection are affected and that all essential functions can still be performed (4.3.6).

7.2.22 Confirm by examination of the SSD that a failure analysis has been performed and documented. The results of the failure analysis and the possibility for continued safe operation of the ship shall be verified by testing a representative selection of failures (4.4).

7.2.23 Confirm by examination of the relevant certificate(s) that the manufacturer complies with ISO 9000 series standards (4.5).

7.3 Operational requirements (clause 5)

7.3.1 Confirm by examination that the IBS includes displays, controls and instrumentation necessary to perform the functions identified in 7.2.2.1.

7.3.2 Confirm by a performance check, performed by suitably qualified personnel, that information presented is understandable without the need to transpose, compute or translate, and that operation of integrated functions of the IBS identified in 7.2.1.1 is as effective as for equivalent stand-alone equipment (4.2.1, 5.1.1, 5.1.2).

7.3.3 Confirm by examination of the manufacturer's SSD that the specific requirements in MSC/Circular 566, paragraphs 10 to 32, are met, if applicable (5.1.3).

7.3.4 Confirm by a performance check that normal execution of functions and use of information are not accompanied by acoustic signals. If provided, ensure that acoustic signals accompanying attempts to execute an invalid function or use invalid information are short, of low intensity and are clearly distinguishable from alarms (5.1.4).

7.3.5 Create an input error and ensure that immediate correction is required and that relevant guidance is given (5.1.5).

7.3.6 Confirm by a performance check, performed by suitably qualified personnel, that layered menus, if provided, are presented such as to minimize workload (5.1.6).

7.3.7 If provided, ensure that multiple pages are uniquely identified and that an overview is available (5.1.7).

7.3.8 Ensure that continuously displayed information and functional areas, for example menus, are presented in a consistent manner in multifunction displays (5.1.2, 5.1.8).

7.3.9 Initiate a situation causing a potentially unintended result and ensure that the result is identified and that confirmation of the action is requested from the operator (5.1.9).

7.3.10 Confirm by a performance check that completion of functions is acknowledged or clearly indicated (5.1.10).

7.3.11 No test is required for 5.1.11.

7.3.12 Confirm that there is an indication of configurations available at each workstation (5.2.1).

7.3.13 Confirm that essential functions cannot be performed simultaneously at more than one workstation and that there is an indication of the configuration in use at each workstation (5.2.2).

7.3.14 The manufacturer shall produce a written statement that training possibilities are provided. Confirm by examination of the training material that it covers general understanding and operation and mastering of uncommon conditions (5.3).

7.4 Technical requirements (clause 6)

7.4.1 As applicable, confirm by examination of the SSD that sensors employed:

- communicate in accordance with IEC 61162 (6.1.1);
- provide details of operational status, latency and validity of essential information (6.1.1);
- respond to a command with minimal latency and indicate receipt of invalid commands when remote control is employed (6.1.2);
- have the capability to silence and re-establish the audible portion of the local alarm (6.1.3);
- have information documented about deterministic and stochastic errors and how they are handled (6.1.4).

7.4.2 Initiate a situation identified in the SSD as requiring immediate reaction by an operator and confirm that the resultant alarm complies with IMO A.686 and A.830 (6.2.1).

7.4.3 Create conditions necessary to generate all types of alarms and indications listed in the matrix prepared in 7.2.2.1.

7.4.3.1 Confirm that appropriate alarm management on priority levels and functional groups is provided and that the number of alarm types and their release is kept as low as possible by providing indications for information of lower importance (6.2.2, 6.2.3).

7.4.3.2 Confirm that alarms are displayed so that the alarm reason and the resulting functional restrictions can be easily understood and that indications are self-explanatory (6.2.4).

7.4.3.3 Confirm that alarms are prioritized as emergency alarms, distress, urgency and safety alarms, primary alarms and secondary alarms (6.2.5).

7.4.4 Confirm by examination, performed by suitably qualified personnel, that:

- a multifunction display is a colour display (6.3.1);
- the size, colour and density of text and graphic information displayed on a VDU is such that it can be easily read from the normal operator position under all operational lighting conditions (6.3.2);
- symbols used in mimic diagrams are standardized throughout the system displays (6.3.3); and
- all information is presented on a background providing high contrast and emitting as little light as possible by night (6.3.4).

7.4.5 Perform an orderly shut-down of the IBS and confirm that when power is turned on again, the default state specified in the SSD is reached (6.4.1).

7.4.6 Record the configuration in use and the recovery times of all subsystems. Disconnect all external sources of power and wait for expiration of the IBS transitional source of power. Restore power and wait for recovery of all subsystems. The recovery times of all subsystems shall be as recorded (6.4.2).

7.4.7 The IBS shall come to the configuration in use and continue automated operation as far as practicable. Verify that safety related automatic functions are continued only after confirmation (6.4.3).

7.4.8 Confirm by examination of the SSD that provisions are made to comply with the power supply requirements listed in annex D and in the matrix prepared in 7.2.2.1 (6.5).

Annex A (normative)

Additional IMO requirements

IEC 60533:1977, *Electromagnetic compatibility of electrical and electronic installations in ships*

IEC 60872-1:1998, *Maritime navigation and radiocommunication equipment and systems – Radar plotting aids – Part 1: Automatic radar plotting aids (ARPA) – Methods of testing and required test results*

IEC 60936:1988, *Shipborne radar – Operational and performance requirements – Methods of test and required test results*

IEC 60936-2:1998, *Maritime navigation and radiocommunication equipment and systems – Radar – Part 2: Shipborne radar for high-speed craft – Methods of testing and required test results*

IEC 61023:1990, *Marine speed and distance measuring equipment – Operational and performance requirements – Methods of testing and required test results*

IEC 61075:1991, *Loran-C receivers for ships – Minimum performance standards – Methods of testing and required test results*

IEC 61097-1:1992, *Global maritime distress and safety system (GMDSS) – Part 1: Radar transponder – Marine search and rescue (SART) – Operational and performance requirements, methods of testing and required test results*

IEC 61097-2:1994, *Global maritime distress and safety system (GMDSS) – Part 2: COSPAS-SARSAT EPIRB – Satellite emergency position indicating radio beacon operating on 406 MHz – Operational and performance requirements, methods of testing and required test results*

IEC 61097-3:1994, *Global maritime distress and safety system (GMDSS) – Part 3: Digital selective calling (DSC) equipment – Operational and performance requirements, methods of testing and required test results*

IEC 61097-4:1994, *Global maritime distress and safety system (GMDSS) – Part 4: INMARSAT-C ship earth station and INMARSAT enhanced group call (EGC) equipment – Operational and performance requirements, methods of testing and required test results*

IEC 61097-5:1997, *Global maritime distress and safety system (GMDSS) – Part 5: INMARSAT-E – Emergency position indicating radio beacon (EPIRB) operating through the INMARSAT system – Operational and performance requirements, methods of testing and required test results*

IEC 61097-6:1995, *Global maritime distress and safety system (GMDSS) – Part 6: Narrow-band direct-printing telegraph equipment for reception of navigational and meteorological warnings and urgent information to ships (NAVTEX) – Operational and performance requirements, methods of testing and required test results*

IEC 61097-7:1996, *Global maritime distress and safety system (GMDSS) – Part 7: Shipborne VHF radiotelephone transmitter and receiver – Operational and performance requirements, methods of testing and required test results*

IEC 61097-8:1998, *Global maritime distress and safety system (GMDSS) – Part 8: Shipborne watchkeeping receivers for the reception of digital selective calling (DSC) in the maritime MF, MF/HF and VHF bands – Operational and performance requirements, methods of testing and required test results*

IEC 61097-9:1997, *Global maritime distress and safety system (GMDSS) – Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and narrowband direct printing (NBDP) – Operational and performance requirements, methods of testing and required test results*

IEC 61097-12:1996, *Global maritime distress and safety system (GMDSS) – Part 12: Survival craft portable two-way VHF radiotelephone apparatus – Operational and performance requirements, methods of testing and required test results*

IEC 61108-1:1996, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 1: Global positioning system (GPS) – Receiver equipment – Performance standards, methods of testing and required test results*

IEC 61108-2:1998, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 2: Global navigation satellite system (GLONASS) – Receiver equipment – Performance standards, methods of testing and required test results*

IEC 61110:1992, *System Omega and differential Omega receivers for ships – Operational and performance requirements – Methods of testing and required test results*

IEC 61135:1992, *Decca Navigator system: Receivers for ships – Minimum performance standards – Methods of testing and required test results*

IEC 61174:1998, *Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements – Methods of testing and required test results*

ISO 449:1997, *Ships and marine technology – Magnetic compasses and binnacles and azimuth reading devices – Class A*

ISO 613:1982, *Shipbuilding – Magnetic compasses, binnacles and azimuth reading devices – Class B*

ISO 8468:1990, *Ship's bridge layout and associated equipment – Requirements and guidelines*

ISO 8728:1997, *Ships and marine technology – Marine gyro-compasses*

ISO 9875:1996, *Ships and marine technology – Marine echo-sounding equipment*

ISO 9876:1997, *Ships and marine technology – Marine facsimile receivers for meteorological charts*

ISO 11606:1997, *Ships and marine technology – Marine electromagnetic compasses*

IMO A.221:1971, *Radio equipment for homing*

IMO A.224:1971, *Performance standards for echo-sounding equipment (see also IMO MSC.74(69):1998 – annex 4)*

IMO A.334:1975, *Recommendation on operational standards for radiotelephone transmitters and receivers*

IMO A.342:1975, *Recommendation on performance standards for automatic pilots* (see also IMO MSC.64(67))

IMO A.382:1977, *Magnetic compasses: carriage and performance standards*

IMO A.383:1977, *Operational standards for radiotelephone watch receivers*

IMO A.385:1977, *Operational standards for VHF radiotelephone installations*

IMO A.421:1979, *Operational standards for radiotelephone alarms signal generators*

IMO A.422:1979, *Performance standards for automatic plotting aids (ARPA)* (see also IMO A.823)

IMO A.424:1979, *Performance standards for gyro-compasses*

IMO A.477:1981, *Performance standards for radar equipment* (see also IMO Resolution MSC.64(67) – annex 4)

IMO A.478:1981, *Performance standards for devices to indicate speed and distance* (see also IMO A.824(19))

IMO A.479:1981, *Performance standards for shipborne receivers for use with differential Omega*

IMO A.524:1983, *Performance standards for VHF multiple watch facilities*

IMO A.525:1983, *Performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships*

IMO A.526:1983, *Performance standards for rate-of-turn indicators*

IMO A.570:1985, *Type approval of ship earth stations*

IMO A.662:1989, *Performance standards for float-free release and activation arrangements for emergency radio equipment*

IMO A.664:1989, *Performance standards for enhanced group call equipment*

IMO A.665:1989, *Performance standards for radio direction-finding systems*

IMO A.696:1991, *Type approval of satellite emergency position-indicating radio beacons (EPIRBs) operating in the COSPAS-SARSAT system*

IMO A.700:1991, *Performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ship (MSI) by HF*

IMO A.702:1991, *Radio maintenance guidelines for the global maritime distress and safety system (GMDSS) related to sea areas A3 and A4*

IMO A.708:1991, *Navigation bridge visibility and functions*

IMO A.741:1993, *International management code for the safe operation of ships and for pollution prevention (International safety management (ISM) code)*

IMO A.802:1995, *Performance standards for survival craft radar transponders for use in search and rescue operations*

IMO A.803:1995, *Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling*

IMO A.804:1995, *Performance standards for shipborne MF radio installations capable of voice communication and digital selective calling*

IMO A.805:1995, *Performance standards for float-free VHF emergency position-indicating radio beacons*

IMO A.806:1995, *Performance standards for shipborne MF/HF radio installations capable of voice communication, narrow-band direct-printing and digital selective calling*

IMO A.807:1995, *Performance standards for INMARSAT standard-C ship earth stations capable of transmitting and receiving direct-printing communications*

IMO A.808:1995, *Performance standards for ship earth stations capable of two-way communications*

IMO A.809:1995, *Performance standards for survival craft two-way VHF radiotelephone apparatus*

IMO A.810:1995, *Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz (see also IMO Resolution MSC.56(66))*

IMO A.811:1995, *Performance standards for a shipborne integrated radiocommunication system (IRCS) when used in the GMDSS*

IMO A.812:1995, *Performance standards for float-free satellite emergency position-indicating radio beacons operating through the geostationary INMARSAT satellite system on 1,6 GHz*

IMO A.813:1995, *General requirements for electromagnetic compatibility (EMC) for all electrical and electronic ship's equipment*

IMO A.814:1995, *Guidelines for the avoidance of false distress alerts*

IMO A.816:1995, *Performance standards for shipborne Decca Navigator receiver*

IMO A.817:1995, *Performance standards for electronic chart display and information systems (ECDIS) (see also IMO MSC.64(67) – annex 5)*

IMO A.818:1995, *Performance standards for shipborne Loran-C and Chayka receivers*

IMO A.819:1995, *Performance standards for shipborne global positioning system (GPS) receiver equipment*

IMO A.820:1995, *Performance standards for navigational radar equipment for high-speed craft*

IMO A.821:1995, *Performance standards for gyro-compasses*

IMO A.822:1995, *Performance standards for automatic steering aids (automatic pilots)* (see also IMO MSC.64(67) – annex 3)

IMO A.823:1995, *Performance standards for automatic radar plotting aids (ARPA)*

IMO A.824:1995, *Performance standards for devices to indicate speed and distance*

IMO A.861:1997, *Performance standards for shipborne voyage data recorders (VDRs)*

IMO MSC.53(66):1996, *Performance standards for shipborne GLONASS receiver equipment*

IMO MSC.56(66):1996, *Amendments to resolution A.810(19) – Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz*

IMO MSC.64(67):1996, *Adoption of new and amended performance standards*

Annex 2: Performance standards for shipborne DGPS and DGLONASS maritime radio beacon receiver equipment

Annex 3: Amendments to resolution A.342:1975, Performance standards for automatic pilots

Annex 5: Amendments to resolution A.817:1995, Performance standards for electronic chart display and information system (ECDIS)

IMO MSC.68(68):1997, *Adoption of amendments to performance standards for shipborne radiocommunication equipment*

Annex 1: Amendments to resolution A.803:1995, Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling

Annex 2: Amendments to resolution A.804:1995, Performance standards for shipborne MF radio installations capable of voice communication and digital selective calling

Annex 3: Amendments to resolution A.806:1995, Performance standards for shipborne MF/HF radio installations capable of voice communication, narrow-band direct printing and digital selective calling

Annex 4: Amendments to resolution A.807:1995, Performance standards for INMARSAT standard-C ship earth stations capable of transmitting and receiving direct printing communications

Annex B (informative)

Abbreviations

A

ABS	American Bureau of Shipping
ACK	operator acknowledgement
ADF	automatic direction finder
ADS	automatic dependent surveillance
AIS	automatic identification system
ALM	alarm; GPS almanac data
ALT	altitude (GPS)
ANSI	American National Standards Institute
ANT	antenna
AP	autopilot
ARPA	automatic radar plotting aid
ASCII	American standard code for information interchange
ASD	autopilot system data
AUT	automatic operation/system/task
AUT/MAN	automatic operation/system/task with manual input
AUX	auxiliary (system/function)

B

BIT	binary digit
BOD	bearing, origin to destination
BRG	bearing
BV	Bureau Veritas
BW	bridge wing(s)
BWW	bearing, WP to WP

C

CAIM	craft autonomous integrity monitoring
CAL	calibrate
CCIR	International Radio Consultative Committee (new name ITU-R)
CCITT	International Telegraph and Telephone Consultative Committee (new name ITU-T)
CCS	China Classification Society
CCW	coded continuous wave
CDI	course deviation indication
CD-ROM	compact disc-read-only-memory
CEP	circular error probable
CIRM	Comité International Radio-Maritime (International Radio-Maritime Committee)
ClassNK	Nippon Kaija Kyokai
CLR	clear

CMG	course made good
CNS	communication, navigation and surveillance
COG	course over ground
COM	radiocommunication
COR	correction
CPA	closest point of approach
CPU	central processing unit
CRT	cathode ray tube
CSE	course selection error
CTS	course to steer

D

DEST	destination
DGPS	differential GPS
DIN	Deutsche Industrie Norm (German industrial standard)
DME	distance measuring equipment
DN	Decca Navigator System
DNV	Det Norske Veritas
DOD	Department of Defense
DOP	dilution of precision
DOT	Department of Transport(ation)
DPT	depth
DR	dead reckoning
dRMS	distance root mean squared
DS	depth sounder
DSC	digital selective calling; dynamically supported craft

E

E	east
EBCDIC	extended binary coded decimal interchange code
ECDIS	electronic chart display and information system
ECS	electronic chart system
EGC	enhanced group call
EMI	electromagnetic interference
EMC	electromagnetic compatibility
ENC	electronic navigational chart
ENT	enter
EOM	end of message
EPFS	electronic position fixing system
EPIRB	emergency position-indicating radio beacon
ETA	expected time of arrival
ETD	expected time of departure
EUT	equipment under test

F

FMEA	failure mode and effect analysis
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G		ITU	
GBAS	ground based augmentation system		International Telecommunication Union
GC	great circle	ITU-R	ITU Radiocommunication Bureau (formerly CCIR)
GDOP	geometric dilution of precision	ITU-T	ITU Telecommunication Standardization Bureau (formerly CCITT)
GGA	global positioning system fix data		
GL	Germanischer Lloyd	K	
GLC	geographic position Loran-C	KR	Korean Register
GLL	longitude – Loran C	L	
GLONASS	global orbiting navigation satellite system	LAT	latitude
GMDSS	global maritime distress and safety system	LCD	liquid crystal display
GMT	Greenwich mean time	LDGPS	local area differential GPS
GNSS	global navigation satellite system	LEP	linear error probable
GPS	global positioning system	LF	low frequency
GRI	group repetition interval (Loran)	LI	lane identification (Decca)
GSA	GPS DOP and active satellite data	LIP	lane identification positioning
GSV	GPS satellites in view	LON	longitude
		LOP	line of position
		LR	Lloyd's Register of Shipping
H		M	
HDG	heading	MAG	magnetic
HDOP	horizontal dilution of precision	MAN	manual operation/system/task
HDT	true heading	MCW	modulated carrier wave
HF	high frequency	MDB	marginal detectable bias
HO	hydrographic office	MDE	marginal detectable error
HSC	heading, steering command; high speed craft	MEPC	IMO Marine Environment Protection Committee
HYP	hyperbolic navigation	MF	medium frequency
		MF/HF	medium and high frequency
I		MMI	man-machine-interface
IACS	International Association of Classification Societies	MNPS	minimum navigational performance specifications
IAIN	International Association of Institutes of Navigation	MOB	man overboard
IBS	integrated bridge system	MOPS	minimum operational performance standard
ICNS	integrated communication, navigation and surveillance	MSC	IMO Maritime Safety Committee
IEC	International Electrotechnical Commission	MSI	maritime safety information
IHO	International Hydrographic Organisation	MTBF	mean time between failures
I/O	input/output	MTTR	mean time to repair
II	integrated instrumentation (data)	N	
IMO	International Maritime Organization	N	north
IN	integrated navigation	NAV	navigation
IND	indication, except alarm and warning		IMO Subcommittee on Navigation
INMARSAT	International Mobile Satellite Organisation	NDB	navigation mode select/display
INP	input	NK	non-directional beacon
INS	integrated navigation system; instrument	NMEA	Nippon Kaiji Kyokai National Marine Electronics Association
IRCS	integrated radio communication system	O	
ISO	International Organization for Standardization	OLN	omega lane numbers
		OM	omega mode
		OMBO	one man bridge operation
		OOW	officer of the watch
		OSD	own ship data; on screen display
		OTA	operational technical accuracy

P		T	
PA	public address (system)	TAD	time and date
PC	personal computer; public correspondence	TAI	temps atomique international (international atomic time)
PDOP	positional dilution of precision	TC	technical committee
PL	position line	TCPA	time to closest point of approach
POS	position	TD	time difference
	position mode select/display	TDOP	time dilution of precision
PPA	position probability area	TETRA	Trans European Trunked Radio System
PPI	plan position indicator	TH	true heading
PRS	Polish Register of Shipping	TM	true motion
PWR	power	TMG	track made good
R		TOA	time of arrival
RAIM	receiver autonomous integrity monitoring	TP	track plotter
RBN	radiobeacon	TR	track
RCL	recall	TST	test
RDF	radio direction finder	TT	true track
RDSS	radiodetermination satellite service	TTG	time to go
REM	remote control/input	TTM	tracked target message
RF	radiofrequency	U	
RFI	radiofrequency interference	UART	universal asynchronous receiver/transmitter
RINa	Registro Italiano Navale	UIT	see ITU
RL	rhumb line	UPS	uninterrupted power supply
RM	relative motion	UR	IACS unified requirements
rms	root mean squared	USCG	United States Coast Guard
RNG	range	UTC	co-ordinated universal time
ROT	rate of turn (data)	UTM	universal transverse mercator
rpm	revolution per minute	V	
RS	Russian Maritime Register of Shipping	VBW	dual ground/water speed
RSD	radar system data	VDR	voyage data recorder
RTE	route	VDU	visual display unit
S		VEL	velocity
S	south	VHF	very high frequency
SAR	search and rescue	VHW	water speed and heading
SART	SAR transponder	VLF	very low frequency
SAT	satellite	VMG	velocity made good
SBAS	satellite based augmentation system	VTG	track made good and ground speed
SDME	speed and distance measuring equipment	VTs	vessel traffic services
SENC	system electronic navigational chart	W	
SEP	spherical error probable	W	west
SL	speed log	WCV	waypoint closure velocity
SMG	speed made good	WDGPS	wide area differential GPS
SNR	signal-to-noise ratio	WG	working group
SOG	speed over ground	WGS	world geodetic system
SOLAS	International Convention for the safety of life at sea	WNG	warning
SPD	speed	WPL	waypoint location
SSD	system specification document	WPT	waypoint
STN	station	WWNWS	worldwide navigational warning system
STL	steer left	X	
STR	steer right	XTE	cross-track error

Annex C (informative)

Operational areas

This annex identifies operations which may be carried out by an IBS and categorizes them as follows.

1. PASSAGE EXECUTION (anchoring, berthing, collision avoidance, manoeuvring, navigation)
2. COMMUNICATION (device-to-person, external, internal, person-to-device, person-to-person)
3. MACHINERY CONTROL
4. LOADING, DISCHARGING AND CARGO CONTROL (cargo, ballast, bunkering, disposal, hull, supply)
5. SAFETY AND SECURITY
6. MANAGEMENT (administration, miscellaneous)

The operations are further subdivided into tasks which are identified according to the possible degree of automation.

AUT	Can be carried out automatically.
AUT/MAN	A certain degree of automation is possible but manual operations are also necessary.
MAN	Carried out manually.

The following lists of tasks are not exhaustive.

Against each task a series of codes has been allocated to the functional inputs and outputs.

These codes are

- INP operator input
- IND indication
- ALM alarm

Due consideration shall be given to restrict access to some operator input and indications.

1. PASSAGE EXECUTION
(anchoring, berthing, collision avoidance, manoeuvring, navigation)

1.01 AUT	steering mode "Heading control" IMO A.342, IMO A.822, IMO MSC.64(67) annex 3 revision of IMO SOLAS V – 15(B) 1.2 (IMO NAV 43/J/1)	INP: heading rate of turn radius of turn rudder limit alarm limits heading reference selection IND: heading preset heading selected heading reference rudder limit reached ALM: off heading alarm limits exceeded heading reference failure power failure
1.02 AUT	steering mode "Track control" IMO A.342, IMO A.822, IMO MSC.64(67) annex 3 revision of IMO SOLAS V – 15(B)1.2 (IMO NAV 43/J/1)	INP: route off-track limit position reference selection initiate track control IND: heading track course cross-track error next manoeuvre/waypoint selected position reference ALM: position reference failure off track manoeuvre not executed or acknowledged other applicable inputs/outputs as per 1.01
1.03 AUT	heading monitor IMO A.342, IMO A.822, IMO MSC.64(67) annex 3 revision of IMO SOLAS V – 20 -1.2.1 (IMO NAV 43/J/1)	INP: alarm limits ALM: alarm limits exceeded
1.04 AUT	speed control IMO A.824, revision of IMO SOLAS V – 20 – 1.5.3 (IMO NAV 43/J/1)	INP: speed emergency stop IND: actual and preset speed ALM: system failure
1.05 AUT	thruster control	INP: direction (lateral speed) IND: r.p.m. and direction (actual and preset speed) control activated ALM: system failure
1.06 AUT	roll stabilization	INP: control parameters ALM: system failure
1.07 AUT	depth monitoring IMO A.224, ISO 9875, revision of IMO SOLAS V – 20 – 1.2.8 (IMO NAV 43/J/1)	INP: range scale depth alarm limit IND: actual depth ALM: depth alarm

1.08 AUT	position determination IMO A.479, IMO A.529, IMO A.816, IMO A.819, revision of IMO SOLAS V – 20.1.2.5 (IMO NAV43/J/1)	INP: position reference selection IND: position quality
1.09 AUT	OOW monitoring IMO MSC/Circular 566, IMO MSC/Circular 733	INP: time interval acknowledgement IND: time-out ALM: no acknowledgement system failure
1.10 AUT	data recording IMO MSC (IMO NAV43/WP2/Add 1 – annex 4)	INP: specification of data recording intervals ALM: system failure
1.11 AUT	maintaining charts	INP: chart selection chart maintenance IND: chart correction or update
1.12 AUT	collision avoidance (traffic surveillance) revision of IMO SOLAS V – 15(B)-1.2, 20 – 1.2.6, 20 – 1.5.1 (IMO NAV43/J/1)	INP: target selection presentation parameters alarm limits IND: situation display ALM: danger of collision
1.13 AUT	hull stress monitoring	IND: stress acceleration ALM: risk of hull damage
1.14 AUT/MAN	voyage planning revision of IMO SOLAS V – 15(B) – 1.1, 20 - 1.2.2 (IMO NAV43/J/1)	INP: chart selection route vessel parameters IND: route potential danger
1.15 AUT/MAN	weather observation	IND: wind speed and direction temperature atmospheric pressure
1.16 AUT/MAN	observation of draught, trim and list	IND: observations
1.17 AUT/MAN	performing safe and economic routing revision of IMO SOLAS V – 15(B) – 1.1, 20 - 1.2.2 (IMO NAV 43/J/1)	INP: voyage plan ship's static and dynamic parameters environmental conditions maritime safety information (MSI) IND: safe and economic route
1.18 AUT/MAN	maintaining ship's log	INP: appropriate entry IND: recorded input, time-out, system failures
1.19 AUT/MAN	maintaining time	INP: zone and time adjustment IND: UTC (GMT) and local time
1.20 AUT/MAN	information retrieval	INP: queries IND: information (e.g. port guide, light lists, manuals)
1.21 AUT/MAN	manoeuvre simulation (collision avoidance)	INP: situation display planned manoeuvre IND: results

1.22 AUT/MAN	follow-up steering	INP: rudder angle IND: (current) rudder angle preset rudder angle steering gear motor running ALM: system failure
1.23 AUT/MAN	propulsion control	INP: revolutions per minute direction pitch IND: (current) r.p.m., direction and pitch preset r.p.m., direction and pitch control activated ALM: system failure
1.24 AUT/MAN	thruster control	INP: revolutions per minute direction pitch IND: r.p.m., direction and pitch preset r.p.m., direction and pitch control activated ALM: system failure
1.25 AUT/MAN	current calculations	INP: position, date and time IND: tide current
1.26 MAN	berthing, mooring and anchoring	INP: movement control (e.g. propulsion, steering, thruster) winch/windlass control IND: situation display including movement parameters, surrounding objects, anchoring point ALM: watch circle limit exceeded
1.27 MAN	control of navigational lights and signals	INP: selection IND: status ALM: navigation lights and signals failure
1.28 MAN	sound signals control	INP: selection
1.29 MAN	control of external lights	INP: selection
1.30 MAN	non follow-up steering	INP: rudder command IND: rudder angle ALM: system failure
1.31 MAN	steering mode selection	INP: selection IND: mode steering gear motor running

2. COMMUNICATION

(device-to-person, external, internal, person-to-device, person-to-person)

2.01 AUT	EPIRB transmission of ship-to-shore distress alerts IMO SOLAS IV/4.1.1, IV/7.1.6 or 8.3, IMO A.805, IMO A.810, IMO A.812	INP: position and time nature of distress IND: transmitting
2.02 AUT	reception of DSC distress alerts* IMO SOLAS IV/4.1.2, IV/4.1.3, IV/6.6	IND: alert received ALM: alert received
2.03 AUT	transmission and reception of automatic identification signals (AIS) revision of IMO SOLAS V – 20 – 1.5.4	INP: ship's particulars IND: interrogation and response
2.04 AUT	reception of marine safety information (MSI) on NAVTEX, EGC or HF IMO SOLAS IV/4.1.7, IV/7.1.4, IV/7.1.5, IMO A.525, IMO A.664, IMO A.699	INP: selection IND: message received ALM: special message received
2.05 AUT	reserve source of energy control and monitoring IMO COMSAR Circular 16	IND: status ALM: ship's power interruption, limits exceeded. UPS failure
2.06 AUT/MAN	transmission of DSC distress alerts* IMO SOLAS IV/4.1.1, IV/4.1.3, IV/6.4	INP: selection position and time nature of distress IND: activation
2.07 AUT/MAN	distress communication* IMO SOLAS IV/4.1.1, IV/4.1.2, IV/4.1.3	INP: information IND: information
2.08 AUT/MAN	communication of vessel traffic service (VTS) information revision of IMO SOLAS V/12.4	INP: information IND: information
2.09 AUT/MAN	reception of distress, urgency and safety messages and search and rescue (SAR) co-ordination information by radio-telex* IMO SOLAS IV/4.1.4	IND: information
2.10 MAN	transmission and reception of voice distress calls by radiotelephone* IMO SOLAS IV/4.1.1, IV/4.1.3, IV/6.4	INP: selection information IND: information
2.11 MAN	communication of on scene SAR co-ordination information by radiotelephone IMO SOLAS IV/4.1.5, IV/7.1.1.2, IMO A.803	INP: selection information IND: information
2.12 MAN	transmission and reception of bridge-to-bridge communications (e.g. collision avoidance, rendez-vous, manoeuvring, tugs, pilot) IMO SOLAS IV/4.1.9, IV/6.3, IMO A.803	INP: selection information IND: information
2.13 MAN	transmission and reception of on-board communications (e.g. rescue and survival craft drills, anchoring, berthing, cargo handling) IMO SOLAS III/6.2.1, IMO A.809	INP: selection information IND: information
2.14 MAN	transmission of marine safety information (MSI)* (e.g. navigational warnings) IMO SOLAS IV/4.1.7	INP: selection information IND: information
2.15 MAN	transmission and reception of general radio communications* (e.g. medical, ship's business, machinery/cargo data) IMO SOLAS IV/4.1.8	INP: selection information IND: information
2.16 MAN	internal communication by voice (e.g. telephone, talk-back, public address system) IMO SOLAS III/6.4, III/6.5	INP: selection information IND: information

* IMO SOLAS IV/6.1 requires that every ship shall be provided with radio installations capable of complying with the functional requirements prescribed by IMO SOLAS IV/4 and IV/7 and, as appropriate, for the sea area or areas through which it will pass during the intended voyage, the requirements of either IMO SOLAS IV/8, IV/9, IV/10 or IV/11 (e.g. VHF: IMO A.803, MF: IMO A.804, MF/HF: IMO A.806 or INMARSAT SES: IMO A.807, IMO A.808).

3. MACHINERY CONTROL

3.01 AUT	alarm management IMO SOLAS II/1, IMO A.830	INP: distribution thresholds acknowledgement IND: active alarm ALM: limits exceeded
3.02 AUT	power generation and distribution IMO SOLAS II/1	INP: generator running order circuit-breaker operation IND: status ALM: failures interruptions
3.03 AUT	battery control and monitoring IMO SOLAS II/1	IND: status ALM: limits exceeded
3.04 AUT	auxiliary systems control and monitoring IMO SOLAS II/1	INP: selection control distribution IND: status ALM: limits exceeded
3.05 AUT	steering gear control and monitoring IMO SOLAS II/1	INP: selection IND: status ALM: limits exceeded
3.06 AUT	store refrigeration system operation	INP: temperature setting IND: temperature ALM: limits exceeded
3.07 AUT	incinerator control and monitoring IMO MARPOL V, IMO MEPC Circular 235, IMO MEPC.59(33)	INP: on/off IND: running furnace temperature combustion air pressure ALM: failures limits exceeded
3.08 AUT	heating, ventilation and air conditioning control IMO SOLAS II/2	INP: temperature/humidity setting IND: temperature/humidity ALM: limits exceeded
3.09 AUT	machinery data logging	INP: selection logging frequency IND: data
3.10 AUT	system performance diagnostics	INP: selection IND: information
3.11 AUT/MAN	fuel transfer/purification system control IMO SOLAS II/1	INP: selection IND: status ALM: failures/limits exceeded
3.12 AUT/MAN	retrieval of information from technical and operation manuals	INP: selection IND: information

4. LOADING, DISCHARGING AND CARGO CONTROL (cargo, ballast, hull, bunkering, supply, disposal)

4.01 AUT	bilge monitoring and pumping IMO SOLAS II/1.21 IMO MARPOL I	INP: selection IND: status ALM: failures limits exceeded
4.02 AUT	pollution prevention monitoring IMO MARPOL I-IV	INP: selection IND: status ALM: limits exceeded
4.03 AUT	cargo monitoring/heating/cooling	INP: temperature setting IND: temperature ALM: limits exceeded
4.04 AUT	inert gas generation IMO SOLAS II/2.62	INP: selection IND: status ALM: failures limits exceeded
4.05 AUT	logging of cargo data	INP: selection logging frequency IND: information
4.06 AUT/MAN	loading calculations	INP: data IND: information
4.07 AUT/MAN	ballast system control and monitoring IMO MARPOL I	INP: selection IND: status ALM: failures limits exceeded
4.08 AUT/MAN	hatch cover, door closure and ramps operation IMO SOLAS II/1	INP: selection IND: status ALM: failures
4.09 AUT/MAN	cargo handling equipment operation/loading and discharging of cargo	INP: selection IND: status ALM: limits exceeded
4.10 AUT/MAN	bunkering, loading supply	INP: selection IND: status ALM: limits exceeded

5. SAFETY AND SECURITY

5.01 AUT	fire detection IMO SOLAS II-2/13, 40	INP: acknowledgement IND: locations of activated detectors and call points status ALM: fire alarm failures
5.02 AUT/MAN	fire extinction IMO SOLAS II-2/4, 5 and 7 to 12 IMO SOLAS II-2/32.1.6	INP: selection activation IND: status ALM: failures
5.03 AUT/MAN	damage control/watertight doors IMO SOLAS II-1/13.6.5	INP: selection activation IND: status ALM: failures
5.04 AUT/MAN	emergency response plans IMO SOLAS II-1/23, SOLAS II-2/20	INP: selection ND: information
5.05 AUT/MAN	protection against intruders IMO MSC Circular 623	INP: selection activation IND: information

6. MANAGEMENT (administration, miscellaneous)

6.01 AUT/MAN	crew education and training IMO A.741/A.6	INP: selection data acknowledgement IND: information
6.02 AUT/MAN	watch, working, drills and exercise schemes IMO A.741/A.7 + A.8	INP: data selection IND: information
6.03 AUT/MAN	voyage administration (certificate maintenance, port clearance, bunkering) IMO A.741/A.11	INP: data selection IND: information
6.04 AUT/MAN	cargo requirements	INP: selection IND: information
6.05 AUT/MAN	availability of safety related equipment IMO A.741/A.8	INP: data selection IND: status
6.06 AUT/MAN	stores, maintenance and repairs IMO A.741/A.10	INP: data selection IND: status information
6.07 AUT/MAN	accounts	INP: data selection IND: information
6.08 AUT/MAN	personnel administration (payroll, travel arrangements, entertainment)	INP: data selection IND: information
6.09	catering/cleaning	INP: data selection IND: information
6.10	records and reports IMO A.741/A.10	INP: data IND: information
6.11	organization and retrieval of documentation IMO A.741/A.11	INP: selection IND: information

Annex D (normative)

Power supply requirements in addition to the main source of energy

Emergency source ¹			
Transitional source ¹			
Reserve source of energy ²			
Integrated bridge system		✓ ³	✓
VHF voice and DSC	✓ ⁴		✓ ⁵
MF voice and DSC	✓ ⁶		✓ ⁷
MF/HF voice, DSC and telex	✓ ⁶		✓ ⁷
INMARSAT ship earth station	✓ ⁶		✓ ⁷
NAVTEX receiver			
EGC receiver			
EPIRB	✓ ⁸		✓ ⁸
AIS transponders			✓ ⁹
Aeronautical VHF SAR voice transceiver			✓ ¹⁰
Lighting for radio installation ¹¹	✓ ¹²		✓
Equipment providing inputs to the radio installation	✓ ¹³		✓
Internal communication equipment and signals required in an emergency		✓ ¹⁴	✓
Magnetic compass and repeaters			✓ ⁹
ECDIS or automatic graphical position display			✓ ⁹
Electronic position fixing system	✓ ¹³		✓ ⁹
Radar			✓ ⁹
Gyro compass and repeaters			✓ ⁹
Echo sounder			✓ ⁹
Speed and distance log			✓ ⁹
Rudder angle indicator			✓ ⁹
Propeller rpm, thrust direction and pitch as applicable			✓ ⁹
Heading control system			✓ ⁹
Rate of turn indicator			✓ ⁹
Voyage data recorder			✓ ⁹
Integrated navigation system			✓ ⁹
Fire detection and alarm system		✓ ¹⁴	✓
Fire door holding and release		✓ ¹⁵	✓
Daylight signalling lamp, ship's whistle and manually operated call points		✓ ¹⁴	✓
Emergency lighting and navigation lights		✓ ¹⁴	✓
Fire pump			✓
Automatic sprinkler pump			✓ ¹⁵
Emergency bilge pump and remote controlled bilge valves			✓ ¹⁵
Steering gear			✓
Power operated watertight doors and associated control, indication and alarm circuits		✓ ¹⁵	✓ ¹⁵
Lift cars			✓ ¹⁵
Machinery alarm system ¹⁶			✓
Alarm transfer system for one person operated bridge ¹⁷			✓

NOTE 1 – Emergency and transitional source is defined in SOLAS II-1/42 and /43. Where the emergency source is an accumulator battery, a transitional source of emergency electrical power is not required, unless otherwise stated.

NOTE 2 – Reserve source for radio installations is defined in SOLAS IV/13.

NOTE 3 – A transitional source is required for essential functions of the IBS (6.5.3).

NOTE 4 – Reserve source is required by SOLAS IV/13.2 for the installation to SOLAS IV/7.1.1.

NOTE 5 – Emergency source is required by SOLAS II-1/42.2.2.2 and 43.2.3.2 responsible for installations to SOLAS IV/7.1.1, 7.1.2 and 7.5.

NOTE 6 – Reserve source is required by SOLAS IV/13.2 for the installation to SOLAS IV/9.1.1, 10.1, 10.2.1 and 11.1 as appropriate for the sea area(s) for which the ship is equipped.

NOTE 7 – Emergency source is required SOLAS II-1/42.2.2.2.1, 42.2.2.2.2 and 42.2.2.2.3 and 43.2.3.2.1, 43.2.3.2.2 and 43.2.3.2.3 responsible for installations to SOLAS IV/9.1.1, 9.1.2, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2 and 11.1 if applicable.

NOTE 8 – If position input provided from external equipment. (SOLAS IV/13.1)

NOTE 9 – Local distribution panel(s) shall be arranged for all items of electrically operated navigational equipment. Each item shall be individually connected to its distribution panel. The power supplies to the distribution panel(s) shall be arranged with automatic changeover facilities between the main and the emergency source (IACS UR N1).

NOTE 10 – If not equipped with primary batteries.

NOTE 11 – Required by SOLAS IV/6.2.4.

NOTE 12 – Reserve source may be used (SOLAS IV/13.5) as supply independent from main and emergency source.

NOTE 13 – Reserve source may be used (SOLAS IV/13.8) for ship's navigational or other equipment which needs to supply uninterrupted input of information to the radio installation to ensure its proper performance as required by SOLAS IV.

NOTE 14 – For cargo ships a transitional source is not required if the emergency source is a generator which can be automatically started and supplying the required load within 45 s (see also NOTE 1).

NOTE 15 – Required for passenger ships only (see also NOTE 1).

NOTE 16 – A standby power supply with automatic changeover from normal power supply is required by SOLAS II-1/51.2.1.

NOTE 17 – A standby power supply with automatic changeover from normal power supply is required by IACS UR N1.

Annex E (informative)

Definition of integration related terms

abnormal operating conditions: When internal technical systems failures require operation of back-up systems on the bridge, or when they occur during an irregular operating condition, or when the officer of the watch becomes unfit to perform his duties and has not yet been replaced by another qualified officer.

absolute accuracy (geodetic or geographic accuracy): The accuracy of a position with respect to the geographic or geodetic co-ordinates of the earth.

accept (alarm or call): Manually acknowledge receipt of an alarm or call.

accuracy: The degree of conformance between the estimated or measured parameter of a craft at a given time and its true parameter at that time. (Parameters in this context may be position co-ordinates, velocity, time, angle, etc.)

accuracy of radionavigation systems: Radionavigation system accuracy is usually presented as a statistical measure of system error and is specified as:

predictable: the accuracy of a radionavigation system's position solution with respect to the charted solution. Both the position solution and the chart must be based upon the same geodetic datum;

repeatable: the accuracy with which a user can return to a position, the co-ordinates of which have been measured at a previous time with the same navigation system;

relative: the accuracy with which a user can measure a position relative to that of another user of the same navigation system at the same time.

acquisition: The process of selecting a target or targets and initiating their tracking.

additional functions: Functions performed on the bridge while the ship is under way, but not related to primary functions. Examples of such functions are:

- general communication;
- cargo monitoring and planning;
- extended monitoring and control of machinery;
- monitoring and control of domestic systems.

aid to navigation: A device external to a craft designed to assist in the determination of position of the craft, a safe course, or to warn of dangers to navigation (see navigational aid).

alarm (ALM): An alarm or alarm system which announces by audible means, or audible and visible means, a condition requiring attention (see also emergency alarms; distress, urgency and safety alarms; primary alarms; secondary alarms).

along-track error: A position error in the direction of the intended track.

alphanumeric: Contraction of alphabetic-numeric. Characters including letters of the alphabet and numbers.

ambiguity: The condition obtained when one set of measurements derived from navigation systems defines more than one point, direction, line of position, or surface of position.

American standard code for information interchange (ASCII): A basic coding table for alphabet and characters to be used in the transmission of digital data (see American National Standards Institute documents ANSI X 3.15, ANSI X 3.16 and ANSI X 3.4).

apparent wind: The speed and true direction from which the wind appears to blow with reference to a moving point. Sometimes called relative wind (see also true wind).

arrival alarm: An alarm signal issued by a voyage tracking unit which indicates arrival, or arrival at a pre-determined distance from a waypoint (see also arrival circle).

arrival circle: An artificial boundary placed around the destination waypoint of the present navigation leg, the entering of which may signal an arrival alarm.

artificial intelligence: The capability of a device to perform functions that are normally associated with human intelligence, such as reasoning, learning, and self-improvement.

augmentation: Any technique of providing enhancement to the GNSS in order to provide improved navigational performance to the user.

automatic radar plotting aid (ARPA): A system wherein radar targets are automatically acquired and tracked, collision situations computer assessed, and warnings given.

autopilot (AP): See heading control system.

availability: The percentage of time that an aid, or system of aids, is performing a required function under stated conditions (see also continuity, usability, signal availability and system availability).

azimuth: The horizontal direction of a celestial point from a terrestrial point, expressed as the angular distance from a reference direction, usually measured from 000° at north clockwise through 360°.

back-up navigator: Any individual, generally an officer, who has been designated by the ship's master to be on call if assistance is needed on the bridge.

base line: The line joining two points between which electrical phase or time is compared in determining navigation parameters. (For ground stations, this will be the line joining the two stations.)

bearing (BRG): The horizontal direction of one terrestrial point from another, expressed as the angular distance from a reference direction, usually measured from 000° at north clockwise through 360°.

NOTE – The terms bearing and azimuth are sometimes used interchangeably, but in navigation the former customarily applies to terrestrial objects and the latter to the direction of a point on the celestial sphere from a point on the earth. A bearing is designated as true, magnetic, or compass, as the reference direction is true, magnetic, or compass north.

Beaufort wind scale: A numerical scale for indicating wind speed. Beaufort numbers (or forces) range from force 0 (calm) to force 12 (hurricane).

bit: Stands for "binary digit", the digit in binary number representation. A bit can only assume the binary values "0" and "1". A binary number representation is composed of bits just as a decimal number is represented by decimal digits.

bridge: Area from which the ship is normally navigated, controlled and operated, including wheelhouse and bridge wings.

bridge system: The total system for the performance of bridge functions, comprising bridge personnel, technical systems, MMI and procedures.

bridge wings (BW): Parts of the bridge on both sides of the ship's wheelhouse which, in general, extend to the ship's side.

byte: A unit consisting of 8 bits, frequently used for measuring the capacity of storing devices (memory). 1 kbyte (kilobyte) = 2^{10} byte = 1 024 byte. 1 Mbyte (megabyte) = 2^{20} byte = 1 048 576 byte. 1 Gbyte (gigabyte) = 2^{30} byte = 1 073 741 824 byte.

call: The request for contact, assistance and/or action from an individual to another person or group of persons, i.e. the complete procedure of signalling and indicating this request.

cancel (of an alarm or call): Manual stopping of an alarm or call after cause has been eliminated.

cathode ray tube (CRT): A vacuum tube in which electrons emitted by a hot cathode are formed into a narrow beam, accelerated at high velocity and directed towards a specially prepared screen which fluoresces at the point where the electrons strike.

chart (nautical): A map intended primarily for marine navigational use.

NOTE – The carriage of up-to-date charts (plus certain other nautical publications) by vessels at sea is a mandatory requirement of SOLAS regulation V/20.

chartroom area: Part of the wheelhouse situated and equipped for adequate performance of voyage planning/plotting activities.

chart symbol: A character, letter, or similar graphic representation used on a chart to indicate some object, characteristic, etc.

circular error probable (CEP): The radius of a circle, centred on the measured position, inside which the true position lies within a given 50 % probability, for example 90 % or 50 %.

closest point of approach (CPA): The shortest target ship to own ship calculated distance that will occur in case of no change in course and speed data.

coastal warning: A navigational warning promulgated by a national co-ordinator covering a coastal region or a portion thereof.

collision avoidance functions: Detection and plotting of other ships and moving objects; determination and execution of course and speed deviations to avoid collision.

commanding view: View without obstructions which would interfere with the navigator's ability to perform his immediate tasks.

communication protocol: A method established for message transfer between a talker and a listener which includes the message format and the sequence in which the messages are to be transferred. Also includes the signalling requirements such as baud rate, stop bits, parity, and bits per character.

compact disc read-only memory (CD-ROM): Disc on which digital data may be stored.

confidence interval: The numerical range within which an unknown is estimated to be within a given probability.

confidence level: The probability that a given statement is correct, or the probability that a stated confidence interval (numerical range) includes an unknown.

confidence limits: The extremes of a confidence interval.

configuration of complete system: All operational functions of the IBS as installed.

configuration available: Operation(s) allocated to and available at each workstation.

configuration in use: Operation(s) and task(s) currently in use at each workstation

connectivity: A complete data link and the presence of valid data.

conning information display: A display which clearly presents the state and/or value of all sensor inputs relevant to navigation and manoeuvring, as well as all corresponding orders to steering and propulsion systems.

conning position: Place on the bridge with a commanding view, providing the necessary information and equipment for a conning officer (pilot) to carry out his functions.

continuity: Ability of a system to function within specified performance limits without interruption during a specified period.

co-ordinate (co-ordinate): One of a set of values defining a point in space. If the point is known to be on a given line, only one co-ordinate is needed; if on a surface, two are required; if in space, three.

co-ordinate conversion: Changing the co-ordinate values from one system to those of another.

Co-ordinated universal time (UTC): Time scale which forms the basis of a co-ordinated radio dissemination of standard frequencies and time signals. It corresponds exactly in rate with international atomic time TAI, but differs from it by an integral number of seconds. It is occasionally adjusted by insertion or deletion of seconds to ensure approximate agreement with universal time UT1.

correction: The numerical value of a correction is the best estimate which can be made of the difference between the true and the measured value of a parameter. The sign is such that a correction which is to be added to an observed reading is taken as positive.

course: For marine navigation, course is the horizontal direction in which a craft is steered or intended to be steered, expressed as angular distance from north, usually from 000° at north, clockwise through 360°. Strictly, course applies to direction through the water, not the direction intended to be made good over the ground (see track). Differs from heading and bearing.

course made good (CMG): The single resultant direction from a point of departure to a point of arrival at any given time.

course over ground (COG): The direction of the path over ground actually followed by a craft.

course-up display: An azimuth stabilized display in which a line connecting the centre with the top of the display is own ship's intended course.

coverage: Surface area or space volume associated with a specific radio service, within which a mobile station must be located to utilize, to a specified level of reliability, such a radio service under specified technical conditions.

craft autonomous integrity monitoring (CAIM): A technique whereby all navigation sensor information available on the craft is autonomously processed to monitor the integrity of the navigation signals (see also "receiver autonomous integrity monitoring").

cross-track: At right angles to the intended track of a craft (in a horizontal plane).

cross-track error (XTE): Position error perpendicular to the intended track.

cursor: A device used to provide a moveable reference on a display

data bank: Also "data base system", a system for description, storage, and retrieval of high volumes of complex structured data. A data bank is comprised of the data base and a set of data bank software (data base management systems, DBMS) which stores and retrieves information according to the predefined data descriptions, and for carrying out additional operations.

data base: Physical storage of data belonging to a data bank.

data compression: A reversible process that reduces the quantity of data, without any loss of information.

data field: A field which contains a data value.

data structure: A logical data organization designed for a particular purpose in which specific relationships and links are implemented.

datum: A set of parameters specifying the reference surface or the reference co-ordinate systems used for geodetic control in the calculation of co-ordinates of points on the earth.

dead (deduced) reckoning (DR): The process of estimating the position of a craft at any instant by applying to the last well-determined position (point of departure or subsequent fix) the run that has since been made, usually based on the recent history of speed and heading measurements.

Decca chain: A group of associated stations of the Decca Navigator System.

Decca Navigator System (DN): A short- to medium-range low-frequency (70-130 kHz) hyperbolic radionavigation system.

depth below keel: Distance between keel and ground.

depth below transducer: Distance of transducer from ground.

depth sounder (DS): An instrument which determines the depth of water by measuring the time interval between the emissions of a sound and the return of its echo from the bottom (also called depth finder and echo sounder).

destination (DEST): The immediate geographic point to which a craft is navigating. It may be the next waypoint along a route of waypoints or the final destination of a voyage.

deviation: The angle between the magnetic meridian and the axis of a compass card, expressed in degrees east or west to indicate direction in which the northern end of the compass card is offset from magnetic north.

differential mode: A use of a differential system.

differential system: A system whereby navigation signals are monitored at a known position and the corrections so determined are transmitted to users in the coverage area.

dilution of precision (DOP): The factor by which the accuracy of the GNSS position and time co-ordinates are degraded by geometrical considerations.

display: Means by which a device presents visual information to the user, including conventional instrumentation.

distance of transducer to keel: Minus sign (–) for distance of transducer above keel-to-keel level, plus sign (+) for distance of transducer below keel-to-keel level.

distance root-mean-squared (dRMS): The root-mean-square of the radial distances from the true position to the observed positions obtained from a number of trials.

distress, urgency and safety alarms: Alarms which indicate that a mobile unit or a person is in distress, or the calling station has a very urgent message concerning the safety of a mobile unit or a person or has an important warning to transmit (see also alarm; emergency alarms; primary alarms; secondary alarms).

docking: Manoeuvring the ship alongside a berth and controlling the mooring operations.

Doppler speed log: An instrument which measures the relative motion between a craft and the reflective sea bottom (for bottom return mode) or suspended particulate matter in the sea water itself (for water return mode) by measuring the frequency shifts between a transmitted and subsequently echoed signal (see also dual axis speed log, SDME).

drift: The speed of a current.

dual axis speed log: An instrument for measuring a craft's speed along the longitudinal (fore/aft) axis of the craft and along the transverse (port/starboard) axis as well (see also doppler speed log, SDME).

duplex operation: Operating method in which transmission is possible simultaneously in both directions of a telecommunication channel¹⁾.

echo sounder: See depth sounder.

electronic chart system (ECS): A generic term to describe the data, the software, and the electronic system capable of displaying chart information.

electronic chart display and information system (ECDIS): A navigation information system which, with adequate backup arrangements, can be accepted as complying with the up-to-date chart required by SOLAS V/20, by displaying selected information from a system electronic navigational chart (SENC) with positional data from navigation sensors to assist the mariner in route planning and route monitoring, and by displaying additional navigation related information.

electronic navigational chart (ENC): The data base, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (for example sailing directions) which may be considered necessary for safe navigation.

elevation: Angle between line of view of an object and the horizontal reference.

¹⁾ In general, duplex operation and semi-duplex operation require two frequencies in radiocommunication: simplex operation may use either one or two.

emergency alarms: Alarms which indicate that immediate danger to human life or to the ship and its machinery exists and that immediate action must be taken (see also alarms; distress, urgency and safety alarms; primary alarms; secondary alarms).

emergency position-indicating radio beacon (EPIRB): A radio station in the mobile service, the emissions of which are intended to facilitate search and rescue operations.

enhanced group call (EGC): A global automatic service based on INMARSAT-C for addressing commercial messages (FleetNet) or marine safety information (SafetyNet) to groups of ships or all vessels in both fixed and variable geographical areas.

en route: A phase of navigation covering operations between a point of departure and termination of a voyage.

ergonomics: Consideration of user needs in the analysis and design of the equipment, its installation and operation.

essential functions: Functions related to determination, execution and maintenance of safer course, speed and position of the ship in relation to the waters, traffic and weather conditions. Such functions include but are not limited to:

- route planning;
- navigation;
- collision avoidance;
- manoeuvring;
- docking;
- monitoring of internal safety systems; and
- external and internal communication related to safety in bridge operation and distress situations.

essential information: That information which is necessary for the monitoring and control of essential functions.

exchange format: A specification for the structure and organization of data to facilitate exchange between computer systems.

facility: The means to assist the performance of an action.

failure: The termination of the ability of a system, or part of a system, to perform its required function.

failure rate: The average number of failures of a system, or part of a system, per unit time (see also mean time between failures).

fault: That condition of a component which may result in the failure of either the system or part of it.

field of vision: Angular size of a scene that can be observed.

file: A collection of data for a specific task or purpose stored on a storage device.

firmware: Computer programs built into hardware and, therefore, not changeable.

fix: A position established by processing information from a number of navigational observations.

fix rate: The number of fixes per unit time.

format: Specification of succession and type of representation of elements of information (numbers, text) on a medium.

FleetNet: A service provided through the INMARSAT EGC system which will be used commercially for national or company fleet group calls.

functionality: Ability to perform an intended function. The performance of a function normally involves a system of displays, controls and instrumentation.

function key: A special key which performs a preprogrammed function.

gateway: A software or hardware component, or a combination of both, which will enable the interconnecting of two networks.

geodesy: The science related to the determination of the size and shape of the Earth (geoid).

geodetic or geographic accuracy: See absolute accuracy.

geoid: A surface along which the gravity potential is everywhere equal (equipotential surface) and to which the direction of gravity is always perpendicular.

geometric dilution of precision (GDOP): The factor for the combined 3D-position and time accuracy of the GNSS.

global maritime distress and safety system (GMDSS): A communication service, co-ordinated worldwide, comprising the following functions:

distress alerting: the rapid and successful reporting of a distress incident to a unit which can provide or co-ordinate assistance;

search and rescue co-ordination communications: the communication necessary for the co-ordination of ships and aircraft participating in a search resulting from a distress alert;

on-scene communication: communications between the ship in distress and assisting units related to the provision of assistance to the ship or the rescue of survivors;

locating signals: transmissions intended to facilitate the finding of a ship in distress or of the location of survivors;

dissemination of maritime safety information: broadcast of navigational and meteorological warnings and urgent information to shipping;

general radio communications: those communications between ship stations and shore-based communication networks which concern the management of the ship and may have an impact on its safety;

bridge-to-bridge communications: inter-ship VHF radiotelephone communications for the purpose of assisting the safe movement of the ship.

global navigation satellite service: The signal in space provided to the user by GNSS space and ground segments.

global navigation satellite system (GNSS): A worldwide position, time and velocity radiodetermination system comprising space, ground and user segments.

global (orbiting) navigation satellite system (GLONASS): A space-based, radio-positioning, navigation and time-transfer system operated by the Government of the Russian Federation.

global positioning system (GPS): A space-based, radio-positioning, navigation and time-transfer system operated by the United States Government.

great circle (GC): The intersection of the spherical surface and a plane containing the two points A and B and the centre of the sphere.

great circle chart: A chart on which a great circle appears as a straight line or approximately so.

great circle direction: Horizontal direction of a great circle, expressed as angular units from a reference direction, usually north.

Greenwich mean time (GMT): Local mean time at the Greenwich meridian.

grid accuracy: The accuracy of a position or position line relative to the grid system, for example a hyperbolic system such as Loran-C, where the grid itself may be subject to fixed errors relative to geographical co-ordinates (sometimes referred to as repeatability).

ground-based augmentation system (GBAS): A system providing additional signals from a ground-based station for a limited geographical area in order to enhance the performance of the GNSS service.

grouping of alarms: A generic term meaning the arrangement of individual alarms on alarm panels, or individual indicators on indicating panels, the combining of individual alarms to provide one alarm at a remote position and the arrangement of alarms in terms of their priority.

gross errors: Gross errors, or "outliers", are errors other than random errors or systematic errors. They are often large and, by definition, unpredictable. They are typically caused by sudden changes in the prevailing physical circumstances, by system faults or by operator errors.

gyrocompass: A compass having one or more directive elements, and which is north-seeking.

gyropilot: See heading control system.

half duplex: See semi-duplex.

hardware: All physical material components of a system, for example a central processing unit (CPU), peripheral devices, etc.

heading (HDG): The horizontal direction in which the longitudinal axis of a ship actually points or heads at any instant, expressed in angular units from a reference direction, usually from 000° at the reference direction, clockwise through 360° (true, magnetic or compass heading). Heading should not be confused with course.

heading control system: An automatic device for steering a craft so as to maintain its heading in an intended direction.

heading-to-steer: The heading that will guide a craft to its destination.

head-up display: One of the orientations of display of relative or true motion on a radar or ECDIS with the heading of own ship maintained up in relation to the display.

helmsman: Person who steers the ship under way.

horizontal dilution of precision (HDOP): The factor for the 2D-horizontal position accuracy.

hyperbolic navigation system: A system for determining the position of a craft by the intersection of hyperbolic position lines. Each such line is the locus of points of constant difference in the phase or arrival time of signals sent from a pair of synchronized transmitting stations.

IMO requirements: IMO conventions, regulations, resolutions, codes, recommendations, guidelines, circulars and related ISO and IEC standards.

inclination: One of the orbital elements (parameters) that specifies the orientation of an orbit. Inclination is the angle between the orbital plane and a reference plane, the plane of the celestial equator for geocentric orbits and the ecliptic for heliocentric orbits.

indicator: Visual information about the condition of a system or equipment.

integrated bridge system (IBS): Any combination of systems which are interconnected in order to allow centralized access to sensor information, or command/control from workstations to perform two or more of the following operations:

- passage execution;
- communications;
- machinery control;
- loading, discharging and cargo control;
- safety and security.

Management operations may also be performed within the IBS.

integrated navigation (IN): Use of an INS.

integrated navigation system (INS): A system in which the information from two or more navigation aids is combined in a symbiotic manner to provide an output which is superior to any one of the component aids.

integrated radio communication system (IRCS): A system where individual radio communication equipments are used as sensors, i.e. without their own control units, providing inputs to, and accepting inputs from, central control stations called workstations.

integrity: Ability of a system to provide user with accurate, timely, complete and unambiguous information and warnings within a specified time when the system should not be used.

intended track: The path of intended travel with respect to the Earth.

International Convention for the Safety of Life at Sea (SOLAS): An instrument developed by IMO to ensure that, from the point of view of safety of life, a ship is fit for the service for which it is intended.

Kalman filtering: A mathematical method by which information from a number of sources can be combined to provide estimates which are optimal in terms of pre-defined criteria.

keel: A longitudinal element extending along the centre of the bottom of a ship.

knots: Speed expressed in units of nautical miles per hour.

latency: Time interval between an event and the resulting information, including time for processing, transmission and reception

line of position (LOP): A locus of points where a navigation parameter has a constant value.

listener: Any device which receives data from another device.

local warning: A navigational warning which covers inshore waters, often within the limits of jurisdiction of a harbour or port authority.

log: Also referred to as speed and distance measuring equipment SDME.

logical channel: A logical communication pathway between two or more parties. A logical channel may be unidirectional or bidirectional.

lookout: Activity carried out by sight and hearing, as well as by all available means appropriate in the prevailing circumstances and conditions, so as to make full appraisal of the situation and of the risk of collision.

Loran: The general designation of one group of radionavigation systems by which a hyperbolic line of position is determined through measuring the difference in the times of reception of synchronized pulse signals from two fixed transmitters.

Loran-C: A low-frequency hyperbolic radionavigation system based on measurements of the differences of times of arrival of signals using pulse and phase comparison techniques.

magnetic bearing: Bearing relative to magnetic north.

magnetic heading: Heading relative to magnetic north; compass heading corrected for deviation.

manoeuvring: Operation of steering systems and propulsion machinery as required.

marginal detectable bias (MDB): The minimum size of the gross error in an observation that may be detected with given probabilities of type 1 and type 2.

NOTE – A type 1 error occurs when an observation without a gross error is wrongly rejected, and a type 2 error occurs when an observation with a gross error is wrongly accepted.

marginal detectable error (MDE): The maximum position-offset caused by an MDB in one of the observations.

maritime safety information (MSI): Navigational and meteorological warnings, meteorological forecasts, and other safety messages.

mean time between failure (MTBF): The actual operating time divided by the total number of failures during that period of time, thus indicating the expected time between two successive failures of a system or part of a system.

memory: The capacity to retain information, address it and use it. By extension, the device carrying out the function.

menu: A list of user selectable commands and/or options.

mercator map projection: A conformal cylindrical map projection in which the surface of a sphere or spheroid, such as earth, is conceived as developed on a cylinder tangent along the equator. Meridians appear as equally spaced vertical lines, and parallels as horizontal lines, drawn farther apart as the latitude increases, so that the correct relationship between latitude and longitude scales at any point is maintained.

modem: Contraction for modulator/demodulator. A device which converts data into signals for transmission and vice versa.

monitoring: Act of checking information from instrument displays, equipment and environment in order to detect any changes or irregularities.

monitor: An electronic device used for presenting visual information (also called monitoring screen or display).

multifunction display: A single visual display unit which can present, either simultaneously or through a series of selectable pages, information from more than one operation of a system.

navarea: A geographical sea area established for the purpose of co-ordinating the transmission of marine safety information and radionavigational warnings.

navigating and manoeuvring workstation: Workstation where ship's speed and heading are considered and controlled.

navigation (NAV): The process of planning, recording, and controlling the safe and expeditious movement of a craft from one place to another.

navigational aid: An instrument, device, chart, etc., carried on board and intended to assist in navigation (see aid to navigation).

navigation leg: The portion of a voyage upon which the craft currently travels. Each leg consists of two waypoints (origin and destination) and a line between them.

navigator: Person navigating, operating bridge equipment and manoeuvring the ship (see also OOW).

NAVTEX: An international automated direct-printing service for promulgation of navigational and meteorological warnings and urgent information to ships.

network: A set of nodes and links that provides connection between two or more defined ports to facilitate communication between them.

network application: The use of a network to connect equipment into a common link so that they can share resources.

node: A point at which a (data) packet is manipulated.

non-directional beacon (NDB): A radio beacon with a fixed omnidirectional aerial (antenna), from which a bearing can be obtained using a directional aerial on the craft. Beacon signals may also be used to carry differential corrections.

non-volatile memory: A memory device which retains information in the absence of external power.

normal operating conditions: When all systems and equipment related to primary bridge functions operate within design limits, and external conditions, such as weather and traffic, or the malfunction of position-fixing systems, do not cause excessive operator workloads.

north-up display: An azimuth stabilized display in which a line connecting the centre with the top of the display is north true bearing.

novel systems or equipment: Systems or equipment which embody new features not fully covered by provisions of SOLAS V but which provide an equal or higher standard of safety.

ocean areas: Waters that encompass navigation beyond the outer limits of coastal waters.

off-course: Deviation of a travelling direction from an intended or last confirmed course, expressed in degrees left or right of the course.

officer of the watch (OOW): Person responsible for the safety of navigation and bridge operations until relieved by another qualified officer (see also navigator).

OMBO ship: One man bridge operated ship.

Omega navigation system: A worldwide, continuous, radionavigation system of medium accuracy which provides hyperbolic lines of position through phase comparisons of VLF (10 kHz – 14 kHz) continuous wave signals transmitted on a common frequency on a time-shared basis.

on-board (communication) station: Low-powered mobile station in the maritime mobile service intended for use for internal communications on board a ship, or between a ship and its lifeboats and life-rafts during lifeboat drills or operations, or for communication within a group of craft being towed or pushed, as well as for line handling and mooring.

one-way communication protocol: A protocol established between a talker and a listener in which only the talker may send messages (compare to two-way communication protocol).

operational technical accuracy (OTA): The accuracy with which the craft is controlled as measured by the indicated craft position with respect to the indicated command or desired position. It does not include operator errors.

PE-90: See WGS.

performance check: A representative selection of short qualitative tests, to confirm correct operation of essential functions of an EUT.

pixel: Contraction for picture element. The smallest element resolvable by electronic raster devices.

polling: Interrogation of mobile stations by other stations.

position dilution of precision (PDOP): The factor for the 3D-position accuracy.

position probability area (PPA): An indication of the uncertainty of the ship's position, such as an error ellipse, determined by statistical evaluation of the random fluctuations of the position.

precision: The accuracy of a measurement or a position with respect to random errors.

primary alarms: Alarms which indicate a condition that requires prompt attention to prevent an emergency condition (see also alarm; emergency alarms; distress, urgency and safety alarms; secondary alarms).

primary functions: See essential functions.

priority message: Messages for distress alert, distress, urgency and safety calling and communication in a radio system.

probable circular error: See circular error probable.

probable spherical error: See spherical error probable.

pseudolite: Contraction of pseudo-satellite. A ground-based augmentation station transmitting a GNSS-like signal providing additional navigation ranging for the user.

PZ-90: See WGS

radar: Radio detection and ranging. The use of radio waves, reflected, or automatically retransmitted, to gain information concerning a distant object.

radar plotting: The whole process of target detection, tracking, calculation of parameters and display of information.

radio beacon: See non-directional beacon.

radiocommunication (COM): Telecommunication by means of radio waves.

radiodetermination: The determination of position, velocity and/or other characteristics of a craft, or the obtaining of information relating to these parameters by means of the propagation properties of radio waves.

radio direction finding (RDF): A system for measuring the direction of radio waves.

radiolocation: Radiodetermination used for purposes other than radionavigation.

radionavigation: Radiodetermination used for the purpose of navigation including obstruction warning.

random error: That error which can be predicted only on a statistical basis.

receiver autonomous integrity monitoring (RAIM): A technique whereby all navigation information available at a receiver is autonomously processed to monitor integrity of the navigational signals (see also craft autonomous integrity monitoring).

redundancy: The existence of multiple equipment or means for accomplishing a given function.

relative bearing: The direction of a target from own ship expressed as an angular displacement from own ship's heading.

relative motion display: A display on which the position of own ship remains fixed and all targets and/or chart information move relative to own ship.

relative accuracy: The accuracy with which a user can determine position relative to that of another user of the same navigation system at the same time.

relative wind: The speed and direction from which the wind appears to blow with reference to a moving craft. Sometimes called apparent wind.

reliability: The probability of performing a specified function without failure under given conditions for a specified period of time.

reliability of a service: The probability that a service, when it is available, performs a specified function without failure under given conditions for a specified period of time.

reliability of an observation: The reliability of an observation ("internal" reliability) is a measure of the effectiveness with which gross errors may be detected. This reliability is usually expressed in terms of the marginally detectable bias (MDB).

reliability of a position fix: A measure of the propagation of a non-detected gross error in an observation to the position fix. This "external" reliability is usually expressed in terms of the marginally detectable error (MDE).

repeatability: The accuracy of a positioning system taking account only the random error.

repeatable accuracy: The accuracy with which a user can return to a position whose co-ordinates have been measured at a previous time with the same navigation system.

resolution: Capability of depicting detail, represented by the smallest distance apart at which two objects can be seen to be separate.

rhumb direction: The horizontal direction of a rhumb line, expressed as angular distance from a reference direction, normally north. Also known as Mercator direction (see Mercator map projection).

rhumb line (RL): A line on the surface of the earth making the same oblique angle with all meridians. A rhumb line is a straight line on a rhumb (or Mercator) projection.

root-mean-squared (rms): Square root of the arithmetical mean of squares of a group of numbers.

root-mean-squared error: Root-mean-square error refers to the variability of a measurement such as a single LOP in one dimension. In this one dimensional case, the root-mean-square error is also an estimate of the standard deviation of the errors.

route (RTE): A planned course of travel, usually composed of more than one navigation leg.

route monitoring: Continuous surveillance of the ship's movement in relation to a planned route.

route planning: Pre-determination of course and speed in relation to the waters to be navigated.

route system: Any system of one or more routes aimed at reducing the risk of casualties during a voyage.

safetynet: A service provided through INMARSAT EGC system, which will be used by administrations for the promulgation of MSI, such as navarea and storm warnings, shore-to-ship distress alerts and routine weather forecasts to the high seas and those coastal waters not served by NAVTEX.

satellite based augmentation system (SBAS): A system providing additional satellite signals over a wide area in order to enhance the performance of the GNSS service.

sensor: A device which provides information to, or is controlled or monitored by, an equipment.

scale: The ratio between the linear dimensions of a chart, map, drawing, etc., and the actual dimensions represented. It may be called chart scale or map scale when applied to a chart or a map.

screen: See monitor.

seagoing ship: Ship navigating on the high seas, i.e. areas along coasts and from coast to coast.

secondary alarms: Alarms which are not emergency alarms, distress, urgency and safety alarms and primary alarms (see emergency alarms; distress, urgency and safety alarms; primary alarms).

semi-duplex operation: A method which is simplex operation at one end of the circuit and duplex operation at the other.²⁾

service capacity: This is the number of users a service can accommodate simultaneously.

set: The direction towards which a current flows.

signal availability: The availability of a radio signal in a specified coverage area.

signal-to-noise ratio (SNR): The ratio of the magnitude of a signal to that of the noise (interference), often expressed in decibels.

simplex operation: Operating method in which transmission is made possible alternately in each direction of a telecommunication channel, for example, by means of manual control.²⁾

single point of failure: That part of a system which lacks redundancy, so that a failure in that part would result in a failure of the whole system.

software: All programs which can be used on a computer system. In particular, the system software (i.e. the operating system) consists of all programs which are necessary for the proper functioning of the computer and for the provision of appropriate services to the user. The application software consists of all programs developed for special user applications.

speed (SPD): The absolute value of the velocity. May either be the ship's speed through the water, or the speed made good over the ground.

speed and distance measuring equipment (SDME): An instrument for measuring the speed and/or distance travelled by a craft.

speed log (SL): An instrument for measuring a craft's speed through water and/or speed over ground (see also Doppler speed log, dual axis speed log, SDME).

speed made good (SMG): The adjusted speed which takes into account current and wind.

speed over ground (SOG): The speed of a craft along the actual path of travel over the ground.

spherical error probable (SEP): The three-dimensional analogue of CEP.

standard deviation (sigma): A measure of the dispersion of random errors about the mean value. If a large number of measurements or observations of the same quantity are made, the standard deviation is the square root of the sum of the squares of deviations from the mean value divided by the number of observations less one.

state of the art: The state of knowledge with respect to the subject matter considered at the moment in time when it is appraised.

²⁾ In general, duplex operation and semi-duplex operation require two frequencies in radiocommunication: simplex operation may use either one or two.

superstructure: Decked structure, not including funnels, which is on or above the freeboard deck.

surveillance: The observation of an area for the purpose of determining the position and movements of craft in that area.

systematic error: An error which is non-random in the sense that it conforms to a pattern.

system availability: The availability of a [radio] system to a user, including signal availability and the performance of the user's receiver.

system electronic navigational chart (SENC): A data base resulting from the transformation of the ENC by ECDIS for appropriate use, updated to the ENC by appropriate means, and other data added by the mariner. It is the data base that is actually accessed by ECDIS for the display generation and other navigational functions, and is the equivalent of the up-to-date paper chart. The SENC may also contain information from other sources.

talker: A device which sends data to other devices.

target: Any object fixed or moving whose position and motion is determined by measurements of range and bearing on radar.

time difference (TD): In Loran-C, the time difference measured from the time of reception of the master station signal to the time of reception of the slave station signal.

time dilution of precision (TDOP): The factor for the time accuracy.

time to alarm: The time elapsed between the occurrence of a failure in the system and its presentation.

track (TR): The intended or desired horizontal direction of travel with respect to the earth. The track expressed in degrees of the compass may differ from the course due to allowances made in the course for such factors as sea and weather conditions in order to resume the desired track (see track made good).

track control system: An automatic system for steering a craft so as to maintain its track (see also heading control system, autopilot).

tracking: The process of observing the sequential changes in the position of a target in order to establish its motion.

track made good (TMG): The single resultant direction from a point of departure to a point of arrival at any given time.

track plotter (TP): A device used to plot the track or course of a craft.

transducer: A device that converts one type of energy to another.

transducer depth: Distance of the transducer from water surface.

true bearing: Bearing relative to true north.

true heading (TH): Heading relative to true north.

true motion display: A display across which own ship and each target moves with its own true motion on the earth-fixed chart background.

true position (2D-position): The error-free latitude and longitude co-ordinates in a specified geodetic datum.

true position (3D-position): The error-free latitude, longitude and height co-ordinates in a specified geodetic datum.

true wind: Wind relative to a fixed point.

two-way communication protocol: A protocol established between a talker and a listener in which the listener may also issue requests to the talker when required (compare to one-way communication protocol).

universal asynchronous receiver/transmitter (UART): A device which produces an electrical signal and timing for transmission of data over a communications path, and circuitry for detection and capture of such data transmitted from another UART.

variation: The angle between the magnetic and geographic meridians at any place, expressed in degrees and minutes east or west to indicate the direction of magnetic north from true north.

velocity (VEL): The vectorial quantity specifying speed and direction of a moving body.

vertical dilution of precision (VDOP): The factor for the 1D-vertical accuracy.

video plotter: The generic name for a device showing a craft's position in relation to a grid or chart data provided by the manufacturer or user.

visual display unit (VDU): See monitor.

voyage data recorder (VDR): A complete system, including any items required to interface with the source of input data, for processing and encoding the data, the final recording medium in its capsule, the power supply and dedicated reserve power source.

watch alarm: Alarm that is transferred automatically from the bridge to the master and/or the backup navigator.

waypoint (WPT): A reference point on the track.

Wheelhouse: Enclosed area of the bridge.

window: In computer applications, a rectangular subdivision of the display showing information without affecting other parts of the screen.

world geodetic system (WGS): A consistent set of parameters describing the size and shape of the Earth, positions of a network of points with respect to the centre of mass of the Earth, transformations from major geodetic datums, and the potential of the Earth.

The current set of parameters for GPS and ECDIS is WGS '84.

The current set of parameters for GLONASS is PE-90 (PZ-90).

worldwide navigational warning system (WWNWS): A co-ordinated global service for the promulgation by radio of information on hazards to navigation which might endanger international shipping.

workstation: Position at which one or several tasks constituting a particular activity are carried out.

zoom: A method of enlarging an area of a graphical display.

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