Resolution A.1106(29)

Adopted on 2 December 2015
(Agenda item 10)

**REVISED GUIDELINES FOR THE ONBOARD OPERATIONAL USE OF
SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEMS (AIS)**

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO the provisions of regulation V/19 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, requiring all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size to be fitted with an automatic identification system (AIS), as specified in SOLAS regulation V/19.2.4, taking into account the recommendations adopted by the Organization,

RECALLING FURTHER resolution A.917(22), as amended by resolution A.956(23), by which it adopted *Guidelines for the onboard operational use of shipborne automatic identification systems (AIS)*,

HAVING CONSIDERED the recommendations made by the Maritime Safety Committee at its ninety-fourth session,

1   ADOPTS the *Revised guidelines for the onboard operational use of shipborne automatic identification systems (AIS)*, set out in the annex to the present resolution;

2   INVITES Governments concerned to take into account the annexed revised guidelines when implementing SOLAS regulations V/11, 12 and 19;

3   ALSO INVITES Governments which are considering setting or have set regional frequencies or otherwise make use of AIS channel management, including changing to narrow-band operation for whatever reason, to take into account the possible impact on the use of AIS at sea and that it should only be used for urgent temporary situations. In such cases Governments should notify the Organization of such areas and designated frequencies, for urgent circulation of that information to all Member Governments;

4   REQUESTS the Maritime Safety Committee to keep the revised guidelines under review and amend them as appropriate;

5   REVOKES resolution A.917(22), as amended by resolution A.956(23).

Annex

REVISED GUIDELINES FOR THE ONBOARD OPERATIONAL USE OF SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEMS (AIS)

PURPOSE

1   These Guidelines have been developed to promote the safe and effective use of shipborne Automatic Identification Systems (AIS), in particular to inform the mariner about the operational use, limits and potential uses of AIS. Consequently, AIS should be operated taking into account these Guidelines.

2   Before using shipborne AIS, the user should fully understand the principle of the current Guidelines and become familiar with the operation of the equipment, including the correct interpretation of the displayed data. A description of the AIS system, particularly with respect to shipborne AIS (including its components and connections), is contained in annex 1.
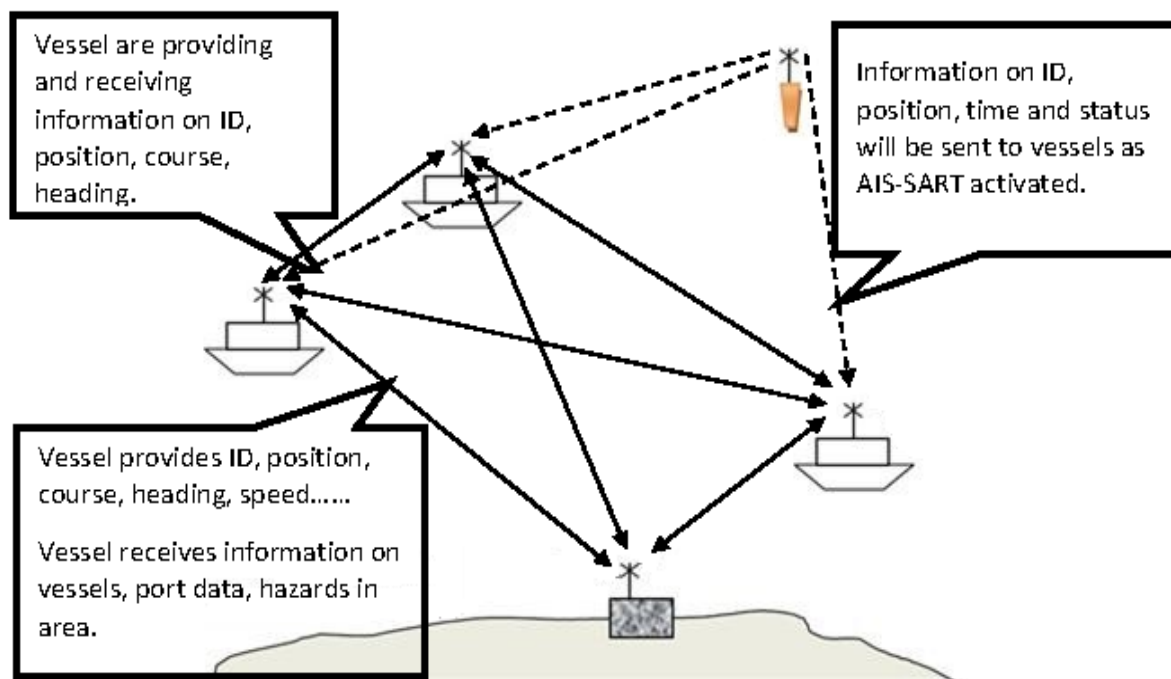

CAUTION

Not all ships carry AIS.

The officer of the watch (OOW) should always be aware that other ships, in particular leisure craft, fishing boats and warships, and some coastal shore stations including Vessel Traffic Service (VTS) centres, might not be fitted with AIS.

The OOW should always be aware that AIS fitted on other ships as a mandatory carriage requirement might, under certain circumstances, be switched off on the master's professional judgement.

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3   The internationally-adopted shipborne carriage requirements for AIS are contained in SOLAS regulation V/19. The SOLAS Convention requires AIS to be fitted on certain ships through a phased implementation period spanning from 1 July 2002 to 1 July 2008. In addition, specific ship types (e.g. warships, naval auxiliaries and ships owned/operated by Governments) are not required to be fitted with AIS. Also, small ships (e.g. leisure craft, fishing boats) and certain other ships may be exempt from carrying AIS. Moreover, ships fitted with AIS might have the equipment switched off. Users are therefore cautioned always to bear in mind that information provided by AIS may not be giving a complete or correct "picture" of shipping traffic in their vicinity. The guidance in this document on the inherent limitations of AIS and their use in collision avoidance situations (see paragraphs 40 to 44) should therefore be observed**.**

Objectives of AIS

4   AIS is intended to enhance: safety of life at sea; the safety and efficiency of navigation; and the protection of the marine environment. SOLAS regulation V/19 requires that AIS exchange data ship-to-ship and with shore-based facilities. Therefore, the purpose of AIS is to help identify ships, assist in target tracking, *assist in search and rescue operation,* simplify information exchange (e.g. reduce verbal mandatory ship reporting) and provide additional information to assist situation awareness. In general, data received via AIS will improve the quality of the information available to the OOW, whether at a shore surveillance station or on board a ship. AIS is a useful source of supplementary information to that derived from navigational systems (including radar) and therefore an important 'tool' in enhancing situation awareness of traffic confronting users.

DESCRIPTION OF AIS

Vessel are providing and receiving information on ID, position, course, heading.

Information on ID, position, time and status will be sent to vessels as AIS-SART activated.

Vessel provides ID, position, course, heading, speed......

Vessel receives information on vessels, port data, hazards in area.

Figure 1 – AIS system overview

5   Class A shipborne equipment complies with relevant IMO AIS carriage requirement. Class B shipborne equipment provides functionalities not in full accordance with IMO AIS carriage requirement. Class B devices may be carried on ships which are not subject to the SOLAS carriage requirements.

6   Shipborne AIS (see figure 1):

-        transmits ship's own data to other ships and vessel traffic service (VTS) stations; and

-        receives and makes available data of other ships and VTS stations and other AIS stations, such as AIS-SARTs, AIS-ATON, etc.

7   When used with the appropriate display, shipborne AIS enables provision of fast, automatic information by calculating Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) from the position information transmitted by the target vessels.

8   AIS operates primarily on two dedicated VHF channels. Where these channels are not available regionally, the AIS is capable of being automatically switched to designated alternate channels by means of a message from a shore facility. Where no shore-based AIS or Global Maritime Distress and Safety System (GMDSS) Sea Area A1 station is in place, the AIS should be switched manually. However, this capability should only be considered for use in urgent, temporary situations, noting the possible adverse effects on AIS at sea.

9   The capacity of the system allows for a great number of ships to be accommodated at the same time. Priority in the system is given to Class A devices. Class B devices operate at a reduced reporting rate or when free time slots are available.

10   The AIS is able to detect ships within VHF/FM range around bends and behind islands, if the landmasses are not too high. A typical value to be expected at sea is 20 to 30 nautical miles depending on antenna height. With the help of repeater stations, the coverage for both ship and VTS stations can be improved.

11   Information from a shipborne AIS is transmitted continuously and automatically without any intervention or knowledge of the OOW. An AIS shore station might require updated information from a specific ship by "polling" that ship, or alternatively, might wish to "poll" all ships within a defined sea area. However, the shore station can only increase the ships' reporting rate, not decrease it.

AIS INFORMATION SENT BY SHIPS

Ship's data content

12   The AIS information transmitted by a ship is of three different types:

-      static information, which is entered into the AIS on installation and need only be changed if the ship changes its name, Maritime Mobile Service Identity (MMSI), location of the electronic position fixing system (EPFS) antenna, or undergoes a major conversion from one ship type to another;

-      dynamic information, which, apart from "Navigational status" information, is automatically updated from the ship sensors connected to AIS; and

-      voyage-related information, which might need to be manually entered and updated during the voyage.

13   Details of the information referred to above are given in table 1 below:

Information item	Information generation, type and quality of information
Static	
MMSI	Set on installation Note that this might need amending if the ship changes ownership
Call sign and name	Set on installation Note that this might need amending if the ship changes ownership
IMO Number	Set on installation
Length and beam	Set on installation or if changed
Type of ship	Select from pre-installed list
Location of electronic position fixing system (EPFS) antenna	Set on installation or may be changed for bi-directional vessels or those fitted with multiple antennas

Dynamic	
Ship's position with accuracy indication and integrity status	Automatically updated from the position sensor connected to AIS The accuracy indication is approximately 10 m.
Position Time stamp in UTC	Automatically updated from ship's main position sensor connected to AIS
Course over ground (COG)	Automatically updated from ship's main position sensor connected to AIS, if that sensor calculates COG This information might not be available
Speed over ground (SOG)	Automatically updated from the position sensor connected to AIS. This information might not be available
Heading	Automatically updated from the ship's heading sensor connected to AIS
Navigational status	Navigational status information has to be manually entered by the OOW and changed as necessary, for example: - underway by engines - at anchor - not under command (NUC) - restricted in ability to manoeuvre (RIATM) - moored - constrained by draught - aground - engaged in fishing - underway by sail In practice, since all these relate to the COLREGs, any change that is needed could be undertaken at the same time that the lights or shapes were changed
Rate of turn (ROT)	Automatically updated from the ship's ROT sensor or derived from the gyro. This information might not be available

Voyage-related	
Ship's draught	To be manually entered at the start of the voyage using the maximum draft for the voyage and amended as required (e.g. – result of de-ballasting prior to port entry)
Hazardous cargo (type)	To be manually entered at the start of the voyage confirming whether or not hazardous cargo is being carried, namely: - DG (Dangerous goods) - HS (Harmful substances) - MP (Marine pollutants) Indications of quantities are not required
Destination and ETA	To be manually entered at the start of the voyage and kept up to date as necessary
Route plan (waypoints)	To be manually entered at the start of the voyage, at the discretion of the master, and updated when required

Safety-related	
Short safety-related messages	Free format short text messages would be manually entered, addressed either a specific addressee or broadcast to all ships and shore stations

Table 1 – Data sent by ship

Due to the amendment of MARPOL categorization of hazardous cargo by resolution MEPC.118(52), cargo type may be categorized as A, B, C or D, rather than X, Y, Z or OS on older AIS equipment, as described in SN.1/Circ.227 and SN.1/Circ.227/Corr.1.

The table below indicates the equivalence of the old and new category indications:

Current MARPOL category	Equivalent category on older AIS units
X	A
Y	B
Z	C
OS	D

14   The data is autonomously sent at different update rates:

- dynamic information: dependent on speed and course alteration (see tables 2 and 3);

- static and voyage-related data: every 6 minutes or on request (AIS responds automatically without user action); and

- safety-related text message: as required.

Type of ship	General reporting interval
Ship at anchor or moored and not moving faster than 3 knots	3 min
Ship at anchor or moored and moving faster than 3 knots	10 s
Ship 0-14 knots	10 s
Ship 0-14 knots and changing course	3 1/3 s
Ship 14-23 knots	6 s
Ship 14-23 knots and changing course	2 s
Ship >23 knots	2 s
Ship >23 knots and changing course	2 s

Table 2 – Class A shipborne equipment reporting intervals

Crafts not subject to SOLAS	Nominal reporting interval
Class B "SO" shipborne equipment not moving faster than 2 knots	3 min
Class B "SO" shipborne equipment moving 2-14 knots	30 s
Class B "SO" shipborne equipment moving 14-23 knots	15 s
Class B "SO" shipborne equipment moving > 23 knots	5 s
Class B "CS" shipborne equipment not moving faster than 2 knots	3 min
Class B "CS" shipborne equipment moving faster than 2 knots	30 s

Table 3 – Class B shipborne equipment reporting intervals

Short safety-related messages

15   Short safety-related messages are fixed or free format text messages addressed either to a specified destination (MMSI) or all ships in the area. Their content should be relevant to the safety of navigation, e.g. an iceberg sighted or a buoy not on station. Messages should be kept as short as possible. The system allows up to 158 characters per message but the shorter the message the more easily it will find free space for transmission. At present these messages are not further regulated, to keep all possibilities open.

16   Operator acknowledgement may be requested by a text message. The operator should be aware that there are special safety-related messages and special user identities form devices such as the AIS-SART. Details are given in SN.1/Circ.322, as amended. There is no need for acknowledgement by a text message.

17   Short safety-related messages are only an additional means of broadcasting maritime safety information. Whilst their importance should not be underestimated, use of such messages does not remove any of the requirements of the GMDSS.

18   The operator should ensure that he displays and considers incoming safety-related messages and should send safety-related messages as required.

19   According to SOLAS regulation V/31 (Danger messages)

"*The master of every ship which meets with dangerous ice, a dangerous derelict, or any other direct danger to navigation, or ...is bound to communicate the information by all the means at his disposal to ships at his vicinity, and also to the competent authorities...*"

20   Normally this is done via VHF voice communication, but "by all the means" now implies the additional use of the AIS short messages application, which has the advantage of reducing difficulties in understanding, especially when noting down the correct position.

Confidentiality

21   When entering any data manually, consideration should be given to the confidentiality of this information, especially when international agreements, rules or standards provide for the protection of navigational information.

OPERATION OF AIS ON BOARD

OPERATION OF THE TRANSCEIVER UNIT

Activation

22   AIS should always be in operation when ships are underway or at anchor. If the master believes that the continual operation of AIS might compromise the safety or security of his/her ship or where security incidents are imminent, the AIS may be switched off. Unless it would further compromise the safety or security, if the ship is operating in a mandatory ship reporting system, the master should report this action and the reason for doing so to the competent authority. Actions of this nature should always be recorded in the ship's logbook together with the reason for doing so. The master should however restart the AIS as soon as the source of danger has disappeared. If the AIS is shut down, static data and voyage-related information remains stored. Restart is done by switching on the power to the AIS unit. Ship's own data will be transmitted after a two-minute initialization period. In ports AIS operation should be in accordance with port requirements.

Manual input of data

23   The OOW should manually input the following data at the start of the voyage and whenever changes occur, using an input device such as a keyboard:

-      ship's draught;

-      hazardous cargo;

-      departure, destination and ETA;

-      route plan (way points);

-      the correct navigational status; and

-      short safety-related text messages.

It is recommended to use the United Nations Code for Trade and Transport Locations (UN/LOCODE) for the entry of the port of destination. In addition, it is recommended that the existing destination field be used for entering both the port of departure and the next port of call (space for 20 characters of 6 bit ASCII is available) using the UN/LOCODE.[1]

Check of information

24   To ensure that own ship's static information is correct and up-to-date, the OOW should check the data whenever there is a reason for it. As a minimum, this should be done once per voyage or once per month, whichever is shorter. The data may be changed only on the authority of the master.

25   The OOW should also periodically check the following dynamic information:

-      positions given according to WGS 84;

-      speed over ground; and

-      sensor information.

26   After activation, an automatic built-in integrity test (BIIT) is performed. In the case of any AIS malfunction an alarm is provided and the unit should stop transmitting.

27   The quality or accuracy of the ship sensor data input into AIS would not however be checked by the BIIT circuitry before being broadcast to other ships and shore stations. The ship should therefore carry out regular routine checks during a voyage to validate the accuracy of the information being transmitted. The frequency of those checks would need to be increased in coastal waters.

DISPLAY OF AIS DATA

28   The AIS provides data that can be presented on the minimum display or on any suitable display device, as described in annex 1.

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[1]   SN/Circ.244.

Minimum display

29   The minimum mandated display provides not less than three lines of data consisting of bearing, range and name of a selected ship. Other data of the ship can be displayed by horizontal scrolling of data, but scrolling of bearing and range is not possible. Vertical scrolling will show all the other ships known to the AIS.

Graphical display

30   Where AIS information is used with a graphical display, the following target types may be displayed:

Sleeping target A sleeping target indicates only the presence of a vessel equipped with AIS in a certain location. No additional information is presented until activated, thus avoiding information overload.

Activated target If the user wants to know more about a vessel's motion, the target (sleeping) may be activated so that the display shows immediately:

-      a vector (speed and course over ground);

-      the heading; and

-      ROT indication (if available) to display actually initiated course changes.

Selected target If the user wants detailed information on a target (activated or sleeping), it may be selected. Then the data received, as well as the calculated CPA and TCPA values, will be shown in an alpha-numeric window.

The special navigation status will also be indicated in the alpha numeric data field and not together with the target directly.

Dangerous target If an AIS target (activated or not) is calculated to pass preset CPA and TCPA limits, it will be classified and displayed as a dangerous target and an alarm will be given.

Lost target If a signal of any AIS target at a distance of less than a preset value is not received, a lost target symbol will appear at the latest position and an alarm will be given.

Other targets Other targets such as AIS-SART, AIS-AToN, may be displayed with special symbols (see SN.1/Circ.243/Rev.1 on *Guidelines for the presentation of navigational-related symbols, terms and abbreviations*).

Symbols

31   The user should be familiar with the symbology used in the graphical display provided.

INHERENT LIMITATIONS OF AIS

32   The OOW should always be aware that other ships, in particular leisure craft, fishing boats and warships, and some coastal shore stations including VTS centres, might not be fitted with AIS.

33   The OOW should always be aware that other ships fitted with AIS as a mandatory carriage requirement might switch off AIS under certain circumstances by professional judgement of the master.

34   In other words, the information given by the AIS may not be a complete picture of the situation around the ship.

35   The users must be aware that transmission of erroneous information implies a risk to other ships as well as their own. The users remain responsible for all information entered into the system and the information added by the sensors.

36   The accuracy of AIS information received is only as good as the accuracy of the AIS information transmitted.

37   The OOW should be aware that poorly configured or calibrated ship sensors (position, speed and heading sensors) might lead to incorrect information being transmitted. Incorrect information about one ship displayed on the bridge of another could be dangerously confusing.

38   If no sensor is installed or if the sensor (e.g. the gyro) fails to provide data, the AIS automatically transmits the "not available" data value. However, the built-in integrity check cannot validate the contents of the data processed by the AIS.

39   It would not be prudent for the OOW to assume that the information received from other ships is of a comparable quality and accuracy to that which might be available on its own ship.

USE OF AIS IN COLLISION AVOIDANCE SITUATIONS

40   The potential of AIS as an assistance for anti-collision device is recognized and AIS may be recommended as such a device in due time.

41   Nevertheless, AIS information may merely be used to assist in collision avoidance decision-making. When using the AIS in the ship-to-ship mode for anti-collision purposes, the following cautionary points should be borne in mind:

>   .1   AIS is an additional source of navigational information. It does not replace, but supports, navigational systems such as radar target-tracking and VTS; and
>
>   .2   the use of AIS does not negate the responsibility of the OOW to comply at all times with the Collision Regulations, particularly rule 7 when determining whether risk of collisions exists.

42   The user should not rely on AIS as the sole information system, but should make use of all safety-relevant information available.

43   The use of AIS on board ship is not intended to have any special impact on the composition of the navigational watch, which should continue to be determined in accordance with the STCW Convention.

44   Once a ship has been detected, AIS can assist in tracking it as a target. By monitoring the information broadcast by that target, its actions can also be monitored. Many of the problems common to tracking targets by radar, namely clutter, target swap as ships pass close by and target loss following a fast manoeuvre, do not affect AIS. AIS can also assist in the identification of targets, by name or call sign and by ship type and navigational status.

ADDITIONAL AND POSSIBLE FUTURE APPLICATIONS

AIS IN VTS OPERATIONS

Pseudo Targets broadcast by VTS

45   VTS centres may send information about vessels which are not carrying AIS and which are tracked only by VTS radar via the AIS to vessels equipped with AIS. Any VTS/generated/synthetic target broadcast by VTS should be clearly identified as such. Particular care should always be taken when using information which has been relayed by a third party. Accuracy of these targets may not be as complete as actual directly-received targets, and the information content may not be as extensive.

Text messages

46   VTS centres may also send short messages either to one ship, all ships, or ships within a certain range or in a special area, e.g.:

-      (local) navigational warnings;

-      traffic management information; and

-      port management information.

47   A VTS operator may request, by a text message, an acknowledgement from the ship's operator.

Note: The VTS should continue to communicate via voice VHF. The importance of verbal communication should not be underestimated. This is important to enable the VTS operator to:

-      assess vessels' communicative ability; and

-      establish a direct communication link which would be needed in critical situations.

(D)GNSS corrections

48   (D)GNSS corrections may be sent by VTS centres via AIS.

MANDATORY SHIP REPORTING SYSTEMS

49   AIS is expected to play a major role in ship reporting systems. The information required by coastal authorities in such systems is typically included in the static voyage-related and dynamic data automatically provided by the AIS system. The use of the AIS long-range feature, where information is exchanged via communications satellite, may be implemented to satisfy the requirements of some ship reporting systems.

AIS IN SAR OPERATIONS

50   AIS may be used in search and rescue operations. By receiving messages from AIS-SART, operators get more accurate information, especially on the position of survival craft. In combined aerial and surface searches AIS may allow the direct presentation of the position on other displays such as radar or ECS/ECDIS, which facilitates the task of SAR craft. For ships in distress without AIS, the On Scene Coordinator (OSC) could create an AIS target.

AIDS TO NAVIGATION

51   AIS, when fitted to selected fixed and floating aids to navigation can provide information to the mariner such as:

- position;
- status;
- tidal and current data; and
- weather and visibility conditions.

AIS IN AN OVERALL INFORMATION SYSTEM

52   AIS will play a role in an overall international maritime information system, supporting voyage planning and monitoring. This will help Administrations to monitor all the vessels in their areas of concern and to track dangerous cargo.

REFERENCE DOCUMENTS

- SOLAS Convention, chapter V

- Recommendation on performance standards for a universal shipborne Automatic Identification System (AIS), (MSC.74(69), annex 3)

- Performance Standards for survival craft AIS search and rescue transmitters (AIS-SART) for use in search and rescue operations (resolution MSC.246(83))

- Guidance on the use of the UN/LOCODE in the destination field in AIS messages (SN/Circ.244)

- ITU Radio Regulations, appendix 18, table of transmitting frequencies in the VHF maritime mobile band

- Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band (Recommendation ITU-R M.1371-5)

- IEC Standard 61993 Part 2: Class A shipborne equipment of the Universal Shipborne Automatic Identification System (AIS) Operational and Performance Requirements, Methods of Testing and required Test Results

APPENDIX 1

DESCRIPTION OF AIS

COMPONENTS

1   In general, an onboard AIS (see figure 1) consists of:

- antennas;

- one VHF transmitter;

- two multi-channel VHF receivers;

- one channel 70 VHF receiver for channel management;

- a central processing unit (CPU);

- an electronic position-fixing system, Global Navigation Satellite System (GNSS) receiver for timing purposes and position redundancy;

- interfaces to heading and speed devices and to other shipborne sensors;

- interfaces to radar/Automatic Radar Plotting Aids (ARPA), Electronic Chart System/Electronic Chart Display and Information System (ECS/ECDIS) and Integrated Navigation Systems (INS);

- built-in integrity test (BIIT); and

- minimum display and keyboard to input and retrieve data.

With the integral minimum display and keyboard unit, the AIS would be able to operate as a stand-alone system. A stand-alone graphical display or the integration of the AIS data display into other devices such as INS, ECS/ECDIS or a radar/ARPA display would significantly increase the effectiveness of AIS, when achievable.

2   All onboard sensors must comply with the relevant IMO standards concerning availability, accuracy, discrimination, integrity, update rates, failure alarms, interfacing and type-testing.

3   AIS provides:

- a BIIT running continuously or at appropriate intervals;

- monitoring of the availability of data;

- an error detection mechanism of the transmitted data; and

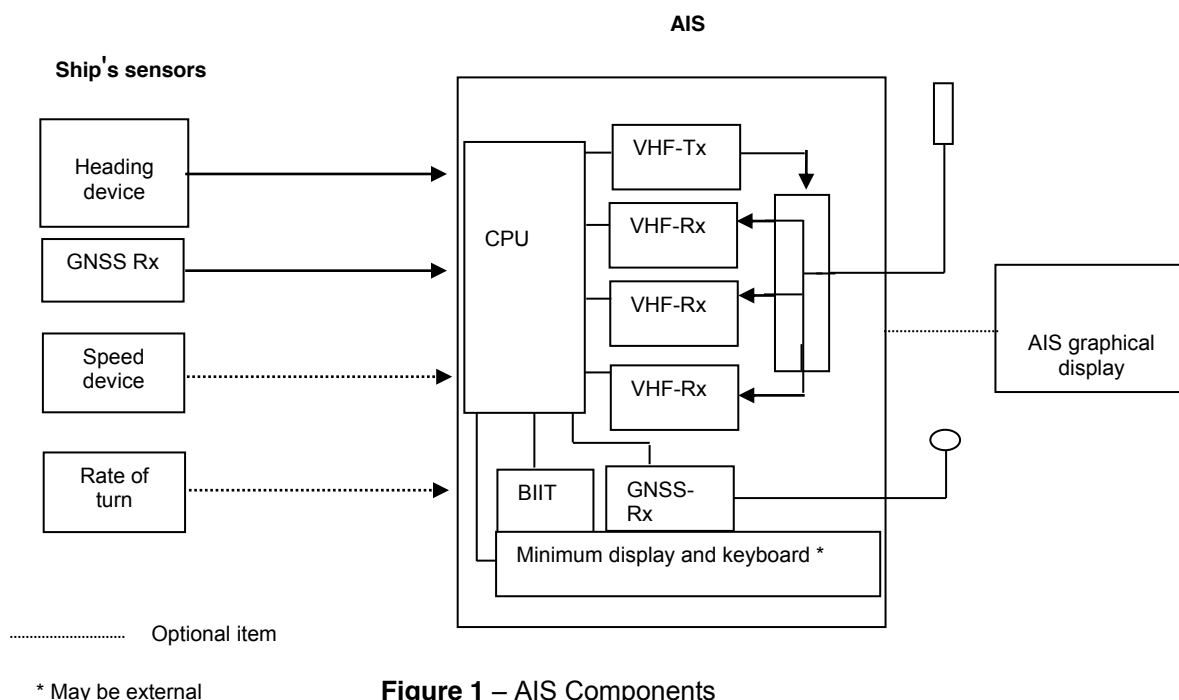- an error check on the received data.

Figure 1 – AIS Components

CONNECTIONS

The connection of AIS to external navigational display systems

4   The AIS can be connected either to an additional dedicated AIS display unit, possibly one with a large graphic display, or as an input to existing navigational system devices such as a radar display, ECS, ECDIS, or INS. Such system interconnection and data integration is recommended."

The connection of AIS to external portable navigational equipment

5   It is becoming common practice for pilots to possess their own portable navigational equipment, which they carry on board. Such devices can be connected to shipborne AIS equipment and display the targets they receive. Some Administrations require this connection to be provided at the bridge front.

APPENDIX 2

TECHNICAL DESCRIPTION

1   AIS operates primarily on two dedicated VHF channels (AIS1 – 161,975 MHz and AIS2 – 162,025 MHz). Where these channels are not available regionally, the AIS is capable of automatically switching to alternate designated channels. However, this capability should only be considered for use in urgent, temporary situations, noting the possible adverse effects on AIS at sea.

2   The required ship reporting capacity according to the IMO performance standard amounts to a minimum of 2000 time slots per minute (see figure 1 below). The ITU Technical Standard for the Universal AIS provides 4500 time slots per minute. The broadcast mode is based on a principle called (S)TDMA (Self-organized Time Division Multiple Access) that allows the system to be overloaded by 400 to 500% and still provide nearly 100% throughput for ships closer than 8 to 10 NM to each other in a ship-to-ship mode. In the event of system overload, only targets far away will be subject to drop-out in order to give preference to targets close by that are a primary concern for ship-to-ship operation of AIS. In practice, the capacity of the system allows for a great number of ships to be accommodated at the same time.
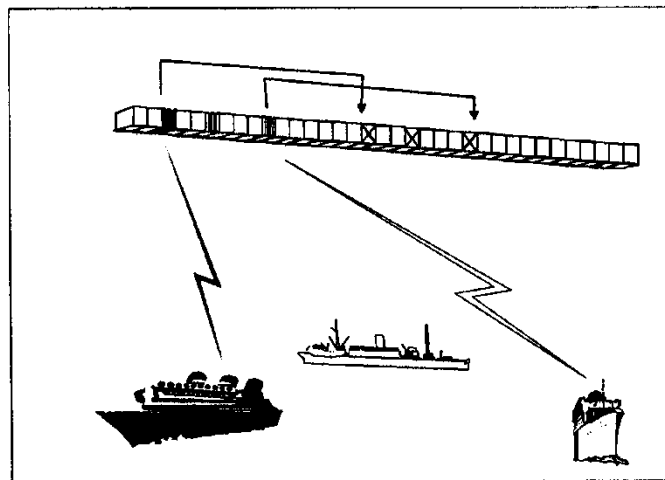

Figure 1 – Principles of TDMA