

AUTOMATIC IDENTIFICATION SYSTEM

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What is AIS

1. What does AIS do?

Automatic Identification System (AIS) is an information and communications system that utilises maritime VHF frequencies to send and receive data both between suitably equipped vessels and between suitable equipped vessels and shore stations.

The information communicated includes data directly associated with navigation such as the vessels identity, position, speed and course and other information in a message format.

Picture a shipboard radar display, with overlaid electronic chart data, that includes a mark for every significant ship within radio range, each as desired with a velocity vector (indicating speed and heading). Each ship "mark" could reflect the actual size of the ship, with position to GPS or differential GPS accuracy. By "clicking" on a ship mark, you could learn the ship name, course and speed, classification, call sign, registration number, MMSI and other information. Maneuvering information, closest point of approach (CPA), time to closest point of approach (TCPA) and other navigation information, more accurate and more timely than information available from an automatic radar plotting aid, could also be available. Display information previously available only to modern VTS operations centers could now be available to every AIS-equipped ship.

With this information, you could call any ship over VHF radiotelephone by name, rather than by "ship off my port bow" or some other imprecise means. Or you could dial it up directly using GMDSS equipment. Or you could send to the ship, or receive from it, short safety-related email messages.

The AIS is a shipboard broadcast system that acts like a transponder, operating in the VHF maritime band, that is capable of handling well over 4,500 reports per minute and updates as often as every two seconds. It uses Self-Organizing Time Division Multiple Access (SOTDMA) technology to meet this high broadcast rate and ensure reliable ship-to-ship operation.

2. What is the difference between Class A and Class B AIS equipment?

Class A units

Class A devices are designed to meet the current IMO Performance Standards. SOLAS Chapter V (Safety of Navigation) dictates their carriage requirement. Carriage of Class A units may be required for other vessels as domestic or regional carriage requirements dictate.

Class B units

Class B devices may not necessarily meet all the performance requirements specified by IMO MSC Resolution 74 (69) Annex 3. They are designed to operate harmoniously with Class A units on the VHF data link. The Class B units may be used on craft not subject to SOLAS.

Onboard Installation

3. How does the master know that his AIS unit is working properly?

AIS provides:

- a built-in integrity test (BIIT) running continuously or at appropriate intervals;
- monitoring of the availability of the data;
- an error detection mechanism of the transmitted data; and,
- error checking of the received data.

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 integrity check cannot validate the accuracy of the data received by the AIS. The AIS requires that an alarm output (relay) be connected to an audible alarm device or the ship's alarm system, if available. Alternatively, the BIIT alarm system may use the alarm messages' output on the Presentation Interface (PI), provided its alarm system is AIS compatible.

4. Is there any calibration of the AIS equipment needed?

No – a correctly installed AIS unit should not need any further calibration to continue operating. The Built-In Integrity Test component of each AIS will activate an alarm should the unit fail to operate in accordance with specified parameters.

5. Is there any set up (initial/regular/frequent) of the AIS equipment needed?

Yes. Static data (vessel name, call sign, MMSI, IMO number etc) must be entered upon installation in accordance with the ship's registration documents. Voyage-related data (draught, destination, ETA, navigation status etc) must be entered at the commencement of each voyage or if there are any changes. It is recommended that both static and voyage-related data be checked and updated at appropriate intervals, as required. The failure to correct the vessel's navigational

status when it changes (a vessel comes alongside from being underway, for example) is commonly overlooked.

Note: Static data fields are password protected, which Masters will require should there be a need to update these fields or reprogram the AIS. Improper input of antenna location can create a navigation hazard, since this data is used to calculate ships dimensions, which is in turn broadcast to other ships. OOW's are reminded that the AIS Navigation Status field should always report the ships status as per the Collision Regulations and must be updated accordingly.

6. Is there any training on the use of AIS available?

All AIS manufacturers provide operating manuals may well offer initial training on their equipment. IALA provides Operational and Technical Guidelines that address most aspects of AIS. It is recommended that ship owners and managers take advantage of these sources and incorporate AIS training in their ISM procedures

Operating your AIS

7. Will AIS replace radar?

AIS is a useful source of additional information available to the OOW. Information received via AIS supplements and improves radar information and that derived from other navigational systems. AIS is therefore a valuable aid to assist in collision avoidance.

There always will be ships without AIS onboard. However, radar detects targets independent of the target's onboard equipment. Therefore, AIS cannot replace radar, which is, in many ways, a 'complete' system.

8. How does AIS supplement radar information?

In addition to radar, AIS has the following benefits:

- Automatic vessel identification;
- Automatic provision of heading, course over ground (COG) and speed over ground (SOG), as derived from external sensors;
- Automatic provision of CPA (Closest Point of Approach) and Time to Closest Point of Approach (TCPA);
- Improved vessel tracking (no target swap);
- Generally greater range, although in some circumstances e.g. mountainous areas, this may only be achieved with the provision of shore-based repeater stations;
- AIS can also be used as an aid to navigation and possibly replace racons;
- greater positional accuracy, dependent on the position input sensor;
- Provides information in radar shadow areas ('sees' around bends and behind islands);
- Near real time manoeuvring data;
- No loss of targets in sea, rain and snow clutter;

9. What are the main limitations of AIS?

- Data received is only as good as the data entered into the AIS. To ensure that correct AIS information is broadcast to other vessels and shore authorities, mariners are reminded to enter current voyage related data such as draught, type of hazardous cargo, destination and ETA properly at the beginning of each voyage and whenever changes occur.
- Not all ships carry AIS. The OOW should always be aware that other ships, in particular pleasure craft and fishing vessels, may not be fitted with AIS. Also not all vessels accurately report all AIS information.
- The AIS unit may not, in all cases, be installed in accordance with the IMO Guidelines. This can result in poor performance and erroneous transmissions.
- The OOW should always be aware that AIS fitted on other ships as a mandatory carriage requirement, may, under certain circumstances, be switched off, particularly where international agreements, rules or standards provide for the protection of navigational information.
- AIS is subject to the vagaries and limitations of VHF-FM propagation.
- **Mariners should be aware the accuracy of AIS positional information is the accuracy of the EPFD connected. For example, LORAN C can be used, but will typically have a far lower accuracy than GNSS.**
- Mariners are reminded to periodically check that correct information is being broadcast by their own vessel, particularly position, heading (provided by the ships master gyro) and speed.
- The mariner must always remember that AIS is just one of the several tools available to watch-keepers, to fulfill their obligations under the Collision Regulations.

10. How does the master know that the information received from another AIS unit is accurate?

The master should authenticate the information received by his AIS unit by cross-checking with his radar and/or by other means.

11. Can I send a letter to my agent via AIS?

No. AIS is a navigation safety device and is not intended for routine messaging. AIS is mainly used for identifying and tracking other ships. However, it does provide for the ability to transmit short safety related messages on the AIS designated frequencies. Why do AIS messages not include the rudder angle?

Rudder angle information is not a required AIS sensor input and may not always be representative of the actual movement of the vessel. Transmitting rudder angle information may mislead the recipient and can therefore be dangerous. On

the other hand, Rate of Turn (ROT) information can be included in the AIS information, as this device is required to be carried on vessels over 50,000 gross tonnage.

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13. How is AIS information displayed?

The display panel with the unit is often the only means of showing AIS received data. Together with a keypad, this basic configuration is known as a Minimum Keyboard and Display (MKD).

The display part of a MKD, as a minimum, consists of three lines of data, each showing bearing, range and name of the target. In practice, most MKDs display more lines of data and may also have a simple graphical display, showing the relative location of targets, rather like the Plan Position Indicator of a radar.

To achieve the full benefits of AIS, information ought to be display graphically on a radar, ECDIS or on its own dedicated display.

Recognizing this, IMO has mandated that from 1 July 2008 onwards, all new radar installations must be able to display AIS targets.

The ability to display AIS information on radar or ECDIS depends entirely if the radar/ECDIS has been designed or modified for this purpose. If so, the connection can easily be made by a qualified installer.

Equipment manufacturers are the best source of information and available options in this regard.

14. Can I connect my GNSS to the AIS?

Practically all AIS units have an in-built GNSS receiver (such as GPS or GLONASS). This is required primarily to provide accurate UTC. The GNSS antenna and receiver are part of the ship's AIS equipment, separate from any other GNSS equipment on board.

AIS can use positional and other data from the ship's GNSS or other radio-navigation system that is being used to navigate the ship. However, if positional information is lost from the ship's GNSS or other equipment, the AIS will transmit position and other data from the internal GNSS.

Regardless, any GNSS connected to the AIS should comply with IMO Resolution MSC.112 (73) (*Revised performance standards for ship-borne Global Positioning System (GPS) receiver equipment*) and IEC Test Standard 61108-1.

Vitaly, GPS units that comply with the older IMO performance standard should not

be interfaced to the AIS. This is because differences between the two standards are considerable. Under the new standard, there is a requirement for integrity monitoring (RAIM), satisfactory operation in typical interference conditions, higher accuracies for position, Course Over Ground (COG) and Speed Over Ground (SOG) output, higher update display rate (every second, as opposed to every two seconds). The most significant of these are the RAIM requirement and interference rejection standards.

15. Can I connect my gyro compass to the AIS?

AIS requires the input of the ships gyro or transmitting heading device (THD), which meets the relevant IMO and IEC standards. Without heading information, the presentation of the ship shape will not be generated. However, in this case, the isosceles triangle representing the ships position will be aligned with the COG (without the heading marker) on the display of receiving stations.

16. What is the accuracy of navigational information provided?

The accuracy of navigational information such as position, course, speed etc. output by AIS, depends on the accuracy and proper operation of the sensors used. There is an indication of the positional accuracy transmitted by AIS ('low' or 'high'), depending on whether GNSS or DGNSS is used. Further, the accuracy of data, such as voyage related data, depends on the accuracy with which this is entered and the frequency of its update. Masters must always bear in mind that a third party manually enters some the information they receive.

17. How will AIS contribute to the prevention of collisions?

AIS should not be used as an anti-collision device in isolation. It should be used in conjunction with all means available to assist the mariner in assessing the risk of collision. It is important to note that there will always be other vessels that do not have AIS. IMO recognises the potential of AIS as an anti-collision device and may recommend AIS as such a device in due course.

In summary, AIS is a valuable navigational aid, one of several on the bridge of a ship. It can assist in the early appraisal and subsequent resolution of a close quarters situation, or of a risk of collision. Initially, detection by AIS alone should be considered in the same way as detection by radar alone, with particular caution being exercised until the AIS information has been verified by other means.

18. Is AIS information stored somewhere?

The storage of AIS data ashore is a matter for individual administrations to decide. Historic AIS information is not stored on board. A VDR or Simplified VDR fulfils the role of storing data elements such as time, position, heading, speed etc.

19. Is there a limit on the length of AIS messages?

Yes. All AIS messages have a predefined structure and length, as specified in ITU-R Recommendation M.1371-1. Each AIS message occupies at least one slot of the VHF data link. This can extend to a maximum of 5 slots (as in the of short safety related text messages; which translates to approximately 158 characters of text).

20. Should AIS data be integrated on the same display as information from other sensors in a VTS?

Ideally, yes. All sensor information should be integrated on a single display. This will enhance situational awareness. The operator should have the ability to customize the display to suit the task at hand.

21. What methods are available to prevent inappropriate use of AIS?

This is a matter for national administrations to regulate. However, the protection of AIS frequencies and information should be embodied in individual national legislation.

As regards Class A shipborne mobile stations, a security mechanism is provided to detect disabling of the AIS and to prevent unauthorized alteration of input or transmitted data. Means are also provided to automatically record all periods when the AIS installation is non-functional. The most recent ten instances when the kit was non-functional for more than 15 minutes, is captured (UTC and duration) in a non-volatile memory.

Regulatory Requirements

22. Who should have AIS fitted

The international requirement for the carriage AIS as ship-borne navigational equipment on vessels is detailed within Chapter V (Safety of Navigation) Regulation 19, of the SOLAS Convention. This requires that:

“All ships of 300 gross tonnage and upwards engaged on international voyages and cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size shall be fitted with Automatic Identification System (AIS), as follows:

- *Ships constructed on or after 1 July 2002;*
- *Ships engaged on international voyages constructed before 1 July 2002;*
 - *In the case of passenger ships not later than 1 July 2003;*
 - *in the case of tankers, not later than the first survey for safety equipment* after 1 July 2003;*
 - *In the case of ships, other than passenger ships and tankers, of 50,000 gross tonnage and upward, not later than 1 July 2004;*
 - *In the case of ships, other than passenger ships and tankers, of 300 gross tonnage and upwards but less than 50,000 gross tonnage, not later than the first survey for safety equipment after 1 July 2004 or by 31 December 2004, whichever occurs earlier; * and*
 - *Ships not engaged on international voyages constructed before 1 July 2002, not later than 1 July 2008.*

** As determined at the IMO Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974: 9-13 December 2002.*

Ships to which Regulation 19 of Chapter V of SOLAS do not apply are broadly fishing vessels, pleasure craft, support vessels and inland waterway vessels. It is expected that national administrations and the operators of these vessels will quickly realise the potential of AIS and its capability to enhance the safety of navigation.

23. When is a vessel permitted to sail without operational AIS equipment?

International regulations do not prohibit a vessel to depart a port with an inoperative AIS. However, national administrations may require its operation prior to entering port. If the vessel does not fall under SOLAS, it depends on the regulations of the national maritime administration.

24. Under what circumstances can the AIS unit be switched off?

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 the ship or where security incidents are imminent, the AIS may be switched off. In port, AIS should be operated in accordance with port requirements. Oil terminals in particular, may have special requirements.

Actions of this nature should always be recorded in the ship's logbook, together with the reason for doing so. The master should restart the AIS as soon as the source of danger has disappeared. Ship's own data will be transmitted after a two minute initialisation period.

25. Are naval ships required to fit AIS?

No. Chapter V of the SOLAS Convention does not apply to them. However, national administrations may require the installation of AIS on board naval vessels. National administrations may dictate the use of AIS on board naval vessels. Many navies have outfitted their vessels with AIS. However, they may not always be transmitting AIS information (e.g. operating in a 'receive only' mode).

26. Are AIS messages limited to safety information?

Yes. ITU-R Recommendation M.1371-1 limits transmission on AIS designated channels to maritime safety related messages. In addition, IMO has permitted the exchange of seven other ancillary messages, for a test period of four years. Examples of such messages are number of persons on board, meteorological and hydrological information, indication of dangerous cargo, status of fairway etc.

27. Will AIS messaging grow to include commercial usage?

No. Commercial messages should not be transmitted on the designated AIS frequencies – channels 87B and 88B (AIS 1 and AIS 2). Further, AIS is not the ideal tool for routine commercial correspondence. It is best to use other available means

for this purpose.

28. Is AIS mandatory for inland waterways?

This is a matter for individual administrations.

Integrity/Security of AIS data

29. Is it possible to transmit fraudulent messages?

Although it is possible to generate and transmit false or misleading messages ('spoofing'), mariners are cautioned that there may be severe penalties imposed by national administrations for these actions, in accordance with national legislation.

Other uses of AIS

30. For what purposes can the stored or recorded data be used?

The data can be used for a variety of purposes, such as:

- legal evidence and accident investigation;
- sharing of data between VTS' and with national administrations;
- gathering information on the presence and pattern of traffic;
- planning of aids to navigation;
- fleet management;
- risk analysis, and
- generating statistics.

31. Can I get DGNSS corrections over the AIS link?

Yes, if the administration decides to do so. The message structure and technical approach have been defined in the IALA AIS Guidelines. It is important to note that such corrections will only correct the *internal* GNSS. Any external GNSS equipment interfaced to the AIS will not be corrected by such messages.

32. How is meteorological/hydrological information displayed?

A message structure has been adopted by IMO that allows the transmission of meteorological and hydrological information. At this time, broadcast and display of this information is a matter for manufacturers and authorities.

Reference List

- IMO Resolution MSC 74 (69). Annex 3, RECOMMENDATION ON PERFORMANCE STANDARDS FOR AN UNIVERSAL SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEMS (AIS). This standard defines the basic performance requirements for AIS

equipment, and was used by International Telecommunications Union and International Electrotechnical Commission in developing technical and test standards.

- IMO Resolution A.917(22), GUIDELINES FOR THE ONBOARD OPERATIONAL USE OF SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEMS (AIS). These 14 page 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.
- IMO Safety of Navigation Circular.227, GUIDELINES FOR THE INSTALLATION OF A SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM (AIS). These 14 page guidelines, prepared by the International Association of Lighthouse Authorities (IALA) and adopted by the International Maritime Organization (IMO), contains guidelines for manufacturers, installers, yards, suppliers and ship surveyors. It does not replace documentation supplied by the manufacturer. IMO SN Circ.245 amends these guidelines to recommend that AIS be connected through an uninterrupted power supply.
- IALA GUIDELINES ON THE AUTOMATIC IDENTIFICATION SYSTEM (AIS)
VOLUME 1:
[Part I - Operational Issues, Edition 1.3..](#)
[Part II - Technical Issues, Edition 1.1.](#)

The [International Association of Lighthouse Authorities](#) (IALA) is a non profit making international technical association. Established in 1957, it gathers together marine aids to navigation authorities, manufacturers and consultants from all parts of the world and offers them the opportunity to compare their experiences and achievements. IALA is encouraging its members to work together in a common effort to harmonize aids to navigation worldwide and to ensure that the movements of vessels are safe, expeditious and cost effective and at the same time protect the environment.

- ITU-R Recommendation M.1371-1, TECHNICAL CHARACTERISTICS FOR A UNIVERSAL SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM USING TIME DIVISION MULTIPLE ACCESS IN THE MARITIME MOBILE BAND. The International Telecommunications Union Sector for Radiocommunications formally adopted this standard in August 2001. This is the standard that defines in detail how the AIS works, and as such is the primary AIS standard. It can be [purchased electronically from ITU](#). ITU gave [IALA](#) the responsibility of maintaining technical guidelines for AIS design, and is available from them as "[IALA TECHNICAL CLARIFICATIONS ON RECOMMENDATION ITU-R M.1371-1](#)".

The [International Telecommunications Union](#) (ITU), headquartered in Geneva, Switzerland is an international organization within the [United Nations System](#) where governments and the private sector coordinate global telecom networks and services. The Union was established last century as an impartial, international organization within which governments and the private sector could work together to coordinate the operation of telecommunication networks and services and advance the development of communications technology. While the organization remains relatively unknown to the general public, ITU's work over more than one

hundred years has helped create a global communications network which now integrates a huge range of technologies, yet remains one of the most reliable man-made systems ever developed.

- IEC 61993-2 Ed.1, MARITIME NAVIGATION AND RADIOCOMMUNICATION REQUIREMENTS - AUTOMATIC IDENTIFICATION SYSTEMS (AIS) - PART 2: CLASS A SHIPBORNE EQUIPMENT OF THE UNIVERSAL AUTOMATIC IDENTIFICATION SYSTEM (AIS) - OPERATIONAL AND PERFORMANCE REQUIREMENTS, METHODS OF TEST AND REQUIRED TEST RESULTS. The [International Electrotechnical Commission](#) (IEC) formally adopted this standard in November 2001, and a published version is available from IEC. This standard defines the certification test requirements for Class A shipborne AIS equipment.

The IEC is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. These serve as a basis for national standardization and as references when drafting international tenders and contracts. Through its [members](#), the IEC promotes international cooperation on all questions of electrotechnical standardization and related matters, such as the assessment of conformity to standards, in the fields of electricity, electronics and related technologies