



Shipborne Automatic Identification System (AIS)

Fact Sheet

What is AIS?

The Shipborne Automatic Identification System (AIS) as specified by IMO, is a ship and shore based broadcast system, operating in the VHF maritime band. It is capable of sending and receiving ship information such as identity, position, course, speed, ship particulars and cargo information to and from other ships, suitably equipped aircraft and shore. It can handle over 2,000 reports per minute and updates information as often as every two seconds. It uses Self-Organising Time Division Multiple Access (SOTDMA) technology to meet this high broadcast rate and ensure stable and reliable ship-to-ship and ship-to-shore operation.

When used with an appropriate graphical display, shipboard AIS enables the provision of fast, automatic and accurate information regarding risk of collision by calculating Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) from the positional information transmitted by target vessels.

System description

Each AIS station consists of one VHF transmitter, two VHF receivers, one VHF DSC receiver, a standard marine electronic communications link and sensor systems. Timing and positional information is derived from an integral Global Navigation Satellite System (GNSS) receiver.

How it works

The AIS transponder will normally operate in an autonomous and continuous mode, regardless of whether the fitted vessel is operating on the high seas, in coastal waters or on inland waterways. As VHF reports are essentially short range, require a substantial data rate and must not suffer from interference, two VHF frequencies in the maritime mobile band are utilised. These channels are VHF channels 87B (AIS1) and 88B (AIS2), in the maritime mobile band.

Messages are packed in slots that are accurately synchronised using GNSS timing information. Each station determines its own transmission schedule (slot), based upon data link traffic history and knowledge of future actions by other stations. A position report from one AIS station fits into one of 2250 time slots established every 60 seconds. This is shown in the diagram below.

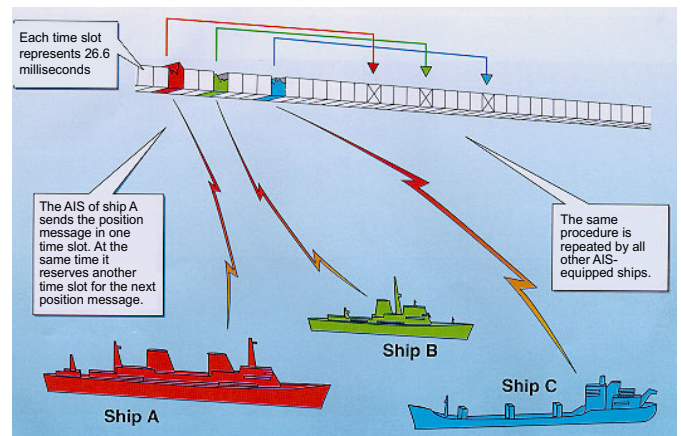


Diagram 1 - Principles of SOTDMA

AIS must be able to operate in “ship-to-ship” and “ship-to-shore” mode everywhere and at all times. Thus, the shipborne AIS is required to simultaneously support both “ship-to-shore” and “ship-to-ship” modes on two separate channels in a Vessel Traffic Services (VTS) area. To meet this requirement and mitigate the effects of radio frequency interference (since one channel may be jammed due to interference) shipborne AIS transponders are designed to operate on two frequency channels simultaneously. The AIS standard provides for automatic channel switching (channel management using DSC and frequency-agile AIS devices) and for duplex as well as simplex channels.

IMPLEMENTATION SCHEDULE

The IMO Diplomatic Conference on Maritime Security in December 2002, modified the implementation schedule for ships to which the International Safety of Life at Sea Convention applies.

- Passenger ships and tankers must have installed AIS not later than 1 July 2003.
- Ships of 50,000 gross tonnage and upwards must have installed AIS not later than 1 July 2004.

- The new rule is that 300 gross tonnage and upwards but less than 50,000 gross tonnage will be required to fit AIS not later than the first safety equipment survey after 1 July 2004 or by 31 December 2004, whichever occurs earlier.

Administrations also have scope under SOLAS Chapter V to determine to what extent the provisions of the AIS regulation will apply to:

- ships below 150 gross tonnage on all voyages; and
- ships below 500 gross tonnage not engaged on international voyages”.

Such coastal states can therefore apply the AIS requirements to include a wider range of smaller vessel categories including fishing vessels, recreational craft and port services vessels.

Functionality and capability

The IMO Performance Standard for AIS requires that the system should be capable of operating:

- In the ship-to-ship mode, to assist in collision avoidance.
- As a means for littoral States to obtain information about a ship and its cargo.
- As a VTS tool, i.e. ship-to-shore (traffic management).

This functionality is further expanded in the Performance Standard to require the capability of:

- Operating in a number of modes:
 - an “autonomous and continuous” mode for operation in all areas. This mode should be capable of being switched to/from one of the following alternate modes by a competent authority;
 - an “assigned” mode for operation in an area subject to a competent authority responsible for traffic monitoring such that the data transmission interval and/or time slots may be set remotely by that authority; and
 - a “polling” or controlled mode where the data transfer occurs in response to interrogation from a ship or competent authority.
- Providing information automatically and continuously to a competent authority and other ships, without involvement of ship’s personnel.
- Receiving and processing information from other sources, including from a competent authority and from other ships.
- Responding to high priority and safety related calls with a minimum of delay.
- Providing positional and manoeuvring information at a data rate adequate to facilitate accurate tracking by a competent authority and other ships.

Message types and formats

AIS employs the principle of using a ship’s speed and manoeuvring status as a means of governing information update rates and ensuring the appropriate levels of positional accuracy for ship tracking. This is shown in Table 1. A similar process is applied to the content of ship information messages to ensure that the data being

transferred is not encumbered with static or low priority information.

The different information types, identified as “static”, “dynamic” or “voyage related” are valid for a different time periods and thus require a different update rate.

Information included in the various message types is:

- **Static information:** *Every 6 minutes and on request*
 - MMSI;
 - IMO number (where available);
 - Call sign & name;
 - Length and beam;
 - Type of ship; and
 - Location of the position-fixing antenna on the ship (aft of bow / port or starboard of centreline).
- **Dynamic information:** *Dependant on speed and course alteration (see Table 1)*
 - Ship’s position with accuracy indication and integrity status;
 - Position time stamp (in UTC);
 - Course over ground (COG);
 - Speed over ground (SOG);
 - Heading;
 - Navigational status (e.g. at anchor, underway, aground etc. - *this is input manually*); and
 - Rate of turn (where available).
- **Voyage related information:** *Every 6 minutes, when is data amended, or on request*
 - Ship’s draught;
 - Hazardous cargo (type);
 - Destination and ETA (at masters discretion); and
 - Route plan (waypoints).
- **Short safety-related messages:**
 - Free format text message - sent as required.

Ship’s Manoeuvring Condition	Nominal Reporting Interval
Ships at anchor or moored and not moving faster than 3 knots	3 minutes
Ships at anchor or moored and moving faster than 3 knots	10 seconds
Ship 0-14 knots	10 seconds
Ship 0-14 knots and changing course	3 ^{1/3} seconds
Ship 14-23 knots	6 seconds
Ship 14-23 knots and changing course	2 seconds
Ship >23 knots	2 seconds
Ship >23 knots changing course	2 seconds

Table 1 - Reporting intervals for AIS on board SOLAS vessels

Display requirements

The danger of overloading the screen with information and the likely need for correlation between radar and AIS targets are primary considerations for any display.

Currently, ECDIS does not have the capability or the type approval to accept AIS generated data. Consequently, AIS units may display their information on radars or on a dedicated display.

Long Range Mode

An AIS long-range reporting mode is available to satisfy the IMO performance requirements and to fulfil coastal States' responsibilities. These include safety of navigation, Search and Rescue (SAR), resource exploration, environmental protection in offshore areas and Economic Exclusion Zones (EEZ).

So far, the ITU technical standards define only the interface for the long-range mode and are silent on any specification. It will therefore be up to the users and equipment manufacturers to develop the necessary sub-system to link AIS with a suitable communications bearer. INMARSAT C has been suggested as a suitable wide area communications system.

Application of AIS technology

Shipboard Applications

The functionality and benefits provided to the Officer of the Watch by AIS include:

- real time tracking of own ship;
- near instantaneous presentation of position (at DGPS accuracies), SOG, COG;
- presentation of predicted track when turning or manoeuvring;
- ETA functionality for own ship;
- record of track history;
- availability of DGPS corrections from Base Station over the SOTDMA data link;
- continuous (and autonomous) broadcast of own ships dynamic, static and voyage related data to other ships and to VTS Centres (via an AIS Base Station); and

- ability to send or receive short text message to/from other ships and shore.

AIS as an aid to navigation

A further application of AIS is its use as an aid to navigation. When positioned at a significant geographical point or danger to navigation, a special type of AIS station can provide a positive identification of the aid. In addition, this equipment can provide information and data that would, amongst other things:

- complement an existing aid to navigation, providing identity and additional information such as real tidal height and local weather to surrounding ships or back to a shore authority;
- provide the position of floating aids (mainly buoys) by transmitting an accurate position (corrected by DGNSS) to monitor if they are on station; and
- provide real-time information for performance monitoring, including state of 'health'.

Potential contribution of AIS

The AIS station, with its ability to exchange large blocks of information at high data rates, offers a new tool to enhance the safety of navigation and efficiency of shipping traffic management. In the ship-to-ship application, AIS will become an important supplement to existing navigational systems, including radar. It would be reasonable to anticipate that, *in regard to potential collision situations*, near real time target information transfer, including course and speed being made good, will result in improved decision-making and a corresponding reduction in human error.

Coastal ship reporting systems, VTS and ports will be significant beneficiaries of this wealth of near real time ship data. The AIS data transfer also provides the means for a wide range of maritime regulatory, traffic monitoring, administrative and logistical management activities that can be exploited to advantage by the maritime industry.

The following website provide useful information about AIS: www.iala-aism.org/web/pages/AIS/cadreaais.html

Further information may also be obtained from:

Australian Maritime Safety Authority
Manager Navigation Safety
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