AIS Overview

by

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Background

AIS (Automatic Identification System) is a VHF radio system which automatically communicates vessel information (vessel identity, position, speed, etc) between AIS equipped vessels.

AIS was developed as a collision avoidance tool to enable commercial vessels to 'see' each other more clearly. AIS does this by continuously transmitting a vessels identity, position, speed and course along with other relevant information to all other AIS equipped vessels and port authorities within range. AIS was made compulsory in 2002 for most large commercial ships (ships of +300 gross tonnage engaged on international voyages, cargo ships of +500 gross tonnage not engaged on international voyages and passenger ships irrespective of size).

An AIS transponder determines its own position, speed and course using a built in GPS receiver, with optional connections to other instruments like a gyrocompass. This information is combined with other navigation information entered by the operator (vessel call sign, MMSI number, size, etc.) and automatically communicated between AIS equipped vessels without any user interaction.

AIS transponders on other vessels and coast stations, and inexpensive 'receive-only' units, receive this information and use it to create a real-time graphical display of traffic in the area. A transponder can be connected to many types of chart plotters or PC charting software to overlay vessel positions on the chart. It can similarly be overlaid on many radar screens. In the simplest application, target information is displayed on a text screen.

AIS uses digital VHF signals to transmit its information. The range of the system is similar to VHF radios. These VHF radio signals can be picked up around corners, over islands and through heavy rain, giving better coverage than RADAR in some conditions or enhancing a RADAR picture when used together.

There are 3 different classes of AIS systems: Type A, B and receive-only.

- Type A: Required on IMO/SOLAS commercial vessels, this equipment includes a 12.5watt VHF transmitter (typical 20-40 mile range, mostly depending on antennae height), a dual channel receiver and either a built in GPS or port to external gps. It can transmit and receive the full complement of AIS information.

- Type B: Does not meet the SOLAS standards but does meet ISAF OSR Cat 1 & 2 requirement and has been designed to provide less expensive AIS functionality for smaller commercial vessels and pleasure vessels. This equipment also includes a VHF transmitter, a dual channel receiver and is required to have a built in GPS (and is forbidden to take external gps data). However, transmission power is restricted to 2W, giving a typical range of about 5 – 10 miles. In addition, only a subset of the possible AIS information (for instance, not destination, ETA, draft, navigational status) is transmitted at a reporting rate less than a Class A (e.g. every 30 sec. when under 14 knots, as opposed to every 10 sec. for Class A). At the time of writing (November 2009) almost all Class B units use boards from Software Radio Technology (SRT). Exceptions to this are Furuno and AMEC.

- Receive-only: Inexpensive, low power systems that only receive information from other vessels and do not transmit any information about the vessel they are installed on. Does not meet ISAF OSR Cat 1 & 2 requirement.

Benefits and Drawbacks of AIS

AIS gives you a graphic screen showing the targets around you and will display warnings if the closest point of approach of any of those targets is 'too close'. This is very much like a radar with an ARPA (Automatic Radar Plotting Aid) function. AIS has several distinct pros and cons in comparison to RADAR with ARPA:

Pros:

1. The AIS system will give you the MMSI number and description (and the call sign for type A AIS systems) of other vessels. This allows users to easily establish VHF voice contact (by name or call sign) or to initiate a DSC VHF, facilitating discussion of joint actions, rather than having to call "big ship near the Bay Bridge" and hoping the right vessel answers. The ability to know the ship's MMSI number is valuable because it allows you to send a DSC message directly to them

which will ring an alarm in the deckhouse and possibly be noticed by the watchkeeper even if the VHF volume is turned down.
2. The AIS system will 'see' better through rain squalls, over islands and around corners than recreational radar systems.
3. The AIS system draws somewhat less power than a radar system. But the difference is less than one would expect. A 2.2kW (small) radar will draw about 3.5 amps (at 12 vts) and a 4kW unit about 4 amps, while a class B will draw about 2 amps. Most radar also have 'watch' functions which scan only every 30 or 60 seconds, further reducing the energy gap. Note: the amp numbers all come from furuno equipment, and so are directly comparable.

Cons:

1. By far the biggest drawback is that AIS only shows other targets that have functional AIS systems. This means that users miss other traffic – pleasure vessels, small fishing vessels, commercial vessels with failed AIS (not that uncommon), foreign flagged vessels offshore not in compliance with the IMO requirements, large weather buoys, long line marker buoys, etc. Thus AIS is in no way a replacement or a substitute for a visual deck watch and, in low visibility, a radar watch. AIS can only be viewed as a supplement to other watch keeping. This is easy to say, but poses a difficult practical problem because modern AIS and plotter displays can be mesmerizing. They look very 'real', much more real than a RADAR screen. We know a boat that was watch keeping below in bad weather while entering a channel and their radar showed a target in front of them and their plotter/AIS did not, and they believed the plotter because it looked so much more real.
2. AIS was developed for commercial ship use. There is some concern that if thousands of pleasure vessels start transmitting AIS signals it will clutter the system to the point that it will be less useful. Near very busy harbors there can be so many targets (mostly boats at anchor or on docks) that it can be difficult to see if one is coming out the entrance without zooming way in. Recreational vessel should definitely turn their AIS off when they are not navigating.
3. AIS is a relatively complex system. It is mechanically simpler than the moving parts of a radar, but with AIS, users are depending on the other vessel having properly maintained, interfaced and functional equipment. For the system to function you must have at least one AIS transceiver and one receiver working on two different vessels. Each transceiver must have a functional multi-channel digital VHF and GPS. As the system has developed there have been both interfacing and compatibility problems. These will hopefully be minimized as the system matures.

4. The power requirements, while much lower than for full time RADAR, will still be significant for a sailboat. Furuno's specs call for 7.3 amps (12vts) for a Class A, 2 amps for a Class B, and 1.2 amps for a receive only. Running a Class B for 24hrs will require 50amp-hrs, which could easily be a 33% increase in power usage for a simple boat. And that power does not include the draw of the screen (plotter/PC or radar) necessary to display the AIS data, which could be from 1.1 amps (for a small 6" screen) to 3 amps (for a 15" screen).

There are public websites that display AIS targets along almost all the US coast and much of the world. http://www.marinetraffic.com is one. You can get a good feel for what an AIS system will do for you by looking at this. Generally the feeling is that AIS is particularly important in shipping lanes and crowded harbor approaches, where there are lots of potential crossing situations and you may need to identify and talk to one particular vessel among several in your area.

Costs and installation options

To decide whether to install AIS, consider three questions. First, decide what class AIS suits your needs by considering the following tradeoffs between the different systems:

- Comparing Class A to Class B: With a Class A you get 6 times the transmit power compared to Class B – which means 2 to 4 times more range at about 4 times the price and 4 times the electrical draw.
- Comparing Class B to receive-only – With a class B you can see other targets and they can see you, but with a receive-only you can see the other targets but they cannot see you. So it provides about half the collision avoidance capability for about half the price and electrical draw.
- The new ISAF Offshore Special Regulations for Cat 1 and 2 races require a Class B AIS. However, many US races, like the 2010 Bermuda Race, have waived this requirement.

The second question is whether you are already using a screen (plotter or PC or Radar) on board that can display the AIS signal. You will obviously save a lot of money and installation hassle if you already have something that is AIS capable.

The third question is how and where to install the required extra VHF and GPS antennae. The 'best' installation uses a separate, dedicated antenna for

each, and mounts the VHF antennae as high as possible (which increases its range). However, that can make for a more difficult and expensive installation – running new cables and mounting the two new antennae. One short cut is to install an 'antenna splitter' black box in the cable to the main VHF antenna and connect the AIS to that box. This can work well but limits AIS transmission to times when you are not talking on the VHF and adds a point of complexity which if not done correctly can potentially degrade the signal of both the vhf and AIS. It is also possible to put a splitter into the GPS antenna cable but that has proven more problematic in practice and is not recommended.

The installed costs vary tremendously based on the answers to these three questions. It can start somewhere around $1750 for a receive-only unit with antenna splitters for both antennae and using an existing AIS capable plotter, but this solution will not meet the ISAF Cat 1 requirement. A typical installation that meets the ISAF requirement – a Class B with both antenna mounted on the stern using an existing screen – might cost $3500. A SOLAS approved Class A system with the antennae installed on the first spreader and a new AIS capable multi-function screen could run $12,500.

The following gives a very rough idea of costs by component (Note: These prices assume all labor is hired, and are typical 'good brand' prices not 'lowest available' prices.):

- AIS units installed with power cables and fuses/circuit breakers but without antenna connections/mounts. Receive-only: $750, B: $1500, A: $4500. This part of the AIS system cost is expected to drop rapidly - West Marine has just introduced a class B unit for $500, without vhf cables/antennae or screen.
- Very rough costs for screens, again with power cable and fuses/circuit breakers. Existing AIS compatible screen: $0, small 6" screen: $1000, medium 12" screen: $4500
- Antennae installation. Two splitters: $1000, one splitter on the VHF and GPS antenna mounted on stern: $1500, separate VHF & GPS antennae on a spreader: $4000.

The above are for 'standard' furuno solutions. There are 'roll your own' solutions that can lower both the cost and the amp draws. It's possible to

build a transceiver system (not class B approved) for $500. And it may be possible to build a Class B system that draws only an average .5 amp.

This is a rapidly developing technology, and every six months the hardware costs come down and the features improve. The latest development is to include AIS capability inside new VHF transceivers. Some of these have a rudimentary AIS graphic display on the transceiver or remote mic.

Summary

AIS is an attractive anti-collision technology. However, it will always be merely an accessory and not a primary watch keeping tool, because unlike a visual or radar watch it does not show all targets. It is also a rapidly changing technology where the familiar tradeoff applies of ‘buy and use now’ vs. ‘buy cheaper/better later’.