How AIS can improve your navigation and safety

Is it worth getting AIS and if you have it, how best to use it on a cruising yacht? Tim Bartlett reveals all.

Cruising yachts, by and large, don’t get involved in collisions. Most of the ones we do hear of are pretty trivial – the odd bump from a misjudged approach to a marina berth, perhaps, but seldom very much more. Collisions at sea are rare, and collisions between yachts and ships are rarer still. Around the UK, there’s an average of one or two per year. The ones that make headlines by killing people are very rare indeed: the most recent was Ducro, sunk off the Isle of Wight four years ago, and the one before that was Tulips, thought to have been rammed by a cargo ship in the North Sea, in 2000. But although the risks of collision are slight, the possible consequences of a collision are so serious that it makes sense to do as much as we can to see and be seen. Until relatively recently, that hasn’t amounted to very much. In bad weather, especially, a white-hulled, white-sailed boat doesn’t stand out well against a background of white wave-tops. The passive radar reflectors sold for yachts don’t meet even the basic performance standards that were set in the last century, and our nav lights are less bright and reliable than we might like to think. Low battery voltage, long cable runs and corroded connections all have an effect, while their lenses – great for boosting intensity when they are new and the boat is upright – become less effective when they are frosted with salt or old age, or when the boat heels.

‘It does far more than just identify the ship that might be about to hit you’

As we were moored in Wolverstone Marina on the River Orwell, the AIS on our yacht showed a ship, Norderau, out of our view in Harwich Harbour. Her closest point of approach (CPA) to us would be 0.16 of a nautical mile and the time to closest point of approach (TCPA) was 22 minutes, 35 seconds. We could see that her destination would be Ipswich, not normally a significant piece of information at sea, but for us it showed the ship would pass right by the marina.

As predicted, Norderau motored past the marina 22 minutes later, en route to Ipswich Docks. If we had been under way ourselves, the CPA would have fluctuated with our own movements. The AIS data would have enabled us to predict the risk of collision and to take any necessary avoiding action.

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**Is AIS useful on a yacht?**

For us leisure yachtmen, there are a couple of far more attractive and affordable alternatives known as 'receive-only AIS' and 'AIS B'.

The first option, receive-only AIS, means receiving AIS information from ships, without transmitting your own. This is by far the cheapest AIS option, and for about the price of a pair of mid-range binoculars (from £30 to around £560), it gives us most of the collision avoidance information we could possibly want. But receive-only AIS is a bit like riding a bicycle without lights. It might, for instance, have warned Ouzer's crew that the Pride of Ilfracombe was turning towards them, but it would not have told the ferry's watchkeepers that there was a small boat in the darkness ahead of them.

The other option is AIS B. This is the equivalent of fitting lights to your bicycle and basic units cost between £600 and £1000. You become visible to commercial traffic. However, AIS B transmitters are much less powerful than those of commercial AIS. Their range is about 10 miles rather than 20. Their messages contain less information, and are transmitted at much wider intervals. While a cargo ship will broadcast once every two seconds, a leisure boat with AIS B – even a powerboat travelling at 40 knots – will transmit only once every 30 seconds. Perhaps the most significant feature of AIS B is that it doesn’t use SOTDMA to reserve transmission slots. Instead, it listens to see if anyone else is using a particular slot, and transmits only when a slot is empty. So no matter how many leisure boats are transmitting on AIS B, they can never crowd out the AIS A broadcasts from commercial ships.

**Is AIS complex to use?**

The short answer is that AIS is incredibly easy to use. As with all pieces of electronic kit, there is no substitute for familiarity with your own system, but most small craft displays present AIS information in a choice of three different forms:

- A target list, showing all the vessels in your area from which AIS information has been received.
- A text screen or data box, giving comprehensive information about one particular target that you have selected.
- A graphic display, showing a radar-like diagram of the situation.

There is also usually an alarm function, which is useful if you take the trouble to set it to suit your circumstances, but can be incredibly annoying if you don’t, sounding every few seconds in busy shipping areas. AIS is very useful in what most yachtmen would regard as open water, such as the Channel, North Sea and Celtic Sea. But our small displays easily become cluttered so, out of consideration to other users, switch off your AIS B transmissions in crowded inshore waters such as the Solent, and for your own sake, switch off any alarms.

**Tim’s expert tips continue overleaf on p 32**

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**What is AIS?**

The principle of AIS is very simple. Virtually every commercial ship broadcasts a short digital message giving details of its position, course and speed, and rate of turn, along with information such as its identity and its status under the collision regulations. Any other vessel within a radius of 20 miles or so can receive that information and display it, either as a text message, or as a graphic, or as an overlay on a chartplotter or radar.

Each AIS transmission from a ship, otherwise known as AIS A, packs a lot of data into a few milliseconds, so even though each ship updates its message every few seconds, there is plenty of time available for several hundred ships to exchange information with each other.

**Leisure yacht overload?**

Of course, it’s possible that two ships might start ‘talking’ at once, so AIS A uses a sophisticated operating protocol, called ‘self-organising time division multiple access’ (SOTDMA), to make sure that this doesn’t happen. In effect, SOTDMA means that each broadcast reserves a transmission slot only for the next broadcast. But even with 4,500 transmitting slots available per minute, the system could soon become overloaded if every boat in the Solent on a sunny summer weekend were to start broadcasting. In this respect, the fact that full-blown commercial AIS is relatively expensive at around £3,000 and the fact that it is complex to use, are an advantage. It is unlikely that more than a tiny minority of small craft will ever be fitted with it.
The basics of collision risk assessment haven’t changed since cavemen Ug and Og first discovered that if they were sitting on two separate logs floating in a bay, there was a risk they might bump into each other. It took several thousand years before the principle found its way into the collision regulatory risk (of collision) shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change.

Radar gave us a couple of new acronyms to use in collision avoidance: CPA and TCPA. CPA stands for closest point of approach, and refers to the distance between two vessels when they are as close together as they are going to get. TCPA means time to CPA. AIS can work out the CPA and TCPA for you. In fact, it’s one of AIS’s most appealing features, because the CPA is a very simple way of recognizing which ships pose a threat, and which you can safely ignore. The smaller the CPA, the greater the threat. Many displays will sort the target list with the most dangerous targets – those with the smallest CPA – at the top, and allow you to set an alarm to go off if any vessel has a smaller CPA than you have chosen. Unfortunately, small craft seldom maintain a steady course or speed, so the information received by the AIS about your own boat is likely to be fluctuating. This, in turn, means that the CPA and TCPA are likely to be fluctuating, and probably wrong. So although a small CPA is grounds for more concern than a large one, you cannot safely assume that a CPA of 200m means you will pass 200 metres clear of the approaching ship. It is best to set the CPA alarm to a generous range such as two miles, and regard it as a rough check rather than gospel. It’s the electronic equivalent of lining up an approaching ship with a quadrant. 

PHOTO: GRAHAM SNOOK

ABOVE RIGHT: At ROT L>5°, we can see the VM Displacer’s rate of turn is quite high (greater than five degrees per 30 seconds) as she navigates the channel out of Felixstowe. The bearing, shown top left, was changing accordingly.

RIGHT: Ahead of us, she turns through the channels head out to sea.

The target list may show ships posing the greatest risk at the top. If the CPA is blank, as for some of the ships above, it has already passed you. If you have spotted a potential threat, then it’s a potential lifesaver. Sometimes you don’t need AIS to judge a ship’s intentions!