

# EXPERT ON BOARD

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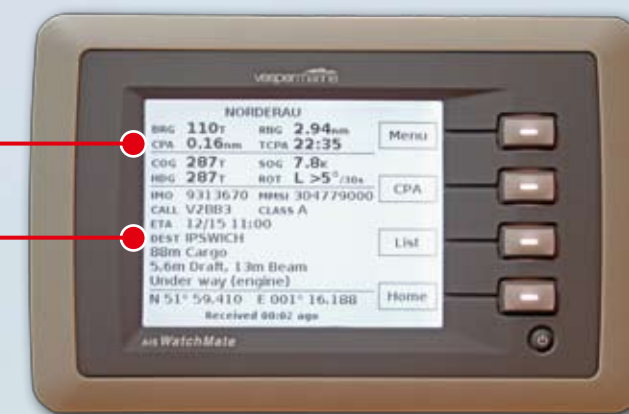
EXPERT ON BOARD

# How AIS can improve your navigation and safety



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.

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

**C**ruising yachts, by and large, don't get involved in collisions. Most of the ones we do have 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 *Ouzo*, sunk off the Isle of Wight four years ago, and the one before that was *Tuila*, 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,

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

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. A relatively new and still somewhat controversial communications system could be the answer. It's called Automatic Identification System (AIS) but it does far more than just identify the ship that might be about to hit you!

**Tim's expert tips continue on p30** →

PHOTO: GRAHAM SINDO © YAZZ

# 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 airtime 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 ready for the next broadcast.

But even with 4,500 transmitting slots available per minute, the system could soon be 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.



AIS takes the guessing out of sailing in the vicinity of shipping

PHOTOS: GRAHAM SNOOK © ZippPhoto

## How ships broadcast their AIS data

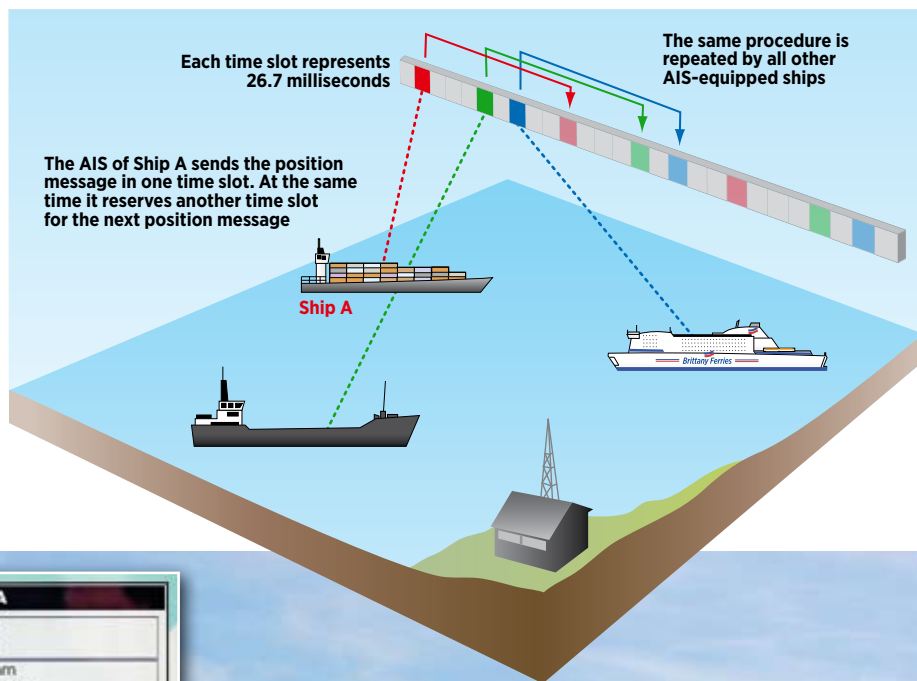


DIAGRAM: MAXINE HEATH

AIS Target Info: MSC MARTA			
Position	51°51' 379N	COG	287°M
Heading	001°36' 427E	SOG	13.3kt
ROT	+001°/min S	CPA	2.168nm
MMSI	371474000	TCPA	01h11m24s
Call sign	3ECV4	Last seen	12/10/2006
IMO No	9295385	Dest	11:36:24
Length	900ft	ETA	12/10
Beam	134ft	Status	14:00:00
Draught	13.1m	Vessel	Under Way Using Engine
		Cargo	

On our yacht's AIS, we picked up the ship MSC Marta, shown. Marta was broadcasting to other ships her position, course, call sign, rate of turn (ROT) and more

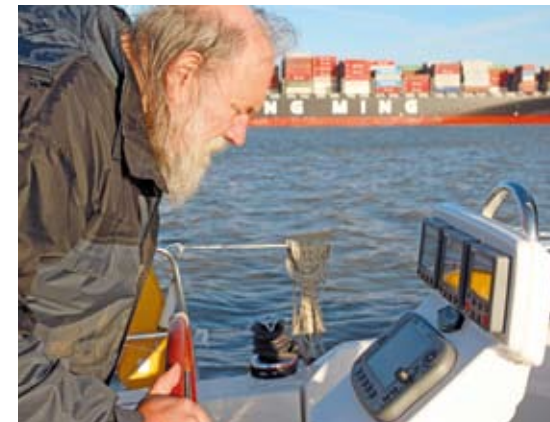


# Is AIS useful on a yacht?

For us leisure yachtsmen, 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 £120 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 Ouzo's crew that the *Pride of Bilbao* was turning towards them, but it would not have told the ferry's



Some AIS units come with an in-built screen, while others are simply antennae that can be wired or plugged into the back of a chartplotter, as we have done here

## 'For about the price of a pair of mid-range binoculars AIS gives us most of the collision avoidance information we could possibly want'

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 £1,000. 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 yachtsmen would regard as



This image from www.marinetraffic.com, a website that follows live AIS transmissions, shows the multitude of ships in the Channel alone and why it is polite for yachtsmen to switch off their own AIS B transmissions in the Solent or other crowded waters

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**

# AIS myths and legends



All commercial ships, bar a few such as chain ferries, are obliged to carry and use AIS, despite scare stories to the contrary

## Can ships filter out AIS B?

Some early AIS A transceivers were unable to receive the 'static' part of the AIS B message. So a ship's watchkeeper might be aware of the presence of a Class B transceiver, and able to read its position, course, and speed, but would not necessarily know its name. Most of the equipment affected has been updated or replaced, so the problem is fading out.

Another possible source of this myth is that some PC software – mainly intended for shore-based hobbyists – can filter out AIS B data.

## Is AIS B as powerful as AIS A?

The answer is 'no'. An AIS B transmitter has an output of just 2 watts compared with the 12.5 watts of AIS A. In practical terms, this does not matter because digital data does not require much power. So ship-to-ship AIS A typically has a range of about 50 miles. On a yacht with AIS A, the range would be about 15 miles, due to the lower height of the VHF aerial. How worried are you by a vessel 15 miles away?

## Do all ships use AIS?

The International Maritime Organisation (IMO) and governments across the world did a bad job of marketing the benefits of AIS to the shipping industry. It was seen as an imposition rather than an aid. Early displays, built down to the minimum specification, did little to help. But AIS is compulsory for most ships, and the proportion of officers who have known it from their first day on the bridge is increasing. And ships do not run down recreational craft for the fun of it. A close encounter with several thousand tons of steel in open water can certainly be unnerving, but the chances are that if the watchkeeper saw you and was required to give way, he almost certainly did so. If you didn't notice, it's probably because he altered course by five degrees when he was still six miles away!

# What is the benefit of the target list?

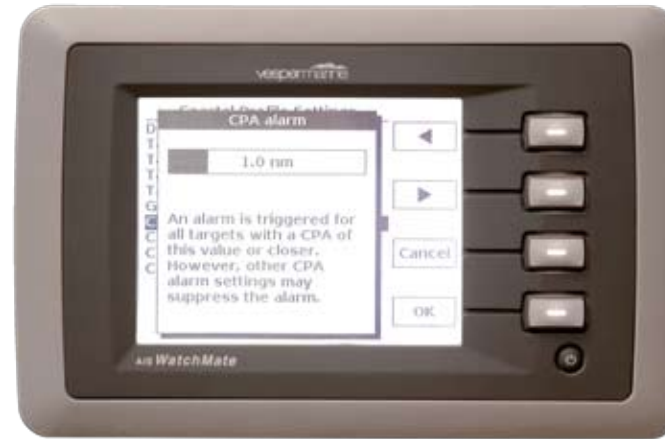
The basics of collision risk assessment haven't changed since cavemen Ug and Og first discovered that if they were sitting on two separate logs floating in a bay, there was a risk they might bump into each other. It took several thousand years before the principle found its way into the collision regulations: *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 recognising 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 guardrail stanchion.



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



Set your AIS's target alarm to a reasonable distance – and when using the CPA, bear in mind your own yacht's fluctuating speed and heading. Allow a safe margin when judging a passing distance

# What is the benefit of the text screen or data box?

One of the greatest features of AIS is its ability to give a highly accurate compass bearing of an approaching vessel. A bearing taken by AIS is better than one taken by hand-bearing compass or radar, because it doesn't swing and is measured independently of your own boat's fluctuating movements. It can also, to some extent, see 'around corners' to show other ships in places radar cannot reach.

AIS's inherent stability makes it easy to recognise very small changes of bearing with complete confidence and at long range.

Even in relatively busy areas such as the English Channel or North Sea, you're likely to be able to dismiss most of the potential threats by checking their CPAs, leaving only one or two at a time that need the more accurate assessment that can be achieved by monitoring their bearings. This is where the text screen or data box comes into its own: it allows you to concentrate on just one target and makes it easy to spot small changes of bearing. At the same time, it will also give you more information including the ship's course and rate of turn – so you will be able to see if it does alter

course.

As an example of why this is significant, imagine that you detect a ship on your port beam at a range of 12 miles. Twenty minutes later, the range has reduced to six miles, and the bearing has reduced by two degrees. If neither of you alters course or changes speed, the ship will pass half a mile astern of you, but with radar or a hand bearing compass, it would be difficult to be certain that the bearing had changed at all.

ABOVE RIGHT: At ROT  $L > 5^\circ$ , we can see the YM Uniform's rate of turn is quite high (greater than five degrees per 30 seconds) as she negotiates the channel out of Felixstowe. The bearing, shown top left, was changing accordingly  
RIGHT: Ahead of us, she turns through the buoys to head out to sea



PHOTOS: GRAHAM SNOOK / NZPhoto



PHOTO: COLIN WORKS/PIXTEL.COM

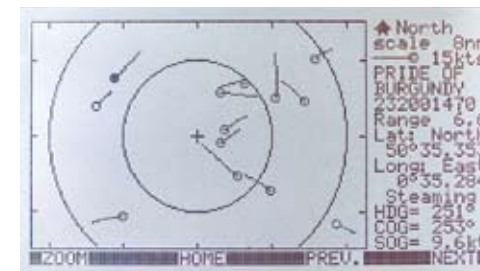
Sometimes you don't need AIS to judge a ship's intentions!

# What is the benefit of the graphic display?

Any AIS display worth its salt offers some kind of graphic display, giving a radar-like overview of the situation. It's particularly useful when crossing busy shipping lanes, because it makes it relatively easy to spot any gaps in the traffic.

Some displays, including the budget-priced Nasa AIS, go a

stage further by creating a 'tail', showing the past movement of each target, rather like the 'wakes' or 'trails' function on a radar. The significance of this is that the tail represents the target's movement relative to your own boat, rather than its course and speed, so a target that is on a steady bearing will appear to be moving straight



LEFT: The Nasa AIS is one model that shows the 'tails' of ships to indicate their wake, allowing the yachtsman to gauge a ship's movement relative to his yacht



The graphic display here shows that our friend Norderau, on the River Orwell, will pass just 0.02 of a nautical mile away from us in 18 minutes

towards the centre of the screen.

If you are using a chart plotter to display AIS data, you may have to make sure that the plotter is in 'ship centred' mode, so your own boat stays in the centre of the screen.

Don't be afraid to change the

scale of your display. You may not want the alarm going off just because your AIS has started receiving messages from a ship that is 20 miles away, but it can be very useful to take a look at the long-range picture every now and again.

# Has he seen me?

If you have spotted a potential collision risk, whether by monitoring the CPA list or by seeing that the bearing of one particular ship isn't changing, then it's likely the watchkeeper on board the target has also noticed it and may well be thinking of taking action. When he does, you may see his 'rate of turn' increase. You will certainly see his course over the ground (COG) change. It may not be a big change, and it doesn't necessarily mean he's seen you, but if it stops you altering course to go behind a ship that's already altering course to go behind you, it's a potential lifesaver.

# How do I install AIS?

The fear of extensive wiring will put many potential buyers off installing AIS. In truth, fitting AIS is remarkably easy. There are dozens of receivers and transceivers available. All of them need to be connected to a power supply, an aerial and in most cases to a compatible display, such as a chartplotter. Some, such as the Vesper WatchMate that we used, have their own display. A new unit from Digital Yacht, the iAIS, even connects wirelessly to an Apple iPhone, iPod Touch or iPad. b

To install the WatchMate, all that was necessary was to wire it into the yacht's

existing GPS using the industry standard NMEA 0183 output. We could immediately see shipping movements in our area on the built-in screen.

For Tim's full installation tips, see [www.yachtingmonthly.com](http://www.yachtingmonthly.com)

RIGHT: We also fitted the SmarterTrack ANT200, which is a single-unit AIS receiver that you can plug or wire straight into your chartplotter, radar or a PC. We mounted it on the guardrails with a



Thanks to: ■ Sailtime Ipswich, Tel: 01206 574 808, Web: [uk.sailtime.com/ipswich](http://uk.sailtime.com/ipswich) ■ Digital Yacht, Tel: 01179 554474, Web: [www.digitalyacht.co.uk](http://www.digitalyacht.co.uk) ■ Marine Electronic Services, Tel: 01179 114111, Web: [www.mesltd.co.uk](http://www.mesltd.co.uk)