
# See and be seen

The ability to transmit your boat's position at sea via AIS is a great comfort for most skippers – but you don't have to buy an expensive off-the-shelf package to get it, as David Berry explains

**Rule 5 of the Colregs (collision regulations) states: 'Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions...'.**

Automatic Identification System (AIS) is designed to be an electronic lookout. But what about transmitting your own position to other vessels? An AIS transceiver will do just that, but the 'plug-and-play' units on the market are expensive bits of kit. So I decided to investigate DIY options.

The simplest way to access AIS data and to see the targets around you is to install an AIS receiver. These devices receive the VHF signals emitted by all the targets within range and encode the data onto an NMEA stream which can be fed to a computer. My choice was the popular AIS Engine 3 from NASA Marine. These cost a little over £100 new, though there's usually a number of used ones available at about half that price.

Installing it is fairly straightforward although there are some points to note: first, in common with all AIS devices, it requires its own VHF antenna; second, it must be fed with an NMEA GPS signal – this is achieved by connecting a wire from the supplied 9-pin plug to the NMEA output of your GPS. If you have any doubts have a look at the NASA Marine manual (available online).

The other end of the supplied serial lead goes into your laptop either directly into a serial port or, more likely these days, via a

AIS transmits and receives signals allowing vessels to be aware of each other's position

David Harding/Sailing Scenes



Marinetraffic.com

**ABOVE NASA Marine's AIS receiver – the 9-pin serial lead on the right has an extra blue flylead which connects to the NMEA output of a GPS receiver. The serial lead then feeds into a laptop**

**LEFT The area around Nydri, Lefkas, on a typical August morning. All the purple targets are pleasure craft**

serial-USB converter (search online for one and make your choice).

Once the hardware is connected you need to do something with the data that's being fed to the laptop. The NASA Marine engine comes with a simple program to display the data, which includes a world map on which vessels are plotted. However, I still have the OpenCPN chartplotter running on an old laptop (old laptops tend to use less power), which allows AIS data to be easily overlaid on marine charts. The AIS can also provide the GPS info, which saves an extra connection into the laptop, but you will need to specify the shared AIS port. In OpenCPN select 'Settings' then the 'GPS' tab then 'AIS Port (Shared)' and set the NMEA Baud rate to 38400.

**OpenCPN** can be downloaded from the web although sourcing charts is something you might want to research before committing yourself. I use rather ancient CM93 charts in Greece for displaying AIS targets.

## AIS transceivers

However, I soon realised that I wanted to transmit my position as well, so I decided to upgrade and replace the NASA unit with a Class B transceiver. The use of these transceivers is on the rise. Many fleet and flotilla operators in Greece now fit transceivers as standard to all their charter yachts so they can be tracked. I sail in the Ionian and this does result in very busy target plots on the charts. Regardless, the reasons you might want to do this include collision avoidance, the ability to home in on AIS-enabled man-overboard locators (SART) or simply letting your family and friends follow your progress online.

The first thing I found when I started looking for an AIS transceiver was the range of prices. If you want to go for the top names then you have to pay the money. Lowrance, Simrad, Furuno, Garmin and Raymarine all produce Class B transceivers but the prices reflect their market status and most are around the £700 to £800 mark. If you want to go down the wifi route it's worth considering the device from Vespermarine, the XB8000 which includes a wifi transceiver for around £600.

If, like me, you want a reasonable performance at a lower cost then the options are limited. I looked first at a Matsutec which was the cheapest device I could find and came with a number of features not found on similarly priced units. However, I found it really hard to discover any information about it online and the company did not respond to any of the emails I sent requesting information. I did find an unofficial copy of the user's manual, which showed that physically interfacing to the laptop might be difficult due to the particular design of plug Matsutec use.

**'If you want to go for top names then you have to pay the money'**

The GPS dongle conveniently sits under the pelmet above the chart table and seems to have a sufficiently unrestricted view of the sky to work flawlessly

So I went looking further and found the ONWA KS200A. I bought mine from Amazon.com for about US$275, though if you don't want to buy abroad there are two distributors in this country (see panel page 67).

## Installing the hardware

Fitting the transceiver box was easy: four screws secured it to the bulkhead. The required connections were: power from the boat's supply, a GPS feed, a VHF feed and a serial connection to a laptop.

■ The power lead comes with a built-in fuse and must be attached either directly to a local power feed (mine comes off the power feed to the VHF radios) or have a suitable plug fitted.

### ABOUT THE AUTHOR

**David Berry began sailing dinghies on the local lake. Now he has the Moody Eclipse *Aderyn Glas* which he owns with his wife Ann and keeps in Preveza in Greece. David retired from his profession as senior design engineer where he was responsible for a team working on equipment for the Royal Navy. Together with Ann he has written an account of their voyage from France to Greece entitled *Time to go South*, available from Amazon. He also runs a website aimed at providing tips and tricks for part time liveaboards at seasolutions.co.uk**


**The ONWA KS200A transceiver has all the features I needed**

■ The GPS feed needs to come from a dedicated source. You can buy a GPS receiver from ONWA but I bought a GPS dongle through Amazon for a few pounds. Make sure the one you buy has a BNC connector on the end of the wire so it will plug straight into the ONWA socket. I didn't check and then had to buy an adaptor plug.

■ Any Class B transponder should have its own antenna. You can use a single radio antenna for both radio and AIS but you would need an active splitter (passive splitters don't work) with some processing that turns off the AIS feed when the radio is transmitting. But these are far more expensive than a simple VHF antenna so it's not something I considered for long. You will need to find somewhere to mount a second antenna at least 2m from the radio VHF antenna. Again, check the connection you need on the end of the


**The unit in place screwed to the bulkhead above the chart table. From the top the connections are: VHF, GPS, RS232 serial and power. You can see I needed to juggle with some adaptors for the radio and GPS feeds, luckily these are easily come by**

connecting cable which has to be a PL259 plug to mate with the box.

■ Finally, you need to connect the box to a laptop using the RS232 serial link so that it can receive the NMEA target signals and you can upload the data which you want to transmit.

As with the NASA box described earlier it should be possible to use the GPS feed into the Class B transponder as the main GPS signal for your laptop by specifying the shared AIS port and setting the NMEA Baud rate to 38400.

## Setting up the software

This, more than anything, took time to figure out. ONWA supplies a set-up program and instructions on how to use it.

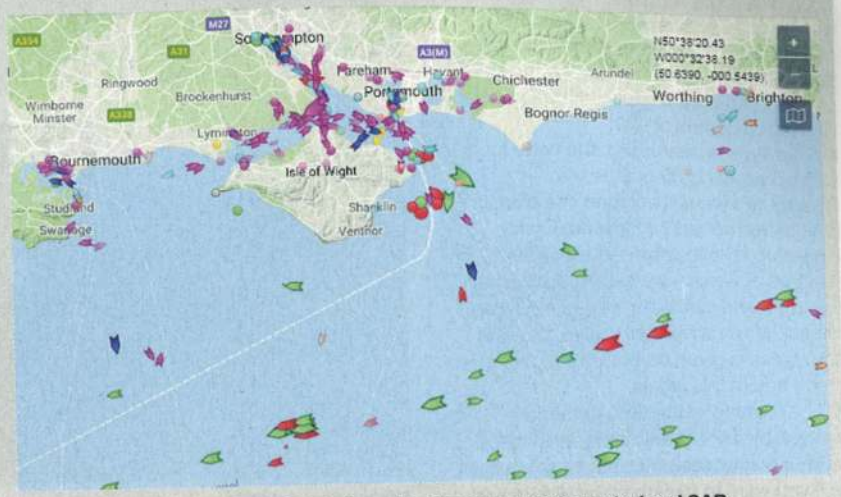
**'The MMSI number, call sign and vessel name are obvious – the rest took a bit of digging'**

## What is AIS?

**An AIS receiver can collect and display data on all the AIS transmitting craft within line-of-sight range around it. If you can feed that data to a suitable chartplotter the targets can be overlaid and updated in real time to present a moving field picture much like a radar.**

**In addition to navigational data the target data can contain MMSI, vessel name and call sign, and some details about the vessel such as whether it is a small yacht or a supertanker.**

**The problem with simply receiving this information is that the whole onus of avoidance is on you – the vessel sending the information can't see you. Which is where Class B transceivers come in.**




**Land stations also receive AIS data to enable them to provide control and SAR operations. Websites such as Marinetraffic.com enable anyone to find a particular vessel. The image shows a quiet time in the Solent! Key: red = tankers, green = cargo, blue = passenger, purple = pleasure craft**

### What is Class A and Class B?

**By international law ships over 300 tonnes must be fitted with an AIS transceiver. In addition all passenger vessels must have an AIS transceiver and these transceivers must be Class A units. Class B units are available for the likes of we yachties. The difference between them is nothing to do with the quality of the unit but the way in which they access the radio environment, the rate at which the vessel's data is updated and their radiated power.**

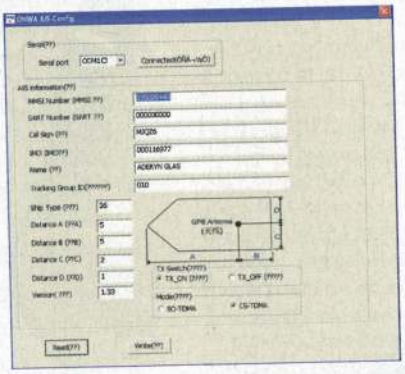
**In the case of Class A (large and fast vessels) data is transmitted every few seconds, while Class B vessels only have to transmit every few minutes. In practise the way in which the different devices (Class A or Class B) access the invisible cloud of radio signals ensures that Class A transmissions always get priority. Class A transmits at 12.5W and Class B at 2.5W so we will always see Class A targets before they see us.**

**One recent development is a hybrid Class B+ announced recently by Digital Yacht. It has the advantage of a higher output power than Class B (5W) and accesses the radio network with the same protocol as Class A (see SO-TDMA bullet point on p66). Digital Yacht seems to be aiming this development at higher speed leisure craft, which will benefit most from faster and guaranteed access to the network. Although the output power is greater, however, the distance at which the vessel can be detected is still determined by the height of the transmitting and receiving antennae above the water, due to the line-of-sight nature of VHF radio.**

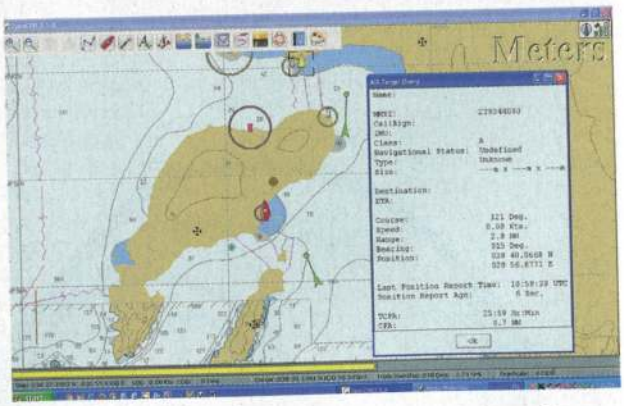
There is a series of screenshots showing how to fill in the fields and how to upload the data, but nowhere does it say what to put in the field.

I found the set-up software was very fussy about which ports it would accept from my laptop. By default the laptop wanted to use COM17 which the ONWA software simply did not recognise. The solution to this (on Windows XP) was to visit the Device Manager and change the port number (through the Advanced tab) to COM1, then the software behaved as the ONWA manual said it should. Other Windows platforms are different, but there is usually help online: search for 'port settings windows xxx' (where xxx is the Windows version you have).

The data shown on the illustration applies to *Aderyn Glas*. The MMSI number, call sign and vessel name are obvious but the rest took a bit of digging. ONWA were not able to help. Here's what I discovered:




**The ONWA setup software provides you with this set of fields. Instructions on how to use this utility program are on the disk that comes with the kit. This is the data for our yacht, *Aderyn Glas***




**OpenCPN allows you to interrogate individual targets so the target's position, course and speed are available. It will also draw a projection line to show where the target will be in the future and whether it will conflict with your own course (at this point we were in port so there is no dynamic data for *Aderyn Glas*). The green targets are ones that have full data available and the yellow target has partial data. Usually yellow targets become green after a few minutes when their transmitters have been able to send a full data sentence**

- The SART number you won't have unless you bought the SART version of the transceiver or a SART beacon device. Whether AIS SART will supersede PLBs and EPIRBs probably depends on where you sail – logically if you're crossing an ocean you'll need a satellite EPIRB or PLB, but if you're in the Solent then an AIS beacon is going to be useful.
- The IMO is another identification number seemingly used by large vessels rather than yachts. You're probably not going to have an IMO number because

you are less than 100 gross tonnes and a pleasure craft. The entry in the record has to be nine digits long and must begin with a zero, so I used the field for my SSR number which seems to work.

- The Tracking Group is something I couldn't find meaningful information on so I left it as it comes at 010.
- Ship Type is interesting: the code for sailing vessels is 36 but the US Coastguard wants everyone in a pleasure craft to use code 37 ('Pleasure Craft'). However, no-one seems to use code 37 in the area of Greece we sail in so I followed the trend and called our vessel a 'Sailing Vessel' which she undeniably is. A list of ship types is given on the webpages listed at the end of this article.
- The location of the GPS antenna is defined by the last few fields so is specific to your own vessel.
- If you want to transmit (and why would you not having spent all that money) leave the TX_ON selected.
- Last, and most important, is the mode selection. The software comes with SO-TDMA (Self Organised Time Division Multiple Access) selected and this is no good for what we want. The setting determines how the device inserts its transmissions into the wealth of AIS frequency radio traffic that surrounds it. This is how the AIS transmitter finds a slot in the traffic stream and squirts its data into it (have a look at the Wikipedia article for an explanation if you are interested in the detail). Class A transmitters use 'SO' because it essentially gives them priority access to the radio traffic, but these are reserved for the big ships that have to update their positions every few seconds. We have class B transmitters and must select CS-TDMA (Carrier Sense) where the AIS device listens for a slot and grabs the first one it finds. This limits access randomly so in a busy environment, where AIS comes into its own, Class B devices will never update their data as frequently as Class A. At present I doubt this matters much but maybe in the future it will.

It's really surprising how much research I had to do to find that the ONWA software had the wrong mode by default. When the device used the SO mode all that would show was the vessel's MMSI. As soon as I corrected the setting the full range of programmed data was transmitted


**The preferred SDR dongle. Although this cost a little more the circuitry has a guaranteed frequency accuracy that reduces the amount of tweaking necessary to centre on the AIS frequencies**

**Registration**

Because the unit is a VHF transmitter it has to be registered. This is easily done online at the OFCOM website where you can add your AIS transmitter to your ship's radio licence.


**The dongle connected to the antenna via a BNC/SMA adaptor with the OTG cable plugged into the USB side of the dongle (this is an alternative dongle to the recommended one)**

correctly to everyone including Marinetraffic.com. It was as if someone had turned the light on.

## AIS and portable navigation

AIS integration onto built-in systems seems well established. The big players provide a range of devices and smaller players, such as ONWA, are also nibbling at the market.

Yet many of us now use tablets of one flavour or another to provide navigational data through apps such as Navionics and iNavX. These are robust and accurate navigational aids so it's unfortunate that AIS data can't be easily integrated. There is no AIS support for Navionics chartplotters on any platform.

Also, it is currently impossible to overlay AIS data from a marine VHF onto any Android chartplotter. There is support for iPads provided you set up a wifi hub that can take the serial data stream from the AIS device and broadcast it as a wifi signal. This can then be received and fed to, for example, iNavX. This is a fairly costly solution, but if you want to follow this path you'll find the iNavX people very supportive, so send them an email.

But there is an interesting alternative for Android users involving Boat Beacon and a device called Software Defined Radio (SDR). Boat Beacon is an AIS receiver and transmitter app for your mobile device available for both iOS and Android platforms. It provides collision warnings, shares your boat's position via the internet and uses real-time AIS data either from the internet or from a VHF AIS receiver. It accesses the built-in GPS on your device and transmits the usual AIS information (location, speed, course and boat details) over the internet, for which it uses the cellular telephone service. This is a limitation for anyone venturing further afield, but company CEO Steve Bennett reports that only a 2G access is required, which is typically available up to 12 miles offshore. While this is not a VHF broadcast system, so you won't appear as a target on most chartplotters out on the water, it is a cost effective way of flagging your position to other Boat Beacon and Boat Watch users and Internet AIS websites such as Marine Traffic, Vessel Finder and Ship Finder.

The complete setup on an Android smartphone

**'Many of us now use tablets of one flavour or another to provide navigational data'**

For use beyond the range of 2G mobile signal, however, it is possible to receive AIS signals using a Software Defined Radio (SDR). This is a small dongle, controlled by an app, that enables you to listen to your favourite FM radio station, ships VHF, or, in our case, AIS streams. It is a stand alone radio receiver – it does not need internet access to function – and it works best on Android devices. For iOS devices you will need a wifi hub.

Firstly you need the SDR – Steve Bennett recommends one that requires a minimum of tweaking from RTL-SDR.com. The next stage is to physically connect the dongle to an antenna and to your device. The length of the antenna determines how much signal strength gets to the radio. For the AIS frequencies the antenna needs to be 0.46m ideally, however, a normal ship (or taxi) VHF antenna will be fine with only a tiny loss in performance. The dongle will have an SMA antenna connector (mobile phone type) so if you are using a ship antenna you will need an adaptor.

To connect the dongle to your Android device you need an OTG (On The Go) cable, but before that you need to check your device supports OTG. There is an app in the store that you can download and run for free which will tell you whether OTG is enabled on your device (on my Bush tablet it is, on my ageing HUDL it is not). The best OTG cables are 'Y' configuration which allows you to power your device while it is connected.

Now you need software. The Pocket Mariner website has step-by-step instructions on the installation and setup, but firstly you need the driver for the dongle. This is the app that simply makes it work and controls it: search for 'RTL SDR AIS Driver' on the Play Store. Then you need 'AIS Share' which controls the driver to monitor both AIS channels (Class A and Class B) simultaneously. Boat Beacon then displays the results. PBO

## More about Boat Beacon

**You can download Boat Beacon from the usual stores for iPhone or Android. The app requires a device (phone or tablet) with a built-in GPS and access to a cellular network. The data stream it transmits is in the order of 400 bytes (no, not Mega or Giga, just bytes) which it does once per minute so it is not a burden on your data allowance. Google or Apple maps are the default charts that the app uses to show the position of targets around you, but you have the option to buy NOAA (US), or UK and IE marine raster charts as an in-app purchase. There are currently no charts available for the Med.**

## Useful websites

- **NASA Marine nasamarine.com**
- **ONWA website: onwamarine.com**
- **IMO information: www.imo.org/en/OurWork/MSAS/Pages/IMO-identification-number-scheme.aspx**
- **AIS ship type information: api.vtexplorer.com/docs/ref-aistypes.html or www.iho.int/mtg_docs/com_wg/CSBWG/CSBWG2/CSBWG2-5.2.2-Ship_Type_Identification_Recommendations.pdf**
- **Wikipedia on AIS: wikipedia.org/wiki/Automatic_identification_system**
- **Make your own antenna: radioforeveryone.com/2013/08/ais-antenna-shootout.html**
- **iNavX support: inavx.com/support**
- **Boat Beacon: pocketmariner.com**

**ONWA suppliers**

- **Amazon USA: amazon.com**
- **ONWA Hong Kong: onwamarine.com**
- **Avesmarine (UK): avesmarine.com**
- **Mantsbrite (UK): mantsbrite.com**