

I'm in the process of upgrading my instruments. It's been expensive and has required a lot of research. Others may be in the process of planning the same thing so I thought they may find it interesting to read about my project. If you've investigated this kind of project, you have probably found that it's very expensive. One of my friends with a similar size sailboat is replacing his instruments. His budget is \$20K. I'd like to keep it well under that and would rather do it piecemeal. It can be also very complicated. My notes are below.

I originally installed a set of Nexus integrated instruments about 30 years ago. These instruments were great, well ahead of their time. They still work but are showing their age. Like many instruments of that period, displays are stand-alone panels about 4 inches square. The system uses a proprietary bus for sharing data but provides an NMEA-183 port for interfacing with external equipment such as a plotter. The standard set of sensors were included, wind, water speed/temperature, depth, and GPS. Maybe I'm old fashioned. I like having these old, dedicated displays for things like boat speed and depth. I'd like to keep the old displays as I upgrade.

Background

NMEA-183 is a now outdated standard that provides point-to-point communication. There can be only one transmitter and one receiver so you can only hook up to one device. Some folks hang a second receiver on the system but it's not designed for that and it may not be reliable. There is no way to hang a second talker. Raymarine expanded the protocol to Seataalk by adding an arbitration line to allow more than one talker. It's basically the same system however. Messages are sent in plain text with a typically three character identifier followed by corresponding data. The low baud rate limits how frequently messages can be sent, approximately 8/second. If the system sends 16 messages, it takes about two seconds to send the full set.

NMEA-2000 is a protocol that uses the CAN bus. CAN is a communication bus designed for automotive applications. If you were wondering what that OBD2 connector under your dash is, think CAN bus. The CAN bus has a significantly higher data rate, 250k BPS. Messages are sent in binary, not plain text. This makes for more efficient messages. Messages are limited by the CAN bus protocol to only eight bytes. This prevents the bus from being used for things like sending RADAR or Chartplotter images. If you have a cockpit RADAR display, the NMEA-2000 bus would be used for boat heading, speed, position and other low data-rate information but the RADAR image would need to use a different cable or wireless connection.

The Project

The whole instrument refit project started when my old JRC RADAR/Chartplotter failed about 3 years ago. I wanted something that was easy to install and didn't want to spend a whole pile of boat-units on the replacement. I settled on a Furuno DRS4W wireless unit. It uses either a dedicated Furuno display or will interface with an IPAD or IPHONE. Since I already own an IPAD, the unit turned out to be very affordable. The IPAD provides a very nice display and comes with a very fast processor. As a bonus, there is a 3rd party app, Tziboat that has a very nice chartplotter and can overlay the RADAR image by connecting wirelessly to the radome.

My IPAD needed data from my heading sensor to overlay the RADAR image on the chartplotter display. I had a Nexus heading sensor so if I needed to get that datum to the IPAD. What I needed was a NMEA-

183 to wireless adapter. I could get a dedicated gateway but I would rather get an instrument that would be of use once I complete the conversion. Vesper makes just such a unit, the XB-6000/XB-8000 transponder. The wireless gateway is included in their AIS transponder. AIS is a wireless system that sends and receives boat heading and position information on a VHF radio frequency. All larger commercial vessels are required to have it. A few private boats have it but since the transponder is expensive, most don't bother. This device receives AIS position reports and sends boat position out. I can connect it wirelessly to the RADAR unit where the IPAD can access these position reports and plot them right on the chartplotter. With this unit, I can see other AIS equipped vessels like barges under tow, right on my IPAD chartplotter. It shows the vessel and puts a thin red line on the screen to show course and speed. If this looks like it crosses my course and speed, I can take evasive action. The other vessel can see my position too. I can click on the vessel's icon and get a pop-up window with his name, size, course and speed. Very nice.

The Vesper AIS has an NMEA-183 input port. I connected my old Nexus system NMEA-183 output to the AIS transducer box input and voila. My IPAD gets heading, depth, and wind data so I can overlay the RADAR image on the IPAD display. In addition to the AIS icon mentioned above, I get a RADAR echo at the same point on my chartplotter. I can also display the added depth and wind data on my IPAD. I still like the old Nexus wind display however. As a backup, I can use my IPHONE for the same data. The screen is small but it works just as well. The Vesper AIS transducer also retransmits and receives sensor data on the NMEA-2000 bus should I ever get additional new equipment.

The story doesn't end here. Although I really like the IPAD display, it's a bit hard to see in direct sunlight. I purchased the matching Furuno display and plan to mount that in the cockpit this spring. It has a much brighter display that is visible in full sunlight. It's marketed as a fish-finder but you don't have to use the echo display if you don't fish. It provides all the features of the IPAD chartplotter including a wireless connection to the RADAR unit and RADAR overlay. I plan to upgrade my Nexus depth sounder and install the matching Furuno transducer before I launch. Depth from the fishfinder will be returned to the old Nexus displays using the Furuno NMEA-183 output. From there, it can be displayed on my old instruments if I chose.

The IPAD chart-plotter is much better than the Furuno display. It's a bit larger and the processor is much faster, and the Nobletec Tzlboat is a much better chartplotter. The Furuno RADAR accepts only two wireless connections. The Vesper AIS unit takes one and the Furuno Fishfinder takes the other. It would seem that there is no way to connect the IPAD, but there is a way around this. The Furuno RADAR has but two entries in its network DNS table. If static addresses are used, more connections can be made. I believe that Furuno did this for a reason. My guess is that the processor used in the radome can only handle two client connections because of either bandwidth or memory limitations. The Vesper AIS doesn't request RADAR images however. When connected, the RADAR unit just acts as a router to direct instrument data to requesting clients. By using a static address for the Vesper AIS connection, the remaining two dynamic connections are still available for both the IPAD and Furuno displays.

The Nexus heading display sensor I have is inaccurate. I can't properly calibrate the unit. It works but the RADAR echo overly that gets displayed is not always correct. As the boat turns, the image doesn't rotate accurately. It may be as much as ten degrees off. I purchased a new Furuno heading sensor. This would be compatible with a new Furuno autopilot if I chose to replace my ancient Autohelm 2000 at

some point. This connects to the Furuno display using the NMEA-2000 network. From there, it also gets sent to the Vesper AIS gateway where it gets forwarded to the IPAD.

The VHF radio on my boat, a GX2200, is a DSC capable radio that has an AIS receiver. While it won't transmit AIS position data, it receives it. With a very crude display, it shows the relative position of targets on its front-panel. Having more than one scary encounter with large vessels in fog, I thought this would be a great addition. As it turns out however, the screen is useless. The radio has an NMEA-183 output. With new AIS transponder, there is no need to use AIS position data from the radio. There would be value in having the DSC position reports displayed however. DSC is similar in some ways to AIS. It is used to report vessel position. Reports are not broadcast however. They are sent out to other vessels who register to receive specific position reports. You must know the MMSI number of another vessel and request his position. The exception to this is an emergency report. In an emergency, a crewmember can press a button on a DSC equipped radio and send out an emergency message with position data to all vessels within radio range. It would have been nice to connect the radio to the Vesper and have it forward DSC emergency messages to the IPAD. The transponder gateway doesn't forward DSC messages however so there was no way to get that data to my IPAD. The fixed mount Furuno display I just added has an NMEA-183 input that can accept these messages. Much like the AIS position data, emergency DSC messages will be received and displayed on my chartplotter.

The last piece of the wiring puzzle is how to get depth and water temperature from the Furuno fishfinder to the rest of the system once I install the new transducer. Getting it to the Vesper AIS unit is done by connecting the NMEA-2000 network between the two units much like was done with the heading sensor data.

Now that the equipment has been selected, I am looking at new pedestal mounts and a new guard to mount them.

Afterthoughts

The DRS4W is quite adequate for my needs. It's easy to install and remove for winter storage. It's not expensive and I like the wireless connection. It's not as sensitive as my previous RADAR however. This may be because it lacks some controls like variable gain and variable sea-clutter. Gain is fixed and sea-clutter is either on or off.

Once Furuno was selected for the RADAR, I got locked into Furuno for the rest of the system. I tried to use a Maretron heading sensor but that required a Maretron display unit to calibrate it. Some instrument manufacturers use proprietary NMEA-2000 connectors making it difficult to mix sensors. Furuno uses generic mini NMEA-2000 connectors.

Links below

<https://mytimezero.com/tz-iboat>

<https://www.furunousa.com/en/products/drs4w>

https://shop.vespermarine.com/transponder-packages/xb8000-navstation-package?utm_term=&utm_campaign=%2BUSA+%26+EU+Priority&utm_source=adwords&utm_medium=

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<https://www.furuno.com/en/products/chartplotter/GP-1971F>

[https://www.milltechmarine.com/TIMEZERO-TZ-iBoat-Vesper-XB-8000-FURUNO-1st-Watch-Wireless-
Radar-A-new-mobile-solution-for-charting-AIS-and-radar_b_30.html](https://www.milltechmarine.com/TIMEZERO-TZ-iBoat-Vesper-XB-8000-FURUNO-1st-Watch-Wireless-Radar-A-new-mobile-solution-for-charting-AIS-and-radar_b_30.html)