
# Digital Radar

*Marine Electronics Expert Alan Watson takes a look at High Definition Radars and how the technology can benefit cruising sailors.*

## Introduction

Once found only on large vessels, radar is now a common feature on small craft. The early sets were very basic but today's small craft radar is a very sophisticated piece of kit and now includes the anti- collision features (MARPA) of large sets as well as target processing software, formerly only found in military sets.

The latest range of Raymarine radars is described as "Digital high definition". This results in sharper, multi-coloured pictures providing a great deal more information that is easier to assimilate than the conventional single colour "blobs".

Even with all these aids, operator skill is still essential in order to understand - and make correct decisions based on - the information that is presented. Proper training cannot be recommended too highly.

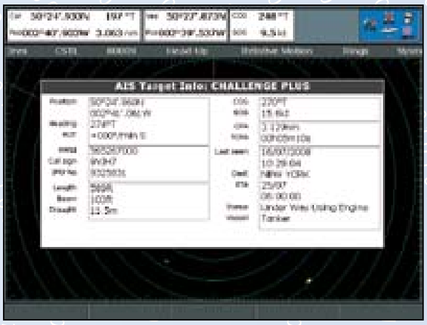
## How it works

Radar works by firing a very short burst of radio energy out from the scanner and then listening for an echo coming back. The scanner rotates, sweeping the beam around, much like the beam used in a lighthouse. By knowing which way the scanner is pointing and how long it took for the echo to return, the radar works out where the target is relative to its own position and places a spot on the screen in the correct place. How strong that echo is depends on the size, material and aspect of the target as well as on the extent that the target is masked by waves. Ideally we want the beam to be as fine as possible in the horizontal (plan) view in order to give a sharp picture and to differentiate between objects close together and to show up narrow harbour entrances. The larger the antenna, the finer the beam, the better the detail.

## What it is used for

Radar really comes into its own in poor visibility when it will identify potential collision situations and confirm that avoiding action has worked. We are used to sighting a ship on the horizon visually and seeing if its relative bearing changes; constant indicates a potential collision situation. Radar works in just the same way. If a target stays on the same relative bearing, then there is a problem. The easiest way of checking this is to put the Electronic Bearing Line (EBL) on the target and if it moves down the line then there is a potential collision situation.

This method is easy and very effective but does not give information about the course and speed of the other vessel. This can be determined either by plotting the target on a plotting sheet and then doing some calculations or, more usually these days, using the MARPA (Mini Automatic Radar Plotting Aid) facility on the radar. To use this, a "cross hair" is placed on the target and the target "Acquired". After a few moments, MARPA will give detail of the target course and speed as well as the minimum passing distance (CPA) and length of time before this happens (TCPA).




Having AIS (Automatic Information System) information overlaid on the radar is very useful as it will identify the target. Before the days of chartplotters, radar was used for pilotage and for position fixing. It's still worth knowing the techniques.

Radar is quite power-hungry and for this reason sailing vessels tend only to use it when they have to. It is essential in poor visibility but is also very useful in busy seaways to give early warning of potential collision situations. Power consumption can be reduced by using the "Timed Transmit" function which does an occasional sweep and stores the picture.

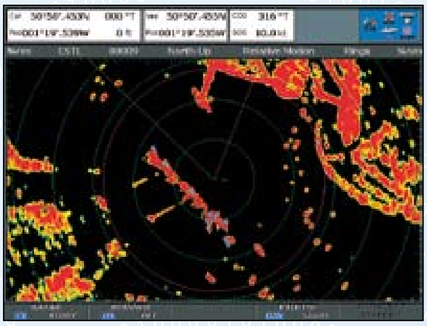
## Digital Radar

The echo coming back from a target is very weak and the radar receiver has the difficult task of detecting this and displaying it on the screen. The receiver uses special amplifiers to make sure that weak targets show up on the screen as well as strong ones. Unfortunately this means that information on how strong the echo is, and hence the nature of it, is lost. There is also the unfortunate side-effect that noise is also added and amplified thus limiting the sensitivity of the radar.

Although modern radars use digital processing, this is done fairly late on in the chain. The latest Digital High Definition sets from Raymarine turn the echo into a digital signal far earlier. This means that the echo strength information is retained and can be displayed as a range of colours, from red for a very strong target through to green for weak ones. Once the signal is digital there is no further addition of noise so the sensitivity of the radar is improved as well.

Once the echo information is in digital form, advanced processing techniques, previously only found in military radars, can be used to give performance equivalent to a conventional radar with a larger, higher powered scanner.

## Digital Radar In use



I fitted a 48-inch open array Digital HD scanner to my boat, a Nelson 42 "Trinity Star" in the spring of 2008. It was much easier to fit than previous models as the thick multicore cable from the scanner has been replaced by a thin cable that links into the network switch unit along with the DSM300 fishfinder module.

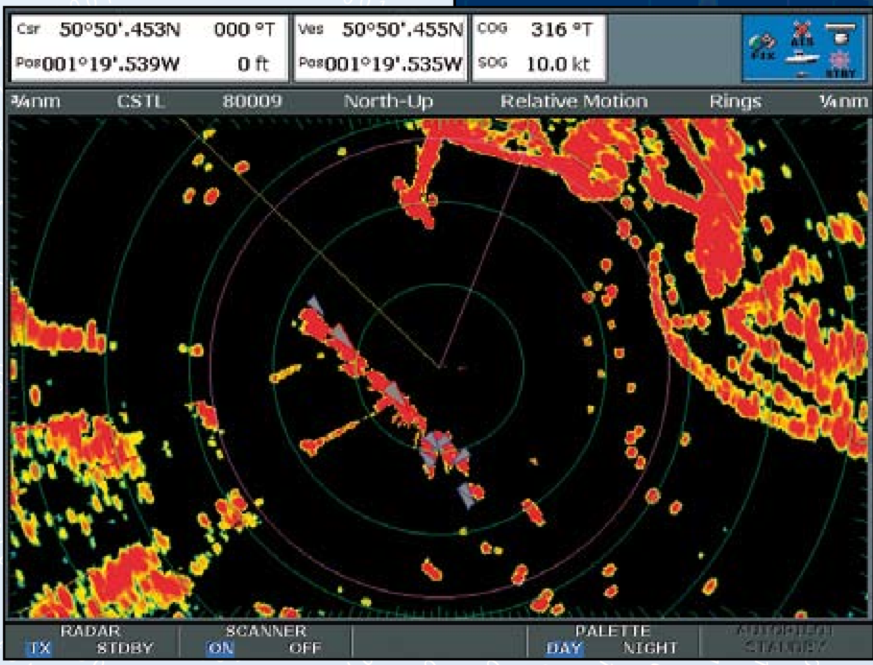
The difference was immediately apparent with a very sharp picture. The illustration shows the entrance to the Hamble with each of the marker posts showing clearly.

At sea there was a noticeable lack of sea clutter with just the targets showing up on the screen sharp and clear. Perhaps the greatest surprise was the way in which rain showed up. The image below was on passage up the coast from Dartmouth with a belt of rain ahead. The coastline is clearly defined in red, whilst the rain shows up in yellow and green.

It is immediately apparent that there are no large solid objects in the rain (they would show up in red) and application of the rain clutter confirms this.

## About the author

Alan Watson has been afloat from an early age, on small craft in his childhood and then serving as an Electronics Officer in the Merchant Navy before returning to small craft. Back ashore he combined a career in communications with boating. He is an RYA instructor/examiner for VHF (SRC), radar, diesel engines as well as the range of theory courses. He specialises in radar tuition and teaches radar for a number of sea schools including Ondeck and for Raymarine. He is frequently at sea in his own boat, a Nelson 42, "Trinity Star" as well as the preserved warship HMS Medusa.




In conclusion, the Digital HD Radar is a significant step forward in small craft radar, offering a sharper and more easily interpreted picture. The Digital HD is currently available in 48 and 72-inch open array scanners but is expected soon in 18 and 24-inch radome.

## We surveyed some ARC 2008 Skippers for their views on radar for cruising yachts and this is what we discovered.

### *How many yachts had radar?*

Of the 214 yachts entered in ARC 2008, we had 205 replies to our survey, and of these 184 yachts were fitted with radar. The most popular brand was Raymarine with 68% of the equipment fitted, followed by Furuno with 22%.

### *How often were radars used?*

The average daily usage amongst the 87 ARC skippers who responded, was 8 hours, although yachts fitted with AIS receivers tended to run these all the time. The most common usage for radars was during watch keeping at night, or when there was squall activity present.

### *Skippers Comment on their radars*

*"We loved our radar and ran it from late dusk to dawn, as particularly useful for squall spotting and tracking. AIS does not provide collision avoidance, so at night we set a 6 mile circle to warn of shipping, with a 2nd sector guard astern to spot the squalls. Not alarmed by squalls as can't make squalls a radar contact. Radar usually off by day, switched on occasionally as juice hungry."*

*"Really good, especially to detect squalls, though we found our radar to be very power hungry."*

*"Essential for dodging rain squalls. We found the effective range was around 8 nautical miles, possibly less in rough seas."*