NEED TO KNOW

Understanding eNavigation

With the phasing out of paper charts, we explain how to use predicted data from digital aids in real-world situations

The Summer 2023 issue of *RYA Magazine* covered how the RYA is preparing for the withdrawal of paper charts by the UK Hydrographic Office (UKHO) sometime after 2030.

Inevitably, skippers and navigators are increasingly using digital sources to answer basic navigational questions. Although digital aids can take the hard work out of passage planning and monitoring, and enhance accuracy, it's important to be confident that the primary sources of raw data the software is using are still accurate.

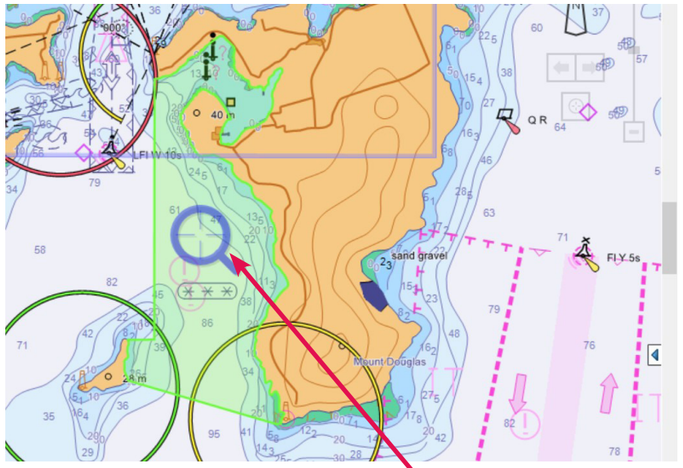
Where in the world?

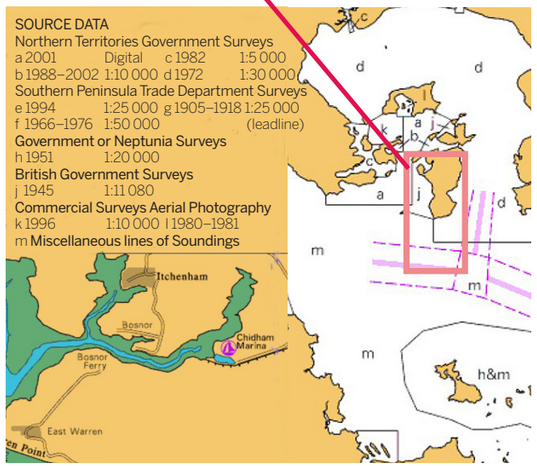
This is equally true of our horizontal position. Now we can accurately plot our position using satellites, the reliability of the electronic charts we are using becomes crucial. We need to know how accurately placed a rock might be if we are navigating to a tolerance of metres rather that hundreds of yards.

In the paper-plotting world we used pilotage at close quarters, in which case our position, relative to fixed objects and charted navigation marks, could be transferred to the chart with an accuracy that had more to do with the competence of the navigator than the skill of the hydrographer and his surveys. When far offshore, dead reckoning (DR), astro and estimated positions (EPs) are used when considerable margins for error had to be factored in and the accuracy of charts was not generally an issue.

The arrival of global navigation satellite system (GNSS) receivers ▸

Running aground is a risk if relying on digital chart data that isn't accurate.





Above and right
The green area on the above electronic chart matches section j (in the boxed area) on the paper chart to the right.

suddenly threw the accuracy of charts, and the information they were based on, into sharp focus. Augmented GNSS can now give positions accurate to less than 1m. But what happens when you transfer that position on to a chart?

The first problem was that paper charts from different countries and hydrographic offices used slightly different models for the shape of the earth – horizontal datums. The UKHO used its own datum, OSGB1936. Internationally one of the most popular was WGS84 and this was adopted as the standard for GPS navigation. Positions arrived at under the two different systems could be different to a significant degree.

In the early days of GPS, corrections had to be applied to WGS84-derived positions to be able to plot them on OSGB36-based UKHO charts. The difference wasn't great but enough to worry conscientious navigators. Today charts are published using a horizontal datum compatible with WGS84 positions.

Reliability of charts

But what if the survey on which the paper chart, and therefore the electronic chart derived from it, is itself inaccurate? In the traditional world of pilotage this doesn't generally matter. In the digital world it really does, because you may know exactly where you are in the world

> "The nature of digital means we assume eNavigation data is more accurate than it is"

but the cartographer may not have exactly identified where the land is.

In most well-travelled parts of the ocean a combination of modern hydrographic and satellite surveys has developed charts accurate enough for all practical purposes, but it's still good to know just how accurate the information is.

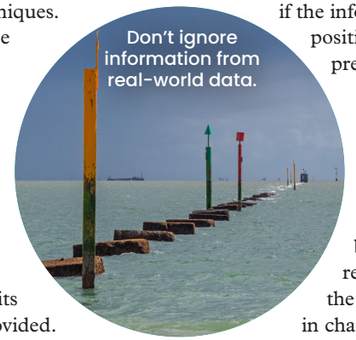
Data comparison

On a paper chart this information will be printed in a table like the one in this illustration, left. It indicates that part of the chart was drawn from a government survey dating from 1945 (line j, in the boxed area) which might be considered unreliable by modern standards. The digital vector chart above it has a note giving a zone of confidence of Grade C, meaning positional accuracy is within +/- 500m and depths up to 10m may be incorrect to +/- 2.5m. Definitely not reliable! Unfortunately, most commercially available digital charts for the leisure industry don't give a 'quality of data' measure.

A real-world example of the risks of relying on such inaccurate data was the grounding and loss of the Cork Clipper in the Java Sea due to the charted position of a reef being 0.9 miles out.

The most accurate chart surveys (graded as A1) have a positional accuracy of +/- 5m and depth accuracy of +/- 0.6m, for charted depths up to 10m. The next grade down (A2) has positional accuracy of +/- 20m and charted depths of +/- 1.2m for depths up to 10m. By the third grade (B) of six we find positional accuracy as +/- 50m. It's estimated the average accuracy of chart data is +/- 60m.

In this digital world there is still a need to make use of all pilotage and planning techniques. The only difference is that in most cases we'll be using these to check the digital information. When entering a small harbour, you would be foolish not to use the buoyage, transits or sector lights provided. Then, even if the electronic chart survey is out by 500m, you'll be safe if you stay in the channel.



At close quarters it's your position relative to dangers or safe areas that's important, not an electronically derived lat/long position. This is essentially what pilotage is all about. It'll remain just as important for the future as a means of monitoring the accuracy if the information and position you are being presented with.

'Digital First' navigation means using electronics for more efficient passage planning and execution, but we must remember that the human is always in charge.

If the electronics aren't providing what you need, switch to plan 'B' – which, at the moment, is still paper charts.

Tides case study

Consider online tidal information. In the pre-digital age, there were trusted sources of printed information. With the advance of digital options there's a greater choice, but it can be difficult to find the source of the data in apps or websites.

The best source for accurate predictions, in the UK, is the UKHO who are the national entity chosen to provide this information for the safety of shipping.

We looked up the predicted height for Southampton Water at 14:30 on the UKHO's page *easytide.admiralty.co.uk* and it's 3.8m. But the reading from the actual tidal height gauge is 4.0m. Other sources showed 4.0m, 3.9m and 3.8m. You may think that the source matching the actual height is more accurate so choose that as your trusted source. But if you repeat this exercise over time, you may find other sources are more accurate on different occasions. That's because there's always a difference between predicted and actual tidal data. No matter how clever a tidal height prediction is there can still be a variance of 20–30cm due to changes in air pressure alone. Adding the effect of wind direction and strength can affect tidal height by up to 0.9m, in the form of storm surges.

Predicted vs real data

The nature of the digital world encourages our assumption that eNavigation data is more accurate, but in reality the difference between predicted and actual data still exists. So, in considering whether a tidal prediction of 3.8m, 3.9m or 4.0m is most accurate, we wouldn't advise navigating to 20cm of accuracy when crossing shallows or passing under bridges anyway.

It's worth checking the reliability of the source of data on digital tidal prediction sites and compare predicted heights and rates of flow with actual data. But the real world differs from what can be predicted, and a good navigator will always build in a margin of safety based on their experience and judgement.