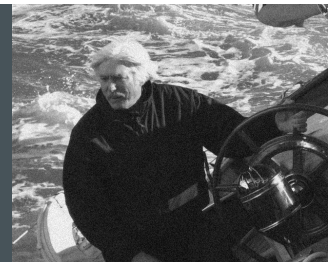
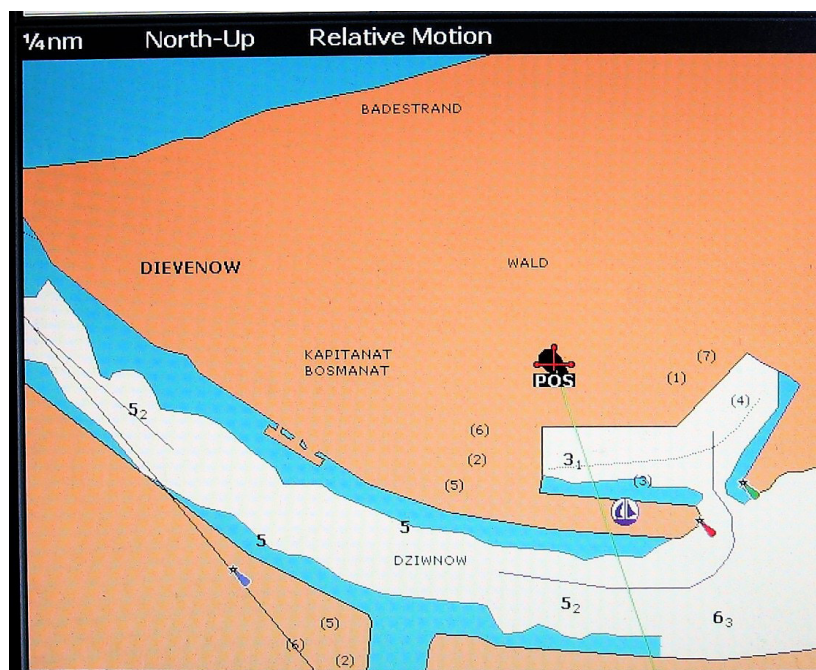


Tom Cunliffe



A Question of Datum

GPS aided and abetted by the chart plotter fixes our position to the nearest metre – or does it?



The vessel has just sailed in but the position shows her ashore

I wrote this article over twenty years ago when GPS navigation was just becoming the accepted norm. In those days, the GPS fix was generally plotted on a paper chart, the modern electronic chart plotter being virtually unheard of. By no means all charts in common use then had been converted from their national horizontal datums to the World Geodetic System 1984 (WGS84) datum now universally accepted as the gold standard and to which GPS positions default. At first sight, then, what follows might seem to be of historic interest only, but wait! Anomalies occur to this day caused by datum shifts in electronic charts that have somehow given the correction people the slip and are presented as Gospel Truth to the luckless navigator.

In my own recent history I have several times seen a plotter reading out a boat's position that is palpable nonsense - as in the introductory illustration. My colleague Bob Bradfield, surveyor of the uncannily accurate Antares raster charts of Scotland, reported datum shifts on Admiralty charts issued in his neck of the woods only a year or two ago.

Forewarned is forearmed. There are two sorts of position in the modern world. The first is where the boat actually is, in terms of headlands, lighthouses, buoys, rocks and shoals. The second is a precise grid read-out, expressed in terms of latitude and longitude, perhaps to three places of decimals representing 2 metres accuracy. So long as the two coincide, all is well under the heaven. When they do not, which one would you rather believe?

Maybe this old article isn't just of academic interest after all...



1999

Last week, I was up-grading my book, *The Complete Yachtmaster*, a regular requirement these days to keep pace with changes in the electronic navigation department. Four years ago, at the time of the previous edition, many of us were still coming to terms with universally affordable GPS and its promise of accuracy to a nominal 100 metres. Now, suddenly, it's Differential GPS (DGPS) telling us where we are to a metre or two for far less outlay of funds than I once laid down for my sextant.

'Wonderful,' we could be forgiven for thinking. 'That's the end of our position problems for ever.' How is it, then, that when I originally tested my old 'steam driven' GPS, it consistently gave a position on the wrong side of the Beaulieu River from my mooring, and the best part of a cable (200 yards) downstream from the charted position of the jetty I could toss a biscuit onto from my cockpit?

There are, as most of us know, various grades of precision available from GPS as administered by the US armed forces. For non-military users, the signals are down-graded so that we can generally hope for something around 50 metres, though it is often better. If we hook up the DGPS we're achieving cruise missile accuracy, yet it can still show my boat stuffed up on Exbury Marches instead swimming in the deep water of Lord Montagu's tidal estate.

The GPS has no doubt about its exact whereabouts; but I know where I am too, because I can see the jetty a couple of boats' lengths off my bowsprit. In fact, we're both correct, and if this sounds like nonsense, remember the apocryphal Irishman who, when asked the way to Ballymena, announced that, 'if he were the traveller, he wouldn't start from here.' The solution to this conundrum is really one of relativity.

If you define my position in terms of how far I am from the pontoon, my eyeball definition of truth is irrefutable, yet were you to fix me by reference to an arbitrary global grid such as latitude and longitude, the fix would also rest beyond argument so long as there was no jetty to present an alternative.

One of the unexpected side-effects of hyper-accurate navigation is the sudden relevance of the way minimal departures from a geometrically perfect lat-long grid are brought about by 'geodetic' irregularities in the shape of the planet. People have known for at least a hundred and fifty years that the globe is not the smooth spheroid we'd like to imagine. Even its mean sea levels are messed about by local variations in gravity. The technicalities need not concern us, but the result is that cartographers in various parts of the globe have had to set up their lat/long lines from slightly different datum points.

None of this mattered in the days when sailors simply didn't notice if a position derived from astronomical observations was a few cables adrift when they started fixing from shore objects after landfall. Nobody cared, even if they knew. Such considerations were the equivalent of asking Dan Dare for a course to steer for Mars.

Today, the same fixing instrument that gives me my position to a boat's length on my mooring will do the same in mid-Atlantic or sailing under Sydney Harbour Bridge, but because it is working in lat/long, its position will only be correct on my chart so long as the chart is drawn to the same geodetic datum as the one the computer is working to. If it isn't, as mine of the Beaulieu River was not, an error of 100 to 150 metres can typically result in home waters. For the record, the discrepancy can be far greater than this, with several miles being not uncommon in the remoter reaches of the Pacific Ocean.

The good news is that issues of datum need present no challenge, so long as we deal with them properly. All modern charts indicate their datum, generally somewhere amongst the title information. Britain generally uses the 'Ordnance Survey of Great Britain 1936' (OSGB36), Europe the 'European Datum 1950', (ED50), while US charts mostly favour the 'World Geodetic System 1984' (WGS84).

If you look carefully, you'll see that the top chart is drawn to Indian datum



Modern GPS receivers are willing to read out in a multiple choice of datums. All I had to do, therefore, was to deselect WGS84 and enter OSGB36. 'Bingo!' My GPS position hopped instantly from where I knew I wasn't, to a point so close to my mooring that my pencil couldn't define the difference.

Both GPS positions offer a form of the truth, but in a world infested with real-time rocks and shoals, the only one you're interested in is the one that stacks up with your working chart.

Look up the chart's datum and enter it into your GPS, otherwise all hopes of precise navigation are in vain. Mind you, I seemed to enjoy my sailing well enough when my sextant gave me a position that was good to a couple for miles...



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@tomcunliffesailor



@cunliffetom



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