

There was considerable scratching of heads at the RE photo survey office. Recalling that the survey depended on a triangulation of Napoleon's day, it was eventually determined that the three provinces, the Pas de Calais, Pas de Havre and Pas de Cherbourg had been surveyed at different times and that very little trouble had been taken to connect them together. The consequence was that there was a 'bend' in the north of France between the three triangulations.

Later, and just after the War, the RE resurveyed the triangulations across the north of Europe, particularly the connections from one country to the next. For example, the connection between Denmark and Sweden was some 195 metres adrift. Around that time, it was estimated that, with poor connections between countries, the distance from London to Istanbul might be half a mile out, and much the same for London to Gibraltar.

A year or two after the War the first Thames Decca chain came into use by Merchant Shipping. It was extended, with rather a poor angle of cut, to the six-cable-wide deep water channel along the Dutch coast and was giving errors of up to four cables. The charts had not been corrected for the latest RE's geodetic data which was, at that time, still classified.

KEY WORDS

1. History.
2. Military navigation.
3. Maps and charts.

The ECDIS Paradox

L'Ingénieur Général J. N. Pasquay

(*Directeur du Service Hydrographique et Océanographique de la Marine, Paris*)

In the January issue of the *Journal of Navigation*,¹ Dr F. Bianchetti explains what he calls 'The ECDIS Paradox'. As Hydrographer, I want to make my comments on the author's affirmations and proposals.

1. The main points about Dr F. Bianchetti's EPNIS concept can be summed up as follows:

1.1 Current paper charts are inadequate for the safe navigation of large ships. Consequently ECDIS, defined as equivalent to paper charts, is also inadequate.

1.2 Definition by an authority of the 'usable space' for a given category of ships and loading conditions. Navigation to be conducted in this 'usable space' only.

1.3 Setting up all rules and procedural instructions for the voyage in the usable space.

1.4 Automatic warnings in case of any violation of the rules and instructions.

1.5 The paper chart to be maintained as a back-up of last resort.

2. My remarks will address these points in order:

Point 1.1 The reasons given by the author for the inadequacy of the present paper charts are not convincing.

Depth figures, depth contours, wrecks, etc. shown on charts are not purely 'scientific/geographic' information. This information is indispensable for SOLAS class ships, both for route planning and for the voyage itself. When for any reason the ship must deviate from her planned route the mariner needs to have this information immediately for his safety.

'Positional clues' are indispensable even if the ship is fitted with an integrated radio-navigation system (Loran-C, GPS, etc.). The position derived from such systems must be

checked by taking bearings of landmarks or by radar observations. Some accidents have occurred in recent years for the very reason that the navigator had put a blind faith in his modern positioning system and had not made any check.

But there are major shortcomings in the present charts which the author did not mention. Charts and other nautical publications are not fully reliable. In coastal areas surveyed before the advent of radio-positioning systems, the positional error in sight of the shore may reach 100 metres. Beyond the optical range, on the continental shelf, we may expect errors of 300 metres and even more. Inaccuracy of the soundings shown on the chart can reach one metre. Tidal predictions have their own limitations, specially off-shore in such areas as the English Channel and the North Sea. But the main risk comes from the shoals and wrecks which have been missed during the survey, especially when the survey is at small scale in areas of irregular bottom.

All this requires the adoption of a reasonable underkeel allowance and a convenient horizontal safety margin (the planned route must give a wide berth from submerged hazards shown on the chart). Another shortcoming of the paper-chart may be the 'surfeit of information' in certain areas which makes reading difficult.

Point 1.2 The concept of 'usable space' according to ship and loading conditions is interesting but not easy to apply. 'Usable space' is no longer defined by the captain but by an authority. There is a shift in responsibility. Furthermore, I doubt that a captain would be willing to navigate without any depth information on the screen of his EPNIS. Having no indication on the depth under the keel is blind navigation.

I see other difficulties with *time-dependent usable space* and no depth information on EPNIS. Some fairways cannot be used when the height of the tide is under a certain value. The mariner needs both depth information and tidal predictions to decide the passage in such fairways. Fairways with limited depth which are practicable in fair weather may be unsafe in rough seas given the pitch and heave of large ships which change underkeel clearance.

If a new shoal or a new wreck are discovered in a 'safe draught area' the usable space has to be redefined by 'the authority'. Such a procedure requires more time than the introduction of a new hazard to navigation on ECDIS through notices to mariners.

If for any reason a ship has to steer outside the 'usable space', or drifts outside, the mariner must have depth information on the screen which shows his position. The last minute use of a paper chart on which he must first plot his position may not prevent him from grounding.

Points 1.3 and 1.4 I have no objections on these points.

Point 1.5 Of course, given the concept of EPNIS and its limited content, a paper chart would be indispensable. But, as already stated, the last minute use of the paper chart is dangerous.

3. There is clearly a need for an ECDIS on which the mariner will find information on his nautical environment (depth figures for shoals and wrecks, depth contours, landmarks, buoys, etc.), information which is usually displayed on paper charts. However, ECDIS has two main advantages:

- (i) continuously showing on the screen the position of 'own ship' and her nautical environment
- (ii) the possibility of selective display of information which is actually needed at a given time (no surfeit of information).

But this does not mean that ECDIS should be 'the paper chart in electronic form'. For the purpose of ECDIS, some ideas expressed by Dr Bianchetti may certainly be useful.

4. CONCLUSION. A hydrographer is obviously, but not exclusively, concerned with cartographic aspects. He is also interested in navigational and regulatory issues.

It is indeed useful for the captain of a ship to be able to define usable space and have its limits drawn on ECDIS. But permanently available depth information on the screen is essential for the safety of navigation (both inside and outside usable space). Landmarks and other features on the screen allow positional checks.

More than 10 years ago, hydrographic offices started comprehensive surveys (sidescan sonars and multibeam echosounders may give 100 percent coverage of the bottom) on major sea lanes and approaches to harbours. In areas of comprehensive surveys the navigator has the guarantee that no danger to navigation has escaped detection. Those areas will help greatly to define usable space in the years to come. Route planning inside usable space belongs to the captain.

Having, as proposed by Dr Bianchetti, an EPNIS on one side and a paper chart on another, will not improve safety to navigation. The screen should display a synthesis of positional, navigational and hydrographical information with the possibility of selection. This is indeed the true ECDIS, which is far more than a chart in electronic form.

At the end of his paper, Dr Bianchetti is clearly asking for reactions from the readers. I would be grateful if you could publish my opinion in your *Journal*. I must add that I have already had an exchange of letters with the author when a similar paper was published in 1993 in *Lighthouse*, the journal of the Canadian Hydrographic Association.

REFERENCE

¹ Bianchetti, F. (1994). The ECDIS paradox: a controversial view on navigation, freedom and safety at sea. *This Journal*, 47, 20.

KEY WORDS

1. Charts.
2. Electronic charts.
3. Display of information.

'The Nautical Almanac's Faulty Calculator Instructions'

From Alastair D. Macfadyen

I read Mike Pepperday's article¹ in the January 1994 edition of the *Journal* with some interest, particularly the part at the foot of page 91, where he queries the need to set $X = 1$ if X is outside the range -1 to $+1$.

A number of years ago, having purchased a small programmable calculator, I decided to write a program for astro sight reduction as an exercise. When the program was complete, I tried a few test examples, all of which compared favourably with the corresponding answers from NP401. On a whim, I input a set of data which corresponded to a meridian altitude sight; that is, the GHA was the same as the DR longitude. The program ran for a while and then crashed.

For the uninitiated in computer jargon, 'crash' means that the program stops working properly (or even at all). This is usually because it has got into some irrecoverable situation, or sometimes that it has been asked to do the impossible. This latter, one might think, would be avoided by any competent programmer, but there are occasions when it can happen by unique combinations of operating conditions.

It was this latter situation that caused my problem: the program performed a series of trigonometric calculations and then worked out the inverse cosine of the result.