

All Plain Sailing

from E. G. R. Taylor

'THE Earth is an ellipsoid', says the *Admiralty Navigation Manual* firmly, although in a later volume the expression is softened to 'approximately ellipsoidal'. For in fact, as was implied by Captain Topley,* the exact shape of the Earth is not yet known. Nevertheless, for nautical purposes it appears sound teaching practice to consider it a perfect sphere and then explain the departures of the nautical mile or minute of arc from its mean value. Nor need one quarrel with the Manual's statement that 'to regard certain small triangles as plane is not to disregard the initial decision to regard the Earth as a sphere'. But the writer next indulges in an historical aside which cannot be allowed to pass. 'This assumption (he says) gives rise to the expression *plane sailing*, which is popularly referred to as if *plane* were spelt *plain* and the sailing were free from difficulty'. But this is to put the cart before the horse. 'Plain sailing' was the original term, and it was only sophisticated into 'plane sailing' during the eighteenth century by teachers of navigation among whom John Robertson was the chief. Robertson was master at the Mathematical School of Christ's Hospital towards the middle of the century, and afterwards taught at the Portsmouth Naval College, finally becoming Librarian to the Royal Society. His *Elements of Navigation* was considered authoritative and ran into many editions, a later master at the Hospital, James Wilson, prefixing to it a Dissertation on the history of navigation which was also accepted as definitive. It is in this volume that we read: 'Plane sailing is the art of navigating a ship upon principles deduced from the notion of the Earth's being an extended Plane. On this supposition the meridians are esteemed as parallel right lines . . .', and the author goes on to what he terms the Plane Chart, with its equally-spaced meridians. There is little doubt that his passage is the source of the theory taught to modern sailors that 'Plain Chart' is a corruption of 'Plane Chart', while the latter was drawn by people who believed the Earth was flat. Actually we have only to go back a generation from Robertson to find an almost identical description of the chart—actually an equal-spaced conventional cylindrical projection of the sphere—but with the addition of the words 'The rectangle formed by these meridians and parallels they (i.e. mariners) call the Plain Chart'. This was said in 1714 by John Wilson, a teacher in Edinburgh.

The suggestion that the plain chart was drawn on the 'notion' that the Earth was a plane is also easily disposed of when we consider the history of the chart. A chart is first met with in the thirteenth century, at a time when lectures on the Earth as a sphere formed part of the University curriculum, and when no educated person, indeed, supposed it flat. But in fact this was irrelevant. The chart was drawn as a plan is drawn, by plotting observed bearings and distances, and the question of relating it to the surface of the globe never arose. The situation only changed when, during the Great Age of Discovery the sailing method of 'running down the latitude' was introduced, and when moreover,

* Topley, H. (1955). Navigating on the spheroid. This *Journal* (Forum), 8, 369.

charts covered a much wider area than the Mediterranean Sea. Mathematicians now pointed out that the chart, with its network of rhumb lines, ignored the convergence of the meridians, but masters and pilots continued to draw their sketch-maps in what appeared the 'common-sense' fashion and handed them over to the chart-makers. Meridians in fact were not drawn on their charts, and they found reason enough for errors and contradictions in undetected leeway and the variation of the needle. Meanwhile the chart-makers improved matters as best they could by using a correct scale along some middle latitude of the chart. Not until 1599, when Edward Wright published a table of meridional parts, was there any real solution of the problem. Chart-makers could now draw a Mercator network, and two types of charts had to be distinguished, the old and the new. Ralph Handson, who taught sailing to adventurers on the North-west Passage discovery, while Wright lectured for the East India Company, used the terms 'true chart' and 'ordinary chart', but occasionally substituted the word 'plain' for 'ordinary', using it in exactly the same sense. He published his *Nautical Questions* in 1614. A contemporary teacher was the famous mathematician Edmund Gunter. He, too, compared the results of sailing by the two charts, using the terms common sea-chart, ordinary chart and plain chart indifferently for the older one, as opposed to Mercator's chart. It is of course, true, that the word 'plain' was also used at that period where 'plane' was intended, but there is no suggestion in this case that the 'plain chart' was other than the straightforward, uncomplicated chart. Gunter used the word 'plane' only when writing of dials in the same work, and in reference to the various superficies on which the hours were projected. It is not without interest to note that the instrument which at that period was called the 'plain table' has also been transformed today into the 'plane-table'. And here the evidence is unequivocal. Originally the geometrical table, it was called 'plain', writes the surveyor, Aaron Rathborne in 1616, 'for the playneness and perspicuitie thereof, and of his easie use in practice'. And this exactly applied to the old sea-chart, or plain chart.

The suggestion that the name arose from a notion that the Earth was flat is first to be found in *The Doctrine of Plaine and Sphericall Triangles*, a work written by another and younger teacher of navigation, Richard Norwood, in 1631. Norwood had taught himself mathematics as a youth, when he went to sea, but had made his reputation as a land surveyor. The ambiguous word 'plain' here appears in the very title of his book, for to most people the 'right-lined triangle' was a plain one in the sense of being ordinary, while later on Norwood uses the heading 'Questions of sayling by the playne or ordinary sea-chart', although the two words were synonymous. But he goes on to say 'although the ground of the projection of the ordinary sea-chart (is) false (supposing the Earth and sea to be a plaine superficies), we will not wholly neglect it', and concludes: 'Thus much of the plain chart, which as it has this commoditie that it is most easie, so it has some discommodities intollerable'.

It became customary (for he was read for over a century) to use Norwood's terms for the three kinds of sailing, i.e. Plain, Mercator, and Great Circle, and John Harris who compiled the *Lexicon Technicum* in the days of Queen Anne borrows almost his very words. Plain sailing 'tho' notoriously false in itself, supposing the Earth and Sea to be a Plain Flat' is yet 'very easy and useful for short voyages'. The word 'plane' here appears in several short definitions but is applied neither to sailing nor to chart. In a cross-reference from 'planes' to

'dyalling', however, we find it there spelt 'plaines', and this characteristic indifference of the age to consistent spelling has helped to confuse the issue. But it is John Robertson who first unambiguously defines Plane Sailing and speaks of 'principles' from which it was 'deduced'. To those hard-bitten mariners who still continued to prefer the old-fashioned chart, it was because it was simple, plain, and straightforward: 'all plain sailing' in fact.

Early Pole Star Tables

from Lieutenant-Commander D. W. Waters, R.N.

I THINK Professor Taylor and I are at cross-purposes in our discussion of the influence of scientists upon the art of navigation before the nineteenth century.* Dr. Freiesleben expressed the view that until 1800, 'when our technical age began', there was a big gap between what interested scientists and what the seaman could understand and apply, that men of science were too remote from practical requirements.¹ The implication was that scientists were not concerned with seamen's problems nor seamen with obtaining scientific help. I pointed out that whatever the situation in the eighteenth century might have been, in the sixteenth and early seventeenth centuries improvements of a radical nature were made by scientists, working with and for seamen, in the means of practising the art of navigation, in particular by English scientists working in the latter part of the period under the aegis of Gresham College and the East India Company.² This is historical fact, little known perhaps, but none the less fact. I certainly never intended it to be understood that the seaman-scientist relationship peculiar to this period and resulting in such important developments typified, to use Professor Taylor's expression, 'the degree of cooperation between sailor and scientist prior to the nineteenth century'. I intended it to be understood as being descriptive of the situation or relationship peculiar to the period in which it occurred, roughly 1550-1640 and more particularly 1598-1637.

As the period during which this relationship existed closed over a century and a half before the French Revolution began I felt it desirable to draw attention to it for several reasons. First, because its occurrence invalidates Dr. Freiesleben's generalization about the scientific gap; secondly, because it suggests that 'the approach between seamen and scientists' in the nineteenth century was, in fact, a *rapprochement* and not an unprecedented *liaison*; thirdly, because the seaman-scientist relationship of the sixteenth and early seventeenth centuries had a very distinct effect upon navigation as practised up to that time. But this fruitful cooperation between scientists and seamen in the sixteenth and early seventeenth centuries is a subject quite distinct from that of 'complaints through the centuries . . . about the way that masters clung to outmoded and faulty practices' cited by Professor Taylor.³ However I would like to pursue this latter subject a little further as it is of current interest.

In the last resort navigation is a personal accomplishment. No matter what knowledge and aids may be available to a particular navigator their practical

* Taylor, E. G. R. (1955). Early pole star tables (Forum): *This Journal* 8, 288.