

from S. Ratcliffe

Mr Blanchard's paper on Air Navigation Systems in the September 1991 issue of this *Journal* may give the impression that the Decca Flight Log was the first flight-desk map display to convert hyperbolic coordinates to a fair approximation to lat-long coordinates.

A map display driven from GEE was built at TRE (Telecommunications Research Establishment) and demonstrated to PICA0 (Provisional International Civil Aviation Organization) in 1946. The coordinate conversion problem was considerably simplified by representing the hyperbolae in polar coordinates having the master station at the origin. This technique was apparently independently devised by Decca, whose display was undoubtedly better engineered than TRE's experimental model, which made extensive use of Meccano and was unlikely, in that form, to appeal to aviators.

Incidentally, reference 11 in Mr Blanchard's paper should be to Volume 32, No. 1 – not Volume 43, as was printed.

#### KEY WORDS

1. History.
2. Air navigation.
3. Radio navigation.
4. Hyperbolic systems.

## 'Navigation: Land, Sea, Air and Space'

Myron Kayton

I want to thank Mr J. E. D. Williams for the historical additions he suggested in his review of my book. *Navigation: Land, Sea, Air and Space* (Vol. 44, p. 283). I especially thank him for his information about the existence of four-course ranges outside the United States in the 1940s and for his information about Mercator's recalculation of the east-west extent of the Mediterranean Sea.

Though I am not a maritime historian, I think my statement that the method of lunar distances was little used at sea is correct because of the complexity of the calculations for the navigators of the time. In future editions, I will distinguish two periods. In the period prior to the chronometer, longitude was measured by dead-reckoning, sometimes indirectly by observing magnetic variation using the pelorus in conjunction with magvar charts such as Halley's. Ships were steered by constant-latitude sailing, requiring only a coarse knowledge of longitude. In the second period, during the transition to chronometers from about 1800 to 1900, Bowditch's simplified calculations of lunar distances were used by educated navigators.

Mr Williams chided me for confining 'navigation' to the measurement of position and velocity. He pointed out that our pre-electronic colleagues used the term for measuring position, conning their ships, and other means of 'conducting a craft from one place to another'. He objected to my 'flouting... the unanimity of centuries'. He should be aware that, among practitioners of electronic navigation, which I have been for 35 years, 'navigation' is universally used for the determination of position/velocity, 'guidance'

for the determination of steering instructions, and 'attitude control' for the process of conning the vehicle. This distinction has arisen because of increasing specialization and differentiation of sensors and software.

Mr Williams saw my book as 'an anthology of 39 re-prints'. I would have preferred him to have seen it as a series of introductions illustrated by selected reprints. A few of them are indeed more than ten years old, but they still represent the best work I know on the subjects.

I will include Mr Williams's suggestions in any later edition and thank him for them.