FORUM

'Longitude Without Time'

D. H. Sadler

THE Executive Secretary has referred to me two notes on this subject, one by M. S. Dixon and the other by Bruno Ortlepp. Although submitted independently, and at different times, they clearly relate not only to the same technique, but also to the same set of observations.

Now much has been recently written on the determination of time, and thus of longitude, from observations of the Moon's altitude (for example, in this *Journal*, reference can be made to the notes by Francis Chichester, **19**, 106, 1966; D. H. Sadler, **19**, 107, 1966; J. J. Evans, **19**, 392, 1966; and to the comments in the article by H.M. Nautical Almanac Office in **19**, 133 and 152, 1966) and it should be unnecessary to restate either the principle or the practical disadvantages of this method.

However, the principle must be briefly restated in order to describe the techniques suggested in these notes. The Moon revolves about the Earth once a month and so moves relatively to the stars (and the Sun and planets); simultaneous (or adjusted to be simultaneous) observations of the altitudes of stars (or of the Sun and planets) and the Moon will only be consistent at one particular instant of G.M.T., which then determines the longitude.

The authors of the two notes suggest using the following technique:

(a) first determining a 'fix' from the observed altitudes of several stars; since G.M.T. is assumed not to be known, this gives L.H.A. Aries and latitude corresponding to the time of

(b) an observed altitude of the Moon;

(c) the corresponding Moon position line is plotted, relative to the 'fix', for two assumed values of G.M.T.;

(d) the true value of G.M.T. (and thus the longitude) is found, by interpolation, to be that time at which the Moon position line passes through the star 'fix'.

M. S. Dixon suggests that this 'interpolation' is best achieved by observing stars in nearly the same bearing (or reciprocal bearing) as the Moon; then the lines joining the points of intersection (in the two plots) of the Moon position line with a star position line will intersect at the true fix, giving G.M.T. and longitude. This is, of course, unnecessary, as is pointed out by Bruno Ortlepp; any pair of parallel lines through the two 'fixes' will serve the same purpose, and the stars can be chosen (and are clearly best chosen) to provide the optimum cuts for the fix. Whatever technique of interpolation is used it must be equivalent (and cannot be superior) to simply finding the G.M.T. at which the intercept from the fix to the Moon position line is zero.

Both authors give diagrams showing a fix obtained at N. 24° 13′, W. 66° 17′ at G.M.T. $09^h\ 44^m$ on 1967 August 29 using observations of *Elnath*, *Castor*,

Hamel, *Rigel* and the Moon. No details of the observations are given, but the cocked hat for the star fix is too small to be seen, and the error of the true fix, as compared with an independent determination, is indicated as less than 3 miles. If the error in the star fix, resolved perpendicular to the Moon position line is e' and the error of the observed altitude of the Moon (including the effects of personal error, sextant error, dip, refraction and altitude corrections) is E', then the error in the true fix (at the time of observation) is 27 $(e+E)$ minutes of arc. The actual error of less than 3 minutes of arc suggests that $e+E$ are together not more than 0'·1; this implies a truly remarkable set of observations, and it would be interesting to have details of the actual sextant readings and times.

It is good to know that so many navigators have been experimenting with the old methods of finding longitude without time; let them not be disheartened if they cannot match the accuracy above—if they can get longitude within 10, 15 or even 20 miles they should be well content.

Captain Flinders

R. St. J. Fancourt

The publication of Admiral Ritchie's E. G. R. Taylor Lecture (*Journal*, 20, 1) brings into perspective so many names familiar to the practising navigator; indeed the achievements of these great men are surveyed and charted with great clarity. Captain Flinders receives mention only in passing and his initial surveys of the greater part of Australia do not appear on the summary diagram. Yet, in other contexts, his ship, his mentor and his kinsmen all obtain special mention.

Of the nineteenth-century explorers, Flinders must surely be the first in time as *Investigator* sailed under his command in 1801 for a three-year cruise which ended in Flinders' imprisonment by the French. The *Investigator* was, I suggest, the old *Xenophon* and was converted for survey and exploration purposes at the instance of Sir Joseph Banks. The vessel was provided by the Navy Board and the change of name occurred in 1799 for the purpose of Matthew Flinders' great voyage. This followed upon his earlier achievements in surveying in *Tom Thumb* and *Cumberland*.

It may be worth mentioning that on the *Investigator* voyage Franklin, who was a cousin of Flinders, was a subordinate officer and it may well have been Flinders' example that moulded the character of the subsequently famous Sir John Franklin. Was it a coincidence that Bass, Flinders, Banks and Franklin were all Lincolnshire men from the region of Spilsby?

Can any members complete the following link—Bligh and Banks sailed under Cook, Flinders sailed under Bligh, and Franklin sailed under Flinders?

Rear Admiral G. S. Ritchie (Hydrographer of the Navy) writes:

Flinders' earliest surveys were made at the end of the eighteenth century, whilst those of *Investigator* (formerly H.M.S. *Xenophon* and renamed for Flinders'