FORUM

The Metrication of Navigation

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In his original paper, Turner [1] drew attention to the proliferation of units used to measure the same dimension. Granted the decision to adopt a metric system in this country, there could be no question but that SI was the correct one to adopt. It is not precisely the same as the traditional metric system at present in use on the Continent, but it seemed likely that it would become so, and, as the British Standards Institution [2] pointed out, one change from Imperial to SI was far more logical than a change to traditional metric, followed by a change to SI.

SI avoids all the difficulties mentioned by Turner, but, as B.S.I. state (and Turner indeed infers in his statement that 'speed (will be measured) in kilometres/hour'), we cannot abandon the hour and the day, which SI would require to be expressed as 86·4 kiloseconds and 31·4496 megaseconds respectively. Angle, too, presents a problem. The radian is quite irreplaceable in some mathematical fields but one cannot express a right angle or a complete revolution as a rational figure in radians. Horscroft [3] revives the metric grade of one-hundredth of a right angle, but, as he points out, this logically demands a new basis for time measurement. However, even these two departures could be tolerated, although they lead to proliferation of units in the sense that one has a choice of measuring, for example, volume flow in cubic metres per second (the SI unit), per minute or per hour, or speed in kilometres per second (SI), per hour or per day.

More recently, however, further inroads have been made upon the simplicity of SI. In the two most recent publications from B.S.I., [4, 5] we find that both the International nautical mile and the knot are retained and indeed it seems difficult to support their abolition if the degree is to be kept. What is more surprising is the retention, for tonnage measurements, of the ton of 100 cubic feet (it is explained that international agreement might be required to change both this and the nautical mile) and the introduction of the bar.

Concerning the latter, one can argue a very good case on the grounds of usage in the field of meteorology, and it is a multiple of the SI unit for pressure, the newton per square metre. Unfortunately, it violates an SI principle of simplicity, in that the recognized multiples are the kilonewton per square metre and meganewton per square metre. For pressure measurements, we shall therefore have a choice of the following:

Basic unit	1 N/m^2
millibar	10^2 N/m^2
kilonewton per square metre	10^3 N/m^2
bar	10^5 N/m^2
meganewton per square metre	10^6 N/m^2
hectobar	10^7 N/m^2

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This latter is already used in British Standard publications for stresses in metallic materials.

An excellent illustration of the possible difficulties here is afforded by the recent publication of tables of properties of fluids. Whilst both use SI units, Mayhew and Rogers[6], published at Oxford, use the bar, whilst, at Cambridge, Haywood[7] uses the kilonewton and meganewton per square metre.

However good the reasons for so doing, I feel we have now gone a long way from the original simple concept of SI. I think a study of the British Standard Institution marine publication, particularly the recommended units and area of use shown in Appendix B2, will demonstrate how rapidly units are in fact proliferating.

REFERENCES

1 Ronald Turner (1968). The metrication of navigation. This *Journal*, 21, 81.

2 British Standards Institution (1965). *The use of SI units* (PD 5686: December, 1965).

3 A. D. Horscroft (1968). The metrication of navigation. This *Journal*, 21, 511.

4 British Standards Institution (1969). *The use of SI units* (PD 5686: January, 1969).

5 British Standards Institution (1969). *The adoption of the metric system in the marine industry*: report, basic programme and guide (PD 6430: January, 1969).

from A. F. Whillock

MAY I be allowed to comment in general terms on the recent articles regarding the metrication of navigation (Vol. 21, Nos. 1 & 3).

The essential features of any system of measurement are fitness for its purpose and comprehension for the users. As Captain Cotter stresses, navigation is essentially a question of angular measurement, and the division of the circle by Babylonian astronomers has a precise relation to its geometry which cannot be improved upon by a primitive finger-based arrangement.

The development of the means whereby we communicate with our environment has always been handicapped by an unfortunate biological accident. Decimal division is far from being a special property of time, space or matter and its use inhibits our conceptions of these entities. It is an ill-considered extension of the denary groupings adequate enough for counting sheep or slaves.

Metric units themselves, particularly in their latest SI form, are either too large or too small for ordinary use. Measurement is not the province of any one subject but should allow each interest to select a range and arrangement best suited to its needs. Our naturally evolved system has ample potential in this respect.

To abandon a divisible range of measures for little more than administrative convenience is a retrograde step. Under the influence of computer techniques a new generation now passing through school is familiar with the use of the symbols 10 to represent any radix. Not until they are accepted for a numbering scale capable of expressing the basic scientific and practical proportions as concisely as possible will the age-old contradiction between counting and measuring be finally resolved.