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KEY WORDS

1. Voyage planning. 2. Military navigation.

'Navigation with km and gon'

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In an article published in the September 1991 edition of this *Journal*,[1] S. Stubert put forward an interesting and informative case in support of the universal adoption of the gon (grade) for the measurement of angle and arc in navigation. However, while the gon is a decimal unit, and while it may be said that in general the introduction of simpler decimal measurements into navigation should be beneficial, this would only be the case if the gon system were the best possible. I am unable to agree that it is, for the four main reasons which follow.

First, the gon system does not meet the criteria for good decimal measurement which were outlined in an article entitled 'A decimal system of navigation' which was published in the May 1986 edition of *Navigation News*. Of particular note is the view that a good decimal system for measuring any kind of quantity should be based on one unit only and not on three as in the gon system, namely the circle, the right angle and the gon. Also, it may be noted that the division of the gon into a hundred parts or centigons does not conform with the preference of the International Metric System (SI) for decimal submultiples with prefixes such as milli- and micro- and not for submultiples prefixed by centi-, except in special circumstances.

Secondly, it would seem to be wrong to even consider the suitability of a decimal system for measuring angle and arc for the purposes of navigation without at the same time considering the suitability of a complementary system of measuring time, because the measurement of angle, arc and time are all closely related in navigation. It would appear from Stubert's article that the gon system lacks a complementary decimal time-measuring system, and it is doubtful that one developed on similar lines to the gon involving a division of the day into quarters, followed by a division of each quarter-day into decimal fractions, would find general acceptance.

Thirdly, what is considered to be a better decimal system for measuring angle and arc has been developed and described in the article in *Navigation News* mentioned above. It is based on the circle itself, which is divided into decimal submultiples which are convenient and which conform with SI preferences such as the millicircle and microcircle. This is complemented by a decimal system of measuring time based on the day, which is likewise divided into convenient and preferred SI decimal submultiples such as the milliday and microday. This simple and coherent decimal system of measuring time, angle and arc, which has been called for brevity the 'decimal-day-circle' or DDC system offers, in theory at least, a superior measuring system to any other which is based purely on the decimalization of some non-decimal portion of a circle, like the gon or the degree, and lacks a complementary and coherent decimal time-measuring system.

Fourthly, when major changes are being made to a measuring system the opportunity should not be lost to correct at the same time any less than ideal other aspects of the system. For this reason, it is considered that Stubert's intention to retain the convention of measuring longitude east and west of the meridian of Greenwich should not be followed. In the *Navigation News* article which has previously been mentioned, a simpler, more logical and coherent system is described in which measurements of time, longitude and time(hour)-angle are all measured from east to west from the 'date line' in the units of the DDC system.

It is accepted that more research needs to be done before it can be decided whether the DDC system is the best possible in practice as well as in theory. However, it is thought that some progress has been made towards acceptance of the system because of two developments. First was the manufacture in 1985 of a milliday clock which, as its name implies, divided the day into a thousand parts. It was found to be not only a practical alternative to the traditional non-decimal half-day, hour and minute clock but also to be superior in several respects. A description of the milliday clock is contained in an article in the January/February 1988 edition of *Navigation News*. The second development was gleaned from a book review written by J. Amson in the March/April 1987 issue of *Navigation News*, from which it appeared that the concept of measuring time in decimals of a day for the purposes of navigation was not new or novel but had been used for some time. The review was called *Computerized Almanacs* and explained that in order to use the official publications which are listed as references 2, 3 and 4, the time had first to be converted from the traditional non-decimal time-measuring system into days and decimals of a day. Surely, therefore, the next logical and beneficial step would be for radio time signals to be issued, and on-board chronometers to read, in decimal-day time, in this way avoiding the need for, and dangers of, converting from one system to another.

Finally, one envisages that official almanacs, whether designed for use with computers or not, would be changed to decimal-circle measurement of angle and arc, thus bringing them fully into line with the DDC system of measurement.

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KEY WORDS

1. Terminology. 2. Display of information. 3. Units.