International Hydrographic Review, Monaco, LIX (1), January 1982

FIFTY YEARS AGO...

The significance of development of sonic depth finders and echo sounders in the late 1920s is highlighted in the following paper which appeared in the *Hydrographic Review* of May 1932.

"THE PHYSICAL BASIS OF MODERN HYDROGRAPHIC SURVEYING

by A.L. SHALOWITZ
Cartographic Engineer, U.S. Coast and Geodetic Survey.
A paper read before the National Academy of Sciences, April 28, 1931

Hydrographic surveying, as it is now practised in the Coast and Geodetic Survey, is so radically different from what it was a few years ago that to fully grasp the significance of the new order, one must be acquainted with the limitations and shortcomings of the old methods. To say that it is now possible to conduct major surveying operations in areas hitherto excluded because of the prohibitive cost involved, is only giving one side of the picture. It is now actually possible to survey such areas with an accuracy of detail sufficient to meet the needs not only of the navigator, but of the scientific investigator as well. This remarkable advance has come about principally through the application of the physical sciences, particularly in the field of acoustics, to the problems of the hydrographic engineer.

The possibility of utilizing sound as a means of measuring ocean depths and distances was recognised long before; but no *practical method* had been evolved for meeting the exacting demands of modern hydrographic surveys. The scientific investigations made during the war were quickly focused on peace-time needs by the leading maritime nations of the world, resulting in this country in the development of the sonic depth finder by the United States Navy and the fathometer by the Submarine Signal Corporation.

While other countries have developed other types of echo-sounding machines, the underlying principle of all is the same : a constant speed motor measures the elapsed time between the outgoing and incoming signals, a graduated dial calibrated for a standard velocity of the sound translates this elapsed time into depth units. But since velocity varies with the temperature, salinity and pressure of the water, these variables must first be determined before an accurate sounding can be obtained.

In the Coast and Geodetic Survey temperatures and salinities are measured at well-distributed points over the area to be surveyed, and the mean velocities within any range of depths are ascertained from theoretical velocity tables, to within very narrow limits.

The advantages of this method of sounding over former methods, particularly in deep water, are too well established to be heralded at this late date. Suffice it to say that not only is it possible to obtain a continuous profile of the ocean floor, but a vessel can now, while steaming along at full speed, obtain a sounding of 2 000 fathoms in five seconds, which formerly took from 40 to 50 minutes."

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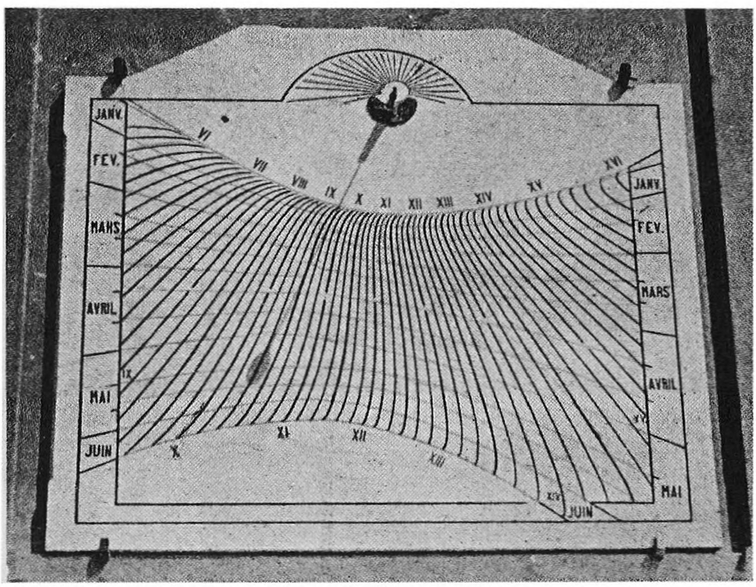
The sun-dial described in the *Hydrographic Review* of May 1932 continues to serve its function even today.

"THE SUN-DIAL OF THE INTERNATIONAL HYDROGRAPHIC BUREAU

The new building erected by the Princely Government on the Quai de Plaisance of the Port of Monaco, and set apart for the use of the International Hydrographic Bureau, has a façade bathed in sunlight at all seasons and, as it lies in a practically East-West direction, particularly well suited to bear a sun-dial.



The sun-dial of the IHB.

Although, in these days, this instrument has fallen somewhat into disuetude, it seemed to the author to be suitable to make a drawing of a dial which might decorate the façade.

Further, he attempted to modernise the drawing of the dial so that it would not show local apparent time, but the legal time in use in the Principality, automatically changing to summer-time on the proper dates, in such a manner that the time indicated by the sun-dial would agree with that shown by the town clocks.

This agreement is, naturally, realised only to the extent that engraving on marble will allow; the differences from clock time amount to about one minute and hardly exceed two minutes at the oblique extremes of the dial.

The drawing of the dial was presented to H.S.H. Prince Louis II of Monaco who kindly provided the funds necessary for its construction and installation."

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Uniform system of buoyage was obviously a matter of great concern even in the 1930s – this is evident from the following report published in the *Hydrographic Review* of May 1932.

" UNIFICATION OF BUOYAGE

The question of the unification of buoyage has already caused much controversy. The International Hydrographic Bureau has kept its Members informed as to the state of the question and of the progress made towards unification at the various International Conferences.

Articles have been published dealing with this subject in the *Hydrographic Review*, particularly in Volumes III, No. I, November 1925 and III, No. 2, July 1926, and reports have been made in the *International Hydrographic Bulletin*. In *International Hydrographic Bulletin* No. XI, November 1930, page 261, a concise report is given of the Buoyage Conference which was held in Lisbon in October, 1930.

The Organisation for Communications and Transit of the League of Nations published an official report of this in Document No. C.163.M.58, 1931, VIII, dated 28 February 1931.

At this Conference, new proposals were put forward by Great Britain regarding the unification of buoyage, as follows:

In 1883, when the Uniform System of Buoyage for the then United Kingdom was drawn up, which, except for the provisions regarding the marking of wrecks, is substantially still in force, lighted buoys were comparatively few and unimportant, and consequently there is no mention whatever of their characteristics in the Regulations comprising that system. The recommendations of the International Maritime Conference, held at Washington in 1889, are similarly silent regarding the characteristics of lighted buoys, and even the recommendations of the International Maritime Conference held at St. Petersburg in 1912 (at which Great Britain was not represented) only dealt with them by inference. Lighted buoys, however, have now become such an integral part of the buoyage of all coasts and harbours that, speaking generally, it may be said that the present tendency is to substitute lighted for unlighted buoys in all positions of importance. This being the case, it is now impossible, or at least illogical, to lay down rules regarding the day characters of buoys without reference to their night characters.

Starting from that standpoint, the responsible lighting and buoyage authorities of the United Kingdom have carefully considered upon what principles any new uniform system of buoyage, which, if it were accepted internationally, they would be prepared to adopt nationally, must be based.

After profound study of the question, the conclusions reached by the Authorities of the United Kingdom on the subject of lighting and buoyage are given in detail in an explanatory memorandum, embodied in document No. C.978.M.543, 1931, VIII, issued by the Organisation for Communications and Transit of the League of Nations on 1 December 1931."

That portion of this document, which describes the arrangement of the uniform system of lateral buoyage which was the subject of the British Government's Proposal at Lisbon, is then given in detail.

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How important it is to select an appropriate chart datum is clearly indicated in a book review which appeared in the *Hydrographic Review* of May 1932.

"CHART DATUMS

by H.A. MARMER

(8vo, 45 pages, 20 fig. – Special Publication No. 170 of the U.S. Coast and Geodetic Survey - U.S. Gov. Printing Office, Washington, 1930. Price: 10 Cents).

Corresponding to a recent distribution of information concerning chart datums, this new Publication is a summary of and, at the same time, a complement to its predecessors on the same subject, namely: – Special Publication No. 135 of the U.S. Coast and Geodetic Survey, *Tidal Datum Planes*, 1927, which was reviewed in *Hydrographic Review*, Vol. VI, No. 2 of November 1929, p. 230, and an article entitled *Hydrographic Datum Planes* published by the author in *Hydrographic Review*, Vol. VI, No. 1 of May 1929, p. 37. The need for and the different kinds of datum planes are explained in the introduction. The first chapter includes general remarks on tidal phenomena, on different regimes and irregularities of tides. The second chapter contains a study of the fluctuations in low water level, its daily, monthly, yearly and long-period variations.

The author then passes to a study of the principal chart datums and the considerations which govern the choice of such datums: mean low water, lower low water; Spring low water; monthly lowest low water; harmonic tide plane.

Another chapter deals with the determination of datum planes and yet another with the changes in these datums and with various assumptions concerning coastal stability and the constancy of tidal phenomena; the book concludes by emphasizing the necessity for the maintenance of bench marks."

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The use of harmonic constants for determination of the establishment of the port was an often-discussed topic in the early 1930s. The following book review was published in the *Hydrographic Review* of May 1932.

"GUIDA PRATICA PER L'ANALISI ARMONICA DELLE MAREE (PRACTICAL GUIDE FOR THE HARMONIC ANALYSIS OF TIDES)

(Published by the *Commissione Mareografica Italiana*. Venice, 1926, 27 pages, tables).

This pamphlet, which is published by the Italian Tidal Committee, is an abridged practical guide for the harmonic analysis of tides.

Definitions of the terms relating to harmonic analysis of tides are given at the beginning of the pamphlet and are followed by an explanation of the method of preparing tables of hourly ordinates, when a sufficiently long set of tidal observations has been made, from which the elements for the calculation of each tide may be taken.

Then the pamphlet passes on to the calculation of each constituent wave by means of previously obtained data and by using the numbers in Table I, which indicate the times at which the particular days of each constituent begin for the different waves. The numbers given in Table II of the pamphlet show the differences between the ordinary hours and the constituent hours exceeding half-an-hour, and for which the hour ordinate should be reproduced for K tides or skipped for the other constituents. By means of these Tables the amplitude of each constituent and then the lag are obtained and the phase lag is deduced from the Tables published in the treatise by FROCHOT: *Le Calcul des Marées* (The Calculation of Tides), Paris, 1906, which permit the value of the astronomical argument to be found. Finally, the pamphlet exposes the method of calculating the establishment of the port by means of harmonic constants for semi-diurnal tides."

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The advent of range-finders using optical instruments made great impact on geodetic work in the early 1930s. The following book review was published in the *Hydrographic Review* of May 1932.

« TRAITÉ DE TÉLÉMÉTRIE
(TREATISE OF RANGE-FINDING)

by P. MAZUIR

(Octavo, 329 pages; 15 plates; *Éditions de la Revue d'Optique Théorique et Instrumentale*, 3 & 5, boulevard Pasteur, Paris (15^{e}), 1931).

Progress in range-finding originated in the necessity of getting over the difficulty of having to use a very long base for measuring the distance of a remote point. The possible solutions of the problem are of two types. One type requires two separate observation stations, each with its observer and measuring instruments. These are sometimes referred to under the name of *bistatic methods*. The other type, adopting a bolder solution, reduces the base sufficiently to allow the two observation stations to fall within the range of one and the same observer; suitable optical instruments bring the two images to the observer, using either monocular vision (coincidence range-finders) or binocular vision, each eye receiving one of the images (stereoscopic range-finders). In the latter case, the device consists of a single rigid apparatus, sometimes cumbersome, but nevertheless transportable and complete in itself. Such device is known as a *monostatic range-finder*, but this should not obscure the fact that a base and two observation points exist, in accordance with the requirements of geometry.

The first chapters are devoted to the study of the optical pieces used in the construction of range-finders, in particular, a very complete study of "deviator systems" is included, this being one of the essential parts of monostatic range-finders. The properties of the eye, in both binocular and monocular vision, have also been studied, with particular regard to those properties used in range-finding. This leads to the examination of the conditions which favour good monocular as well as good stereoscopic observations.

Range-finding devices have attained a degree of perfection and ease of manipulation which opens to them a wide field of application; those using the range-finder (and the number is bound to increase) will find in M. MAZUIR's book a convenient and sure guide."