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A NEW APPROACH TO THE PRESENTATION OF TIDAL INFORMATION

by Audrey LITTLEWOOD, M.C.S.P. (*)

I have an old, beautiful and tiny tide table here. It is part of a directory for Hull in the year 1814. It is simple; anyone could use it. It merely tells the time of high water at Hull and, for those who lived back in the days when the night skies were alive with twinkling stars and sometimes moonlight, it would have been sufficient for the life and commerce of river trade of the time.

It is reproduced below :

MARKET BOATS

HULL TIDE TABLE

moon's age days	*days*		*time of high water minutes*
1	*16*	*high water*	*41 past 6*
2	*17*	.....	*36 ... 7*
3	*18*	.....	*24 ... 8*
4	*19*	.....	*12 ... 9*
5	*20*	.....	*... 10*
6	*21*	.....	*48 ... 10*
7	*22*	.....	*36 ... 11*
8	*23*	.....	*24 ... 12*
9	*24*	.....	*12 ... 1*
10	*25*	.....	*... 2*
11	*26*	.....	*48 ... 2*
12	*27*	.....	*36 ... 3*
13	*28*	.....	*24 ... 4*
14	*29*	.....	*12 ... 5*
15	*30*	.....	*... 6*

BARTON BOATS

Set off from the New Ferry Dock about three hours before high water and return about an hour after high water.

The Ferry Boats go every day.

The Boatmen use the Crown and Anchor Tavern.

BARROW BOAT

The Boatmen use the Crown and Anchor Tavern, come once a fortnight, and set off half and hour before high water.

(*) 7 George Place, George Street, Cottingham, North Humberside, HU16 5QR, U.K.

How are ordinary folk to manage nowadays? Hull is a Secondary Port. Can anyone use the prescribed methods and find available tidal data for Hull? Or would one first need to learn some of the language of hydrography — mathematics — computer programming — or take a nautical tutorial course — before determining the state of tide at Hull? There would be definitions to learn and definitions to define the definitions, lists of tables and tables of corrections for the tables, shallow water corrections and interpolation, the interpolation at the Standard Port on times and heights, then again at the Secondary Port and again between the two. One could then take a Secondary Port reading from the Standard Port diagram, but one may hesitate, the argument being fallacious. What about the rule of twelve? That makes a rough sine curve. Is Hull a sine curve? Then supposing one had not got up early enough to do NP 159, one's computer did not seem compatible with the prescribed programme, and what about 'f' and values at 0000 of Eo+u? It would seem expensive to buy a £45 scientific calculator and keep its programme space permanently occupied, for, there again, it may not like the programme either.

I spoke to Dr. DONALDSON, who is a physicist, and explained that Hydrographers do have a problem in conveying tidal information to others. They provide a wealth of depth sounding information on charts, but this can be rather meaningless if tidal data is not properly interpreted, as Earth's coastal waters make almost unique response to almost infinite change. He said :—

'Numerical information can be shown by :—

(i) Pages and pages of figures,
(ii) A computer programme,
(iii) Diagrams on paper.

Use diagrams, and use only straight line diagrams which will be cheaper and easier to reproduce than curves involving art work, and the answer will be verifiable. Make it so that anyone without any knowledge of English, hydrography, or mathematics can use it, adhere to or improve upon the best previous methods, and stop thinking about Hull and make it for the World.'

So what I envisage with my new approach to the presentation of tidal information is :—

Daily predictions of time and height for a Standard Port followed by :—

— Diagram 1 'Times & Heights of High & Low Water' (*) which gives the same time and height information for Secondary Ports, followed by :—

— The 'Time Data Sheet' (Diagram 2) (*) which is always used underneath the tracing paper 'Height Data Sheet' (Diagram 3) (*), these two providing the intermediate tidal information. The tracing paper sheets are not part of the Tide Tables, but are made up into a separate pad and used when required to directly extract the intermediate information.

The method is very quick and virtually foolproof. No hydrographic, astronomical or mathematical knowledge is required of the user. All one will require

(*) This diagram is contained in an envelope included in this volume.

are Tide Tables as described, a pencil, ruler, and either a pair of parallel rulers or a square. The working and answers are written and easily verifiable. The answers are all pre-computed; I will show you how. The accuracy of Secondary Port tide times and heights is to a higher standard than is available by Admiralty methods. The accuracy of intermediate tidal information is to the same standard for all ports and is equivalent to the accuracy of the Admiralty Standard Port diagrams.

Diurnal Port and tidal stream information is available by the same method but with a twist.

Let us look at the three sheets that are the examples of my new approach. Immingham, with its attendant Secondary Ports, is taken as an example of any Standard semi-diurnal Port with its collection of Secondary Ports. The figures are all taken from my own study of four weeks' tide gauge recordings which make a comprehensive Humber Estuary analysis, and so do not correspond exactly with published figures.

Lay your ruler across the high and low water heights on the tracing paper diagram to show you the range of the tide at the Standard Port. Lay your ruler from that range, down the 'Time and heights' paper to show you the alteration to make for the Secondary Port tide times and heights. The figures obtained are a read out of the time and height difference graphs which is to the best available standard of accuracy, which is better than linear interpolation.

Now let us look at taking intermediate tidal information.

Take the tracing paper and rule the line that joins the heights of water and extend it to show the range of the tide. The heights to rule are Standard Port heights to get Standard Port intermediate tidal information, and Secondary Port heights to get Secondary Port intermediate information. Rule from the range to the top of the diagonal line.

If you require a certain height of water, rule from L.W. to the height you require and extend the line to the range, then rule parallel to the line that is above, going from the range to the diagonal line. Put this diagonal line over the appropriate diagonal line of the 'Time Data Sheet' and read off the height of water at the time indicated.

To find a certain time, put the diagonal lines over one another, rule from the time you require, rule parallel to the line above back to the range, then rule back to L.W., and the height of water at the requested time will be shown.

After a few practice rounds one will be able to mark a whole tidal sequence instead of just one height and one time in one round. The interpolation between springs and neaps is done on the line of the 'Time Data Sheet'.

The figures so obtained are equivalent to the use of the Admiralty NP 159 and/or its computer counterpart and the accuracy is to the same standard as for the Admiralty Standard Port diagrams.

Comments on how Secondary Port tide times and heights are taken

Consider the top graph, constructed from tide gauge recordings. Each plotted position is at the height of H.W. at the Standard Port on the vertical axis and

at the height of the same H.W. at the Secondary Port on the horizontal axis. The plotting is done many many times, matching each 'making' series of heights with a 'falling off' series, and taking normal months such as April, May, October, November, and settled fair weather conditions.

Draw in the best fit graph line; it will show the mean height differences between the two Ports.

On the appropriate line of information about the Secondary Port, these height differences are written down.

It is now possible to go backwards, from the Secondary Port height differences, through the mean graph line, to the Standard Port heights.

On the brief explanatory diagram :—

Second. Port ht. is —0.6, Standard Port range is 2 and ht. is 5
..... —0.7, ... 4 6
..... —0.9, ... 6 7
..... —1.6, ... 8 ..... 8.

In the same way low water height differences, and the time differences, can be set out.

In each case the figures for the Secondary Ports follow the best fit graph line.

Comments on how the rise of tide pole is constructed

The drawing on diagram 2 shows how one rise of tide is put onto a rise of tide pole, and proportioned to a suitable size.

In reality, the data of a carefully chosen collection of tides is made into a mean rise of tide pole. A collection of tides, in matched pairs, representing each of msf, mse, mnf, mne, and, knowing (from the graphs) the required range and duration, each tide can be normalized, processed at each height/time interval, collected into a group, and processed into a mean rise of tide pole. I have made a computer programme for this procedure, but a little diligent human attention is still needed to make the requested inputs from the tide gauge recordings.

Comments on the tracing paper diagram

The vertical lines subtract going one way and add up going the other way. To start with, they subtract L.W. height from H.W. to get the range, and after bringing in the rise of tide times on the diagonal line, they add L.W. height back on again to show the rise of tide + L.W. height, which is the height of water above Chart Datum.

The 'V' shape is 2 sides of a triangle, which gives the ability to transfer marks in exactly the same proportions from one side of the triangle to the other. (Ref. theorem 10 in old English; in new maths : when a triangle is expanded the sides are proportional).

Capt. D. DERRETT (Extra-Master, Head of School) and Capt. J. WITTY (Extra-Master, Principal Lecturer), Nautical Studies, Humberside College of

Higher Education, comment that :— 'Various prescribed methods for the interpretation of tidal data have been available now for many years and are not generally liked or used. Many a lecturer's and student's hours are spent over this area of work, and insight into tidal theory is not gained in this way. It would seem rational in our age of information technology to present tidal data in a pre-computed manner instead of leaving every practitioner to compute his own answers. We consider that if tidal information was quickly and easily available and with the reliable standard of accuracy that Mrs. LITTLEWOOD's method demonstrates, much more beneficial use could be made of the information, as in passage planning; pleasure boating; deep and shallow drafted vessels sharing dredged water channels; engineering type construction work in tidal waters; etc., and more accountability could be taken of the influencing factors of wind and air pressure'.

It seems to me that the choice of method for tidal data presentation is between :—

A. A totally harmonic system.
B. A mixed system — harmonic, mathematical and diagrammatic.
C. A totally diagrammatic system, which has been my choice.

A. I think that quite a degree of responsibility is attached to the ownership, reliable maintenance, and accurate in-putting of possibly 20 or so variables from 4, 5, 6 or 7 harmonics into a calculator/computer programme; if a mistake is made, it is hidden from view.

Quick changes in water pattern do not show well by this method, as an infinite number of harmonics are required to form a right angle, and often high and low waters are poorly depicted from such a limited input.

Where it is not already done, the process of assessing tides into the required number of harmonics would, I think, be a more skilled and lengthy operation than would be required of a computer typist operating the programme previously mentioned.

B. This group contains the methods prescribed by the Admiralty and they are the methods I am fairly familiar with (other than my own). The new Standard Port diagram is excellent — it is self explanatory and anyone could do it. But the application is only within a certain distance of the Standard Port and, once away, the situation becomes very different. Even determining tide times and heights causes problems.

C. It is your turn now; please think about, talk and write about, criticize, praise and condemn all the ways in which the Hydrographer's tidal information can be conveyed to the mariner. Hit out and do not spare the rod on the method I have shown you. One question is, is tidal information worth the telling at all?

If any Hydrographic Authority takes an interest in publishing tide tables on the lines I suggest, I will be very pleased to know. I think that the cost of acquiring established hydrographic data will be of critical importance, and I hope that the Authorities will understand and assist with information, knowing that anything above a fairly nominal charge is likely to be prohibitive, a lot of work will remain to be done, and do we — or don't we — work and hope for the safety of those on the sea?

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