

NAVIGATION

Method of Keeping a Journal at Sea

"A Classic of Science"

For 130 Years the Almost Yearly Editions of "Bowditch"
Sum up the History of Navigation from Sail to Turbines

THE NEW AMERICAN PRACTICAL NAVIGATOR; being an Epitome of Navigation; containing all the tables necessary to be used with the Nautical Almanac, in determining the Latitude; and the Longitude by Lunar Observations; and keeping a Complete Reckoning at Sea; illustrated by proper rules and examples: the whole exemplified in a Journal, kept from Boston to Madeira, in which all the rules of navigation are introduced . . . By Nathaniel Bowditch. First Edition. Printed at Newburyport, (Mass.) 1802, by Edmund M. Blunt, (Proprietor) for William R. Wilder, Newport.

A SHIP'S RECKONING is that account, by which it can be known at any time where the ship is, and on what course or courses she must steer at to gain her port. DEAD RECKONING is that account deduced from the ship's run from the last observation.

The daily occurrences on board a ship are marked on a board or slate, called the log-board, or log-slate, kept in the steerage for that purpose, which is usually divided into seven columns; the first contains the hours from noon to noon, being marked by some for every two hours, but by others for every single hour; in the second and third columns are the knots and fathoms the ship is found to run per hour, set against the hours when the log was hove. Some navigators do not divide the knot into ten fathoms, but into half knots only, marking the third column H. F. The fourth column contains the courses steered by compass; the fifth, the winds; the sixth, the leeway; and in the seventh, the alteration of the sails, the business done aboard, and what other remarks the officer of the watch thinks proper to insert. For it should be observed, that it is usual to divide a ship's company into two parts, called the starboard and larboard watches, who do the duty of the ship for four hours and four hours, alternately, except from 4 to 8 P. M. which is divided into two watches.

—The remarks made on the log-board are daily copied into a book called the LOG-BOOK, which is ruled like the log-board. This book contains the only authentic record of the ship's transactions, and the persons who keep a reckoning transcribe them into their *journals*, and from thence make the necessary deductions relative to the ship's place. There are various ways of keeping these journals, according to the different tastes of navigators. Some keep only an abstract of each day's transactions, specifying the weather, what ships or lands were seen, accidents on board, the latitude, longitude, course, and run: these particulars being drawn from the ship's log-book. Others keep a full copy of the log-book, and the deductions drawn therefrom, arranged in proper columns at the bottom of it: this is the most satisfactory method to those who may have occasion to inspect it, and we have adopted it in the following journal, but shall give an abstract at the end conformable to the former method.

When a ship is about losing sight of the land, the bearing of some noted place (whose latitude and longitude is known) is observed, and its distance estimated and marked on the log-book: this is called *taking a departure*. In working this first day's work, the calculation is made in the same manner as if the ship had sailed that distance, from that place, upon a course opposite to its bearing; and it is entered accordingly into the Traverse Table, after correcting it for the variation. The other courses sailed till the following noon (which ends the sea day, as we have before observed), corrected for the variation, are also put in the Traverse Table, with their corresponding distances. From hence the latitude and longitude of the ship are found, and are marked in the journal. The next and following days' work are calculated in a similar manner; finding the latitude and longitude of the ship by means of her latitude and longitude at the preceding noon.

Having thus explained the general



NATHANIEL BOWDITCH (1773-1838)
American practical navigator who pursued mathematics as an avocation, translated Laplace's "Mécanique Céleste", and refused a Harvard professorship.

manner of keeping a ship's journal, we shall now give a number of examples—Of allowing for the variation; of the estimation and allowance for leeway; of the rules for correcting the dead reckoning by an observation—and then will follow a number of single day's works, and a continued journal of a voyage from Boston to Madeira, in which the various rules of Navigation will be exemplified.

To Allow for the Variation

We have already taught the methods of finding the variation, which must be allowed on all courses steered, and on all bearings taken with the compass: *to the right hand, if the variation be*

His father was afraid it would ruin his reputation and unsettle his ambition to be a clergyman, if he went to sea. But 100 years ago this month

CHARLES DARWIN

a sea-sick youth of 23, set out on the

Voyage of the Beagle.

His first letter home is
THE NEXT CLASSIC OF SCIENCE

east; but to the left hand, if it be west; the observer being supposed to be placed in the centre of the compass, looking towards the point on which the variation is to be allowed. . . .

To Find the Leeway and Allow for it

Leeway is the angle the ship's real course makes with her intended course, occasioned by contrary winds or a rough sea; and may be estimated by observing the angle which the wake of the ship makes with the point right a-stern, or in the direction of her keel. This may be done by a compass cut in lead (or other metal) on the poop, or some other convenient part of the ship's stern. It would be very conducive to the accuracy of a ship's reckoning, if the leeway was marked on the log-board every watch, according to an estimation made at the time, instead of leaving it till the day's work is calculating, and then guessing at it, as is the general practice.

Leeway is to be allowed on all courses steered, in the following manner: Count the nearest way of the compass from the wind to the course set, and as many points and parts beyond as the leeway amounts to, and it gives the correct course: or, allow it to the right hand of the course steered when the larboard tacks are aboard, and on the left hand when the starboard tacks are aboard, the person making the allowance being supposed to be looking towards the point of the compass the ship is sailing upon.

To Correct the Dead Reckoning

After having calculated your days' work, you must compare the latitude by dead reckoning with the latitude by observation; if they agree your day's work is probably correct, but if they differ you must try to discover the causes of it. Examine your log-line and half-minute-glass, to find whether the distance is given exactly by the log; inquire whether the ship came-to or fell-off her course, by bad steerage or sudden squalls, etc.; see if you have made sufficient allowance for variation and leeway; but above all, you ought to discover (if possible) whether there is a current, with its setting and drift. If, after making proper allowance for these things, there is still a difference between the latitude by dead reckoning and by observation, and you feel confident that the error does not arise from an unknown current, you may make a further correction, depending on the following principles: When the course is within three points of the meridian, the error is probably in the distance, because it

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The decided preference given the American editions of the "New Practical Navigator" [by John Hamilton Moore] since its appearance in 1799, calls on the proprietor for his acknowledgements of gratitude. To the honour of the American mariners, and through the good offices of the American book-sellers, be it said, that within two years seven thousand copies have been sold in the United States. He was preparing to put a third edition of the same work to press, but has since been induced to relinquish Moore's treatise for the present more correct and perfect work, furnished by Mr. Bowditch.

While he is tendering his thanks to such as have assisted in the establishment of the work, it would be highly criminal to omit those due to *John Hamilton Moore*; and with the greatest frankness it is acknowledged that he contributed largely to its establishment, as his late editions have been so erroneous that no person would hazard his interest, much less life, in navigating his vessel by the rules there laid down, and it is well known that in all the English West India islands the American edition has invariably been purchased when a supply could be obtained.

EDMUND M. BLUNT.

Newburyport, Jan. 1802.

AN ADVERTISEMENT FOR THE "NEW PRACTICAL NAVIGATOR"

would require a greater error in the course, to cause that difference of latitude, than can be supposed probable to have been committed.—When the course is above five points from the meridian, the error is probably in the course, because a small error in the course would cause a considerable error in the difference of latitude, but an error in the distance would affect it but little. When the course is between three and five points, the error may be either in the course, or in the distance, or in both; and an allowance ought to be made on both of them.

To Correct for Several Days

The preceding rules will serve for correcting any single day's work; but if an observation has been wanting for several days, you must proceed in the following manner.

Take the latitude by observation and longitude in at the time of last observation (or the latitude and longitude of the place you took your departure from, if you have had no observation since) and also the latitude in by observation, and the longitude by account; find the differences of these latitudes and longitudes, and the middle latitude; with the middle latitude and difference of longitude, find the departure; with this departure, and the difference of latitude by account (which is found by taking the difference between the latitude left by observation and the latitude in by account) find the course and distance corresponding, and see what case this course falls under, and correct the de-

parture by it; then having the correct departure, you may find the true difference of longitude and longitude in. . . .

A journal being kept in the preceding manner, the situation of the ship may be known nearly at any time, and the bearing and distance of the place of destination may be found. When the mariner is fearful that his longitude by account is inaccurate, and he has no lunar observations to correct it; he must get into the latitude of the place, and (if possible) run east or west according to his situation and the prevailing state of the winds.

[The "Journal of a Voyage from Boston to Madeira" is too long and too mathematical to reprint in this place, but those interested will find it still being used, 130 years after, to illustrate text-books on the principles of navigation.—Ed.]

Science News Letter, December 12, 1931

PHYSICS

Need Good "Ear" to Play Fixed-Key Instruments

FLUTES, bassoons, trumpets or other wind instruments with fixed finger keys need players with just as good an "ear" as violins or slide trombones where the notes are not made at a fixed position. This result was announced at Cleveland to the Acoustical Society of America by John B. Taylor of the General Electric Company.

The player's mouth cavity, whose air vibrates in tune with that in the column of the instrument, gives him the means of sharpening or flattening at will the note produced, it was explained.

Science News Letter, December 12, 1931