JOLLY ROGERS INSTITUTE

Old Heave-ho Communication

Chip Log ⚓

User's Manual

OLD HEAVE-HO COMMUNICATIONS

Chip Log User's Manual

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Introduction

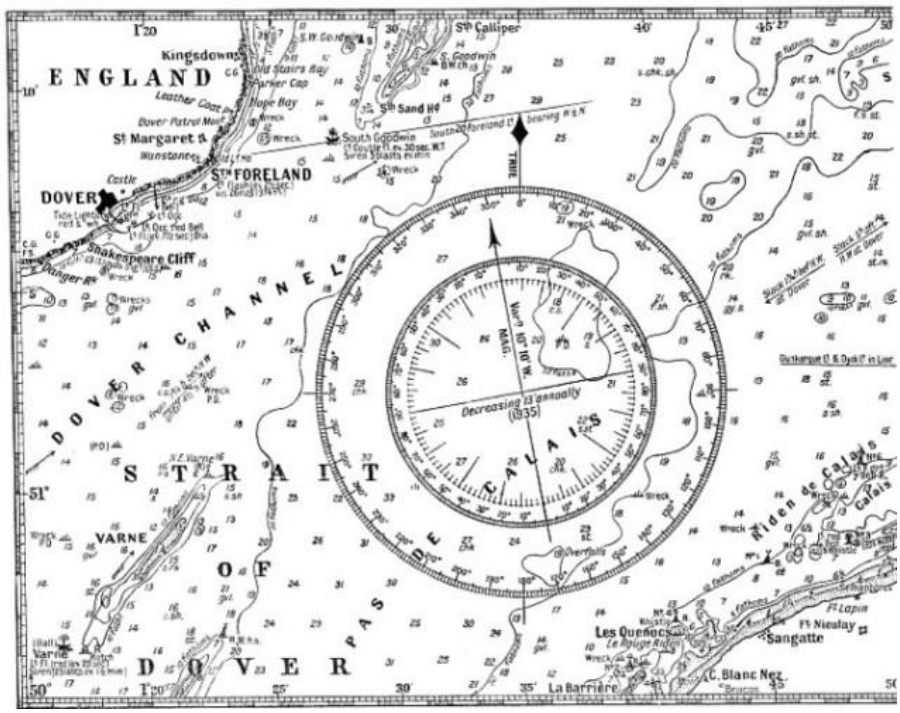
"When the draught of your vessel exceeds the depth of the water, you are most assuredly aground." -Sailor's Proverb, 19th century

All nautical instruments that measure the speed of a ship through water are known as logs. This nomenclature dates back to the days of sail when sailors tossed a log attached to a rope knotted at regular intervals off the stern of a ship. Sailors counted the number of knots that passed through their hands in a given time to determine the ship's speed.

The chip log (aka ship log, Dutchman's log, or common log) was a navigation tool used in the Age of Sail starting from the 16th century. It was used to find the speed of the ship as it traveled through water. Along with the sextant and the chronometer, the chip log was also a crucial tool for navigation. Dead reckoning was the process of calculating one's current position by using a previously determined position, and

projecting the position based upon the estimated speeds over a certain time and direction.

Sure, you've got your GPS and satellites to accurately track your distance and speed these days. But this manual is intended for today's nautical aficionados interested in reliving the Age of Sail (1571–1862), including those who are interested in sailing/boating as well as historical buffs in sailing and technological history. After all, the term "knot" is still used today in nautical lingo. Other enthusiasts of this manual could include model ship hobbyists or ship builders. For sailors of the day, such a manual would be invaluable for their training in taking accurate measurements for navigation.



Like a good navigation map, this manual will be your guide.

How to Use This Manual

This comprehensive manual includes building your own chip log in Chapter 1. If you have a chip log already, you can refer directly to Chapter 2 on how to use it. But because not all chip logs are built equally, and to get more in-depth knowledge of the various parts, it is suggested that you read the whole manual. Happy sailing!

Chapter 1

Constructing a Chip Log

"Twenty years from now, you will be more disappointed by the things you didn't do than those you did. So throw off the bowlines. Sail away from safe harbor. Catch the wind in your sails. Explore. Dream. Discover."– Mark Twain

Overview

This chapter will give you information about how to build your own chip log, right from scratch. Make sure to gather all the materials before you start, all of which can be found at any local hardware store. The drogue (the flat wooden drag) must first be constructed.

Before you start, prepare the following materials: wooden board, scrap pine wood, 500' rope, and lead

Cutting the Drogue

Step 1: On a 1"x12"x12" board, draw a quarter-circle with 12" diameter, measured from one corner.

Tip: The shape of the drogue is more important than the type of wood used.

Step 2: Cut the inscribed quarter-circle.

Step 3: Drill 3/8" diameter holes near each corner.

Step 4: Along the curved edge, about ½" from the edge, drill 5 x 5/8" diameter deep holes, equally spaced (See **Figure 1**).

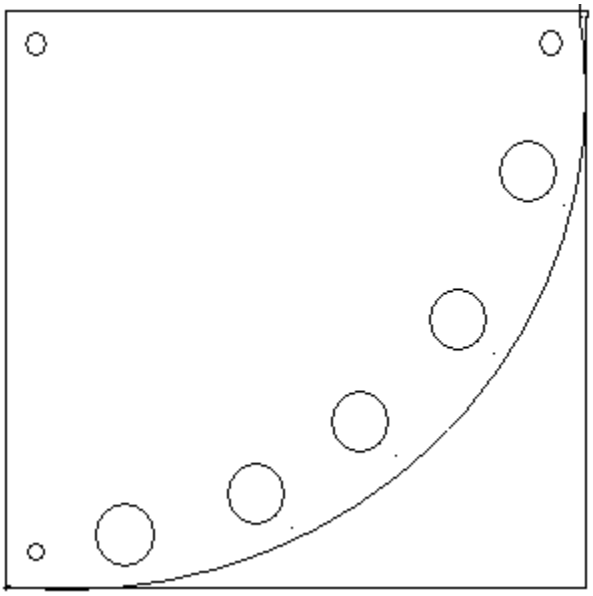


Figure 1. The drogue with location of drill holes

Step 5: Pour melted lead into the equally-spaced holes.

The lead ballast weights make the drogue float upright and submerged to provide maximum drag.

Attaching the Log Line to the Drogue

Step 1: At one end of the 500' line, unlay about 12-14" of the strands.

Step 2: Securely seize the line where the strands part company.

Step 3: Take two of the strands and thread them through two of the holes at the corners of the drogue

Step 4: Tie a figure-of-eight or overhand knot in the end of each (See **Figure 2**).

Figure 2. Figure-of-eight knot.

Cutting the Peg

Step 1: From a piece of scrap pine, carve a peg with a 3/8" taper at one end

Step 2: On the other end, drill a 3/8" hole through.

Step 3: Thread the third strand through the hole in the peg. Bring the end back to itself and securely seize an eye, trapping the peg in the eye.

Step 4: Press the peg firmly into the remaining hole in the drogue.

Tip: When completed, the drogue should lie perpendicular to the axis of the line.

Tying the Knots

Step 1: Measure 47' 3" feet from the drogue.

Step 2: Force open 2" of the strands with a marlinespike.

Step 3: For the first "tag", tie one figure-of-eight knot at one end of the tag, and weave the other end into the line, leaving the last 2" of the tag exposed.

Step 4: Measure another 47' 3" feet, unlay the line, and insert another tag, but this tag will have two knots tied 1/2" apart, at the exposed end of the tag.

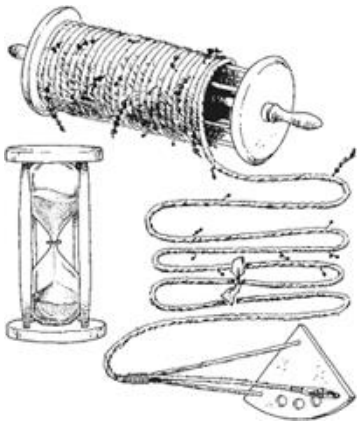


Figure 3. Complete Ensemble

Step 5: Continue adding one more knot in each succeeding tag, until the entire line is marked.

Building the Reel

The exact construction of the reel is not important, only that the following features are adhered to:

(a) The reel should be long enough to allow the reel to be held comfortably aloft over the head without the reel touching the head.

(b) The handles or the axle of the reel should be free-spinning to allow the line to pay out without friction.

Building the Timer

Before you begin, gather the following materials: egg timer, paper, and sand.

Tip: Use glass from an egg timer.

Step 1: Open one end of the glass with a Dremel tool with a dental burr or drill.

!Caution! This is extremely difficult, as too much pressure will break the glass.

Step 3: After opening the glass, get a stopwatch, a piece of clean paper, and sand.

Step 4: Invert the timer and pour out 2:32 worth of sand on to the paper.

Step 5: At the 2:32 point, turn the glass horizontal.

Step 6: Reset the stopwatch and turn the glass back upright as you start the stopwatch again, letting the sand return to the "bottom" half of the glass.

Step 7: Stop the watch as the sand finishes flowing.

Tip: You should have measured 28 seconds. If the time is too long, pour off a small amount of sand, if it is too short, add sand back into the glass.

Chapter 2

Using a Chip Log

"I can't change the direction of the wind, but I can adjust my sails to always reach my destination." -Jimmy Dean

Overview

Now that you have your own chip log, it's time to head out to the water to test it out. If this is your first time "heaving the hog," pick a nice calm day to use your chip log to obtain more accurate measurements.

Casting the Chip Log

Tip: You will need two people to use the log: one facing aft at the taffrail to hold the reel aloft and the other to drop the drogue overboard.

Step 1: Hold the reel firmly above your head (see **Figure 4**).

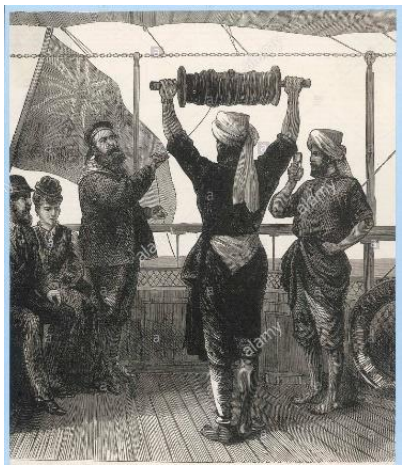


Figure 4. Holding the Reel

Tip: Make sure the line is able to freely unwind from the reel. Any friction that the line encounters will reduce the accuracy of your readings.

Step 2: Drop the drogue aft at the taffrail.

Step 3: Turn the glass immediately.

Step 4: Stop the line when the sand runs out (30 seconds).

Tip: The actual time for the reading is 30 seconds; the time required to drop the drogue overboard and turn the glass accounts for about two extra seconds. This is the reason for the odd amount of sand in the glass. After stopping the line, the number of knots payed out is the speed of the ship.

Step 5: Count the number of knots that has been payed out.

Retrieving the Drogue

Step 1: Give the link a quick, sharp tug to pop out the peg from the drogue.

The board will flip parallel to the flow of the water, allowing it to be retrieved.

Step 2: Wind the line back on the reel evenly, watching carefully for snags.

Tip: To improve accuracy, average three throws. Because of the comparatively short boat lengths involved and the potential for some timing/sighting inaccuracies, it's worth investing a few extra minutes to repeat the above sequence at least twice more.

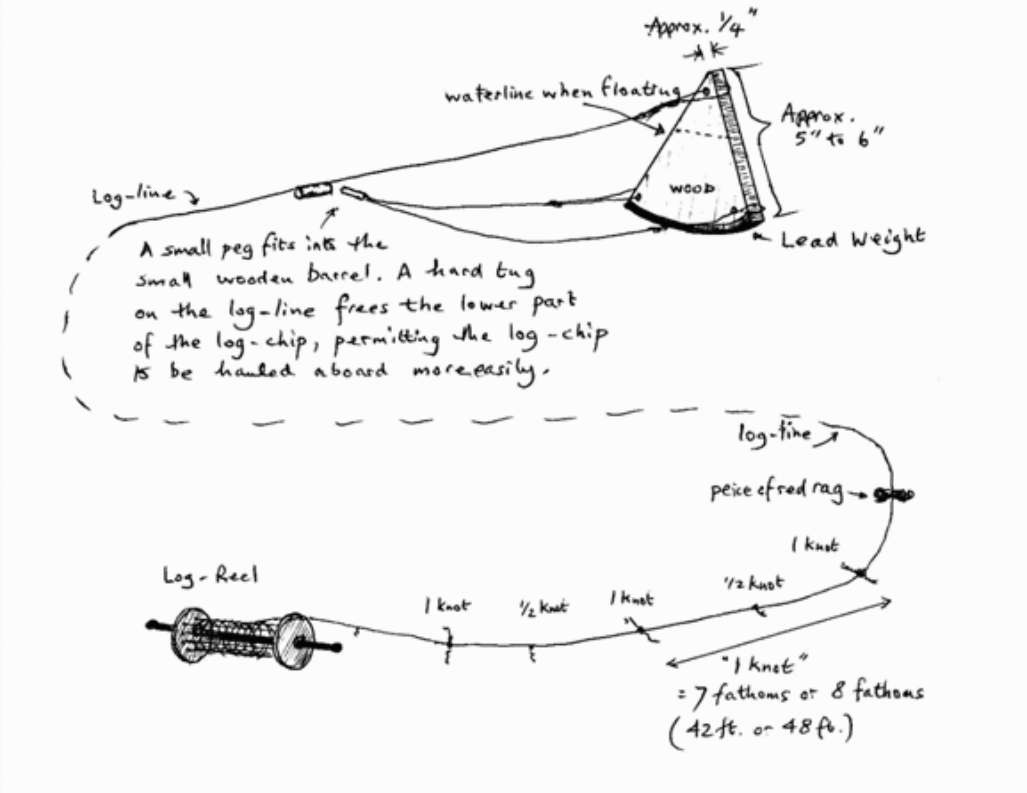


Figure 5. Chip Log, Line, and Reel

Chapter

3

Improving the Accuracy

"There are some things you learn best in calm, and some in storm." - Willa Cather

Overview

This chapter will give you information about some important factors that may affect the accuracy of your measurements.

The Amount of "Following Sea"

"Following sea" refers to a wave direction that matches the heading of the boat. For example, if the waves of the body of water are heading in the same direction as the sailor, then the water is "following" the sailor's boat. If the chip log moves with these waves, the speed of the ship itself will be difficult to calculate.

Fun Fact: "Fair winds and following seas," means a vessel will have good winds, and not have to pound into the waves. The phrase is used as a popular toast or salutation between mariners.

The Effect of Currents

One of the biggest factors that will compromise your readings will be the current surges pulling or pushing your chip log in different directions. To get accurate readings, the chip log must stay immobile as the line is payed out.

Stretch of the Line

Depending on the material of your line, there will be some stretching that could affect the readings as the distance between the knots increase. Therefore, the resultant readings will seem as if the ship is going slower than it actually is.

Inaccurate Time Measurements

The ambient temperature, humidity, and sea state could affect the sand in your sandglass and hence could fluctuate the 30-seconds of allotted time.

Human Error

Too err is human as they say. Numerous errors could be attributed to any of the actions involved in taking measurements, including dropping the chip log, setting the sandglass, and reeling out the line smoothly, among others.

Chapter 4

References

"The wind and the waves are always on the side of the ablest navigator." - Edmund Gibbon

Troubleshooting

Here are some common problems that you may encounter as you build and use your chip log:

Problem	Solution
The sand in my timer is not flowing smoothly.	You're probably using white quartz sand, which is too angular to flow well. Try marble dust, other rock dust or rock flour—powder from glass cutting—or round sand grains, like those found in river sand.
I don't have the means to melt lead to weigh down my chip log.	You can use hammer in lead nails instead to add weight. As long as the log is floating up, any sort of weight will do.
I can't get the peg to pop out.	Add more of a taper to one end of the peg. Or increase the diameter of the hole.
I am unsure of my speed readings.	Error could come from various sources. Find the average of three readings to increase accuracy.

FAQs

What type of wood should I use to construct the chip log?

The type of wood is not as important as the shape of how the chip log is constructed: a quarter circle (6" diameter, ¼" thick) with holes to attach the line and lead weights at the bottom to keep it vertical at the waterline.

How should the reel be constructed?

It should be constructed of three parts: the dowels that will form the reel where the line will be wound and the handles on either side to hold the reel.

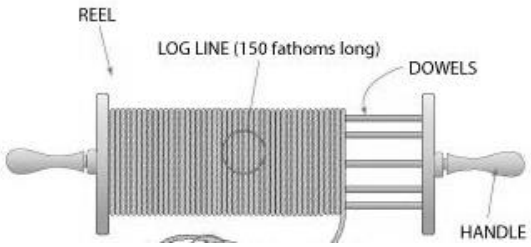


Figure 6. Parts of the Reel

What is the best way to get accurate measurements?

Frequent measurements will help mitigate some of these inaccuracies by averaging out individual errors. Also, over time, experienced navigators will be able determine their speed through the water with a fair degree of accuracy.

Despite the errors that could occur in measuring the ship's speed, why was the chip log still used back in the 19th century?

Any information, however inaccurate, was better than no information for navigation. All officers knew that the log chip was never truly stationary, and that even a second of error in turning the glass could result in an error in the speed logged. However, the ship's Course-Made-Good also was probably only accurate to plus or minus one point of the compass (11°); therefore, the hope was that these errors cancelled out over the length of the 24-hour ship's day, and during the many weeks or months of long ocean voyages. It should be added that even "dead reckoning", one of most important skills to find position was also based on subjective readings of the sextant as well.

When was the first known chip log used?

In 1623, the first known device that measured speed is often claimed to be the Dutchman's log. This invention is attributed to the Portuguese Bartolomeu Crescêncio, who designed it in the end of the 15th century or in the beginning of the 16th century. A sailor threw a floating object overboard and used a sandglass to measure the time it took to pass between two points on deck.

Glossary

Chip Log

A navigational tool used to estimate a ship's speed, from the 16th to the 19th century. See Chronometer and Sextant.

Chronometer

A marine chronometer measures time accurately to determine longitude by means of measuring the time of a known fixed location, for example, Greenwich Mean Time (GMT) and the time at the current location. It is one of the most important instruments of navigation. See Sextant and Chip Log.

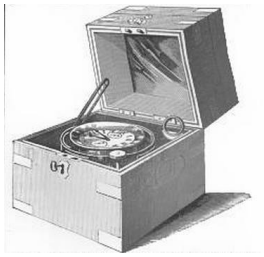


Figure 7. 19th century chronometer

Dutchman's Log

A device to measure ship's speed, predating the chip, in which the floating object (such as a piece of wood or tobacco box) is thrown over the bow and calculations for speed are made based on the time that elapses before it passes the stern.

Drogue

A device that is trailed behind a boat on a long line attached to the stern. A drogue is used to slow the boat down in a storm. Also, it is the part of the chip log that gives resistance to the pull of the ship to remain stationary.

Fathom

A unit of length equal to six feet (approximately 1.8 m) and used for measuring the depth of water.

Following Seas

Refers to a wave direction that matches the heading of the boat. If the waves of the body of water are heading in the same direction as the sailor, then the water is "following" the sailor's boat.

Knot

A unit of speed equal to one nautical mile per hour, exactly 1.852 km/h. The derivation of the knot is:

1 knot = 1852 m/h = 0.5144 m/s, so in 28 seconds that is 14.40 meters (about 47 feet) per knot.

Peg

A wooden tapered piece of wood that is inserted into the drogue of the chip log and popped out when the readings are completed. When the peg is released, the chip log becomes horizontal to reduce water resistance and to facilitate the log's retrieval.

Reel

A spool on which the log line is wound and unwound and composed of two main parts: handle and dowels.

Sextant

A navigation instrument that measures the angular distance between two visible objects. The primary use of a sextant is to measure the angle between an astronomical object and the horizon for the purposes of celestial navigation. See also Chronometer and Chip Log.

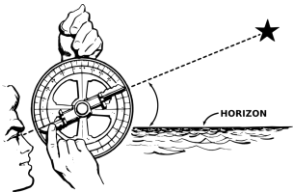


Figure 7. Dead Reckoning with Sextant

Taffrail

The handrail around the open deck area toward the stern of a ship or boat, where the chip log is cast.

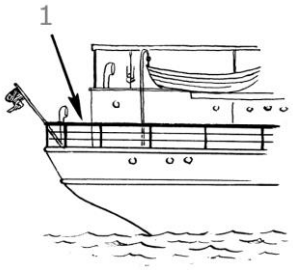


Figure 8. Location of the Taffrail

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