Navigating the *Warrior*

For many hundreds of years a compass has been a standard piece of navigational equipment on a ship. The Greeks or Chinese were probably the first to notice that naturally magnetic rocks called *lodestones* lined themselves up north and south when allowed to move freely.

The Vikings were possibly the first seafarers to use lodestones as a navigational aid. They rested their lump of lodestone on a board floating in a bucket of water which is pretty much the same principle used by modern compasses.

Although a compass is simple enough to use, some care needs to be taken in making sure that there are no large lumps of magnetic material nearby which might deflect the compass needle and give false readings. This is not too difficult in a wooden ship but did cause a problem for the Warrior with it's thick iron hull.

Compass binnacles on the deck of *HMS Warrior 1860*

To compensate the ship was 'swung' several times to check for compass deviation. Swinging involved turning the ship on a fixed point and checking compass bearings against known landmarks. In this way a correcting factor could be applied to readings taken from the compass to give a true bearing. Alternatively, small permanent magnets could be added to the outside of the compass to pull it back into true.

Using a compass is just one method of navigating but it has its limitations. If a storm blows you off course in the open ocean a compass will not, on its own, help you find your position. To do this you will need to use an instrument called a quadrant or a sextant.

Quadrants and sextants were carried by the ship's officers and the master on the *Warrior*. By taking a measurement of the angle of the sun above the horizon at midday latitude, or distance from the equator could be worked out. It was also possible to do the same by taking a sighting of Polaris, the north star. If Polaris was measured at 25° above the horizon it meant that your ship was at a latitude of about 25°.

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Navigating the *Warrior*

Longitude is a measure of the distance from the meridian line which passes north to south through Greenwich. For hundreds of years it was impossible to measure longitude because the Earth turns 15 degrees per hour, making such measurements dependent on time.

Accurate measurements of longitude had to wait for the development of reliable clocks that could be used at sea. These were developed by John Harrison in the early 18th century and by the time of the *Warrior* reliable clocks were a standard piece of equipment. The *Warrior* carried three Arnold chronometers which were wound daily to ensure that any navigational readings taken were accurate.

Measurements were also taken every hour of the ship's speed. This was done by a midshipman who threw the 'log ship' over the side.

The log ship consisted of a flat piece of wood which was weighted at the bottom edge so that it would float upright in the water. A long rope was attached to the log and this was wound onto a spool so that it could be reeled out after the log was thrown into the water.

The friction of the water held the log in place as the ship moved away from it.

The log line was 150 fathoms (900 feet) in length and was marked with a piece of white bunting (duck) to start the measuring and after that by "knots" at fixed distances to represent the speed.

A sextant similar to the ones that were used on the *Warrior* for finding longitude and latitude

The line was then let to run out for either 28 seconds or 14 seconds as measured by a sand glass. The number of knots counted as the line reeled out during that time showed the speed of the ship.

By using all of these instruments; compass, sextant, chronometer and log ship the *Warrior* could be pretty sure of her location at anytime. Up until the invention of satellite navigation in the late twentieth century any ship would have used these same instruments to find its way.

Build your own dry card compass

Never get lost again with your very own dry card compass!

This is what you will need to build this slightly modernised version of an old classic as used by Columbus himself.

- An old plastic spool CD container
- An old CD
- Six needles
- A strong magnet
- A piece of thick copper wire (about 5 cm long)
- A cork
- A thick aluminium foil pie dish
- Epoxy glue
- Craft knife
- Scissors
- A metal file
- A junior hacksaw
- Sticky tape
- A hot glue gun
- Rubber based craft glue
- A fine permanent marker pen and a ruler

Note: Adult supervision is recommended when using epoxy glue. Follow the manufacturers instructions and use in a well ventilated space.

Now here's what you do:

Step 1
Cut out the compass rose (including the centre hole). Coat one side of your old CD thinly and evenly with rubber based craft glue. Carefully stick the compass rose on to the CD, smoothing out any wrinkles. Be sure to use a rubber based glue such as 'Copydex' as water based glue will cause your compass rose to wrinkle. When the glue has dried you can paint or otherwise colour your compass rose.

A compass rose is provided on the next page or you could design your own.

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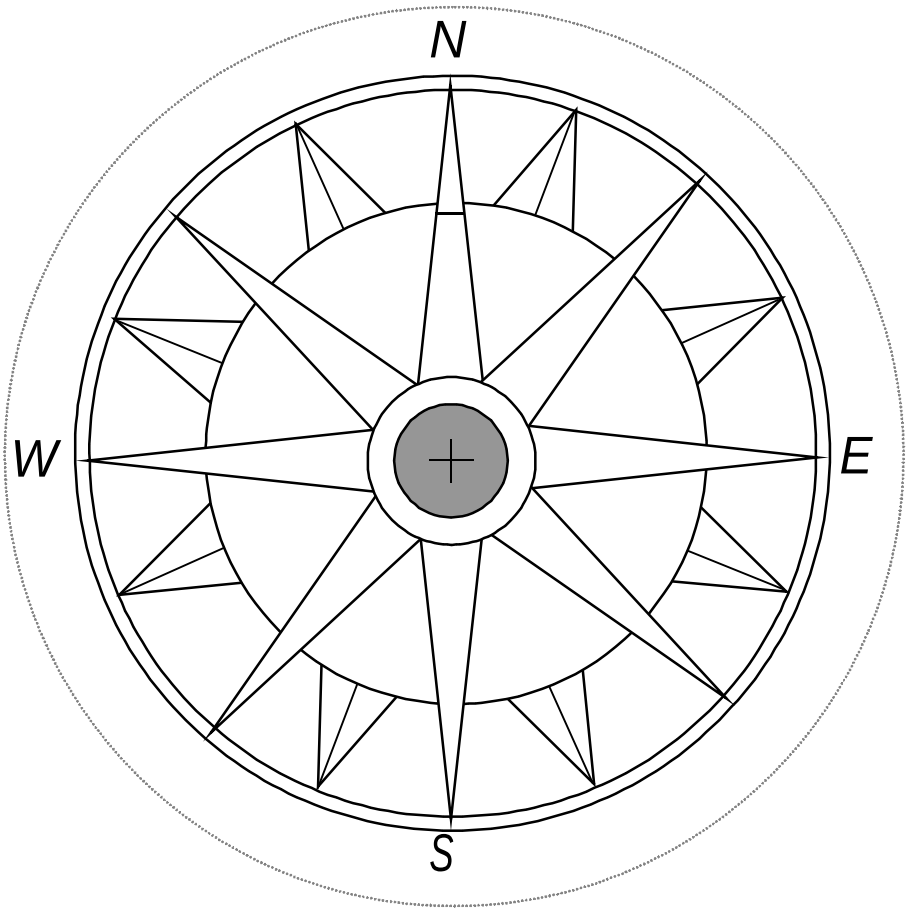
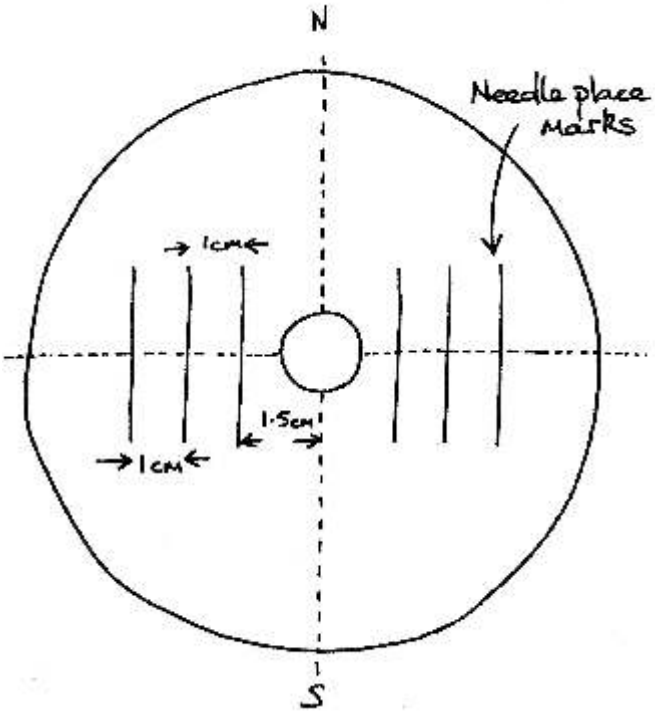
Build your own dry card compass

Cut out and use the compass rose below or why not have a go at making your own?

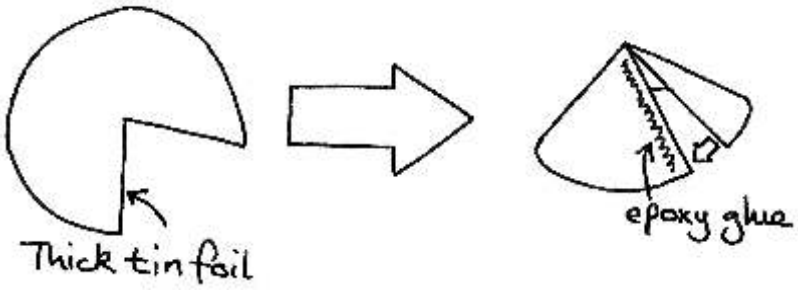


Build your own dry card compass

Step 2
On the reverse of your CD use the marker pen and a ruler to mark a line from North to South. Now draw a line from East to West. Mark three lines to each side of the North - South line. Make sure they are parallel to the North - South line. These lines mark the position of your compass needles.



Step 3
Cut out a circle of thick tin foil from the pie dish and cut a slice of just under 90°out. Carefully fold this into a cone and fix the edges in position with some epoxy glue. Take care not to get the glue on your hands.



Step 4
Use epoxy glue to stick the cone in place over the centre hole of the CD. Make sure you stick the cone to the side that the compass rose is on.

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Build your own dry card compass

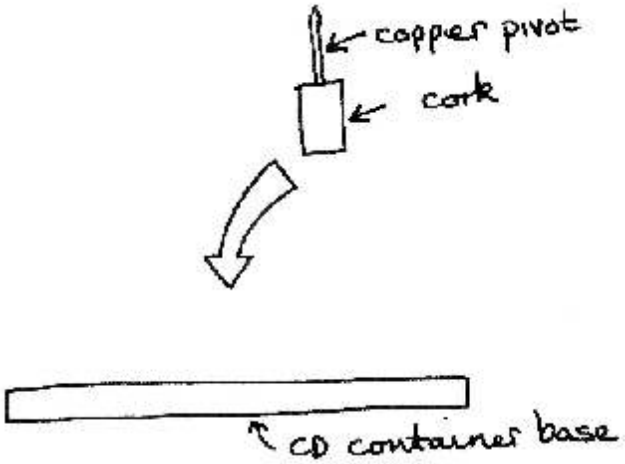
Step 5
Use the metal file to sharpen the end of your piece of copper wire. Use a small nail to push a hole into the centre of one end of your cork. Very carefully push the copper wire into the hole, making sure that the sharpened end is sticking outwards. When doing this make sure that your hand is to the side of the point so that if you slip you will not hurt yourself. Alternatively you could grip the wire with some pliers as you do this.

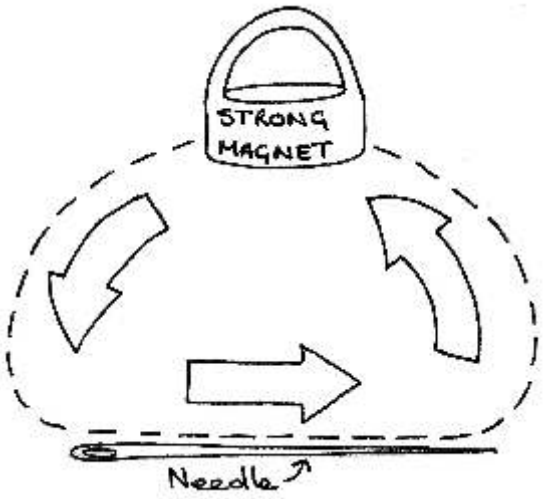
Fix the wire in place with a blob of hot glue.

Use the junior hacksaw to cut the central spool off of the container.

Use the hot glue gun to fix the cork and wire in its place.

Step 6
Stroke the strong magnet along the needles from eye to tip to magnetise them. Do this about 20 times for each needle. Float a small piece of paper on a saucer of water and lay each needle on it as you have finished magnetising them. Check that the same end of each needle points north.





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Build your own dry card compass

Step 7
Turn the compass rose over and use the epoxy glue to stick the needles in position as indicated by the lines you drew. It can be tricky to get the disc to balance properly on the sharpened wire so the best approach is to stick the needles down with a piece of sticky tape across their centre. This way you can check whether the disc balances and if it doesn't you can adjust their positions. Once you are happy that everything is balanced secure the ends of the needles with blobs of epoxy glue.

Make sure the glue has set before you remove the sticky tape. If necessary, you can further adjust the balance by adding little pieces of self adhesive putty to the bottom of the disc.

Now just put the lid of the CD container back on to protect the compass and you are now the proud owner of a dry card compass.