Working up a course to steer

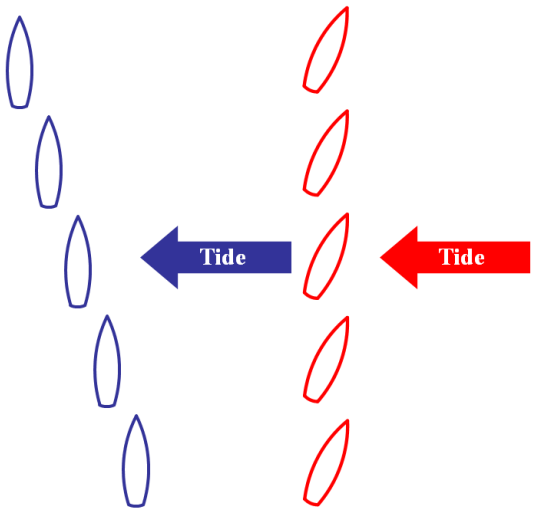
We've seen how the tide can make a boat's ground track considerably different to its water track. In this course module we consider how to calculate a heading which counteracts the expected tide sufficiently to get the boat to its desired destination.

With all the concepts you've covered so far on this course this section should be reasonably straight-forward. You know all the elements required, they are just applied in a different way. However, please be aware that there are some critically important distinctions between a course to steer and an estimated position. You will need to demonstrate your clear understanding of these in order to gain your certificate.

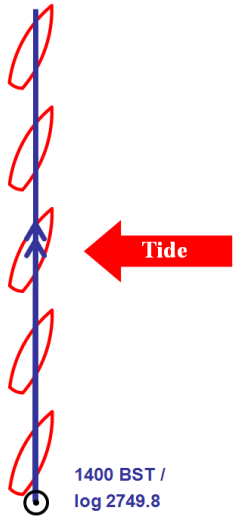
Stemming the tide

To the right the blue boat is heading due north but the west–going tide is pushing it away from its proposed destination. The red boat is heading into the west–going tide just enough so that it will counteract the tide and reach its proposed destination. When a vessel is pointed into the tide in this way, the boat's progress is slowed by the tide. Using the tide as a "brake" like this is a technique taught on practical courses and is also known as "stemming the tide".

The big question is how much should the boat be pointed into the tide in order to counteract its effect? The worked example in this first section shows how to work it out.



The proposed ground track



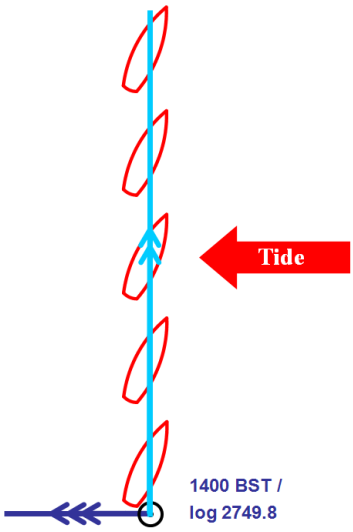
The first thing to do is to plot the proposed ground track from the current position to, and well beyond, the desired destination. We'll see later why it is worth plotting the proposed ground track beyond the desired destination. The current position might be a fix (i.e. a confirmed position) in which case the position on the chart is marked with a dot surrounded by a small circle. The current position might alternatively be an estimated position, in which case the position on the chart is marked with a dot surrounded by a small triangle.

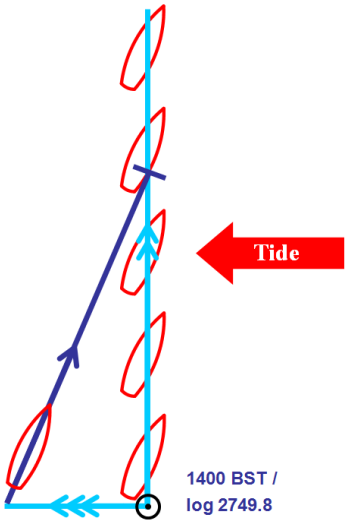
Remember that any position should always be marked with the time and the log reading at the time that the vessel's position was recorded.

The tidal vector

Next plot the tide from the current position, this is what we need to counteract. In the example to the right there is just one tidal vector as we are working up a course to steer for one hour.

Note the difference between this and an estimated position where the tide is plotted at the end of the water track, here we are plotting the tide at the start of the proposed ground track so that we know the scale of what needs counteracting before we actually try to counteract it!





ARC'ing off the boat speed

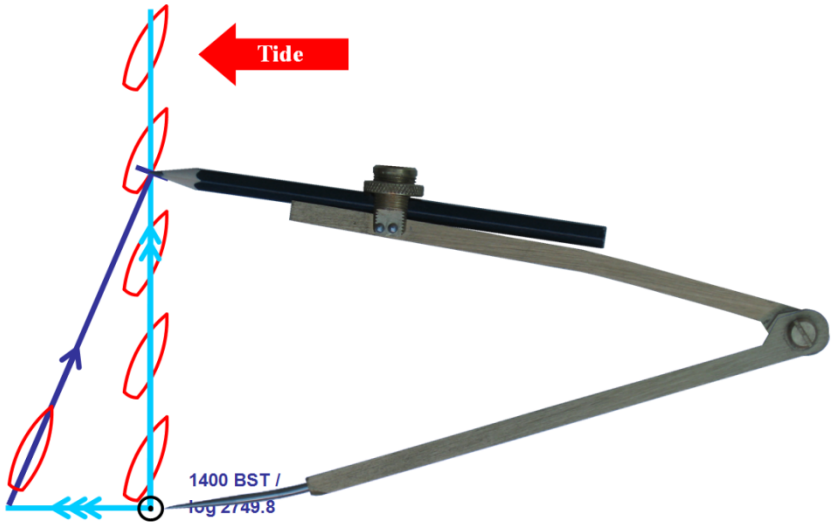
Finally, from the end of the tidal vector, use your compass to "ARC off" one hour's worth of boat speed so that the arc crosses the proposed ground track. If the boat speed was 5 knots, since the course to steer is for one hour the compass should be set to 5 miles. If working up a course to steer for 2 hours, there would be 2 tidal vectors and from the end of the second tidal vector you would "arc off" 10 miles to intersect the proposed ground track (see later for example).

Please note that when working up a course to steer for an hour or more, it is always done for whole multiples of hours, i.e. 1, 2, 3, 4, etc and doesn't include parts of an hour, e.g. 1½ hours.

Mark a line from the end of the last tidal vector to where the arc crosses the proposed ground track, this new line is the water track. Measure the bearing of the water track, this is the heading we need to counteract the effect of the tide. NB: the boat moves along the ground track and NOT along the water track, which is a representation of the heading as seen to the left.

Please also note that as the vessel moves along the ground track, it does so at the angle required to counteract the tide, i.e. the heading is the bearing of the water track. If there were a buoy at the end of the ground track, it would be seen on the port bow due to this angle.

COG and SOG

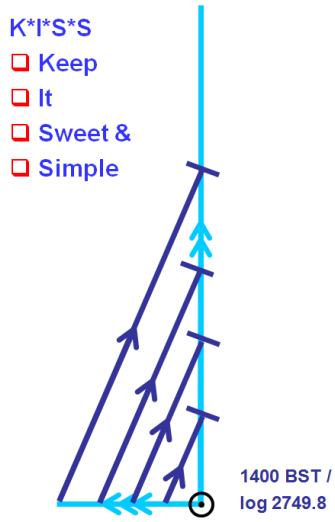


You may remember in the last module on estimated position that we discussed COG (course over the ground) and SOG (speed over the ground).

COG is easy to determine, it is the true bearing of the first line we plotted, i.e. our proposed ground track (2 arrows) from the current position to the proposed destination, in this case 000°T or due north. Please note that COG is expressed as a TRUE bearing and never as a magnetic or compass bearing.

SOG is also straight-forward but can introduce complications. The compass was used to "arc off" one hour's worth of boat speed from the end of the tide so that the arc crosses the proposed ground track. This means that where the arc crosses the ground track, it shows how far the vessel would have travelled along the ground track during that hour. This is because the arc has allowed for boat speed as well as the effect of the tide. If the measurement from the starting position to the arc (along the ground track) was 4.5 miles and it had taken one hour to travel this distance, then the boat must have travelled at 4.5 sea miles per hour, i.e. 4.5 knots. In the same way, if the measurement from the starting position to the arc was 9 miles and it had taken two hours to travel this distance, then the boat must have travelled at 4.5 sea miles per hour, i.e. 4.5 knots.

It is critically important to remember that COG and SOG can ONLY be derived from measurements along the ground track and that the water track plays no part at all in these measurements – EVER!

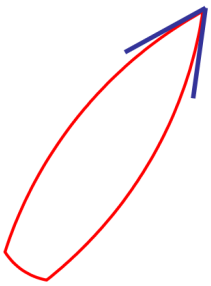


To the left we show what happens for a15 minute, a 30 minute, a 45 minute and a full hour plot. The water tracks are parallel and we'd expect this provided that the correct amount of the same tidal vector was used, i.e. 25%, 50%, 75% and 100% respectively. So if the plot fits on the chart, it doesn't make sense to complicate things and use parts of an hour when things can be kept simple with plots for multiples of a full hour.

Reminder

Remember that the "water track" is a representation of the heading of the vessel, i.e. the direction in which it is pointing and nothing more! Where your vessel actually travels in relation to the sea-bed, i.e. on the chart, is called the "ground track".

Since the water track is the vessel's heading, a really easy way to remember the symbol for it is to think of the bows of your vessel in terms of a single arrow.



Now! How about that worked example?

Worked example

At 1145 UT on Saturday 25th February 2021, when the log reads 2,398.6 miles, a vessel is close alongside the Fl(3)G.10s buoy at position 46º20'.65N 005º48'.50W on RYA Training Chart 3.

a. If the boat speed is 9 knots, and the tidal stream is 178ºT at 2.2 knots, what is the true course to steer (ºT) to a waypoint at the Fl(2)G.5s buoy at position 46º13'.23N 005º39'.91W?

b. If there were 10º of leeway due to a fresh north-easterly breeze, what would be the magnetic course to steer (ºM) to counteract both the tide and the leeway?