COMPASS NAVIGATION

SPORTS DIVER COMPASS – INSTRUCTOR AND STUDENT NOTES

General Notes

Navigation underwater is an important skill and begins before the dive. The key components for good navigation are:

- Compass and bearings
- Waypoints and Pilotage
- Distance travelled – have I missed it?

It often leaves people confused and is sometimes made overly complex, hence these notes.

1. The Dive Compass

A dive compass can be console, wrist, lanyard mounted or can be part of the dive computer. They all have similar general design features, but some have other useful attributes.

Type	Advantage	Disadvantage
Console mounted	Always on your dive kit. Available from a range of manufacturers. No additional bits of kit to forget	More difficult to use Taking sightings on land is difficult – need to either have full kit on or use before regs are on cylinder. Harder to follow a bearing using in-water waypoints.
Wrist mounted	Neat and tidy Available from a range of manufacturers. Easy to put on and take off in water. Can be mounted on a slate so directions can be noted at side	Improvement on console for ease of use but still limited by close distance when your arm is in front of your eyes. Sighting easier but better taken off wrist. Another bit of kit to forget.
Retractable Lanyard	Easy to use and take sightings Can be held at arm's length on surface – some have sighting windows which make usage simple. Direction can be checked by buddy easily. Waypoints easily identified and retraction makes it neat Frees up wrist for computer, slate etc. Can be mounted on a simple slate so directions can be noted at side.	Another bit of kit to forget. Expense of retractable lanyard.
Computer integrated	Always on your dive kit. Can be set to give digital direction of travel making reading easier. Some allow a direction to be set. Available from a range of manufacturers. No additional bits of kit to forget. Must be calibrated – some with an accelerometer that allows it to be used off the level.	Expensive dive computer needed. More button combinations to learn. Surface sighting difficult. Underwater way-point sightings more difficult. Can be console or wrist mounted.

BASIC DIVE COMPASS

Bezel – can be rotated and set out in 10° Intervals.

Gimbel – north seeking inside fluid capsule – stays level (within reason)

Lubber line – direction of travel and sighting

Note – the diver set the lubber line to 330 by setting the bezel.

They then turned around until North arrow is in notch on the bezel – compass is now set to north

Note the top of the red lubber line points to 330 but 330 is also showing at the base of the Gimble and this is because this compass has a sighting window

Same compass using sighting window.

This is a brilliant feature of these type of compass.

You can hold the compass away from you at eye level and sight either an object (buoy or rock, etc) and read the bearing through the window.

Under water, you can hold it at arm's length (hence lanyard mounted is an advantage) or put your console on a lanyard and sight an object to swim to along a bearing (waypoints).

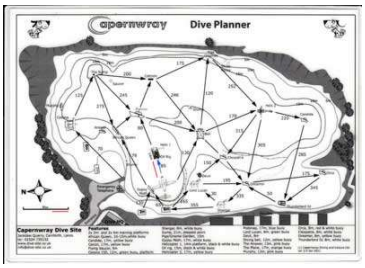
The other way is to set the lubber line to the bezel; the direction you want to swim, and then turn around until the compass north needle is in the north mark of the bezel. The lubber line is then your direction of travel.

Practical Example

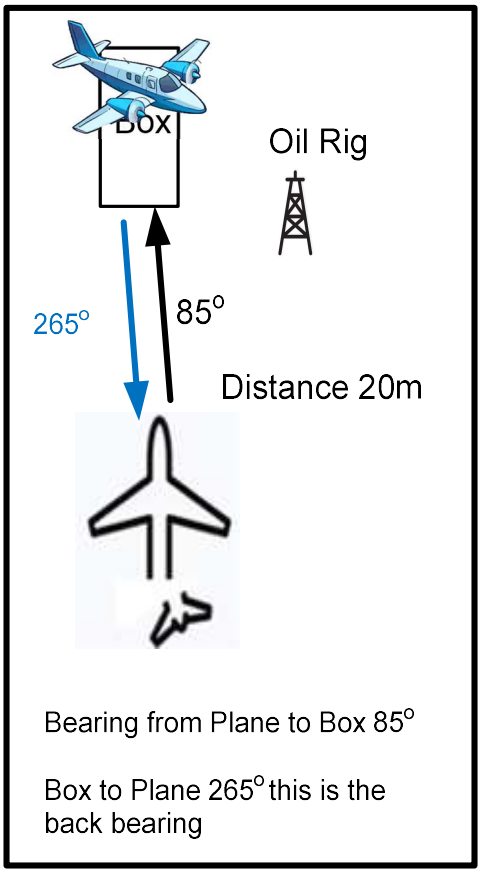
If that seems all very confusing, so let's look at these two methods in practice. We are going to plan a simple dive in Capenwray Quarry. We are going to plan a dive from the Passenger Plane to the container and back. ***Method 1*** *will be Lubber line* and Bezel. ***Method 2*** *will be the sighting window*. They will both introduce the idea of a 'Back-bearing' – or how to get back home.

CAPENWRAY QUARRY

Like most inland locations, underwater maps are useful and can be purchased on site. Capenwray's plastic coated one is A5 and costs £5. It provides a map, compass bearings, and a scale. It is worth all instructors having one or at least 2 per club.



Bezel Method 1



The distance between the plane and the box is about 20m but unless you get a good day, you will not be able to see from one to the other.

Turn the bezel until the lubber line is pointing at the 85° mark. Next turn around until the North arrow on the Gimble is inside the two points at the north of the compass bezel. The Lubber line points you in the right direction.

Sense Check – North is 360 ° and 0, therefore 85 ° should be roughly East – see bezel! Other side of lubber line gives back bearing.

Coming Back – you have a choice to reset the compass to the back bearing of 265 ° or leave it set at 85 ° and simply turn around until the North arrow on the gimble is pointing at the South (single peg) on the bezel. Lubber line still reads 85 ° but is 180 ° out.

Waypoints – these are objects that lay between you and your destination. This is important if you are swimming towards an object and a current is pushing you sideways – you would still be on the bearing but would miss the object. So swim from one object (waypoint) to the next – only use the compass to site another object (waypoint), err not fish because they move.

Sighting Method 2

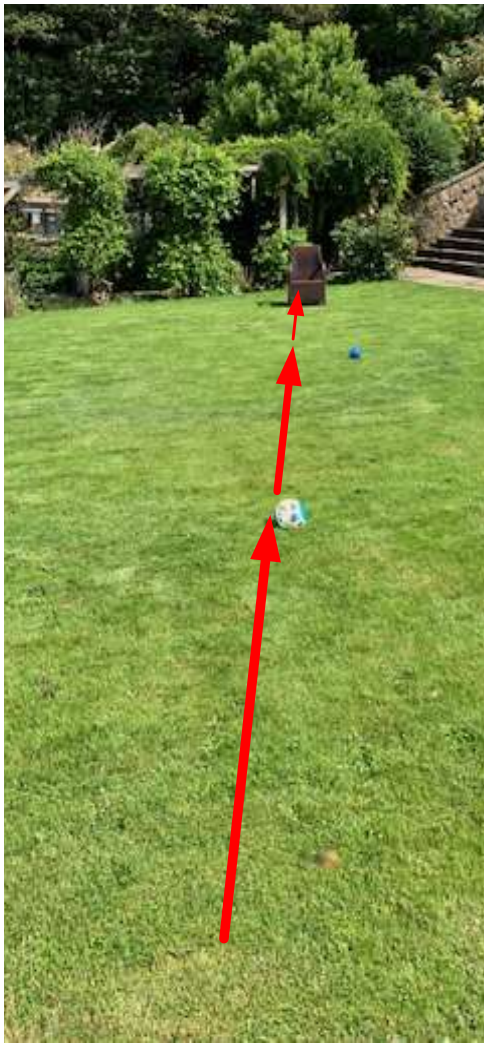
This is probably the easiest and simplest way to use the compass, if you have a sighting window. A computer-based compass would be similar but would not be as easy to sight.

Compass held at arm's length. Turn until the sighting window reads 85° and this is the direction we intend to travel. Simple.

Use waypoints (object, rock etc) – then put compass down and swim to waypoint, once there pick up compass extend arm and pick another object on a bearing of 85°. This is the simplest way to use the compass and allows you to use it to sight objects in front of you.

Back Bearing – turn until the window shows 265°. Choose suitable objects to navigate to as waypoints on the return swim. A simple slate can be used to help plan more complicated routes. Sports divers can plan a very simple out and back navigation. Dive leaders should plan a more challenging exploration with options for divers who are short of air or bottom time. A Capenwray Challenge is included for you to test your skills – see 'navigation challenge'. First more on Waypoints.

Waypoints – These really take the stress out of navigation and prevent currents from pushing you off course.



Following some extremely heavy rain we are now diving my garden which is under water. The good news is, the vis is gin clear – the bad news is, I live at the highest place in Barnsley – shame about you lowlanders who are now hundreds of feet underwater!

I can see the first sunken buoy and the left side of it is my 1st waypoint. Arriving at it, I can't see anything that is on my bearing so choose a point on the lakebed (former lawn) about a meter to the left of the blue sunken buoy. This will be my 2nd and final waypoint and I should be able to see the garden chair (destination) from this point.

Practise this on the surface, in the car park or anywhere. Waypoints can be any thing from a pebble, rock, shell, bit of wreckage but not something that will swim or walk off.

The 'Capenwray Challenge'

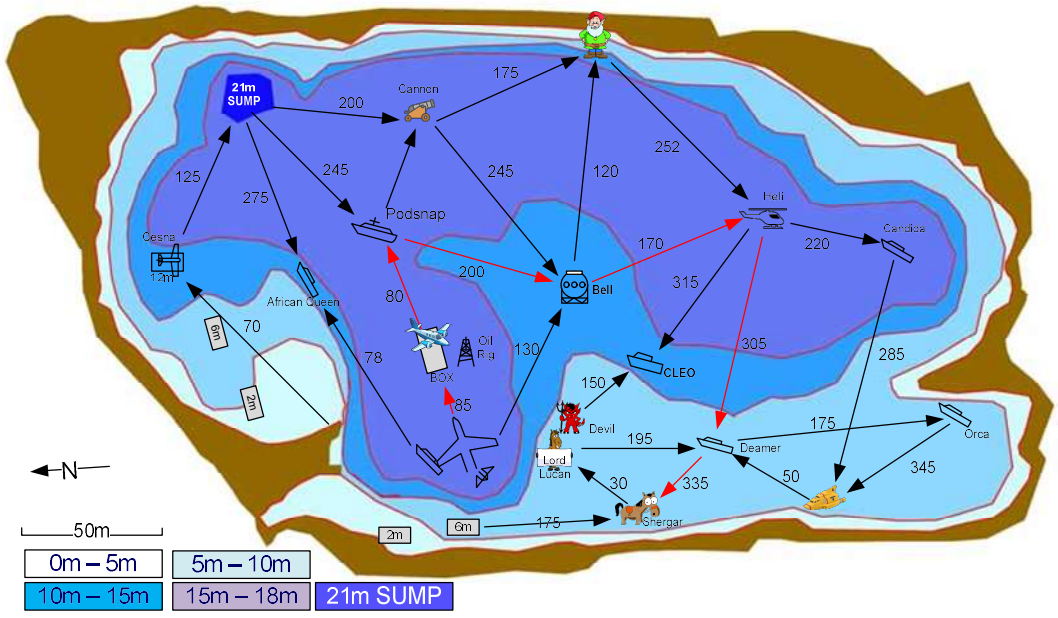
This is a planned route using your compass and spider senses to navigate a grand tour. If you don't have spider senses or other superpowers, we'd better use topology, distances and simple pilotage using bearings. When planning the tour, we also need to think about our bailout plan – short of air, cold and limited bottom time.

Let's look at the Challenge – you are going to swim in a large circle and return to your entry point at Capenwray quarry; our own version of the grand tour.

The route is marked out in red.

The start marked with a dotted red line starts with a giant stride from the pier, followed by a short swim – note the steep decent and the wall on your right shoulder. You should arrive at the plane and make your way to the nose. The tour is then divided into legs:

Plane to Box	85°	about 20m @ constant depth 17m
Box to Podsnap	80°	about 40m @ constant depth 17m
Podsnap to Bell	200°	about 60m - off the stern, bottom rises up a slope (shallower promontory) to 12m level - Bell sits in a large flat area
CHECK POINT		You will have checked you air at intervals along the way but this is a good time to consider the option of a bailout – it should form part of your plan. If air or bottom time is short your bailout is to the plane wing on a bearing of 310° (it is the reciprocal or back bearing of the 130° shown on map.
Bell to Helicopter	170°	About 70m – off the flat area into deeper water (helicopter on top of container)
Heli to Dreamer	305°	About 90m – Long swim with steep ascent to 15m area and then slope up to Dreamer that sits in about 9m depth.
Dreamer to Shergar	335°	Relatively short swim in 7-8m of water.
Part B		You could use a bearing which would be the reciprocal of 175 but keeping the wall on your left shoulder will bring you back past the 6m and 2m platforms to the exit.



How does will this work in the water

The key to safe and enjoyable diving is planning and preparation. In order to navigate this complex route for our grand tour we will need a slate. It is surprising how much information we can put on a small bit of plastic.

Slates

Slates come in a variety of guises. There are multi-layered wrist slates, electronic slates or ones that fasten to your compass. Alternatively, you can make one from a piece of white plastic guttering: cut up and drilled to take some bungy cord which is an inexpensive solution. To use this method, simply put some wide masking tape onto the home-made slate, providing you do not overlap the tape it will stay on and you can write on it with a biro.

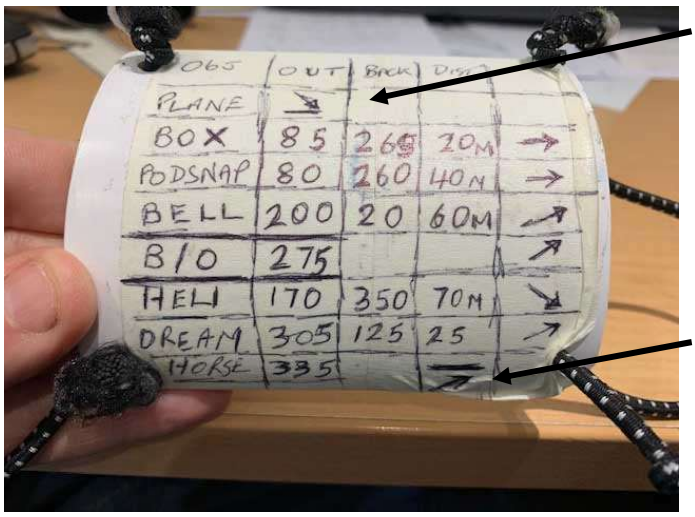
Here is a slate for the dive planned above, you can omit some details like distance or back-bearings but the bailout is useful;

Object	**Out**	**Back**	**Dist**
Box (16m)	85°	265°	20m
Podsnap (16m)	80°	260°	40m
Bell (12m)	200°	20°	60m
B/O DEVIL (6m)	275°	6m ridge N	
Helicopter (17m)	170°	350°	70m
Dreamer (9m)	305°	125°	90m
Shergar (7m)	335°		25m
Home (6m- 0m)	5°	Wall on Left	

This slate is very detailed but looking at it gives lots of useful information, for instance; swimming from the box to the Podsnap is a fairly level swim but from the Podsnap to the Bell you come up about 4m. If the extra depth information is too much you could just put a small arrow after the object name you are swimming towards. Bailout – this is the point at which the dive leader decides if the second half of the route is on. Notice that the 275 bearing does not appear on the original map – we have measured the angle and added it to the map to illustrate the plan. This allows us to move directly to the shallow 6m ridge and swim along its edge North (N), following the rim back to the entry point.

Visualising the dive beforehand is a useful technique – distance, direction, turning right or left, going deeper or shallower, allows you to understand where you are in relation to the topology. If you miss an object, it's important to be able to guess a bearing back – this visualisation will help you plan for when it goes wrong.

Here is my slate for the dive above which is probably the most complex navigation you would do:



Notice the nav to the plane shows an arrow pointing to a thick line – this means descend keeping wall on right.

Arrows on right show whether I'm ascending or descending – putting in depth can help, just replace the arrows you can work out ascent and descent from that.

Dive finishes with similar notation – swim up keeping wall on left this time.

It is up to you how much detail you use. This is a small slate but has a hugely complex dive on it.

Variations on the slate layout – it is entirely up to you how much or how little notation you make. You could scrap the 'Back' column and just read it from the top bezel of your compass. So if you want to retrace your steps just set the bezel and read the reciprocal. This is a small slate with lots of information.

Pilotage

Your compass and slate are great tools for navigation, especially if you know the general direction in terms of depth. However, just as important are geological and topological features; rocks, walls, reef edges, sand ridges, wreck orientation, etc. These can give you a great understanding and special awareness in strange surrounding.

Look Back

Dives like greenends gullies look straight forward from the shore; swim out on the left wall come back on the right, easy. Until you realise that underwater, at depth there are lots of gullies. As you swim out of the end of the gully, look back – you may see two gullies, knowing you came out of the one on the right looking back will let you navigate back to the entry point.

Looking back periodically lets you spot features for your return; keep to the left of the rock on way back, etc.

Cathedral Rock – compass, walls and depth

Walls and reefs are easy navigation aids; wall on left out and right back is a good example. Pilotage helps when you need to navigate around something whilst trying to keep to a bearing. Here is an example where divers set off knowing its 120° from the edge of Broad Craig – I am of course referring to 'Cathedral Rock' from the harbour at St Abbs. I've spoken to many divers who couldn't find it and it is a good example of where you need more than a compass.

This iconic British dive is on most British divers list but surprisingly easy to miss. There is a real maze of gullies and rocks on the swim out and navigating around walls and then getting back onto your bearing is a real skill. However, once mastered the greeting from the resident wrasse and the impressive spectacle is well worth the effort. Worth knowing that the depth under the arch on low tide is about 12m, so if you are looking for it at a depth of 8m you've taken a wrong turn.

Remember – learn to use a range of navigating techniques – knowing how to navigate can be a life saver.

Navigating in Deeper water

Gozo is a great place to dive, you basically hire your kit, throw it in your rented jeep and off you go. The dive shop usually gives you a plan of the island with an explanation and a map of the dive sites. One site in

particular has three wrecks, intentionally sunk for divers. At the jumping in point, there is a noticeboard that shows you the wreck location.

You jump into the water from a rock and the wrecks are in a all in a line. The problem is that there is usually a current flowing and the wrecks are deep, which means you can't use pilotage using the bottom for reference. So how do you find the wreck?

Here is a picture of the Perspex information board at the site.

You can see the car park marked with a P. The compass bearings are marked on the board but it is about 50m to the nearest wreck, the MV Kawela. Swimming on the surface is not ideal, in a current you could drift off the wreck and following the seabed at 35m uses up your dive time and air.

The solution is to enter the sea and then swim on the surface. To dive the MV Karwela where the wrecks deck is at 30m. Swim out along the yellow line I've drawn on the plan. Then drift with the current towards the wreck, using your compass to site the entry point as a back bearing, when the bearing (dotted line) to the entry point is 340° you are over the wreck. Descending just before you get to that point allows you to drift onto the wreck.

A practical example of using a compass bearing.

Diving in Low Light - Finding the Staingarth at Stoney cove

If you have ever dived at Stoney Cove, an inland quarry in Leicester, then you know its usually pretty dark at around 18-20m on your swim out to the Staingarth wreck and there aren't many objects to act as markers you can pic out in limited visibility.

This is a technique one of the Barnsley BSAC, Alexis Moreno, uses in poor lighting conditions. Firstly, the compass gimble is usually fluorescent and so you can read your compass even in poor light. You need to pinpoint anything to swim to on the bottom or something to focus your direction. This can be achieved by using a dive torch, especially if you have one with a tight beam or one where the beam can be focussed.

The illustration below shows this technique in use.

The arm with a wrist mounted compass is held across your body in front of your line of sight and the compass window indicates the bearing. Now holding the torch parallel to the bearing, you can use the beam to pick out your path along the floor.

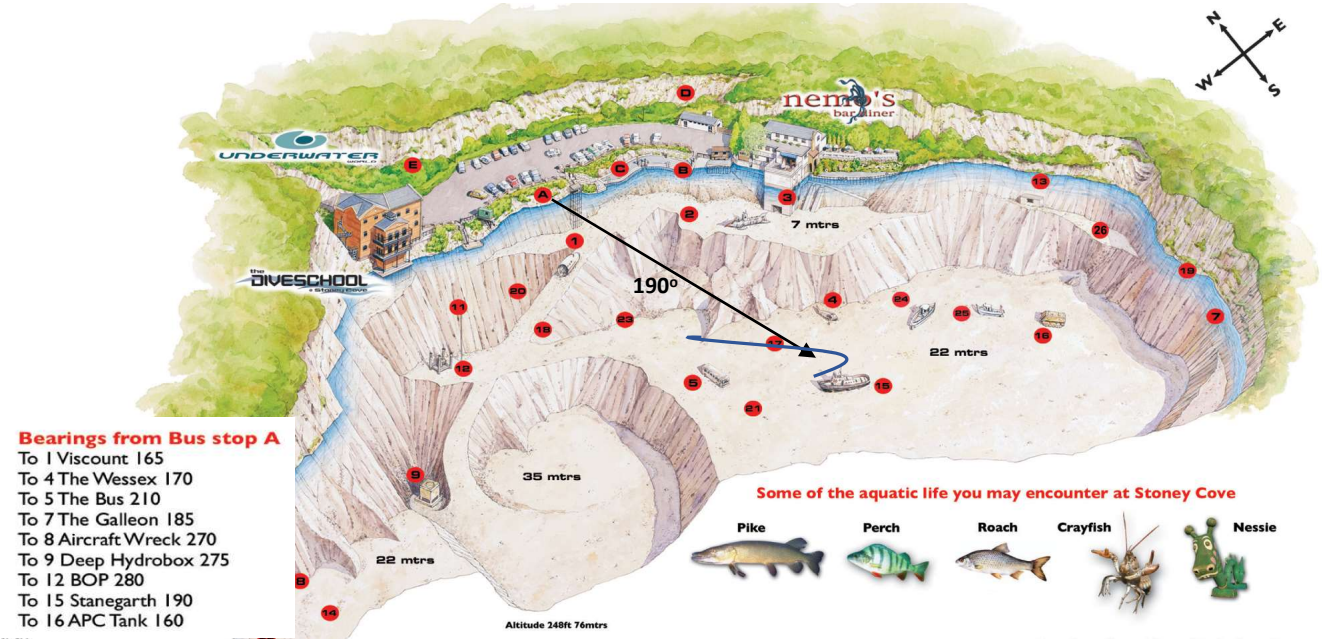
The same technique can be used with the compass held out in one hand on your lanyard and your torch in the other.

This works well on dark sites or where the is a lack of navigation waypoints on the seabed, sandy bottoms etc.

A word of caution

It may seem tempting to try to use this in mid water. However, if you are in any current, the body of water around you is also moving. You seem to be moving in a straight line following your trusty light sabre, but you are in fact moving sideways – same bearing but you'll miss your objective.

Navigate using all the information you have



This is the map from Stoney cove. It has a number of entry points listed and compass bearings to the various points of interest. The illustration above shows the route from the 'Bus Stop' to the Staingarth, a compass bearing of 190 degrees.

Local Knowledge

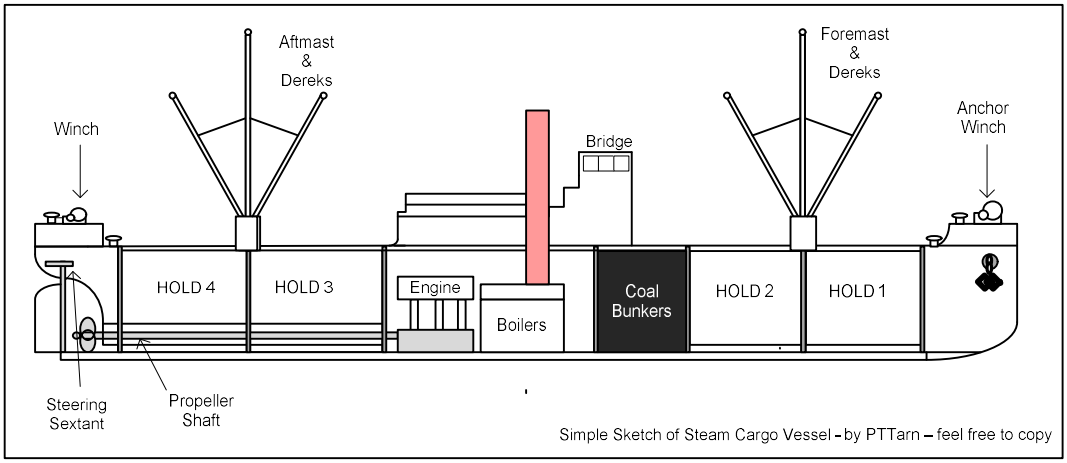
What is not shown on the map is the very long anchor chain from the front of the Staingarth which snakes out a considerable way – I've drawn it with a blue line. This means that if you leave the bus stop and head roughly out at 190 degree and descend down to 20m you will come across the chain!

Although its very dark, so many divers have followed the anchor chain that there is a large black path that follows the chain where they have kicked away any sediment.

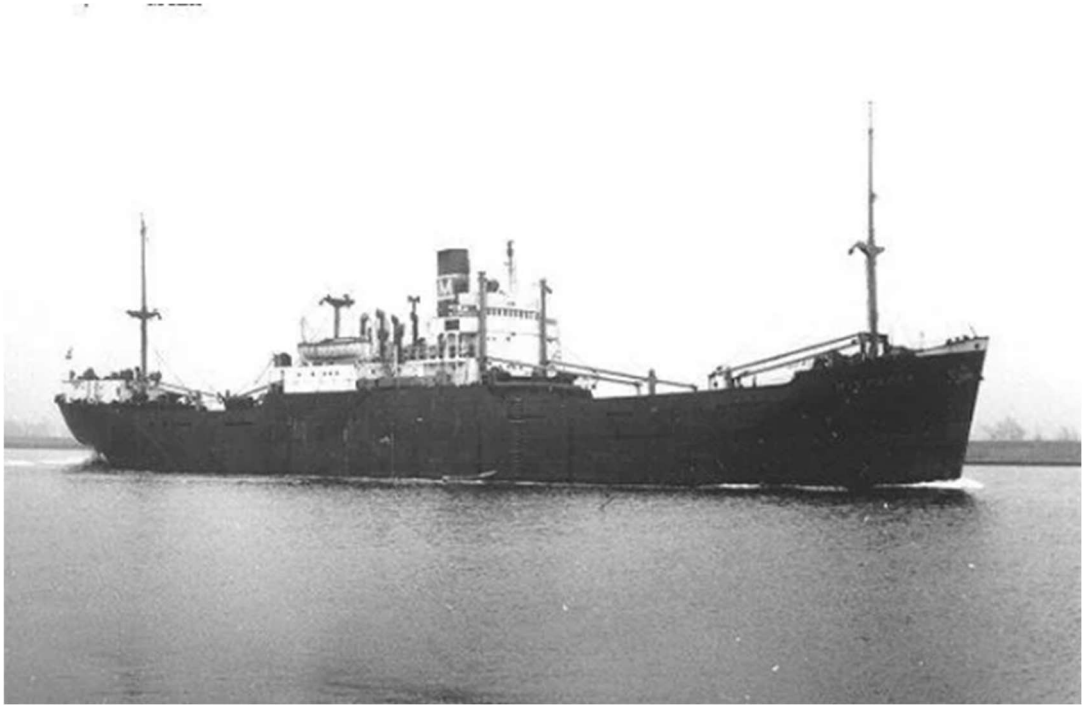
The lesson from this navigation is to ask others. If there are a group of divers on site, talk to them, ask if they have any tips on finding your way or advice about good diving sites. Local knowledge is invaluable and will often save you missing something special.

Wreck Navigation

Your compass can be rendered useless in the presence of a wreck. Knowing something about the structure of a ship can aide you in your orientation of the site. To get started, I've drawn out an example layour of a steam cargo ship, Thistlegorm is probably the most famous of these but the Shuna in the Sound of Mull is mostly intact and a great dive.



Here is an actual picture of the Shuna

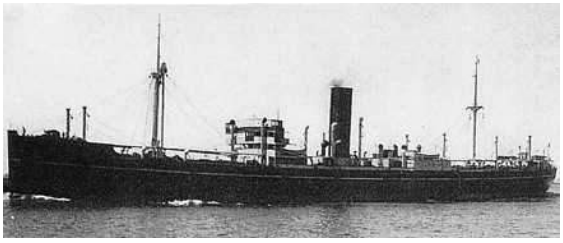


The Shuna sits in range of a Sports diver and is a great dive. It is possible to cover the whole of the ship in one dive and descend down through the open top of the engine room to rest on top of the triple expansion steam engine. Many wrecks have a very similar layout.

Abyssinian, Farne Islands. Wrecked on Longstone in 1921.

However, most are not as intact and to get the most from a dive and navigate the wreckage it's a good idea to understand the parts that resist the impact of the sea.

The join club Farne Islands Trip gave us an opportunity to practise our skills on the reck of the Abyssinian.



Sadly the ship today has been destroyed by the waves over the last 80 years. However, with some rudimentary knowledge the wreck has much to interest us.

The parts that survive.

Arriving on site we are greeted lots of metal plates and ships frames that litter the seabed. Rising up are the boilers. Being very strong, the boilers usually survive and are often the only parts remaining on many wreck sites.

Having found the boilers, we then swim around them to discover the engine block standing 2-3m proud of the seabed. Moving on we soon come across the second boiler. Nearby is the propshaft stretched out along the seabed with bearings and housing still place and bolted the keel. Following the propshaft we find the stern winches sitting upright on the seabed. And sitting on the seabed is the steering sextant. The propeller being salvaged and removed from the site many years ago.