



SEA KAYAK NAVIGATION



GORDON

Hello. This film is all about navigating a sea kayak. Most of the time you can keep things really simple.

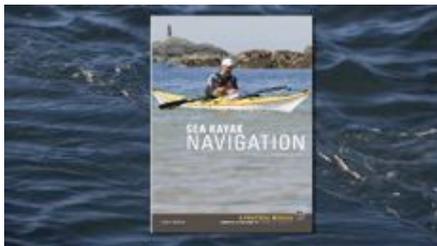
The next thing we're aiming for is the bridge here. We can't miss that one.



FRANCO

However, sometimes in some places and in certain conditions, you're going to have to up the ante and you've got to know what you're doing. I'm Franco Ferrero, and in this video, Gordon and I are going to cover the basics of practical navigation.

SIMON



Gordon has invited Franco to help present this coaching film because, when it comes to navigating a sea kayak, Franco wrote the manual.

A former head of paddle sport at the National Outdoor Centre, Plas y Brenin, his book is a perfect accompaniment to this film.

It goes into greater depth than we have time to pursue.

And you might find navigation easier to learn with the book and film together.

FRANCO

I love paddling!

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For expert coaching contact Gordon Brown at SkyakAdventures.com



SIMON

Franco will coach the techniques that are used off the water, before you even step into a kayak. Meanwhile Gordon will coach two students, Ken and Janice, in other techniques that you'll find useful on the water.

GORDON (Aside)

What did you notice? How much were the boats being deflected?



FRANCO

I'm a great believer in keeping navigation as simple as possible. So quite often I'll just get in my kayak, turn left and follow the coast, or whatever. And just tick off the features as you go along. Nice and easy. And not too much maths involved either. People can make life much too difficult for themselves and funny enough of course, the more complicated you make things, the more likely you are to make mistakes. So let's join Gordon Ken and Janice and look at some simple navigation techniques.

GORDON

"So we've got a couple of maps here, and we're using OS maps today rather than charts, just because we're more used to using these."

Setting the Map

"If you just grab one of these, Janice and Ken if you take one as well. Sometimes it's easier if we rotate the map so that it fits the land we're on, or the land we're paddling alongside."

So where we are just now between the hotel and the memorial in that corner of the bay, which is just here, where we are. And then we've got this spit of land coming out, beyond the yacht along here towards the Skye bridge.

So if we get those lined up, we can then see; we have the Skye bridge over there; the other part of the bridge; Kyle of Lochalsh over here and we can see other things roundabout. So it starts to make sense.

It is important to learn to visualize what the two dimensional world of the map will look like in the real world. It comes with practice.



Large and especially man made shapes such as the bridge, are important but are rarely available. So you have to learn to look for other features,

Small islands are very useful points of reference, but their shape will change as the tide rises and falls.

In time you should be able to identify small bays

and cliffs and be able to visualize what sections of land will look like just by reading the map or chart.

"Your backs are to that right now, so it's probably worthwhile going out a bit, turning around, and then setting the map to what you're actually looking at, so you get an idea of that. OK? Let's go for a wee paddle"

Handrail

We're heading into a cluster of islands just off Skye, following the coast. In navigator's jargon, the coast is our Handrail. We fix our position by constantly relating features on the map to features we see.

"So the idea of using a handrail is that we can mentally tick off features. So we've got this rock we just passed that we identified earlier. And we can use this as our simplest form of navigation to find out where we are. The next thing we're aiming for is the bridge here. The Skye bridge, lots of traffic on it, so we can't miss that one."

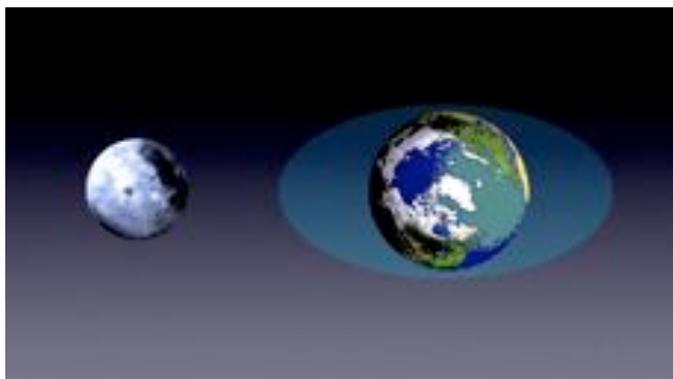
In poor visibility, following an obvious handrail like the coast can be the best way to find safety.

FRANCO

So as we're paddling along this stretch of coastline for example we've got a reef over here and a rock that will be fairly obviously marked on the chart or even the OS map. We've got a nice beach coming up that would be fairly distinctive, and that headland over there. And we can just tick them off as we pass them.

Tides

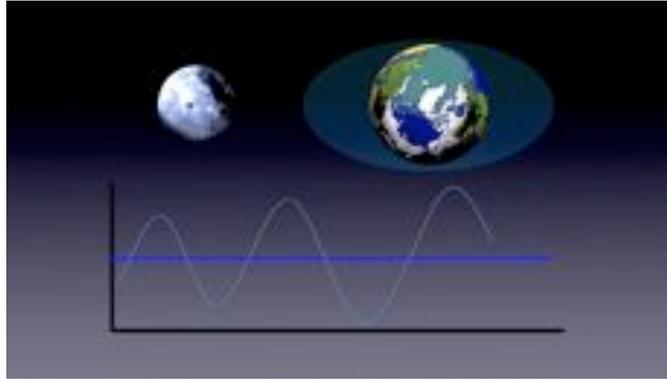
But the sea is not static. To navigate safely we must understand tides. Imagine looking down from space on the earth's north pole. Tides are caused mainly by the gravitational pull of the moon. It causes the water on the planet to bulge towards it - it's exaggerated here but you get the idea.



The water is pulled towards the moon. At this point it's High Water. At this other point it's low water.

However, the earth rotates. So the level of the tide at these two points changes. At one point it falls while it rises at the other. Roughly six hours later, the point that was at high water is now at low water, while low water point has become high water.

This tidal pattern, with two high waters every day, is the most common on the planet and is called Semi-diurnal. This is how it looks graphically.



But it does not apply everywhere. Because the earth is not evenly covered with water, some places have just one high water a day, while others experience very mixed tides.

So whenever you paddle anywhere that's affected by tide, and that's most of the world, you need to check the tide times.

Tidal information sources

There are various sources of information. There's printed forms such as nautical almanacs or the small tide tables you can buy, fishermen's tide tables. Or you can download and print off information from the internet, such as this. You can see the pattern that we talked about earlier.

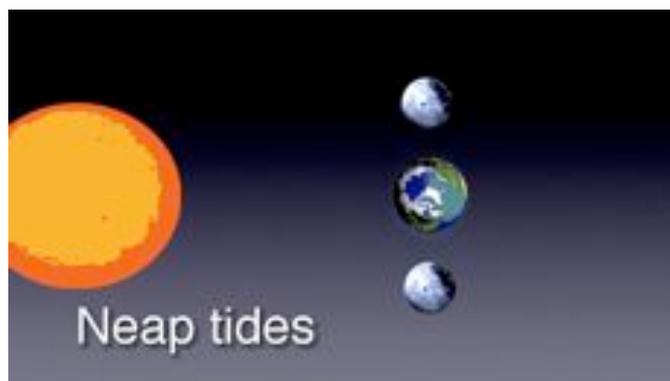
Or you can have tides from a Smartphone App which is quite handy as you usually have your phone on you. However, you could have problems with batteries or with water so therefore I would always carry printed information as well. The key things we need are the times of high and low water and the tidal range, which is very important so I'd better explain that.

Tidal range

When the sun, moon and earth line up, the gravitational pull on the earth's oceans is greatest. It doesn't matter whether they line up like this, when there's a new moon, or like this, fourteen days later, when it's full moon. In either alignment the bulge of water on the earth's surface is greatest, so High water is at its highest and Low water is at its lowest. The Tidal Range between the two is greatest. These are known as Spring tides. The name is nothing to do with the season, 'Spring', but instead comes from an old Viking word.



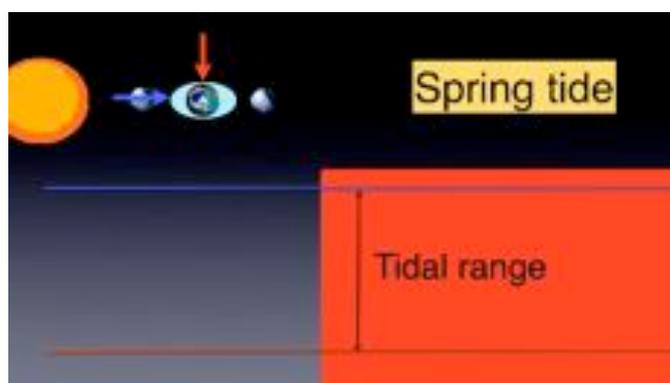
Between the two spring tides, is a period when the sun, moon and earth line up like this. These are known as neap tides. They occur when the moon is waxing in this position, and when it is waning in this position. At these points the gravitational pull on the earth's oceans is weakest. So the difference in height, the tidal range, between high water and low water, is at its least at Neaps.



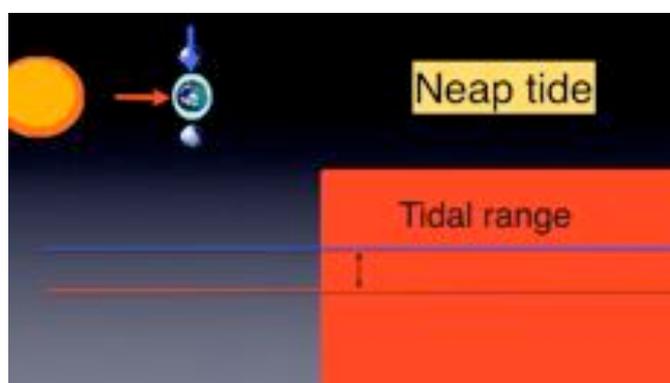
FRANCO

“beautiful day, sunshine, what more could I ask”

This is how the tidal range at Springs and Neaps might look in practice. Let's take a Spring tide first where the gravitational pull of the sun and moon are at their greatest. Low water will be at its lowest and high water will be at its highest. This difference, between low water and high water, is the tidal range and it is at a maximum on Spring tide.



All this volume water has to flow up and down the coast, roughly every six hours, and the speed at which it must travel is also at its maximum on a Spring tide. Maximum volume, maximum speed. Contrast this with Neap tides when gravitational effects are at their weakest.



Low water will be at its highest, and high water will be at its lowest. This difference, between low water and high water, the tidal range is at a minimum on a Neap tide.

Because the smallest volume of water is flowing up and down the coast roughly every six hours, the speed at which it must travel is at its minimum on a Neap tide. Minimum volume, minimum speed.

So that's tidal range. So far we've talked about how the tide goes up and down and that can be very important when you've got a long walk out on a flat beach.

However, most of the time, as kayakers, what we really need to know about is the horizontal flow of water, or tidal streams. I'll come back to that later. Meanwhile let's go back to Gordon and do some more practical navigation.

Speed and distance

GORDON

It is very useful to know how fast you paddle in different sea and weather conditions. I'm going to show Ken and Janice how to work out their paddling speed. This will be useful when navigating short distances in poor visibility.

"So we have a gap here we're going to paddle across between where we are just now and this rock over here. It's about 100 meters. And what I need you to do is just go and paddle that, at your normal speed, and count the number of left-hand, or right-hand, paddle strokes. So count the number of strokes on one side, and that gives us an idea of distance covered per stroke. So it should take us somewhere about a minute."

"It's important to know how far you travel with each paddle stroke and how long it takes you to go a distance. For example, if the fog came down or we were paddling at night, we would want to know how far we travelled for any given time. So if we're going along on a handrail and we pass one feature, and we know it's a hundred meters to the next feature, we know how long it's going to take us to get there or how many strokes it'll take us to get there."

"OK, so how many paddle strokes was that on one side? Ken - 35. Thirty-five. Janice - 28. Twenty-eight. You're not going to believe this, but most people are between twenty five and thirty five paddle strokes on one side for 100 meters."



To help you navigate in poor visibility, I suggest you establish your own figures.

How long does it take to paddle 100 meters? Most people take about one minute.

And how many one-sided paddle strokes does that take? Most people are between 25 and 35 strokes.

Pick a calm place with no tide and use a GPS to establish a 100-meter gap on which to work out your personal metrics. It also helps to know most regular sea kayakers paddle at about 6km an hour, around 3 nautical miles an hour, three knots. In a moment, we'll look at taking a bearing. First, Franco explains some of the differences between Maps and Charts.

Maps and charts

FRANCO

OK so Gordon's been using an OS map, and in the UK most of the time sea kayakers use them. And that's mainly because they contain an awful lot of information about what's on the land. So if we have to make an escape somewhere, we have to get a car to do a shuttle we've got all the information that we need.

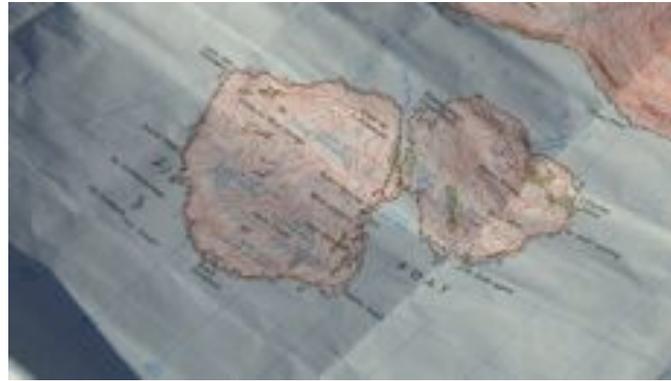
There's quite a lot of information about the coast as well. So there are lots of coastal features such as beaches, isolated rocks, even areas that dry between high and low water. But there's quite a lot of information missing.

If we move over to a nautical chart... They're colour coded. The land is yellow, the sea is white, the shallow water is blue and the areas that dry between high and low water are green. Which makes life very easy. The information that they have about the land is minimal. It's purely what is obvious from the sea, which is not very handy when you're trying to find a

phone or a pub or an escape route. On the other hand they have lots of information about what's in the water.



So if you have a look here. If you look at Soay there's very little information about the land. The one obvious hill, a couple of spot heights and the buildings that are obvious. On the other hand, if we look at the water, off this side you can see that, not only are there drying rocks, isolated rocks and reefs, there are also large areas of relatively shallow water where you'd expect large, breaking waves in stormy conditions.



So if you compare the chart with the OS map of Soay, then you can see that the reefs are fairly obvious but there's really no information about how deep the water is. You can make an educated guess, but you don't actually know. On the other hand, there's lots of information about woodlands, streams, rivers, buildings, tracks and so on.

The other important information you can get off the chart is about buoys and lights and their sequences, and if you're going to do night navigation that's critical.

You can now get most of this information, maps and charts, downloaded onto Smartphones - even what they call chart plotters. And this is extremely handy in that you've also got your current position indicated by the GPS. However, we all know electronic things can go wrong, and the very small screens make them not very good for planning purposes so you should never rely totally on these. OK, let's go back to Gordon.

Taking a bearing - map to compass

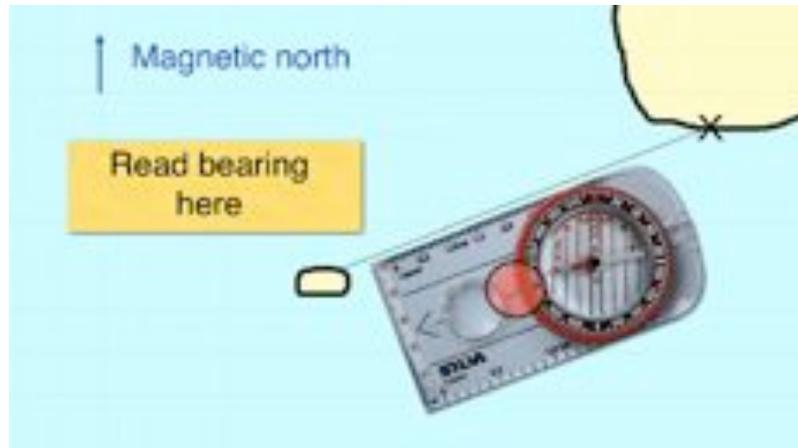
GORDON

"So we've just had a nice lunch break and we know exactly where we are. And we want to get out to this wee island, this rock out here. It's fine on a day like today when we can see it, but if the fog was to come down, or it was at night, we might want to start using the compass or take a bearing on that so we know where we're going.

We're just here, at the tip of the compass, in that wee bay there. And we're going to go out to tis rock out here. So if we take the map and set it as we did earlier back on the beach, so that the bay we're sitting in, and that island, line up there as we're looking towards the island.

So to take a bearing, we put the compass on the map. We line up the edge with the bay and the island. We then turn the bezel until the north arrow and these lines, line up with the grid lines on the map.

We then read it off here, and that gives us a bearing of 249, 250.



Just so we're clear, this is how to work out a bearing from the bay we are in, to the offshore island. Lay the edge of the compass so it points in the direction you want to paddle. Turn the compass bezel so the internal red lines and arrow point to grid north. They line up with the grid on the map. At night it's very easy to be 90 or even 180 degrees out, especially if you've been turning the map to set it. The figure here is the map to compass bearing.

Magnetic variation

"This isn't the whole picture. The bearing we have on our compass now is only from the map to the map. And the map is drawn relative to North Pole. There's another pole which is the magnetic north pole, and the difference between the map and the magnetic north pole here is about four degrees. So we have to add that variation to our bearing to get what it actually is as we hold our compass up. So we take our compass and add onto there four degrees, which gives us somewhere about 254 degrees."

Ken - *"Is the variation the same everywhere?"*



"No it changes, depends on where you are throughout the world. It changes throughout Britain as well.

The further south we go, the bigger the angle becomes. Then as we go closer to the magnetic north pole, it varies.

And sometimes you add, and sometimes you subtract, depending upon where you are. All the information is on the map or the chart you're using, it's all there."

Magnetic variation differs from place to place and year to year in the same place. Charts and maps give the variation for the area they cover on a known date and the rate of change.

Kayaking on a bearing



"To use this type of compass on the boat, you have to push it under the deck elastic so that it's sitting on the peak of the deck and facing along the line of the boat.

So the compass needs to be parallel to the keel line. And as we're paddling, we turn the boat so that the red pointer, which points north, goes into the red area on the compass.

So north points towards north. And that gives us where we have to paddle because the boat is going along that line there. So we're really fortunate today, it's so clear and we can see where it is we're going to go for. We're not always that lucky.

If we stand up, and then point the compass somewhere over this direction here, it doesn't really matter where. And we're just going to swing everything until we've got the red arrow pointing to north and we should be aiming straight for that island. Happy with that? OK, let's go and test it."



"So just check before we head off. Compasses lined up with the line of the boat.

And then just move the boat until you've got the arrow pointing towards north.

And we should be heading straight for the middle of that island out there. OK? Excellent."

"I don't know about you, but I find looking down at the compass is really tedious. You have to be looking down and focusing on that and then lifting our heads and trying to focus on whatever it is we're aiming for.

So we could use a bigger compass which is mounted further forward on the boat, so we've got less to drop our head or drop our eyes as we're looking at the bearing and looking back up to what it is we're paddling towards."



A larger compass, nearer the bow also helps avoid feelings of seasickness some people experience when trying to follow a bearing on a small compass. Finding an island is one thing. Finding a specific bay on an indented coastline is much harder. For that we could use a technique called 'aiming off' .

Aiming off

" If we're going back, to try to find a bay like that, especially in the dark - if you take a bearing from there to here there's absolutely no guarantee you're going to hit that bay. So an idea is to "aim off"; to deliberately set the kayaks and the compass to one side. So that when you miss it, you then know which way to turn.

Let's use Aiming Off. I've asked Janice and Ken to find another small bay, by taking a bearing to the right of its true position, deliberately aiming off. On the map it's 90 degrees, plus four degrees for local magnetic variation.



"So are you happy with that, ninety four degrees? Ninety-four degrees isn't going to take us to where we want to be.

But we know that when we get there, we're going to have to turn left and follow the coast until we find the bay.

We should be able to work out from earlier that it's about 150 meters, so it's going to take us about a minute and a half to do that. OK, let's go. Maps under the deck lines again and then compasses set as you need them to be."

"OK, so we've got to the point of land now, and all we're going to do is turn left and follow this until we get to the bay that we're looking for. So we just turn left, and follow this along until we get to the bay.

FRANCO

It's worth practicing this practical navigation in good weather so, when you really need it, it is already second nature. Now we come to the effect of tides on the flow of the sea - tidal streams.

Tidal streams

So far we've talked about how the water goes up and down. Now as it comes up, it pours into various bays and channels, and as it comes down, the reverse happens, it has to pour out again. And we call these tidal streams, this movement.

So from low water to high water, the tidal movement, the stream is called the flood, and from high water to low water that's called the ebb.

Where the shape of the land is straightforward, the tides are relatively straightforward. But when the land is very indented, and there are lots of bays and channels, then it can get a bit more complicated.



For example, the high and low water won't necessarily correspond exactly to when the tide turns. There are differences at a more local scale as well. So as you approach a headland, for example, the tidal stream is squeezed around the headland and over the submerged part of the headland and it has to go a lot faster, the water. Just the same as a channel between an island and the mainland, the tide is squeezed through at channel. This is a bit like sticking your thumb over the end of a hosepipe and you find the water squirts a lot faster when you do this.

50-90 rule

What happens to the flow of the tide is approximated by the so-called '50-90 Rule'. Initially, there is no flow. This is known as slack water. At the end of first hour, the south going tidal stream of the ebb tide reaches 50% of its maximum speed.

At the end of the second hour, 90 %

And at the end of the third hour 100%. So at the end of the third hour, the tidal stream has reached its maximum flow.

Then it slows down to 90% at the end of hour 4 and

50% at the end of hour 5

before reaching slack water at the end of hour 6



Then the tide start flowing in the opposite direction.

50% in hour 1

90% in hour 2

100% in hour 3

dropping to 90% in 4

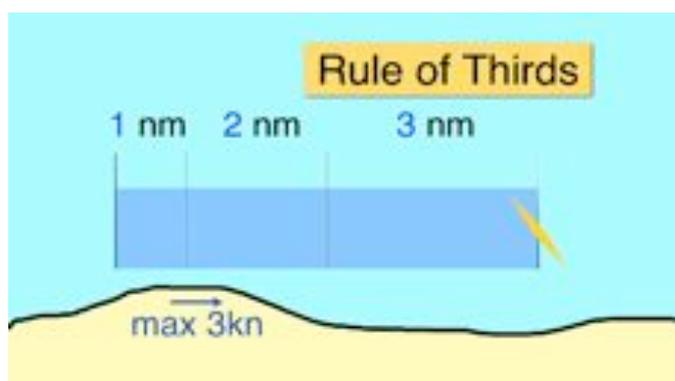
50% in 5

and slack again at the end of hour 6.

So the fifty ninety rule is a very good rough rule of thumb to tell us how fast the tidal stream is moving at a given time. But it is a very rough rule. In fact, you could say it's more of a guideline than a rule. In some ways, far more useful is the rule of thirds and this tells us how far we would move over a given period of time. What's known as tidal drift. Again it's not really a fixed rule; it's more of a rough estimate.

Rule of thirds

Many people think the rule of thirds is about speed. It's not. It's about how far you'd drift with the tide relative to the maximum flow. It's easiest to explain if we assume a maximum flow of three nautical miles an hour.



In the first hour, if you sat in your kayak and didn't paddle, you'd drift one third of the maximum, 1 nautical mile. In the second hour you'd drift two thirds of the maximum, two nautical miles. And in the third you'd drift three nautical miles. Add to this your paddling speed, or subtract it if the tide is against you, and it helps to estimate how far you'll travel under a combination of your own power and the tide.

So if we paddle at 6 kilometres an hour, roughly three knots, then in the first hour, we'd paddle 3 nautical miles and drift one nautical mile, covering four nautical miles. In the second we'd paddle three nautical miles and drift two, covering five. In the third hour we'd paddle three and drift three, covering six nautical miles. We've used the tidal stream to our advantage, covering more ground in a given time than would just by paddling.

Now imagine the tide has turned and the tidal stream is flowing against us, in the opposite direction. In hour 1 we may put in the effort to cover 3 nautical miles, but because we are paddling against a 1 knot drift, we cover just 2 nautical miles. In hour 2 we again put in the effort to paddle 3 nautical miles but the drift against us has risen to 2 knots so we cover just 1 nautical mile. In the third hour the drift against us is equal to our paddling speed of three knots. One cancels the other out. We could paddle for the whole hour and not cover any ground.

This is just one way in which we can work out the extent to which tidal streams can help or hinder our progress.

This is a very rough rule and there are more precise ways of calculating tidal drift. However, for most practical navigation purposes, on the deck of a kayak, that's all you're ever going to be able to use or need.

GORDON

So we now know the basics of using a map or chart, and how to kayak on a bearing. Franco has introduced us to tides and tidal streams, and we know how to roughly work out how they'll work with or against us. But if the wind or the tidal stream is coming from the side, it could push us off course. We need to know how to allow for this. Wind first. I'm going to ask Ken and Janice to take a bearing on a rock then paddle to it, noting carefully by how much they have to turn their kayaks off that bearing to stay on course.

Take a bearing - compass to map

"So if we take our compass and just point the compass straight at that rock out there. And then turn the bezel so that the red arrow is pointing to the north. We'll get our bearing.

They'll all be slightly different. Sometimes it's easier to look directly down on it. I've got somewhere about seventy degrees". Ken - "so have I". Janice- "Just over seventy". "Just over seventy. So that they're very, very similar."



"When you paddle out towards the middle of that rock, you're going to be drifted by the wind."

Allowing for wind

"I want you to turn the kayak so that you're still going straight for the rock, and note from the compass how much you're having to allow. It's going to be very, very little. OK."

"So what did you notice? How much were the boats being deflected by the wind?" Ken - very little. "A couple of degrees. Yes. It's not easy to navigate to within five degrees in a kayak because it moves so quickly. If the wind's a bit stronger, then it turns maybe ten or fifteen degrees and we have to then bring it back onto line there. OK - for most winds, about five

degrees is all you'd have to allow to aim off to get there. So aiming into the wind, about five degrees to get you across there."



To allow for most manageable winds, you need to compensate by up to five degrees. But because a moving kayak can swing around more than five degrees, in practical navigation, there's no precise allowance than can be made for wind. Tide however is different. I'll show you how to allow for tide after we've heard more about tidal streams from Franco.

FRANCO

Let's be clear what we're talking about here because people often intermingle the terms current and stream.

Tidal streams is the horizontal movement of water that happens on a daily basis, directly related to high and low water, the moon and the sun. Whereas Ocean Currents happen out in the ocean where the wind blows the sea and the currents move constantly. In North America, people often refer to what we call "tidal streams" as "tidal currents" but we're going to stick to the terminology, "tidal streams".



So where do we get this tidal stream information from? Well, in the UK there are some very good sea kayaking guides produced by my company Pesda Press, and they cover the more popular areas and will eventually cover the whole of the UK.



You can also get yachtsmen's guides which again cover the areas which are popular with yachties.

Or you can go for the Admiralty pilot which has the advantage of covering the whole of the UK, in fact, the whole of the world.

So all this information is too difficult to access on the deck of your sea kayak so what most of us do is transfer it onto a handy chart or in this case an OS map.

And we do that by putting a couple of arrows with the times that the tide turn and perhaps the maximum rate.

Tidal planning

The map in sea kayak guidebooks published by Pesda Press, will probably have a pair of arrows pointing in the directions of the two tidal streams - in this case, North and South. Above and below the arrows are times. These are the times at which the tidal streams start, relative to the time of High Water at a known port. In this case ULL is short for Ullapool

The book also gives the maximum speed the tidal stream reaches on an average spring tide. It will go faster on some Spring tides and slower on others, but this is a good working average.

Let's imagine you want to kayak through these narrows. The guidebook map shows times relative to high water in the port of Ullapool. So I look up Ullapool in my tide tables and find out the times of high water there for today.

Today, HW in Ullapool is at 04:06 in the morning and 16:14 in the afternoon. But those times are GMT, or UTC and it is summer, so we must add one hour to allow for daylight saving time, British Summer Time.

These are the times of High Water in Ullapool today. Now let's find out when the tidal streams in these narrows start flowing.

The guidebook arrows opposite tell us the North flowing stream starts at +05 hours 52 minutes after Ullapool HW. So we add 5 52 to the two times of high water at Ullapool. We find there are two north flowing streams today in these narrows, at 10:58 and 23:06.

We'll jot that down over here, and move onto the south going stream.

Because we want to kayak south. The guidebook arrows tell us the South flowing stream starts -0015, that's fifteen minutes before High Water in Ullapool.

We've worked out that Ullapool high water is at 05:06 and 17:14.

So subtracting fifteen minutes from these times gives us the times of the south going tidal streams in these narrows, 04:51 and 16:59.

We'll jot that down alongside times of the the north going stream.

So we now know the tidal streams will behave as follows: It will be slack water, and only start to flow south at 04:51, reaching its maximum roughly three hours later. It will be slack again and start flowing north at 10:58. Slack again and start flowing south at 16:59. Slack again and start flowing north at 23:06. It is important to know times for both south and north going tidal stream so that you know at what time the tide turns against you.

We know the average maximum rate at Springs is 4 nautical miles an hour, four knots. A good estimate for the Neaps rate is usually half the rate at Springs. So the speed is going to be roughly between 2 and 4 knots, depending upon where we are in the lunar cycle. This probably gives us enough information to time our journey to take advantage of the tidal stream and predict what sea conditions we're likely to face.

Using tidal streams

OK. we know when it's slack water, we know when the tide is moving with us and we know when it turns against us. We also know roughly how fast it's going at any give time. So how do we use this? Well, if the conditions were goo and we wanted to move quickly then we'd make sure we were on the water in the third and fourth hour when we get the most help from the tide. On the other hand, if we were in nasty, wind-over-tide conditions it would be a good idea to be there in the last hour of the tide as it slows down towards slack water.

GORDON

Of course we don't always want to travel with or against the tide. Sometimes we want to travel across its flow. So let's now look at a couple of ways to handle a tide that's coming from the side and is trying to push us off course.

Allowing for tide

"So we've looked at how the wind affects us and how we have to alter our bearing. We've moved around the coast a bit and we've got an area with a bit of tide now. And we're going to do exactly the same thing, but allowing, how much we have to allow for tide. So when you turn around, you'll see there are some yacht masts over there. I want you to take a bearing on the yacht masts, and then head off towards there and see what angle you have to allow for the tide this time."

"You could see there as they paddled out that Ken was drifting more on the tide than Janice was. A lot of that is to do with boat shape, that it was caught more by the tide."

"OK, that was a wee bit more interesting than the wind, wasn't it. How much were you drifted?" Ken - about ten degrees. Janice, yes about ten. "So you found there it was about ten degrees you had to allow for the tidal drift. A rule of thumb would be that for every knot of tide, so about two kilometers an hour, if you're paddling at three knots, which is about six kph, you'll have to allow twenty degrees. So that would back up what you just found. If we then double the speed of the tide to two knots, we'd have to allow forty degrees. After that, the rule doesn't work."



Paddling at 6 kilometers and hour, three knots, this is a rough guide to use on the water. For 1 kn of tide, about 2 kph, from the side, allow 20 degrees, turning the kayak towards the tide to stay on a bearing. For 2kn of tide, about 4kph, allow 40 degrees. That is as far as this guideline goes. However, when we're planning longer crossings we can calculate tidal drift with greater precision. Franco will explain this later in Shaping a course.

Transits

Now though, let's look at a different way to stay on course. Because if we can see where we're headed it's usually easier to use a transit than a bearing. In this example, the tide is flowing strongly in this direction.



This line shows the bearing I'm trying to follow. If I stick to that bearing, making no allowance for the tide, it pushes me well off course. My bearing is unchanged, but I'm going to end up in a different place. In this case, with land behind, it's much easier to use a transit, also called a range.

"For a transit in its simplest form, we'd take a bearing with a compass on what we're aiming for, set the boat up heading towards that, and then pick something in the background that's easily identifiable. So we'd have two things lining up - the thing we're aiming for and something in the background. Then if we start to drift, then the relative position of these two moves. The thing in the background moves the same direction we're being drifted."

This time, I've lined up the end of the island, where I'm heading, with the white house on the far shore. I could also have used the red buoy.



These two points are a visual reference of my bearing, shown by the blue line. I'm trying to keep the two points lined up while I kayak across a now more powerful tidal stream.



To keep on transit, I have to turn the bow into the flow, which means my compass no longer shows my bearing. But by keeping the transits in line, I'm straying very little from my course. I know when I've been drifted, and I can climb back on course.



On a different piece of coastline you can see this from a kayakers perspective. I paddled here by keeping the end of the island in line with the white building behind.

Now if I allow my kayak to drift to the left, the more distant transit also appears to drift to the left. My kayak is off course, in the direction to which the far transit appears to move. Transits are very useful for coastal sea kayaking and can be applied in all sorts of ways without a compass. For example, knowing when you're in a shipping channel.



"So one way of telling whether we're in the shipping channel or not, because there's no lines drawn on the water, is if we look at the red buoy down here and then on the bridge there's the red mark, on the bridge there, left hand side. If we hold our paddle up in front of us, and line up one end with the buoy, and the other end with the mark on the bridge, if the paddle's in front of us then we're not in the channel yet.

So if we've lined up those marks, the red buoy and the mark on the bridge, of the paddle is in front of us we're not in the channel. As soon as it gets really close then we're getting close to it, but as soon as we can't actually line up the two in front of us, then we're definitely in the channel. OK - happy with that?"

FRANCO

Everything we have covered so far might be all you need for most of your kayaking. But if you want to tackle longer crossings, you'll need to know how to shape a course.

Shaping a course

Right, these are the tools of the trade. A pencil, pair of dividers, and a Portland plotter or a set of parallel rules or square plotter.

Charts are more useful because they contain far more in terms of tides and tidal streams. So because of that we're going to work in nautical miles.



All tidal information is in nautical miles and charts are measured in nautical miles. A knot, is a nautical mile per hour which is roughly two kilometres per hour.

The best way to learn this sort of thing is in a one-to-one situation with an instructor or a competent paddler. So because of that, we're only going to outline the basic principles in this film.

In this scenario you wish to kayak from the large island top left to the small island. There's no transit behind the small island you can use. The tide is pushing you easterly at a rate of 2.4 knots. On what bearing do you kayak to travel in a straight line to the small island?

Firstly draw a line from your position to the small island and well through the intended destination. This is your intended line of travel, your Ground Track, so we mark this with two arrow heads.

Measure the distance between the two islands and work out how long it would take you to paddle this in a straight line. The gap is 3 nautical miles wide, and it takes most of us an hour to paddle that distance. So with no tide, a straight-line crossing would take you an hour.

From your start point, lay off a course in the direction in which the tide is travelling. In this case the set is due east, so 90 degrees. Mark off the distance the tide would cause you to drift in one hour, in this case 2.4 nautical miles. This is the tidal set and drift line, marked with three arrows. This is where you'd end up if you didn't paddle at all.

Take the dividers and open them to the distance you would paddle in one hour, which we know is three nautical miles. Put one leg on the end of the tidal drift line, and mark the point where the other leg of the dividers crosses the ground track. Draw a line between these two points. This is your course to steer, marked with one arrow. The angle of this line is the course to steer to follow the ground track. So set your compass to 144 degrees, and follow this bearing to the island. And in this case, because the tide is assisting you, you'll reach it in less than an hour. An hour would take you to this point. The small island is roughly two third of the way to that point so you'll reach it in roughly forty minutes.

On an open-water crossing of more than an hour, the principle is much the same.

But of course, the tidal stream will probably change in strength and possibly direction during the course of the crossing. So you have to do the calculations one hour at a time. In my book I discuss two ways of shaping a course for longer, open crossings. I also look at some ways of effectively using GPS which most sea kayakers now carry.

Night navigation

GORDON

Our final navigation coaching session takes place at night.

Speed and distance



"When we're paddling at night we have to be much more aware of how far we're actually travelling and the speed we're travelling as well.

Because we tend to travel slower when it gets dark unless we're on the tide as we're about to be here.

So we have to be aware of the timing it takes us, and the distance we're covering and the speed we're going when we're doing that. And then, add in to that the fact that we can't actually see anyone it makes it just a bit more challenging."

Communication

"What we've done is we've numbered off the group, one to seven, so that the leader who'd be number one can call out their number first and everyone else would follow, two three four five six seven. And then the leader would then know where everyone else was. If anyone within the group was concerned at all then they could start the numbering with their own number. So if number four wasn't too sure where everyone else was, they would start four, five six seven then it would go back to the start, one two three, so they would know where they were."

Using a bearing

"It's absolutely normal to come up with different angles or bearing, and the easier, or biggest mistake, is to get it 180 degrees wrong. So you're lining up the baseplate on the compass the wrong direction from your start point to your end point."

So initially estimate the rough direction. If it's east, the bearing will be close to 90 degrees. South, 180 degrees and so on. If the bearing isn't close to your estimate, it's probably wrong.

Lighting

"What we're using for lighting is - everyone has got some form of glow stick on them. So just a snap light and shake it, or a couple of us have got electronic lights, so batteries go in and it's a glow that goes comes around the back of that. We've all got head torches as well so we can light ourselves up."



"Our legal obligation is that we carry an all round white light, we have to do that as kayakers, so we have to carry something that we can shine 360 degrees around us."

Apart from that, extra things we're carrying; probably an extra compass as well at night, something that's a bit easier to see. And lots more warm clothing, definitely a hat to keep warmer, definitely an extra layer to put on if we need that as well, and some extra food and drink."

Night vision

"If we have a lot of light round about us, then it really affects our night vision. And as soon as you get a bright light in your face it kills out the low intensity lights which would be the light sticks we're using to identify people. Something that seems like a good idea is a strobe on the back of someone. As soon as that's on it wipes out everyone's night vision and you get this flicker, almost cartoon effect, of people paddling in front of you. And most people end up sick because they're seeing snapshots of where people are. They're down here one minute and up here the next, then over here so that causes lots and lots of problems inside our brain more than anything else"

"And as soon as we put our own head torch on, and look down at our map or chart, we get a lot of reflected light from that and that also spoils our night vision. So if I was to switch my torch on right now there's a lot of light reflected from there and, for that length of time, if I

switch it off, I now can't actually see very much close to me and there's quite a big, burnt out area of my vision right in front of me. I need to wait, probably twenty minutes for that to recover enough so I can see enough detail and see the group to be able to be able to manage them well."

"Paddling at night is definitely something to practice if you're planning to be a serious sea kayaker, because the chances of you getting stuck at night on a trip, being caught out into the evening and not being able to get to your campsite, is pretty disastrous really. So the whole idea of practicing is so that you can get to a known spot like a campsite. So navigating to a big feature like the bridge here for instance, or the village and knowing where we can land in the village is a great thing to go out and practice. And it's really good fun as well."

For expert coaching contact Gordon Brown at SkyakAdventures.com

