



The Physical World

Waves: Sound waves

ANDREW NORTON, THE OPEN UNIVERSITY: Well out on the trawler the most obvious waves we can see are the water waves like these ripples out here on the lake, but as far as the trawler men are concerned, perhaps more important, at least for their safety, are the invisible waves – the waves we can't see, like the radio waves which are used in their Global Positioning System, in their communications equipment, and in their radar. And then there's the sound waves used in their sonar for detecting fish, but once again, they're invisible so it's rather difficult to really see what's going on.

ANGELA: If we're going to get to the bottom of the invisible waves these guys use to communicate, let's get back to basics. Neil's going to turn all these gadgets off so that we're deaf and blind, alone. Now they're going to have to make do without the technology and do things the old fashioned way.

Ivan Chaston has spent a lifetime at sea. He's retired from fishing now but keeps his hand in running the ferry between East and West Looe. Ivan and his friend Lewis Butters remember the way they used to share news of a good catch.

IVAN CHASTON: Well if you had a bit of rag, if you had a trawl up, you had ten stones, when the other boat was coming closer you held a bit of rag and waved ten times, or whatever amount of fish you had, you know, and he'd wave back and say what he had.

LEWIS BUTTERS: Well sometimes in daylight you had to wave your oilskins to attract their attention or you'd have your sail what we call in vision, and lower it up and down, and things like that. At night time you'd, or you'd blink your lights, or you'd put up an old flare. You'd have a like an old tin, and then you'd have a like a, how can I explain it, like a mop you know, and it'd be soak in paraffin or stuff like that and you'd light it up and put it up.

ANGELA: There were many ways of signalling to another boat but in the days before radio if you wanted a chat the only way to do it was to shout.

Right, well if you're going to give up your radios we'd better test out your lung power. Go on then, off you go.

ARMAND: Can you still hear me?

NEIL: Fine this time.

ARMAND: You got me Neil?

NEIL: Yeah I'm getting you. Are you still getting me?

ARMAND: I'm getting you fine.

ANGELA: So they're not using radio waves to talk now but they're still using waves, sound waves.

ARMAND: Yes I'm still getting you Neil.

ANDREW: The problem with sound waves is that they spread out in all directions so the further away you are, the fainter the sound is. Also sound gets absorbed in the air and if you're outside then the wind blows the air around and the sound's even harder to hear.

NEIL: Can you still hear me now?

ARMAND: You're getting fainter.

NEIL: So are you.

ARMAND: You're gonna have to start shouting.

ANGELA: While they get on with shouting at each other, let's talk sound. Sound waves are really hard to see but the way they work is a lot like this slinky. Imagine for a moment that these slinky links are individual air molecules. If I put in a bit of oscillation at this end, you can see the energy travels down to the other end of the spring as a wave, and that's how your voice works. When you speak, well a tiny scale the air molecules push into their neighbours and then bounce back, and so your voice travels through the air like a compression wave.

ANDREW: As I'm talking now I'm producing a sound wave, that's a compression wave in the air, but what is a wave? Well a formal definition is that it's a periodic or regularly repeating disturbance that transports energy from one place to another. And a sound wave is a so called longitudinal wave that means that the variation is in the same direction that the wave travels. Now sound travels fine through air but it travels even quicker through solids such as metal, that's why if you're in a tube station you'll hear the sound of the train coming along the tracks before you hear the sound through the air. So perhaps one way our fishermen could do better is with the old tin can telephone; you speak into one end, the sound wave travels along the string and is heard at the other, but maybe that's not too practical out at sea so our fishermen will have to think of something a bit better.

TONY PAWLYN: The aids to speak at sea basically were only a tin trumpet, I mean apart from the voice itself, the tin trumpet would focus the sound and help it carry over the water, a bit better than just a straight forward shout.

ARMAND: Is that any better?

NEIL: Yes, that's better.

ANGELA: Yes, that's better. One way to make shouting better is to use one of these. There you go Neil.

NEIL: Thank you very much.

ANGELA: A loud hailer stops the sound energy spreading out all over the place and pushes it all only in the direction that you pointed.

NEIL: Can you still hear me now?

ARMAND: Yes, I'm still getting you Neil.

NEIL: Are you getting me now?

OK Neil, we're going to drop it across, see how far apart we can get.

TONY PAWLYN: The problem with shouting between boats is you've got a lot of noise going on in the background: there's the wave noise, there's the wind noise, and there's just a question of whether you really understand what's being said and whether you hear it properly.

ARMAND: Still getting me Neil?

NEIL: You're just about on the limit now.

ANGELA: This loud hailer technology does have its limit. I don't think it's quite up to the job really. Neil, what do you reckon?

NEIL: No, it's hard on the voice, and also it's, we're quite close together so we need to be a lot further apart to do the job that we're trying to do today.

ANGELA: So this distance here – what are we – about 100 yards, 150 yards – no good for working?

NEIL: No, no, not at all.

ANGELA: Well they can just about talk to each other but there's no way they can talk to land. Now you might think that that would have been scary but it made the captains all powerful.

TONY PAWLYN: The authority of a master mariner was always summed up as master under God, and that was a very real, positive expression. The only one person between you and your Maker it seemed was the captain and whatever he did and decided affected you materially. If he made the wrong decision then the ship may be wrecked and you went to your Maker.

LEWIS BUTTERS: We never had all this when we first started, no echo sounders just, as he said, just a compass, follow the birds and look for the signs – colour of the water, bubbles, fish coming up, things like that.

TONY PAWLYN: When you're out at sea you've got periods of time when you're not working, you've got moments of contemplation when you tend to look out at the immensity of the sea and the huge sky and the stars, and you just wonder how it happened, how it came to be, and how do you fit in, in this little dot in Eternity.

RAYNA TOMS: On occasions he's been out on his own which I really don't like, obviously for safety purposes, and I'm always saying to him that he must, just so that he doesn't fall asleep or anything, that he must like keep in contact. If he isn't pairing, but always on the radio with other people, then I will phone him quite often if he's out on his own.