**Almost as soon as human beings first came up with the idea of nailing a large sheet to a pole and bolting it to the deck of a boat, civilisations started sailing across seas and oceans to discover new frontiers. The earliest record of a sailing ship is an image on an Egyptian vase from about three thousand five hundred BC.**

**About a thousand years ago the Vikings sailed all the way to North America. Eventually, sail power enabled Europeans to colonize a great deal of the planet, from the Americas down to Australia and New Zealand, and by the eighteenth-century wind powered trading ships were crisscrossing the oceans constantly.**

**Nowadays of course, the internal combustion engine has more or less confined sailing to a niche sport and a slightly expensive leisure pastime.**

**I’m a bit of a landlubber myself to be honest, but I can certainly see the attraction of an invigorating sea breeze and the freedom of wide-open spaces that sailboat owners hanker after.**

**And if it wasn’t for that pesky climate change, that’s probably the way wind powered sailing would have remained, but according the the International Energy Agency, commercial shipping accounts for about three percent of global CO2 emissions, and that number is set to rise dramatically as global demand for goods increases in the coming decades. And according to this twenty nineteen report, shipping also produces between eighteen and thirty percent of global emissions of another very powerful greenhouse gas, nitrous oxide. So now the industry has the not inconsiderable challenge of getting to net zero emissions by twenty fifty. That means a blank sheet of paper and some blue sky thinking, with no suggestion too radical to at least be considered. One of those ideas is wind powered or wind assisted freight ships. These are sailing ships, Jim, but not as we know them. In fact, they’re a completely new generation of vessels using cutting edge materials and technologies.**

**So, could wind power once again provide a practical and economically viable solution for the global shipping industry to genuinely reduce its carbon footprint?**

**Hello and welcome to Just Have a Think.**

**When it comes to the art of shoving a boat forward using wind power, it appears that modern technology has moved on from the large billowing sails that we all recognise from the romantic era of the tall ships.**

**There are three main alternative wind power technologies currently hoping to catch the eye of freight shipping companies as a solution to reducing emissions and overhead costs for each voyage.**

**The first of the three is aerofoils, not dissimilar in principle to the wing of a plane, with a contoured top surface and a flat underside. On an plane, that shape forces air to move more quickly across the top of the wing. That reduces air pressure above the wing which causes the air below it to push upwards, and hey presto, we have lift off.**

**If you built a vertical version of a plane wing and nailed it to a boat, you could in theory produce forward thrust instead of upward lift and pull your boat along that way.**

**That’s essentially what Swedish ship designers Wallenius Marine have been developing in a joint venture with industrial technologists Alfa Laval.**

**Their first ship design is this one. It’s called the Oceanbird, and it’ll be enormous, at two hundred metres long and forty metres wide.
The wing sails will tower eighty metres above deck and well over a hundred metres above the waterline, making the Oceanbird the tallest ship in the world**

**But the sails are also telescopic, which means they can be lowered right down to deck to allow the Oceanbird unrestricted access to harbours and other areas.**

**And they can also be rotated about their axis, to keep them in the perfect position to optimise available wind from any direction. That direction is not from behind the vessel as you might think, but from the side. Keeping the wing sails at the correct angle to the side wind maximises the available surface area exposed, which results in the strongest forward thrust for the vessel.

Wallenius Marine claim the wind alone will provide enough power to get the Ocean bird across the Atlantic in twelve days, at an average speed of ten knots, and with an internal freight carrying capacity equivalent to seven thousand cars.**

**You might be thinking twelve days is a lot longer than it takes the fastest modern diesel engine ship to do the same journey, and you would of course be absolutely correct. It’s about twice the time in fact, which is obviously a very considerable concern for a freight company.**

**But Wallenius Marine also claim that their aerofoil technology would reduce the carbon footprint of each journey by ninety percent, not to mention achieving a massive saving on fuel costs. Now before you go hurtling down to the comments section to crucify the messenger, I will point out that those performance figures have apparently been gleaned from tests on a twenty-three foot scale model and there doesn’t yet appear to be any specific technical data available to back up the emissions reduction number, so I think we’ll have to take it with a slight pinch of salt until an actual sea going vessel is launched, but the company are planning for a production-ready design to be complete in 2021, with deliveries by the end of 2024, so watch this space.**

**The second of the three competing wind propulsion systems appears to be the product of some serious blue sky thinking.**

**Believe or not, it’s these rotating cylinders. Looks a bit like a complete no-hoper to a layman’s eye like mine, but give it chance because apparently it not quite as hairbrained as you might think.**

**The system makes use of something the physics bods call the Magnus Effect. You and I observe the effect all the time when we’re watching sports like baseball, cricket or football.**

**When a player puts a bit of spin on a ball they can bend it’s trajectory through the air, usually with the desired effect of being most discombobulating for the opposition.**

**It works because the spin causes air to move faster across one side of the ball and slower across the other. That sets up a similar pressure differential to the aerofoils we just looked at, and that differential causes the ball to move in the direction of the lower pressure air flow. It’s also used in slightly more serious circumstances on things like guided missiles, so it’s a pretty well known and well researched phenomenon.**

**And in the context of freight shipping this is not a drawing board development concept either, it’s already in use on real vessels. It’s known as a Flettner Rotor, named after the Finnish inventor and architect who first came up with the idea in the nineteen twenties along with the German engineer Sigurd Savonius, whose name you might recognise from Savonius wind turbines.**

**Finnish company Norse Power was founded in twenty twelve and has been developing these rotor sails for freight vessels ever since. They’re not designed to provide all of the motive power for the ships though, their job is really to increase the efficiency of each voyage so as to minimise fuel consumption and reduce emissions as much as possible. One of their big advantages though, is that they can be very easily retrofitted to the deck of pretty much any ship, and often within a day, which means they’re a relatively quick win for freight operators.**

**A typical freight ship fitted with these rotors could expect to reduce fuel use by four hundred tons a year, saving nearly three hundred thousand dollars at today’s prices, and reducing its CO2 emissions by twelve hundred tonnes.**

**So far, Norse Power’s rotors have achieved a hundred and forty thousand hours of operational service, saved more than three thousand tons of fuel and reduced CO2 emissions by almost ten thousand tonnes.**

**And the rotors are tiltable too, so access is not hampered either.**

**The biggest obvious drawback is that they reduce the amount of deck space available, which on a large container ship would mean lost revenue for the freight operator.**

**That’s not an issue that would be encountered by our third wind power technology though. This one is probably the whackiest looking of all three. Rather than mounting your sails straight to the deck, how about extending them up into the air on the end of a winch?**

**Effectively, what you’ve got here is a kite assisted propulsion system.**

**It looks bonkers I know, but again there’s some definite method in the madness here.**

**It’s a concept that was first tried way back in two thousand and seven on a heavy cargo vessel called the MS Beluga SkySails. Again, not as a full replacement for a diesel engine but as a complimentary technology to maximise efficiency and minimise fuel consumption and emissions.**

**The ship was fitted with a one hundred and sixty square metre kite sail for its maiden voyage across the Atlantic from Bremerhaven in Germany to Guanta in Venezuela.**

**On route, the efficiency of the SkySails system was tested for eight hours a day in winds of up to force five. And it was considered a great success, with calculated savings of up to two and a half tonnes of fuel per day, saving a thousand dollars for every day of the voyage. The designers reckoned that with really large kite sails of up to six hundred square metres of surface area, fuel savings of between ten and thirty five percent would be possible depending on the route.**

**But why should a sail that’s tethered to the boat on a very long rope be any better than a sail that’s tied to a mast on deck?**

**Well, there’s two fairly significant advantages over traditional sails, and for that matter over the other two technologies we’ve looked at in this video.**

**The first is wind speed. The closer the air movement is to the water, the more friction it encounters and therefore the slower it travels. But way up at three hundred metres above the sea the wind encounters no such impediment so it’s much stronger.**

**The second big advantage of a kite sail system is that you don’t lose any deck space, so a full container ship could easily have this technology retrofitted on deck with immediate benefits in cost and emissions reductions.**

**It’s probably unlikely that wind-power will ever completely replace mechanical propulsion systems of one description or another in ocean going vessels, and it’s quite likely that a greater reduction in emissions will be achieved through the development of batteries for short distances and, biofuels, hydrogen and ammonia as low or zero carbon fuels for longer voyages. But as a complimentary source of power, these wind assistance technologies may well prove to be a very attractive option. As our global population grows, shipping of goods around the world is likely to increase as well – the International Maritime Organization projects that emissions from shipping will increase by fifty percent up to 2050 if no changes are made, so developments like this could be crucial in our efforts to mitigate climate change.**

**If you’ve crewed one of these boats or if you’ve been involved in developing these technologies, or even if you’ve got views on how you think wind power could and should be deployed in the coming years, then jump down to the comments section below and leave your thoughts there.**

**That’s it for this week though.**

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**As always, thanks very much for watching, have a great week, and remember to Just Have a Think.
See you next week.**