

The long read

# 'It's a little bit of utopia': the dream of replacing container ships with sailing boats



Global trade depends almost entirely on huge, dirty, dangerous container ships. Now a team of French shipbuilders is bringing back wind-powered sea freight

by Wendell Steavenson

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Last March, the whole world saw one of the largest cargo ships in existence – 400 metres long, weighing 265,000 tonnes, loaded with 20,000 shipping containers – get stuck in the Suez canal. For six days, tiny tugs tried to nudge the EverGiven off a sandbar. Waiting at both ends of the canal were more than 300 cargo ships and tankers, carrying petrol, semiconductors, microchips, scrunchie hair bands, sneakers, hand-held travel steamers, ice-cream-makers, novelty socks and electric milk-frothers. As the global supply chain ground to a halt, we became aware that 90% of everything in our homes – clothes, appliances, food – has, at some point, been transported by sea.

Cargo ships burn some of the dirtiest fuel going, known as bunker. Made from the sludgy leftovers of petrol refining, it is as viscous and black as molasses and full of sulphur; when it burns it gives off carbon monoxide, nitrogen oxide and sulphur dioxide. Container ports are consequently wreathed in smog. Shipping accounts for 2%-3% of global carbon emissions, but it also damages the environment in other ways. Ships regularly dump garbage and contaminated bilge water into the ocean, and underwater noise pollution disrupts the life cycles of fish, whales and dolphins.

While other industries are turning to alternative fuels, shipping has lagged behind. The International Maritime Organization, the UN agency that oversees the shipping industry, has drawn up plans to reduce carbon dioxide emissions of the global cargo fleet. But many observers consider the targets unambitious and, as there is little threat of punishment if they aren't met, toothless. "They're a sham ... window dressing," one shipping journalist told me.

Olivier Barreau and his twin brother, Jacques, are part of a small but growing number of entrepreneurs who are grappling with the problem of how to transport goods across the globe at a scale that makes economic sense, without further damaging the planet. One blustery wet winter day at the end of 2010, Olivier found himself standing on a quay at Paimpol, a small fishing harbour on the rocky north coast of Brittany, looking up at a steel-hulled three-masted boat, built in 1907, that had clearly seen better days. Olivier had just turned 40, had cashed out of a wind-energy business he co-founded and was looking for new projects. He had been brought to the quay by Stéphane Guichen, a friend of a friend, who had given up an academic career to take up harvesting salt in the ancient way, using solar evaporation, and had the crazy idea to transport his salt around the coast by sailing boat.

Olivier clambered aboard. "I could see it was ugly, dangerous, it had no real cargo capacity, and it was rotting," he told me. It was, he said, a great idea for someone who wanted to lose a lot of money. He is not someone who likes to lose a lot of money. "If it's not going to make a profit, there's no sense in it," he told me.

Still, the idea of a cargo sailing boat stirred something deep in Olivier. He and his brother's childhood had been shaped by sea and wind. They had grown up in Brittany, and there were several generations of seafarers in the family. As a child, Olivier loved paragliding, windsurfing and kitesurfing. "It wasn't a rational feeling," he told me of the moment he stepped aboard the boat. "It brought together many things that were familiar to me: the sea, sailing, ecology, the use of a different kind of energy, the use of wind."

The environmental argument for cargo sailing was sound, he thought. Paul Hawken, an American environmentalist, businessman and writer, has said: "The first rule of sustainability is to align with natural forces." But the economics of it presented a problem. Shipping costs are all about economies of scale. The larger the boat, the greater the cargo capacity and, correspondingly, the smaller the cost per tonne. Cargo would cost more to ship on a small sailing boat, no matter the savings in fuel.

Over the course of several months, the Barreau brothers developed the idea, along with Guichen, a sailmaker named François Liron and an assortment of other friends, boat builders and sailors. Here was the challenge: could they make a viable business out of a cargo sailing boat? And behind this was an even larger question: was it really possible to create a business that operated on environmental principles? Could you make money and do no harm? Olivier Barreau was not the first entrepreneur to dream of reviving cargo shipping under sail. One model was a Dutch company called Fairtransport. It was founded by three Dutch sailors in 2007, who bought an old, partially sunk second world war minesweeper for €3,000 and managed to raise €500,000 to refurbish her as a cargo sailing boat. It took a while to get going, but Fairtransport now has two ships, which carry freight across the Atlantic and around the coasts of Europe. It's a niche business and costs are high: their clients are mostly organic food traders whose customers demand sustainable produce transported in an environmentally responsible way.

Olivier's plan was a little different: he wanted to build his own boat, not refurbish an old one. The problem was that no modern-built cargo sailing boats existed. There was no template for such a vessel that would conform to modern safety criteria. Developing the design and build would take time and money. No client – even one committed to low-carbon global transport – was going to enter into a contract to ship their goods by cargo sail years before a boat was even built, and no bank would finance such a risk. Olivier wasn't sure how he would pay for it. He was not even sure that sailing ships, with all the vagaries of wind and exigencies of tide, could survive modern economic reality. The shipping industry has been optimised to run on tight schedules. Cargo ships have scheduled docking times and are in port for only the brief time it takes to unload and reload. By contrast, the crew of a sailing boat can't predict how long a crossing will take, masts take up deck space where containers could be stored, and the largest sailing ship ever built is 134 metres long, less than half as long as the EverGiven.



Tres Hombres, a cargo boat operated by Dutch company Fairtransport.

What does it take to make a cargo sailing boat more than a romantic dream? For Andreas Lackner, one of the co-founders of Fairtransport, part of the answer was time. When we spoke recently, he was in Copenhagen, where he had just unloaded 22,000 bottles of French wine and was about to ship a consignment of 100 cargo bicycles to Liverpool. He told me that his company is only now, 10 years after launching, thinking about being able to pay dividends to their original participant-investors.

There are several similar small projects refurbishing old cargo vessels around the world. Timbercoast operates a 1920 schooner between Europe and Central America and Colombia, and last year the Apollonia, a 20-metre sailing boat built in the 1940s, started ferrying hot pepper sauce, honey and malt for brewing along the Hudson River to New York. But, like Fairtransport, these are small operations servicing a very specific organic artisanal demand, with the costs of transport reflected in the price of the products. For Olivier, the excitement of the challenge was as much about figuring out a new business model as it was about building a new kind of boat. If the cargo was small, and the costs high, at least in the development stage, how would he make a profit? To pay for the boat, he realised, they needed cargo. Early on, Olivier determined that, rather than try to find a client prepared to pay the cost of shipping, the enterprise would have to become its own client: if they became a manufacturer, he thought, they could ship the raw materials to make their own product. But what product? Since the principle of sustainability demanded that raw materials should be sourced locally if possible, it would have to be something that could not be found in Europe. And if they were to be profitable, it would have to be something with a high value, not a bulk commodity, in order to offset the relatively higher cost of shipping by cargo sail.

He came up with a list that recalled the days of yore: pepper, vanilla, rum, silk, tea. In the end, he chose chocolate and coffee. He then drew up a wildly ambitious plan to start a coffee roasting company, create a chocolate manufacturing plant and build a cargo sailing boat, all within a year. He showed his plans to Jacques, his brother, who scratched his head. “Olivier thought it would be possible to do everything at the same time,” Jacques told me. “He thought you just pushed a button and could go ahead.”



Grain de Sail's Jacques (left) and Olivier Barreau. Photograph: Fred Tanneau/AFP/Getty Images

If Olivier is the big-picture guy, Jacques is all about the details. He studied physics at university and spent the early part of his career figuring out how to integrate software and hardware in everything from microwave ovens to Airbus flight simulators. He knows how to turn ideas into reality. “The spreadsheet gives the answer,” Jacques said to me, more than once. “You can’t finance anything by crossing your fingers.”

The Barreau twins are now in their early 50s. Usually wearing jeans, hiking boots, lumberjack shirts and quilted jackets, they exude a hands-on energy, generally eager to leave their desks to help haul sacks of coffee beans or tour a new factory site. Somehow, they always seem to be the tallest people in the room.

It was Jacques who convinced Olivier he needed to be more schematic: “He had it all mapped out, but without knowing the order of doing things.” Together, they drew up a new plan. First, they would establish a coffee and chocolate business. The business would then generate the income needed to finance the boat. Despite being the whole point of the project, they realised, the boat was going to have to come last.

Olivier had never roasted coffee or made chocolate. He began by sourcing organic beans from European importers who worked with cooperatives and paid fair prices. He founded a company and called it CargO2. In 2013, they started roasting coffee beans in an abandoned wharfside warehouse in Morlaix, an old port town in northern Brittany. The warehouse was cold and dank and full of junk, rusted pulleys and piles of old rope. There were only two full-time employees to do almost everything – roasting, delivering, overseeing sales. The brothers also partnered with a French government agency that helps people with learning disabilities find work, paying a small team to help grind and package the coffee.

In its first year, the company sold its products into 10 stores and turnover was a modest €100,000. In the second year they added an employee and turnover almost doubled. When Jacques joined as operations manager full-time in 2015, he knew the next step of the plan, making chocolate, was going to be more complicated than roasting coffee. “But I didn’t understand how complicated,” he said.

They sourced cacao mass from Peru and the Dominican Republic, and blended their first practice batch in a second-hand conching machine – a churn that turns cacao into a structurally stable chocolate. When Jacques took a sample home to his wife, she pronounced it terrible. The machine was too small and primitive to maintain the right temperature to achieve a smooth texture, and the chocolate came out gritty.

With an initial capital investment of €400,000, in 2015 they took over an old vegetable packing warehouse and equipped their new chocolate factory with brand new conching and crystallisation machines. But no one understood how to operate them. The chocolate kept clogging and clogging in the conching machine before they figured out how to toggle the timing and

temperatures. Then, four months into production, the gearbox on the machine broke, and they had to wait a month for the delivery of a new one. “No deliveries would mean no cashflow. It could have been very serious,” said Jacques. “For me this was the most stressful moment.”

They renamed the company Grain de Sail, a play on the French term grain de sel (grain of salt), which, as an idiom, connotes the germ of a good idea. They printed the story of their cargo sailing idea on their packaging (a card envelope, no plastic or foil). “This was not an easy decision,” Jacques told me, “because there was always a risk of there not being any boat. But now that the word ‘sail’ was in the title of the business, we had to succeed. In some ways, I think we chose it as a deliberate motivation.”

In 2016, their coffee and chocolate were in around 40 supermarkets, and turnover was €380,000. By 2017 they were in 150 stores, and it was €1.4m. Now they could turn their attention to designing the boat.

No shipbuilder they spoke to had any experience of building a cargo sailing ship. The first mistake the team made, Jacques now admits, was to try to design the boat in-house. The technical specifications needed for a commercial cargo vessel turned out to be highly complex, and their design was challenged at every stage by official inspectors. The Barreau brothers now parted ways with François Liron, the Morlaix sailmaker who had been a founding part of the company. The split was not amicable; neither side likes to talk about it. (Liron wrote to me in an email that for him, Grain de Sail has become too much of a marketing exercise. He is now involved in a crowdfunded project to source cacao in an environmentally and ethically sustainable way.)

In early 2019, a Breton man named Loïc Briand happened to pick up a chocolate bar that his wife had bought at the supermarket. He noticed the sailing boat embossed on the chocolate and read the Grain de Sail blurb on the back of the packet. Briand had crewed round-the-world racing yachts, worked on fishing trawlers and captained a construction boat, building offshore wind turbines and laying deep sea cables. At one point in his career he had actually founded a company to work with alternatives to conventional engines for the maritime industry. At first, he thought the project was “rather mad”, but he could see the potential, and got in touch. When they offered him a job, he came on board.

Briand oversaw much of the boat building, which began in Couëron, near Nantes, in October 2018. He remembers long, frustrating arguments between the naval architect, the engineers at the shipyard and the official body responsible for certifying the boat as a seaworthy cargo vessel. The international standards for cargo ships were made for conventional ships with engines, and didn’t apply to a sailing boat.



“The officials told us that the boat was basically too small to receive a permit,” said Jacques. “The minimum usually would be 30-40 metres.” All the standard sizes for cargo vessels were simply too big for a small boat that a crew had to be able to move around easily. They got an exemption to have smaller-than-regulation size cabins, but they had to install bulky aluminium fire doors, and the slop lip for the doorways (the raised edge that stops water flowing between compartments) had to be the regulation 60cm, even though that was much too high for the size of the boat. Every time they were given a new specification, alterations had to be made. There were many arguments with the shipyard.

As a sailing boat, the Grain de Sail was designed to be able to tilt 90 degrees and then right herself. A ship with an engine wasn't supposed to tilt anything like that far, “or it would sink,” said Jacques. To comply with stability regulations, they were forced to double the weight of the bulb keel – which places ballast below the boat to help with righting – from about 7 tonnes to 13 tonnes. This also resulted in increased lateral resistance to wind, and thus increased stress on the masts.

“Nothing is impossible!” Briand, one of those stubbornly optimistic people, told me. But even for him, it was a constant, uphill struggle. “Your specifications don't translate!” he kept telling the officials. “Trust me, I've been sailing a lot!” The safety officials said they understood, but it was impossible to change the rules, which were internationally agreed.



The Grain de Sail in a dry dock in Lorient in 2020. Photograph: Fred Tanneau/AFP/Getty Images

Two years on the drawing board, two years being built in the dry dock. After another falling out with the shipyard, the crew decided to move the boat and finish it themselves. They craned it out

and towed it up the Loire river to another shipyard, where they hoisted the masts into place. Then they towed it to another shipyard in Lorient in the south of Brittany, where they set about reinstalling the plastic lining panels of the hull and resealing the rubber gaskets. The electricians were glitchy and the pumping system wasn't working. On one test run out of the boatyard, Jacques recalled, the engine stalled, and they had to tow it back to the yard using an inflatable boat with an outboard motor.

In October 2020, the boat was finally ready. The budget had initially been €1.3m; the finished thing ended up costing €2m.

On the day of her launch, they invited all the employees of Grain de Sail. Olivier baptised her with a bottle of their parent's homemade cider smashed against her aluminium hull. Then he stood back, as everyone clambered aboard, looking up at his finished vision, tears wet on his cheeks, clearly moved by the moment. The twins' father and mother stood beside, modestly proud in the Breton manner. "You need a good measure of courage and conscience to do this kind of thing," their father said, "I think they have both. C'est bon."

There are other designers and engineers who have been thinking how to use wind to transport goods. Last autumn, I visited St Nazaire, a big shipbuilding centre on the south coast of Brittany, where many of the leading figures in wind propulsion had gathered for a conference. Attendees talked excitedly about their hybrid solutions – different kinds of modern sails, including fixed wings, foldable, foam or kite sails – added to engine-powered ships, which can help power the ship and thus cut down on fuel consumption.

Consider the alternatives on offer for shipping companies that want to use less fuel. Despite rising prices, oil is still the cheapest and easiest fuel to use. Greener options remain a morass of compromises. Liquid natural gas can cut CO2 emissions by 20%, but it costs between \$10m and \$30m to retrofit a ship to be able to use it, and gas needs larger storage tanks than regular fuel oil, which take up cargo space. Maersk, the world's largest shipping company, is banking on a mix of new fuels. Last year it invested in a US company that manufactures green methane, and in a startup that is trying to produce carbon-based electrofuels from direct air capture of CO2. There is excitement around the possibilities of hydrogen fuel, but it is expensive, flammable and not entirely clean. Biofuels can reduce CO2 emissions by as much as 80%, but they are derived from plants – and growing vast swathes of plants for fuel means intensively farmed monocultures of palm oil or corn or soya beans, which means deforestation.

"There is now a real technology gap," said Lise Detrimont, who runs the French chapter of the International Windship Association, a London-based group dedicated to promoting wind propulsion. "Everyone just thinks you can replace dirty fuel with cleaner fuel and continue on as you did before. But alternative fuels are very difficult to find, they are expensive, and their costs are likely to vary a lot over time, so shipowners are like," – and she shrugged. For Detrimont, the solution has to be wind. As Olivier Barreau told the conference: any kind of fuel will require





A Flettner rotor on a Danish hybrid ferry in 2020. Photograph: Annegret Hilse/Reuters

extraction, processing, storage and transportation – all costs and potential CO<sub>2</sub> emissions. Wind, on the other hand, is free and abundant.

Entrepreneurs and engineers were coming up with all sorts of solutions to the problem of making sail a viable way to transport freight. Walking into the conference exhibit, I was greeted by what looked like a Victorian iron smokestack riveted to one hull of a catamaran. In fact, it was a rotor that turns in the wind, creating a forward thrust known as the Magnus effect after the German physicist Heinrich Gustav Magnus, who first invented it 100 years ago. These Flettner rotors have already been installed on several Norwegian ferries and a handful of experimental cargo ships.

As I wandered through a hall displaying pioneers and prototypes, I passed by a mix of weather-beaten sailors, naval architects, former merchant marine officers, ex-aeronautical engineers and young windsurfers showing off their ideas and inventions: vertical, rigid sails that look like aeroplane wings and work on much the same principle; kites that can be tethered to the bow of giant container ships and deployed like far-out spinnakers; a solid sail made of light-weight carbon fibre that folds like an accordion; a system of foam panels instead of sails that don't luff and flap in the wind; a sail that was made out of inflated compartments like a padded jacket.

I saw artist illustrations of the Canopée, a 121-metre ship that has been commissioned to transport the Ariane 6 rocket, which carries satellites into orbit, from France to its launch site in French Guiana. It is being designed and produced by a company called Zéphyr & Borée under contract to the French government. Fixed sail-wings will help reduce carbon emissions by up to 35%.

“The greatest challenge is commercial rather than technical,” Nils Joyeux, the co-founder of Zéphyr & Borée, told me. Everyone I talked to bemoaned the difficulty in securing investment. They could solve almost any issue of cargo capacity, mast height, docking and loading – or so they claimed – but it was almost impossible to get anyone to pay for a prototype to prove the new concepts work. In the spring, Neoline, one of the more prominent startups at the conference, announced that their partly crowdfunded project to build a 136-metre, four-masted cargo sailing ship, was delayed for lack of investment, despite having an impressive roster of clients – Renault, Hennessy Cognac, Michelin, Clarins – already signed up to fill the hold.

The first Atlantic crossing of the Grain de Sail was scheduled from St Malo in December 2019, carrying organic French wine (part of the business plan – they needed something to fill the hold for the outward leg) to New York, then picking up cacao from the Dominican Republic. “It was somehow crazy to test the boat on a transatlantic crossing in the middle of winter,” Jacques admitted. Briand told me: “Everything on the boat that could break, broke.”

The wind blew at 60 knots and the waves got to 10 metres high. One sail was shredded by the wind. Two spars on the masts fell off. Seawater leaked into the cabins. The rotor blade of a wind turbine sheared off and disappeared into the sky. Briand laughed at the retelling. He had clearly been in his element. “At sea there is no time, no internet, no pollution of media. You just eat and live according to what you need and what the boat needs,” he said.

When they were within two days of New York, after more than three weeks at sea, Briand tried to turn on the small diesel engine to be able to manoeuvre into port, only to discover the exhaust had flooded and it would not work. It took two days to arrange for a tugboat to ferry them a new motor, and they had to install it themselves overnight in the dark.



The Grain de Sail in New York. Photograph: Grain de Sail/Bjoern Kils

Sailing into New York was special and strange. “You can see the light 30 hours out at sea before you arrive,” said Briand. “There is a glow, and you think: what the fuck is this? And then you come closer and closer and see the great high buildings, a place where money is the religion.” At sea all the materialism of the land had washed away into the elements of sky and wind. “Money only has the value that you give to it. I didn’t want to go ashore,” he told me.

A blizzard hit New York the day the boat docked. It was -5C, and snow was piled 15cm deep on the deck, but still, people were lined up on the quay cheering them in. “We arrived like heroes,” said François Naoures, one of the crew members. “I don’t think a cargo ship carrying wine under sail had arrived in New York since prohibition. The welcome was incredible. We were all amazed.”

Last summer I joined the Barreau brothers to meet the Grain de Sail as it returned from the Dominican Republic with its hold full of cacao, after its second transatlantic voyage. We zoomed out of Brest, on the western tip of Brittany, in a pair of bouncing inflatable boats, into the wide mouth of the Channel where it meets the Atlantic. Past the old forts, beyond rocky promontories and the last sandbars, the water darkened into a deep ocean blue. In the distance, a triangle of white sail slowly grew larger, until there she was – the Grain de Sail, a 24-metre schooner, double-masted, its solar panels flashing in the sun. Astern, twin water turbines churned in her wake. We clambered up a rope ladder to go aboard and were greeted by the rich scent of cacao. Jacques lit one of the cigars the crew had brought him back from the Dominican Republic.

The crossing was deemed to have been a good one, even though a new crew member had broken his leg, caught between the steel guy ropes along the side of the boat when a wave lurched. In quieter spells, the crew had listened to podcasts, read, trailed fishing lines from the back of the boat and caught tuna and mahi mahi for dinner. Close to the American coast, they had seen the effects of our consumer societies: great floating swags of shredded balloons, and in the Sargasso Sea, acres of multicoloured plastic matted into giant drifting rafts.

Even with good intentions and real effort, the brothers admit the company is far from pure green. In October 2021, the brothers opened a new, larger, chocolate factory in Morlaix. They installed solar panels on the roof to generate 40% of the electricity, state-of-the-art insulation, a pump that captures residual heat from the conching machine and a special kind of ventilation system whereby the air going out heats the air coming in. They have employed an external company to audit the carbon footprint of the company, including, for example, the distance each employee must drive to work. But it’s a work in progress. “Our carbon footprint as a company is still not great,” Jacques told me. “We really have to improve.” Their delivery vans still run on petrol.

They are planning a second, larger sailing cargo boat, with 10 times the cargo capacity of her smaller sister. Grain de Sail II, at 50 metres long and designed to carry 350 tonnes, is pushing against the upper size and scale of a sailing boat. Any larger and – apart from the fact that a whole new slew of regulations comes into effect – the extra size and weight of the sails would

require custom-built winches (they are using the largest ones in current manufacture) and thicker ropes, beyond the capacity of a crew to handle without machinery. “It’s a spiderweb of constraints,” said Loys Leclercq, the naval architect for the new boat, when I asked him about building a vessel that can sail in rough winds and take advantage of light breezes, fit a cargo and wide loading hatches beneath masts and rigging, and balance economic necessities with ecological principles.

Leclercq is in his 30s and based in Lorient, the capital of French racing yacht design and manufacture, and usually designs small inshore boats powered with electric engines. “It is a little bit of utopia, this project,” he said. “It resembles no sail boat yet built, so it’s a very difficult exercise.”

The Barreau brothers know that using wind is only part of the solution. “It’s not enough if we can’t reduce the global appetite for sea transportation,” said Jacques, sitting at lunch at a quayside restaurant in Morlaix one day. “This planet is our only home, and if we continue with our incredibly high carbon and environmental footprint, nature will come back and hit us, kick our asses with bigger storms, floods, fires. Nature will reduce our carbon footprint violently. The way we think as consumers in this society, is not compatible with sustainable development.”

“Human beings,” echoed Olivier, “are driven by pleasure, by the need to feed endorphins, by the rush of pleasure, of greed. That will always override reason, modesty and restraint.”

Our discussion roved to population growth, consumer demand, the logic of capitalism, our own fallibilities – eating avocados, buying farmed salmon, wearing cheap cotton underwear. We had all driven cars to lunch.

“It’s the growth paradox,” said Jacques. “We understand very well that in order to have a perfect carbon footprint, the best thing would be if the Grain de Sail company did not exist.”

This article was amended on 19 July 2022. An earlier version incorrectly described bunker, the fuel used to power cargo ships, as “petrol”.