NEW ATLAS
THERE'S ALWAYS A BETTER WAY

consumption cut for cargo ships

By David Szondy
July 31, 2024

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Artist's concept of a ship with the CoFlow system CoFlow Jet

Looking like a set of bridge supports that were accidentally installed on a cargo ship, a new wind-driven system by startup CoFlow Jet promises to reduce ship fuel costs by up to 90% using stationary cylinders with no moving parts.

Between rising fuel costs and increasing government mandates requiring shipping companies to go carbon neutral by 2050, there's a strong push to increase the efficiency of cargo ships while reducing their emissions. One way of doing this is to take a page from the history books and readopt sails to harness the wind.

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On the surface, that makes sense. Sails have been propelling ships all over the world for millennia and were still used for commercial transport until after the Second World War. However, there are two problems with sails that have pushed them out of the cargo market for all except the most local of niches.

CoFlow

First, traditional sails require huge crews. Something the size of the 921-tonne tea clipper Cutty Sark needed a crew of about 30 to handle the sails and the complex sheets and lines that controlled them. Compare that to a modern 196,000-tonne container ship that needs only 13 officers and sailors – and most of them are pushing buttons instead of hauling lines.

The second problem is that sails are completely dependent on the wind. If the wind is blowing hard enough and in the right direction, great. If it's blowing too little or too hard, or if it's blowing from the wrong quarter, that's not so great. If it's not blowing at all, you're not going anywhere.

As a result, once steam and diesel power became practical with their lower labor costs and energy on demand, sails were soon shifted to recreation and explorers.

Today, the idea of using sail is undergoing a similar renaissance as the one during the energy crisis of the 1970s, as shipping companies look at updated versions of the old technology to reduce fuel costs. However, instead of acres of canvas strung from a forest of timber masts, the new systems use kites, wind vanes made of composites or are inflatable, while some even use the hull of the ship itself as a sail.

GeCheng Zha, a professor of aerospace engineering and director of the Aerodynamics and Computational Fluid Dynamics Lab at the University of Miami College of Engineering is using an approach that is a variant of the Flettner rotors developed in the 1920s, but with a fundamental twist.

Flettner rotors are large rotating cylinders that produce aerodynamic thrust at right angles of the air passing over them. The CoFlow Jet cylinders developed by Zha don't rotate. They draw in a bit of the air from the wind blowing across and through them and then expends it at another part of the cylinder. By drawing in a small amount of air from the intake, pressurizing it using an impeller, and squirting it through the outlet, this generates a pressure imbalance and a considerable amount of thrust, which extends the full length of the cylinders.

According to Zha, this makes for a very effective wind propulsion system that can provide 100% of the needed thrust to move the ship due to the system's very high lift coefficient and drag reduction. Unlike the Flettner system, there are no rotating parts and it can deliver a fuel reduction of up to 50% in large cargo ships and 90% for small ones.

That may seem sensational, but bear in mind that any sailing ship can get a 100% reduction by setting the sails and turning off the engines entirely. Of course, this all depends on the force and direction of the wind. However, one other advantage is that the system can be retrofitted to existing vessels and the cylinders can be retracted for getting in and out of harbor.

"What's old is new again," said Zha. "With the technological advancements of today, wind-assisted propulsion is an efficient alternative to diesel engines. And the major advantage is that it's environmentally friendly – an effective way to decarbonize the shipping industry that's responsible for about 3% of global greenhouse gas emissions. The shipping industry has had a tendency to resist change because diesel engines are so powerful but now, with pressure mounting, either willingly or unwillingly, it will have to change."

Source: University of Miami

TAGS MARINE SHIPPING SAIL WIND POWER MARINE INNOVATIONS

25 COMMENTS

David Szondy

David Szondy is a playwright, author and journalist based in Seattle, Washington. A retired field archaeologist and university lecturer, he has a background in the history of science, technology, and medicine with a particular emphasis on aerospace, military, and cybernetic subjects. In addition, he is the author of four award-winning plays, a novel, reviews, and a plethora of scholarly works ranging from industrial archaeology to law. David has worked as a feature writer for many international magazines and has been a feature writer for New Atlas since 2011.

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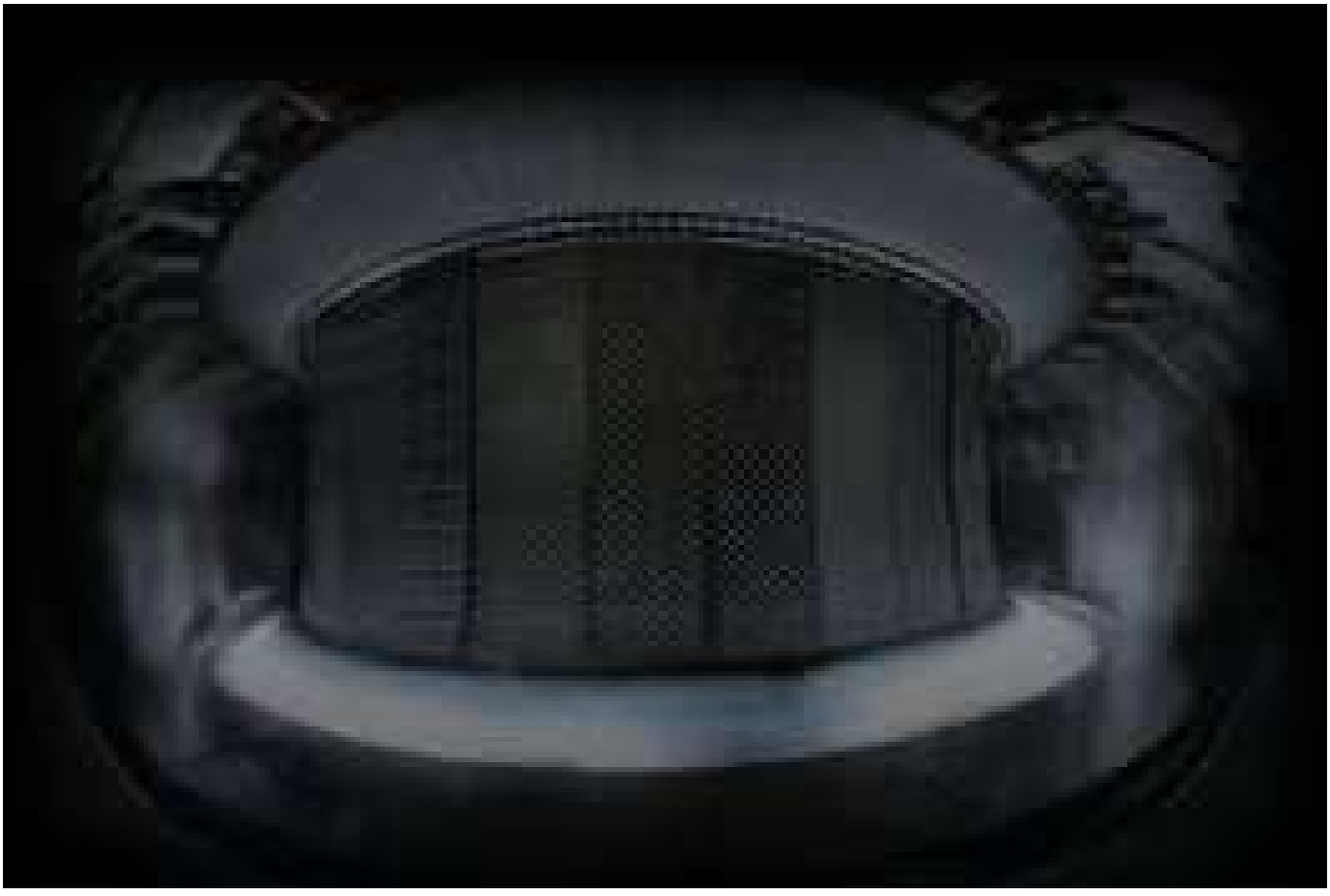

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riczero-b JULY 31, 2024 05:17 AM

This is not very well presented , but I think the idea is that the pressure transfers create a sort of virtual rotation of the cylinder which triggers the Magnus effect . I would guess this would need a similar order of input energy to rotating the cylinder . More info needed .

Trylon JULY 31, 2024 07:52 AM

Well, that was a useless video. So short and bereft of information that it might as well have been a still picture.
@riczero-b, what you're looking for is the Coanda effect.

TechGazer JULY 31, 2024 08:43 AM

The title is a bit misleading. 90%, or even 100% reduction in fuel is possible by sails of any sort. The fuel reduction for commercial ships that have to meet a tight schedule is going to be much lower.

I would like to see the comparison of energy cost of Flettner rotors vs these ones for the same thrust. I made a Flettner turbine from soda cans driven by computer cooling fans, and when I put that into moving water, the rotors stopped. Generating the Magnus effect took much more energy than I'd expected.

1stClassOPP JULY 31, 2024 08:47 AM

Still no go if no wind. Will need auxiliary support of some kind.

Tech Fascinated JULY 31, 2024 09:04 AM

Wikipedia has some more useful info: "The E-Ship 1 was launched in 2008, and new vessels continue to appear. Since then, multiple rotor installations have been completed, including tilting rotors to allow passage beneath bridges.[4] Typically, rotor sails have been reported to generate 5-20% fuel savings.[4]"

Flyhound JULY 31, 2024 09:26 AM

The title to this article stated there were no moving parts to these sails. The text revealed that there is an impeller and intake/exhaust slits that presumably have to be repositioned relative to the wind direction to provide forward thrust. That sounds like moving parts to me. It also sounds like a control system and power supplies would have to be connected to these units so they aren't really simple attachments to existing ships. Are any shipping companies showing interest, or is this purely an academic exercise? The brief article leaves more questions than is answers and the "video" clip is nothing more than a still, 3D image of the ship viewed from several angles. It does nothing to better explain the operation of these "sails". A little more flesh is needed on the bones of this story.

Username JULY 31, 2024 09:49 AM

Would this kind of "sail" work on a recreational sailboat?

rgbatduke JULY 31, 2024 11:23 AM

"Pressurizing it with an impeller" -- meaning that an engine is required to run the impeller. Note that the article still does not explain how the sail can move the vessel into the wind. Building a passive sail that moves something forward against the wind would seem to violate the second law of thermodynamics (sailboats only manage it at an oblique angle by means of having a keel stuck down into a denser but still fluid medium, and they still have to tack to

make progress). It's not like having high pressure on one side of an object and lower pressure on the other ever exerts a force TOWARDS the high pressure side...

Adrian Akau JULY 31, 2024 03:11 PM

Please provide a clearer explanation with diagrams for better understanding.

Dave Holland JULY 31, 2024 07:42 PM

Yep, not the greatest article. The Miami University version is in't a lot better but does does include the following "Now, the only challenge that remains for Zha is securing funding to develop a prototype." Another useful inclusion in the article above would have been "On some shipping routes, the cylinders could cut fuel consumption by as much as 50 percent, according to Zha, who is still in the design and simulation phase for his wind-propulsion instruments. ". This clearly has potential and deserves much better treatment than given by David's article and the one linked to at University of Miami. Combining this with Ammonia adapted powered engines could make a major contribution to emissions reduction.

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