By Marijan Jozic

The Magnus Effect at Sea

Every Airbus airplane is the result of international collaboration and painstaking precision across Europe. But before these airplanes ever climb into the sky, they must complete a remarkable journey of their own — traveling thousands of kilometers by sea from various facilities of the Airbus group. This voyage, as extraordinary as the aircraft itself, is made possible by a unique transport vessel that has attracted global attention not only because of its precious cargo, but because of the six towering white cylinders rising above its deck. Airbus has a fleet of three vessels, each with six Norsepower Rotor Sails. The shipowner is Louis Dreyfus Armateurs (LDA), and it is chartered by Airbus.

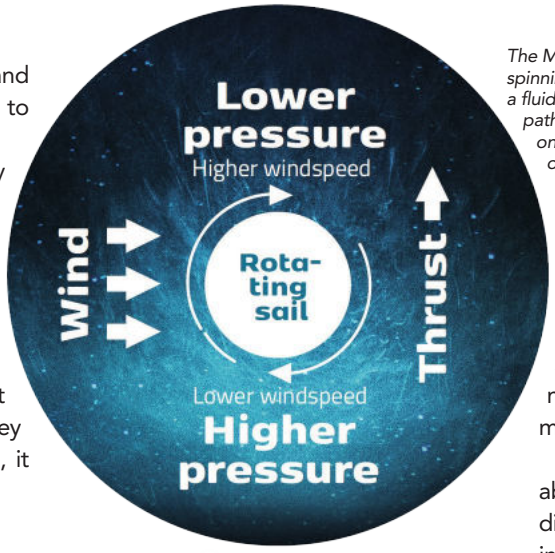
These structures are far more than decorative curiosities. They represent a new chapter in maritime innovation and a quiet revolution in how we move heavy cargo across oceans.

The Special Transport Ship: An Unmissable Sight

The vessel built to ferry Airbus parts is unlike any standard cargo ship. Most striking are the six enormous white cylinders — standing upright in two perfect rows — each resembling a futuristic lighthouse or monumental rolling pin. To casual observers, they may look whimsical, even mysterious. But engineers designed them with purpose: to harness

wind power, reduce fuel consumption, and demonstrate a sophisticated approach to green maritime technology.

There is no coincidence that highly advanced airplane structural parts such as those of Airbus are transported on an equally advanced ship. Engineers continually seek ways to conserve energy, and detailed calculations showed that using rotor sails would deliver substantial benefits. They are not merely an eye-catching feature — they are a necessity. If energy can be saved, it should be saved.



The Magnus effect is a physical phenomenon where a spinning object (like a ball or cylinder) moving through a fluid such as air or water curves away from its straight path due to a pressure difference. The rotation causes one side of the object to have lower pressure than the other, resulting in a force that acts perpendicularly to the direction of motion. A Magnus rotor used to propel a ship is called a rotor sail and is mounted with its axis oriented vertically. When the wind blows from the side, the Magnus effect creates a forward thrust.

The Magnus Effect: Physics in Motion

The secret behind these cylinders is rooted in the Magnus effect, a phenomenon first documented in the 19th century by German physicist Heinrich Gustav Magnus, who demonstrated the effect with a rotating brass cylinder and an air blower in 1852. The story says that Isaac Newton (of course) was the first to explain the effect in 1672 after observing tennis players at a Cambridge college. I was not aware that they played tennis in 1672 in Cambridge, but you never know with Newton.

When a cylinder spins rapidly in a moving airstream, it creates a difference in pressure: lower on one side, higher on the other. This produces a force perpendicular to both the airflow and the axis of rotation.

It is the same aerodynamic effect responsible for a swerving football or a sharply curving tennis shot. In maritime engineering, this effect allows a spinning cylinder to function like a sail, causing thrust and reducing reliance on engine propulsion.

Flettner Rotors: Spinning Cylinders at Sea

German engineer Anton Flettner first applied the Magnus effect to shipping in the 1920s, creating what would become known as "Flettner rotors." These tall rotating columns — powered by electric motors — spin rapidly and interact with the wind to generate propulsion. Although the idea was far ahead of its time, today's focus on decarbonization, fuel savings, and emissions reduction has given Flettner rotors powerful new relevance. They are now reappearing on modern vessels, including the Airbus fuselage parts and Ariane rocket transport ship.

Norsepower: Pioneers of Modern Rotor Sails

At the forefront of this resurgence is Norsepower, a Finnish company founded in 2012 that has become a global leader in designing, manufacturing, and installing Flettner rotors — now commonly called "rotor sails" — for commercial ships. The term rotor sails was coined by Norsepower, and it is now commonly used in the industry.

I met Norsepower engineers at Europort 2025 in Rotterdam after searching for them for some time; I wanted to learn more about rotor sails directly from the experts. There I discovered that Norsepower is based in Helsinki, Finland — a country known for having the happiest people on Earth. In a way, it made perfect sense: happy people tend to create exceptional things, so the birthplace of modern rotor sails being in Finland felt entirely fitting.

Technical Details: Cylinder Dimensions and an Airbus A320 neo Comparison

The cylinders installed on the Airbus transport ship are impressive by any standard. Each rotor stands nearly 35 meters tall and measures around five meters in diameter.

For perspective, an Airbus A320neo is about 35 meters long and has a fuselage diameter of about four meters. Can you imagine removing the wings from an A320neo and installing it upside down on the ship? And then six of them in two rows of three. It is huge.

How the Rotor Sails Work: Electric Power, Spinning Towers, and Extra Thrust

The Norsepower Rotor Sail is a large cylindrical structure mounted on the ship's deck. Contrary to a common misconception, wind does not spin the rotor. Instead, an electric motor continuously rotates the cylinder at high speed. The spinning rotor interacts with oncoming wind, and a physics phenomenon called the Magnus effect takes place. It creates a large pressure difference, which produces a strong thrust force at a 90-degree angle from wind direction. In favorable wind conditions, this additional thrust allows the ship's main engines to be throttled back, saving fuel and reducing emissions. Alternatively, it can be used to achieve higher top speeds. Rotor sails are considered a completely new system installed on the ship.

A typical system includes:

1. The Norsepower Rotor Sails, which generate forward thrust.
2. A foundation structure, sometimes with tilting capability, installed on the deck. Tilting capability is sometimes needed for loading operations and for ships going under bridges.
3. The Norsepower Control panel and automation system, giving the captain full operational control and optimizing

savings.

4. Measurement devices monitoring ambient conditions.
5. A Remote Service Support Agreement, offering round-the-clock technical support and maintenance.

The electric motors spin each rotor at several hundred RPM (up to 225 RPM). As wind sweeps across the deck, the interaction between the rotating cylinder and airflow creates a powerful thrust. By adjusting the direction of rotation and rotor speeds, this force becomes useful propulsion. The result is reduced fuel consumption, lower emissions, and greater operational efficiency. And that is what we want.

Norsepower Sentient Control: Smarter Sailing Through Data

Launched in 2024, Norsepower Sentient Control integrates multiple smart modules to maximize overall system performance. It accounts for complex aerodynamic interactions between the sails, main engine, and ship maneuvering systems.

To achieve optimal performance, the system considers everything from sail aerodynamics to ship hydrodynamics. Intelligent power distribution improves fuel economy by analyzing the Specific Fuel Oil Consumption (SFOC) of both the main engine and auxiliary generators. Norsepower Sentient Control also provides route optimization insights, enabling a more economical voyage. The system can improve sails' efficiency by an additional 10–25%, which is a lot.

Retrofit Solutions: Greening the Existing Fleet

One of Norsepower's most compelling advantages is the ability to install rotor sails on existing ships. The Airbus transport vessel was designed for rotors from the outset, but about 60% of Norsepower installations today are retrofits. And that is good news. Transport vessels are built to last a few decades. It is wonderful that such an upgrade can be done on present vessels, which can make them more energy efficient. That can extend their useful life.

Norsepower is a Finnish company founded in 2012 that has become a global leader in designing, manufacturing and installing Flettner rotors. These are now commonly called "rotor sails" and are being used for commercial ships.

These retrofits come with engineering challenges: the ship's structure must be strong enough to handle the substantial forces produced by the rotor sails. In many cases, structural reinforcement is required. Despite these challenges, the installation process is relatively straightforward, and energy savings — typically 5–25%, depending on route, wind, number and size of sails, etc. — are realized immediately. In some conditions, vessels can even turn off their main engines entirely, achieving 100% fuel savings, though this is not typical and requires extremely favorable winds. Of course, the crew of such a retrofitted vessel should be trained to operate the ship under new circumstances. Therefore, Norsepower also provides one day of crew training to ensure that energy savings begin from day one, with additional training available upon request.

A modern feature is remote diagnostics. If a malfunction occurs, Norsepower engineers can remotely access the ship's system, troubleshoot the issue, and even update software. This capability allows predictive maintenance, health monitoring, and alerting — and enables Norsepower to remotely advise the crew to make needed smaller repairs when required. Norsepower receives about 1,000 real-time data streams per customer ship. The data is used for everything that helps Norsepower enhance the product and its efficiency, e.g., troubleshooting, R&D, real-time optimization of thrust power, preventive maintenance, compliance, financial reporting, etc.

Norsepower has installed systems on tankers, bulk carriers, cruise ships, RoRo and RoPax vessels, general cargo ships, and ferries. Their strongest customer base is in Europe, Japan, and major Asian shipyards.

Environmental Benefits: Lower Energy Use and Fewer Emissions

By capturing wind power through the Magnus effect, rotor sails enable ships to burn less fuel and emit fewer pollutants. For the Louis Dreyfus Armateurs ship carrying Airbus cargo, this capability is more than a technological achievement — it is a meaningful commitment to a greener future. Across global shipping, small improvements in efficiency accumulate into enormous reductions in carbon emissions, making innovations like rotor sails crucial to sustainable maritime transport.

A Hopeful Course Toward Sustainable Seas

The image of white cylinders spinning above a ship is more than an engineering curiosity. It symbolises the ingenuity and optimism driving the maritime sector toward cleaner, more sustainable technologies. Thanks to companies like Norsepower and the enduring brilliance of the Magnus effect, every voyage not only carries cargo — it charts a course toward a more responsible future for global shipping. Airbus and LDA, in their own way, have pioneered that journey.

Looking Ahead: Airbus, New Fleets, and a Changing Industry

A new generation of low-emission vessels will transport aircraft components for Airbus. These ships will rely on a combination of six 35-meter Norsepower Rotor Sails and dual-fuel engines running on maritime diesel oil and e-methanol. Advanced routing software will optimize transatlantic passages, maximizing wind propulsion and avoiding drag from adverse ocean conditions.

The IMO has set ambitious goals for achieving net-zero emissions. Wind propulsion is increasingly recognized as an essential element of the future energy mix for ocean-going ships. "We are proud to be part of the energy transition through our partnership with Norsepower," said Mathieu Muzeau of Louis Dreyfus Armateurs, who highlighted the importance of offering innovative solutions and driving sustainable change.

By 2030, this new transatlantic fleet is expected to produce 50% fewer CO^2 emissions compared to 2023. The rotor sails will incorporate the new patented Norsepower Sentient Control system, featuring real-time force measurement and individual rotor management. This allows optimization of complex aerodynamic and hydrodynamic interactions. Extensive CFD analyses and wind-tunnel testing were performed to perfect the design.

Heikki Pöntynen, CEO of Norsepower, calls the fleet-wide arrangement "a game changer for the entire auxiliary wind-propulsion industry." It was the largest deal ever made for mechanical sails and the first to fully integrate Norsepower Sentient Control. "We thank LDA and Airbus for being forerunners of this industry," he added, expressing optimism for continued collaboration.

Norsepower has the ability to retrofit rotor sails on existing ships and about 60% of their installations are retrofits.