Above the surface: how airborne wind could support shipping's decarbonisation future

Three hundred metres above the ocean, a rigid-wing drone flies controlled figure-of-eight patterns at the end of a high-strength tether attached to a ship's bow. WindTracX SAGL, a Swiss deep-tech startup, is applying aerospace engineering to one of shipping's hardest decarbonisation challenges, combining wind-assisted propulsion with potential applications in weather intelligence, maritime surveillance and risk reduction.

A sector under mounting regulatory pressure

Shipping accounts for nearly 3% of global greenhouse gas emissions and the regulatory landscape is making that cost impossible to ignore. The IMO's Carbon Intensity Indicator (CII) requires ships to report and improve operational carbon intensity, with corrective action required for persistently poor ratings.

The EU's FuelEU Maritime regulation sets tightening greenhouse gas intensity limits through to 2050, while the EU Emissions Trading System now places a direct carbon cost on maritime emissions linked to EU voyages.

Without action, decarbonisation could significantly increase the cost of maritime transport. DNV modelling suggests that by 2050, the cost of transport in a decarbonised shipping industry could be 69% to 112% higher than in a business as usual scenario, depending on the type of vessel.

Wind assisted ship propulsion (WASP) has emerged as one of the most commercially practical near-term responses. Wind is widely available, requires no bunkering infrastructure and can reduce reliance on fuel when conditions are favourable. Market forecasts for wind-assisted ship propulsion vary significantly, but most point to rapid growth as shipping faces tighter carbon regulation and rising fuel efficiency pressure.

The sector's central challenge, however, is variability: wind at sea level is turbulent and unpredictable, shaped by wave interaction, thermal gradients and hull turbulence. Two vessels running identical equipment on similar routes can report substantially different fuel savings. That inconsistency is where the current generation of WASP technology meets its limits and where WindTracX begins.

The Dragonfly: going above the problem

WindTracX SAGL was founded by Aldo Cattano, an aerospace engineer with 28 years of R&D design experience, six international patents and prior experience leading Skypull, a high-altitude wind energy venture, to Technology Readiness Level 7.

When Cattano examined the WASP sector, he saw not an energy-harvesting problem but a control problem: existing systems are embedded in the most aerodynamically chaotic part of the atmosphere and can only react to what the wind provides them. His solution was to leave that environment behind entirely.

The Dragonfly Aero Kite Drone launches vertically from a pivoting deck station at the ship's bow, climbs to more than 250 m above the sea surface and flies controlled crosswind patterns on a Dyneema tether. The aerodynamic traction generated is transmitted directly to the vessel as supplementary propulsion. At this altitude, the atmospheric boundary layer instability caused by wave interaction and hull wake is largely absent. Wind is stronger, smoother and significantly more consistent than at deck level, creating a very different operating environment.

More importantly, the drone does not drift passively. It is actively flown in figure-of-eight crosswind trajectories, constantly moving through the air mass and generating its own apparent wind through motion. The faster the wing moves, the greater the aerodynamic lift, the greater the traction. The rigid biplane, or box-wing, architecture amplifies this with a higher lift coefficient per unit area than soft fabric kites. Furthermore, there is no risk of catastrophic collapse under turbulence loading, a failure mode that has limited the reliability of kite-based competitors in real conditions.

Launch and recovery are fully autonomous. Wings fold for compact storage and the deck station pivots clear of cargo operations. In congested waters, the system retracts automatically on detecting approaching traffic. Previous test flights were operated under approval from BAZL, the Swiss Federal Office of Civil Aviation, including fully autonomous modes.

WindTracX says the development will scale from 25 kW for smaller vessels to 1 MW for large bulk carriers and tankers. The company's performance modelling projects average annual fuel savings of approximately 5% and up to 15% on optimal trade routes for a 50,000 DWT vessel, translating to estimated savings of $700,000 to $1 million per vessel per year, a payback of three to five years and an internal rate of return of 21 to 28%.

More than 250 m of intelligence: weather, surveillance, insurance

Once the Dragonfly is airborne, it commands a panoramic view of the ocean that no deck-mounted instrument can match. The company has formalised this second value layer through three letters of intent that extend the drone's role beyond propulsion.

The first LOI, signed with Omenic.AI, integrates a meteorological station into the drone airframe. Real-time wind speed, direction, pressure, temperature and humidity data at more than 250 m is combined with satellite datasets and processed through AI models to generate hyper-local atmospheric forecasts for the vessel's immediate environment.

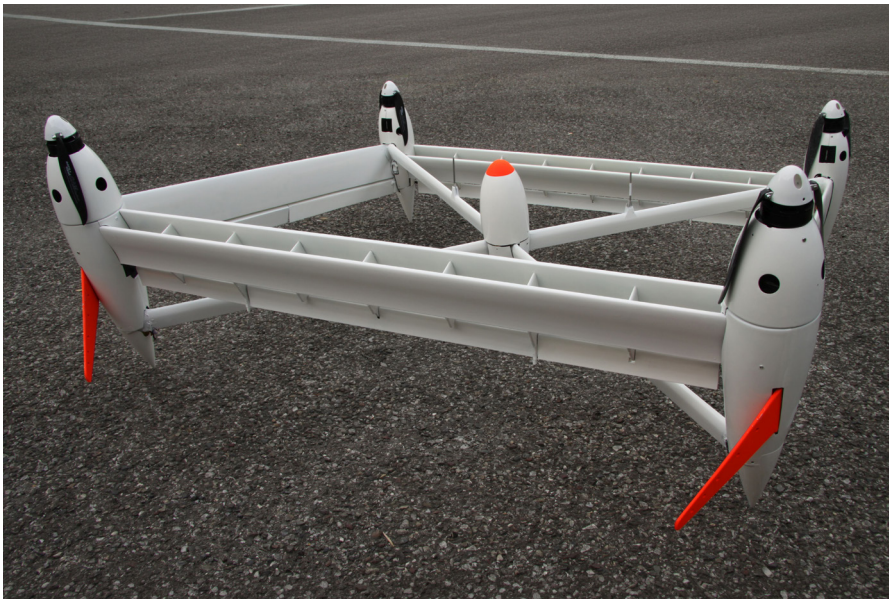
Current weather routing relies on global numerical prediction models with spatial resolution measured in tens of kilometres and temporal resolution measured in hours. These are models that cannot resolve the conditions fifty kilometres ahead of a single vessel at sea. The drone provides in-situ atmospheric intelligence at altitude, in real

time, where the ship needs it: earlier detection of adverse weather, more confident routing decisions and far more accurate modelling of the WASP contribution to fuel reduction for CII reporting purposes.

The second LOI, signed with Abintel Sagl, integrates optical sensors and cameras into the airframe. At more than 250 m, the drone monitors the ocean surface to the horizon, providing warning of approaching small craft or unlit vessels. In piracy-prone corridors, such as the Gulf of Guinea, the Strait of Malacca and the Horn of Africa, situational awareness at a distance is operationally significant. A third LOI with a Helvetia insurance consultant adds a further commercial dimension: better weather routing, lower incident rates and documented WASP performance combine to create a risk profile that should attract reduced marine premiums, strengthening the overall return on investment case.

Engineering credibility and market position

The product is at TRL 5, with a fully functional 1.5-metre prototype carrying multiple hours of successful autonomous flight under BAZL approval. WindTracX states that two PCT patent applications have been filed with the European Patent Office; one has already received full permission for grant, confirming the novelty of the rigid biplane kite-drone architecture for ship traction at altitude. The roadmap scales to a 3.2-metre TRL-8 system in 2026, a commercial 4.4 m product in 2027 and 6 m, 8 m and flagship 17 m variants by 2029.



In a competitive WASP landscape that includes Norsepower's rotor sails, bound4blue's suction sails, BAR Technologies' WindWings and Airseas' soft-kite system, WindTracX's differentiation is specific. Against deck-based systems, the Dragonfly requires no hull modifications, adds minimal weight, draws near zero parasitic electrical load and leaves deck space clear.

Against soft-kite competitors, the rigid biplane eliminates collapse risk and delivers higher thrust per unit of surface area. WindTracX estimates that the target segment, bulk carriers, general cargo, RoRo and tankers between 10,000 and 60,000 DWT, comprises 13,500 vessels globally, with a serviceable retrofit market valued between $10.8 billion and $33.8 billion. Initial commercial focus is on European shipowners facing the most immediate EU pressure, with discussions already underway with shipping companies and a US-based pilot candidate.

The company is seeking CHF 5.2 million in staged investment over three years to reach a first commercial installation in 2027 and EBITDA profitability by 2030. Based in Lodrino, Ticino, WindTracX presented at the BlueWeek Natural Propulsion Seminar in Marseille in April 2026, has submitted a Horizon Europe grant proposal and is associated with the Swiss Drone Competence Centre and Zestas maritime association.

The engineering foundations appear strong, the IP position is developing and the regulatory environment is creating a clear incentive for adoption. For fleet operators building decarbonisation strategies under IMO and EU pressure: this is a system worth watching closely.

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