SIEMENS

MARINE

CargoKite

Marine startup reduces simulation setup time by 87.5 percent as it seeks to transform ocean freight

Platform

Siemens Xcelerator

Business challenges

Develop freight ships with more flexibility and lower emissions

Optimize wind energy generation and hydrodynamic performance

Cooperate among globally dispersed engineering teams

Test high number of variants

Keys to success

Use Simcenter STAR-CCM+ for wind and water flow simulation

Use Simcenter 3D for structural analyses

Use NX for 3D design

Leverage Siemens startup program

Results

Reduced simulation setup time by 87.5 percent

Saved hundreds of hours of engineering time

Established best-in-class engineering environment

Built digital twin of freight ship

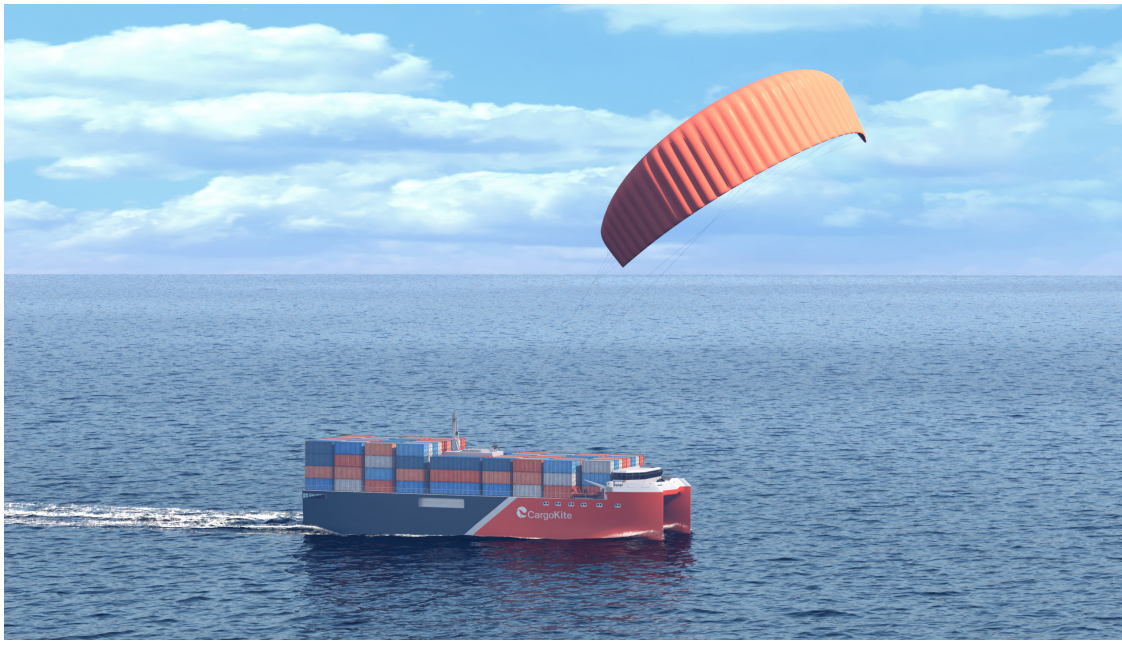
Virtually achieved proof of technology

CargoKite uses Siemens Xcelerator to save hundreds of engineering hours as they develop low emission container ships

Sustainable ocean transportation

Container ships transport more than 90 percent of all global goods. Due to the enormous size of these ships, which can carry up to 24,000 sea freight containers, economies of scale make it a particularly cost-effective way to transport goods. This also keeps energy consumption and emissions comparatively low.

However, this form of transportation is slow and not particularly resilient, as a single ship blocking a port or canal can disrupt global supply chains and result in empty store shelves. Many individual shipments need to be combined and separated for a single shipload, requiring large and complex infrastructure and making it time-consuming to load and unload. Consequently, traditional sea transport is also less than customer friendly. Energy accounts for more than one-third of the cost, and ships today typically burn heavy fuel oil; a single container ship emits more carbon dioxide (CO_2) than 65,000 cars.



CargoKite uses a kite to develop a new kind of cargo sailing ship for the short sea and feeder market.

"The conditions of the Siemens startup program enable CargoKite engineers to leverage the full power of the Siemens Xcelerator portfolio with industry-leading software tools for all specializations involved in the complex creation process."

Tim Linnenweber
COO
CargoKite

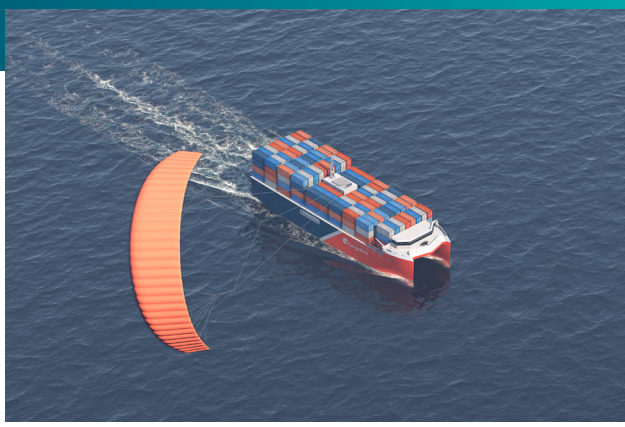
"Alternative fuels are expensive and will not be fully available for a long time, and they can at best only solve one of the issues the shipping industry faces," says Tim Linnenweber, cofounder and chief operating officer (COO) of CargoKite GmbH (CargoKite) based in Munich, Germany. "We believe that decarbonizing the shipping industry and improving its customer orientation requires a more radical approach."

To help achieve these twin goals, CargoKite implemented Siemens Digital Industries Software's Simcenter™ software and NX™ software, part of the Siemens Xcelerator business platform of software, hardware and services.

Gone with the wind

The idea that inspired the startup, which was founded by Linnenweber and fellow students of the Technical University of Munich (TUM), is returning to smaller vessels to support individualized supply chains. They believe in a future where economic growth no longer comes at the expense of the environment. To develop the cargo sailing ship of the 21st century, CargoKite uses novel technologies to make this economically and ecologically feasible.

"We don't merely put a kite on a ship, we are designing a new type of ship around the wind," says Linnenweber. "A kite-based propulsion system and a newly developed ship and our intelligent control software



Container ships can carry up to 24,000 sea freight containers, but due to their enormous size they are slow and require complex infrastructure and feeders for loading and unloading.

make it possible to power our highly automated cargo vessels for the short sea and feeder market primarily by wind." This facilitates transporting goods at the same or lower costs while reducing emissions up to 80 percent.

Although the original concept was a hydrofoil-supported catamaran with a capacity of 16 containers, the company later turned to larger designs that could carry more than 300. At sea, the kite taps into reliable and steady high-altitude winds for propulsion.

Using artificial intelligence (AI) for a proprietary route planner, the CargoKite container ship is designed for near-autonomous navigation. The tool calculates the vessel's optimal route and determines the estimated time of arrival

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By using Siemens Xcelerator, we trust we can make the maritime paradigm shift a reality."

Tim Linnenweber
COO
CargoKite

The autonomous, wind-powered CargoKite ship uses novel technologies to transport goods at the same or lower costs as traditional container vessels while reducing emissions up to 80 percent.

"Siemens made substantial improvements, so the time required to set up a new simulation fell from eight hours to one hour. In our development process that spans two to three years from start to first prototype, this saves us hundreds of hours of engineering time and enables us to test many more variants to ensure optimal results."

Giuseppe Musca
Head of Naval Architecture
CargoKite

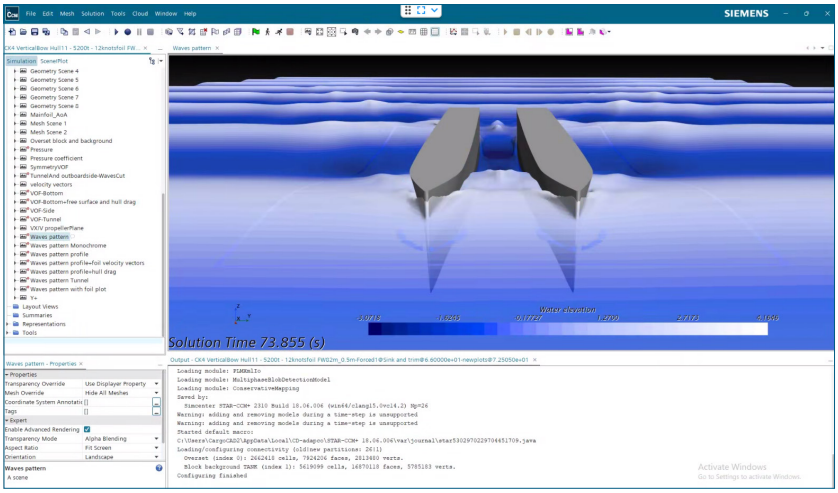
(ETA) based on real-time weather conditions. Likewise, all other ship functions will be fully automated, including launching, positioning and retrieving the propelling kite according to weather conditions.

Optimizing seagoing properties

"Software models alone cannot produce a solution," says Linnenweber. "This is why an interdisciplinary team of entrepreneurial engineers, driven by common vision of leading the shipping industry into the future, is working on the different aspects of the novel freight ship design."

The company's engineers combine more than 100 years of experience in the industry. Between them, they develop the new class of low-emission cargo vessels. They use Siemens Xcelerator to create the digital twin of the ship and conduct feasibility studies based on design variants.

Giuseppe Musca, head of naval architecture, uses Simcenter STAR-CCM+ to develop and optimize the ship's hydrodynamic performance. To simulate and optimize vessel hull designs, the naval engineer has been using computational fluid dynamics (CFD) software for more than 15 years. "After using third-party software for that for several years, I converted to Simcenter STAR-CCM+," says Musca. "It is much more sophisticated and it makes it much easier to implement and test new designs, shapes and appendages."

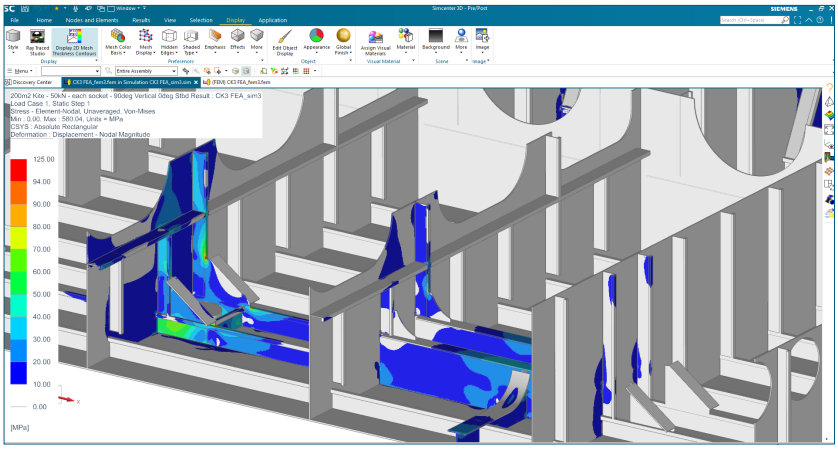


Using Simcenter STAR-CCM+ to simulate and optimize the critical hydrodynamic performance of the ship's hull, CargoKite engineers can test many variants to deliver optimal results.

Siemens Xcelerator is the most powerful package of software tools on the market for our purpose.”

Giuseppe Musca
Head of Naval Architecture
CargoKite

When Musca switched to Simcenter STAR-CCM+, setting up a new simulation was reduced from three or four days to one day, about a 70 percent reduction. “Siemens has made substantial improvements since then, so the time required to set up a new simulation fell from eight hours to one hour, a reduction of 87.5 percent,” says Musca. “Our development process spans two to three years from start to first prototype, so that saves us hundreds of hours of engineering time and enables us to test many more variants to ensure optimal results.”



CargoKite engineers use Simcenter 3D to perform FEM analyses.

End-to-end data consistency

The ease and speed of setting up simulations for new design is in part due to using Simcenter STAR-CCM+, which includes best-in-class computer-aided design (CAD) capabilities, so engineers can complete complex tasks without leaving the accustomed engineering environment and without converting data between software platforms.

It applies likewise to Siemens Xcelerator, which offers a common look-and-feel as well as end-to-end data consistency between the individual software products throughout the platform to prevent information silos. It also features tools that support collaboration between experts in different domains, often working in remote locations. “To achieve the maritime transition, we need the best in their field, and we don’t necessarily find them in or around Munich,” says Linnenweber. “Musca lives and works mainly in New Zealand, and he is not the only example of a long-distance relationship between CargoKite and its crew.”

CargoKite needs to conduct simulations beyond CFD. The company’s engineers use Simcenter 3D software for advanced structural analyses. They have recently started combining both simulation software packages with the advanced CAD capabilities of NX and more detail.

Solutions/Services

Simcenter
siemens.com/simcenter

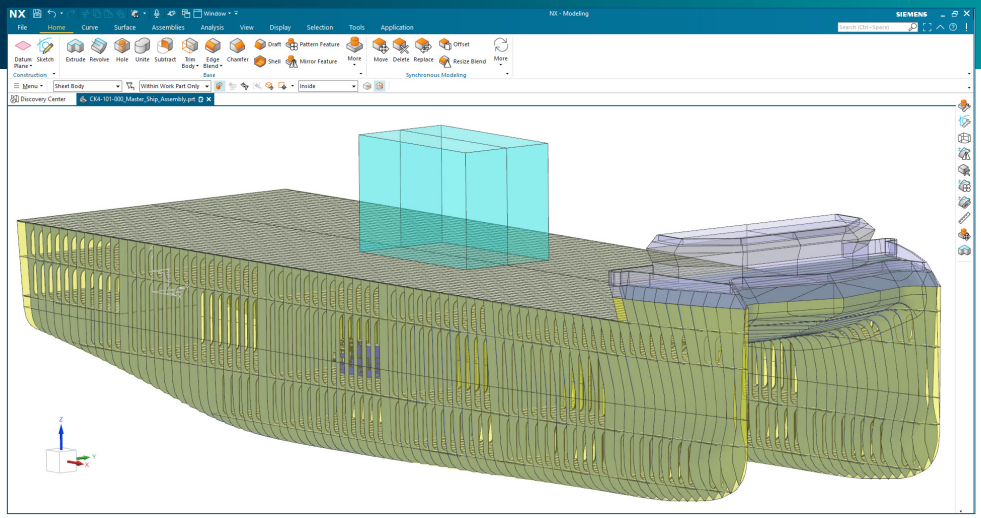
NX
siemens.com/nx

Customer's primary business

CargoKite is a maritime hard tech company based in Munich, Germany. The company was founded in 2022 with the mission of developing sustainable and economically viable commercial shipping solutions.
cargokite.com/

Customer location

Munich
Germany



The Siemens startup program enables CargoKite engineers to leverage the full power of Siemens Xcelerator with industry-leading software tools for all specializations involved in the complex creation process, including NX for the ship's hull design.

Lift off for startups

CargoKite is a typical startup company, relying on venture capital for all its financial needs, including an adequate engineering software environment. As this can add up to substantial amounts of money, Siemens supports startup companies with scalable, low-cost design and simulation engineering solutions. The simulation package CargoKite is using bundles NX CAD, Simcenter solutions including 1D, advanced structural analyses and full CFD simulation.

The Siemens offer to new program members can also accelerate their startup journey with credits for one of the leading cloud service providers.

"The conditions of the Siemens startup program enable CargoKite engineers to leverage the full power of the Siemens Xcelerator portfolio with industry-leading software tools for all specializations involved in the complex creation process," says Linnenweber.

"Siemens Xcelerator is the most powerful package of software tools on the market for our purpose," says Musca. Linnenweber adds: "By using Siemens Xcelerator, we trust we can make the maritime paradigm shift a reality."

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