Fraunhofer IWES

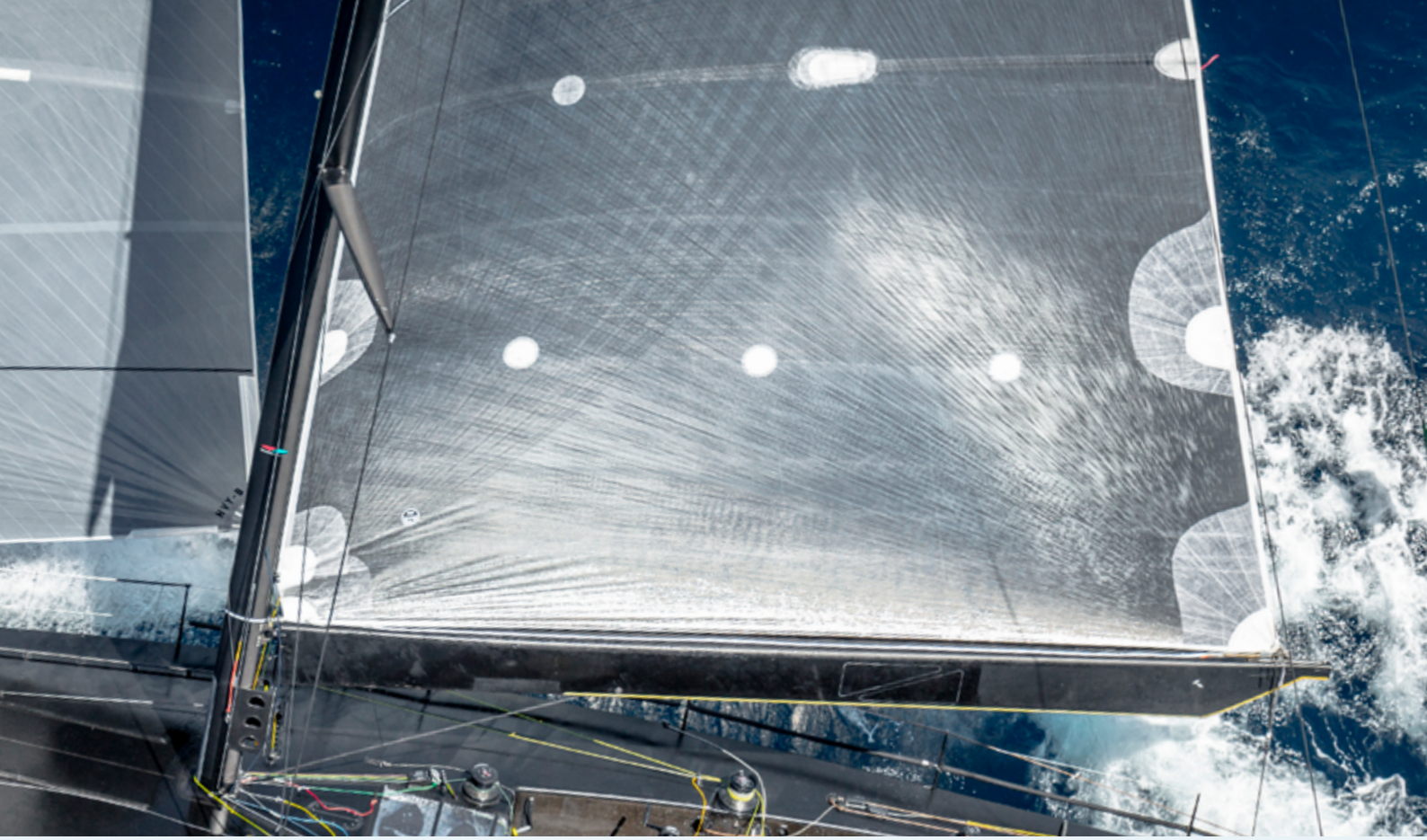
Sustainable commercial shipping

Fraunhofer Working Group Sustainable Maritime Mobility: Design, construction, and operation of trendsetting wind propulsion systems

Boosting research and development for sustainable shipping: The foundation of the Fraunhofer Working Group Sustainable Maritime Mobility signals the start of a close collaboration under joint management between the University of Applied Sciences Emden/Leer and Fraunhofer IWES. The teams in Leer and Bremerhaven are focusing in close coordination on wind propulsion systems, design concepts, and scientific studies for emission-free shipping. In the experimental field, the Maritime Experimental Center in Leer forms the central facility of the working group. The unique testing infrastructure at the other IWES locations supplements the validation options in the area of full-scale applications. The many years of experience in the field of offshore wind energy flow into the working group, and synergies are created.

The joint methodological focal points are in the fields of maritime hydro- and aerodynamics, automation and systems technology and materials technology. Hybrid model concepts result from the intersection of powerful modeling and simulation with measurement technology both in the laboratory and at sea. One special joint area of expertise lies in the use of crossover and upscaling effects between wind propulsion technology for vessels and classic wind energy systems.

Installation of a Flettner rotor prototype on the Fehn Pollux as part of a reallab



Our core competences at a glance

Systems:

- System understanding of commercial shipping and offshore wind energy
- Nautical operational concepts for commercial shipping
- Investigation of ship-waterway-marine environment interaction

Development, testing, and validation:

- In-depth modeling expertise (CFD, FEM, FSI, MBS)
- Availability of large-scale laboratories for versatile engineering questions in the field of shipping and maritime technology
- Laboratory infrastructure from towing tank to testing facilities for the static and dynamic investigation of components up to 115 m in length
- Comprehensive and customizable multidisciplinary measurement technology both in the laboratory and at sea (fluid mechanics, structural mechanics, electrotechnical, geoscientific)
- Hybrid modeling concepts for the performance prediction of sailing systems
- Ship handling simulation for vessels with wind propulsion systems
- Automation and control of wind propulsion systems incl. integration of navigation and ship operation technology
- Testing and validation from the material sample to complex systems to solve problems from functionality to robustness taking into account relevant issues such as vibrations and acoustic signatures
- Established component-accompanying tool chains for optimization (weight, operating behavior)

Expertise transfer:

- Transfer of expertise from wind energy to the application of wind propulsion systems in commercial shipping
- Exploitation of upscaling effects in wind propulsion systems on vessels
- Development of energy supply concepts for the commercial fleet using offshore wind energy and synthetic fuels

Certification and technical analyses:

- Accompaniment and co-design of certification processes
- Technical risk analysis for investors, banks, and insurance companies

Offshore wind energy as a source of synthetic fuels for shipping

Joint projects:

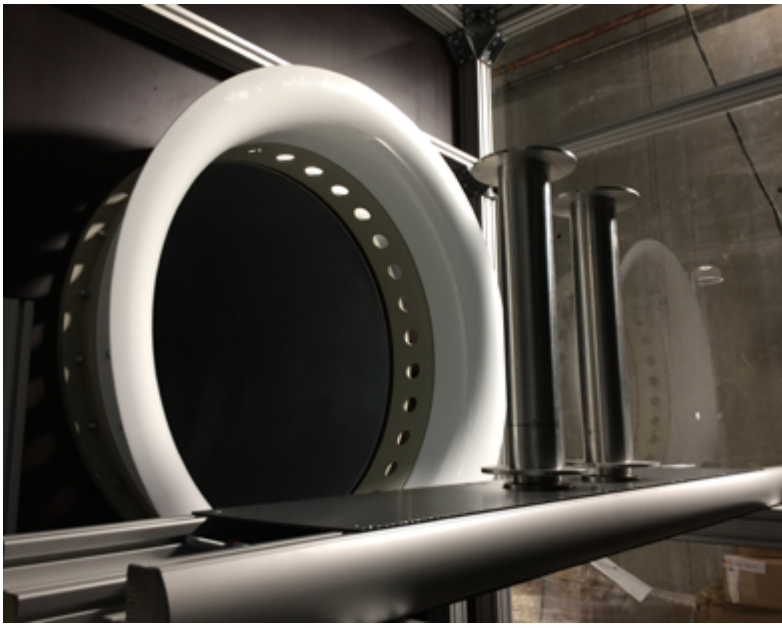
FlettnerFLEET

Development of a scientific-technological platform for the preparation of the market penetration of Flettner rotors on different types of vessels as a contribution to lower-emission shipping.

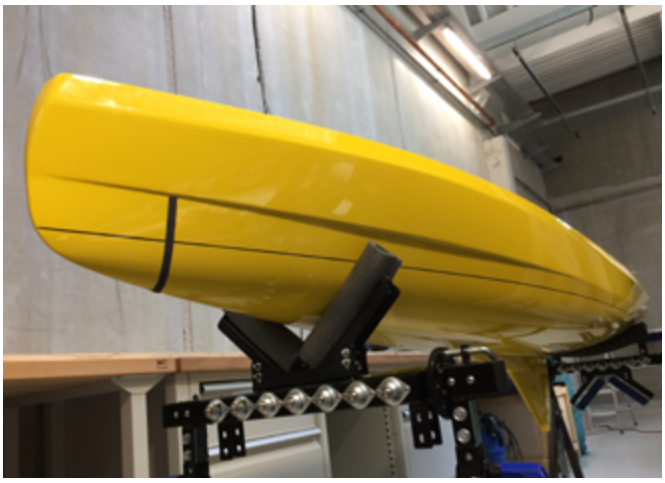
The FlettnerFLEET joint project aims to further develop Flettner technology in Germany for widespread use in national and international shipping and to contribute to climate protection in shipping with this wind hybrid propulsion system.

Additional partners:

ABH, Bureau Veritas, Dirks Elektrotechnik, ECO-Flettner, Fehn Ship Management, HB Hunte Engineering, HSVA, IBK Fibertec, Krey-Schifffahrt, LAIS Nord, MARIKO, NSB Niederelbe Schifffahrtsgesellschaft



Investigation of the interaction of Flettner rotors in the wind tunnel of the Maritime Technical Centre of Emden/Leer University of Applied Sciences



Model hull made by 3D printing process

INNOSegler

The INNOSegler joint project focuses on the design, including costing, for the construction of a CO_2-free passenger and research vessel. The aim of the project is to design an appropriate ship that will be able to accommodate 250 guests and carry out day trips in the sense of public science from a northern German port. In the course of the design process, all relevant data from different types of wind propulsion systems for large vessels will be included in the performance prognosis. Furthermore, the plan is for the ship to be used as a research vessel for 30 scientists on worldwide voyages outside of the tourist season from March to October. The research will focus on optimizing the fully CO_2-free alternative propulsion systems, including the high-performance sailing systems. Furthermore, the ship is to become a floating laboratory and demonstrator for highly innovative and sustainable shipbuilding technology from Germany.

Additional partners:

BIS Bremerhaven, judel/vrolijk & co design+engineering, Marbos, Siemens Energy Marine

Cargo sailer with alternative propulsion

The aim of this joint project is to develop an innovative cargo ship with climate-neutral propulsion systems employing hydrogen-based fuels. The marketability of the vessel is to be achieved through low energy costs and a high degree of automation, producing a prototype for climate-neutral shipping with great upscaling potential. The project will run in close cooperation between four research institutions and 12 companies from the maritime industry. The results will be presented in the form of a feasibility study, including a concept design, and thus present all the relevant data for the estimation of the costs for the building and operation of the vessel. The validation will be effected through the technical "Approval in Principal" of a classification society as well as a nautical test in a ship simulator. A market survey will be conducted to estimate the construction and operating costs in order to demonstrate the marketability.

Additional partners:

American Bureau of Shipping, Bureau Veritas, ECO-Flettner, Freudenberg Fuel Cell e-Power Systems, Hartmann Shipping Services Germany, HB Hunte Engineering, Flensburg University of Applied Sciences, judel/vrolijk & co design+engineering, MARIKO, Nautitec, Ostseestaal, Peters Werft, Rörd Braren Bereederungs, German Shipowners' Association (VDR)

Test benches like this one for large bearings at Fraunhofer IWES in Hamburg are available for testing wind propulsion systems on ships

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Further information

Fraunhofer IWES secures investments in technological developments through validation, shortens innovation cycles, accelerates certification procedures, and increases planning accuracy by means of innovative measurement methods in the wind energy and hydrogen technology sectors. At present, there are more than 300 scientists and employees as well as more than 100 students employed at the nine sites: Bochum, Bremen, Bremerhaven, Leer, Görlitz, Hamburg, Hanover, Leuna and Oldenburg.

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