Foldable Flettner Rotor for Small Sailing Boats
Focus Project-Presentation 05.05.2014

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World cargo shipping lanes

Source: adapted from Kaluza, P., et al., The complex network of global cargo ship movements, Carl von Ossietzky Universitat, Germany; dataset refers to 2007.
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- Rational: Today over 90% of the world’s commercial goods are transported by seaway.
- Marine engines emit with 800 million tons CO$_2$ per annum nearly as much CO$_2$ as the whole aviation.

(*) Image source: DLR Institute for Atmospheric Physics
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- E-Ship 1 using Flettner Rotors

https://www.youtube.com/watch?v=2pQga7jxAyc&spfreload=10
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(*) Image source: "Windenergie aktuell" 11/1992; page 18
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▪ **The Problem**: Rotors are shaped similar to huge advertising pillars

Obstructive while bridge passing

In case of a storm rotor sail can’t be folded away
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- **Specifications:**
  - 1 Flettner Rotor (3x0.5m) on a small catamaran
  - Rotor should be folded to 20% of its original size
  - 1-2 persons should be able to sail it

- **Key challenges:**
  1. Design of a foldable but robust sail
  2. Aerodynamic optimisation for higher fuel savings
  3. Smart design control for optimal wind forces

- **Our design solution:**
  A foldable rotor sail system
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- key challenges (1/3):
  - design a deployable structure: how can one fold a cylinder?
    - computer modelling and simulation
  - prototyping and 3D printing
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- key challenges (2/3)
  - aerodynamics: how can we improve the airstreams of a Flettner Rotor?
    - wind tunnel measurements and testing
  - flow optimisation and visualisation
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- key challenges (3/3)
  - **control design**: how can we use as much of the wind power as possible (wind angle, rotation speed etc.)?

- **finances**: sponsoring
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- United Nations Agreement on technical regulations

**IMO Agreement 2011:**

international shipping became the first industrial sector to adopt binding rules to reduce CO₂ emissions*

(in force since 2013)
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- Join our team:
  - 4-5 mechanical engineers
  - 1-2 electrical engineers
  - 1 product designer/business economist

Application: Monday 26.05.15
(motivation, CV, transcript)
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