

Magnuss



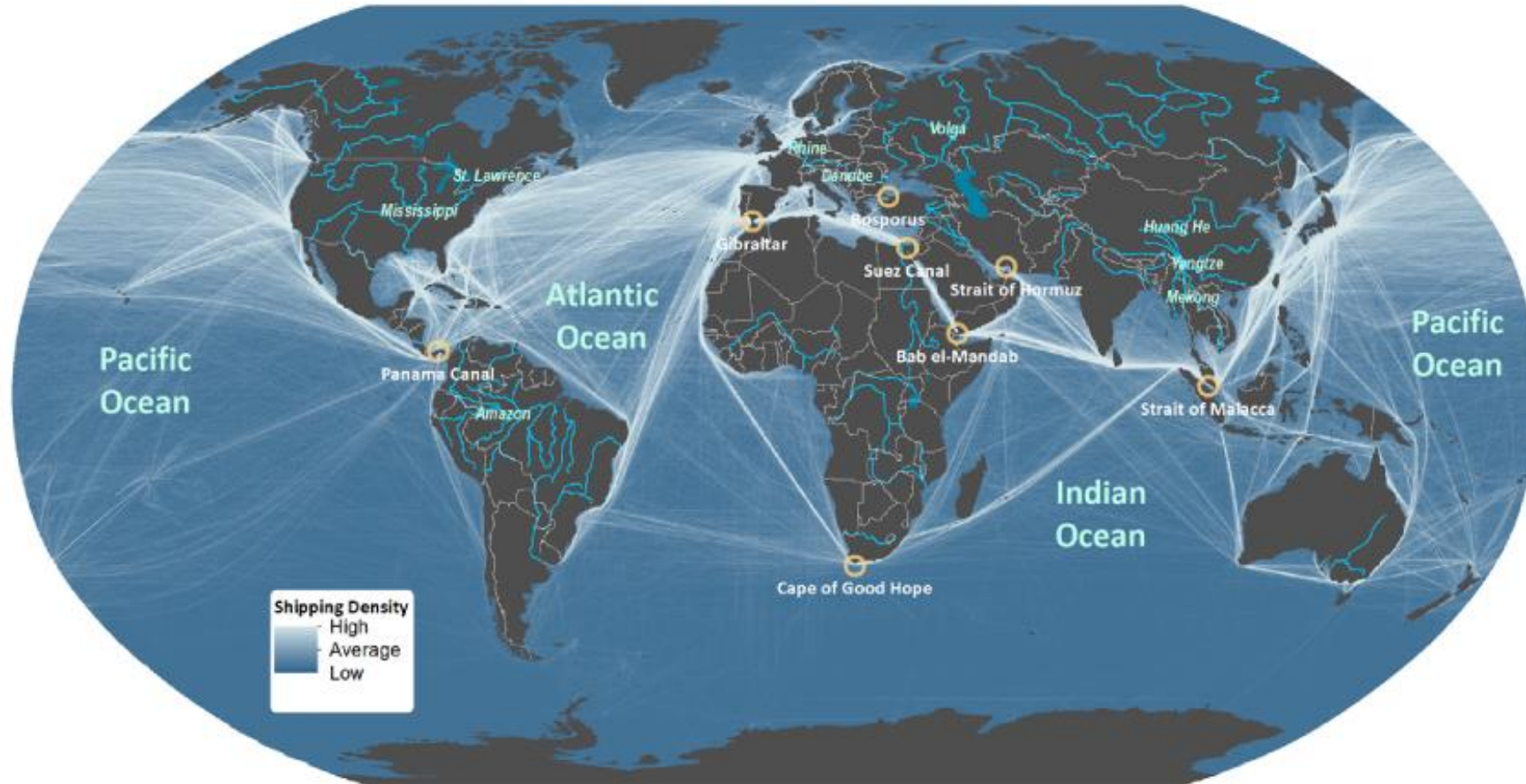
James Rhodes

Co-Founder & CEO



GLOBAL IMPACT

Shipping transports 90% of all goods



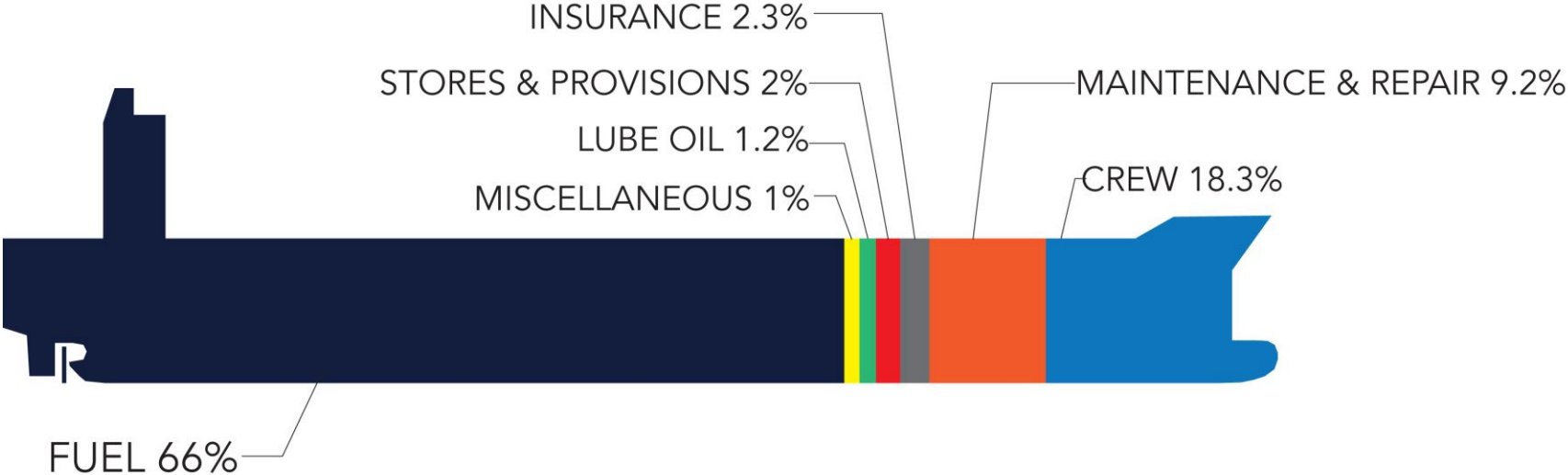
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WIND POWER FOR THE WORLD'S SHIPPING FLEET



PROBLEM # 1

Economic - Shipping requires a lot of high cost fuel

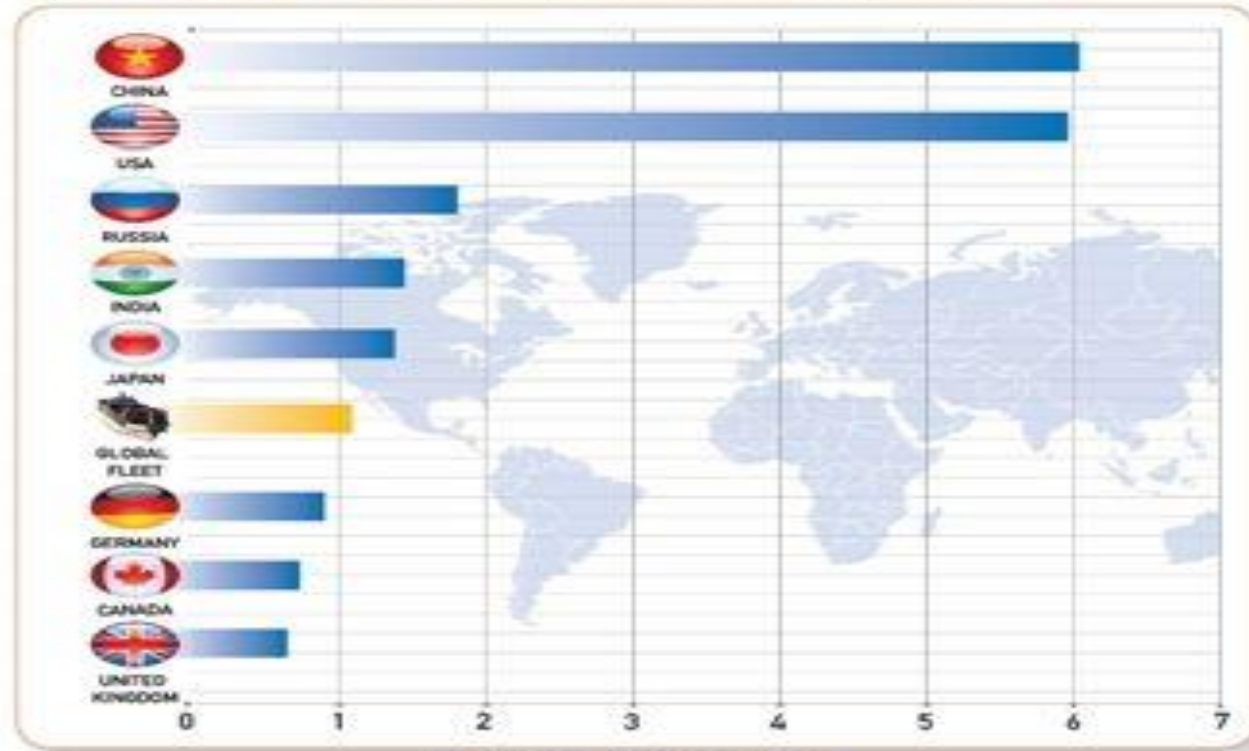


PROBLEM #2

Environmental – Shipping emits 1B tons of CO₂ / yr



GLOBAL SHIPPING ACTIVITY -
AMONG THE LARGEST CARBON DIOXIDE EMITTERS



Source: 2006 Country data from www.eia.doe.gov/pub/international/leaflettable/1co2.xls and 2007 Shipping data from Buhaug, et al. (2009) Second IMO GHG Study 2009; International Maritime Organization London, UK.



SOLUTION

Supplement engine power with wind

- Fuel Savings of up to 50%
- Real means to reduce carbon emissions
- Proven tech applied in a unique way

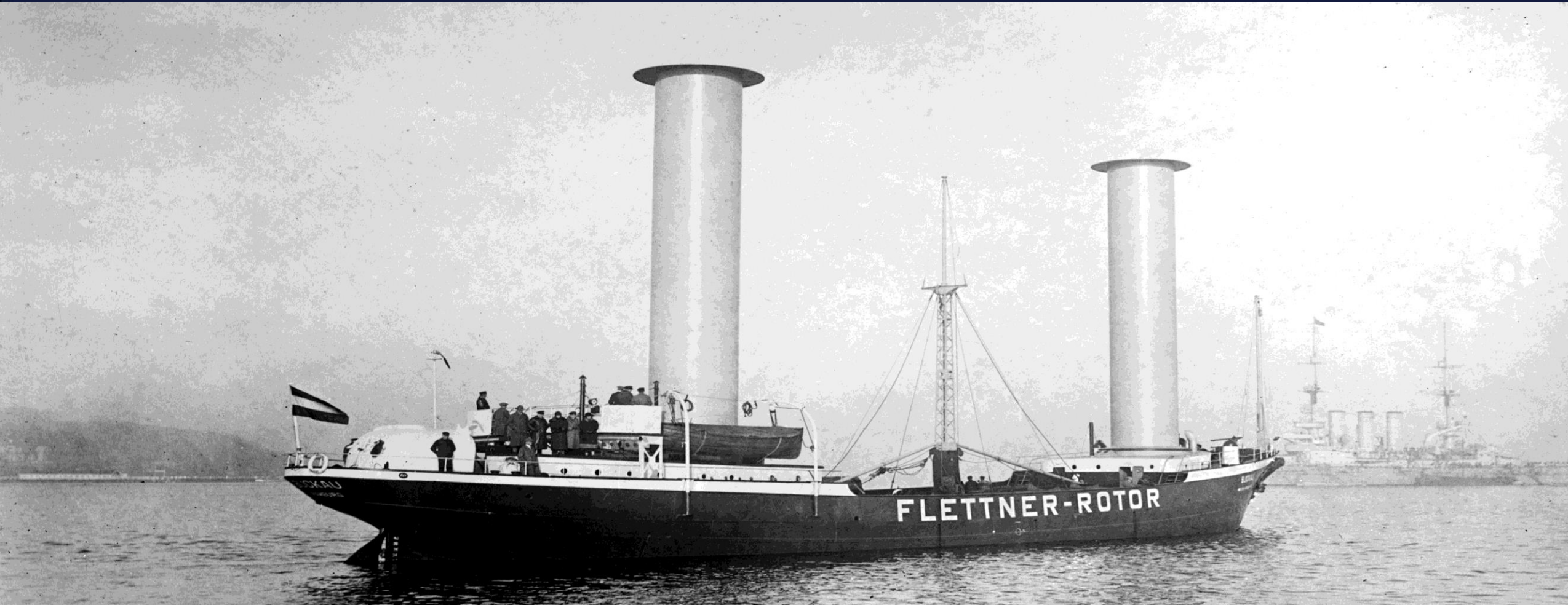
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FLETTNER ROTOR

Rotating cylinders used in 1926 to propel ships



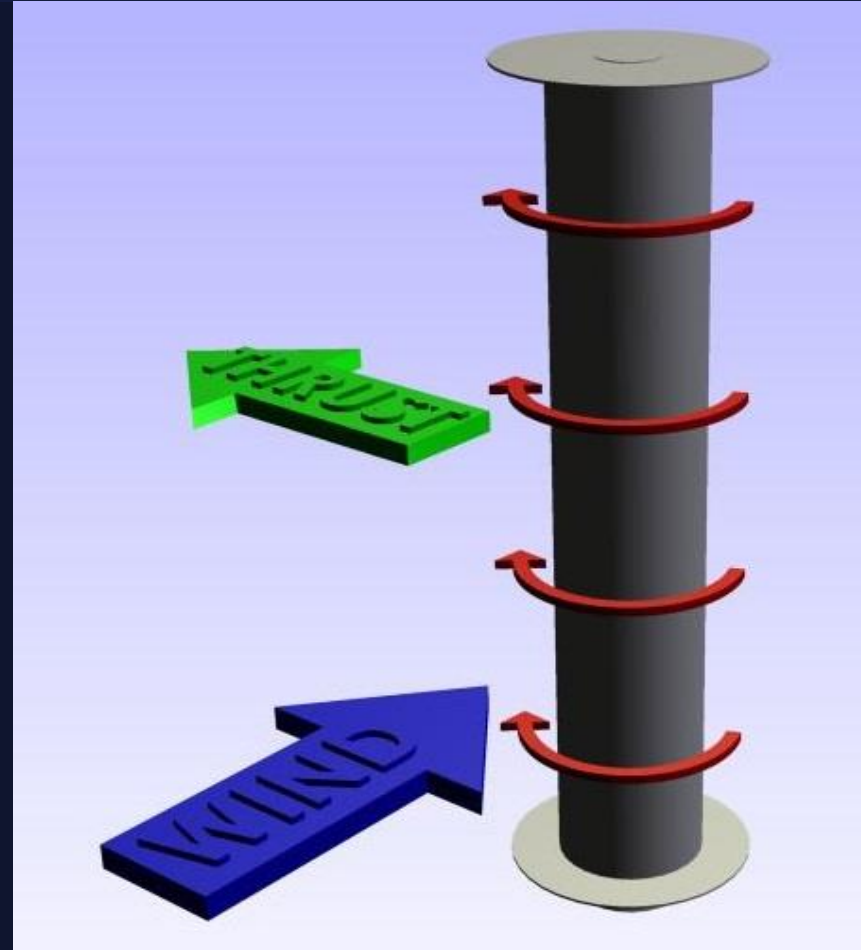
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MAGNUS EFFECT

Thrust created perpendicular to the wind



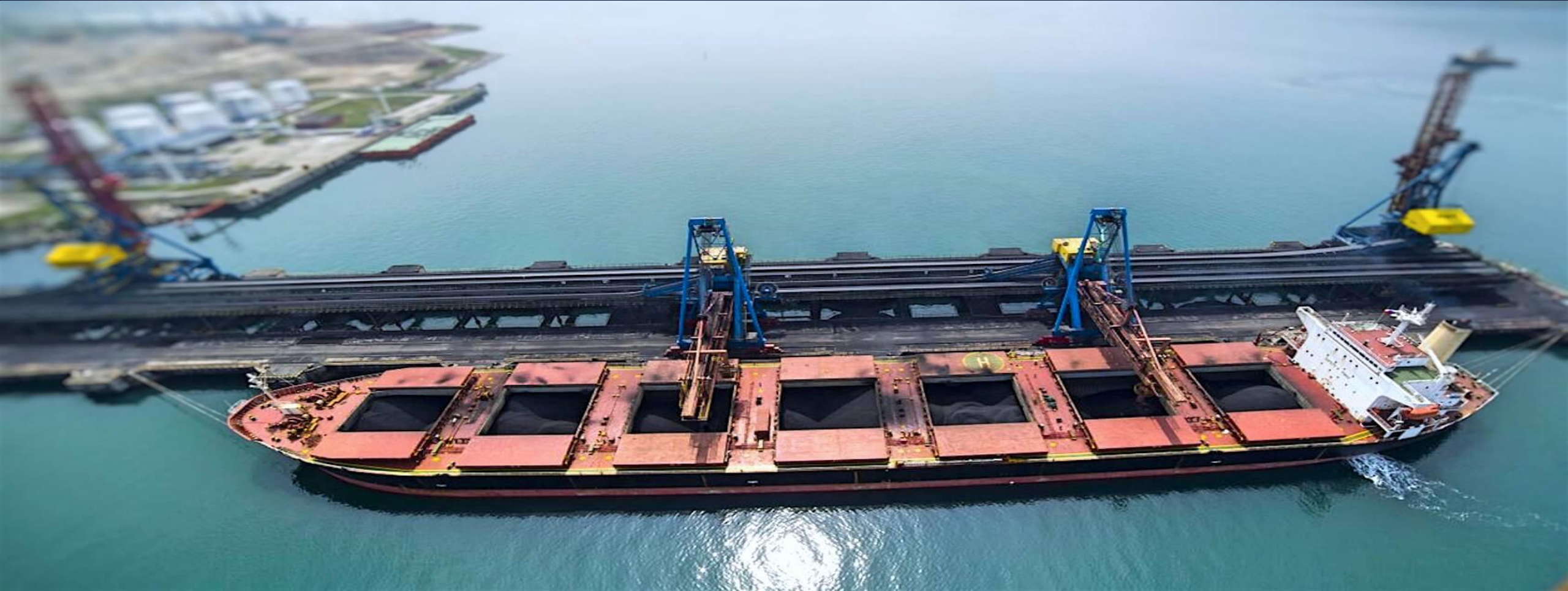
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TECHNOLOGY RE-IMAGINED

Meets the needs of today's shipping operations



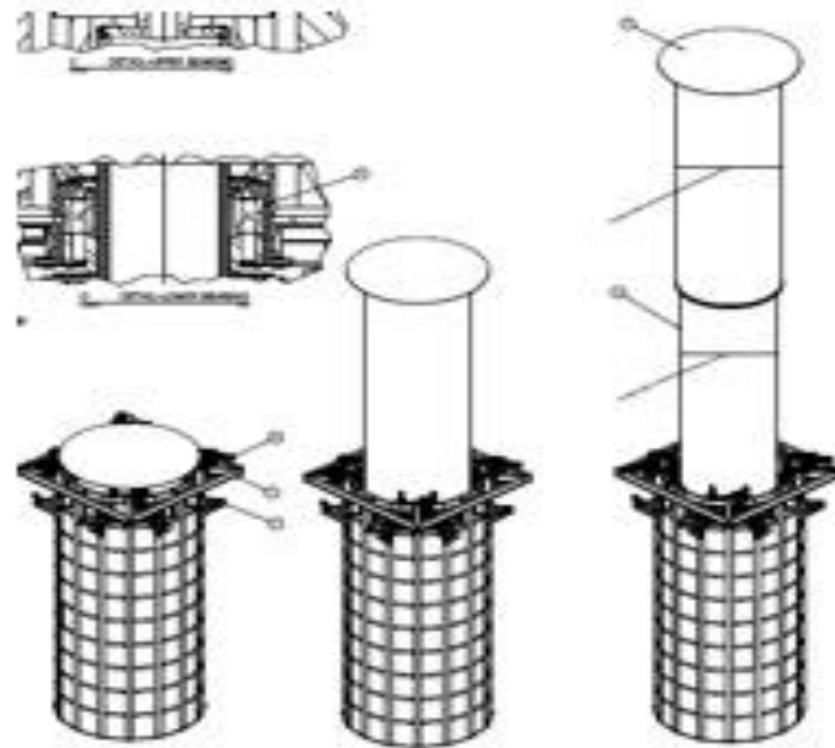
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VOSS (Vertically-variable Ocean Sail System)

Wind-based, auxiliary propulsion



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VOSS - DEPLOYED

Power to propel a ship



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VOSS - RETRACTED

No obstructions to operations or adverse conditions



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.... SOFTWARE

Routing for “best wind” increases fuel savings potential



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PATENTED & CLASS APPROVED

International coverage

US 2013/0042798 A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.:** US 2013/0042798 A1
 (43) **Pub. Date:** Feb. 21, 2013

(54) **VERTICALLY-VARIABLE OCEAN SAIL SYSTEM**

(75) **Inventors:** Eric Holohan, Mill Neck, NY (US); Edward Anthony Shergalis, Riverside, CT (US); James Gibson Rhodes, New York, NY (US); Jeremy Wyatt Linzee, Stony Brook, NY (US)

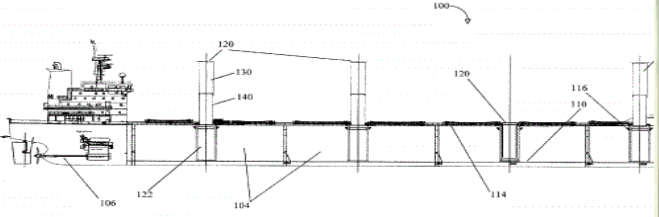
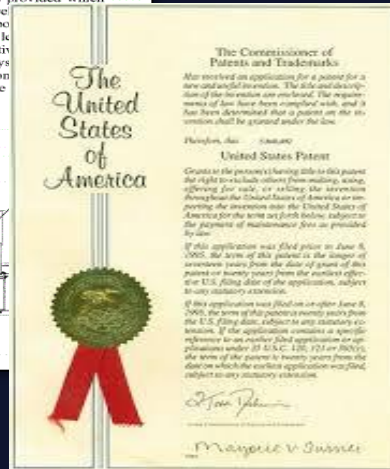
(73) **Assignee:** MAGNUSS LTD, Hamilton (BM)

(21) **Appl. No.:** 13/530,534
 (22) **Filed:** Jun. 22, 2012

Related U.S. Application Data
 (60) Provisional application No. 61/499,904, filed on Jun. 22, 2011.

Publication Classification

(51) **Int. Cl.** B63H 9/02 (2006.01)
 (52) **U.S. Cl.** 114/39.3; 114/102.29
 (57) **ABSTRACT**
 Embodiments of the present invention provide mechanical sail systems, methods, apparatus, and code which allow use of the Magnus effect to provide thrust to a ship. In some embodiments, a mechanical sail system is provided which includes a silo, positioned below a deck level carriage, mounted within the silo, and a support cylinder and a second sail cylinder, and at least one motor coupled to a control system for selecting the lift carriage within the silo, the control system controlling at least one drive motor to position at a top position within the silo to deploy the sail cylinders.

Document no: ENG 153
 Issue number: 0
 Page 1 of 3

Lloyd's Register Marine Design Appraisal Document

Lloyd's Register EMEA
 Engineering Systems
 71, Fenchurch Street
 London
 EC3M 4BS

Date: 12 April 2018
 Please quote the document number on all correspondence

Machinery General Design Approval
 Magnus V055
 Valid until 12 April 2018

The Plans and Document(s) listed in the appendix have been examined applicable sections of Lloyd's Register's Rules and Regulations for the Classification of Machinery for Self-Assisted Ships 2008 and are assigned subject to the following conditions:

1. Machinery

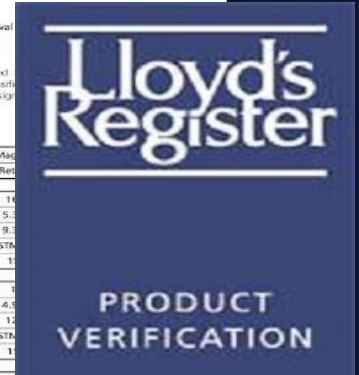
Manufacturer	Magnus
System Type	Powered Rotor (PWR)
Main Rotor Length, m	19
Main Rotor Diameter, m	5.2
Main Rotor Thickness, mm	9.2
Main Rotor Material	ASTM
Main Rotor Speed, rpm	1
Lower Rotor Length, m	1
Lower Rotor Diameter, m	4.5
Lower Rotor Thickness, mm	12
Lower Rotor Material	ASTM
Lower Rotor Speed, rpm	1
Top Bearing Specification	C 3164 KM SKF
Bottom Bearing Specification	CAK/W33 SKF

FINAL ACCEPTANCE OF ACTUAL FITNESS DEPENDS ON SATISFACTORY SURVEY AND TESTING

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R0416/08/2012 110



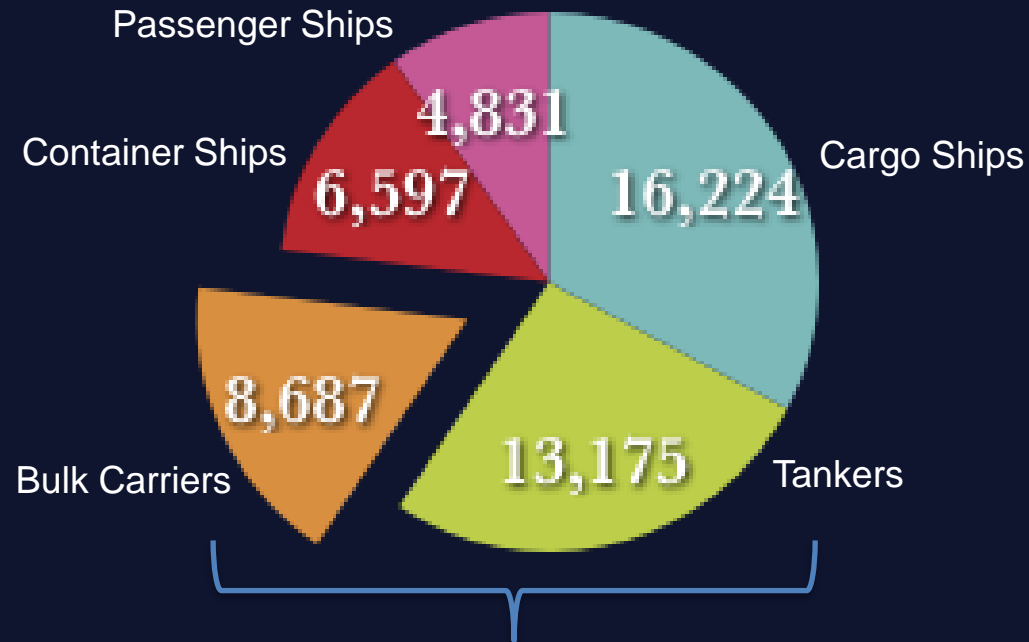
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LARGE MARKET

Ideal for dry bulk carriers and tankers



Target market is 22,000 ships

VALIDATED CUSTOMER INTEREST

Quantifiable benefits based on real world data

- **Savings = 30-50% per yr**
- **Payback = 2-3 yrs**
- **Decision?**
 - GO**
 - NO-GO**



READY TO CUT STEEL

Full-scale, commercial build out



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MAGNUSS – WIND POWER FOR SHIPPING

Double bottom line benefit



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