



ANEMOI



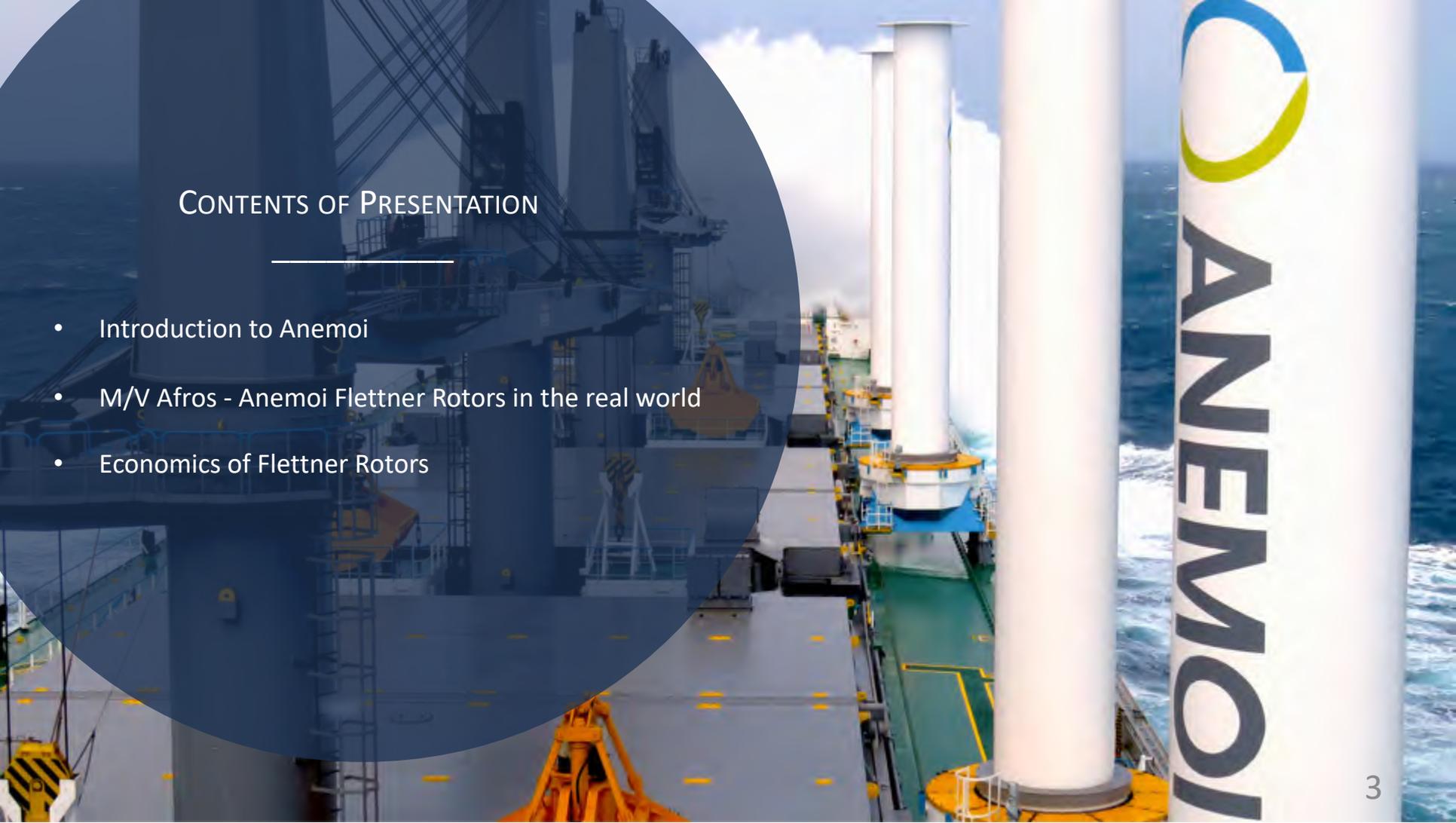
GREEN SHIPPING CONFERENCE

3RD ANNUAL MEETING OF EISAP 2019

M/V Afros – Ship of the Year 2018
“Flettner Rotors in the Real World”

15th May 2019
Nick Contopoulos





CONTENTS OF PRESENTATION

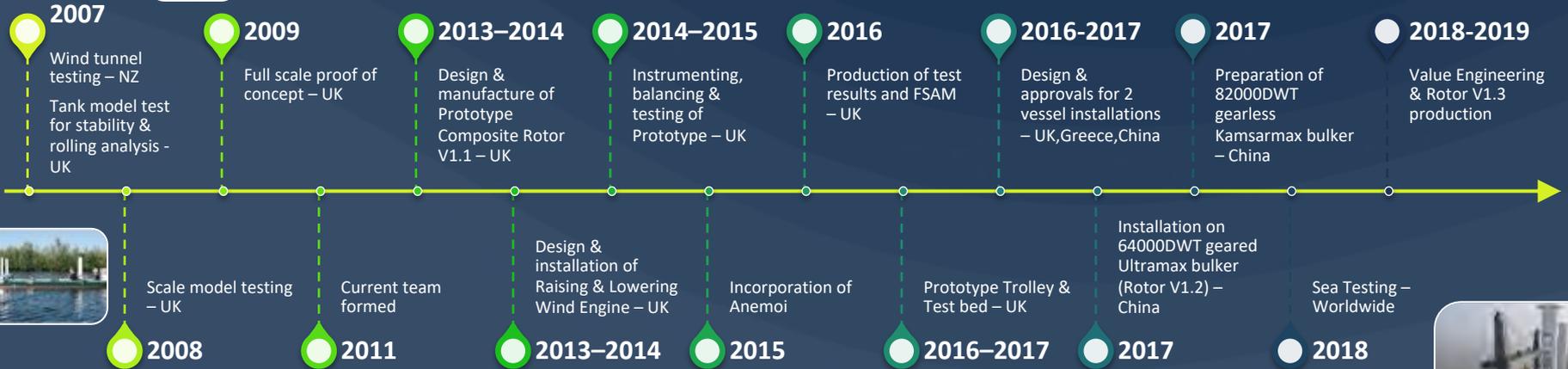
- Introduction to Anemoi
- M/V Afros - Anemoi Flettner Rotors in the real world
- Economics of Flettner Rotors

ABOUT ANEMOI



GSS Greenest Marine Service Provider of the Year 2018

OUR HISTORY



Wind Assisted Ship Propulsion

M/V AFROS



*Winner of Lloyd's List Greek Shipping Awards 2018,
Ship of Year*



*Winner of 2019 GREEN4SEA Dry Bulk Operator
Award*



Flettner Rotors – Magnus Effect

Air is accelerated forward of the Rotor – low pressure



WIND DIRECTION

Air is decelerated aft of the Rotor – high pressure

DELIVERING THE SYSTEM

UK:

- Anemoi HQ (London)
- Test sites (North England)
- Structural & Mechanical Consultants
- LR Classification society
- Rotor Manufacture

Greece:

- Blue Planet Shipping HQ
- Electrical & Control Consultants
- LR Classification Society

North America:

- High tech component supply



China:

- Blue Planet Shipping New Builds
- LR Classification Society
- Shipyard vessel preparation
- Low tech components supply

Europe:

- High tech component supply

- Ports Visited



Wind Assisted
Ship Propulsion

SOLVING THE CHALLENGES – BULK CARRIERS & MV AFROS

- Movement system required
- Limited deck space
- Avoiding issues with:
 - Loading/unloading gear
 - Hatch Covers
 - Navigation and helicopter ops.
 - Deck outfittings



WIND ENGINES AT SEA



Afros delivered in January 2018

- Ultramax 64k dwt Geared Bulk Carrier
- LR Class Ship, Marshall Island Flag State
- Owned/Operated by Blue Planet Shipping

No. days at sea	245
Distance sailed	75000 Nm (3.5x around the equator!)
Longest voyage	10806 Nm (37 days, sailed 4 times)
Maximum roll angle	>20°
Ports visited	17
Port delays due to Wind Engines	0
Operational Availability	>97%

ELECTRICAL & CONTROL SYSTEM

Control system automatically sets Rotor speed and direction based on wind – minimal crew interaction

Variable load

- Input power varies with wind speed
- Mean input power ~15kW per Wind Engine

On the Afros is used in conjunction with other energy efficiency systems (e.g. VFD's on pumps & fans)



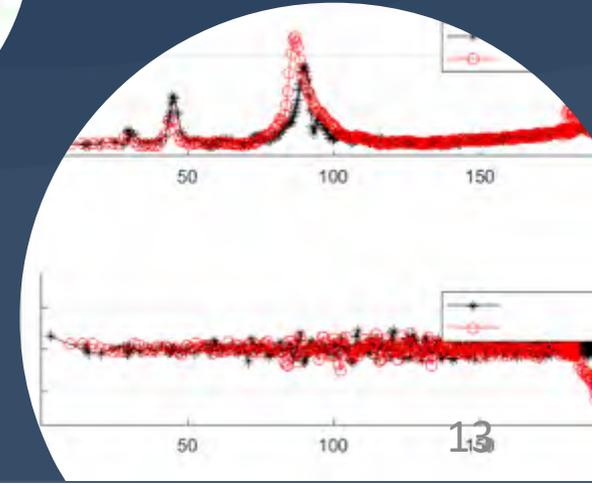
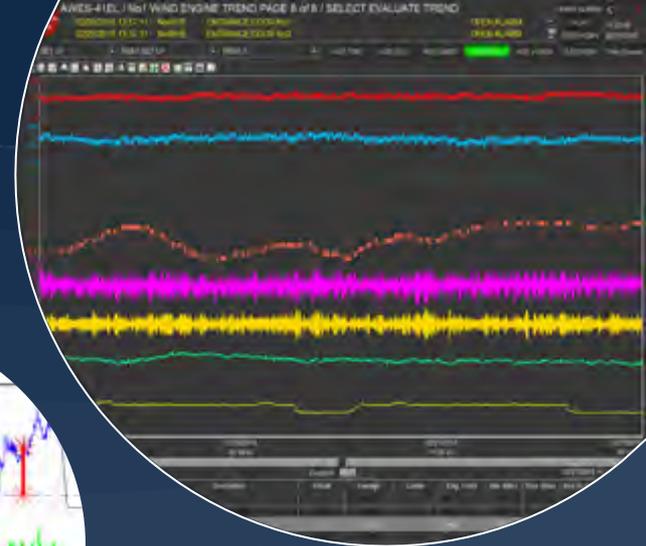
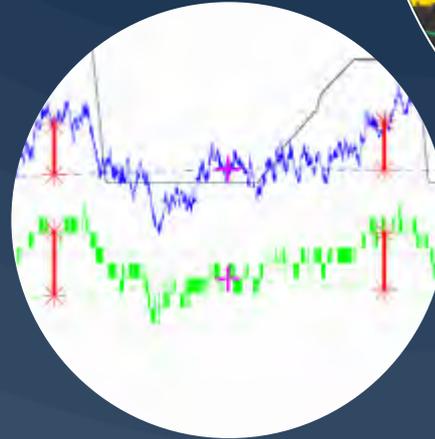
DATA ACQUISITION

Automatic satellite upload of 500 data channels, 1Hz-1kHz

Current data acquisition includes:

- Vessel motion
- Environmental
- Engine room
- Navigational
- Rotor

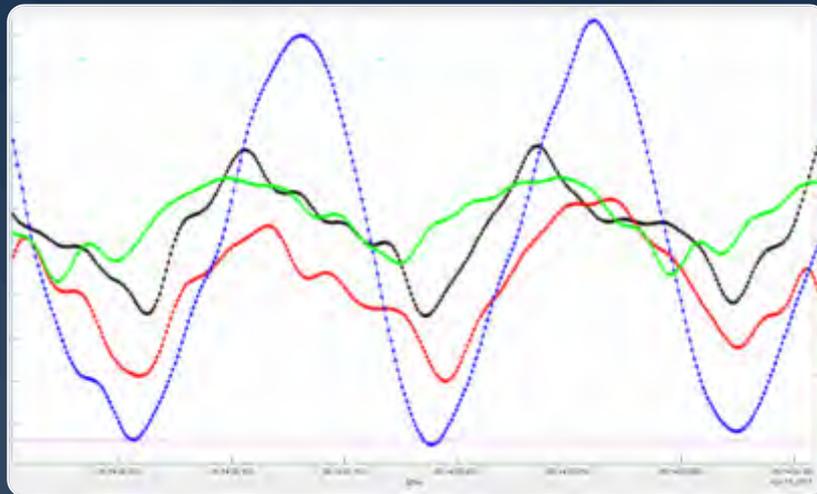
Dashboard display of data available in real time in office



DATA ANALYSIS – CONTINUOUS IMPROVEMENT

Rotors highly engineered for severe loads

Value engineering and continuous improvement are fundamental



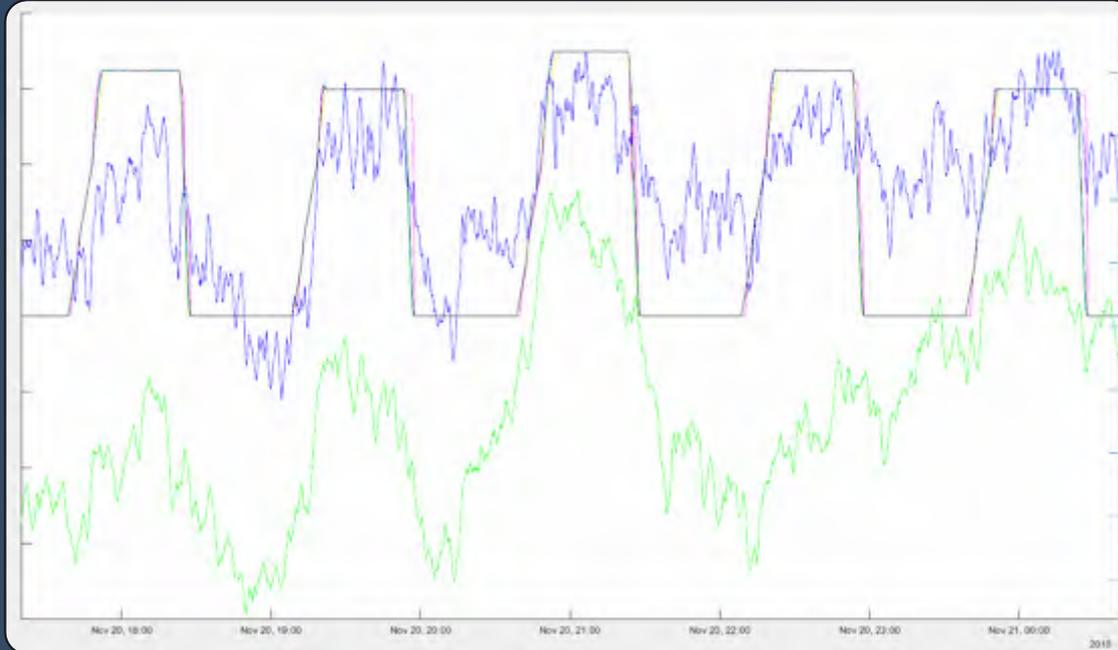
Analysis to:

- Design a stronger, lighter, cheaper Rotor
- Reduce input power
- Improve and monitor component life



Wind Assisted
Ship Propulsion

DATA ANALYSIS - VERIFICATION



- Structured test programmes
- Comparison of at-sea results to existing land-based test site
- Validation of fuel saving predictions



ECONOMICS OF FLETTNER ROTORS

FACTORS REDUCING PAYBACK PERIOD

Ideal Vessels:

- Many days steaming
- Equipment owner pays fuel bill
- Best routes with good winds

Other Factors:

- Low cost of installation
- High oil price
- Reliability & availability
- Optimisation of controls & route



Wind Assisted
Ship Propulsion

SUMMARY

The M/V Afros is a highly successful pilot demonstrator of Wind Assisted Ship Propulsion in action

Flettner Rotors are a reliable real world solution available today to reduce future fuel price risk and the harmful emissions from the shipping industry

