Stolt Tankers - Shipshave In-Water Hull Cleaning Technology

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Webb Institute, November 2022

Stolt-Nielsen

- Stolt Nielsen – Stolt Tankers
- Biofouling
- In Transit Hull Cleaning

Stolt-Nielsen at a Glance

World's leading liquid chemical product logistics provider

LOGISTICS BUSINESSES | **AQUACULTURE**

Stolt Tankers

- Leading global provider of transportation services for bulk-liquid chemicals, edible oils, acids, biofuels and CPP

Key Highlights

~160 deep-sea, coastal and inland parcel tankers

>3m total deadweight tonnes

Stolthaven Terminals

- Global provider of storage services for bulk-liquid chemicals, edible oils, acids, biofuels and CPP

Key Highlights

~5.0m cbm total storage capacity (including JVs)

10 wholly-owned terminals

4 joint venture terminals

Stolt Tank Containers

- Leading global provider of tank container door-to-door transportation services for bulk-liquid chemicals and food-grade products

Key Highlights

~43,500 tank containers in the fleet

~140,000 shipments

22 depots and hubs

Stolt Sea Farm

- Leading global land-based aquaculture company focused on the production of turbot and sole
- 14 land-based, flow through and RAS farms across five countries

Key Highlights

5,700 tonnes turbot production capacity

1,570 tonnes sole production capacity

Investments

- Invests in industries where Stolt-Nielsen can leverage its knowledge and experience
- Stolt-Nielsen Gas Ltd invests in opportunities in LNG supply, shipping, storage and distribution

Key Highlights

47.2% stake in Avenir LNG

2.5% stake in Golar LNG

2.5% stake in Cool Company Ltd ("CoolCo")

7.6% stake in Odfjell SE

9.8% stake in Ganesh Benzoplast

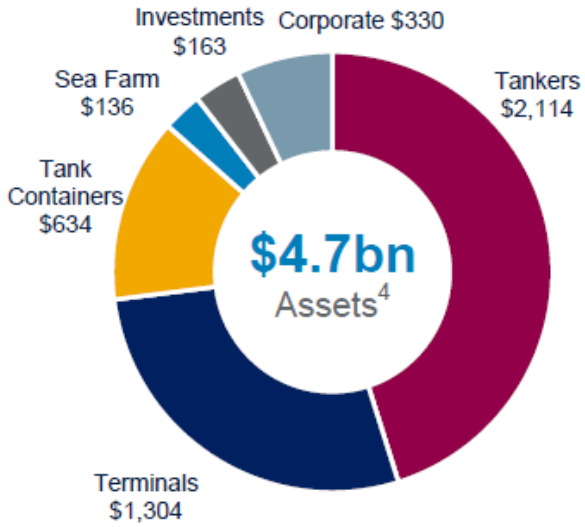
$2.5bn
LTM Revenue

$646m
LTM EBITDA[1/2]

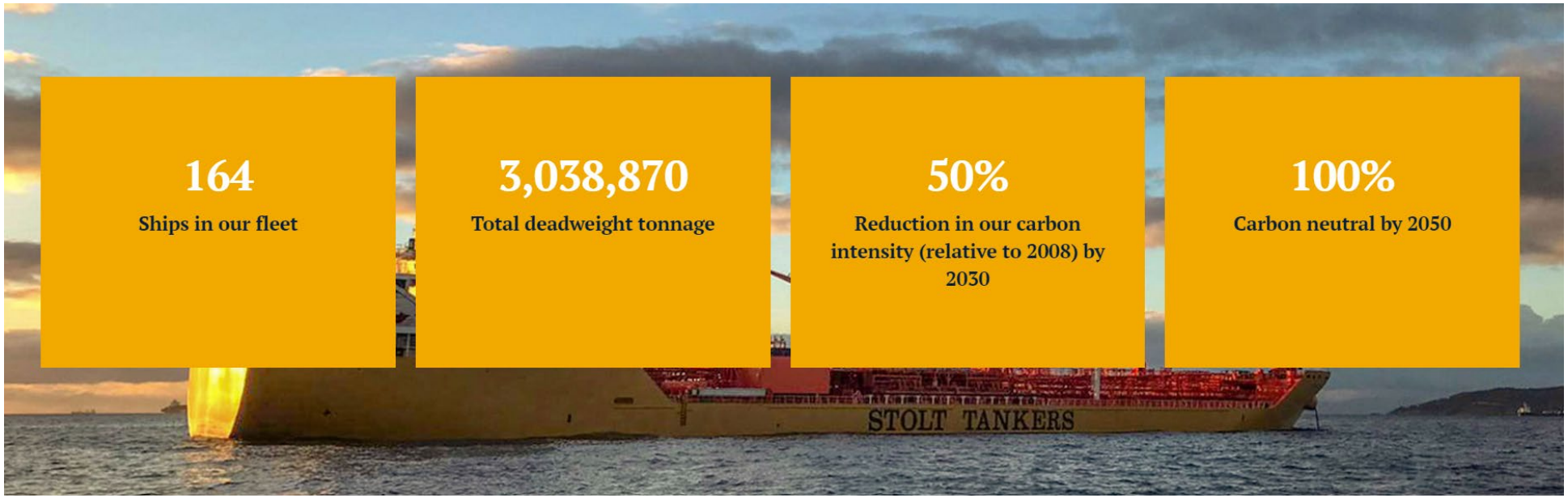
$1.2bn
Market Cap[3]

c.6,600
Employees

Figures in USD millions



Stolt Tankers at a Glance

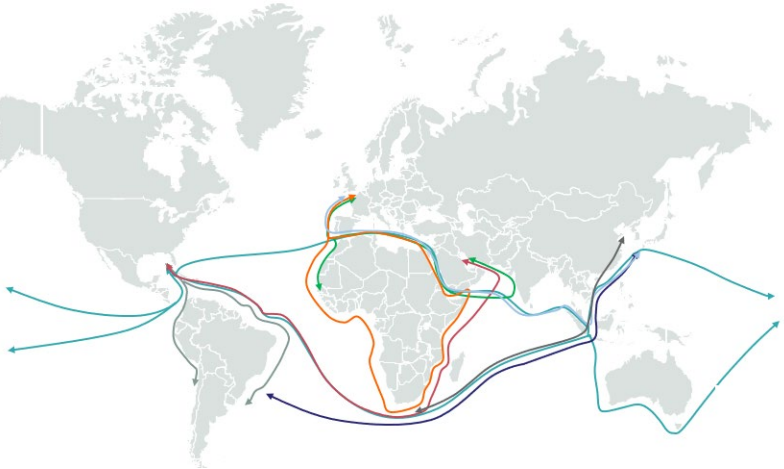


164
Ships in our fleet

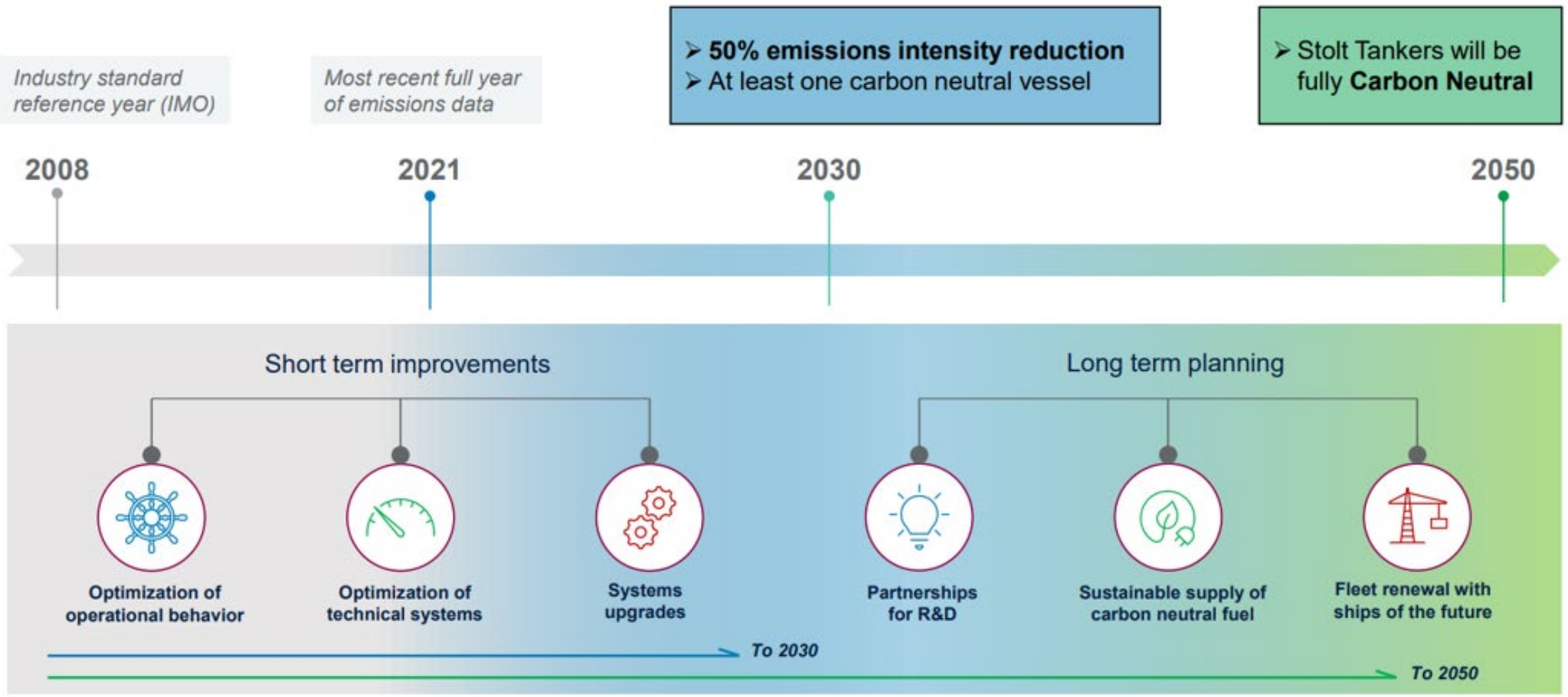
3,038,870
Total deadweight tonnage

50%
Reduction in our carbon intensity (relative to 2008) by 2030

100%
Carbon neutral by 2050



Our decarbonization ambition

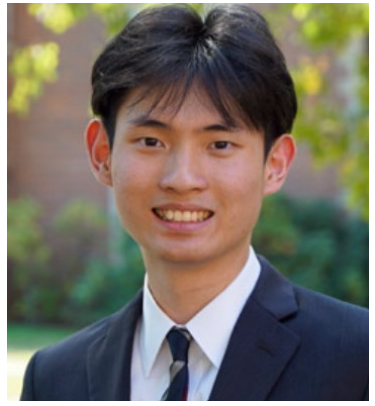


Stolt Tankers Energy Conservation Team and Webb Institute

- Energy Conservation department part of Fleet Support Shipowning
- Main goal: to optimize energy usage on board and reduce energy waste of the fleet
- In principle most vessel energy systems operate with an ‘energy waste’ principle, for organisations which manage to reduce the above-mentioned ‘energy waste’ there is a potential for direct savings on energy costs
- 5 teams members located worldwide and hosting interns under yearly bases

Webb Institute

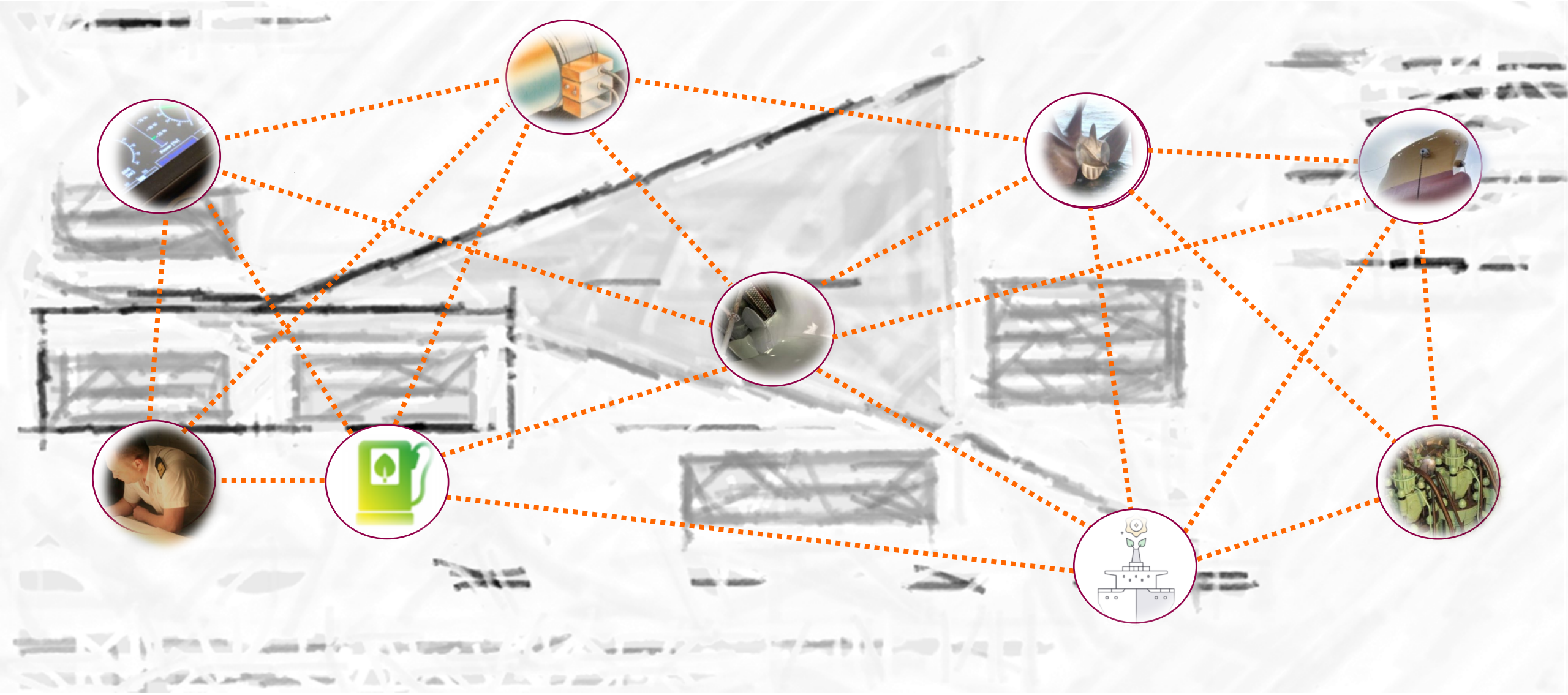
Matthew Migliozzi



Duane Lee

Kevin O’Keefe

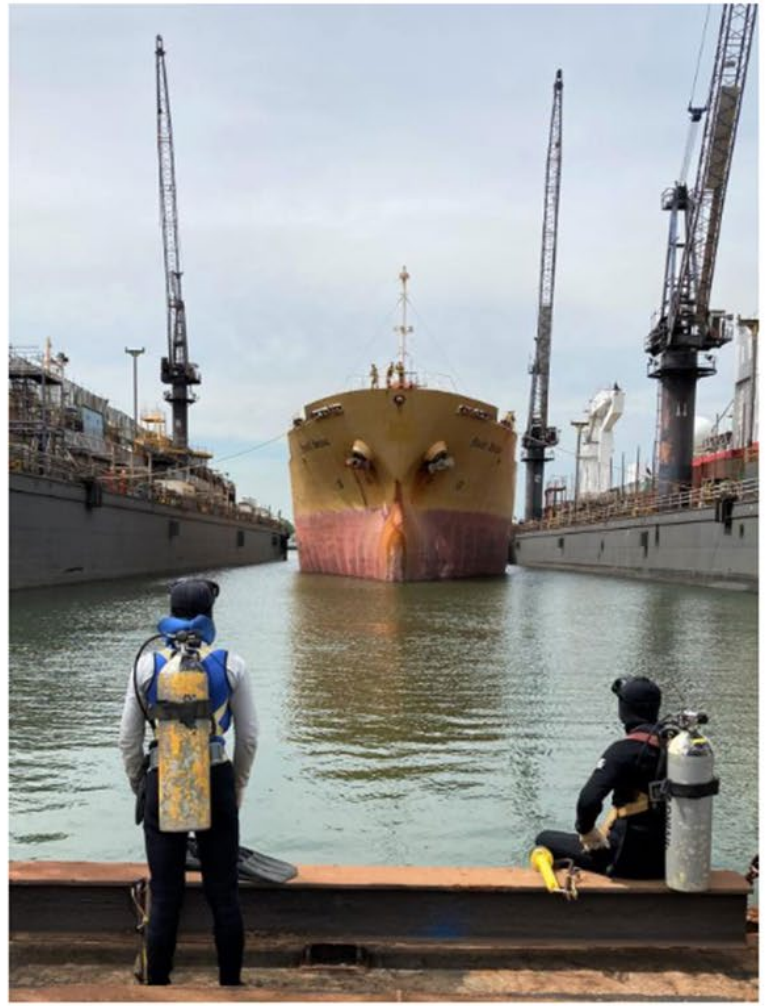
Diversity is key



- Stolt Nielsen – Stolt Tankers
- **Biofouling**
- In Transit Hull Cleaning

Biofouling; An old ceremony

French corvettes Astrolabe and Zélée performing a careening at Torres Strait
Author: Louis LeBreton



Biofouling; The principles

Definition:

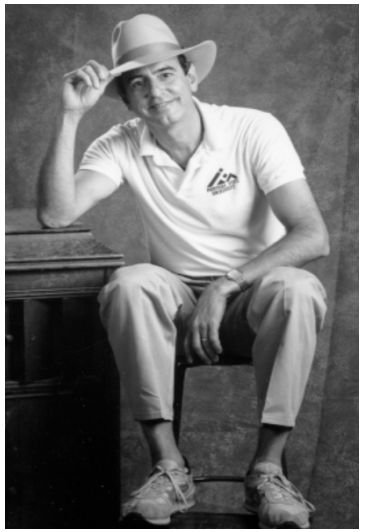
"Accumulation o aquatic organisms as a micro-organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment" (IMO, 2011)

"Undesirable accumulation of a biotic deposit on a surface" (Characklis, 1990)

Types:

Microfouling: Fouling due to microorganisms (fungi, algae, bacteria). Formation of biofilms

Macrofouling: Fouling due to macroorganisms (mussels, barnacle, etc.). Formation of fouling screens



Source: Centre for Biofilm Engineering website

Biofouling; How long does it take?

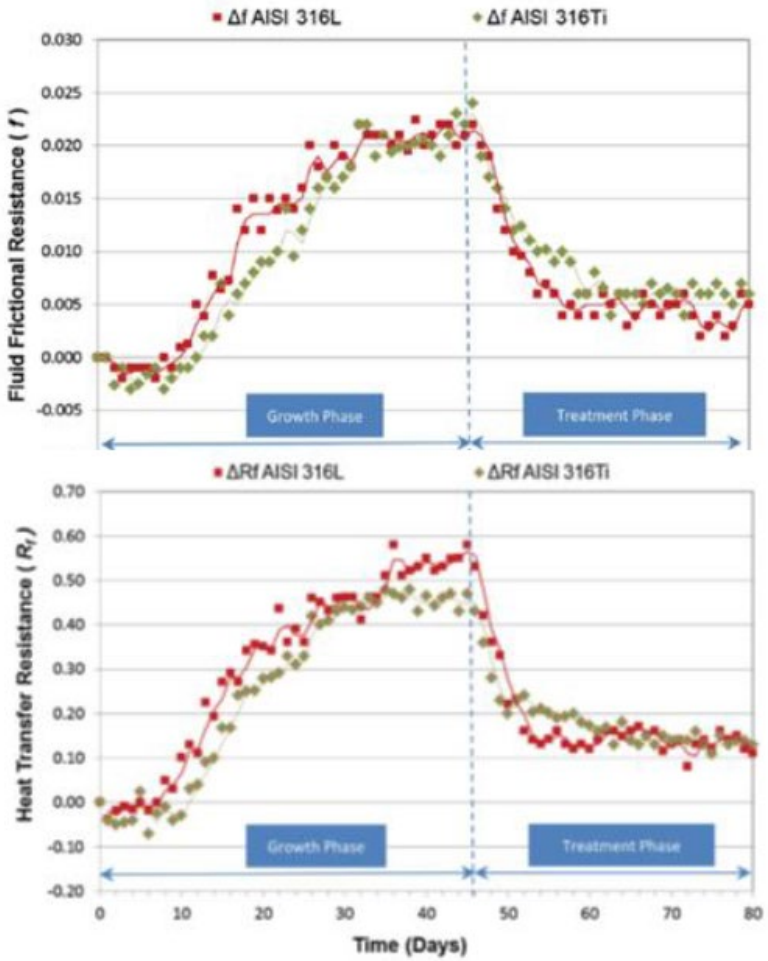
- Results presented are part of a research on heat exchangers' efficiency impact due to microfouling

- The variables that indirectly define the growth of the biofilm inside the tubes were: fluid frictional resistance and the heat transfer resistance

- Growth phase as per sigmoidal curve: (i) induction/ colonisation or initial bacterial attachment, (ii) exponential growth or development of the biofilm, (iii) plateau or quasi-steady state in which the mortality balances growth of the biofilm

- It took ≈ 45 days for both materials to have a biofilm able to decrease equipment efficiency and act as a settlement for macrofouling

- Average SW temp 15ºC / Period: May to September / Location: Atlantic Sea



Source: Gonzalez, Journal of Marine Engineering and Technology (2019)

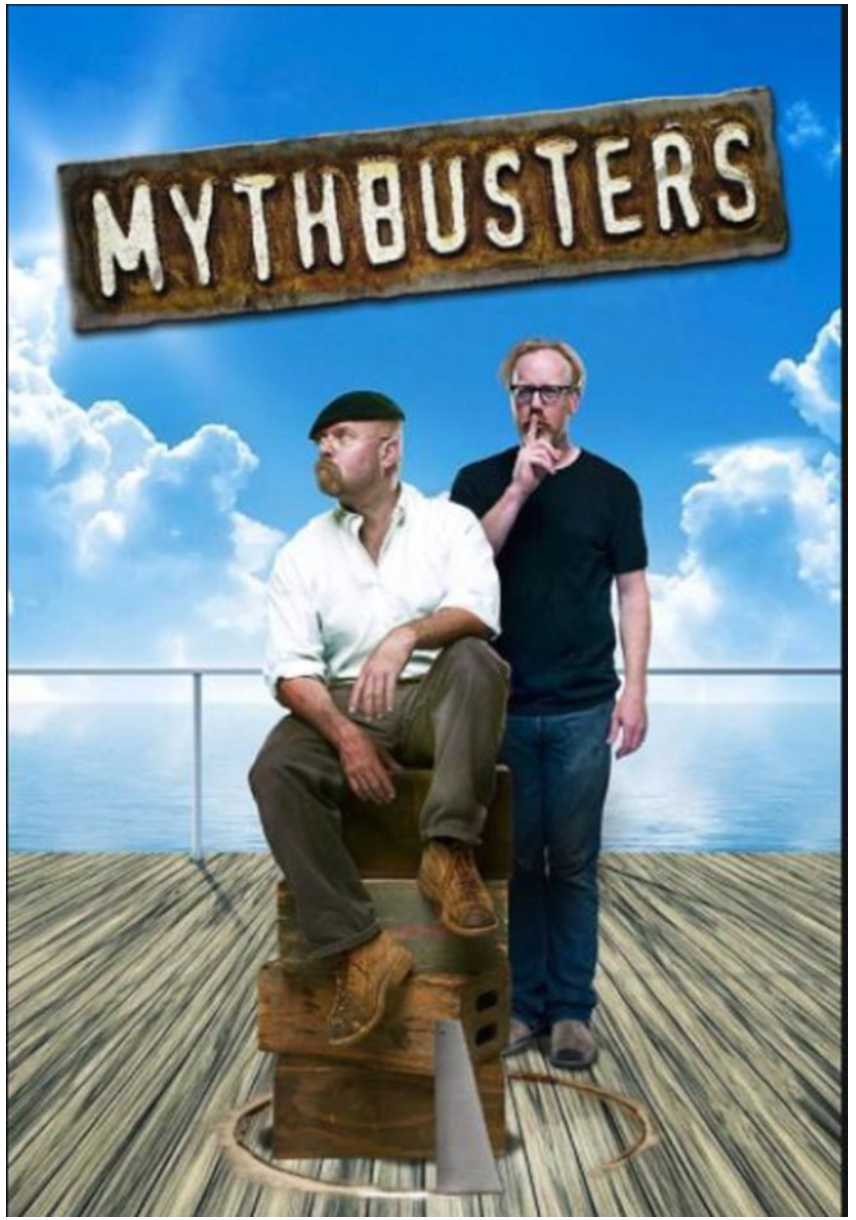
Biofouling; What is the impact?

- Biofilms can increase vessel surface-friction up to 70%; increase in power estimated to be between 1.5% and 10% depending on the biofilm thickness and percentage coverage (Schultz et al., 2015)

- The increase in the effective power for a heavy slime fouling on a container vessel was 38% at 24 knots (Demirel et al., 2017)

- Niche areas, such as internal spaces and seawater systems tend to be difficult to access, and they may not be sufficiently cleaned during routine hull maintenance. Thus, they are considered to be high risk areas for biofouling (Coutts and Dodgshun 2007; Frey et al., 2014)

© D. Williams, International Paints Ltd, 2008


MYTHBUSTERS

Biofouling myths in marine industry

- The impact is not so high
- Cold water does not favour/help/create fouling
- The cheaper the better
- It is only about hull and propeller
- Adequate hull shapes' design minimizes fouling factor/growth
- This is a matter of concern only for our containership fellow colleagues – they full blast the whole time!
- We have always done this way….

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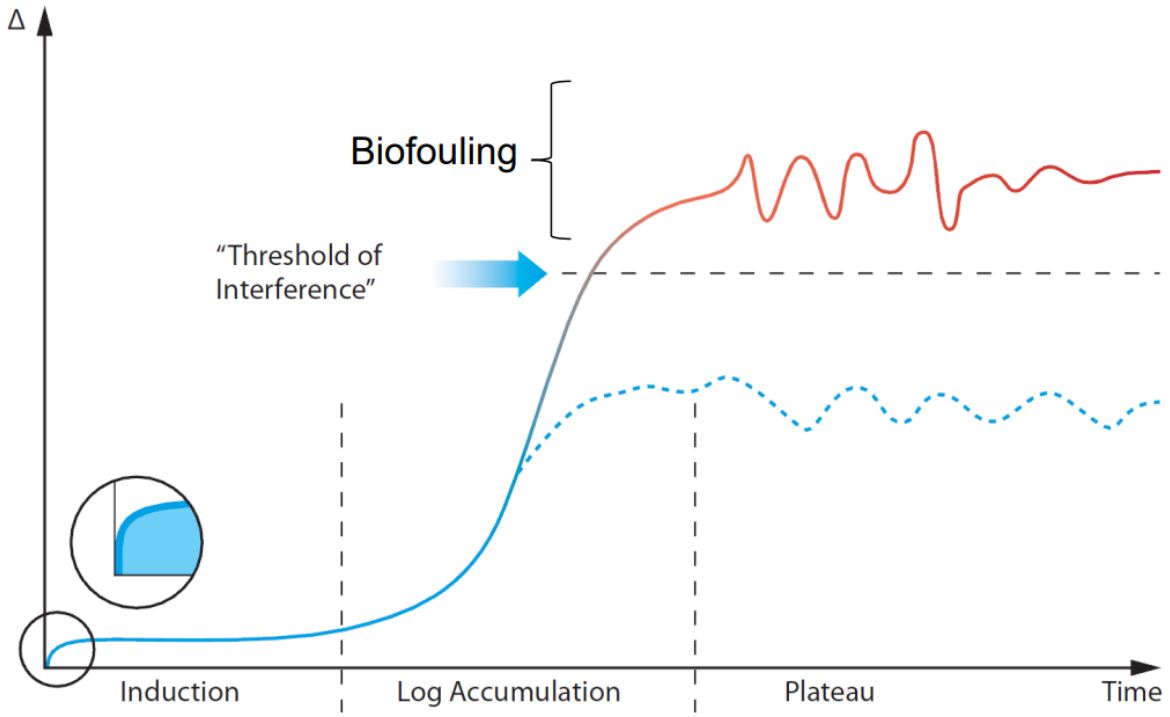
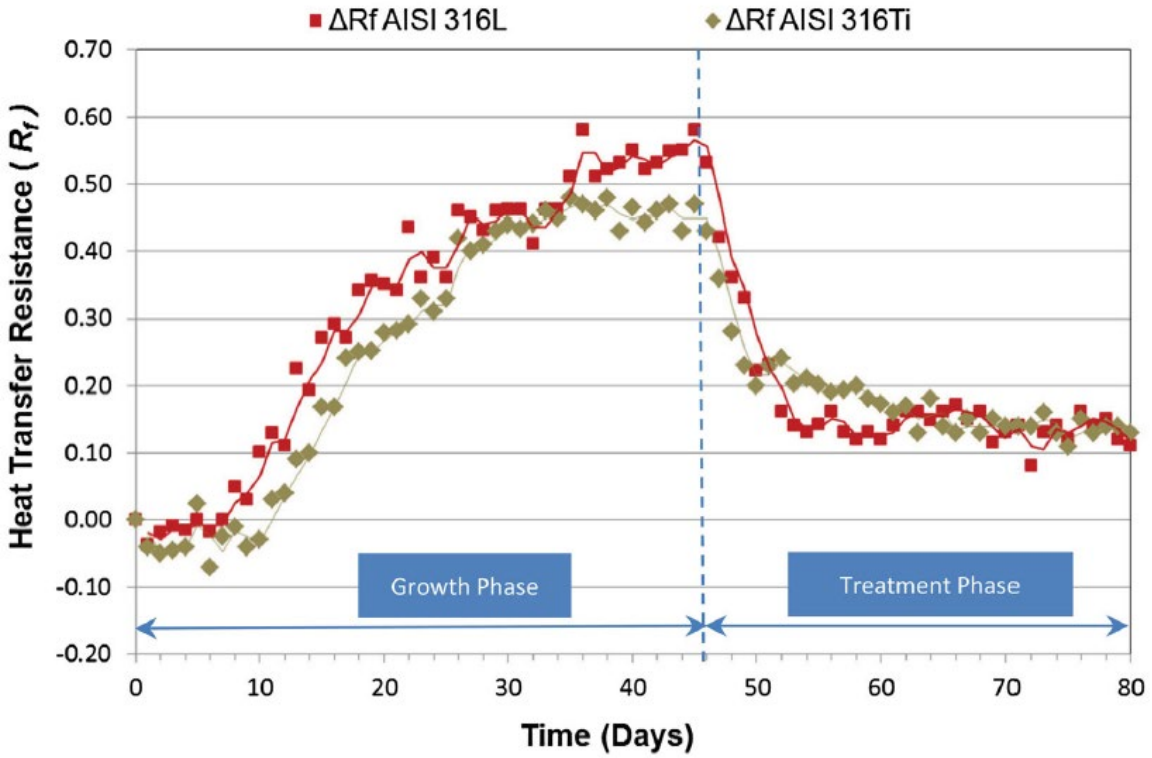
Sigmoidal Curve, everything is about it



Source: Fleming, 2011



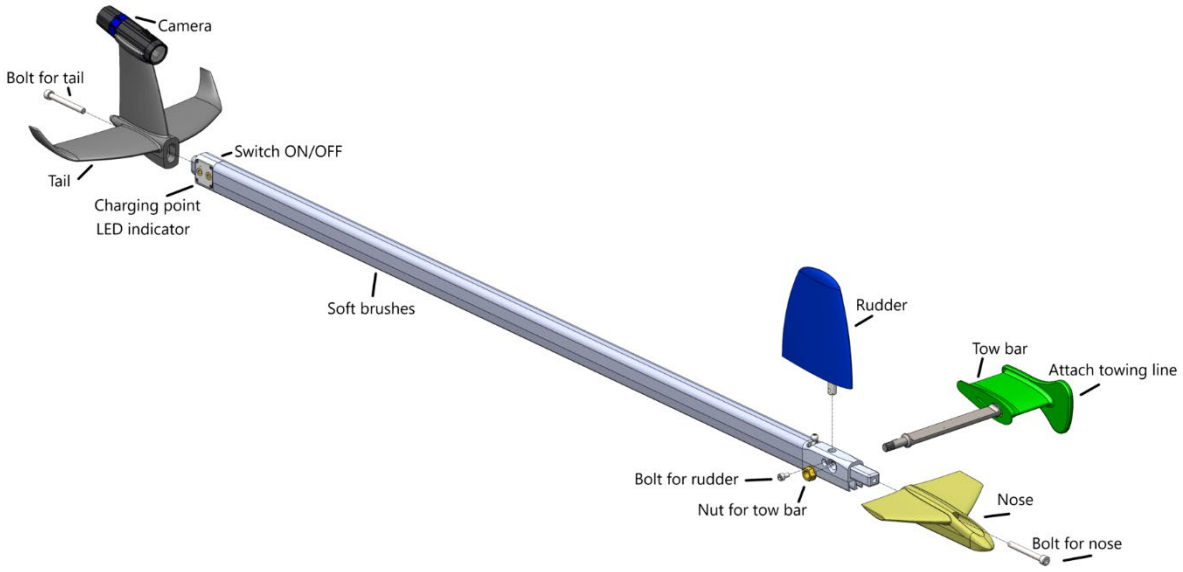
Source: Gonzalez, 2019

Working Principle

- ITCH consists of a semi-autonomous hull cleaning robot tethered to a winch on the forecastle deck. The robot harvests propulsion energy to stay attached to the hull and swipe up and down. Soft brushes clean the hull under water using a defined pattern with controlled brush forces

- ITCH should be used before fouling becomes a real problem. It has however also proven to remove settled fouling

- ITCH system can easily be hand-carried by the crew. Before cleaning, the winch needs to be secured to a strong point on the forecastle deck, connected to a source of power and attached to the ITCH device



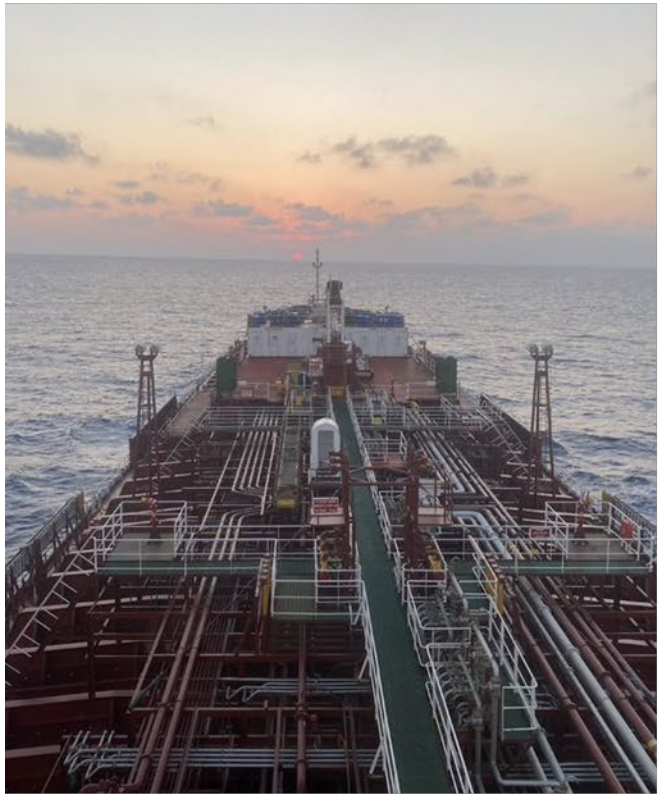
Stolt Acer

- Stolt Acer is a chemical parcel tanker that belongs to Stolt Tankers fleet as part of its Asian fleet
- She was built in 2004 by Kitanihon Shipbuilding in Hachinohe, Japan.
- She is powered by a 2-stroke engine able to deliver a total power of 7,980 kW @ 120 rpm and equipped with 3 generators able to deliver a total power of 1,950 kWe

Main Characteristics:

IMO Number	9272668
Length Overall (m)	170
Draught (m)	8.3
Breadth (m)	25.63
DWT (Tons)	29,709

The Trial

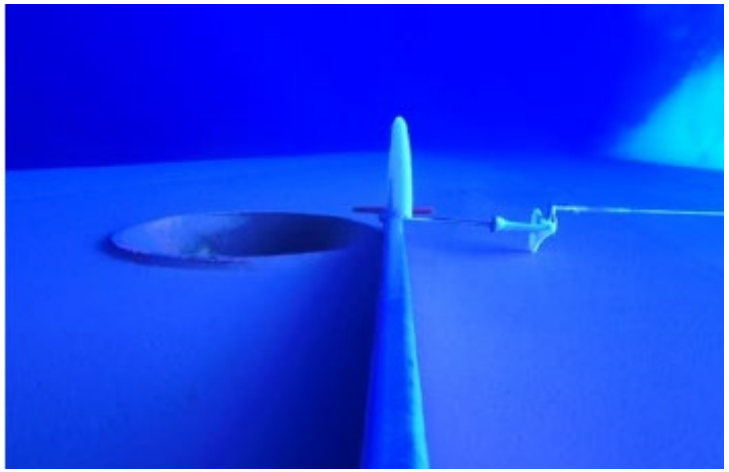


- Mid August 2022 // Port Said to Algeciras
- Presentation on board
- Familiarization aboard with crew

The Trial

- ITCH tethered to a winch on the forecastle deck
- Air winch in place (option for electric)
- Soft brushes details

Result of the trial aboard Stolt Acer was successful



Initiative description

- ITHC stands for In Transit Hull Cleaning
- The trial ranged from 10th June 2022 to 12th August 2022 (from purchase to test aboard)
- Ship: Stolt Acer – STJS – Asia Fleet – J30 – Daily consumption: 20.8 Tons/day
- Duration: 2.5-3 hours per vertical side. Total: 1 working day. Resources needed: 2 crew members
- Result of the Trial: ***Successful***
- Acknowledgments: Asia FM – Stolt Acer Superintendent – Stolt Acer Crew – P&L Dept).

Identified value

- Hull fouling impact reduction on vertical sides (average 8% impact)
- Regular maintenance and supervision of hull condition
- CII rate maintenance
- Unscheduled hull cleaning reduction (reducing financial and operational impact)

Let’s deep dive!

Measurements showed impact between 1 to 1.5% during the trial

Regulatory Framework

WITH CAPTURE vs W/O CAPTURE

- Some discussions are going on as part of different industry forums
- The IMO CG (Corresponding Group) will issue a report to the IMO PPR subcommittee (draft report to be submitted in Jan 2023), which will then be discussed at IMO PPR 10 (tentatively scheduled for Apr 2023)
- After IMO PPR 10 there may be additional submissions to the following MEPC in addition to the report. There is no consensus up to date with regards to the slime removal capture devices, it is envisaged the consensus will take a while
- But for sure it must follow the IMO channels prior definitive endorsement
- Removing slime mid sea should not cause any damage. Some paint manufacturers are arguing the same for slime removed in shallow water/port and obtaining traction for that and approval in ports
- Australia and New Zealand are in the forefront of regulating this aspect. Australia allows for cleaning of microfouling outside the 12nm zone

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