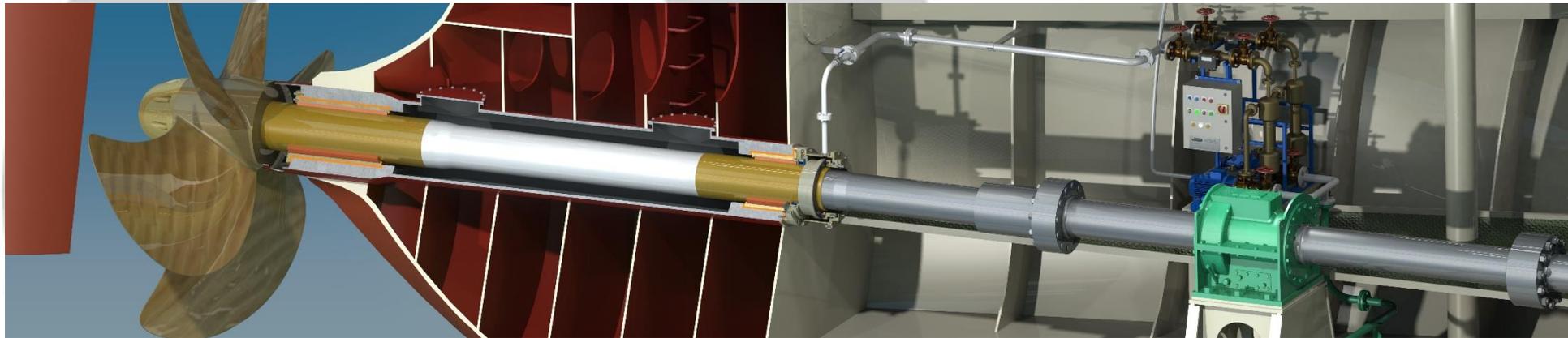


The Zero Emission Vessel

Below the Waterline



Presented by:
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Thordon Bearings Inc.
March, 2020

THORDON

Overview

- Current Situations
- Problems with oil/sea interfaces in propeller shaft lines
- The seawater lubricated shaft choice
- Ship owner and operator benefits
- The COMPAC System

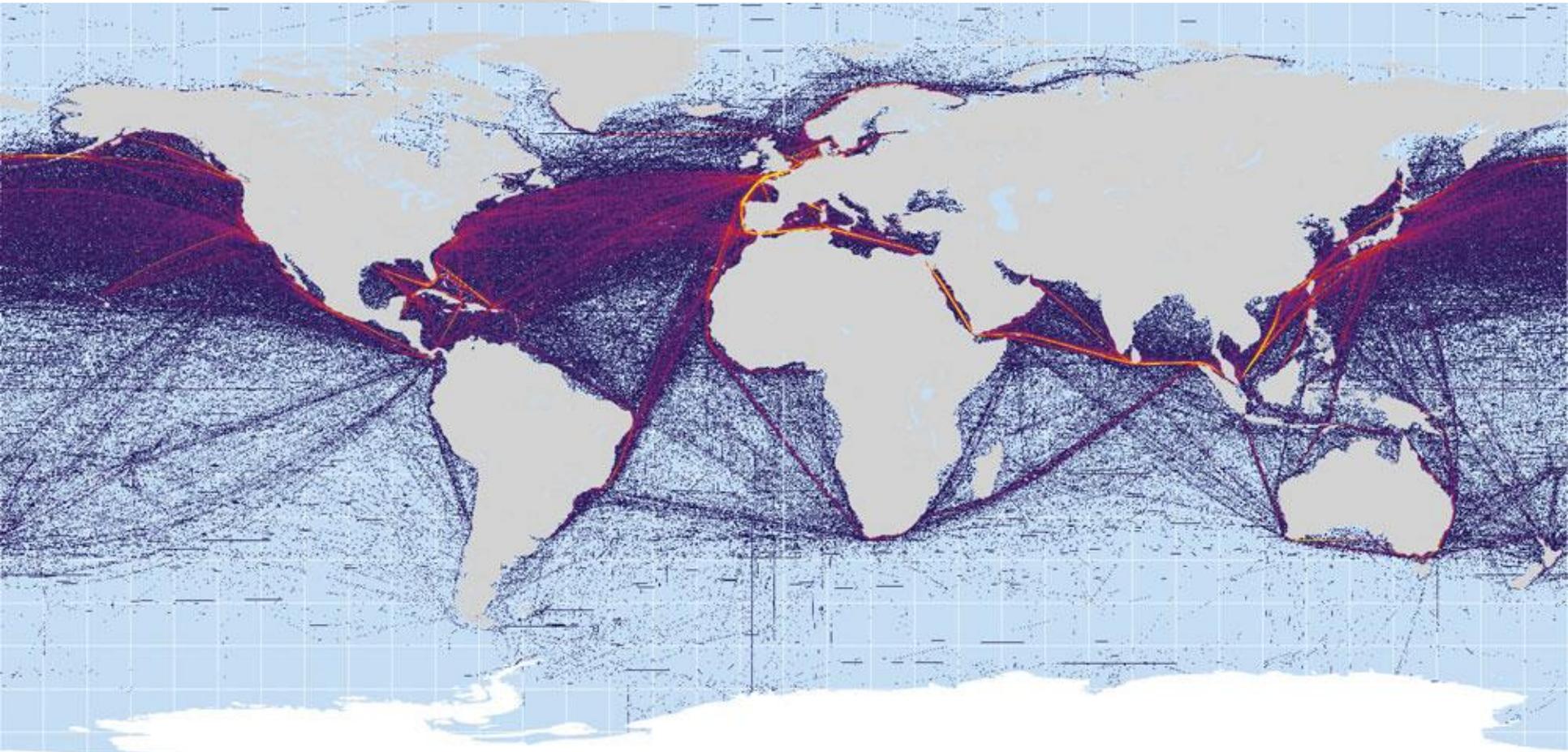
Going Green... Below the Waterline



Oil discharges from commercial ships... a serious problem

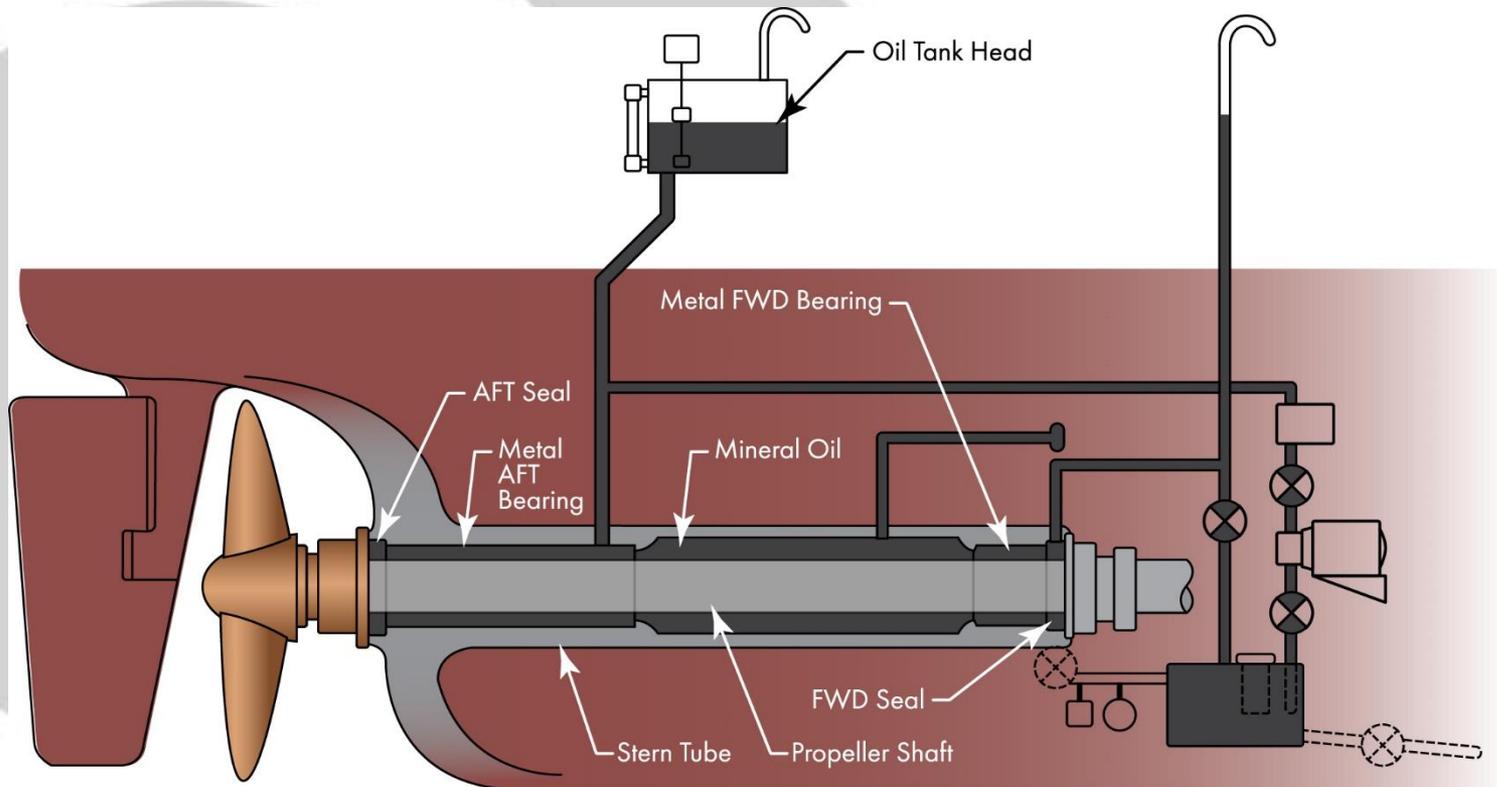


Evolving Legislation

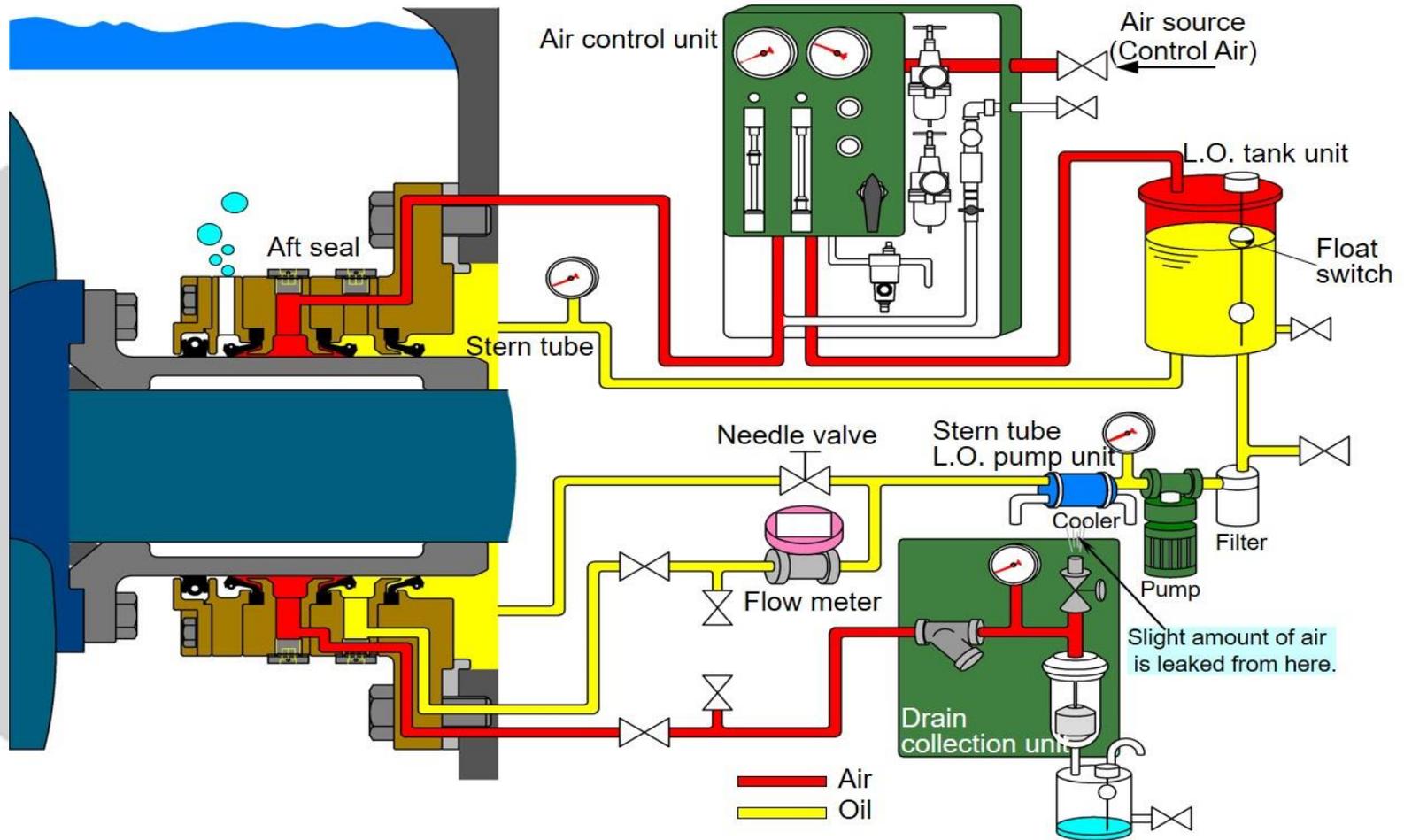


Propeller Shafts Lubricated With Oil

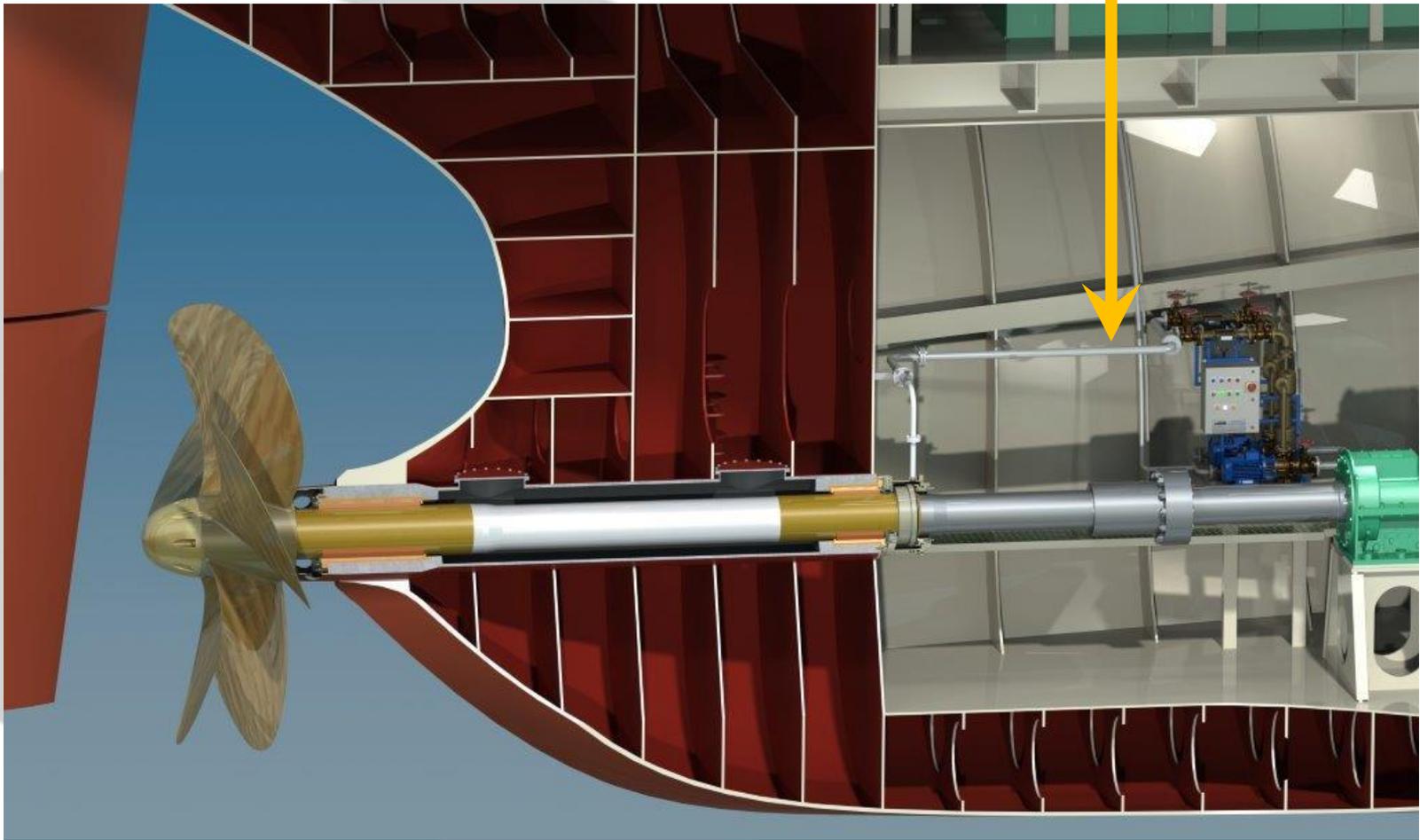
- Typical stern tube system has 1500 to 3000 litres of mineral oil



Propeller Shafts Lubricated With Oil and AirSeal



Only one Seawater Pipe



Compliance with the VGP Solutions for Ship Owners

Cost Comparison of Propeller Shaft Lubricants

Mineral Oil (Sealed system requiring FWD and AFT seal)	 US \$1.25/L (US \$4.73/U.S. gal)
Environmentally Acceptable Lubricants (EAL's) (Sealed system requiring FWD and AFT seal)	 US \$10.50/L (US \$39.75/U.S. gal)
Seawater (Open system requiring only FWD seal)	US \$0.00/L (US \$0.00/U.S. gal)

Rev.1

Benefits of Water Lubrications

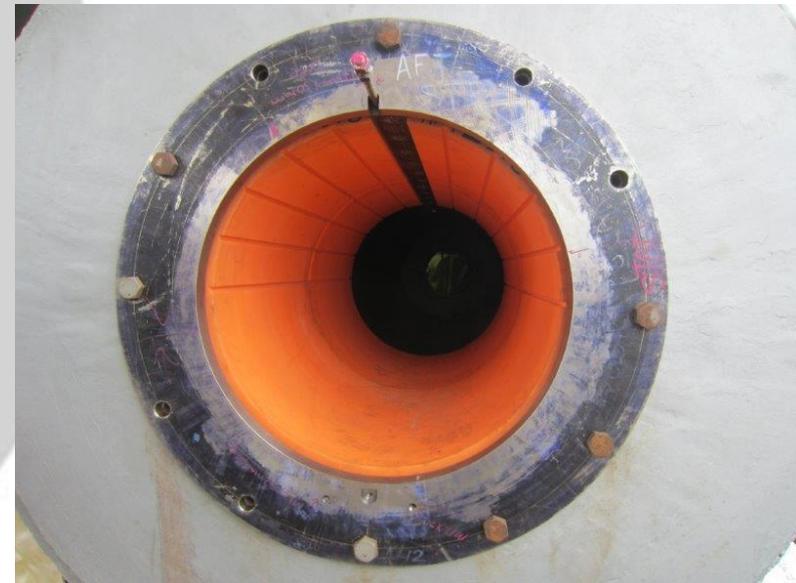
- **Reduced Operating Costs**
 - no purchase of oil; no storage of oil
 - no sampling of oil; no disposal of oil
 - no labour required to top up header tanks (due to the leakage)
- No Aft seal to maintain
- (water lubricated FWD seal only)
- No emergency AFT seal repairs
 - No risk of rope/line damage to AFT seal as there is no AFT seal

Benefits of Water Lubrications

- Long predictable bearing wear life
 - Lifetime bearing wear life guarantee
 - Proven with wear data
 - Winner of Sperry Award
- **Survivability**
 - Non catastrophic failure mode with seawater lubrication allows vessel to get back to port
 - Maintenance of seawater lubricated propeller shaft bearing system is virtually none
- **Zero Pollution Risk (zero fines)**

Thordon COMPAC Bearings

- Class approved design for pressures to 0.6MPa (87 psi)
- Fitted in bronze carrier or installed directly into stern tube

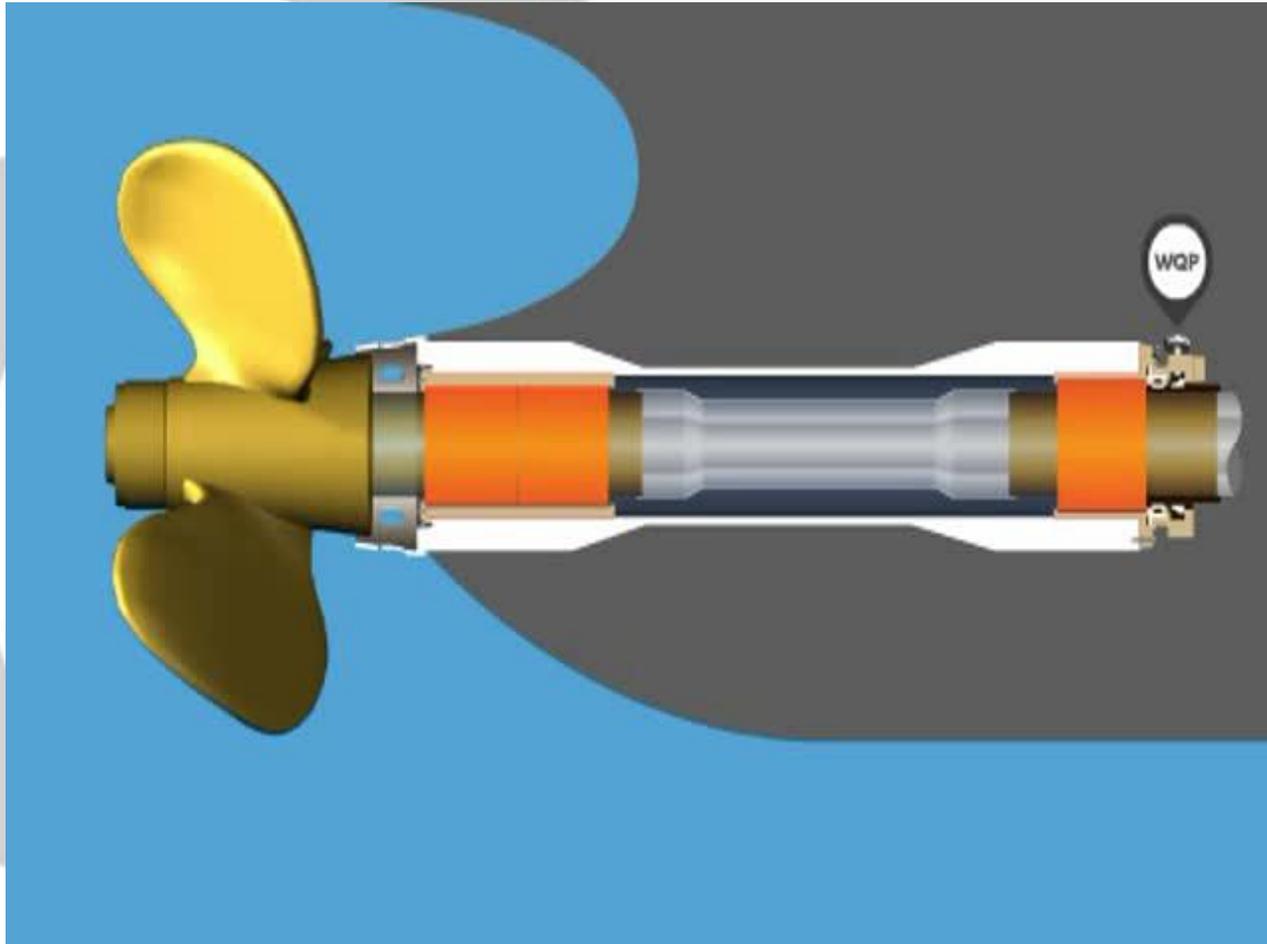


Thordon Water Quality Package

- Designed to provide a clean supply of water to the water lubricated bearings
 - Controlled environment
 - Flow is monitored and low flow alarms provided
 - Removes abrasives
 - Improves bearing wear life
 - Self contained unit
 - Several configurations available



Seawater Lubricated Propeller Shaft Bearings



Seawater Lubricated Propeller Shaft Bearings

Over 2,000 vessels with Thordon propeller shaft bearings installed



COMPAC seawater lubricated propeller shaft bearing systems



Groupe Desgagnés (Canada): Two 15,100dwt dry cargo vessels



COSCO (China): Three 62,000dwt bulk carriers



MSC Cruises (Italy): Two 154,000gt cruise ships



Lomar Shipping (UK): Two 37,000dwt container ships



Matson Navigation (U.S.A.): Two 3600TEU container ships

The Future

- Ships with lowest operating costs bring highest profitability for ship owners
- Crews are happiest when there is virtually no maintenance to ship's equipment
- A seawater lubricated propeller shaft bearing system is the only system that guarantees compliance and has **ZERO Emissions** below the waterline.

Dirty Beach



Clean Beach



Questions?

Thank you

