



**ROBERT ALLAN**

Naval Architects & Marine Engineers

# **2020 CISMART Online Workshop – Day 2**

## **Panel on Maritime Autonomous Surface Ships (MASS)**

Vince den Hertog – VP Engineering

Robert Allan Ltd

# Robert Allan Ltd.

Founded 1930 in Vancouver; Canada's most senior consulting naval architectural firm

Designer of high-performance escort & ship-handling tugs, fireboats and other workboats for the international market

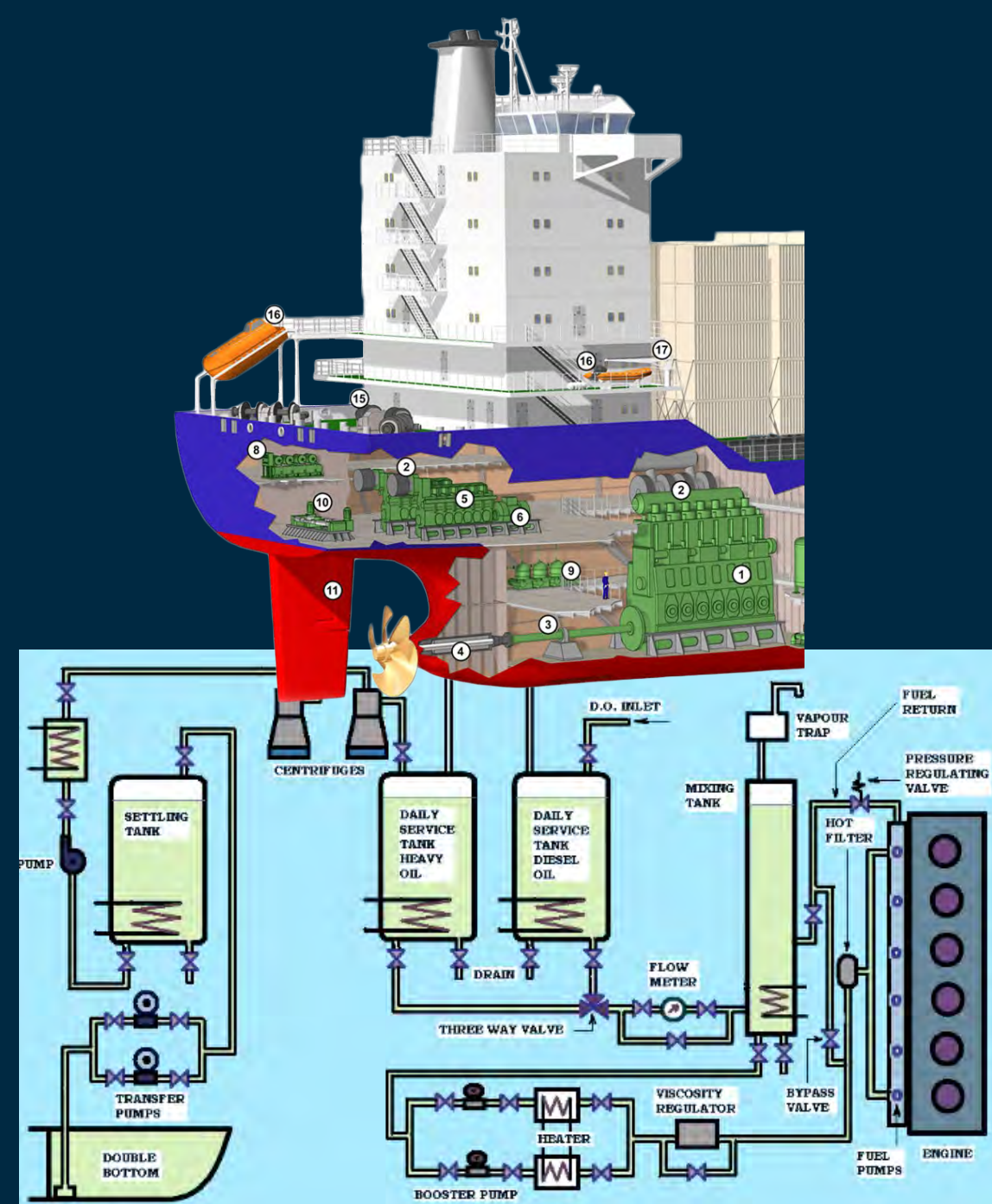


# Uncrewed workboats



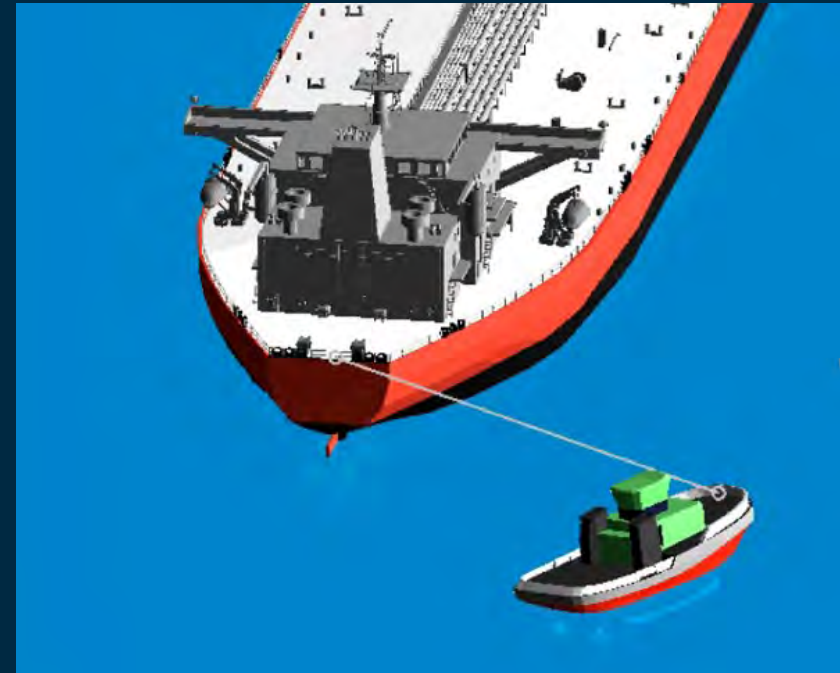
# Reliability of Machinery-Related Systems

- Reliability of modern engines and other machinery is already high. Unattended Machinery Spaces (UMS) and sophisticated monitoring & alarm systems are common
- Machinery-related systems also need to be highly reliable; challenging in cold climates
  - Fluids – Cooling water, lube oil, air, fuel
  - Pumps, piping, valves, filtration, leak detection
  - Heating of fluid systems & spaces in cold climates
  - Managing fault/shut-down scenarios
- Future work area: *Guidance on designing reliable, fault-tolerant machinery-related systems on uncrewed ships for cold climate operations*



# Fault Detection & Management

- Sensors can be unreliable!
- Fault diagnosis should be informed, not by sensor detection alone, but by comparison to predictions from 'higher level' models (a.k.a. digital twins)
  - E.g. A fault detected in rudder system should be diagnosed with respect to predicted rudder actuator response AND predicted ship turning maneuverability
- Fault Management (i.e. responses to detected, diagnosed faults) needs to be tailorable to the operational activity, situational state and location of the ship at the time the fault occurs, with consideration of prevailing risks
- Future work area: *Development of programmable Fault Management systems for ships*



# Telepresence Systems Reliability

- Early uncrewed vessels will be operated remotely, or remotely-supervised in real time with high levels of on-board automation. 'Autonomy' may only be needed for short periods of fail-safe operation during data link drop-outs
- Reliable, secure, low-latency, high-bandwidth data links are crucial
  - Port operations: tugs, fireboats, spill response, ferries... (point-to-point, cell network, VSAT)
  - Coastal: short-sea shipping, ferries, icebreakers... (cell network, VSAT)
  - Oceangoing: cargo vessels... (VSAT)
- Future work area : *Technology assessment of data link systems for uncrewed vessel port & coastal operations in Canada*

