Methanol in a Dual Fuel Tug Application

CoMC / BCTOA 2024 Conference – May 31, 2024

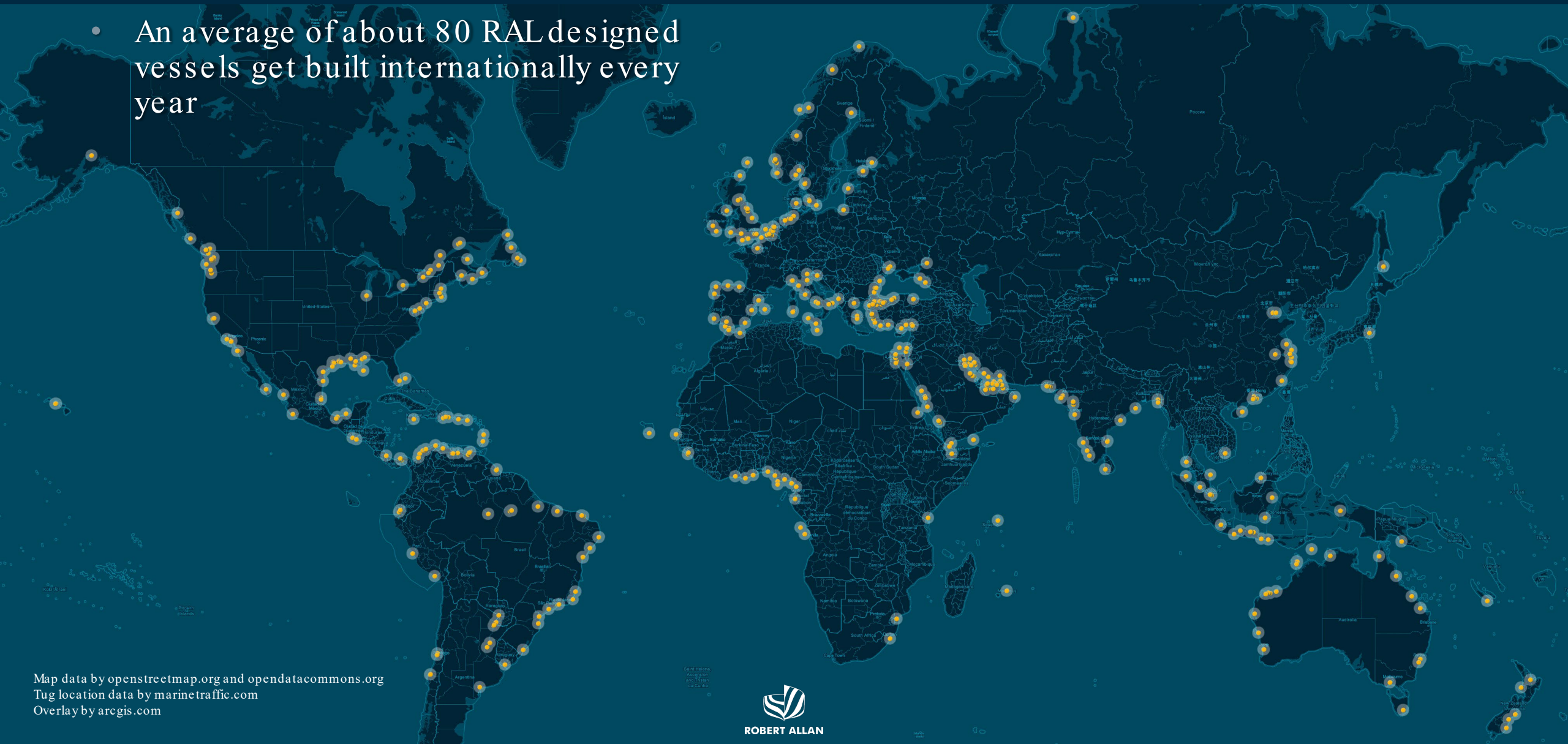
ROBERT ALLAN
Naval Architects & Marine Engineers

Robert Allan Ltd.

- Founded 1930 in Vancouver; Canada's oldest consulting naval architectural firm
- Recognized internationally as the leading independent designer of high-performance escort, ship-handling tugs, shallow draft towboats and fireboats
- ~95 employees including ~40 professional engineers

Global Fleet – Latest Thousand Deliveries

- An average of about 80 RAL designed vessels get built internationally every year



Map data by openstreetmap.org and opendatacommons.org
Tug location data by marinetraffic.com
Overlay by arcgis.com

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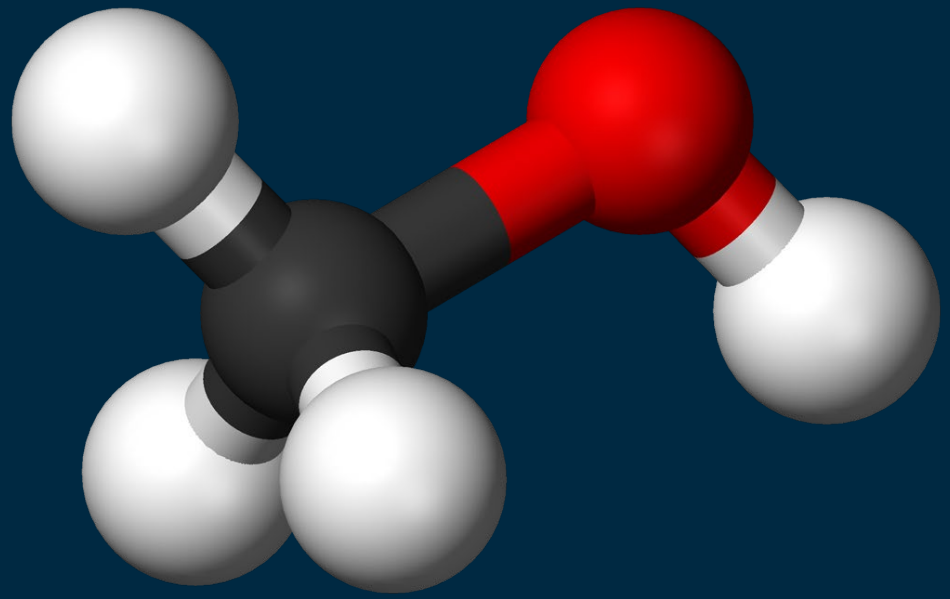
What is Methanol Exactly?

- The simplest alcohol – CH_3OH
  - But don't drink it! (50ml can be fatal)
- Also known as methyl alcohol or wood alcohol
- Occurs naturally in the environment
- Completely soluble in water
- Technically not considered a dangerous chemical
- Colourless
- Liquid at room temperature and pressure
  - Not cryogenic like LNG
- Lighter than water as a liquid (S.G. ~0.8)



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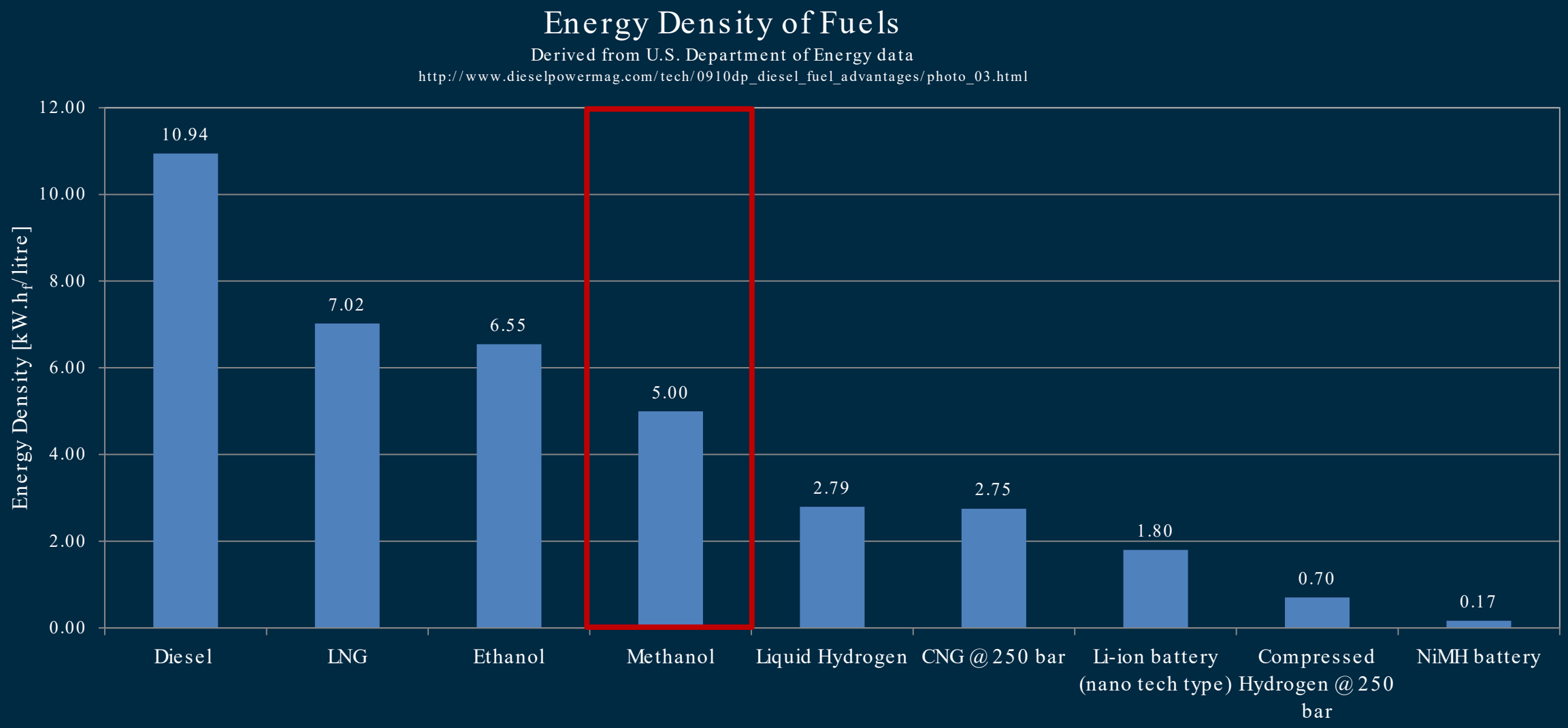
How it Stacks up to Alternatives



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Why Methanol?

- Low emissions (NOx, SOx, particulate matter)
- Available globally
- Cost somewhat comparable to marine diesel (per unit of energy)
- High energy density vs. other clean fuels
- Low infrastructure cost
- Relatively simple bunkering and storage
- Low risk to the environment if spilled
- Common mitigations for low flashpoint risks
- Pathway to near-zero net carbon emissions

(Source: DNVGL)

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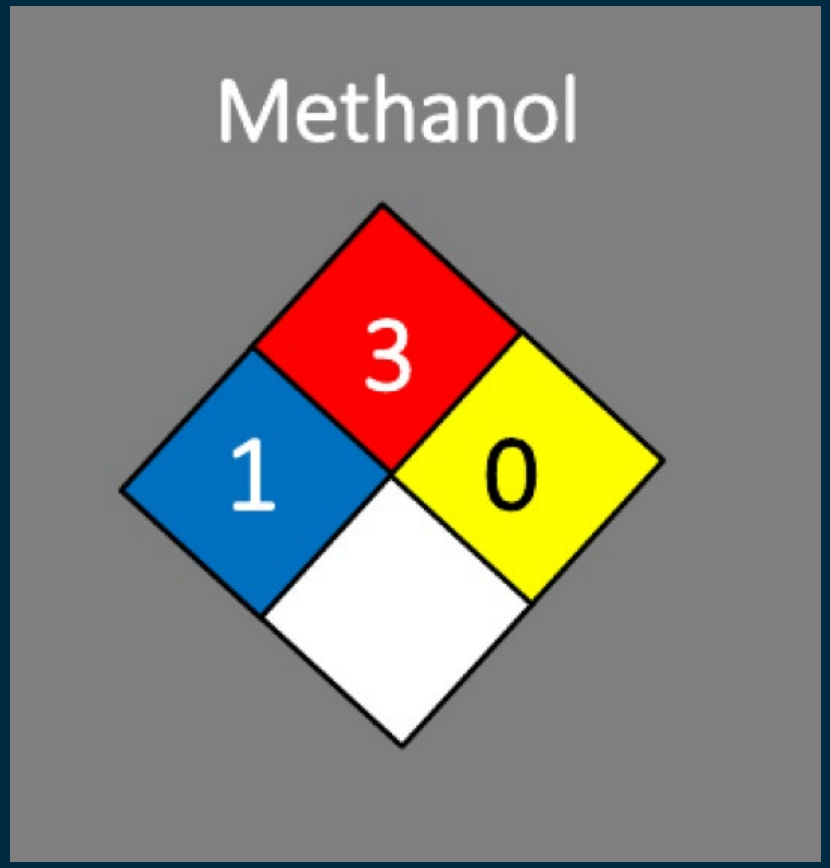
Hazard Preview

- NFPA Rating
  - Health Hazard 1 – “Can cause significant irritation”
    - Absorbs through skin, can cause dermatitis
    - Wear PPE
  - Flammability Hazard 3 – “Can be ignited under almost all ambient temperatures”
    - Low flash point (12°C)
    - Vapour density ~1.1 S.G.
    - Broad explosion limits (5.5-36.5% volume)
    - For reference, diesel is Flammability Hazard 2
  - Instability Hazard 0 – “Stable”

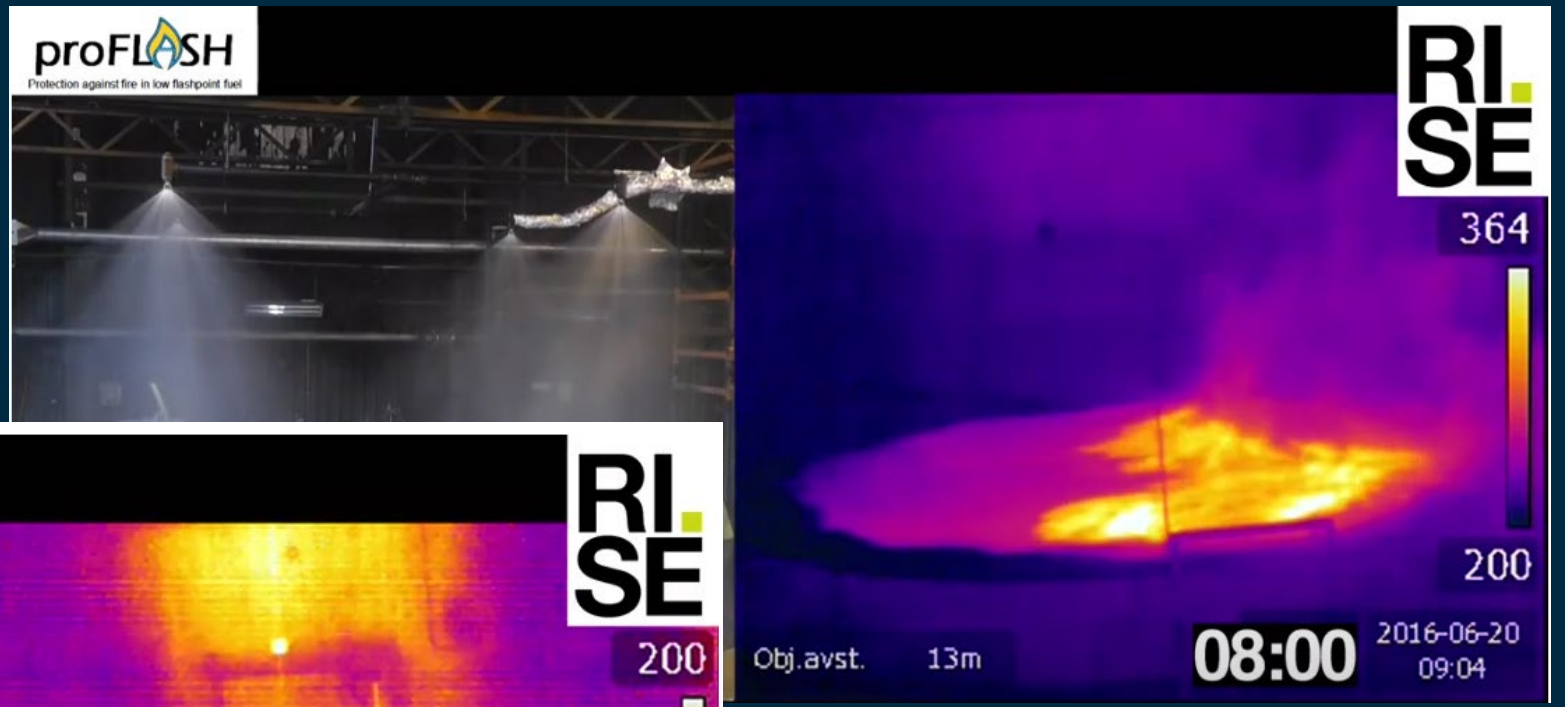


The Biggest Risk - Methanol on Fire

- Presents unique detection (vapour and/or flame) and fire-fighting challenges
  - Need vapour detectors, possibly IR cameras
  - Need to pick fire-suppression mediums carefully

Fire Suppression

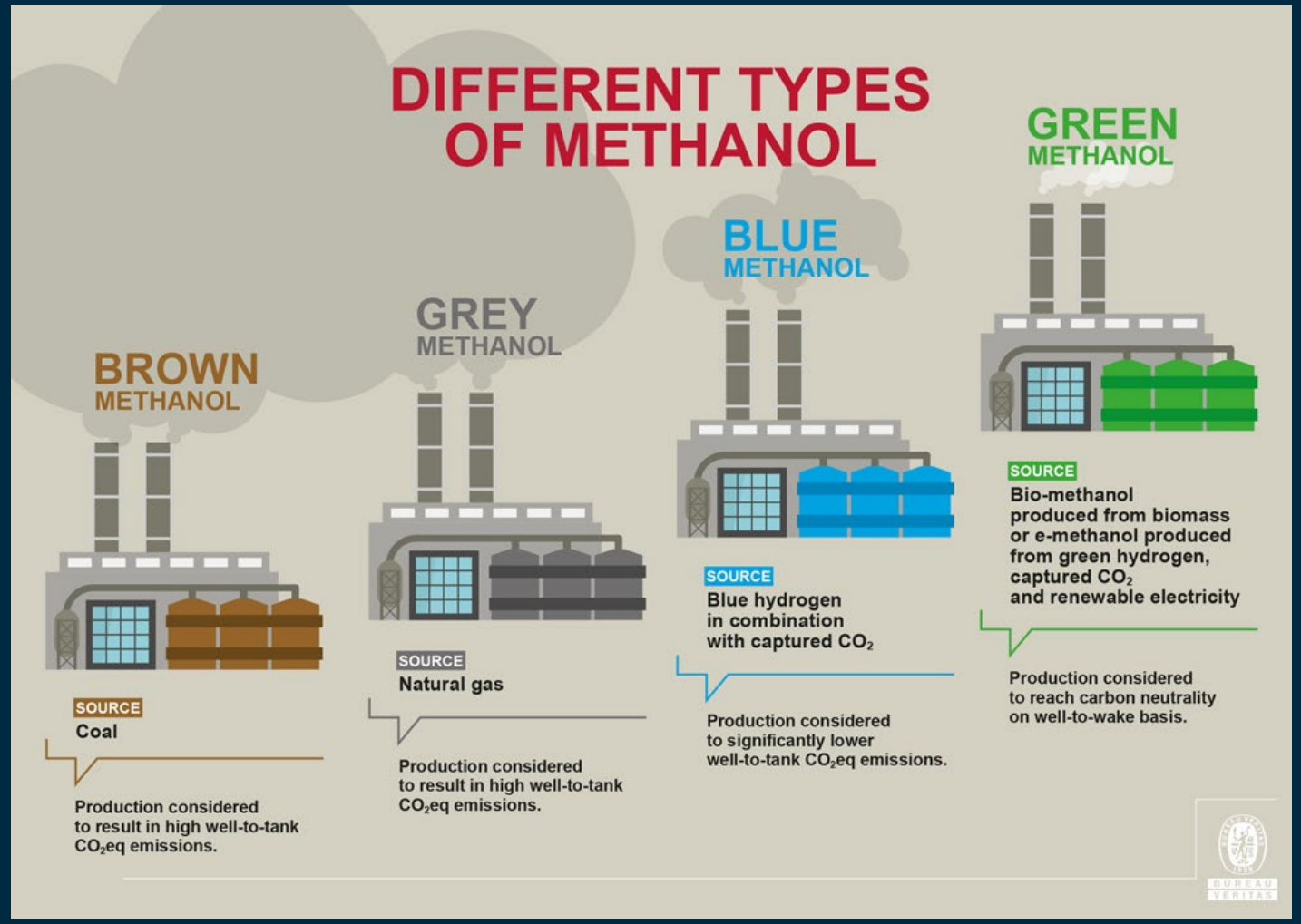
- Film-forming foams most effective, but must be alcohol-resistant
  - Required by Class



https://www.youtube.com/watch?v=18eGaGHx_RU

Should you Proceed - What Colour is your Potential Methanol Supply?

- Your vessel <u>will</u> emit CO_2 when burning methanol
  - ~69 gCO_2/MJ
  - vs. ~75 gCO_2/MJ for diesel
- $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$
- The question is whether those emissions are roughly neutral (releasing CO_2 that was previously captured)?
- Well-to-wake CO_2 emissions compared to diesel:
  - Brown/grey HIGHER
  - Green/blue LOWER



Bunkering your Vessel with Methanol

- Fuel supply & logistics
  - Vancouver's Methanex Corp is the largest producer of methanol in the world
    - Also a pioneer in the use of methanol as a marine fuel – through subsidiary Waterfront Shipping
  - Still need to get it to your vessel(s)
    - Canadian production mostly in Alberta
    - Delivery by truck or barge?
    - Demand will help develop a logistics supply chain

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I Can Source It, But How Will I Burn It? – Engine Availability

- Current:
  - ABC
  - Wartsila
  - MAN
  - Scania (via ScandiNAOS)
- In Development:
  - Caterpillar
  - Hyundai (HiMSEM)
  - MTU

- Many still use considerable amounts of diesel even in “methanol” mode. For example, maximum substitution rate of 70% at 85% power.
- Current choices limited to relatively large medium speed engines for most tugboat applications.
  - Exhaust after-treatment (SCR) still required for IMO Tier III compliance with some options, with additional DOC segment making the installation even larger than for diesel-only.

What's the Regulatory Framework?

- Regulatory framework
  - No regulations from Transport Canada
  - IGF Code only has prescriptive requirements for natural gas applications
  - IMO MSC.1621 – Interim Guidelines for the Safety of Ships Using Methyl/Ethyl Alcohol as Fuel establishes the goals, functional requirements, and prescriptive requirements for methanol as marine fuel
  - Class Society rules well developed and largely follow MSC.1621
  - Each vessel subject to Risk Assessment process (HAZID & HAZOP), subject to acceptance by Flag

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Ready to Convert your Fleet?

- Demo project for port of Antwerp-Bruges
- Key particulars:
  - 29.5m LOA
  - 584 GT
  - 50t BP
- Repowered with:
  - 8-cylinder ABC methanol dual fuel engines
- Result:
  - ~2 year project length?
  - 12 m^3 methanol storage
    - Equivalent to ~5-6 m^3 diesel

Methatug, named May 14th, 2024

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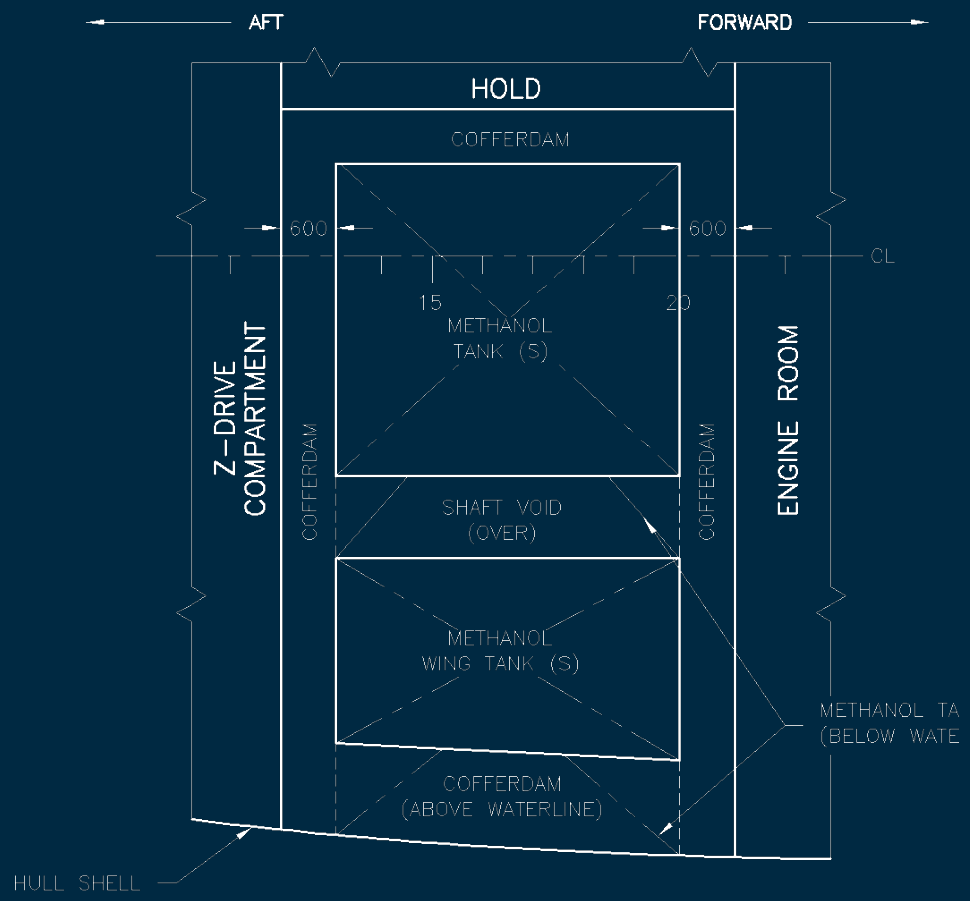
Why is it so Challenging?

- Methanol storage tanks require cofferdam on all sides
  - Except where they touch hull sides underwater (below lowest waterline)
  - There are some alternatives that have gained AiP (SRC's "methanol super storage" and others)
    - Not type approved (yet)

- Need a methanol fuel preparation space
  - Hazardous "zone 1"
  - Access via airlock (zone 2) or directly from open deck
  - Treated as Category "A" machinery space (structural fire protection, escape, etc.)



HOLD PLAN

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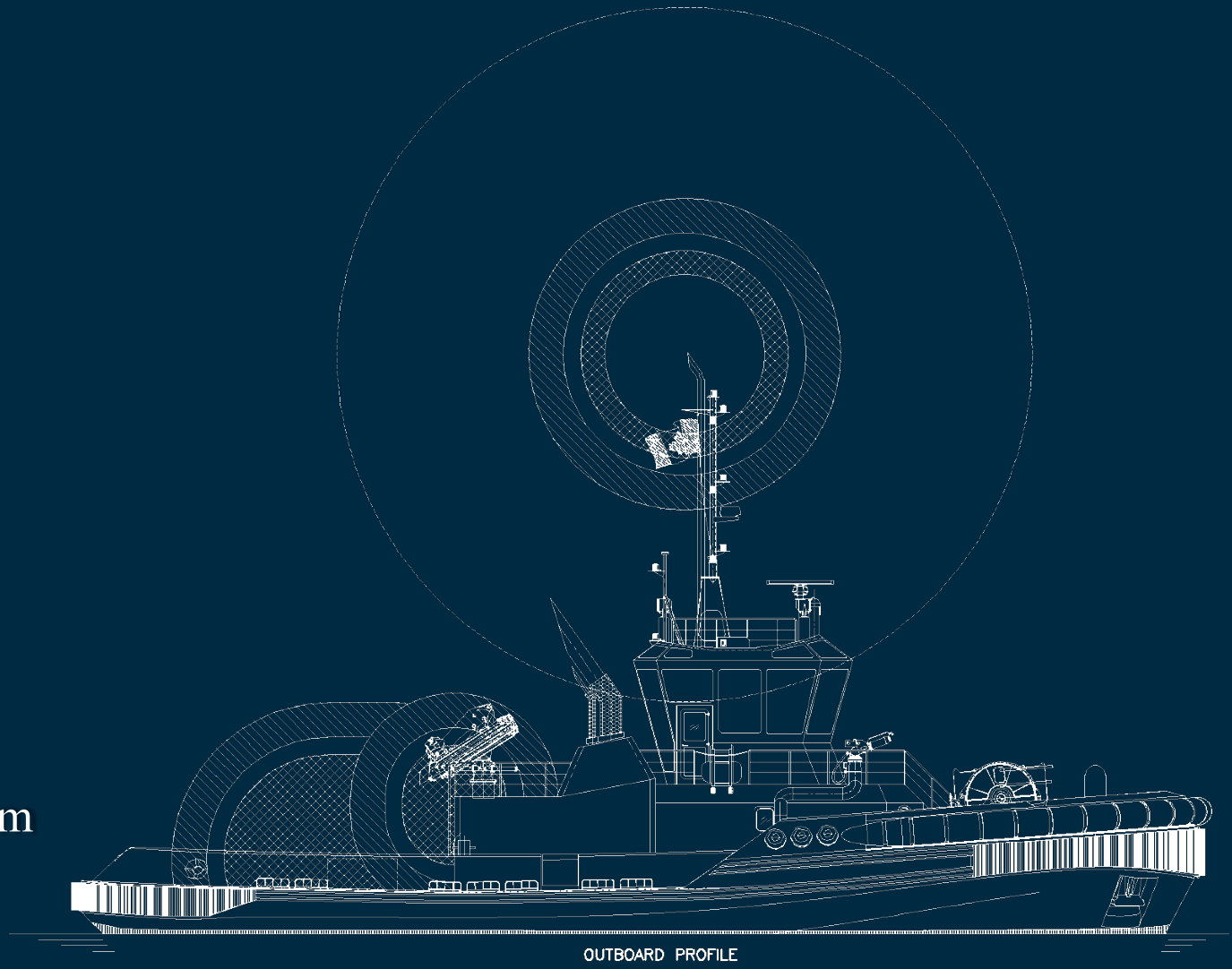
Why is it so Challenging?

- Need a bunkering station on deck
  - Also hazardous “zone 1” when bunkering

- Additional hazardous zones for:
  - Methanol tank vents
  - Inlets and outlets to methanol ventilation system
  - Engine crankcase vents
  - Airlock vents

- Need ample supply of nitrogen for inerting tanks (constantly), and system piping as required
  - i.e. N_2 generation equipment



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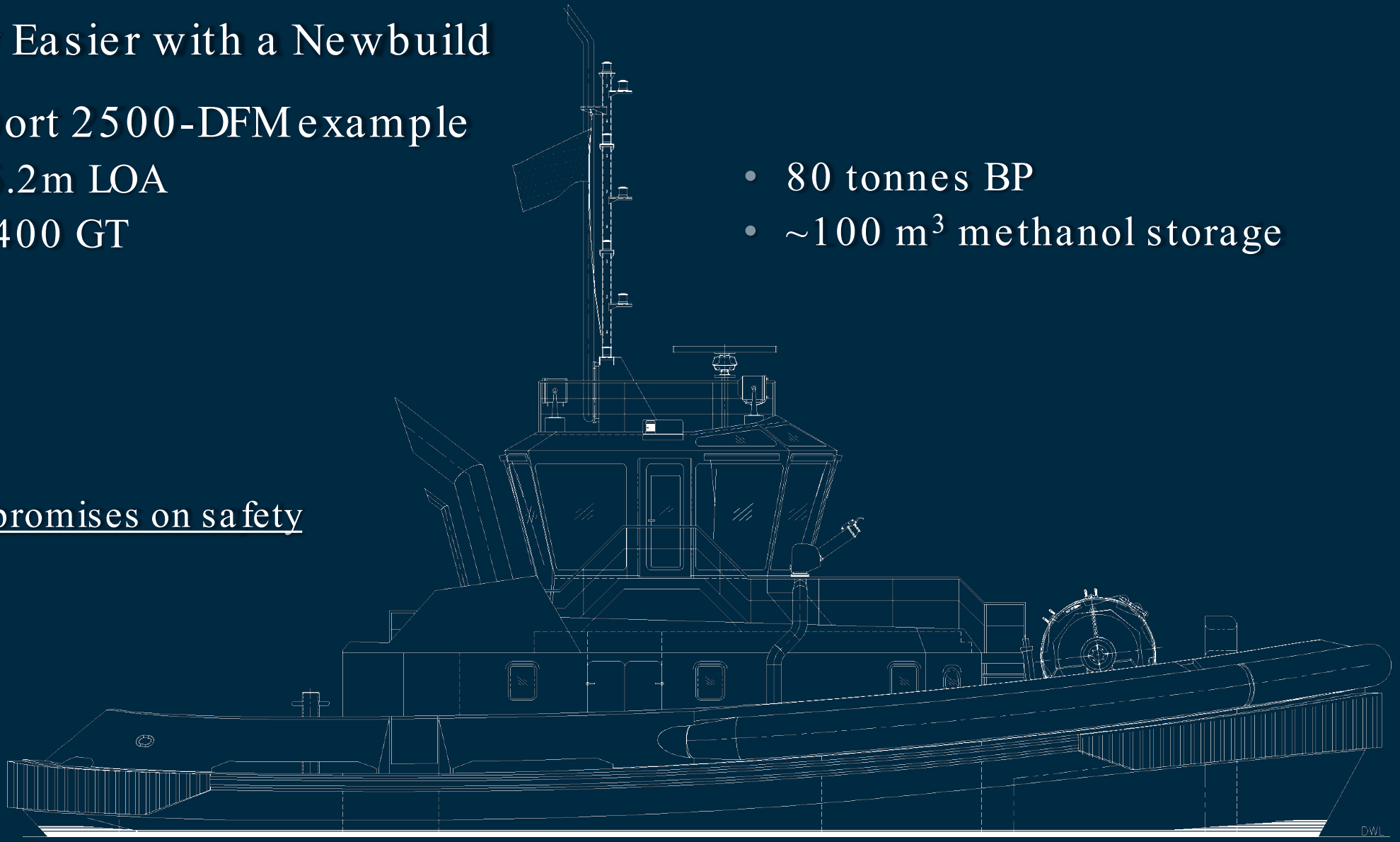
Usually Easier with a Newbuild

- RApport 2500-DFM example
  - 25.2m LOA
  - < 400 GT
  - 80 tonnes BP
  - ~100 m^3 methanol storage

<u>No compromises on safety</u>



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A Practical First – *RAsalvor 4400-DFM* for KOTUG Canada

- Length overall: 43.8 m
- Bollard pull: ~120 tonnes
- Methanol: 202 m^3
- Diesel: 256 m^3
- Recovered Oil: 409 m^3
- Fi-Fi 1 class
- Underwater noise reducing coatings

SC'IANEW • CHEANUH • FIRST NATION

Will be the most powerful and eco-friendly escort tugs on BC's South Coast

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The Ball is Officially Rolling

- RAsalvor Steel Cutting - February 13th, 2024 – Sanmar Shipyards, Türkiye
  - And HAZID risk assessment successfully completed
- Designs for another global towing majors already underway

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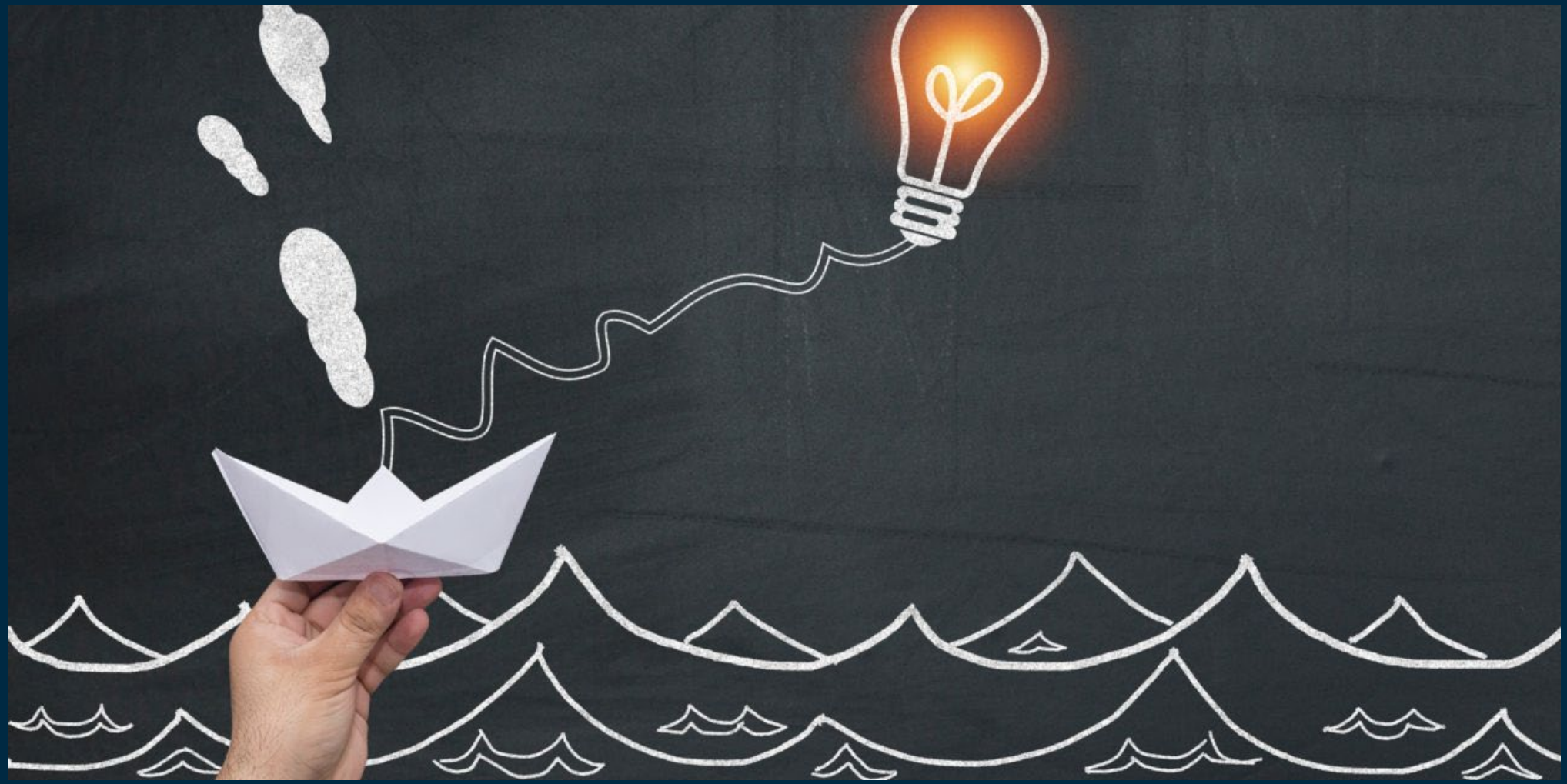
Thank you! Questions?



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