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Coast Guard

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RVOC 2024 CCG Fleet Renewal Update – Way Point Check

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Outline

- The National Shipbuilding Strategy (NSS)
- CCG Fleet Renewal Update
 - Taking stock of progress
- Key Issues
 - Shipbuilding
 - Ship design
- Greening the Future Fleet
 - Our experience to date



National Shipbuilding Strategy (NSS)

- Long term project to renew Canada's fleet of combat and non-combat vessels
- Objective:
 - to restore Canada's shipyards and rebuild our marine industry along with job creation while ensuring sovereignty and protecting interests at home and abroad
- Three Pillars:
 - Construction of large vessels
 - Construction of small vessels (less than 1000 tonnes)
 - Vessel repair and refit
- First pillar is in partnership with 3 Canadian Shipyards:
 - Irving Shipyard – Halifax, NS
 - Seaspan Shipyard – Vancouver, BC
 - Davie Shipyard – Levis, QC

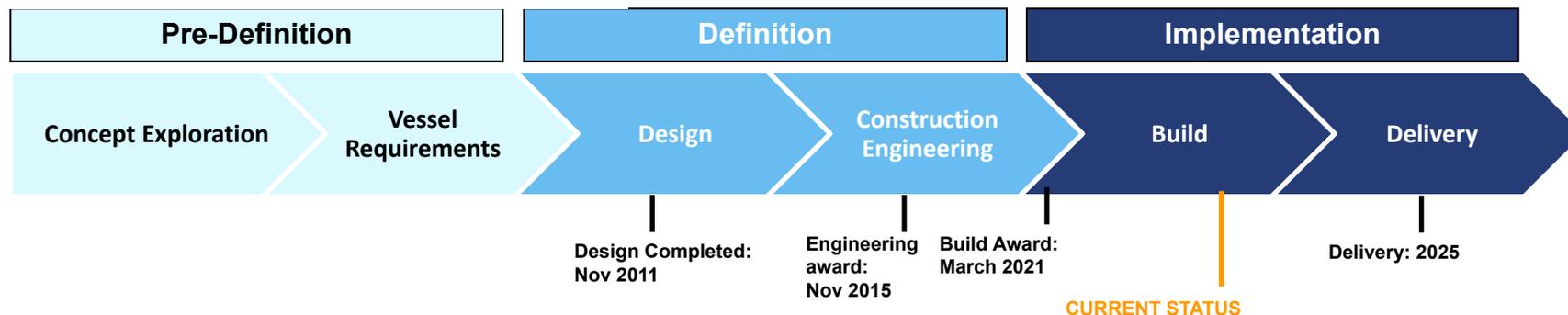


Offshore Oceanographic Science Vessel (OOSV)

- Construction of the OOSV is progressing well following cut steel in March 2021
 - Ship consolidation occurred mid-Nov 2023
 - Launch planned for summer 2024
- OOSV delivery expected in early 2025

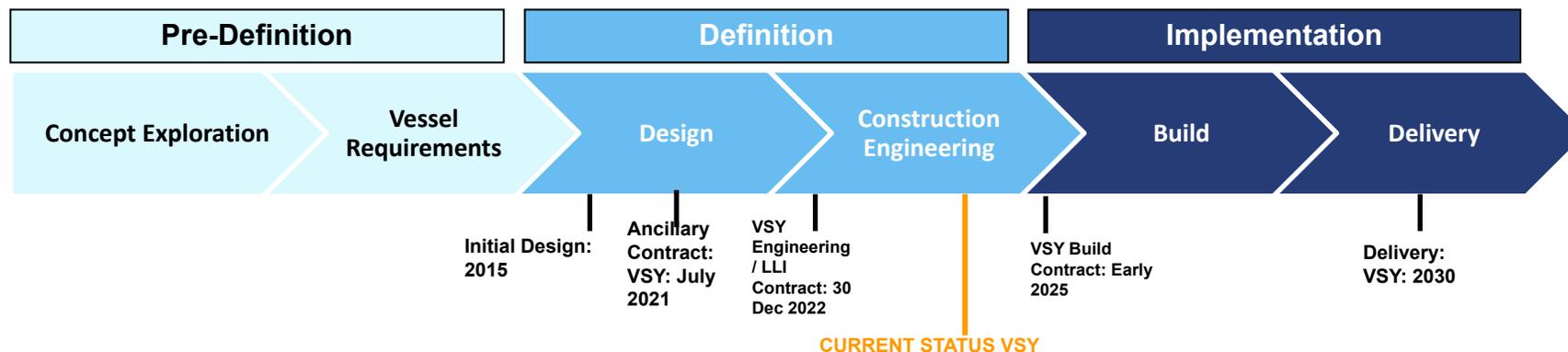
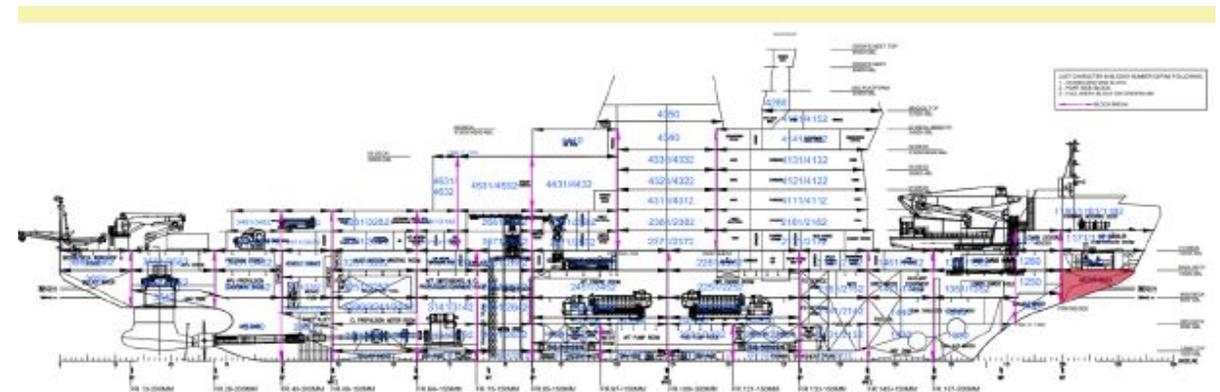
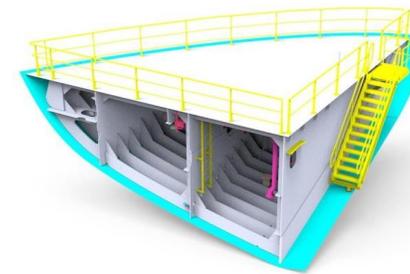


Mast & Marine Mammal Observation Room and the Casing erected to Hull



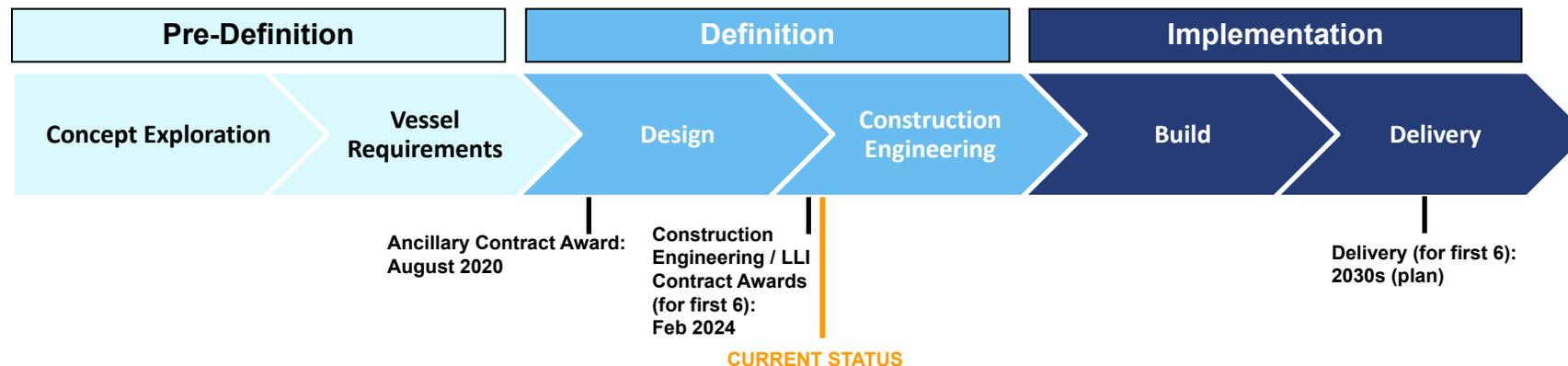
Polar Icebreakers

- Construction engineering (CE) and material procurement work ongoing since 30 Dec 2022 on Polar Icebreaker at Vancouver Shipyards
 - Work on a prototype block was successfully completed in early 2024
 - Construction expected to occur in 2025
- Other Polar to be built at Chantier Davie
 - Schedule TBD following negotiations with shipyard



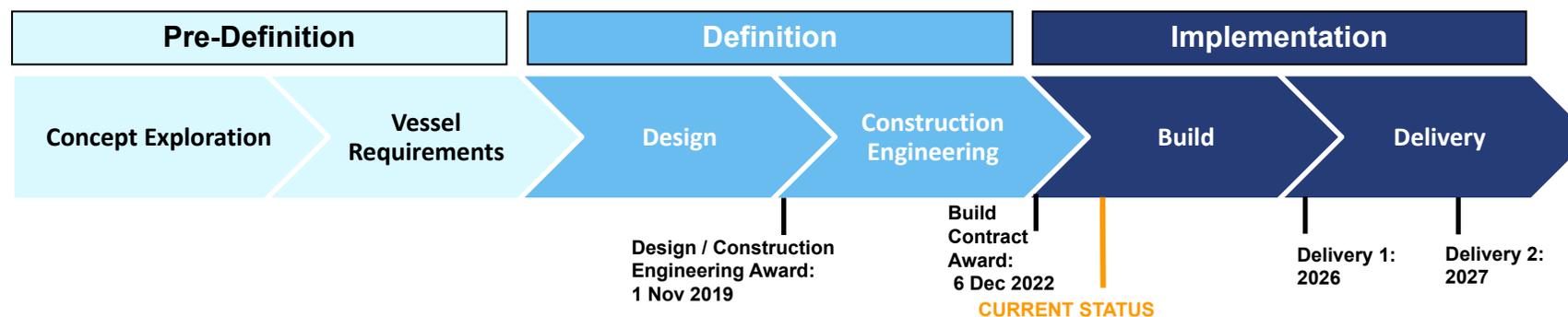
Multi-Purpose Vessels (MPV)

- Construction Engineering and Long-Lead Items contracts awarded 9 Feb 2024
 - Work under those contracts underway
- Up to 16 MPV will be designed / built in three flights
 - First flight of 6 vessels expected to be largest and most capable to position CCG with increased capability to operate in Arctic
 - Flights 2 & 3 expected to be smaller and designed to work in shallow waters to deliver services outside Arctic



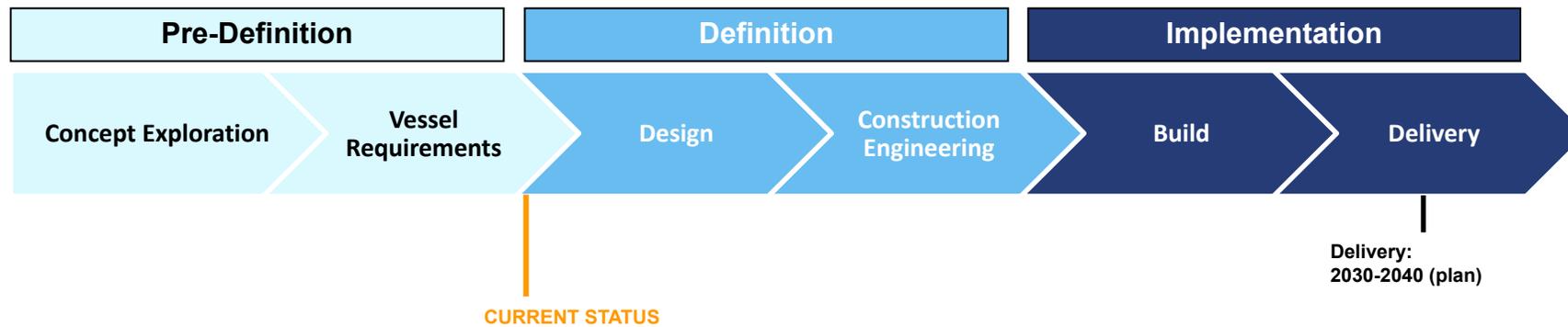
Arctic and Offshore Patrol Ships (CCG Variant)

- Cut steel on AOPS 7 (first CCG variant) occurred on 8 Aug 2023, marking start of construction
 - Cut Steel on AOPS 8 (the second CCG variant) expected to occur by fall 2024
- Shipyard expects delivery of AOPS 7 in late 2026 and AOPS 8 by end 2027



Program Icebreakers (PIB)

- Umbrella Agreement signed with Chantier Davie on 4 Apr 2023
- Ancillary Contract awarded in March 2024
- Concept design work anticipated to start in the coming months



Small Vessels

- In May 2023, Canada announced \$2.5B in funding to renew CCG small vessel fleet (up to 61 vessels) to be built amongst Canadian Shipyards (excluding the three strategic partner yards which build large vessels)

Search and Rescue (SAR)

Lifeboats

- Acceptance of the 16th SAR Lifeboat (CCGS Baie des Chaleurs), out of the 20 under contract, occurred on 30 Oct 2023
- Next two deliveries planned for 2024



Near Shore Fishery Research Vessel (NSFRV)

- Build contract award announced on 20 Oct 2023 to Chantier Naval Forillon in Gaspé, Québec



Air Cushion Vehicle (ACV)

- CCG is procuring up to four replacement ACV
- Contract awarded to Griffon Hoverworks (United Kingdom) on 31 Jan 2024 to update current ACV design and investigate alternative propulsion systems



Maintaining Services through Interim Measures

Sustaining operational capacity to deliver critical services is Coast Guard's top priority

- Vessel Life Extension (VLE) Program
 - VLE Phase 1 is in progress
- Interim Icebreakers
 - All three medium commercial icebreakers have been converted and entered service
 - Announced in Jan 2024, refit and conversion of one light commercial icebreaker has commenced and is expected to continue into 2025
- Charters
 - Supply arrangements are in place to support icebreaking



CCGS Judy LaMarsh



CCGS Vincent Massey



Key Challenges - Shipbuilding

- Everything is taking longer than expected
 - Schedules have been reset and revised - often considerably
 - Capacity is an issue
- Everything costs more than anticipated
 - OOSV was initially planned for delivery in 2017 at a cost of \$109M
 - Current delivery date is 2025 at a cost of \$1.28B
- Rebuilding an industry is hard
 - Skills shortage, developing and establishing processes, merging different experience sets



Key Issues – Ship Design

- Requirements:
 - understanding their impact
 - achieving compromise
- Engaging stakeholders – its complicated
- New ships are big!



Key Issues – Requirements

- Decade long gaps between ship building programs = skill gaps
- Evolving and edge case requirements
 - Not fully understanding impacts resulted in design compromises that weren't fully understood



Increased Requirements Sophistication -

- Mid-Shore Multi-Mission Vessel (MSMM) is a small vessel under NSS. Lightship must be less than 1000 tonnes
- With experience gained we are far better positioned to demonstrate impact of requirements on design
- This resulted in many internal conversations such as:
 - The vessel can't accommodate those two missions while remaining within the lightship target
 - We can't fit that many people in single cabins but we could do this...
 - All those sensors won't fit but what about...
 - The working deck is not large enough to support those two missions but a compromise could be...

Mid-Shore Multi-Mission Vessel (MSMM) Roles

- Aids to Navigation (AToN)
- Ice Breaking in the form of shallow harbor breakouts
- Flood control
- Commercial track maintenance
- Ecosystem and marine science
- Hydrographic surveys
- Search and Rescue services



Engaging Stakeholders – it's not easy

- Getting stakeholder input is not easy.
 - Figuring out who to engage, when and how often is challenging
- Demonstrating impact of requirements takes effort and design work
- Lengthy schedules complicates the matter because missions change and stakeholder requirements change
- It's difficult understanding that just because a ship is a 'paper ship' doesn't mean it can easily be changed



Big Ships – Why?

- Shipboard equipment is bigger
- Regulations have changed
- List of mission requirements keeps getting longer
- Shipyards are risk averse and, in our case, not constrained by firm, fixed price contracts
- Weight and volume margins are bigger driving increased weight and size
- Shipyards are wary of complexity and spatial density. Simple solution - make the ship bigger

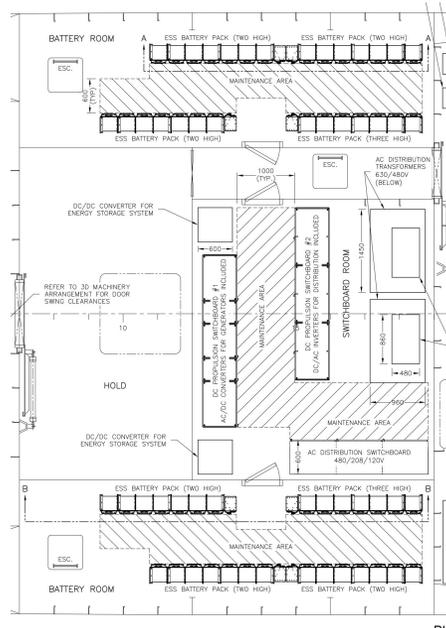
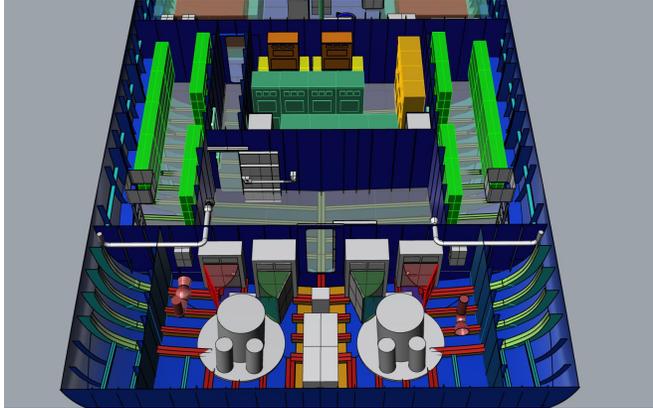


Greening the Future Fleet

- Coast Guard is committed to the net-zero emissions Greening Government Strategy 2050 target
- Coast Guard is expecting to use diesel on early builds of new large vessels but we are continuing to seek other ways to reduce emissions and improve efficiency
 - CCG's new large vessels are estimated to operate 10-40 per cent more efficiently than the current fleet
 - Ship designs will include design margins and other considerations to accommodate adoption of new technologies / fuels at the mid-life modernization stage
 - Early bio-diesel trials have been very positive. A couple large vessels in existing fleet currently operating on bio-fuels. Future fleet ships will all be capable of operating on bio/renewal diesel



Near Shore Fishery Research Vessel (NSFRV)

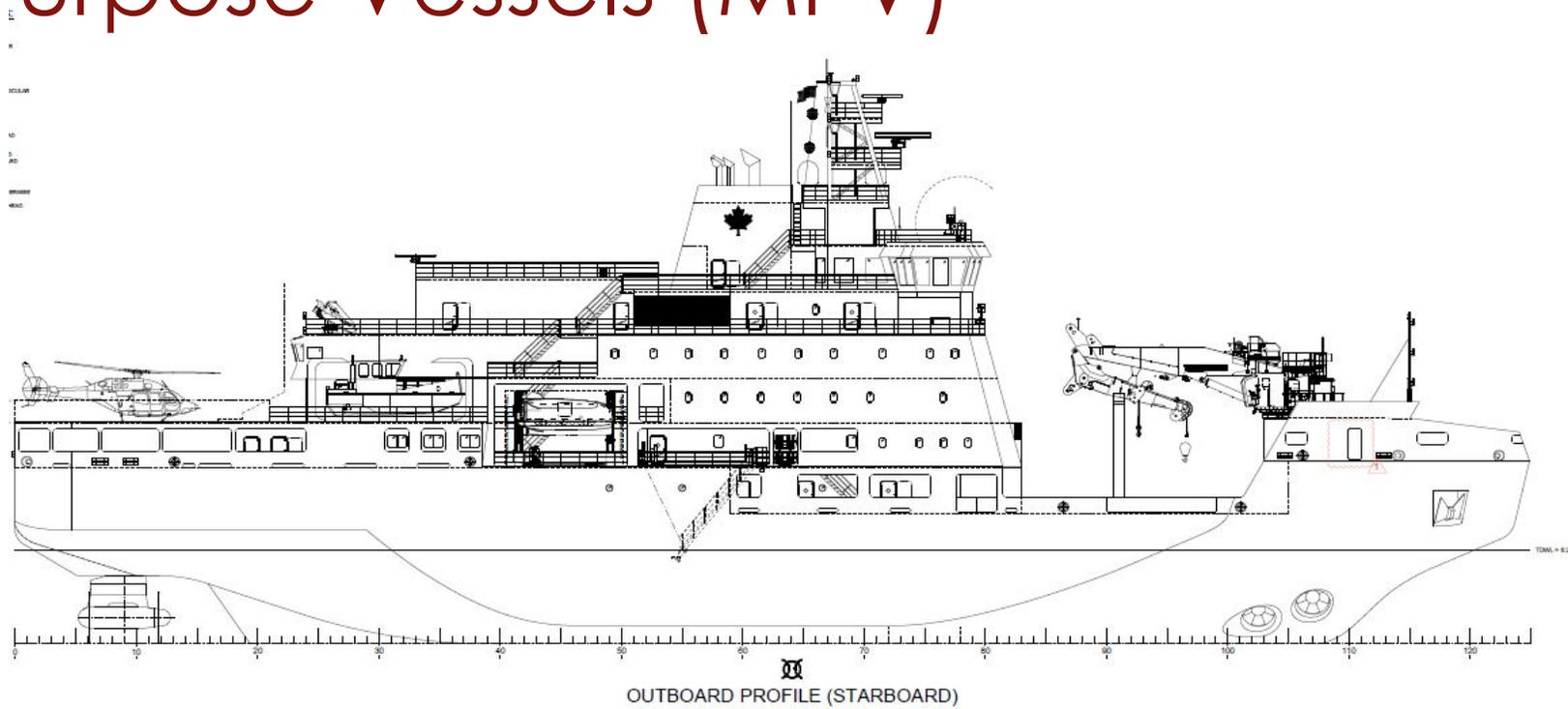


NSFRV will be first CCG vessel with diesel-electric hybrid propulsion with a battery energy storage system (BESS)

- BESS was sized to enable 8 hour silent overnighting for crew comfort
- Large battery also significantly increases efficiency by supporting load optimization and peak shaving. Also allows approximately one hour of silent science ops
- Note that these arrangement drawings are already out of date as rapid evolution of battery technology has resulted in smaller batteries for the same energy storage



Multi Purpose Vessels (MPV)

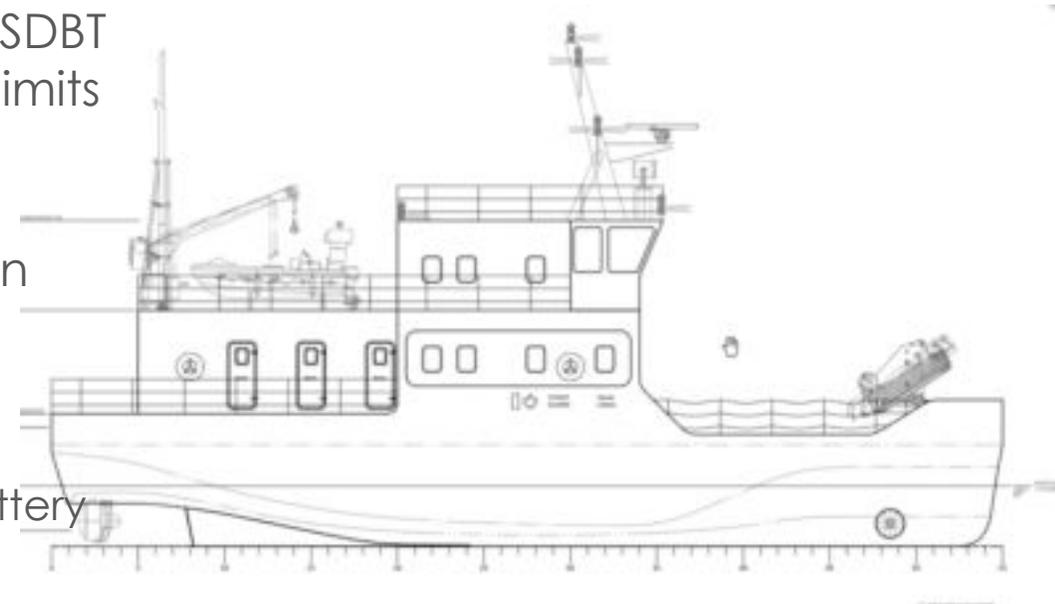


- Considerable emphasis placed on energy efficiency and emissions reductions
- MPV will have a fully integrated electrical propulsion system with variable speed DC generators and a DC propulsion bus. Optimizes efficiency during low power ops
- MPV will be capable of operating on bio and renewable diesel fuel
- A battery energy storage system is also being considered

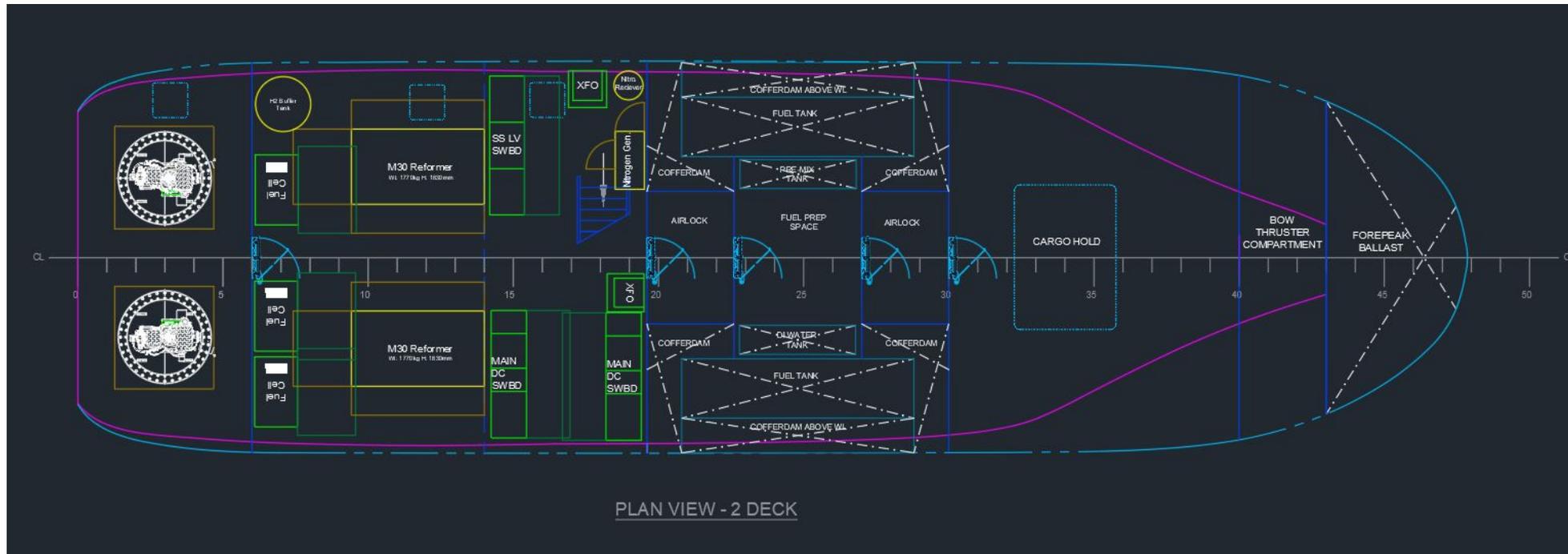


Special Shallow Draft Buoy Tenders (SSDBT)

- As part of the May 2023 announcement on investments in the small vessel fleet, CCG is procuring four SSDBT
- Given its central area of operation and missions, the SSDBT provides an ideal platform for CCG to better explore limits of available commercial technology to help achieve emission reductions targets
- SSDBT is currently undertaking in-house concept design and a range of propulsion system options are being considered:
 - Liquid hydrogen fuel cell option
 - Fully integrated diesel electric propulsion system with battery energy storage system capable of operating on bio or renewable fuel. A methanol fuel option is also being considered
 - Methanol reformer, hydrogen cell propulsion system with battery energy storage



Special Shallow Draft Buoy Tenders (SSDBT)



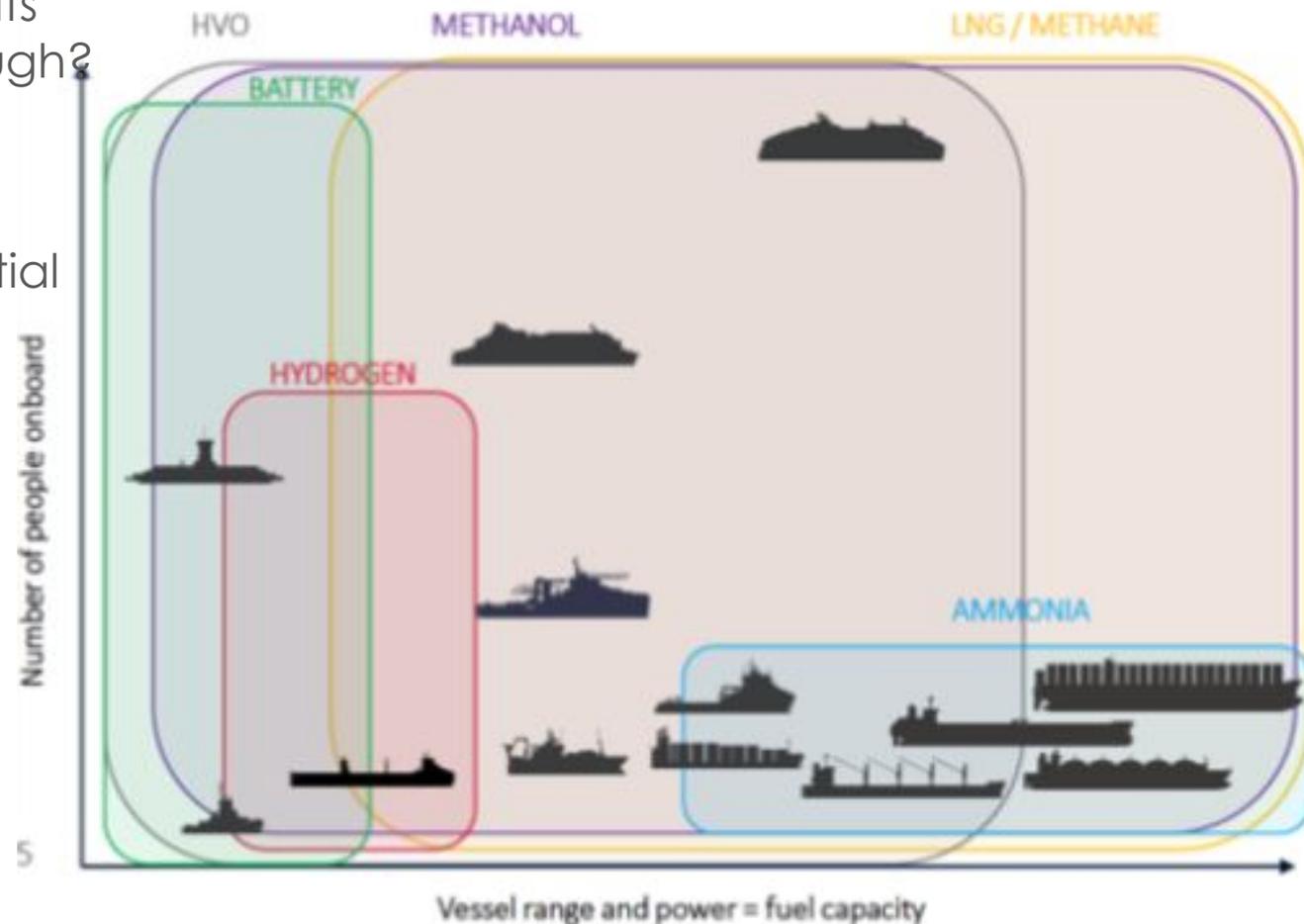
Methanol Reformer – key issues

- Range remains a significant challenge but extracting hydrogen from methanol on board seems a better option than carrying liquid hydrogen
- hazardous zones and safety requirements around methanol significantly impact the design
- concept is larger than the largest acceptable size.



CCG Perspectives on Low Carbon Fuels

- Bio and renewal diesels
 - in-service trials are underway and results are very positive but will there be enough?
- LNG
 - Infrastructure will not be available in Canada and there is significant potential to increase GHG emission
- Hydrogen
 - Storage is a significant challenge
 - Likely will not be a pathway for CCG
- Ammonia
 - Too hazardous for CCG ships.
- Methanol
 - Will likely remain our focus



Concluding Thoughts

- CCG has a lot going on designing and building the future fleet
- Everything is taking longer than expected and costing more
- The future fleet is going to be bigger than the fleet it is replacing and more capable in some areas but not all
- There is a lot of learning going on internally and externally.
 - Not building ships for 30 years is not an effective way to maintain a fleet
- We are doing a lot of work on low carbon fuels but marine diesel is an excellent energy source
 - Replacing it will not be easy





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