UC San Diego | SCRIPPS INSTITUTION OF OCEANOGRAPHY

Scripps zero-emission hydrogen-hybrid research vessel

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R/V *Robert Gordon Sproul*

Built: 1981

Length: 125 feet (38 m)

Crew: 5 Scientists: 12

Endurance: 14 days

Approaching end of service life

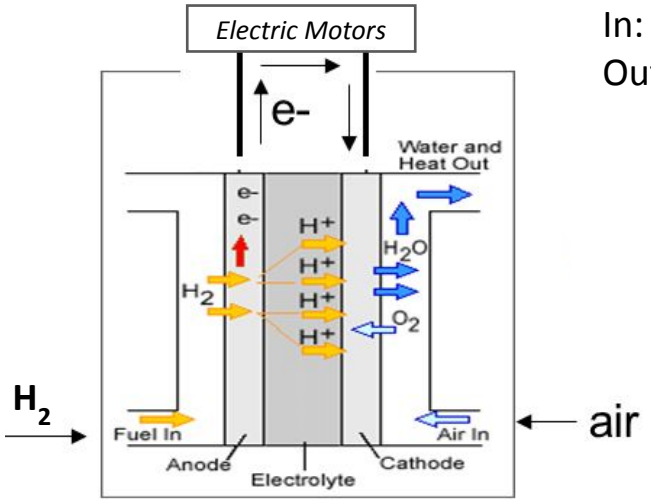

CCRV
Built: 2026
Length: 164 feet (49.9 m)
Crew: 7-9 Scientist: 14
Endurance: 11 days*
LH2
CCRV

2023 ON TRACK TO BE THE HOTTEST YEAR ON RECORD

Last month was hottest October since records began, with average global temperature thought to be 1.7C above late-1800s levels

By burning fossil fuels, humans have pumped heat-trapping gases into the atmosphere and raised temperature of planet by 1.2C since the Industrial Revolution.

Hydrogen fuel cells produce ZERO GHG or criteria emissions

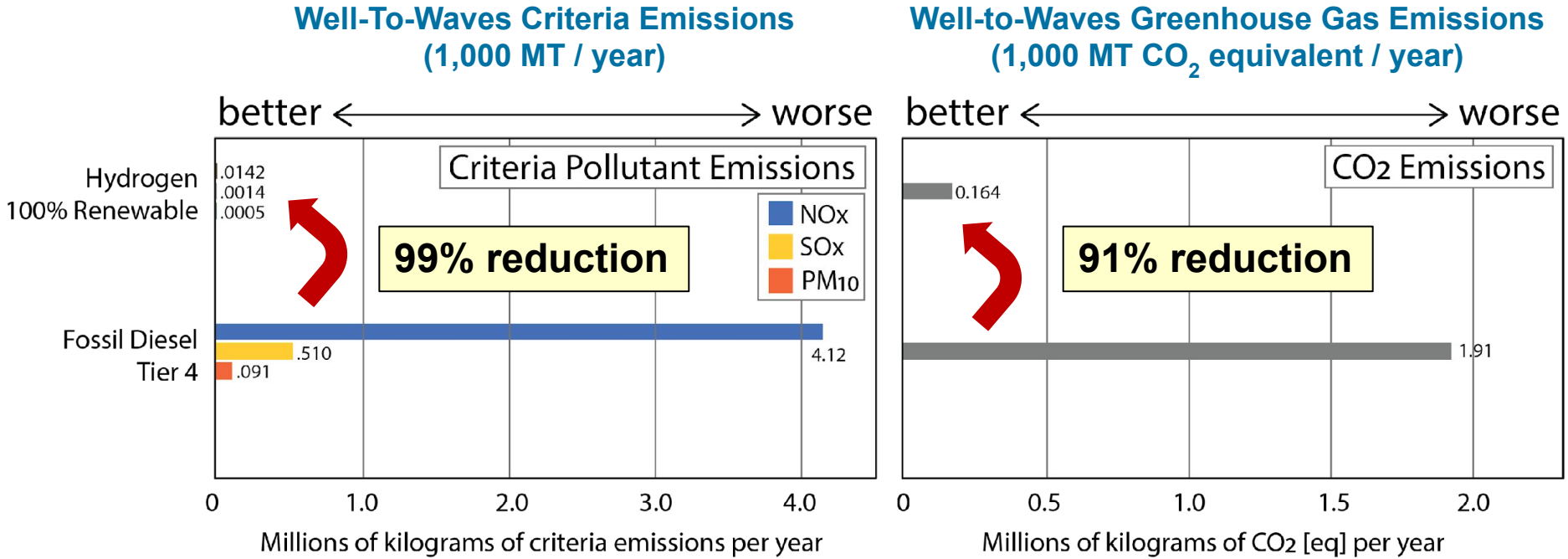


$2\,H_2 + O_2 \rightarrow 2\,H_2O$

In: H_2 and air
Out: Electricity
Waste Heat
Warm humidified air

- Commercially available
- More energy efficient than diesel generators
- No emissions at the point of use
- Eliminates fuel spills, greatly reduces noise
- Emissions only arise from H_2 production/delivery

Emissions: Total impact from H_2 production and delivery



Criteria pollutant emissions can be reduced using LH_2. Dramatic reductions in GHG can be achieved with ***renewable*** LH_2. Renewable LH_2 is available now from commercial gas suppliers.

CCRV WILL BE DELIVERED METHANOL READY

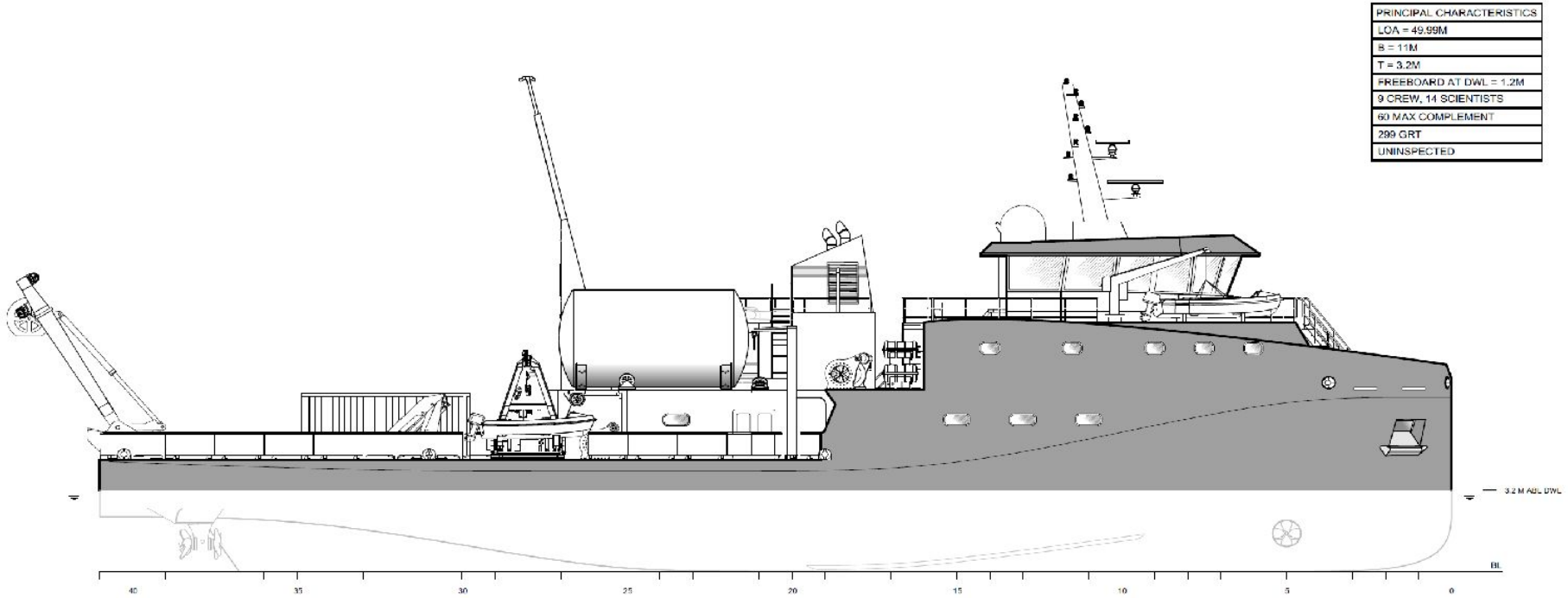
As a potential future maritime fuels, methanol ticks a lot of the right boxes:

- Dramatically reduces NOx, SOx and particulate emissions
- Easy to store and handle onboard a ship
- Storage and handling facilities close to most major ports

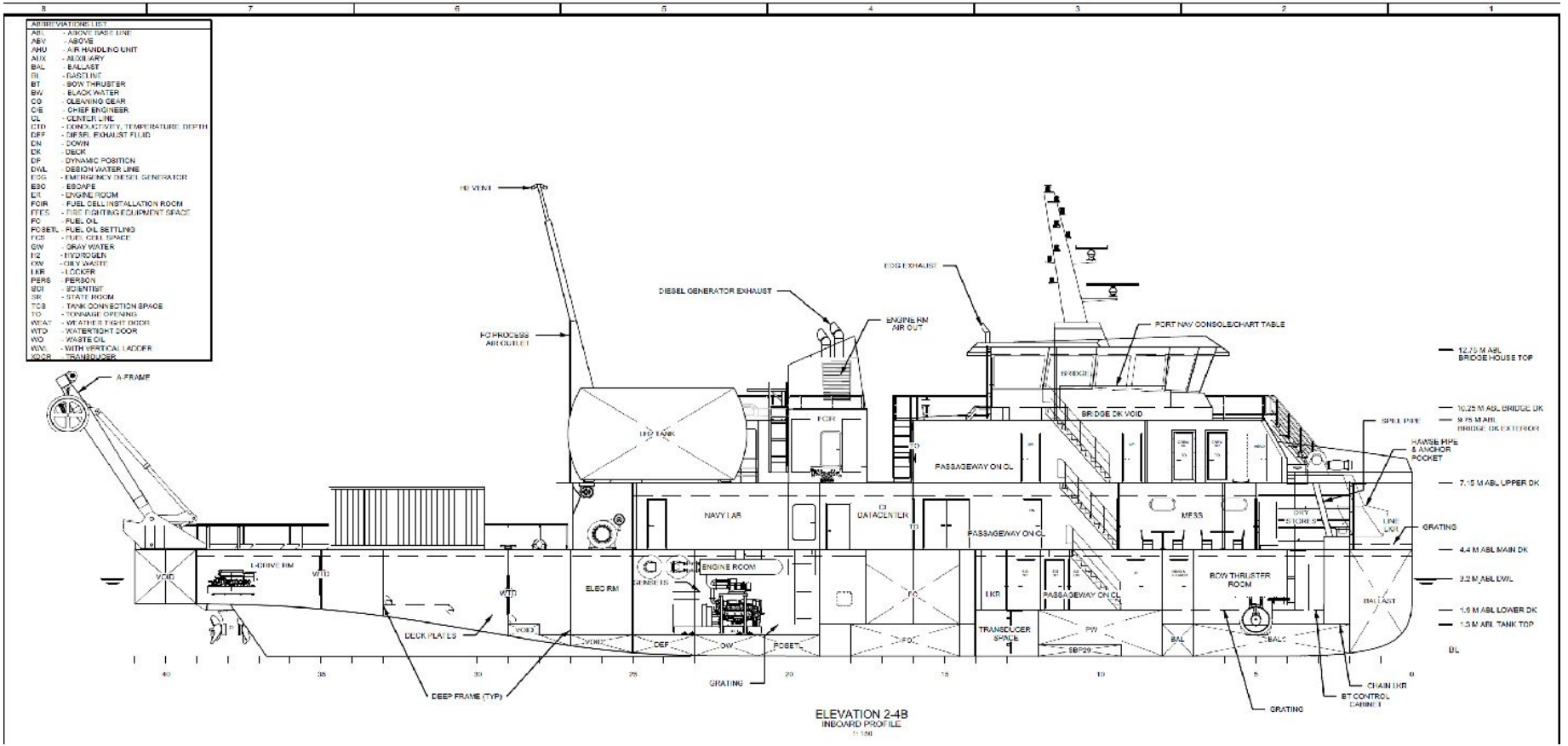
METHANOL FUEL TANK ADDED to CCRV

Small methanol marine engines not yet proven but under development

OUTBOARD PROFILE

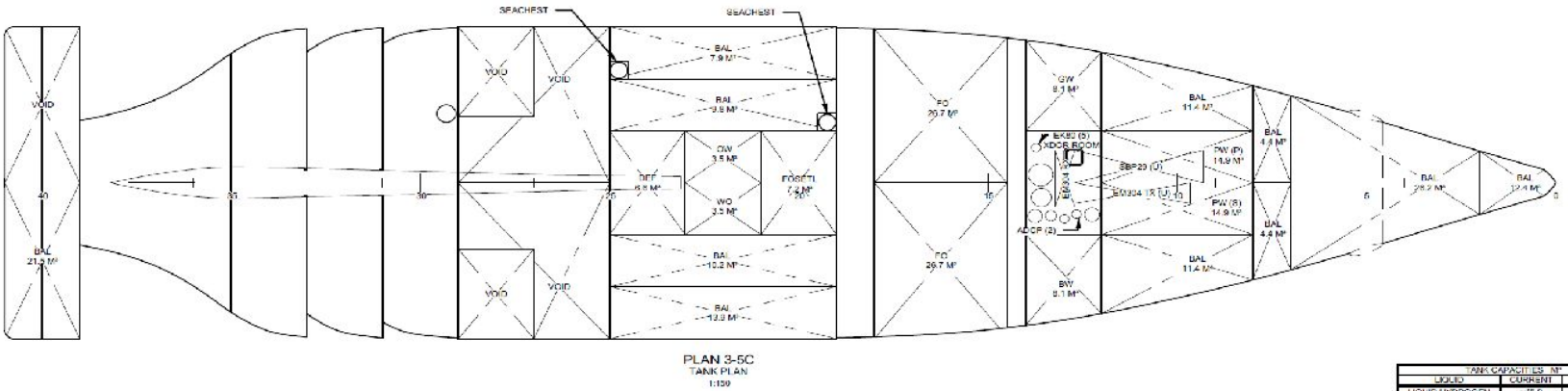


INBOARD PROFILE



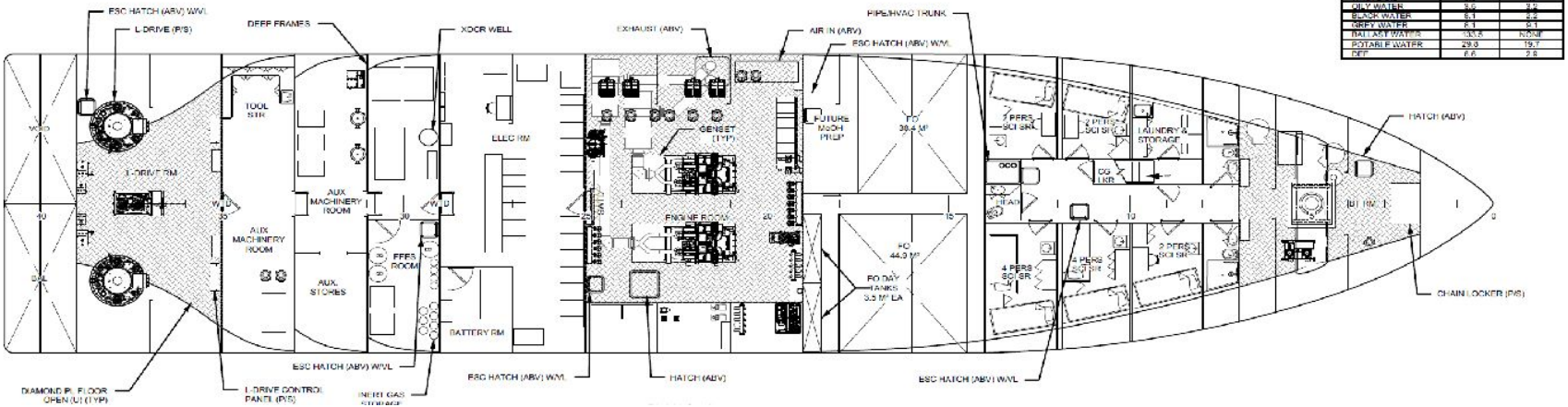
ELEVATION 2-4B
INBOARD PROFILE
1:150

LOWER DECK

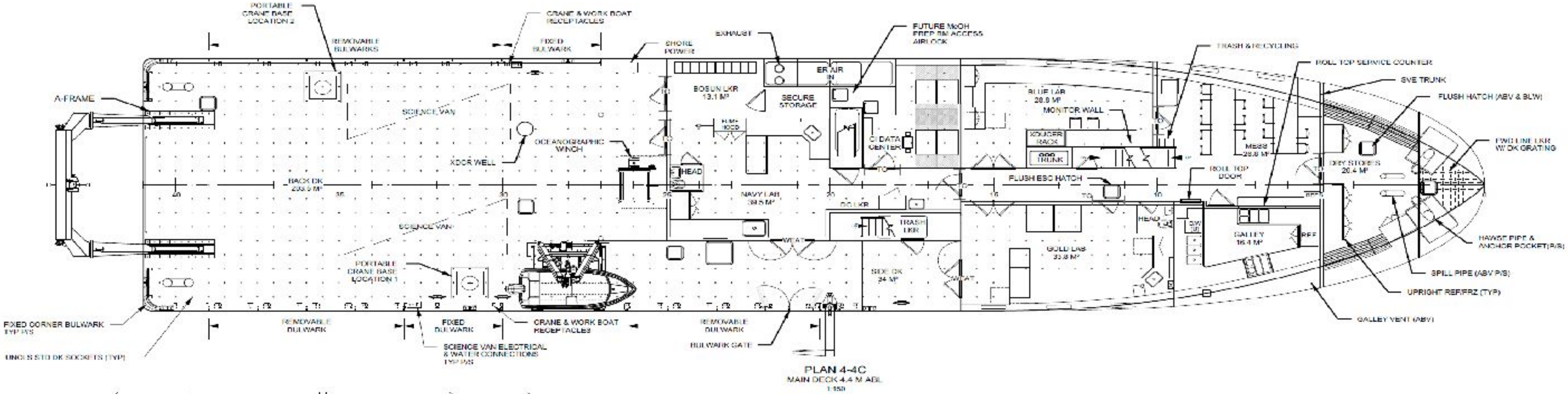


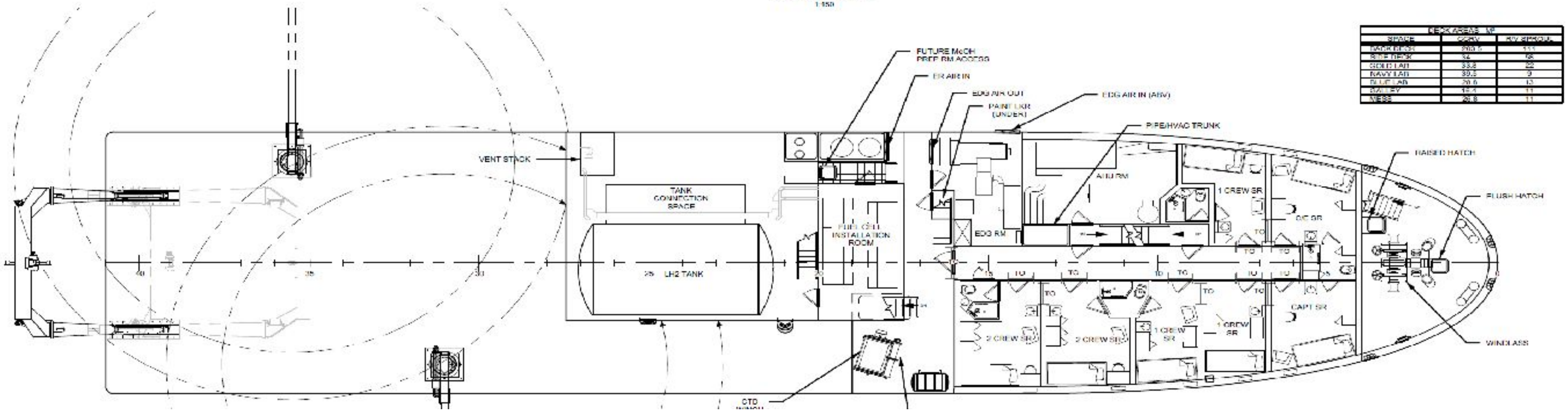
PLAN 3-5C
TANK PLAN
1:150

TANK CAPACITIES - M³		
LIQUID	CURRENT	REQUIRED
LIQUID HYDROGEN	46.0	15.0
DIESEL	188.6	24.3
WASTE OIL	3.5	3
OILY WATER	9.6	9.6
BLACK WATER	6.1	6.2
GREY WATER	6.1	6.1
BALLAST WATER	100.5	NONE
POTABLE WATER	29.0	19.7
DFT	6.6	2.8



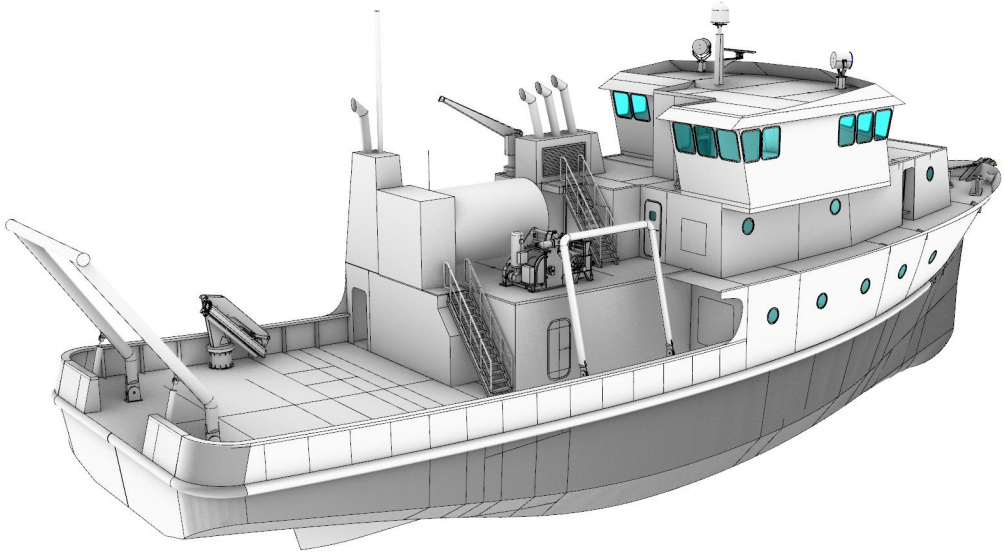
UPPER DECK





DECK AREAS M²		
SPACE	CCRV	RV SPROUL
BACK DECK	203.5	111
SIDE DECK	34	58
GOLD LAB	33.8	22
NAVY LAB	39.5	9
BLUE LAB	20.6	13
GALLEY	16.4	11
MESS	26.8	11

The San Diego Union-Tribune



Glosten

Jul 23, 2021

UC SAN DIEGO RECEIVES $35 MILLION IN STATE FUNDING FOR NEW CALIFORNIA COASTAL RESEARCH VESSEL

First-of-its-kind hydrogen-hybrid vessel will be vital to education and research

California Budget Act of 2021

On 12 July 2021, Governor Newsom signed SB 129, which contained one-time appropriations to Scripps, for a hydrogen hybrid research vessel

Feds designate California as a hydrogen ‘hub’

California is one of seven hydrogen “hubs” nationwide that the U.S. Department of Energy says will be a key part of the country’s clean-energy future.

State officials said California must use its $1.2 billion in federal grants to build an industrial ecosystem that makes hydrogen more plentiful, available and cheaper.

State agency that administers the plan:
Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES)

CCRV competitively selected to be part of ARCHES

California Air Resources Board
Advanced Technology Demonstration and Pilot Projects

CARB's goal is support of a wide array of zero-emission off-road equipment and **vessel projects (including research vessels).**

Accelerate the advancement of innovative and economically viable technologies into the commercial marketplace while supporting the State's equity and **emission reduction goals.**

October 2023: SIO submitted CCRV as a proposed project.

Timeline

Complete:

- **Design Agent Selection: 27 May 2022**
- **CCRV Project Kickoff Meeting: 31 August 2022**
- **CCRV Design Refresh: 17 October 2022**
- **25% Preliminary Design Review: 2 February 2023**
- **50% Preliminary Design Review and Design Preview for Regulatory: 4 April 2023**
- **75% Preliminary Design Review: 29 September 2023**

Future:

- **Hydrogen Hazard Identification Workshop: 11-14 December 2023**
- **100% Preliminary Design and Shipyard Bid Package Review: February 2024**
- **American Bureau of Shipping Approval in Principle: February 2024**
- **Vessel Construction Shipyard Selection: March 2024**
- **Construction Kickoff Meeting: April 2024**
- **Construction Begins: January 2025**
- **100% Detail Design Review: April 2025**
- **Construction Complete: March 2027**
- **Sea trials and acceptance testing: April-October 2027**
- **Science system commissioning / emissions testing: October 2027 to March 2028**
- **CCRV operations: April 2028**


Any questions?