IMPACT ON THE DESIGN OF NEW DEEP-SEA RESEARCH VESSELS CONSIDERING THE NEW SUSTAINABLE REQUIREMENTS AND TECHNOLOGIES.

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ALTERNATIVE FUELS

✓ **LNG – GNL**

✓ **BIOFUELS**

✓ **METHANOL**

✓ **AMMONIA (FUEL/HYDROGEN GENERATOR)**

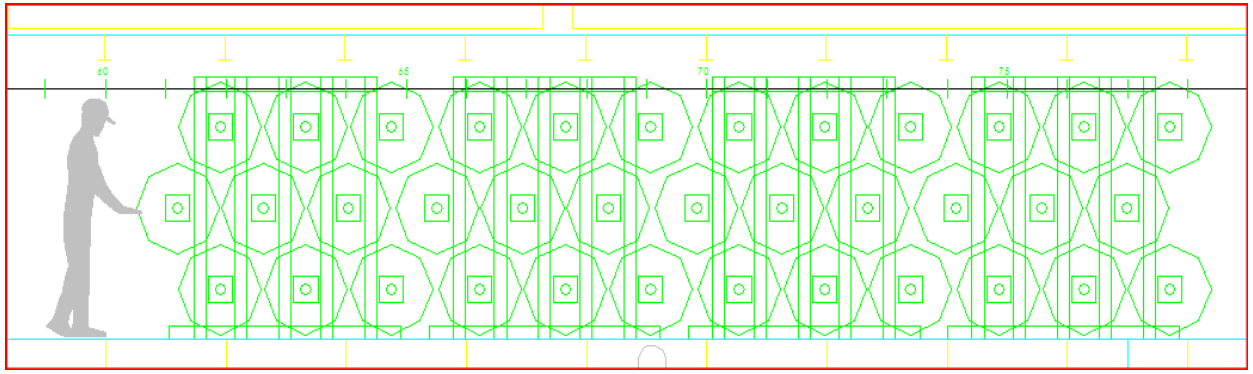
✓ **HYDROGEN, FUEL CELLS**

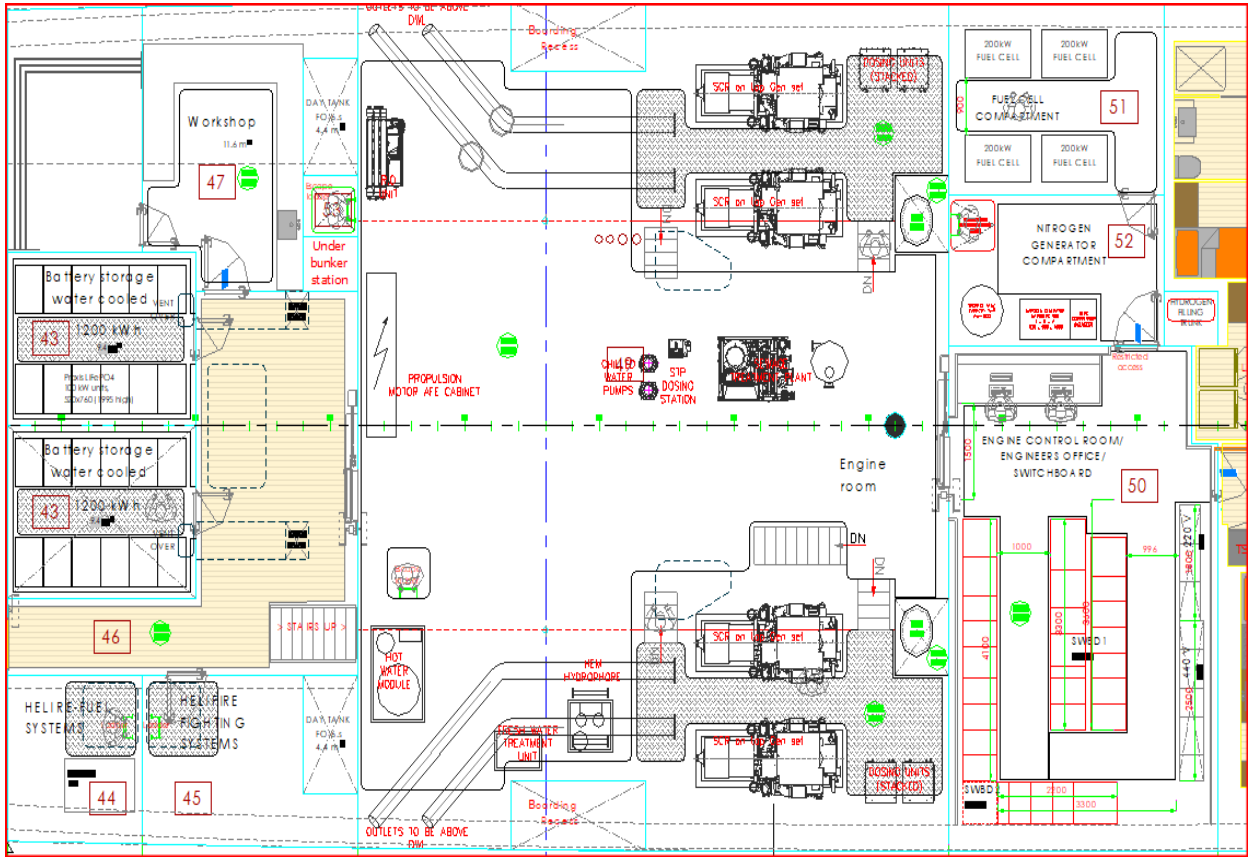
✓ **BATTERIES**

The above leads to some challenges in the design:

- **New arrangements and space distributions:**
  - ➢Hydrogen tanks
  - ➢ Fuel cells
  - ➢Methanol
  - ➢Ammonia
  - ➢Nitrogen generators
  - ➢Batteries storage

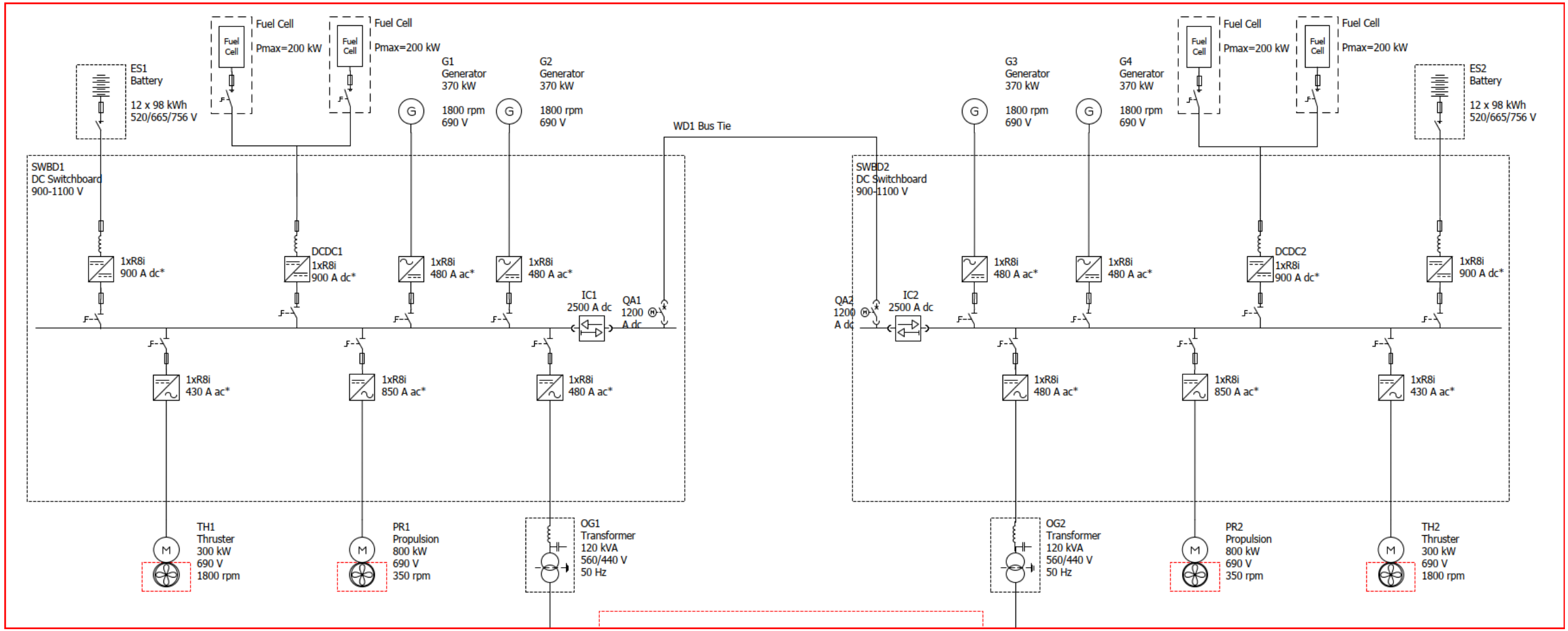
- **Combination + Standard fuel configurations: RELIABILITY**





ALTERNATIVE FUELS

Example of main line diagram configuration



ALTERNATIVE FUELS

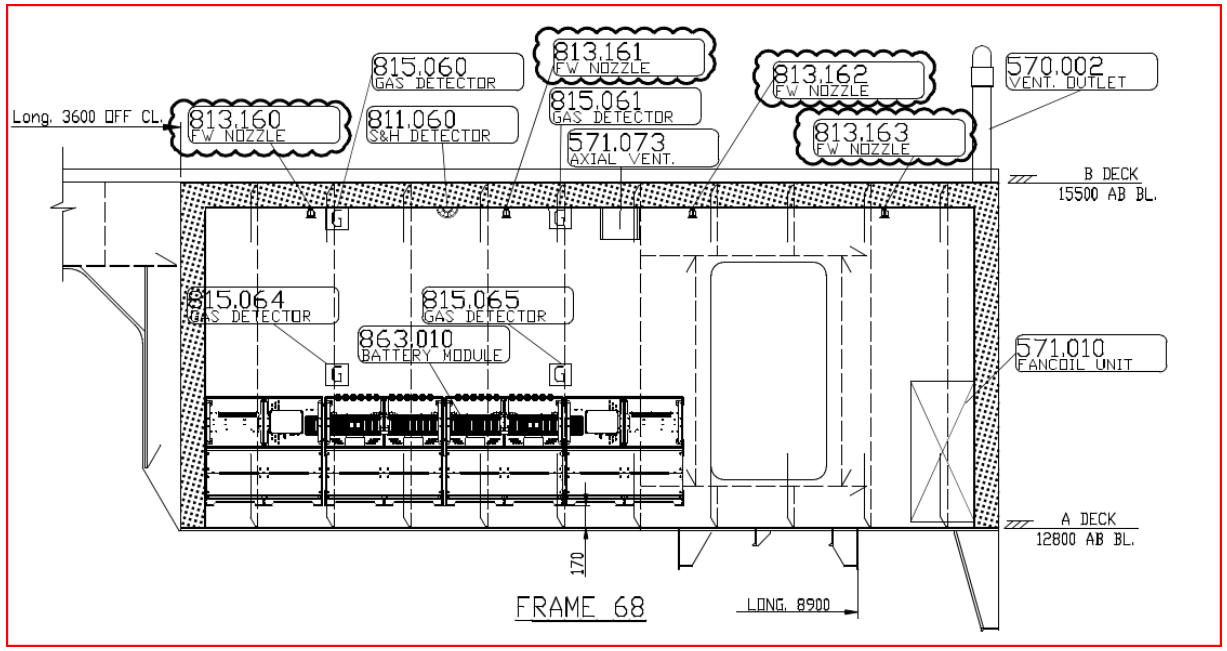
- **Protection, dedicated spaces:**
  - EX PROFF areas. Ventilation Study.
  - HAZID, HAZarous Identification.
  - Fire Fighting. Batteries.

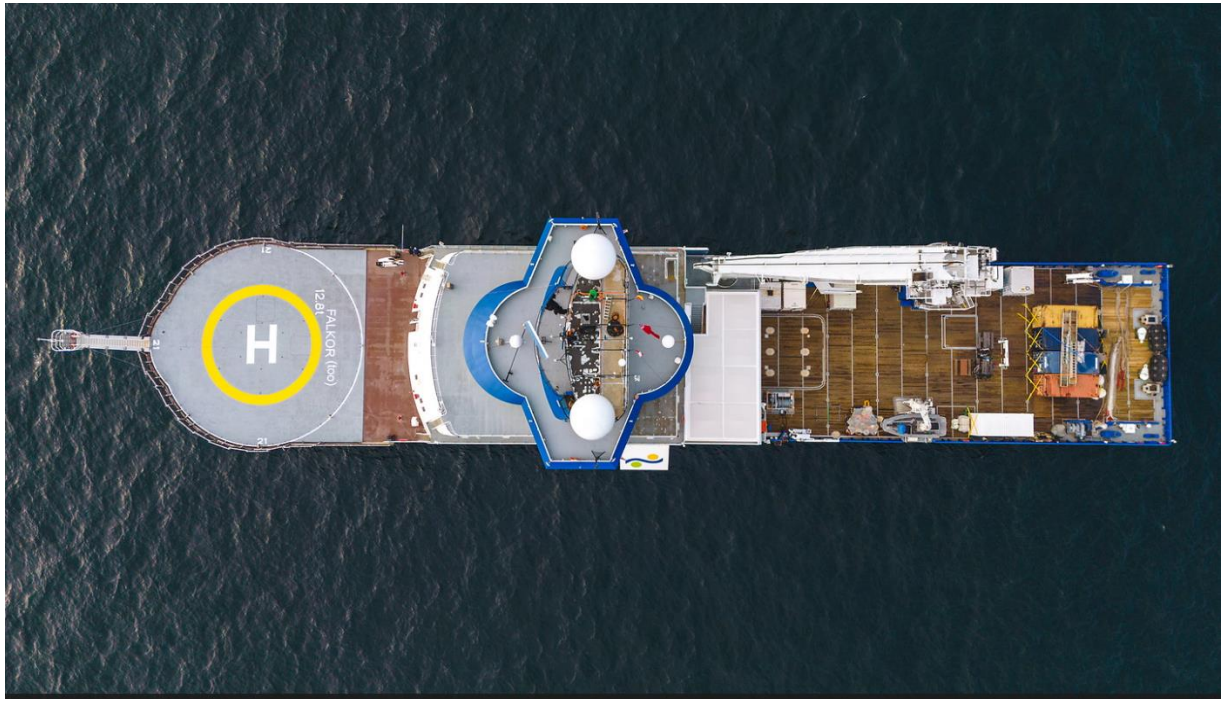
- **New or modified equipment. Capable suppliers.**

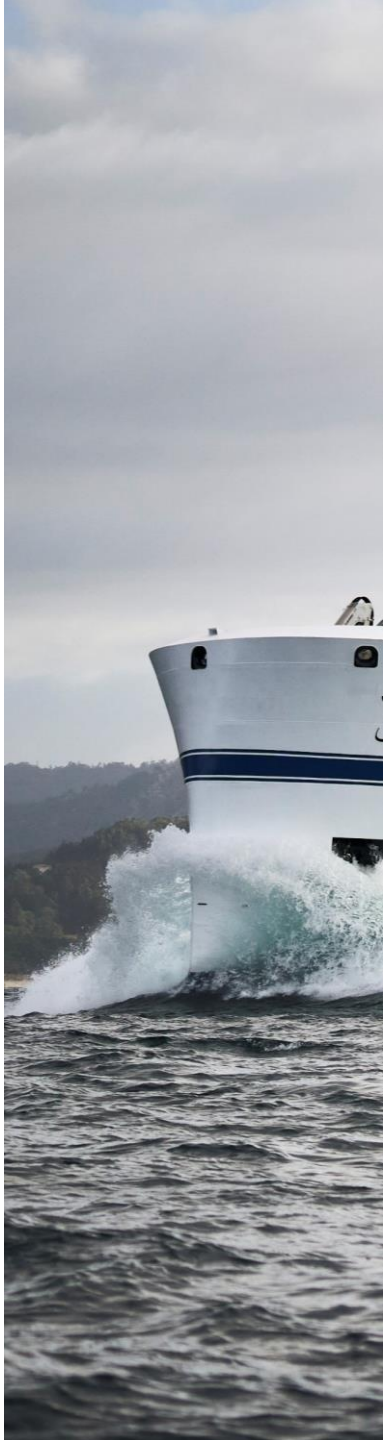
Owner to consider:

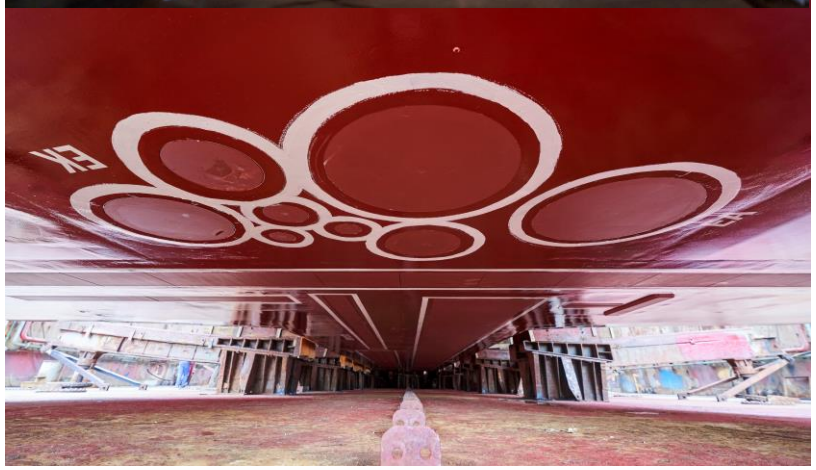
- Technology maturity and crew capabilities.
- Spares Availability.
- Fuel Availability. Logistics. (RV do not operate always in the same route as a ferry).

THE BEST TECHNOLOGIE FOR THE FOLLOWING 10 YEARS?









SENSORS

✓ **MULTIBEAMS**

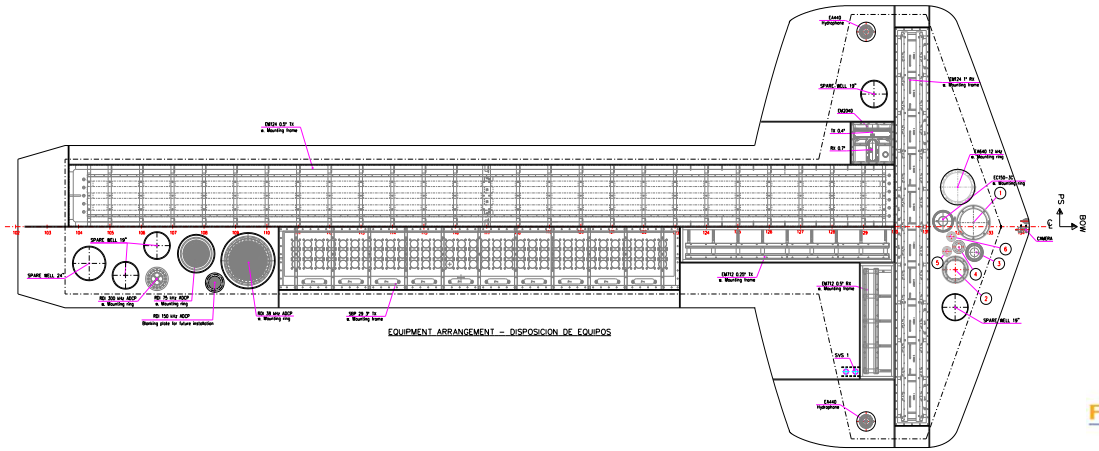
✓ **ADCP**

✓ **SUB BOTTOM**

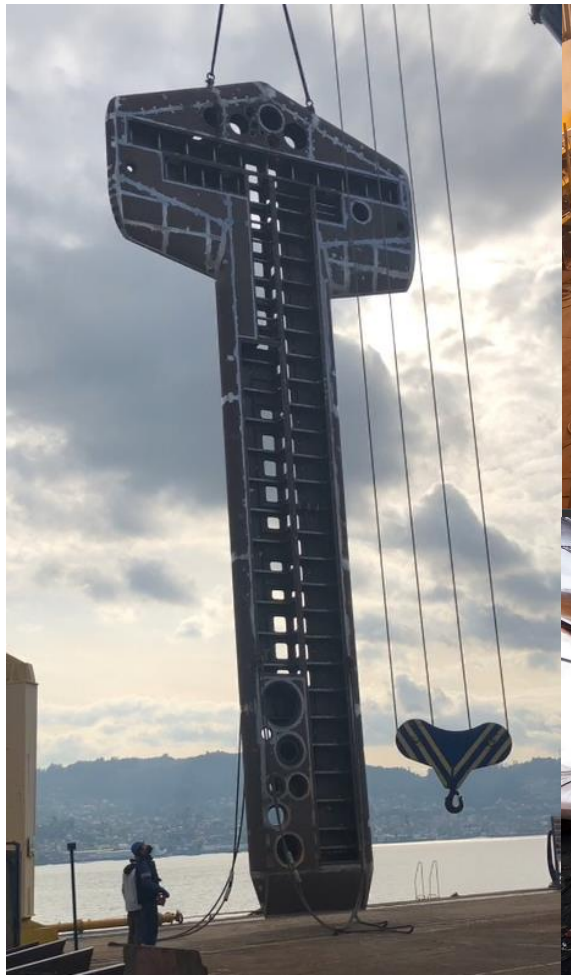
✓ **SONARS**

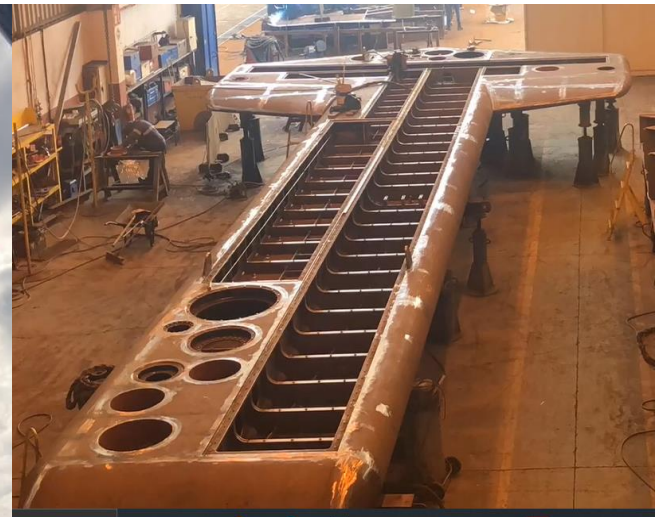
Last generation of sensors - **Significant big areas in the bottom**

- Free areas to consider
- Cable routing through technical areas (limited length).
- Tank distribution.



FREIRE SHIPYARD





SENSORS

Design and construction effects:

- **Blister or Gondola (Draft limitations – Weight monitoring).**
- **Structure design and integration.**
- **Alignment and dimensional survey of big areas. Fairing process (smooth surface, fill gaps, removal of welding seems)**
- **Maintenance, DRY DOCK, block supporting areas (Gondola, Drop keels, etc)**

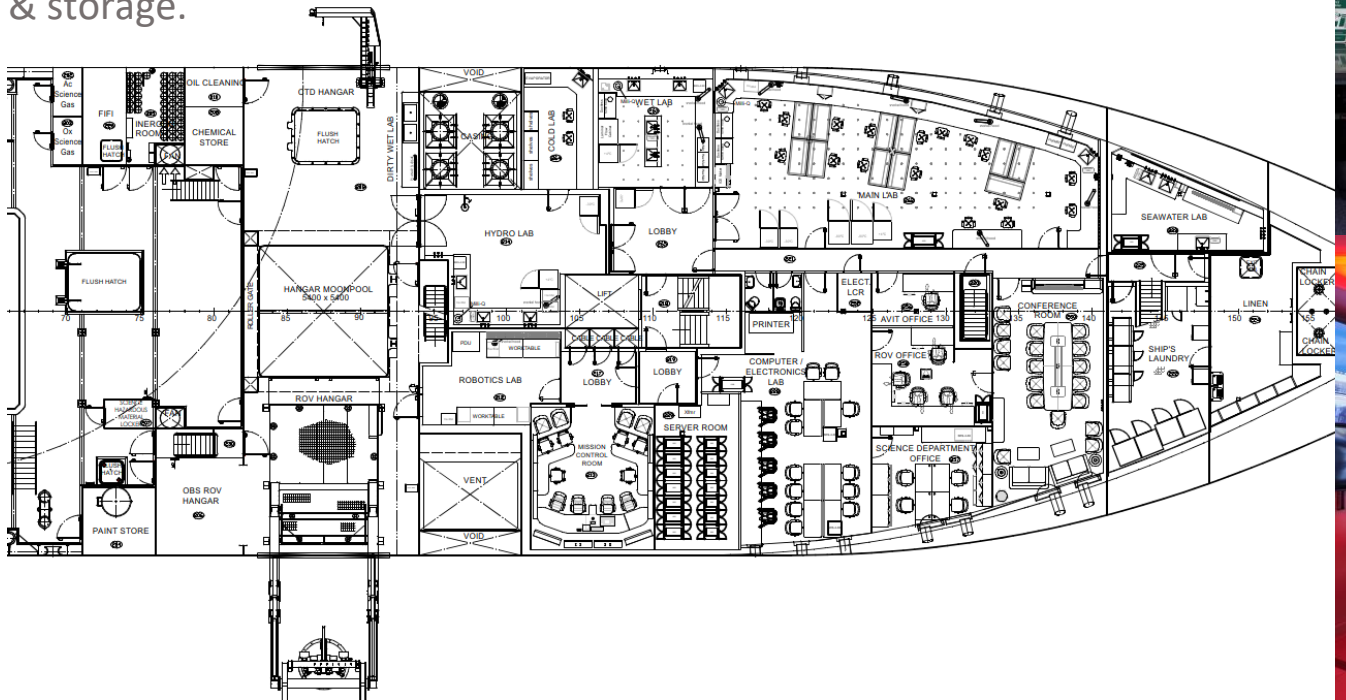
FREIRE SHIPYARD

WORKING SPACES, LABS, HANGARS

Larger campaigns with different group of specialized scientific working in different tasks: **INTEROPERABILITY** (working together).

The necessity of big working areas equipped

- Hangars for CTD, ROV, Corer, AUV.
- LABS: Wet, Chemical, Clean Sea water, Tº controlled laboratories.
- Services at deck & storage.

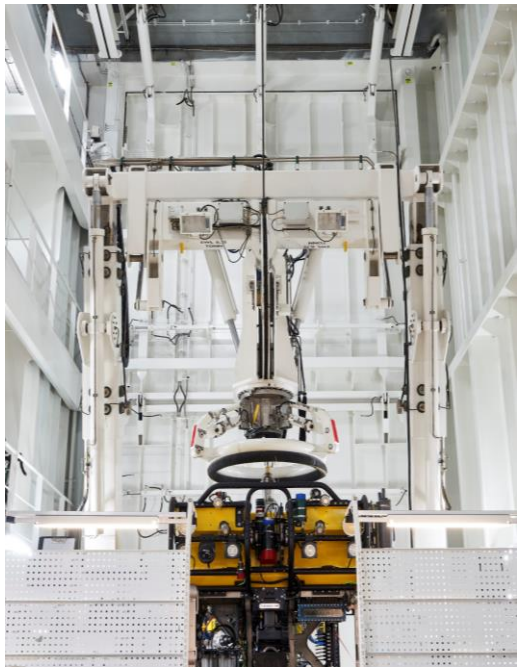


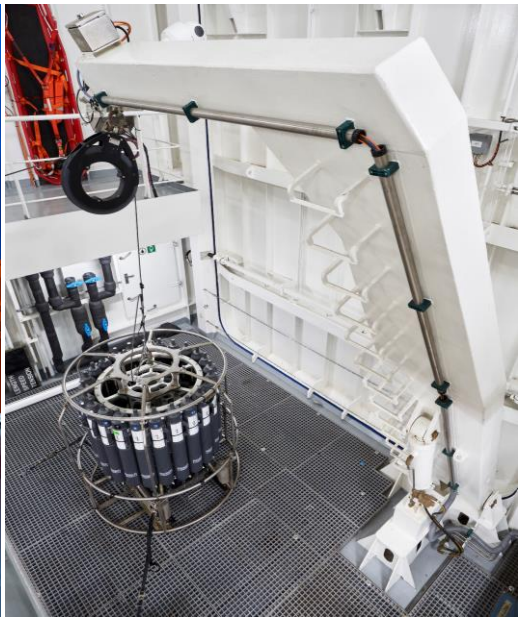
WORKING SPACES, LABS, HANGARS

The above leads to some considerations in the design of the vessels:

- **Possibility of easy scenarios modification, even at sea.**
- **Understanding of the different maneuvers on working deck with a lot of variety equipment.**
- **Services at deck: Hanging tools, Electricity, Fresh Water, Compress air, Hydraulic, Data etc.**
- **Operational controls areas.**
- **Standardization for working with different references from different countries/systems.**

MULTIDISCIPLINARY OR MORE SPECIALIZED PLATFORMS?





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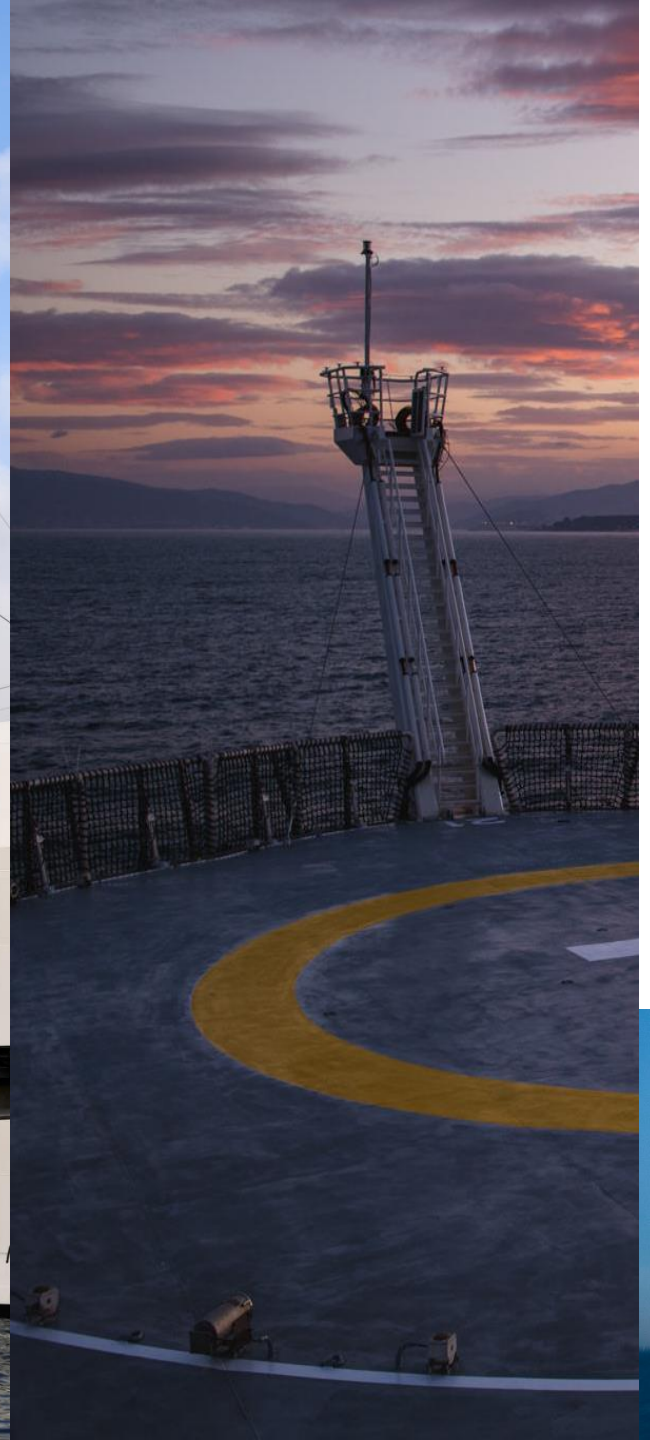


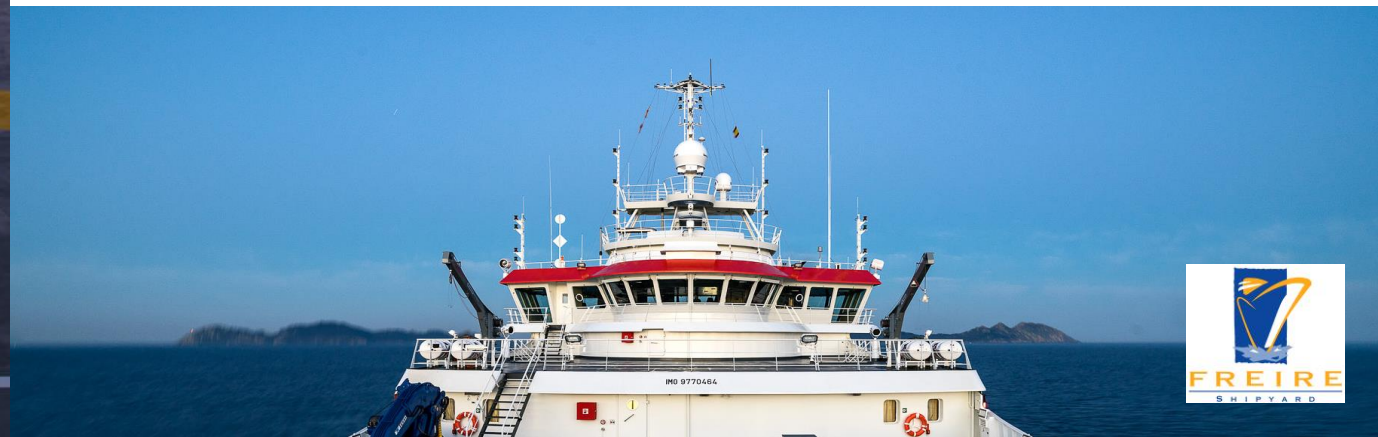
COMUNICATIONS, CYBERSECURITY

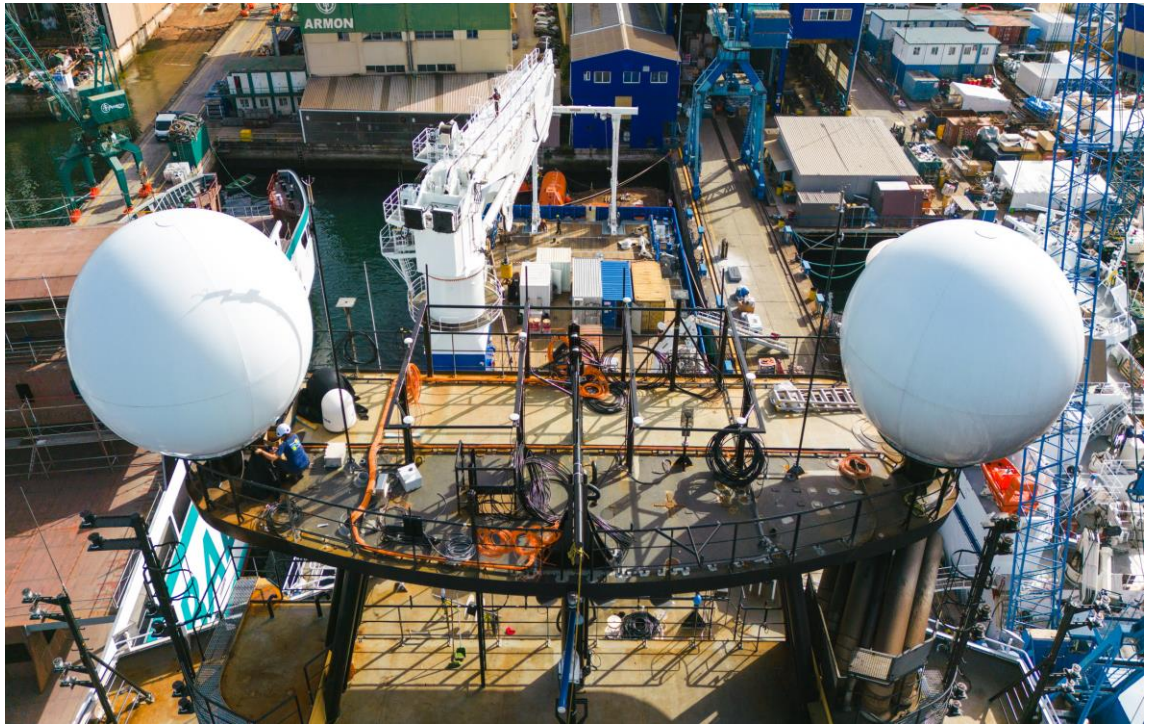
Research Vessels: Scientific + Technical antennas

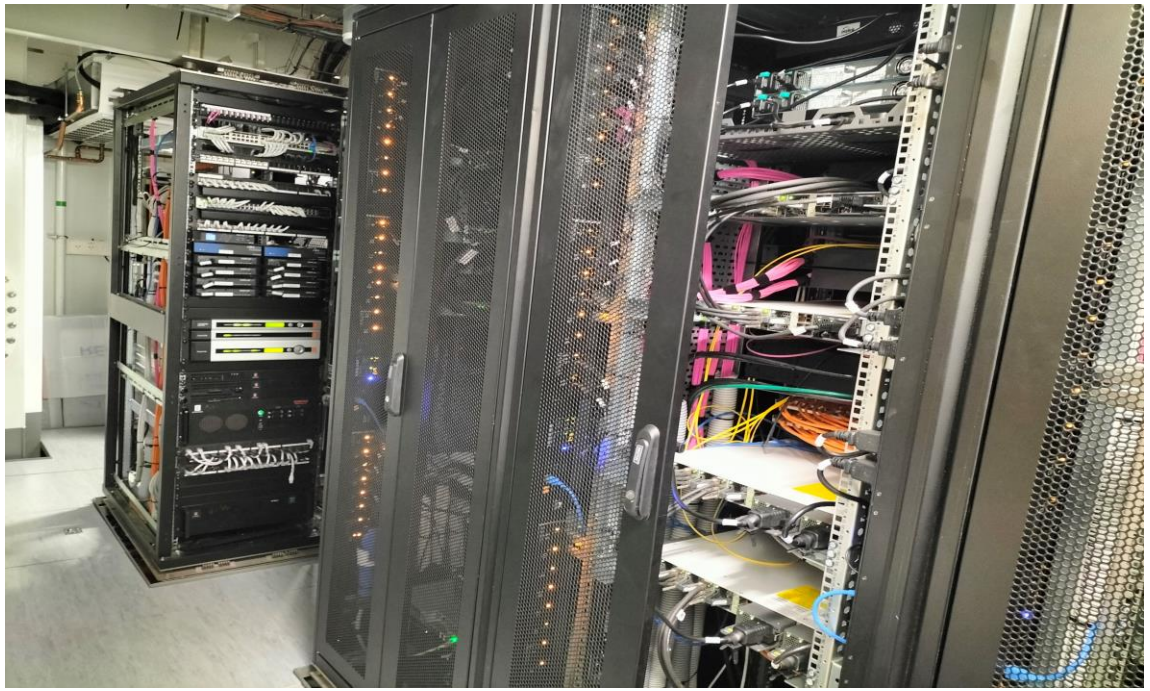
Moreover, necessity of interchanging a significant amount for data/information:

- **Increase of LAN networks.**
- **Increase capacity of communication antennas.**
- **Increase servers.**
- **Physical networks separation. Security zones**

Crews and scientific request to have personal communication with shore







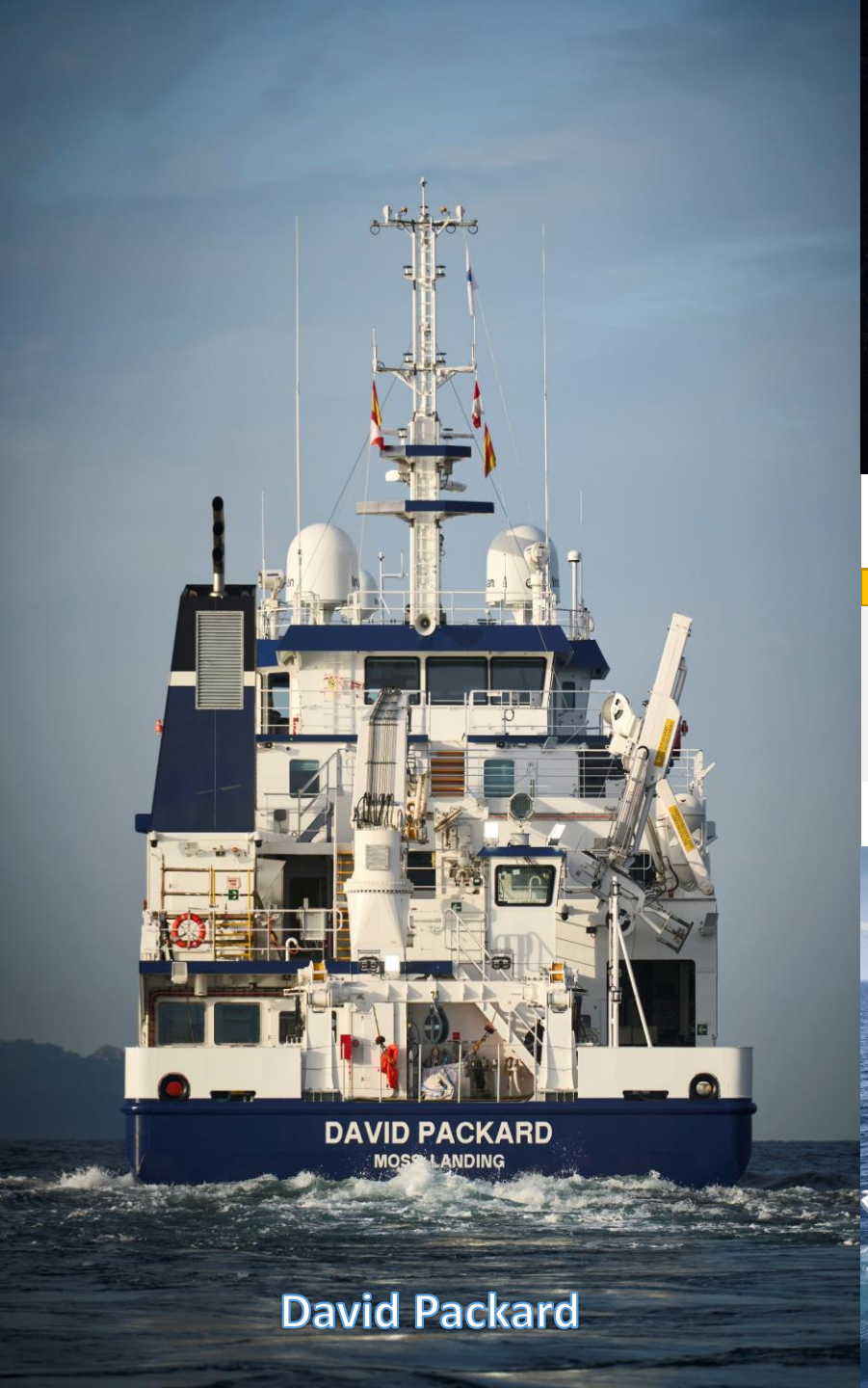
COMUNICATIONS, CYBERSECURITY

✓ **CYBERSECURITY**

New class and flag regulations. IACS 166. All new contracts from July 24

- Analysis from design: Involving designers, builders, suppliers & owners.
- Identify vital systems and study the security zones. Even interaction with those that seems not need of a security process.
- Protection against possible cyber attacks. Protocols.

FREIRE SHIPYARD



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Belgica

Thank You

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