ENABLING POLAR OPERATIONS INCL. AZIPOD®

NAVY TECH 2025

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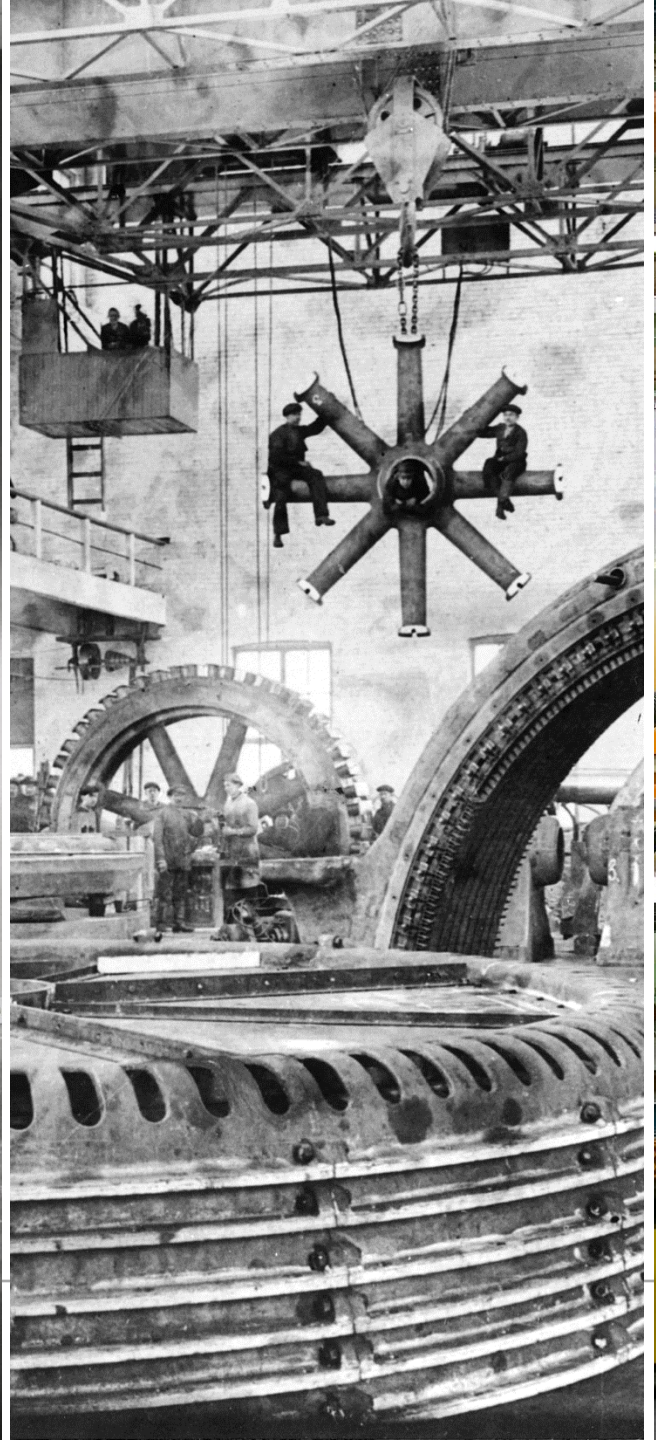
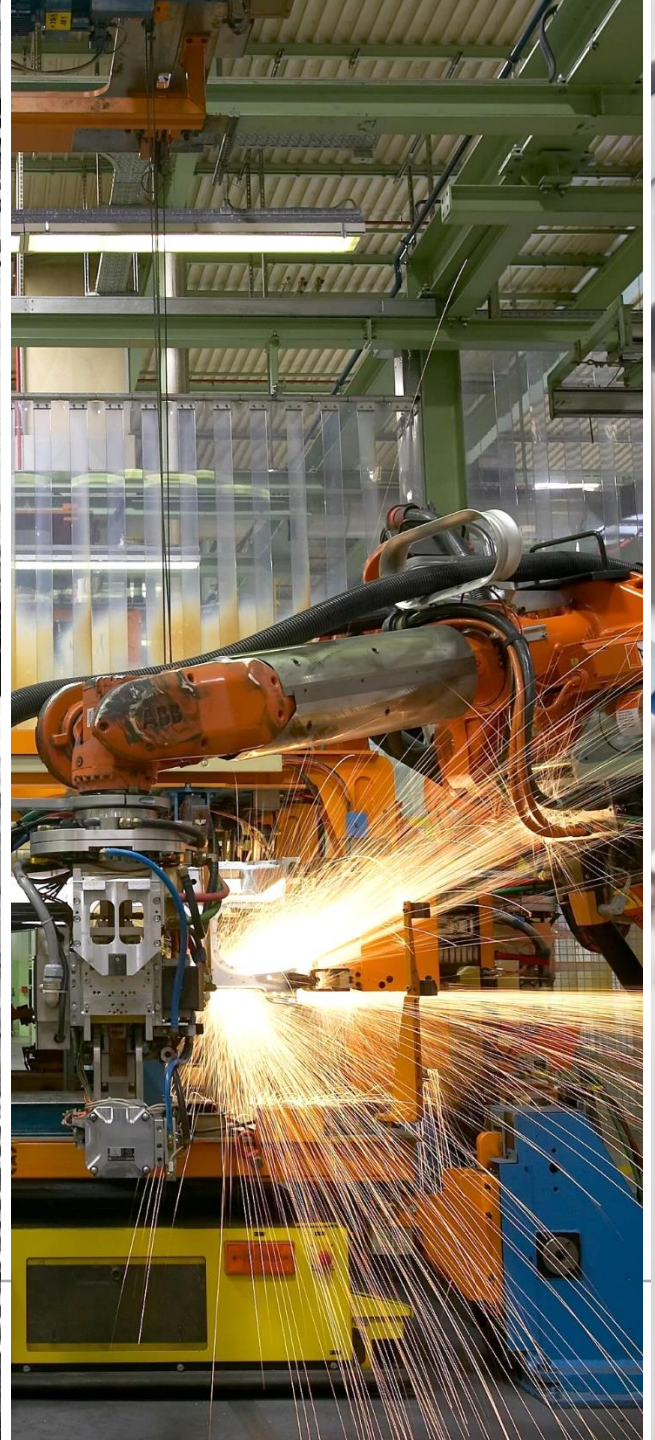
ENGINEERED
TO OUTRUN

ABB has been pushing the boundaries of technology for +140 years





Azipod® propulsion

Icebreaker operations Re-Thinked

Azipod® propulsion

Icebreaker operations Re-Thinked

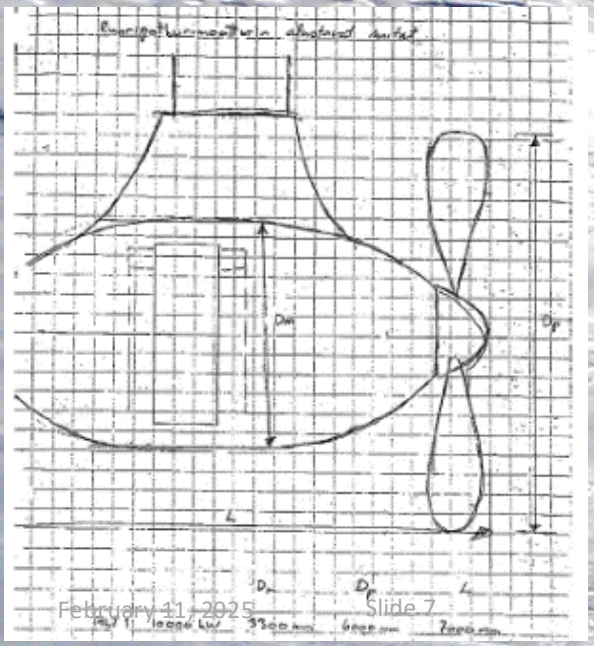
- Imagine free power vector
- Re-think operational approach
- No tugs
- No IB's for DA-vessels
- Increased safety and Operational envelope

Azipod® Value proposition

1. Enhanced maneuvering and control
2. Icebreaking done safely
3. Fuel savings up to 20%
4. DAS concept
5. Transition to zero carbon operations

History of Azipod® propulsion

From Concept to Conquer



Azipod® propulsion today

Key facts and figures

~90

Icebreakers or ice-going vessels

~110

cruise vessels ordered with Azipod® propulsion

18,000,000+

Azipod® operational hours in total

25+

Vessel types equipped with Azipod® propulsion

~610

Azipod® units in operation or on order

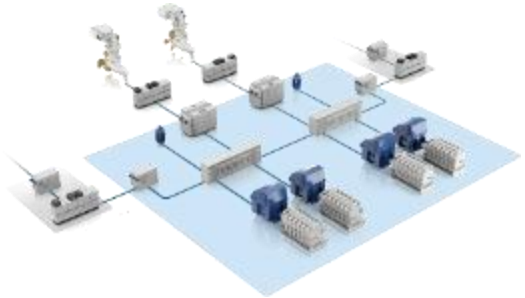
30

Years of successful operation

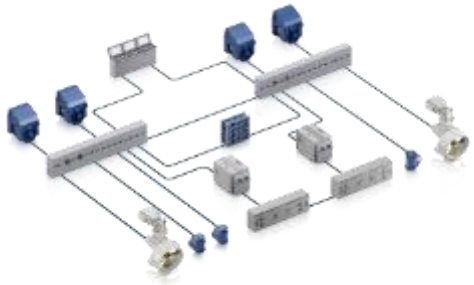
Typical ABB scope in Icebreaker new build

Path to improve energy efficiency and to decarbonize shipping

Electric power and propulsion systems as a backbone of electric and hybrid vessels



Up to 10% reduced fuel consumption with AC solutions



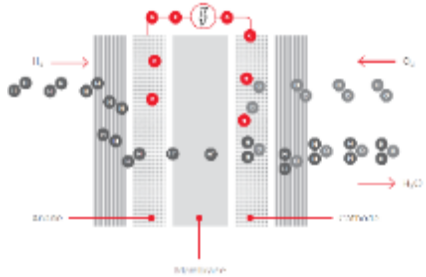
Azipod® electric propulsion

Additional 10% increased energy efficiency with Azipod® electric propulsion

Energy storage

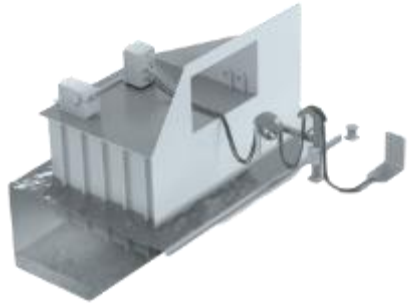
Hybrid or fully electric operation with stored energy and charging solutions

Fuel cells



Zero-emission operation with hydrogen fuel cell power system

Shore connection



98% greenhouse gas emissions eliminated in port call

Recent References
Coast Guard

US Coast Guard Polar Security Cutter

The Polar Security Cutter will fill a current, definitive need for the Coast Guard's statutory mission and **provide support for other mission needs in the higher latitudes vital to the economic vitality, scientific inquiry and national interests of the United States.**

The propulsion will be diesel electric and readily capable of breaking ice between six to eight feet thick.

Finnish Border Guard MPPV

"Our new patrol vessels will be **at sea about 330 days a year**, performing operations under busy and diverse conditions," said Commander Marko Aheristo, Head of Ship Technical Unit at the Finnish Border Guard.

"The vessels are designed for **low-emission operations** and for **energy efficiency** and need a versatile and sophisticated power and propulsion system based on advanced, proven technology.."

Canadian Coast Guard Polar Ice breaker

"The Canadian Coast Guard eagerly awaits the construction of the polar icebreakers, which will extend our on-water operations and ensure the continuous delivery of critical services in the high Arctic. This includes search and rescue, environmental and humanitarian response, as well as playing a key role in supporting ocean science.

Congratulations to Seaspan Shipyards and ABB on striking this new partnership," said Mario Pelletier, Commissioner, Canadian Coast Guard.

Recent References

NAVY

German Navy F126

“We selected ABB to supply **the integration of power and distribution systems** for the F126 Frigates because of their **outstanding expertise in DC power systems,”** says Damen Naval Managing Director Hein van Ameijden.

“The technical specifications offered by their systems will yield valuable flexibility and modularity to these state-of-the-art frigates, while **enabling the German Navy to adapt to rapidly developing energy sources.”**

Spanish Navy Juan Carlos I

The first **Azipod® propulsion** retrofit order for a naval vessel, replacing the existing system onboard the Spanish Navy flagship, Juan Carlos I

The contract follows a feasibility study that identified Azipod® technology as an optimal solution for the retrofit project

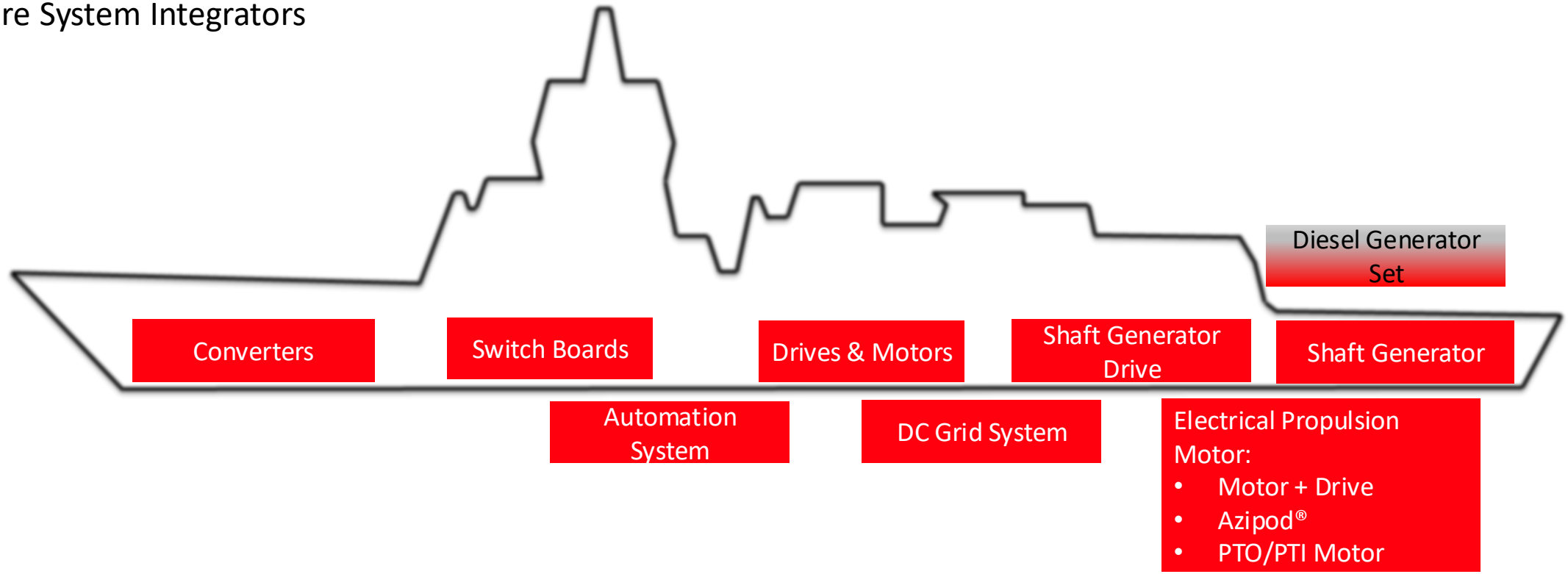
Dutch and Belgian navies

"It is a testament to the positive cooperation between our two companies and the quality of their systems that we have now also signed an agreement for the ASW project," ***explains Joop Noordijk, ASWF Project Director at Damen Naval. "ABB's Onboard DC Grid™ provides the operational efficiency and sustainability that the Dutch and Belgian navies demand from their new frigates."***

Marine Systems for Navy & Coast Guard applications

Integration from bridge to propeller

We are System Integrators



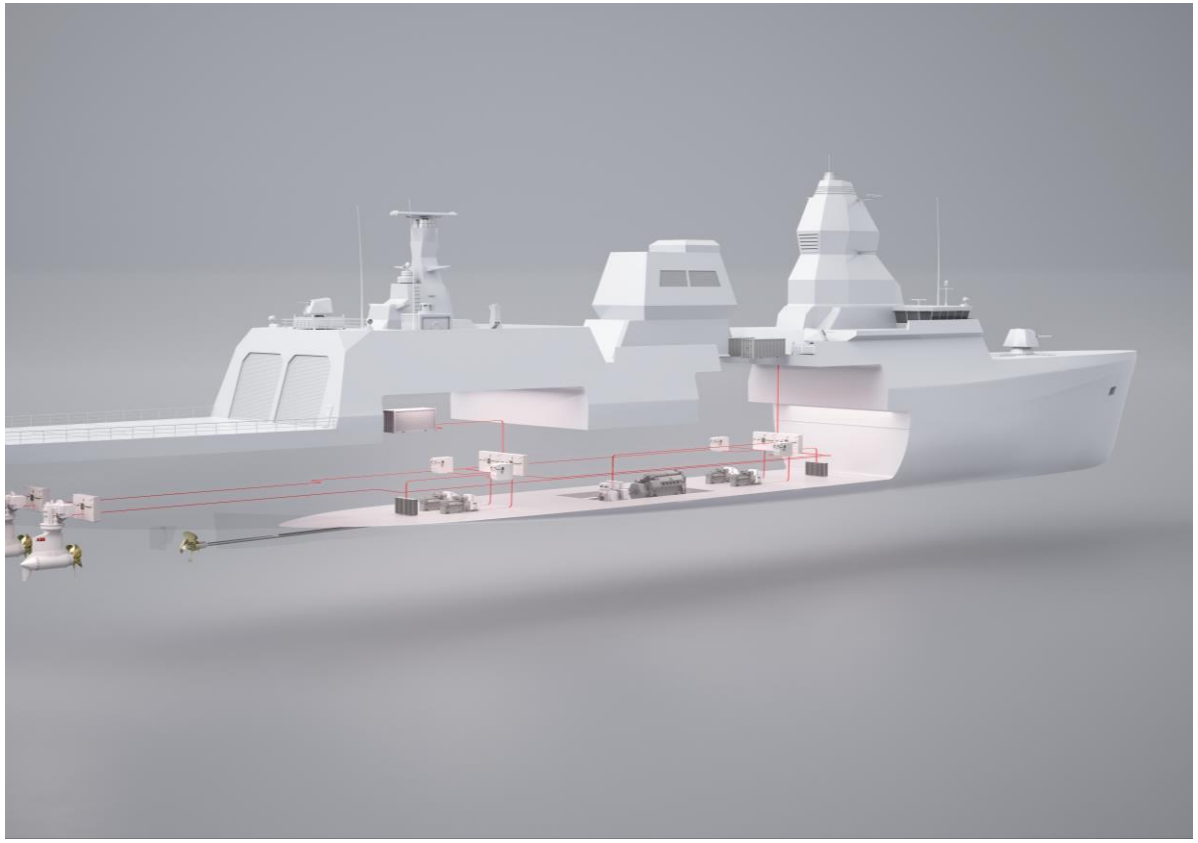
DC GRID Technology

Actual and Future . The Future is here

High Energy Demand systems increasing significantly
Requirements on Power systems

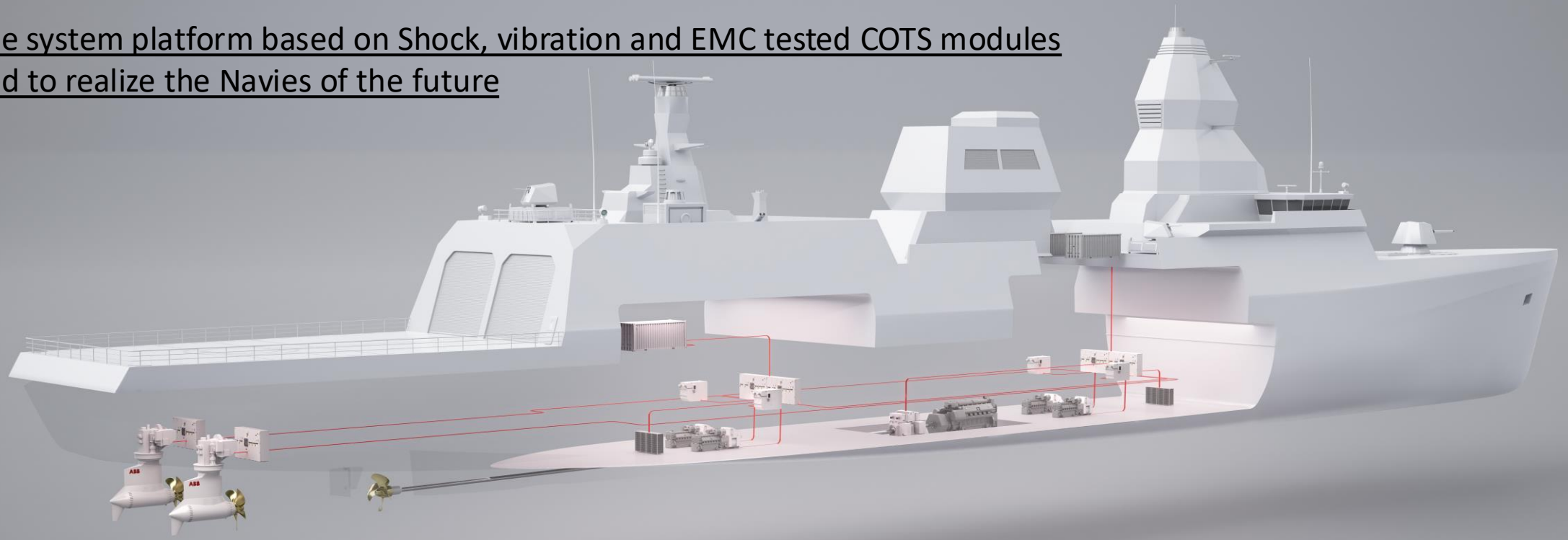
- Flexibility on propulsion system.
- High on board Energy demand
- New systems, Communications, Weapons
- Modularity
- Emissions

SYSTEM INTEGRATION



Onboard DC Grid™

A flexible system platform based on Shock, vibration and EMC tested COTS modules
Designed to realize the Navies of the future

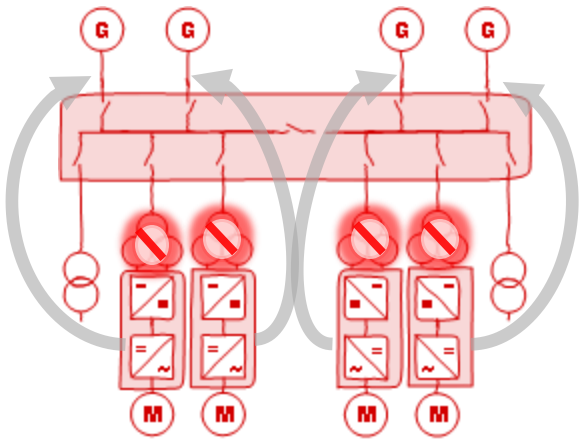


- ✓ Variable Speed generators
- ✓ Energy Storage integration
- ✓ Increased 440VAC Quality
- ✓ DC Mission Systems

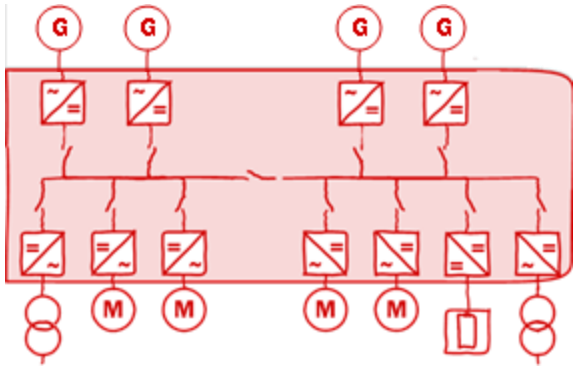
- ✓ Cabling benefits vs 690VAC
- ✓ Most Compact
- ✓ Most Efficient
- ✓ Futureproof & Flexible

DC on Navy Vessel

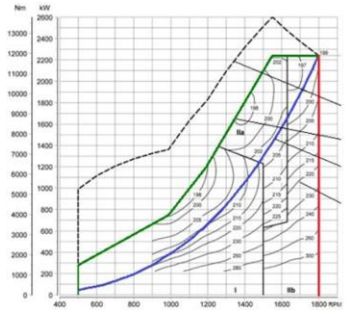
Traditional AC System

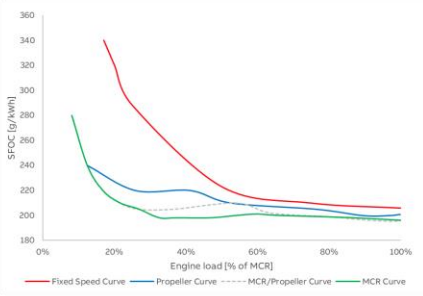


Onboard DC Grid™



Variable Speed Generators

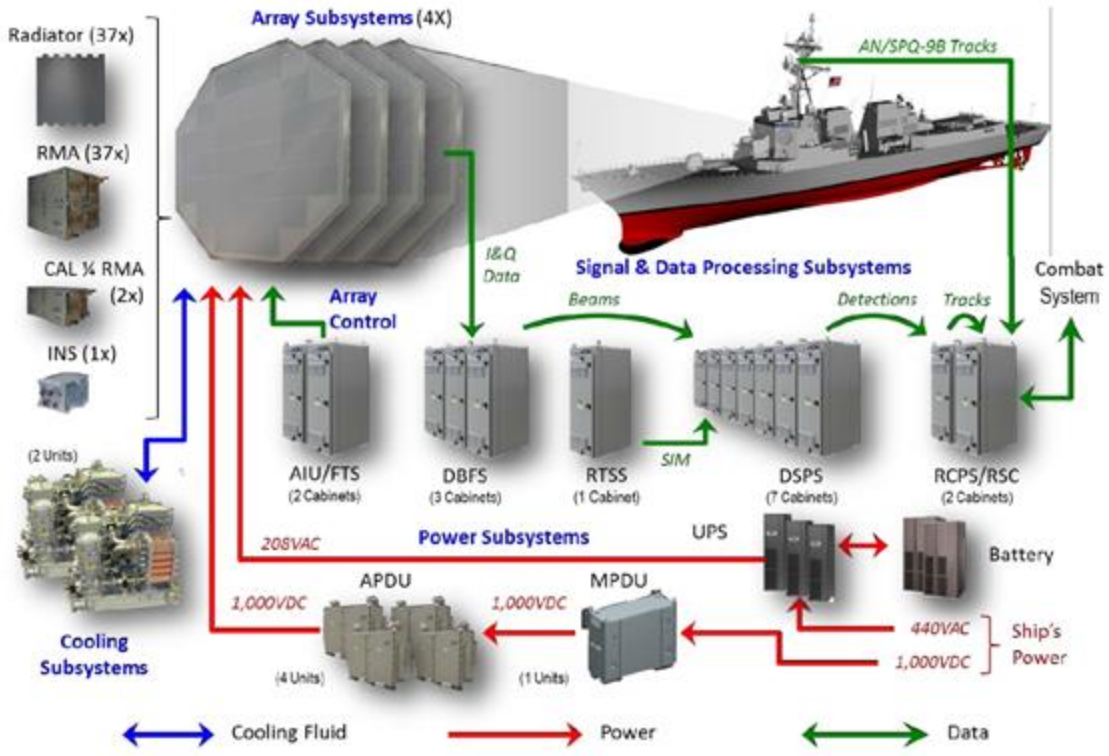




Energy Storage Integration

Mission loads – Inherently DC based

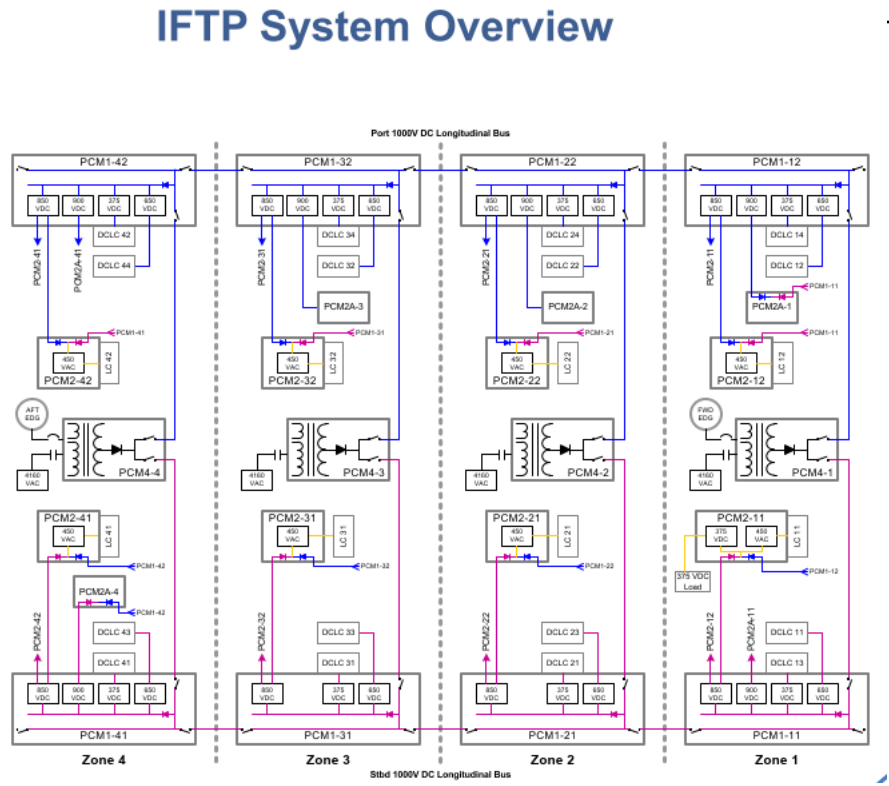
Raytheon SPY-6 1kV DC, LM SPY-7 375 VDC



IFTP DDG-1000/ PCM's

4 Electrical Zones

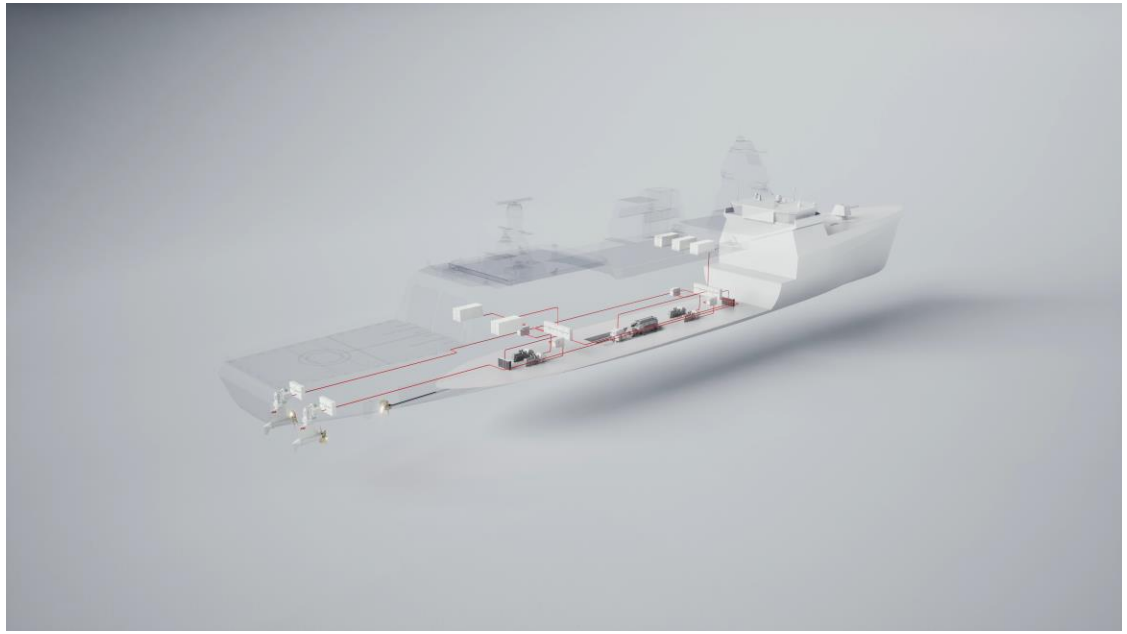
- (4) 3MW PCM-4s
- (8) PCM-1s with 375VDC Isolation and Load Centers attached
- (8) PCM-2s (5) with attached 450VAC Load Centers
- (3) Standalone 450VAC Load Centers
- (8) Standalone 650VDC Load Centers
- (4) PCM2A
- (8) AFD Controllers



DC Distribution with BESS on a Navy Vessel

Conclusions

1. **Distributed DC power generation with BESS provides:**
   - **Superior resilience and survivability**
   - **Increased efficiency and Dynamic performance**
   - **Futureproof for Pulsed loads and Mission systems**
2. **Selected LTO in small footprint < 5 ton**
   - **250 kWh Energy**
   - **2.5 MW Pulsed power available**
   - **Extraordinary life cycle**
3. **Can be achieved in a safe manner even for combatants**



Thank you for your attention!

ABB – stand 42

ALEJANDRO ZORZO

SAMPO VIHERIÄLEHTO