



NAVAL

STEALTH ELECTRIC PROPULSION AND POWER SYSTEMS FOR THE ENTIRE FLEET





MODULARITY – INTEGRATED ELECTRIC PROPULSION & EDF

John O Teige – VP Sales & Business Development



AGENDA

1. INTRODUCTION TO STADT
2. FOU - STADT & FMA - NAVAL STEALTH PROPULSION PROJECT
3. EDF – MMPC –MODULAR MULTIROLE PATROL CORVETTE PROGRAM
4. THE ALL ELECTRIC NAVAL SHIP & INTEGRATED ELECTRIC PROPULSION (IEP)

STADT HISTORY

35 YEARS IN AC DRIVES

LEAN DRIVE - SYSTEM INTEGRATION

PWM DRIVE DEVELOPMENT



Two divisions :
 - STADT COMMERCIAL
 - STADT NAVAL

MORE THAN 150 SHIPS AND RIGS POWERED BY STADT DRIVES

THE LEAN PROPULSION PHILOSOPHY & DESIGN

- Disruptive design
- Remove unnecessary elements
- Close to Zero power-loss
- Well proven
- Low weight and space
- Scalable for high power
- Experience and Knowhow
- Sustainability
- Reliability
- SILENT – by all means



→ Made out of passion for low Life Cycle Cost for Ship owners

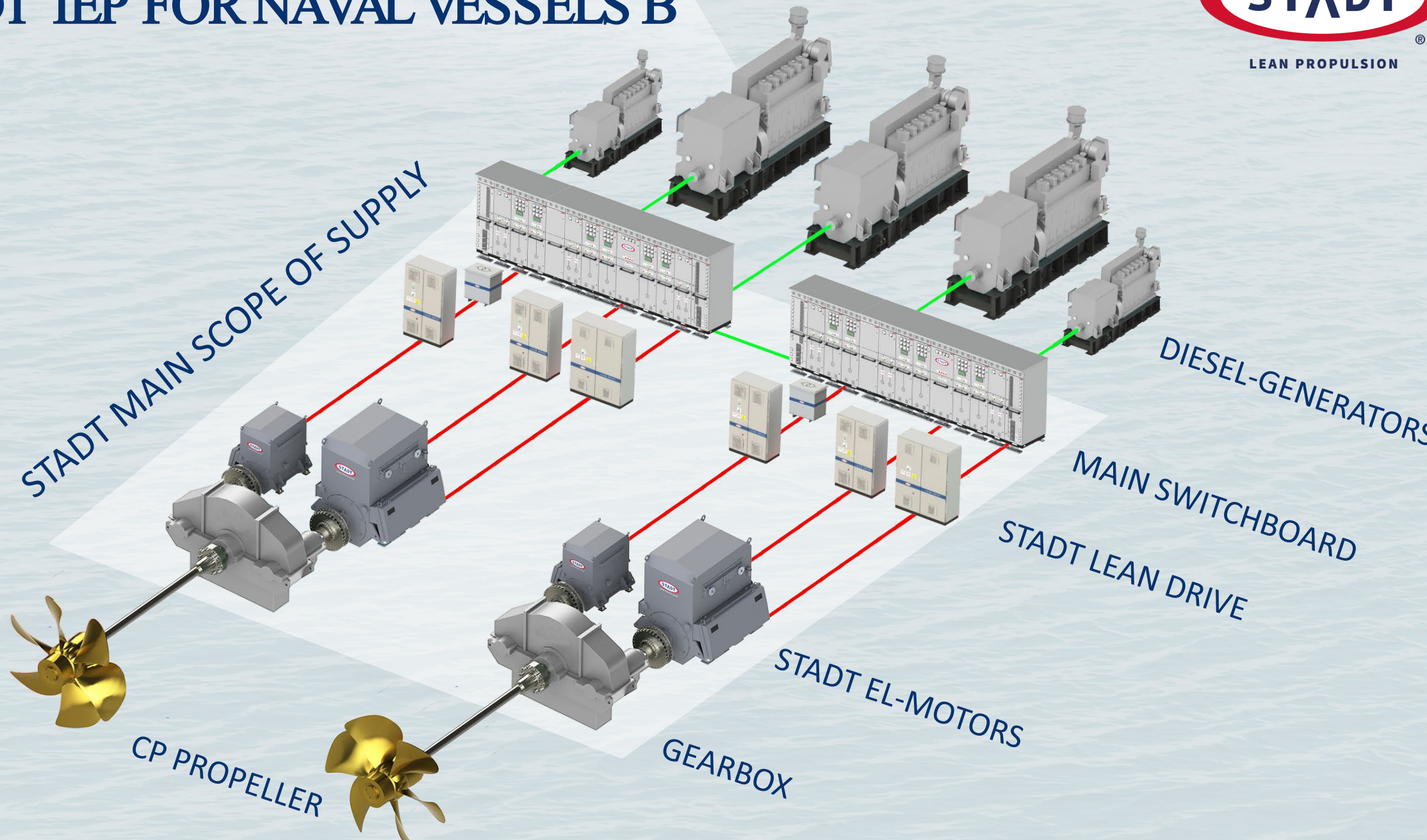
STADT HIGHLIGHTS



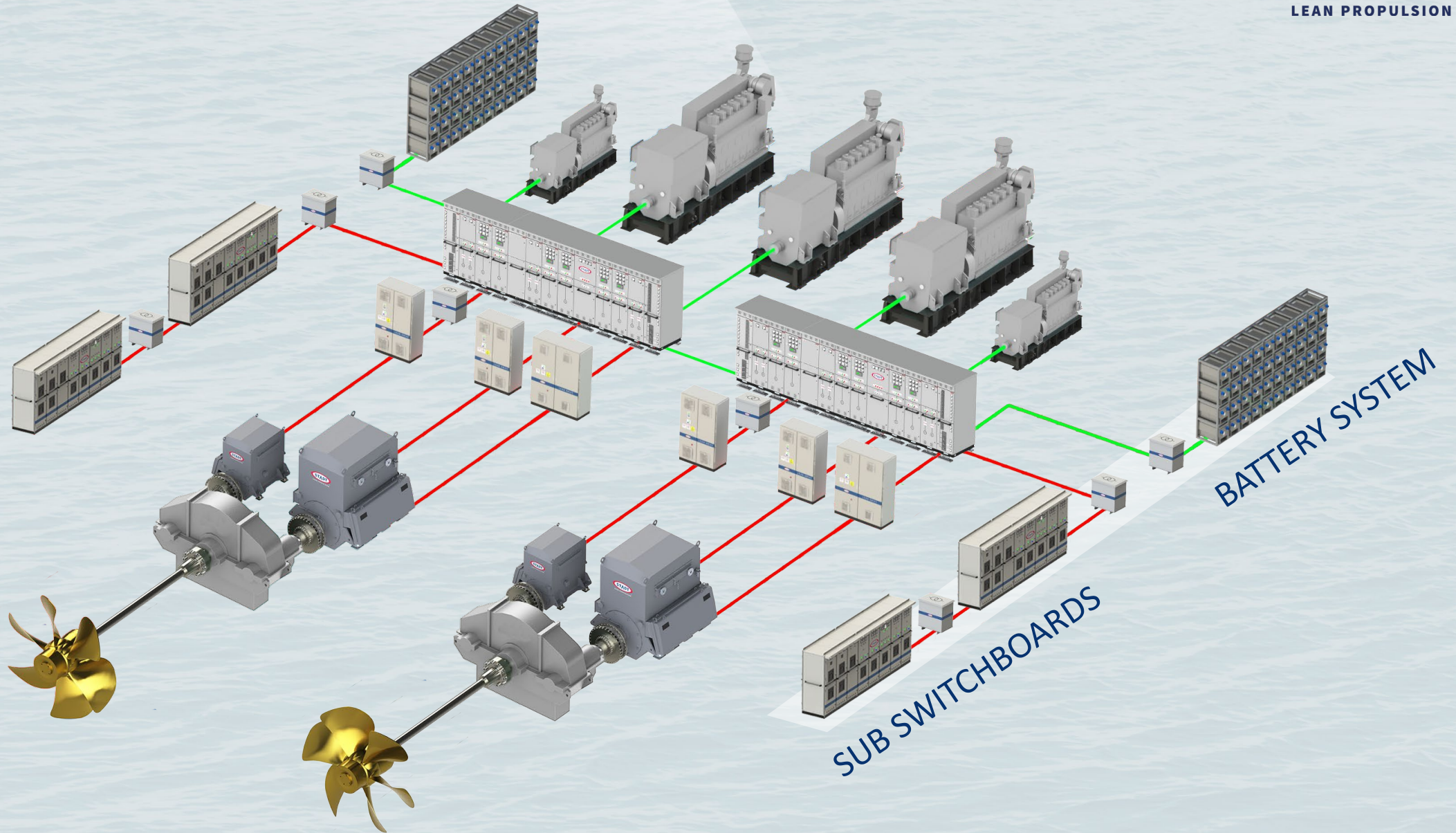
- ^ **Experienced System Integrator** and supplier of electric propulsion
- ^ **Disruptive design** - Lean way of thinking - a challenger
- ^ Highly **efficient** and **reliable** solutions
- ^ For any type of vessel and **any power source or fuel**
- ^ **STEALTH**- no electrical interference – low Underwater Radiated Noise (URN)
- ^ Future proof- modularized - **zero emission** ready
- ^ Highly scalable in power and voltage - **from 1 MW to 50 MW** per propeller
- ^ **Awarded** for innovation - world wide patented



STADT IEP FOR NAVAL VESSELS B



STADT NAVAL IEP SOLUTION





THE LEAN DRIVE
- with STEALTH performance

STADT - FMA Stealth Naval Propulsion Project

R&D PROJECT IN COOPERATION WITH FMA MARKAP



STEALTH NAVAL PROPULSION PROJECT

R&D project to meet future goals for electric propulsion drive technology for Norwegian Navy - future vessels

Phase 1 – Define and meet requirements for signature – acoustic, magnetic, electromagnetic

Phase 2 - Define and meet requirements for shock and vibration



PROJECT GOALS

- **INCREASED OPERATIONAL CAPABILITY**
- **ENSURE FLEXIBLE AND FUTURE-ORIENTED PROPULSION TECHNOLOGY**
- **CONTRIBUTE TO REDUCED SERVICE AND MAINTENANCE COST**
- **SUPPORT UN SUSTAINABLE DEVELOPMENT GOALS**
 - **COMMERCIAL DEVELOPED TECHNOLOGY - FOR MILITARY USE**
 - **as commercial as possible - as military as required**
- **CONTRIBUTE TO INCREASED EXPORT OF NORWEGIAN MILITARY TECHNOLOGY**



STATUS - PROTOTYPE DEVELOPED



- Developed and completed according to plan and specification
- Based on standards defined by FMA-MARKAP
- Test environment established in STADT test-facilities
- Test procedures and test equipment according to FMA standards

STATUS - TESTS ON PROTOTYPE PERFORMED



- Signature tests : Magnetic, Acoustic, EMI, EMC and THD performed during March
- Preliminary main findings:
 - Zero Electro Magnetic Interference and low acoustic signature verified
 - Very low URN from measured on commercial ship sailing with STADT Technology
- Final analysis, test-result and test-report finalized by May 22

EUROPEAN DEFENCE FUND - MMPC PROGRAM

MODULAR MULTIROLE PATROL CORVETTES



EDF – MMPC PROGRAM – BACKGROUND

- European Union is facing increased types of threats
- A strong call for Europeans to take responsibility for own security.
- EU to develop common military capabilities to face common challenges
- Need to meet 21 century military challenges

DEVELOPMENT OF NEW EUROPEAN PATROL CORVETTES

- **Ambitious project – common development of new naval capacities and capabilities across EU nations**
- **Break down national barriers and establish common platform and standards for EU nations (...ref US)**
- **Increase cooperation and competitiveness of European Defence Industry to design, development of a new family of Naval ships**
- **Define common standard, interfaces & type of vessels - at same time able to meet individual national requirements**



EPC CONSORTIUM – NAVIRIS



- Fincantieri, Naval Group, and Navantia boost their cooperation for the Modular Multirole Patrol Corvette (MMPC) program → EPC project
- Work together in order to develop the first common naval capability in Europe.
- **Naviris** (joint venture between Fincantieri and Naval Group) with selected partners submitted industrial proposal to EDF for the MMPC call

EPC OVERALL GOALS



- **Dramatically increase flexibility** of 2nd line vessels
 - **Extended range of capacities** both during peace- and wartime
 - Expand naval capacities for **interoperability and cooperation** between European Countries
 - **Modularity** in design – **flexibility** in mission
 - Significantly increase **availability and sustainability**
- Develop **modular, flexible, energy-efficient, green, safe, interoperable, and cyber-secure** family of ships

STADT –CHOSEN EPC CONSORTIUM PARTNER FOR IEP

➤ System design - **preliminary and basic design** for hybrid and electric propulsion.

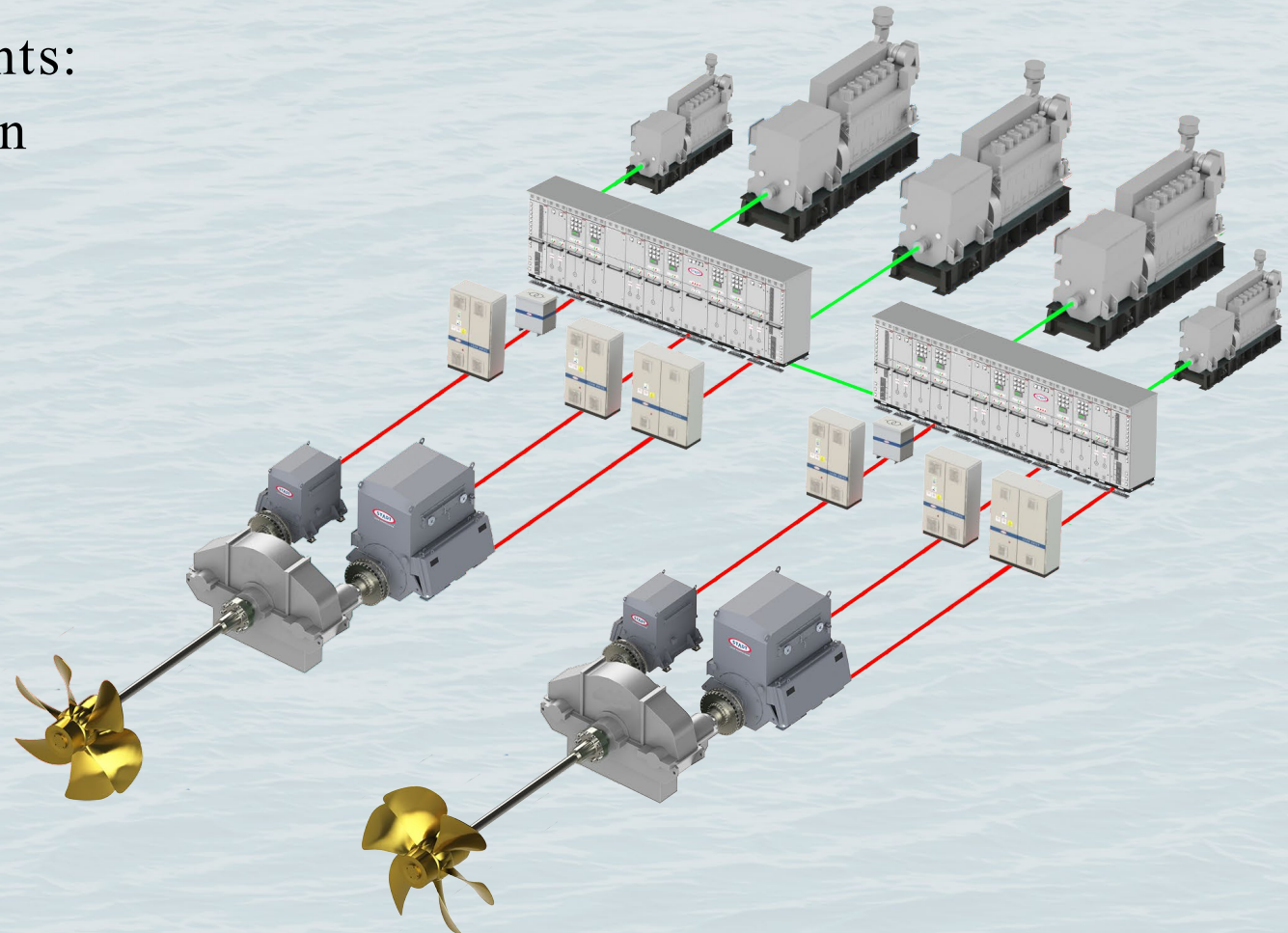
➤ Studies and design for main components:

- Switchboards & Electric Distribution
- Electric drives,
- Electric motors,
- Geared propulsion solutions
- Power management system

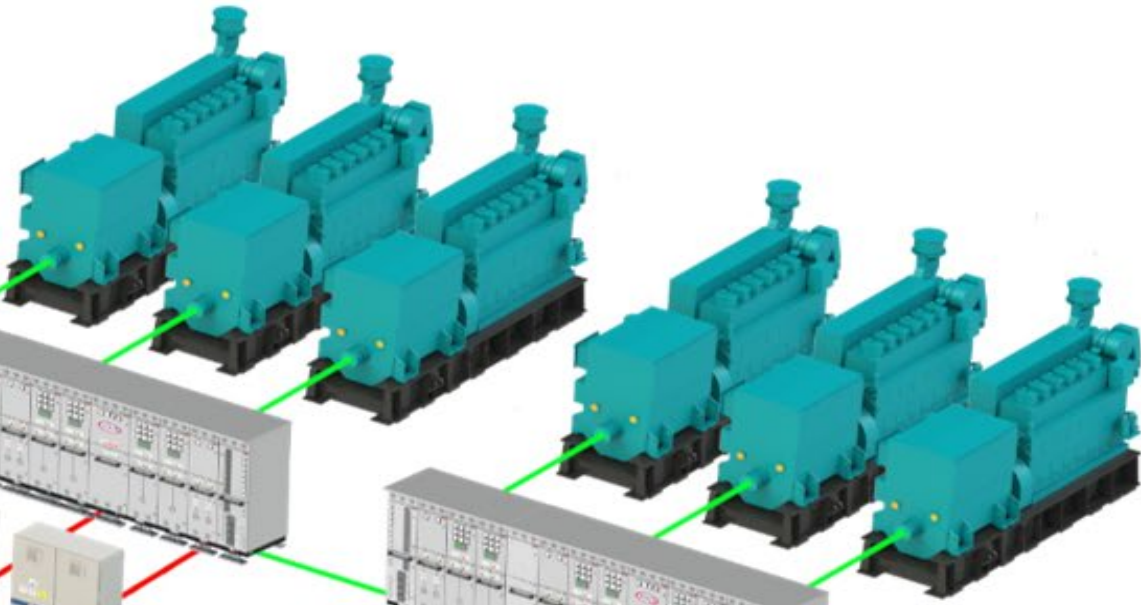
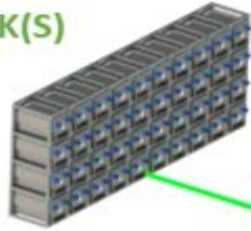
➤ Vital part of studies and design will be:

- interface definition
- integration
- Modularisation

➤ Potential supply of IEP to 1 + 19 vessels



BATTERY PACK(S)



GEN-SETS

- PURE FUEL / DUEL FUEL
- DIESEL/AMMONIA /H2/BIO

STADT LEAN PROPULSION

- STADT AC SWITCHBOARDS
- STADT LEAN ELECTRIC DRIVES
- STADT ASYNCHRONOUS EL-MOTORS
- POWER MANAGEMENT SYSTEM

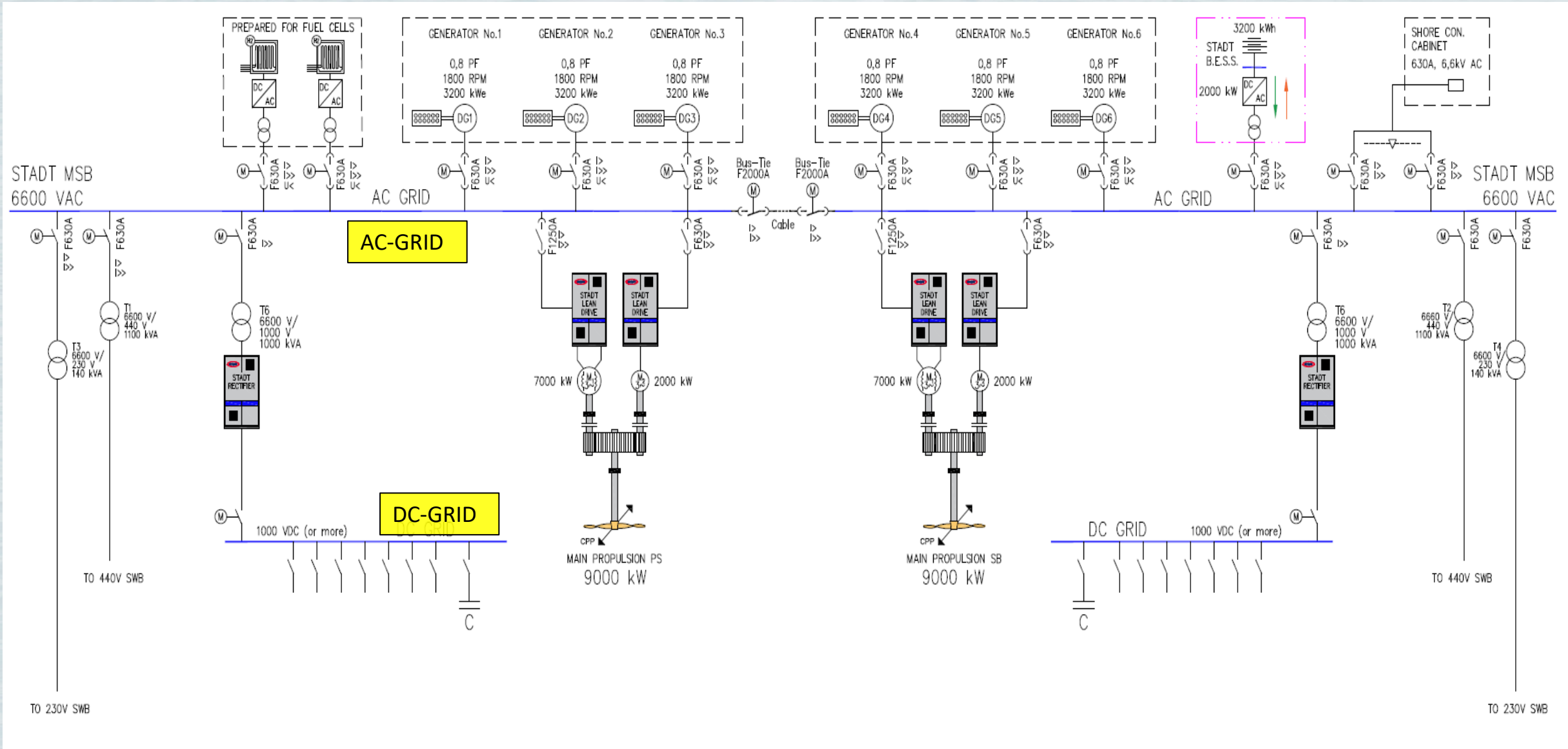
GEAR AND CP-PROPELLER

- SHAFTLINE / AZIMUTH

GRID STRUCTURE – SINGLE LINE DIAGRAM



LEAN PROPULSION



AWARD CRITERIA FOR PARTNERSHIP IN EPC

- **Disruption and Excellence** for Naval Vessels
- **Innovation** and technological development for **European Defence industry**
- **Competitiveness**
- Contribution to creation of **cross border cooperation**
- **Quality and efficiency** during implementation
- Increased efficiency across the **life cycle** of technology
- Environmental – **sustainability**

The full electric Naval Ship - IEP



FUTURE WARSHIP – TRENDS AND REQUIREMENTS

- **INCREASED ELECTRIC POWER NEEDED**
 - INCREASING NUMBER OF ELECTRIC CONSUMERS ON BOARD
 - HIGH POWER RADARS AND PULSE WEAPONS
 - ELECTRIC PROPULSION
 - FLEXIBILITY TO USE ELECTRIC POWER WERE NEEDED

- **MULTI ROLE OPERATION → FLEXIBILITY**
- **AVOID DETECTION → STEALTH OPERATION & LOW SIGNATURE**
- **SURVIVABILITY/ LOW VULNERABILITY → REDUNDANCY AND SAFETY**
- **MODULARITY - STANDARD INTERFACE**
- **LESS CREW / UNMANNED SHIPS**
- **AUTONOMOUS / AUTOMATION**
- **GREEN AND SUSTAINABLE NAVAL SHIPS**

- ➔ **CALLS FOR THE ALL ELECTRIC NAVAL SHIP & IEP**



STATEMENTS FROM ADMIRALS



“ ONE OF THE THINGS THAT IS REALLY IMPORTANT FOR US AS WE BUILD THESE PLATFORMS, IS TO MAKE SURE THAT PLATFORMS HAVE ENOUGH SPACE, WEIGHT, AND POWER SO THAT YOU CAN MODERNIZE AND ADAPT TO FUTURE THREATS.

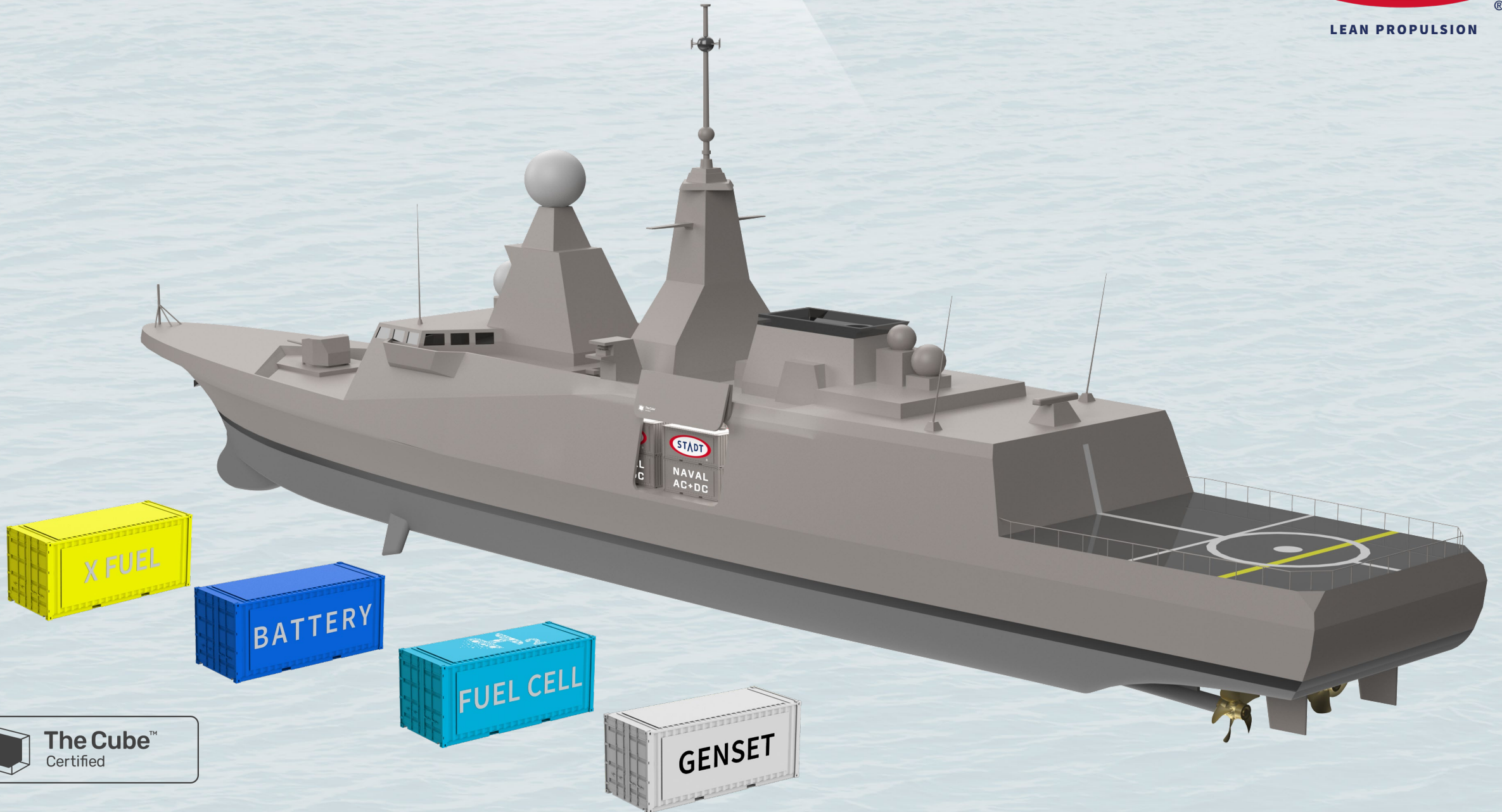
VICE ADMIRAL THOMAS MOORE
COMMANDER, NAVAL SEA SYSTEMS COMMAND



“ I’M GOING TO BUY AS MUCH AS I CAN AFFORD. AS MUCH POWER AS I CAN AFFORD. BECAUSE I KNOW BY THE TIME I RETIRE THE SHIP I’LL USE IT ALL.

ADMIRAL JOHN M. RICHARDSON
31st CHIEF OF NAVAL OPERATIONS

FULL ELECTRIC WAR SHIP – MODULARIZATION





LEAN PROPULSION

The Cube[™]
Certified



NAVAL
AC+DC

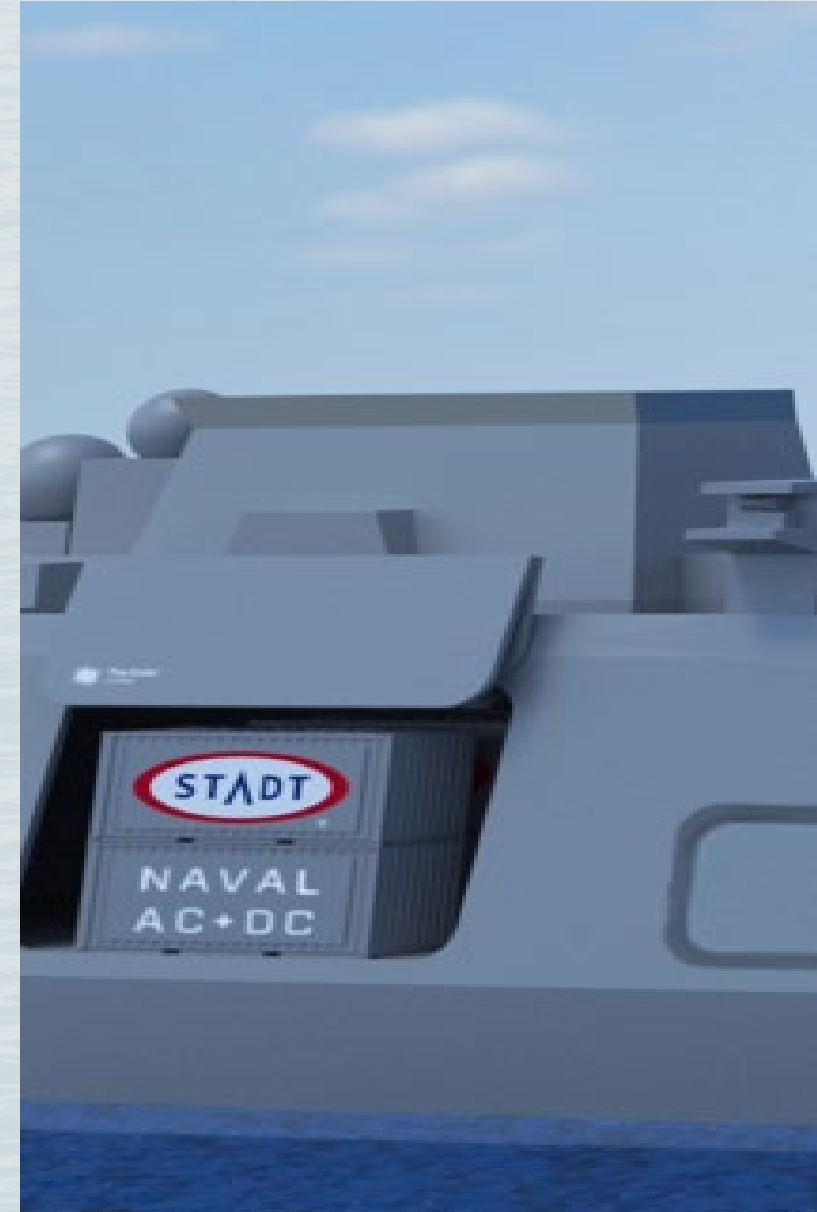




WHY LEAN PROPULSION FOR NAVAL SHIPS



- RELIABILITY & REDUNDANCY
- STEALTH OPERATION - LOW UNDERWATER NOISE
- HIGH EFFICIENCY → ENDURANCE / EXTENDED OPERATION RANGE
- REDUCED WEIGHT AND SPACE → MORE SPACE FOR WARSHIP MATERIAL
- HIGH MTBF – SHORT MTTR → LOW MAINTENANCE & LIFE-CYCLE COST
- LONG LIFETIME – DESIGNED AND PROVED FOR +30 YEAR
- EASE IN OPERATION AND MAINTENANCE → REDUCED TECHNICAL CREW
- FUTURE PROOF - FLEXIBLE AND MODULAR



STADT NAVAL PROJECTS



LEAN PROPULSION

STADT Engineering & Shipbuilding
www.stadts.com



Zumwalt-class destroyer (USA)

STADT Engineering & Shipbuilding
www.stadts.com



Gerald R Ford-class carrier

STADT Engineering & Shipbuilding
www.stadts.com



Ticonderoga-class cruiser

STADT Engineering & Shipbuilding
www.stadts.com



Arleigh Burke-class destroyer

STADT Engineering & Shipbuilding
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Harpers Ferry-class dock landing ship

Freedom-class littoral combat ship



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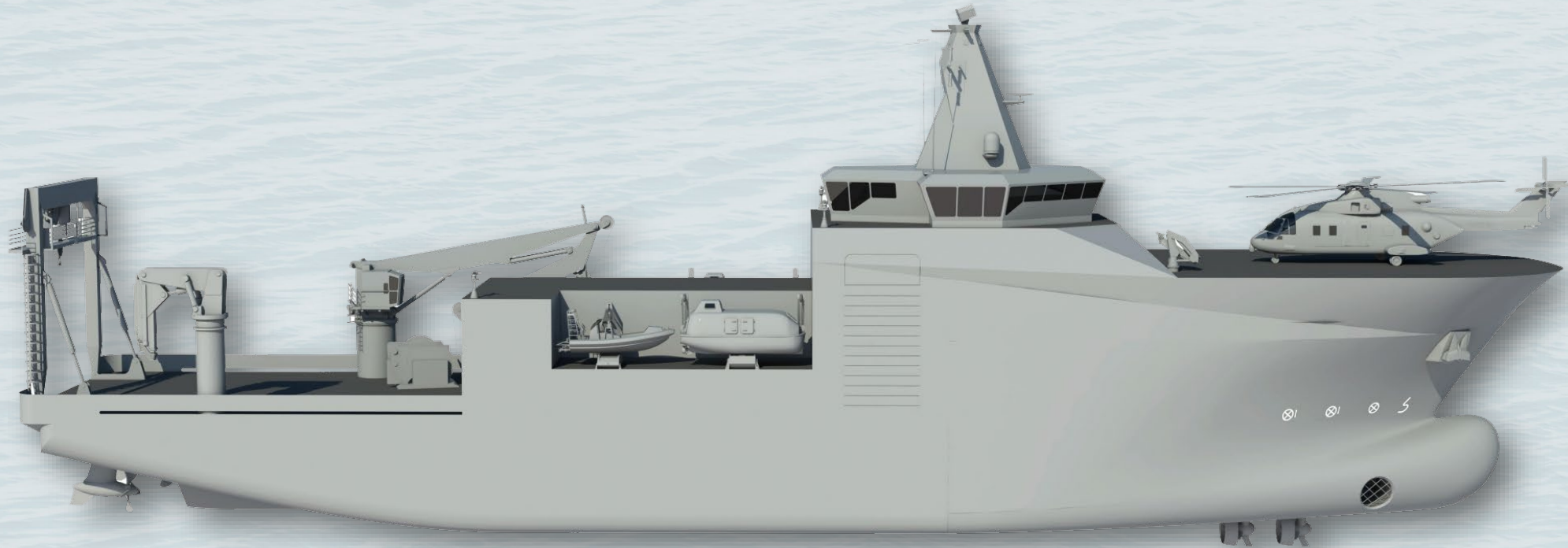
SIGNAL INTELLIGENCE VESSEL – EUROPE - IEP



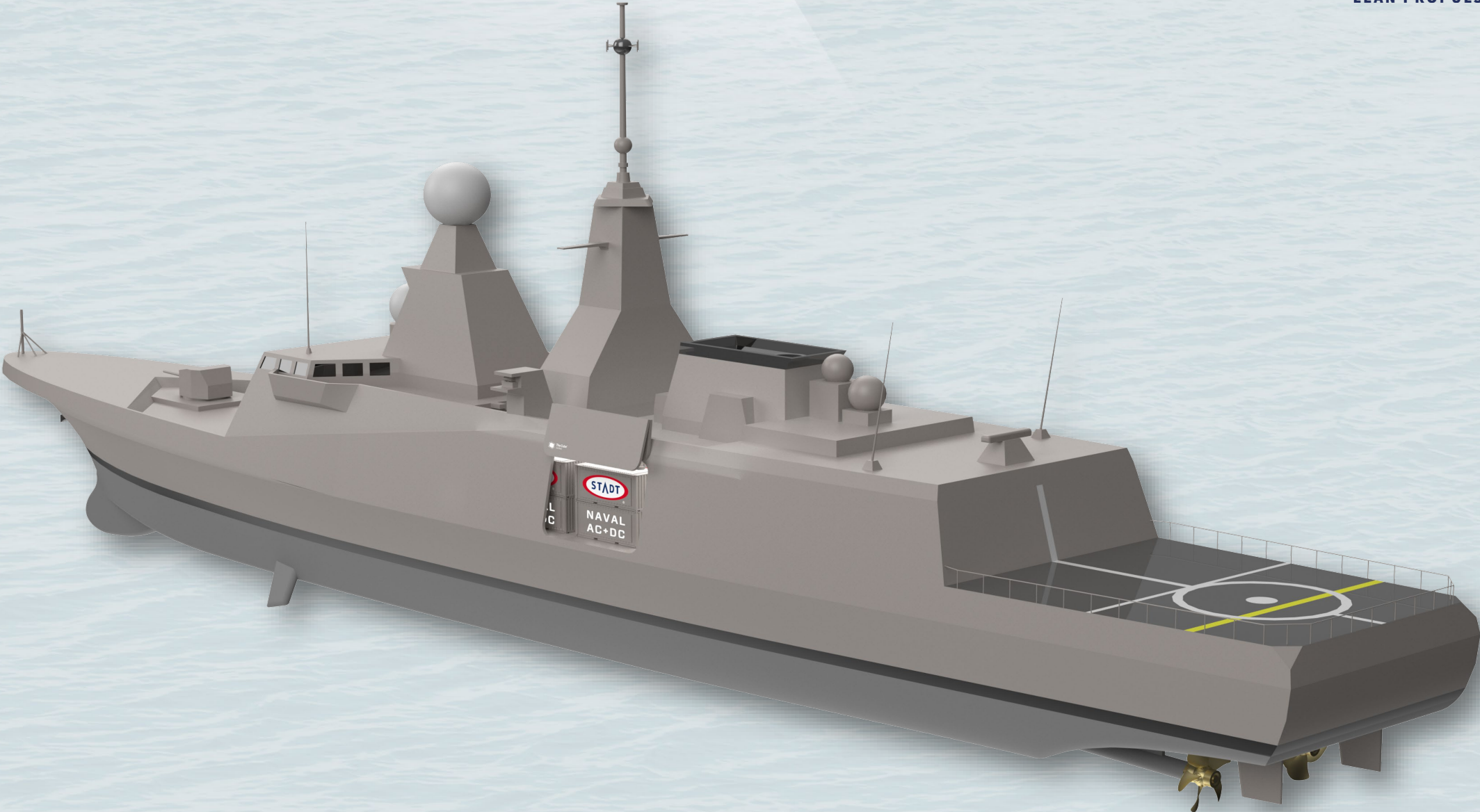
MULTI ROLE COMBAT VESSEL – FRIGATE - IEP



SUBMARINE RESCUE VESSEL - NATO COUNTRIES - IEP



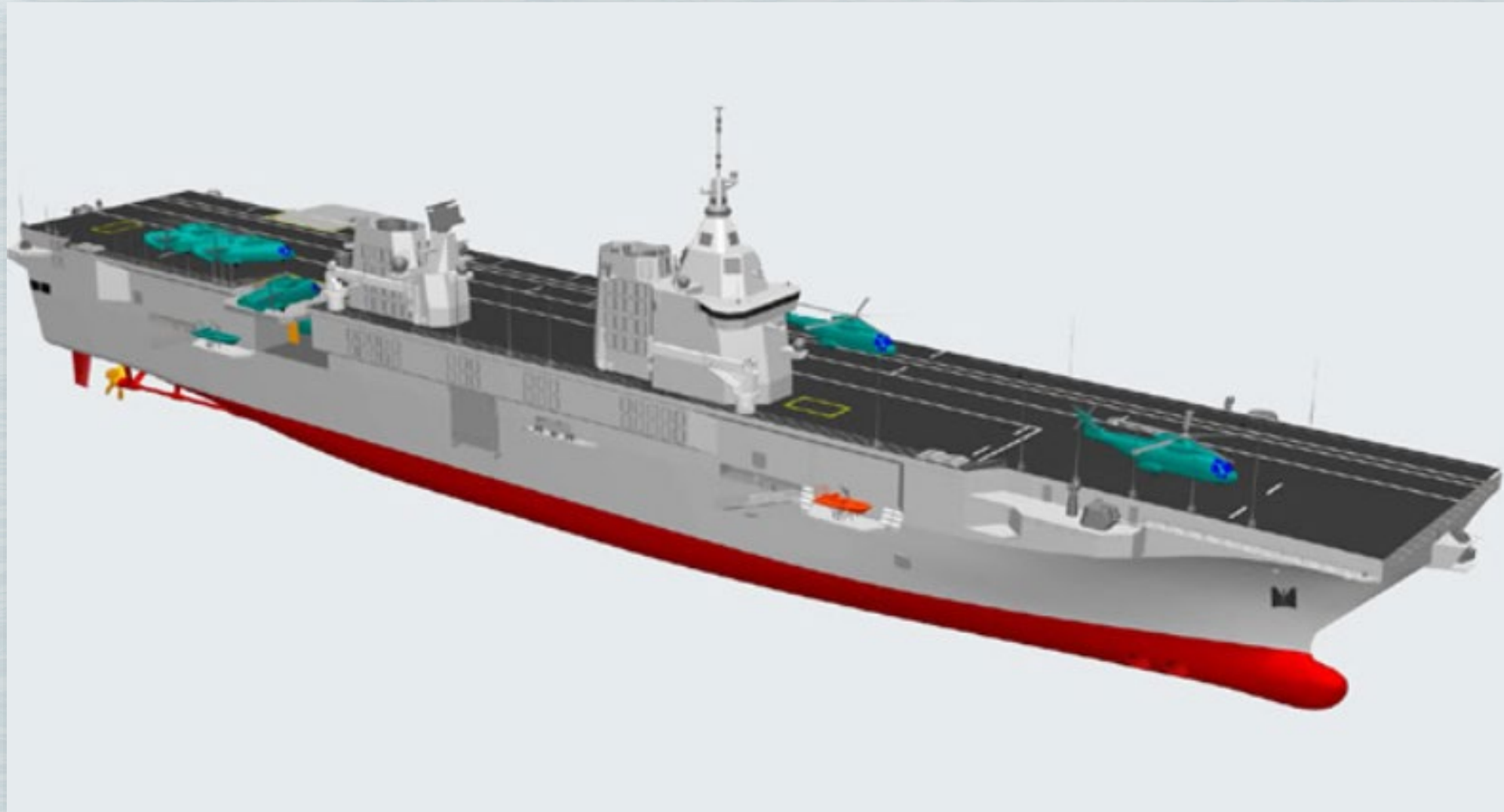
OPV – OFFSHORE PATROL CORVETTES - IEP



MCRV FOR NATO COUNTRIES - IEP



LPD – LANDING PLATFORM DOCK VESSELS - IEP



SUMMARY & INVITATION

- STADT achieved international recognition for own STEALTH propulsion technology
- STADT invited to participate in several major international Naval projects –
 - the major being the MMPC program
- MoD, Norwegian Navy, Norwegian Defence Industry interest in the MMPC program need to be catered for.

STADT hereby invite MoD Norway and Norwegian Navy :

- To continue development in our common R&D Naval Stealth Propulsion Project
 - Pilot / prototype – project
- Norwegian Navy to actively join and participate with STADT in the EPC project
 - Gain knowledge – and take advantage of technology development in the program
 - secure Norwegian interests and Naval requirements into the program

ALL ELECTRIC WARSHIP – DEFINITION

- **ELECTRIC POWER PLANT GENERATES ELECTRIC POWER FOR ALL CONSUMERS : PROPULSION. WARFARE HOTEL LOAD.**

 - **GENSETS DRIVEN BY CONVENTIONAL FUEL - UPGRADABLE FOR FUTURE FUELS**
 - **INTEGRATION OF NEW POWER SOURCES (FUEL-CELLS, NUCLEAR ETC)**
 - **ENERGY STORAGE – BATTERY AND FLYWHEEL OPTIONS**

 - **WARFARE EQUIPMENT**
 - **PULSE WEAPONS**
 - **HIGH POWER RADARS**

 - **IEP - ELECTRIC MOTORS DRIVING PROPELLERS**
 - **SWITCHBOARDS AND POWER DISTRIBUTION – AC MAIN GRIDS, AND DC SUBGRIDS**
 - **DRIVES**
- 