

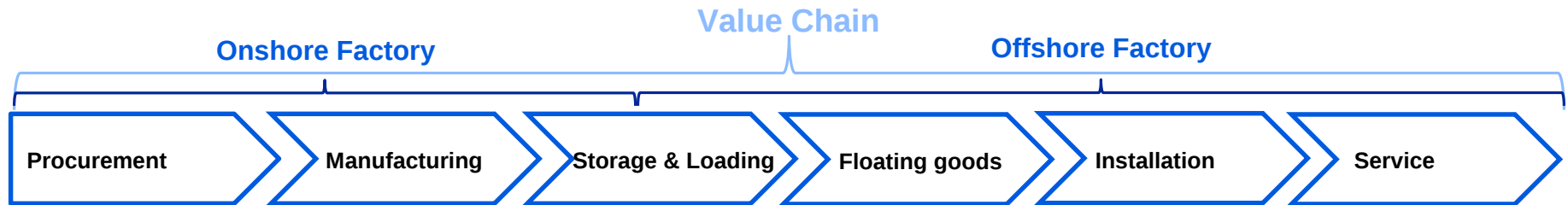


Mika Mäkelä, ABB High Voltage Cables, 2015-10-20

ABB High Voltage Cables

Most advanced cable-laying vessel for subsea installation and service

ABB High Voltage Cables Value Chain



Cable Manufacturing:

- High end production facilities in Karlskrona, SE
- Double capacity investment
- Sea cable focus
- Technological leader in extruded DC Cables, 525kV

Cable Installation:

- Full in-house installation competency for land and sea
- Offshore Engineering Center in Rotterdam, NL
- Secured assets
- Long term strategic partnerships

Cable Service:

- Fully dedicated Service unit
- Service people & assets
- Market leading offering over whole life cycle - Cable Care



ABB High Voltage Cables - Secure assets Investments to Hardware

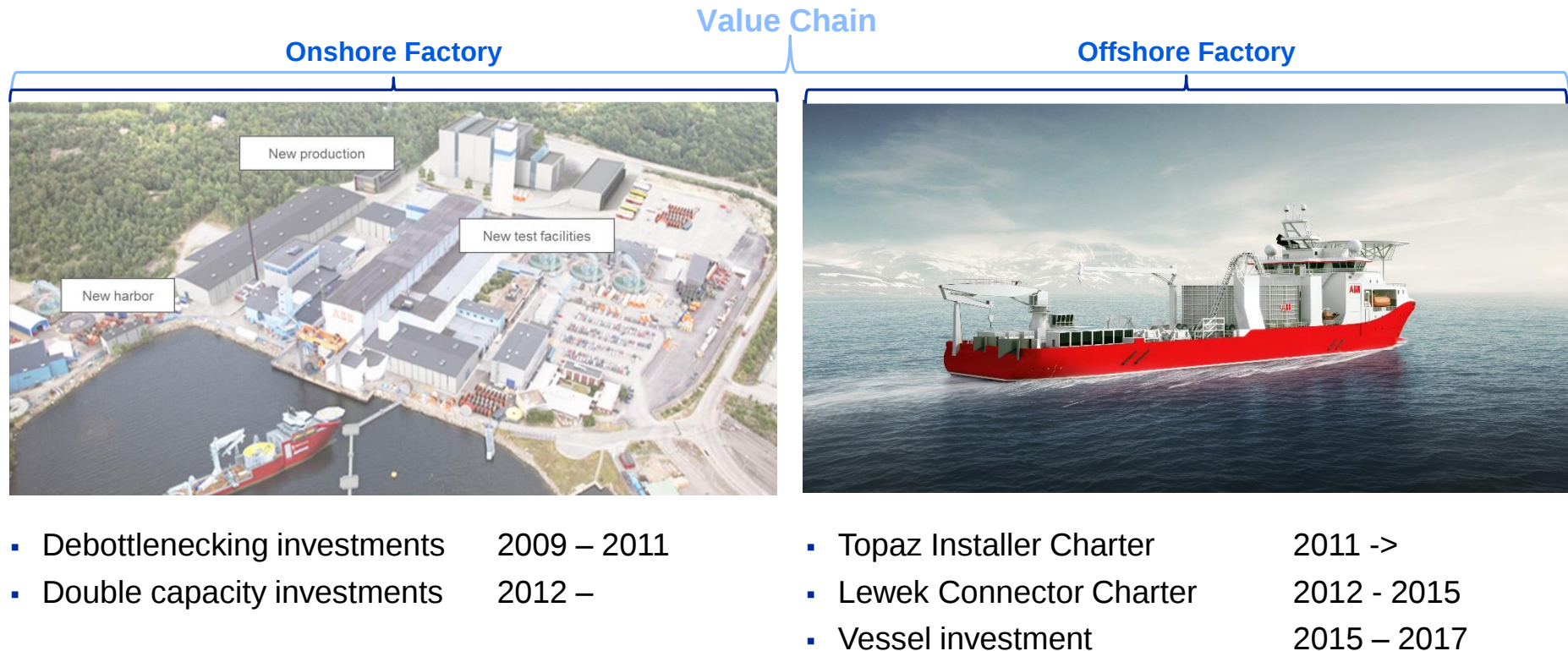


ABB Vessel – Last link to complete the whole value chain in-house!

ABB High Voltage Cables – It's all about people Investments to Software with Hard hats!

Installation Organization Installation Department Structure

Installation Organization Installation Portfolio

ABB High Voltage Cables Installation Risk Management

Monitor and coordinate residual risks during all installation phases and take proper mitigation methods to keep these risks as low as reasonably possible.

Avoidance & Mitigation

- Risk Assessments
- Client - Contractor Interaction
- Route Engineering
- Cable Protection by Trenching

Installation Organization Phases & Processes

ABB HVC Cable Installation is involved in all technical and operational phases of the cable installation process both onshore and offshore.

Phases in Cable Installation Projects

Processes in Cable Systems

Installation Associated Considerations ABB Training Center

Training & Development of Employees

- Training theoretical & practical
- Method development
- Tools development
- Test assembling of new accessories
- VPPs, Working Procedure Specification
- Instructions
- Offshore Competence Group

Installation Organization ABB Offshore Engineering Centre (OEC)

The OEC is a multi-faceted service unit within ABB HVC for supporting all project phases:

Offshore Engineering Centre (OEC) Engineering Competencies

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Offshore Engineering Centre (OEC) Engineering Competencies

ABB High Voltage Cables - ORAT a Continuous Improvement Cycle

- ABB DataPack
 - Inform and train stakeholders to use the system
 - Provide feedback and reporting capabilities
- Daily Progress Report
 - Record of all daily events and notable events
 - Reported to OEC
- Project Data
 - In-kind documentation
 - Formal daily alignment charts, coordinates, etc.
 - Reviewing contractual costs
 - Checking contractual agreements
- Quality Check @ OEC
 - Review of documentation (DPR, TRL, etc.)
 - QC data being made by field and assessed
- QA/QC
 - Data to spot and correct data from database
 - Accessibility from any location with internet
- Real Time Info
 - Daily updates of progress
 - Efficiency comparisons

**Over 120 Cable Installation & Service specialists on-shore
+ vessel teams off-shore at your service!**

ABB High Voltage Cables

Why do we invest – to meet the market dynamics

Market Dynamics

- Cable manufacturing and laying is a continuous process where disruptions are detrimental
- Coordination between production and vessel is key to successful delivery
- Cable integrity needs to be secured at all times, cable design to determinate the platform & methods
- Schedule shifts are common in the market – anyhow challenging to manage when not in full control over asset
- Actual contracting parties often relatively young despite of well aged parents
- The offshore vessel market is very closely correlated with oil price

**Historical Offshore Company Stock Performance
vs. Brent Crude Spot Price**

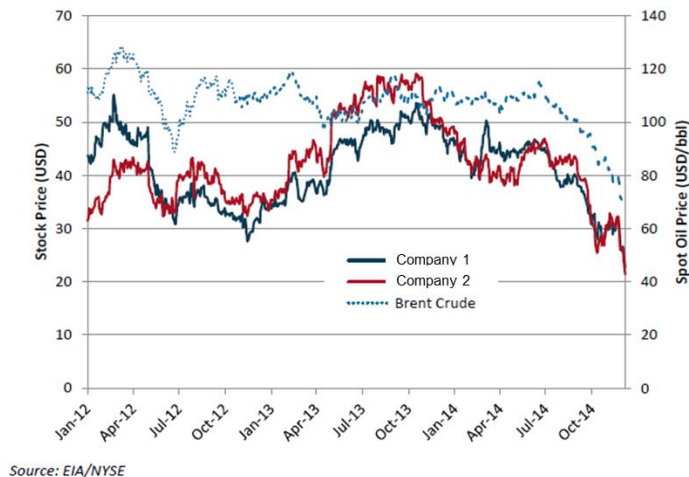


ABB High Voltage Cables

Why do we invest – reasoning

“People who are really serious about software should make their own hardware”

-Alan Kay, 1982-



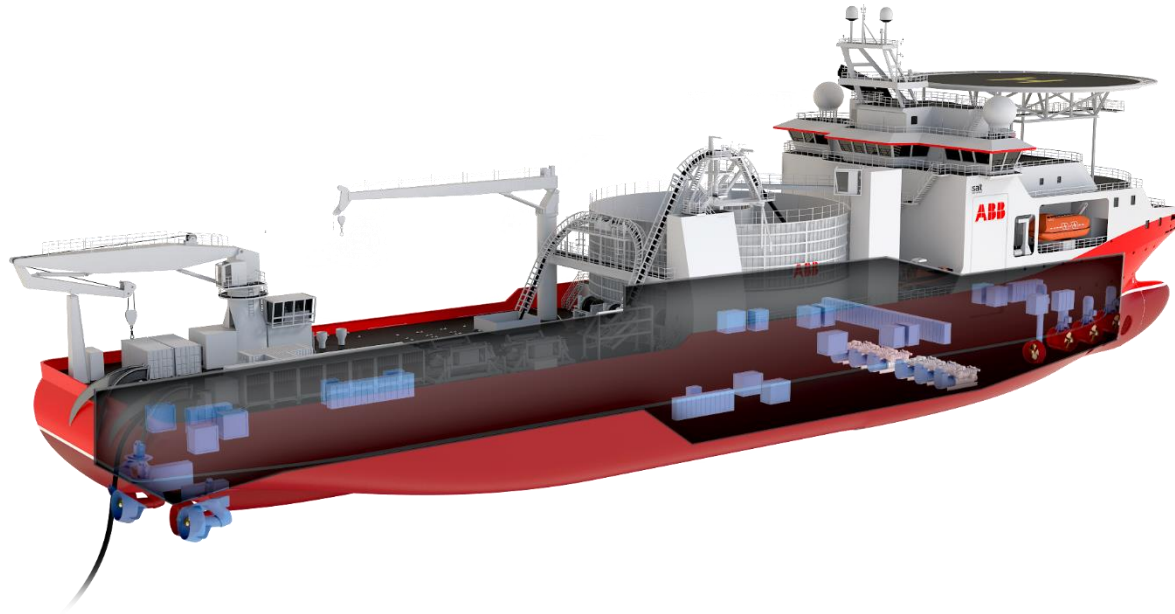
Security for the future to come

Reasoning

- Secure safe platform for people, cable and neighboring assets
- Match customers' requirements and expectations
- Full control of the complete value chain de-risks the business
- Guaranteed availability of vessel supply
- Avoid peak-pricing (high & down term)
- Calculation certainty for system business
- Tailor-made asset optimized to on-shore factory for cable integrity and performance

Introduction to most advanced cable-laying vessel

A result of true collaboration & team work



High Voltage Cables



KLEVEN

salt
SHIP DESIGN



Marine & Ports





Artist impression of order book

SALT 301 – VIKING NEPTUN

- > 145.0 x 31.0m
- > 18kn Transit speed
- > 150 pax
- > DP III
- > 400t AHC Crane
- > 50t AHC Crane
- > 4500t Carousel
- > Client : Eidesvik Offshore
- > Yard : Kleven (Norway)



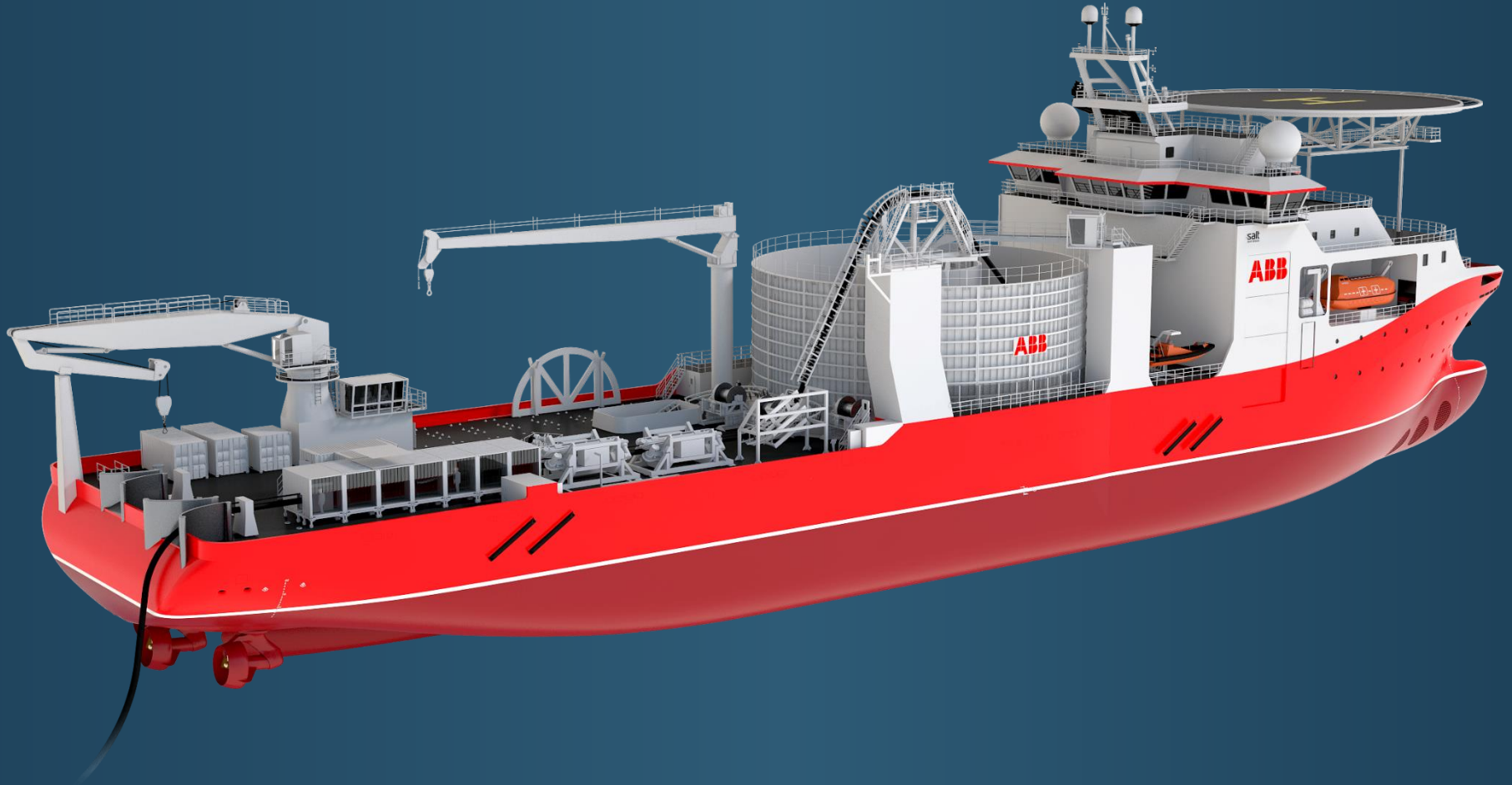
SALT 306 – State of art cable layer

- > 140.0 x 29.6/28.6m
- > 100 pax
- > DP III
- > ROV hangars for up to 2 x WROV
- > Helicopter deck



Optimized for purpose

- Deck width and length -> effective operations
- Hull optimization / Seakeeping



- Maintain operation after loss of one unit
- Flexibility in terms of unit running -> Avoid wash towards cable during lay/ recovery



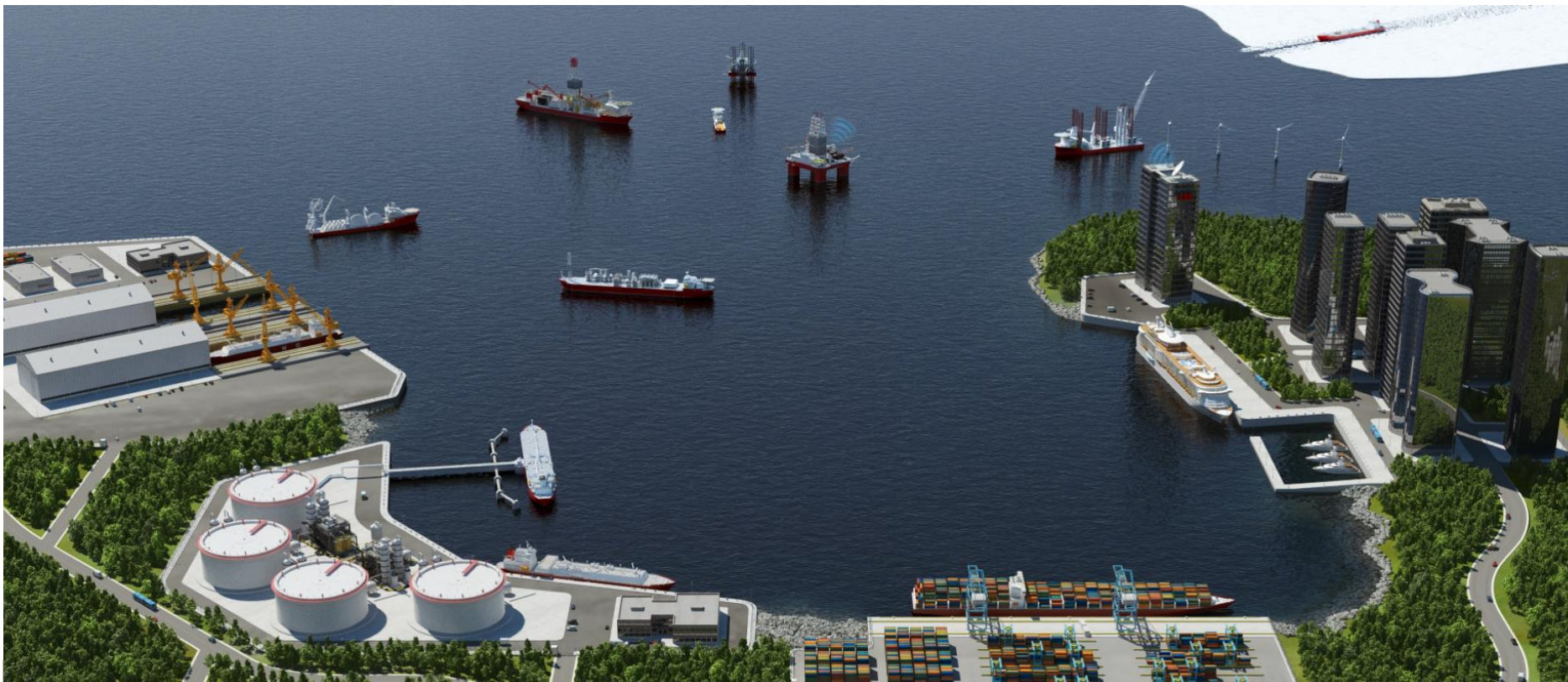


- Accommodation for 100 persons
- Office facilities
- Gym and dayrooms
- Helicopter reception/ lounge
- Entertainment/ multimedia system

Summary of highlights

- Optimized for purpose based on mission criteria specification
- Based on proven design
- Carousel arrangement layout with one carousel below deck
- Flexible aft deck area
- Roll damping
- Freeboard
- Redundant main propulsion (also after one unit out of operation)
- Operability
- Environmental footprint





Jostein Bogen, BU Marine Global Sales, Karlskrona 20.10.2015

Karlskrona 20.10.2015

ABB Total Integrated Solutions – SALT 306 CLV

ABB Marine and Ports

Our Portfolio

Azipod® propulsion and Thruster units



Electric Propulsion



Power Generation and Distribution incl. DC Grid



Integrated automation



Advisory Systems



Marine Services



Onboard DC Grid

Onboard DC Grid

Basic Principle Explained

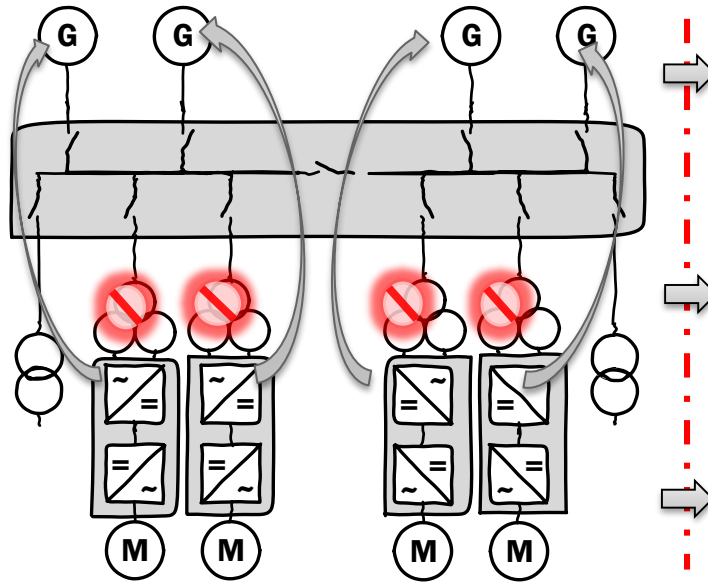
A paradigm change

- ✓ Variable speed
- ✓ Energy Storage
- ✓ Alternative Energy Sources

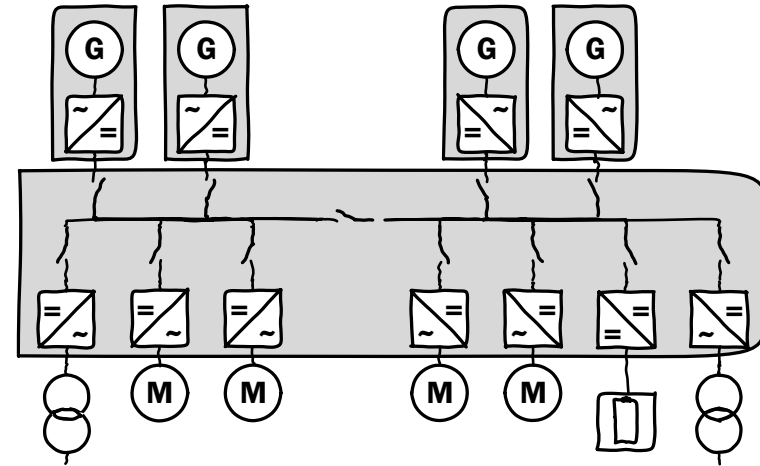
Driving Factors

1. ~80% of consumers are frequency converters
2. Energy Storage is largely DC based
3. AC swbd forces synchronicity
4. AC swbd bases protection on availability of high currents
5. ...

Traditional AC System



Onboard DC Grid

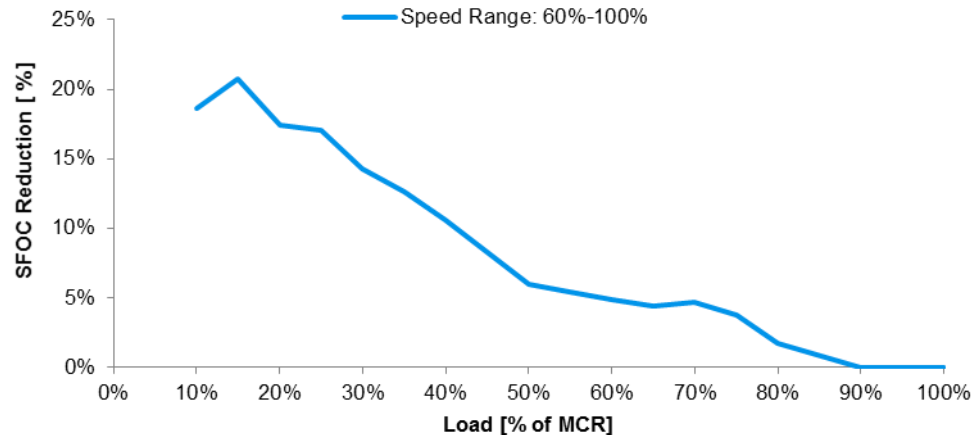
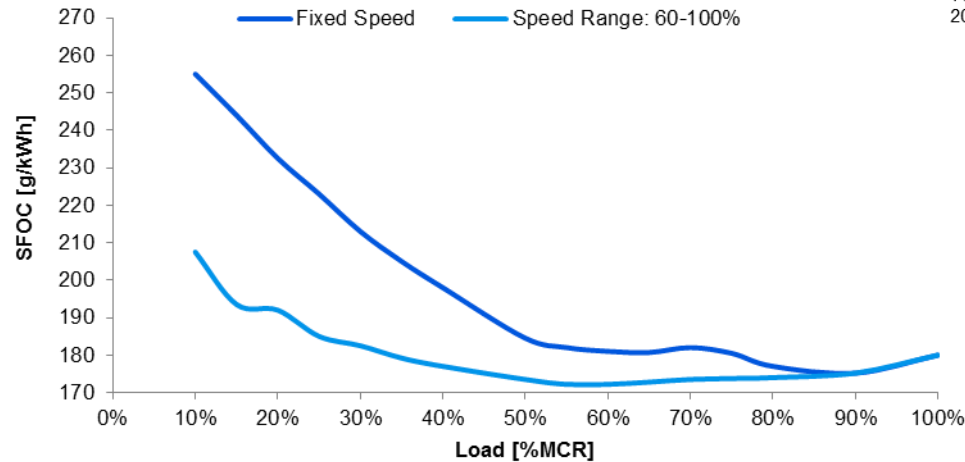


... reclaiming past benefits ...

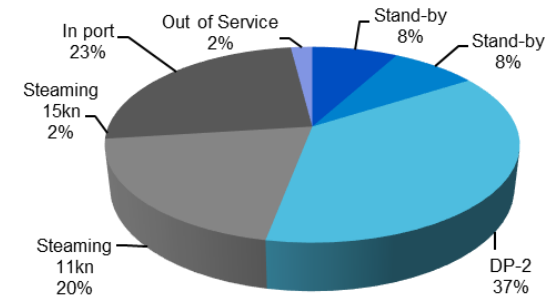
Variable Speed Generators

Potential for:

1. Data taken from an example medium speed engine.
2. Reduced Emissions
3. Cleaner combustion with less soot-buildup
- 4) Reduced wear and tear on engines
- 5) Higher exhaust temperatures -> better working scrubbers
- 6) Lower noise and stress levels



Case Dina Star



↓ 10%*
**with given operational profile*

...tapping into *Energy Storage*...

Potential Uses for *Energy Storage*



Spinning Reserve

- Backup for running gensets
- Fewer engines needed online
- Improved fuel efficiency
- Reduced engine running hours



Peak Shaving

- Level the power seen by engines
- Offset the need to start new engine
- Improved fuel efficiency
- Reduced engine running hours



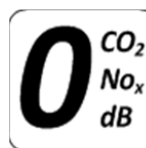
Enhanced Dynamic Support

- Instant power in support of running gensets
- Enable use of «slower» engines in dynamic applications;
 - LNG/DualFuel engines
 - Fuel Cells



Strategic Loading

- Charging and discharging ES media in such a way that it optimizes the operating point of the gensets.
- Power is produced at peak efficiency



Zero Emission Operation

- Zero emissions in harbour
- Quiet engine room



Enhanced Ridethrough

- ES storage solutions can give UPS like functionality for all or portions of power system
- New ways of achieving high ERN numbers
- Higher power system availability

Our deliveries to the ABB CLV

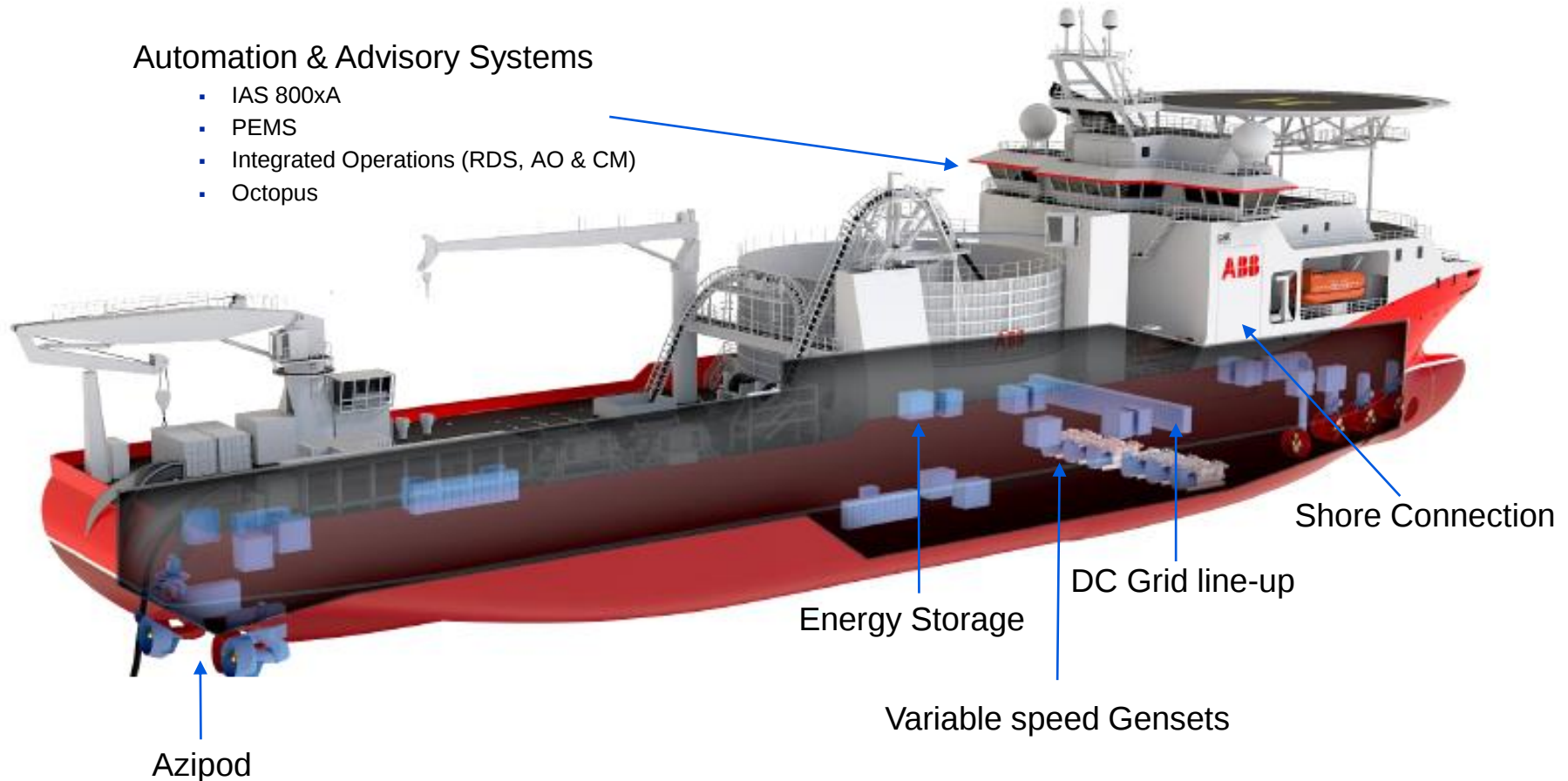
ABB Marine – Total Integrated Solutions

Our deliveries to the ABB CLV

Complete power conversion through Onboard DC Grid and Energy Storage

Automation & Advisory Systems

- IAS 800xA
- PEMS
- Integrated Operations (RDS, AO & CM)
- Octopus



Octopus Advisory Systems

Operation planning tool for Offshore operations

Features:

- Integrated monitoring and forecasting of motions and DP capability, and derived quantities (slamming, fatigue, stresses, sloshing)
- Identification of critical and safe headings, speeds, drafts
- Support during weather-sensitive operations
- All operational data stored onboard & onshore
- Optimum trim and speed/RPM advice

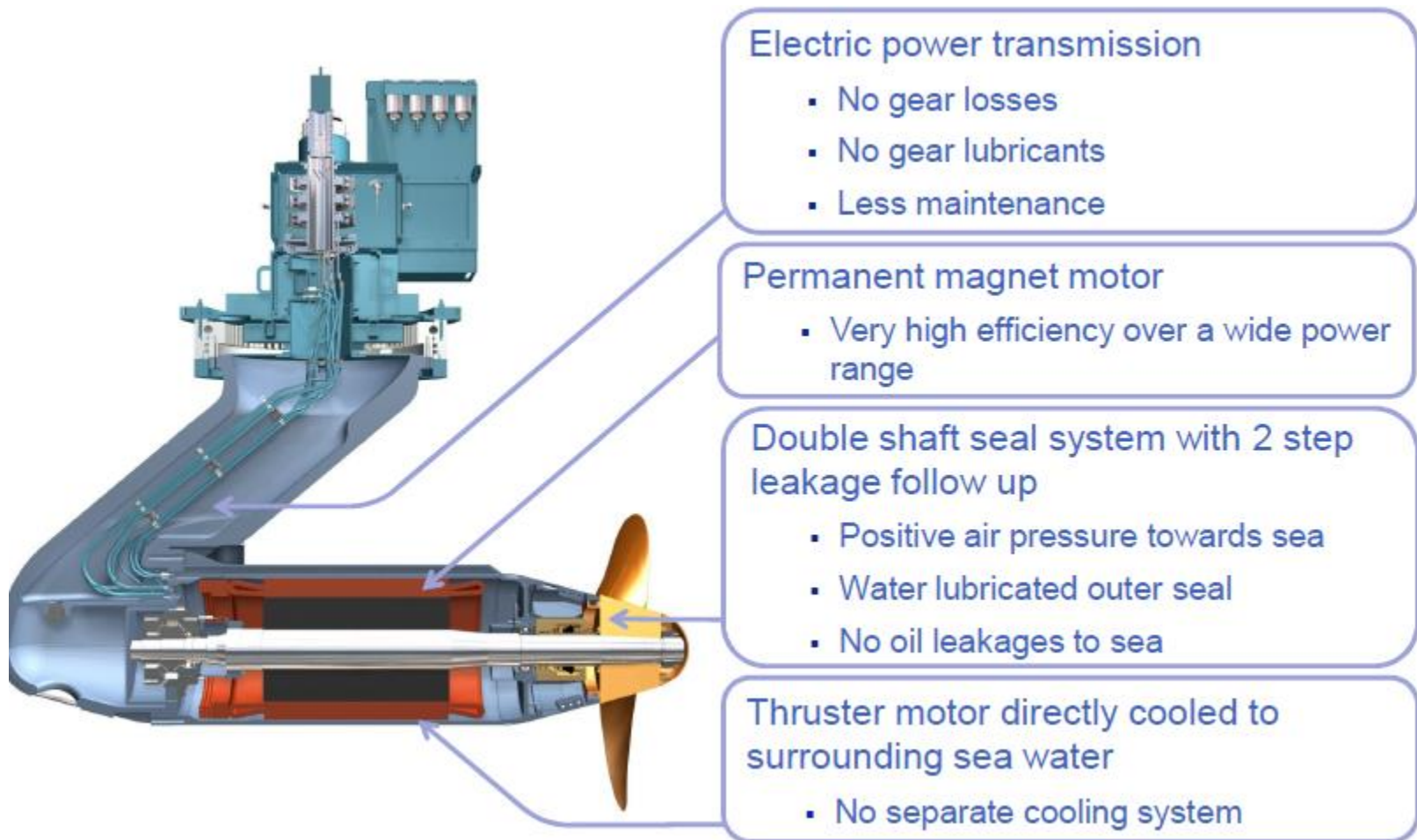
Resulting in:

- Optimum use of weather windows
- Maximized operability in waves
- Reduced fuel consumption
- Increased crew awareness
- Increased safety of ship operation



Azipod CZ

Technical Principle



Energy Storage

Main Functionalities;



Peak Shaving

- Level the power seen by engines
- Offset the need to start new engine
- Improved fuel efficiency
- Reduced engine running hours



Enhanced Dynamic Support

- Instant power in support of running gensets
- Enable use of «slower» engines;
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Back Up Emergency Function

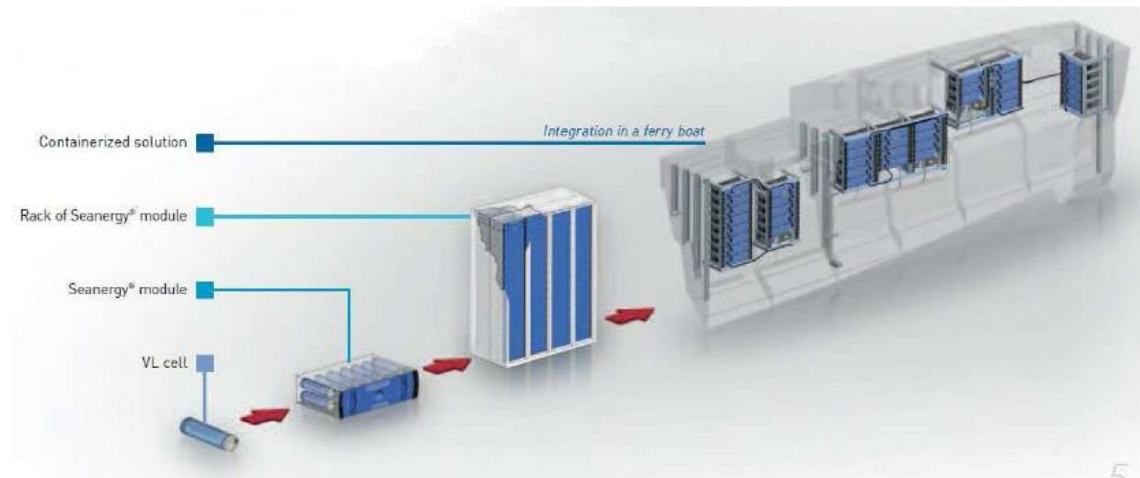
- 800kW@10sec -> Fast reduction of power next 10 sec. Intended to cover controlled close down of cable drum when black out of shore connection.

Capacities; SAFT Water Cooled Li-ion Super-Iron Phosphate

- Type; SAFT VL30Pfe
- Charging; 250 kW
- Discharging;
 - Cont; 66.5kWh
 - Peak; 12C @ 800kW (10 sec.)



Excellent energy & power in a modular format, from kW to MW



Shore Connection

Shore Connection – Supplied by 11kV Switchboard

- Full power supply for loading of cables (drum) and Hotel
- Not allowed to use gensets when loading of cable's
- Primary side (onshore); 11kV, 50Hz, 2500kVA
- Secondary Side; 800V (AC), 1000V (DC), 2500kVA
- Independent rectifier, allowing power from onshore or genset

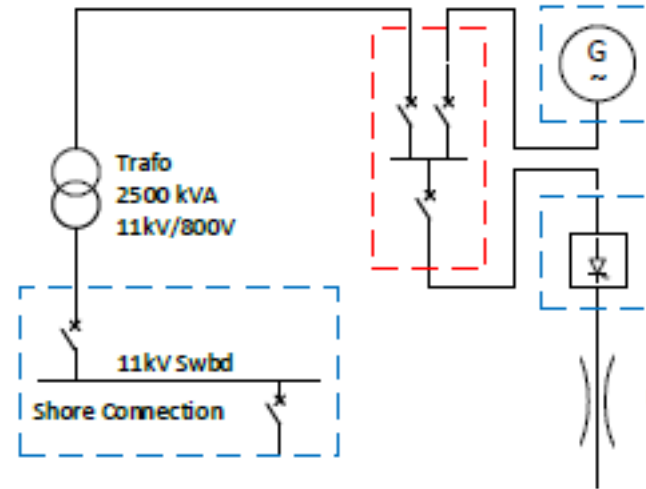
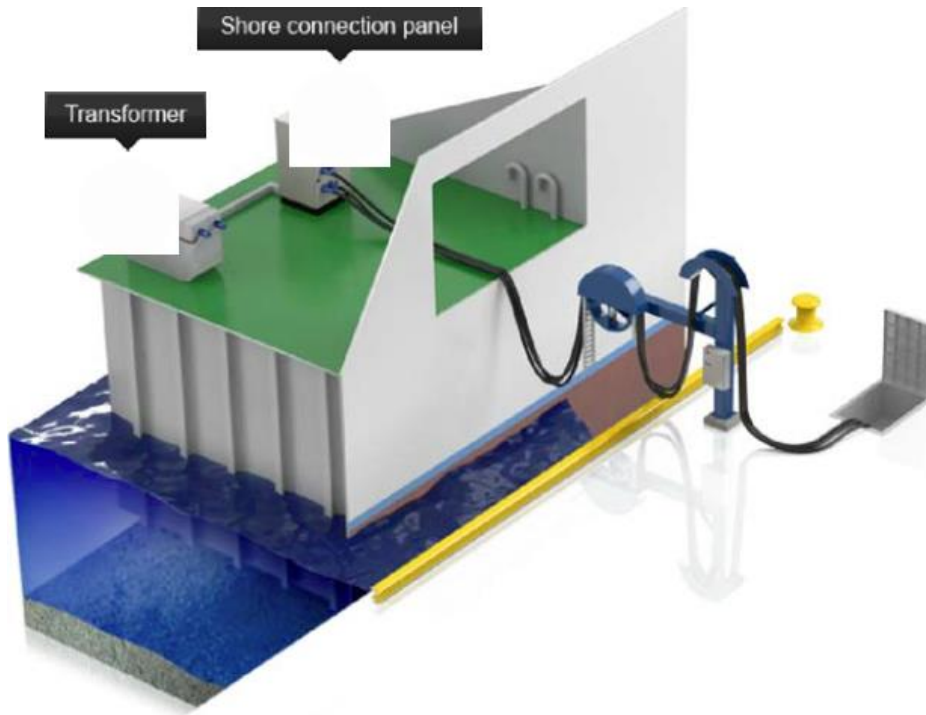
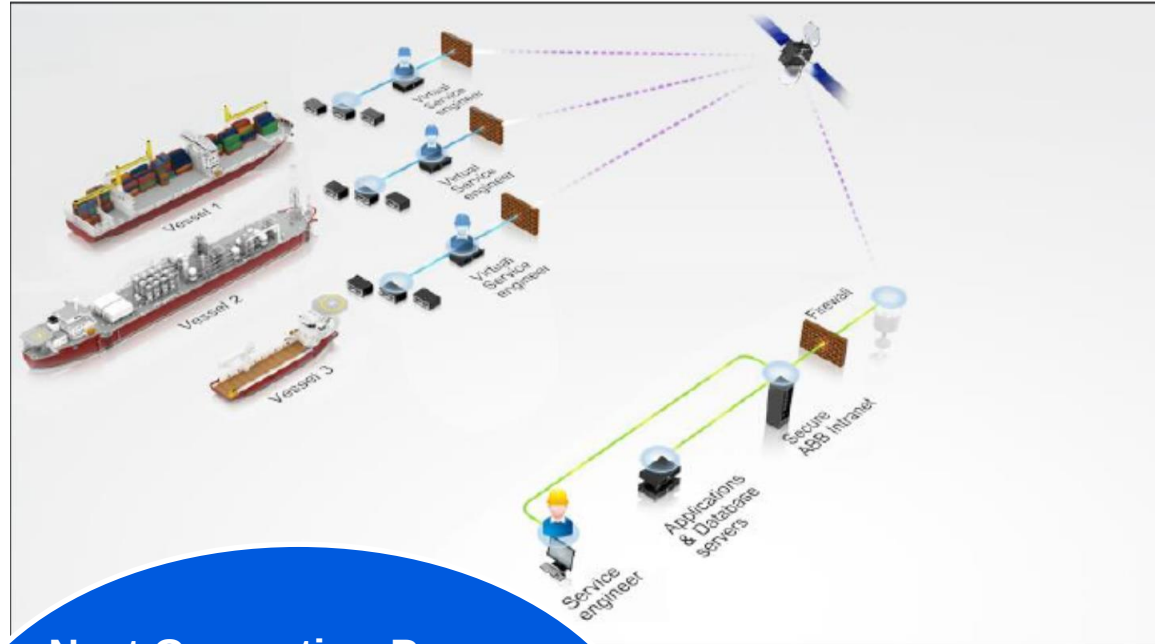
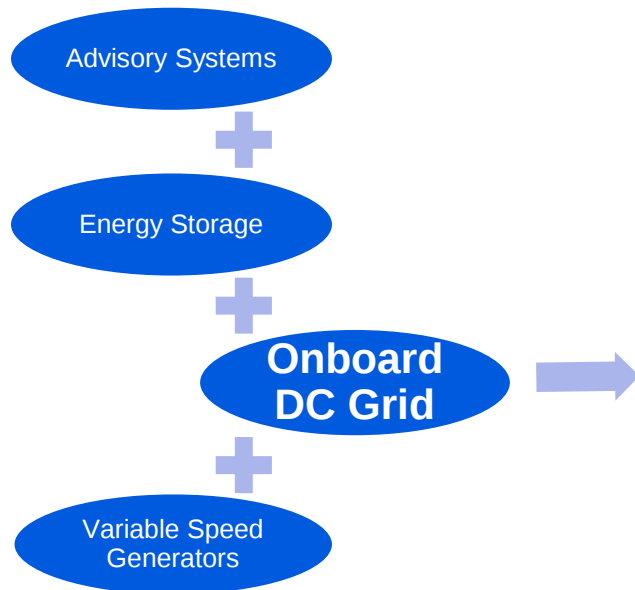


ABB Marine Delivery to ABB CLV – Summary

Next Generation Propulsion System with Remote Access

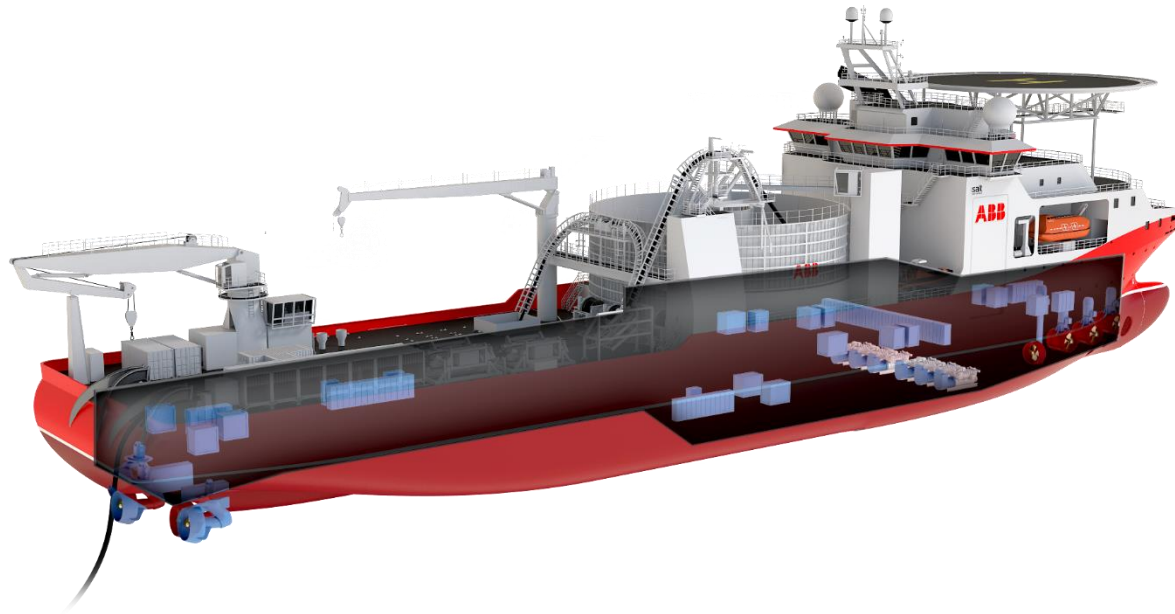


Next Generation Power & Propulsion System

- Reduced Operational & Maintenance Costs
- Improved Dynamic Performance
- Improved Safety & Availability
- Increased Operational Windows

The cable layer for the future

A result of collaboration & true team work



The Cable Layer for the future

Experience from generations of cable laying vessels



- ABB was involved in numerous cable layer projects over the last decades – in design and operation



Power and productivity
for a better world™

