Considering the Ship as a System

Energy Efficiency at Ship level

Palemia Field, Global Marketing Communications - Digital
## Ship Design

### Traditional Thinking

<table>
<thead>
<tr>
<th>Services</th>
<th>Expert Support</th>
<th>Field Services</th>
<th>On call service offering for spares and support</th>
</tr>
</thead>
</table>

**Control Systems**

- Power Management Systems
- Propulsion & Remote Control
- Device Monitoring
- Ship Automation
- Navigation Electronics

**Functional Products**

- Marine Propulsion Core
- Products & Non-ABB Systems
- Navigation HW

**Isolated Systems** – Lot of Interfaces – No benefits to connect system - No possibility for pre-delivery testing.
Maximizing the full potential in shipping

Electric.

Digital.

Connected.

... something we know a whole lot about.
**Electric. Digital. Connected.**

**Simplicity**

**Mechanical power train**

**Electric power train**

Electric is more efficient, simpler, flexible, more digital and better integrated

System integration creates simplicity and efficiency

- **Navigation and positioning**
  - Situational awareness and docking assistance

- **On-board software**
  - Decision support to maximize safety, efficiency, and up-time

- **Propulsion systems**
  - Fully integrated with automation

- **Automation systems**
  - Fully integrated navigation

Bridge to Propeller Integration through the ship power train.
Connecting vessels and shore operations with our experts

ABB Operations Center
Performance and condition analysis

Vessel
Data capture and real-time optimization

Customer Operations Center
Fleet management


October 11, 2018 Slide 7
Advisory Systems

OCTOPUS 8 targets value drives

- Dynamic Trim
- DP Capability Advice
- SFOC monitoring
- Performance Monitoring
- Speed Advice
- Heavy Weather Advice
- Power Plant Optimizer
- Clean Hull

- Fuel / Energy
- Safety
- Availability
- Repair / Maintenance Cost
- Fuel / Energy
- Emissions
- Fuel / Energy
- Environment
- On-time arrival
- Passenger Comfort
- Cargo Preservation
- Safety
- Insurance Cost
- Fuel / Energy
- Fuel / Energy
- Environment
Integrating New Fuels
Shipping’s Decarbonization

Ballard Signs MOU With ABB for Development of Fuel Cell Systems to Power Marine Applications

VANCOUVER, CANADA and AMSTERDAM, THE NETHERLANDS – Ballard Power Systems (NASDAQ: BLDP; TSX: BLD) today announced signing of a Memorandum of Understanding (MOU)