INNOVATIONS IN FERRY TECHNOLOGY

Fairway Forward

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RAUMA MARINE CONSTRUCTIONS

Fairway Forward
Swedish-Finnish Maritime Collaboration

Innovations – Presentation Content

1. Innovations – a Shipbuilder's Perspective
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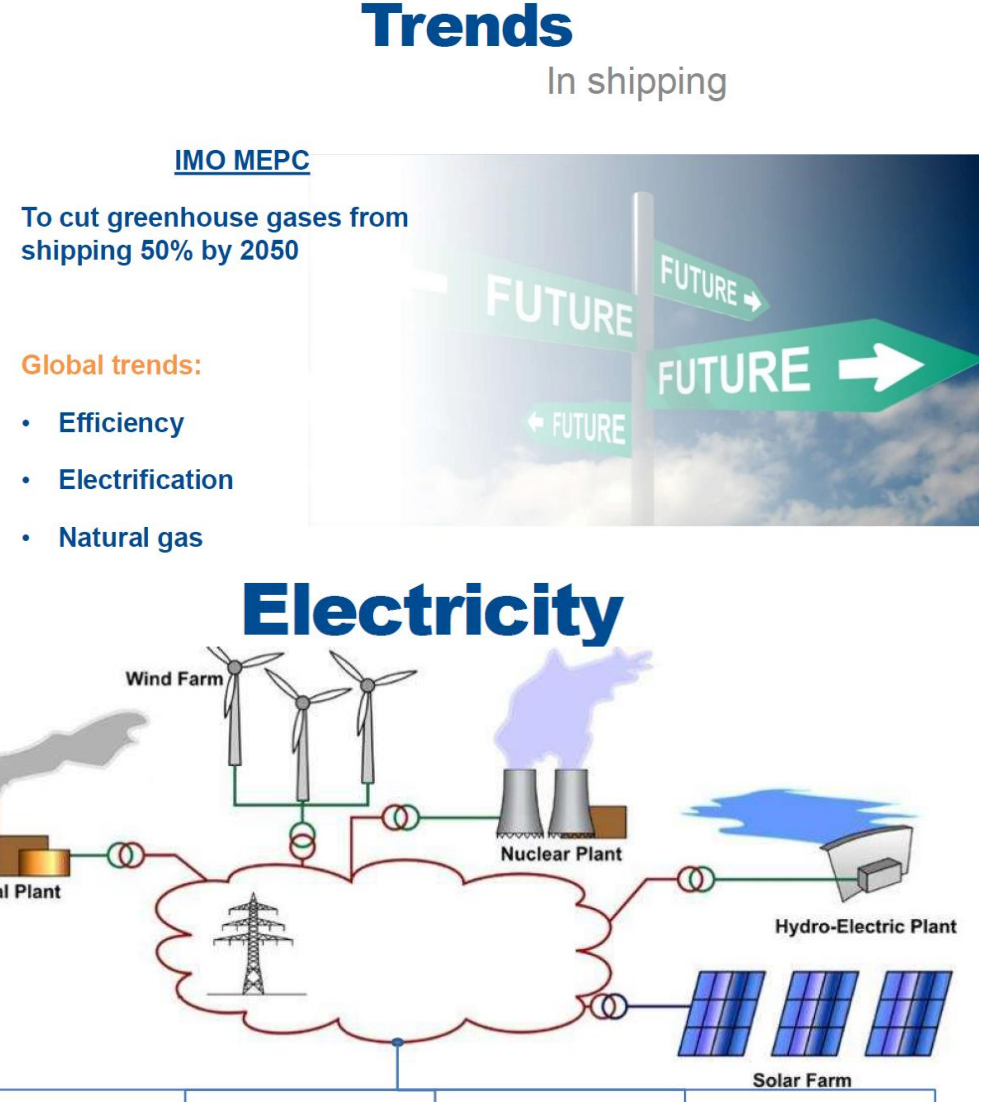
INNOVATIONS IN FERRY TECHNOLOGY

Industrial Innovations – a Shipbuilder's Perspective

- Energy Sources – Realistic Fuel Alternatives
  - "Post LNG" Sources with Applicable High Energy Density
  - Environmental True Footprint
- Power Management in Autonomous Ships
  - Reliability with Sensors, Multiplied Control Units and Software
- Integration of Complex Systems – Big Data enter Ferries
  - Lack of Interface Standards or too many Protocols ?
  - Open source Interfaces – a Way to prevent dictated Monopoly
- The Ferries are becoming DATA PLATFORMS
  - Do we need an "fOS" – ***ferry*** Operating System



Courtesy of Tomas Aminoff, Elomatic

Newbuilding 6002 for Kvarken Link – State of the Art

TECHNOLOGY

- Dual Fuel with LNG as primary energy source
  - Possibility to use bio-LNG
- Electric Propulsion Drive with Azimuth Thruster Units
- Battery Power for Port entry/departure, Peak Shaving, Hotel Load and Boost Power
- Energy recovery and Environmental footprint in focus
- Ice Class 1A Super
- Passenger and Crew Comfort

MAIN DIMENSIONS

Loa	150.0	m
Lwl	137.8	m
Beam mld.	26.0	m
Draught, Design	6.10	m
Gross Tonnage, about	24 300	
Deadweight, Design abt.	3 500	t
Max. persons onboard (LSA)	1 000	

CAPACITIES

Passengers	800
Lane metres	1500
Cabins	68
Speed	20 kn
Public Decks	2 (Restaurants, Business Lounge, Family Cafeteria, Shop, Conference)
Route:	Vasa - Umeå Bothnian Corridor Service

INNOVATIONS IN FERRY TECHNOLOGY

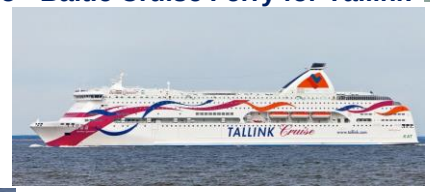
References

- More than 30 Large Rauma Ferries since 1993
  - Front End Technology for Reliable Operation
- Supporting Special Vessels' Programme
  - Technology Development
  - Sensor and Data Processing Technique for Automation, Control and Operation

World's First SOLAS 2009 + SA Ferry

2008

5th Baltic Cruise Ferry for Tallink



2009

World's First SRtP Ferry

2011 and 2012

MGO, PTO/PTI Hybrid

2018

Full Scale Sensor Technology

2012

LNG Hybrid Drive

2014

LBG/Electric + Batteries, 1A Super, SOLAS 2020 + SA – CLEAN DESIGN

2021

DE, Battery + Fuel Cell

2018

LNG/Electric, DATA Platform

2022

New Technology

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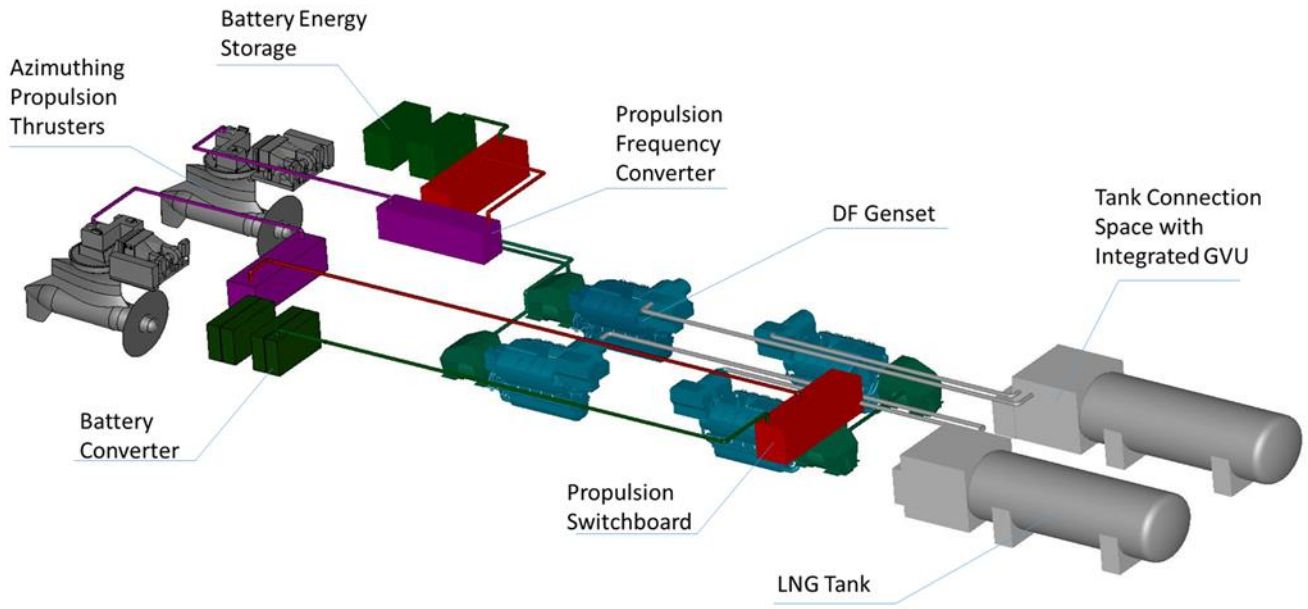
INNOVATIONS IN FERRY TECHNOLOGY

Technology – State of the Art

- How to Create Stability in a Rapid Development
  - …. Which is Accelerating
  - Boosted by the Aim to Create Autonomous Ships
- Digitalisation equal to “get the Wit out of the Iron”
  - Can we reach a Total Control
- Naval Architecture in the Driver’s Seat
  - Only Way to Manage this Complex Whole
- Urgent Need for Simulation
  - Verification of the Data Platform
  - Independent for Ship’s All Functionalities and Control
  - Required before Testing and Commissioning



INNOVATIONS IN FERRY TECHNOLOGY

Energy Sources & Fuel Alternatives:

- Battery storage
- LNG / LBG
- Biodiesel
- Fuel Cell
- Renewable energy sources
- Waste heat energy

Power Generation:

- Electrical propulsion
- Mechanical propulsion
- Shaft Generation PTO/PTI

Energy Efficiency:

- Optimized hull shape
- Minimize waste energy (heat & losses)
- Optimum machinery layout
- Total energy consumption
  - Manoeuvring, sailing,
  - Hotel & harbour stand-by

Integrated Automation & Navigation System:

- Power management system
- System complexity
- Operation optimisation
- Smart maintenance schedule

INNOVATIONS IN FERRY TECHNOLOGY

Integrated Automation and Navigation Systems

Automation System:
- Monitoring & Control Ship Equipment/Systems
- On-board Energy Optimisation
- Automatic Systems
- Autonomous Operations
- Automatic Reporting

Radars & Sensors:
- Navigation Data
- Auto Pilot – Dynamic Positioning
- E-Navigation
- Weather data – Traffic data

Bridge:
- On-board Decision Centre
- Navigation & Piloting
- Situation Awareness
- Collision Avoidance
- Safety Centre

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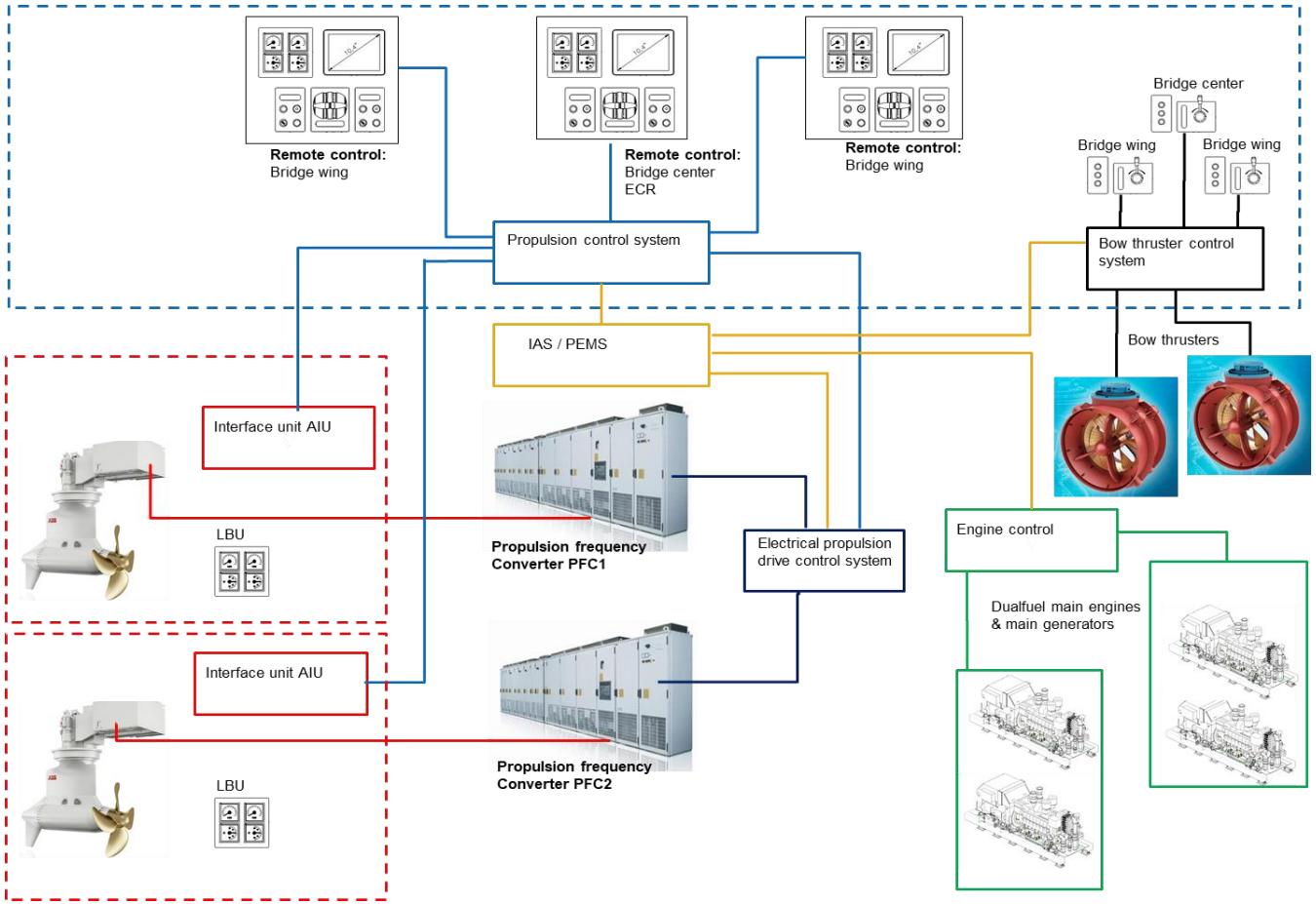
Interface Testing and System Simulation

PROCESS

- Identify system interfaces
- Gather control software (or hardware controllers, interface units etc.) with open interfaces from suppliers
- Assemble complete control systems (e.g. propulsion) in a simulation environment in cooperation with system suppliers.
- Create models to simulate physical components (batteries, propulsors, etc.)

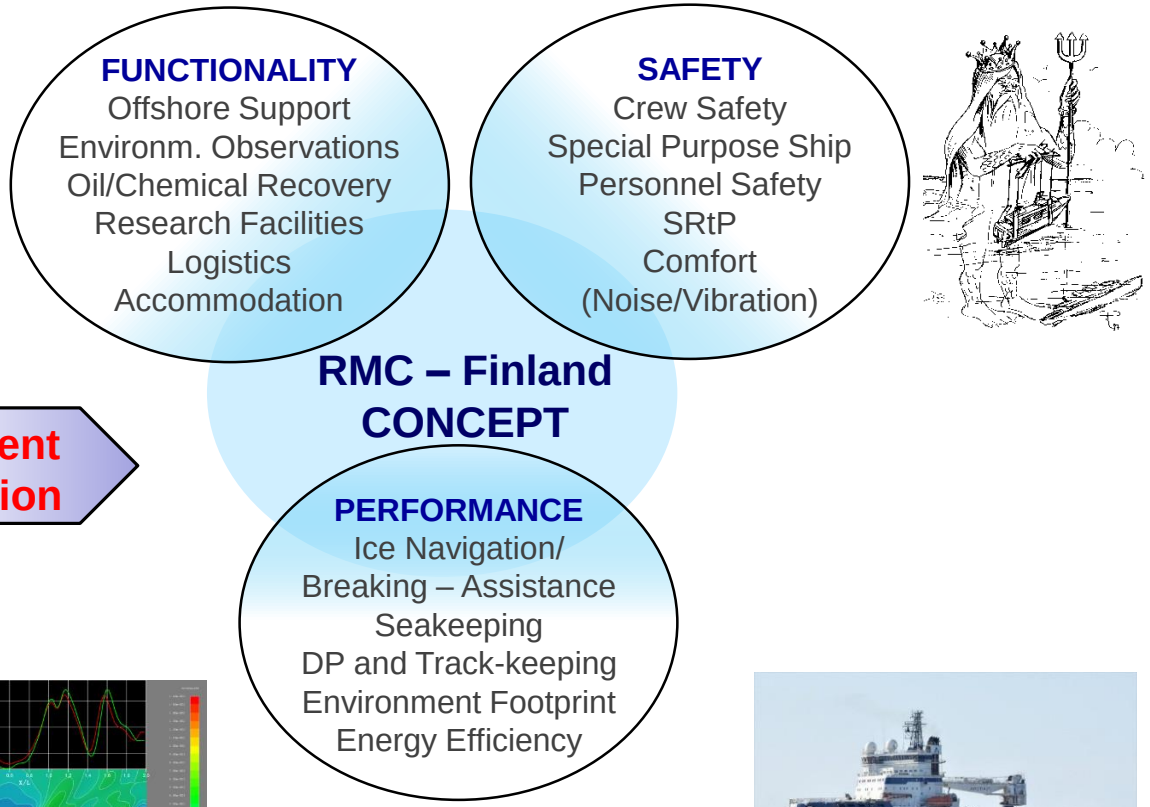


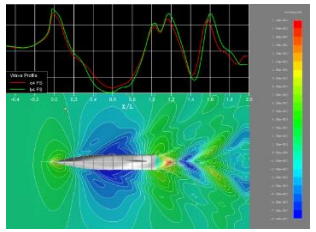
INNOVATIONS IN FERRY TECHNOLOGY

Introduction – Design Approach

TECHNOLOGY AND INNOVATION INTERACTION

- Mission based design – task for innovative functionality solutions
- Solve Customers' problems and challenges
- Mathematic modelling of complex physical phenomena
- Decisions based on understanding, which comes only through experience
- Cutting-edge technology in combination with a broad polytechnic understanding





INNOVATIONS IN FERRY TECHNOLOGY

Intelligent Shipbuilding Technology – Conclusions

- Increased automation in modern ships have created new weak points in the overall performance of the ships
  - increased instability in integration due to software mal functions
- Autonomous ships' R&D-efforts will give a higher reliability of components and sub systems
  - by extension an increased safety
- Mission based development of future ships will ensure deeper technology understanding
  - theoretical knowledge supported with experience and deep understanding
- Talent and well educated people will contribute to keep continuity in the shipping value chain
  - a guarantee for the sustainability – education – research – development – shipbuilding – operation
- Legislation constraints and guidance integrates the Authorities into the business development