FUTURE SHIP BRIDGE CONCEPTS WITH SITUATIONAL AWARENESS

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This presentation will give insight to:

- Operator experience (oX) driven design of future ship bridge concepts
- Resulting future ship bridge solutions, focusing on situation awareness
ENVISIONING FUTURE MARITIME OPERATIONS

- A case study within FIMECC (Finnish Metals and Engineering Competence Cluster) UXUS programme:
  - Enhanced command bridge operations for the future
- We considered three different types of vessels:
  - Tugboats
  - Cargo ships
  - Platform supply vessels (PSVs)
- The project included people from Rolls-Royce, VTT Technical Research Centre of Finland, Aalto University, Troll VFX, Cresense, and Leadin
Future ship bridge concepts / cargo ship
OPERATOR EXPERIENCE DRIVEN CONCEPT DESIGN PROCESS

1. Trend review
2. User studies
3. Concept creation
4. Expert evaluations
5. Final concepts
6. Concept videos
TREND REVIEW

- General technology trends
- Human-technology interaction trends
- Maritime business trends

- Studies regarding the chosen vessel types
- Studies of operation of the vessel types

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USER STUDIES

- **Tugboat** visit with interviews and observations in Naantali
- **Cargo ship** first mate interviews in Espoo
- **PSV** simulator visit with interviews and observations in Ålesund, Norway
- VTT’s Core-Task Analysis method

Main results:
- Explicated **work demands** in each bridge environment
- Generic Operator experience(oX) goal for all the vessel types *(Being one with the ship and the sea)*
- Several oX subgoals regarding each vessel type
Core-task analysis model – analysis of field study findings
Core-task analysis – examples from the future ship bridge cases

<table>
<thead>
<tr>
<th>Control Demands</th>
<th>Resources</th>
<th>Knowledge</th>
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<tbody>
<tr>
<td><strong>Dynamism</strong></td>
<td>1. Optimal sharing of efforts</td>
<td>2. Readiness to act</td>
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<tr>
<td><strong>Complexity</strong></td>
<td>4. Shared awareness and problem-solving</td>
<td>5. Focus on what is essential</td>
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<td><strong>Uncertainty</strong></td>
<td>7. Dialogue-based communication a. Experience of unity and good interaction with others increases work motivation b. Radio communication allows knowing the location and activities of fellow crewmembers</td>
<td>8. Flexibility in action and reorientation a. Escorting ships with a tugboat requires anticipation of the movements of the escorted boat b. This anticipation requires skill and radio communication between the tug and the escorted boat</td>
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<tr>
<td>Design aim: better communication</td>
<td>Design solution: Tele-present Crew</td>
<td>Design aim: enhanced anticipation on the escorted boat</td>
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CONCEPT CREATION

- General-level idea brainstorming workshops
- Interaction method and design workshops
- Defining the Operator experience (oX) subgoals
- Concept development workshops
- Evaluation of preliminary concepts by professionals from Rolls-Royce Marine
  - Selecting the most promising concepts and developing them further based on the evaluations

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OPERATOR EXPERIENCE DRIVEN CONCEPT DESIGN PROCESS

Trend review → User studies → Concept creation → Expert evaluations → Final concepts → Concept videos
The concept ideas were illustrated with scenario stories, concept pictures and further 2-3 min 3D animated videos.

Cargo ship, tug boat and PSV concept videos illustrate e.g. the following situation –aware features:
- Adjustable workstation
- HUD-based navigation
- Intelligent towing
- See-through deck objects
- Sea-ice analyzer
- Augmented crane operations

Tug boat: https://www.youtube.com/watch?v=27uCL90s20o
Cargo ship: https://www.youtube.com/watch?v=_nApv-C7qSg
PSV: https://www.youtube.com/watch?v=_kv1hQLKOB0
Tug boat situational awareness: intelligent towing

Core-task analysis:

8. Flexibility in action and reorientation
   a. Escorting ships with a tugboat requires anticipation of the movements of the escorted boat
   b. This anticipation requires skill and radio communication between the tug and the escorted boat

Design aim: enhanced anticipation on the escorted boat

Design solution: Intelligent Towing
Cargo ship situational awareness: see-through structures
Situational awareness in arctic shipping: Sea-ice analyzer

Core-task analysis:

9. Interpretative nature of activity
   a. Training and work experience allow operation-readiness
   b. Ice conditions are difficult to interpret, especially in the dark

Design aim: better interpretation of the environment

Design solution: Sea-Ice Analyser
VTT’s new innovation service!

More info:
www.vtt.fi/innoleap

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