



EFFICIENSEA
2.0 GETTING CONNECTED

Human factors

- and e-Navigation solutions

09-11-2016

Thomas Porathe & Jeanette Juul Jakobsen



Agenda

- Human factors and ship systems
- Examples of project work
 - Design- and interaction review
 - Design work with users
- Display of e-Navigation information



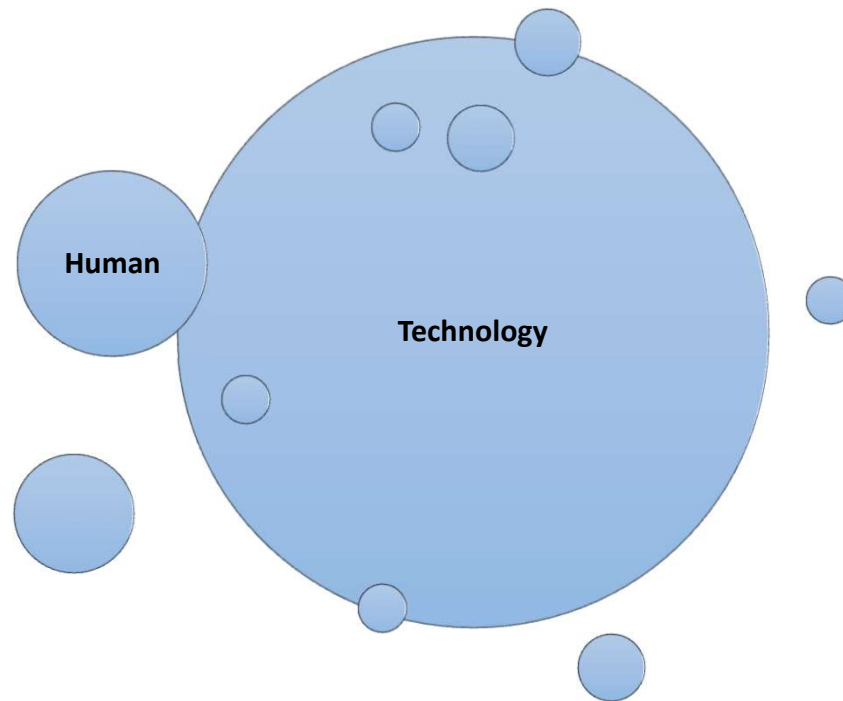
Human Factors and ship systems



Human factors

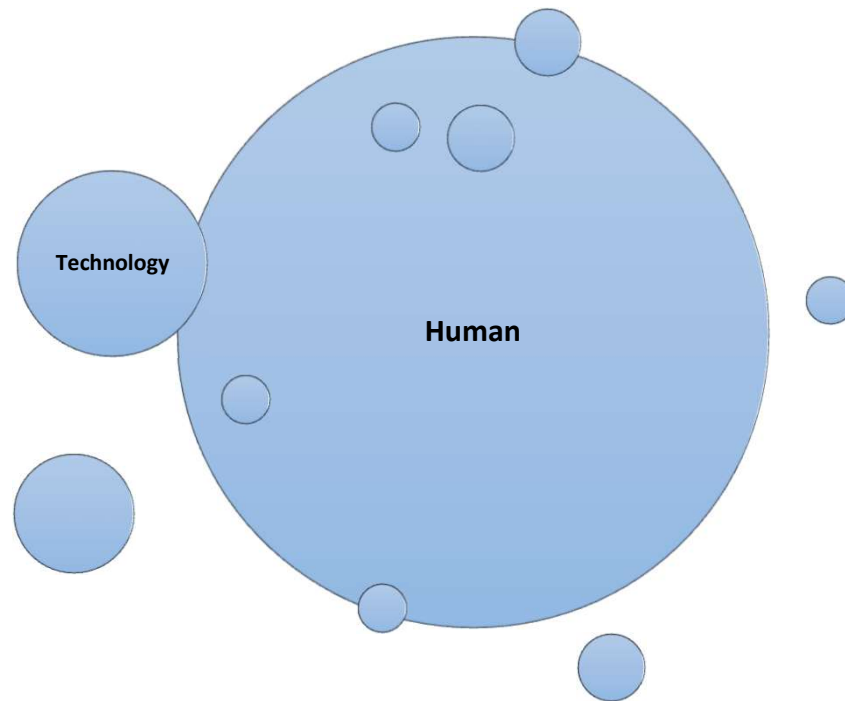
- Discipline of research and practice - aiming at design, optimization and improvement of systems with human and technical components
- Focus is primarily on safety, occupational health, efficiency and quality
- The theory and methods used, is based on psychological and ergonomic research and knowledge

Human factors

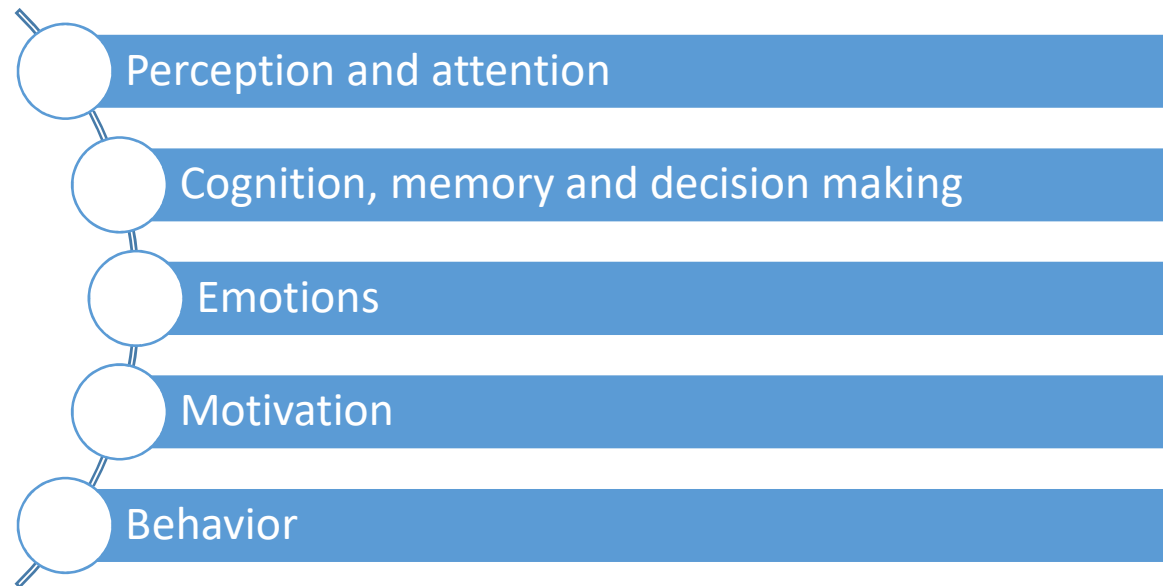




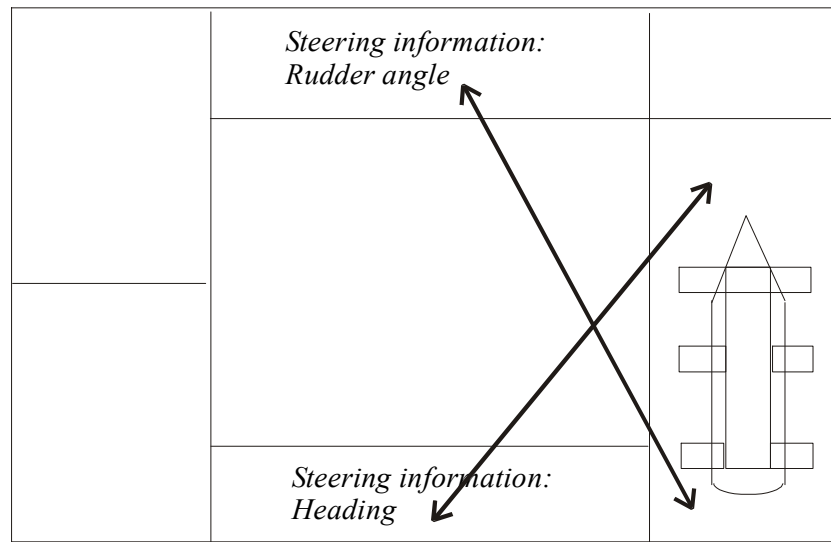
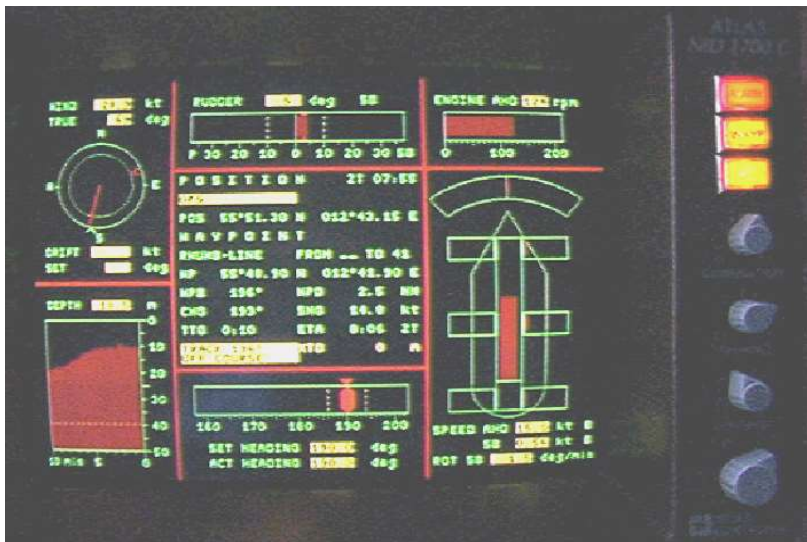
Human factors



The human element



Human factors and ships





Examples of project work



Design- and interaction review

- An expert based analysis that utilize background knowledge of human behavior and psychological processes to asses the usability of a tool – in this case the Arctic web
- The analysis identified potential issues and provided suggestions for improvements of the ArcticWeb – moreover, these inputs has been integrated in the development of the BalticWeb



Input 1

- Selected vessels can be difficult to identify on the map
- The link between selected vessel and information needs to be remembered

The screenshot shows the ArcticWeb interface. At the top, there is a navigation bar with links for "Vessels", "Ice", "Maritime Safety", "Weather", "Forecasts", and "Search and". Below this, a sidebar on the left contains a search bar and a panel for "Selected Vessel - POLAR QAASIUT". This panel displays AIS information in a table format:

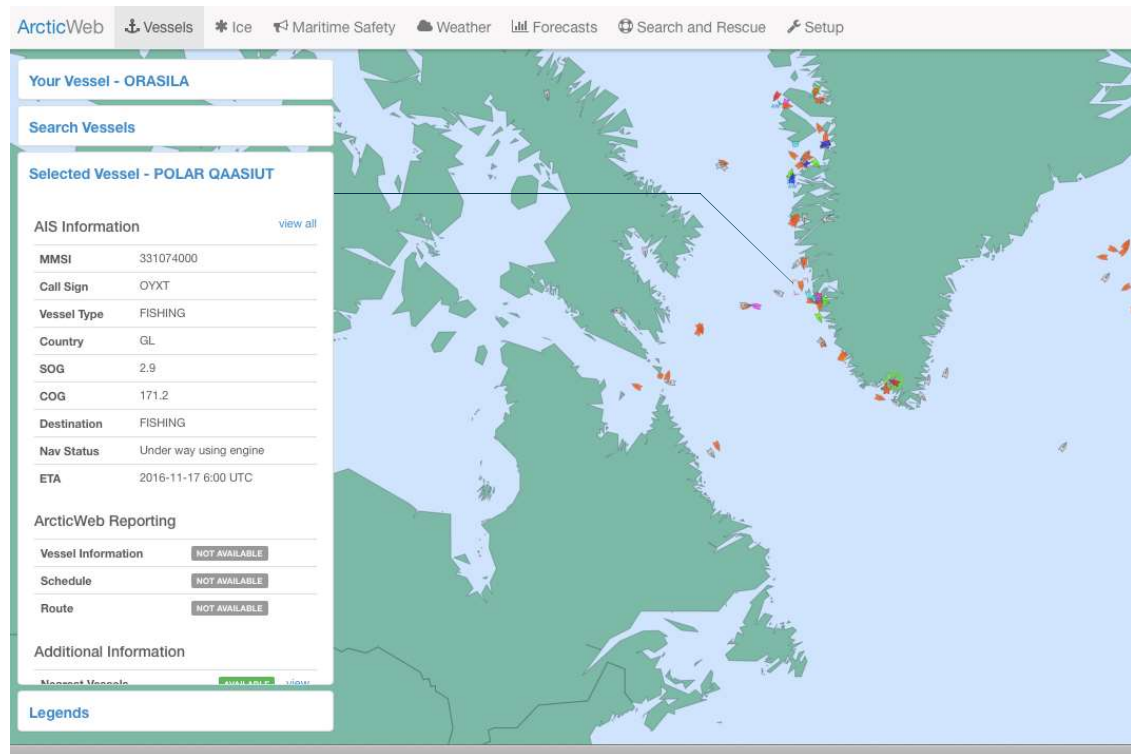
| AIS Information | |
|-----------------|------------------------|
| MMSI | 331074000 |
| Call Sign | OYXT |
| Vessel Type | FISHING |
| Country | GL |
| SOG | 2.9 |
| COG | 171.2 |
| Destination | FISHING |
| Nav Status | Under way using engine |
| ETA | 2016-11-17 6:00 UTC |

Below the AIS information, there are sections for "ArcticWeb Reporting" (with buttons for "Vessel Information", "Schedule", and "Route", all marked "NOT AVAILABLE") and "Additional Information" (with a button for "Nearest Vessels" marked "AVAILABLE"). The main area of the interface is a map of the Arctic region, showing landmasses in green and water in light blue. Numerous small, colorful icons representing vessels are scattered across the map. A dashed black box highlights a specific area in the upper right quadrant of the map, where several vessel icons are clustered together, illustrating the difficulty of identifying individual vessels in a dense area.



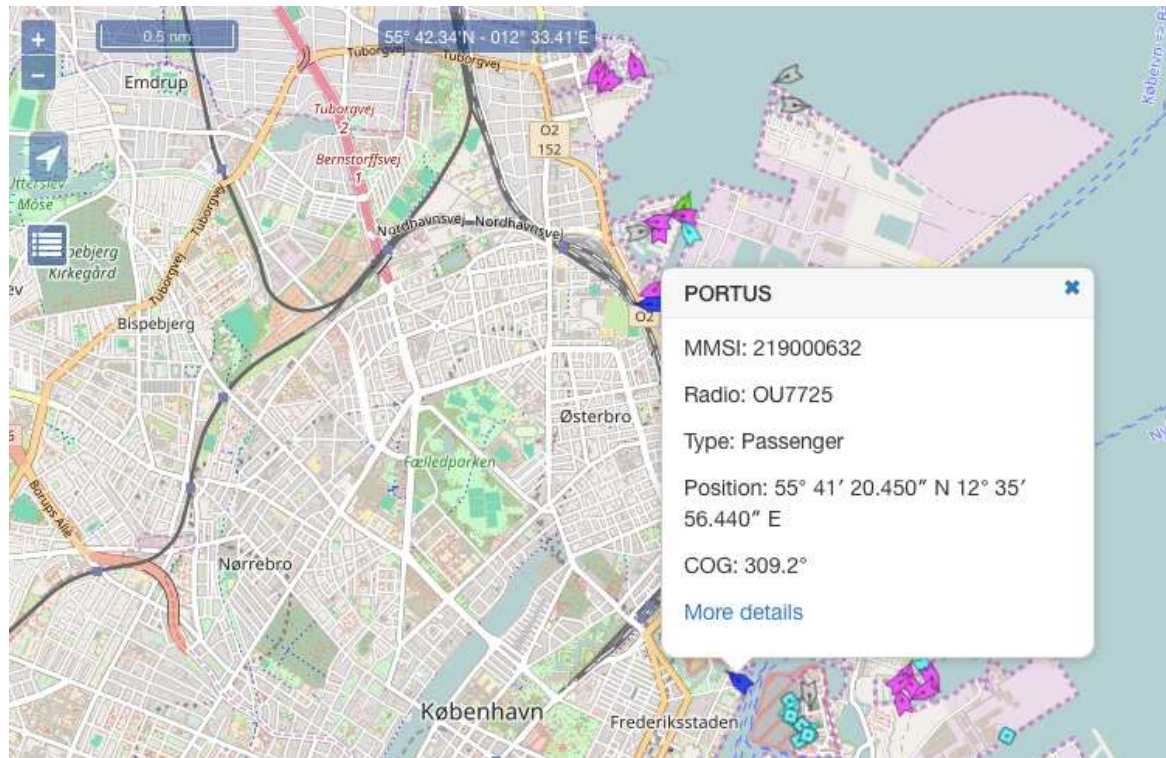
Input 1

- A traditional tracking line was suggested
- It helps:
 - Improve visualization of active vessels
 - Minimize the load on cognitive resources



Input 1

- The tracking line input has been integrated in the development of BalticWeb
- Here, the tracking line is designed as an arrow – creating a direct link between information and vessel





Input 2

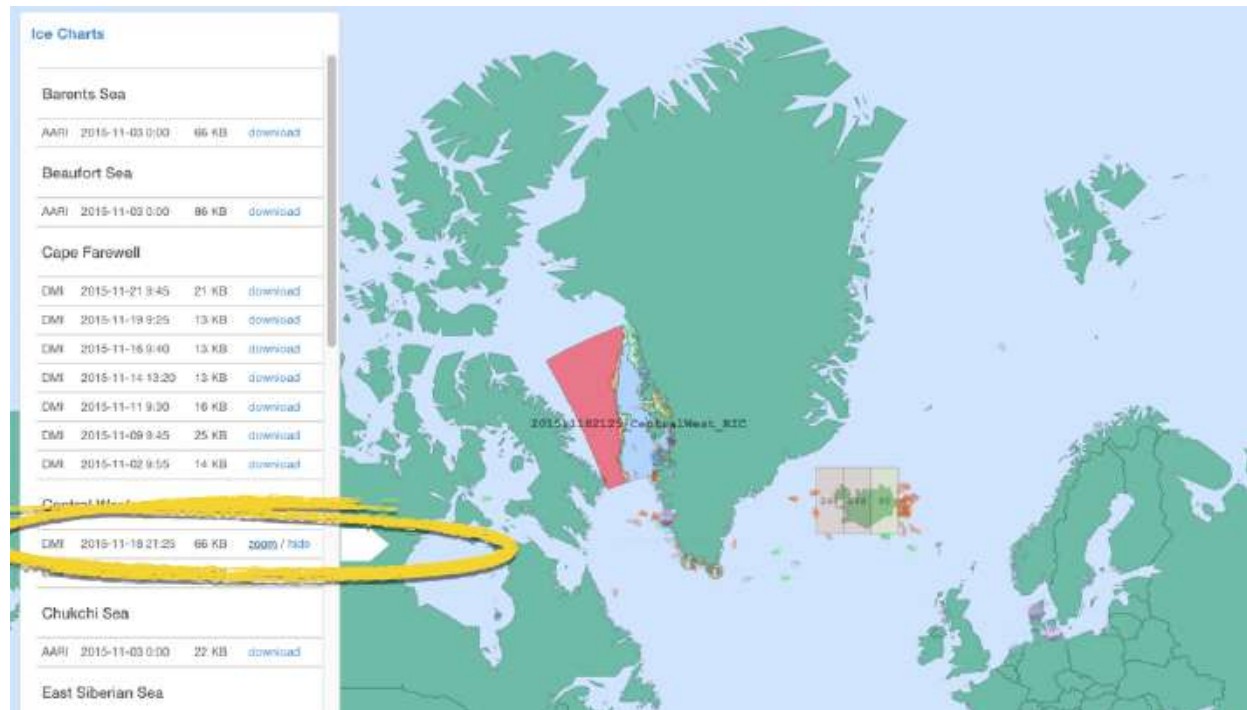
- It can be difficult to keep track of which chart layers has been selected from the menu
- Without clear indication of selected layers, the load on cognitive resources increases

zoom / hide

| Ice Charts | | | |
|----------------------|------------------|-------|-------------|
| Barents Sea | | | |
| AARI | 2015-11-03 0:00 | 86 KB | download |
| Beaufort Sea | | | |
| AARI | 2015-11-03 0:00 | 86 KB | download |
| Cape Farewell | | | |
| DMI | 2015-11-21 9:45 | 21 KB | download |
| DMI | 2015-11-19 9:25 | 13 KB | download |
| DMI | 2015-11-19 9:00 | 13 KB | download |
| DMI | 2015-11-14 13:20 | 13 KB | download |
| DMI | 2015-11-11 9:20 | 16 KB | download |
| DMI | 2015-11-09 9:45 | 25 KB | download |
| DMI | 2015-11-02 9:55 | 14 KB | zoom / hide |

Input 2

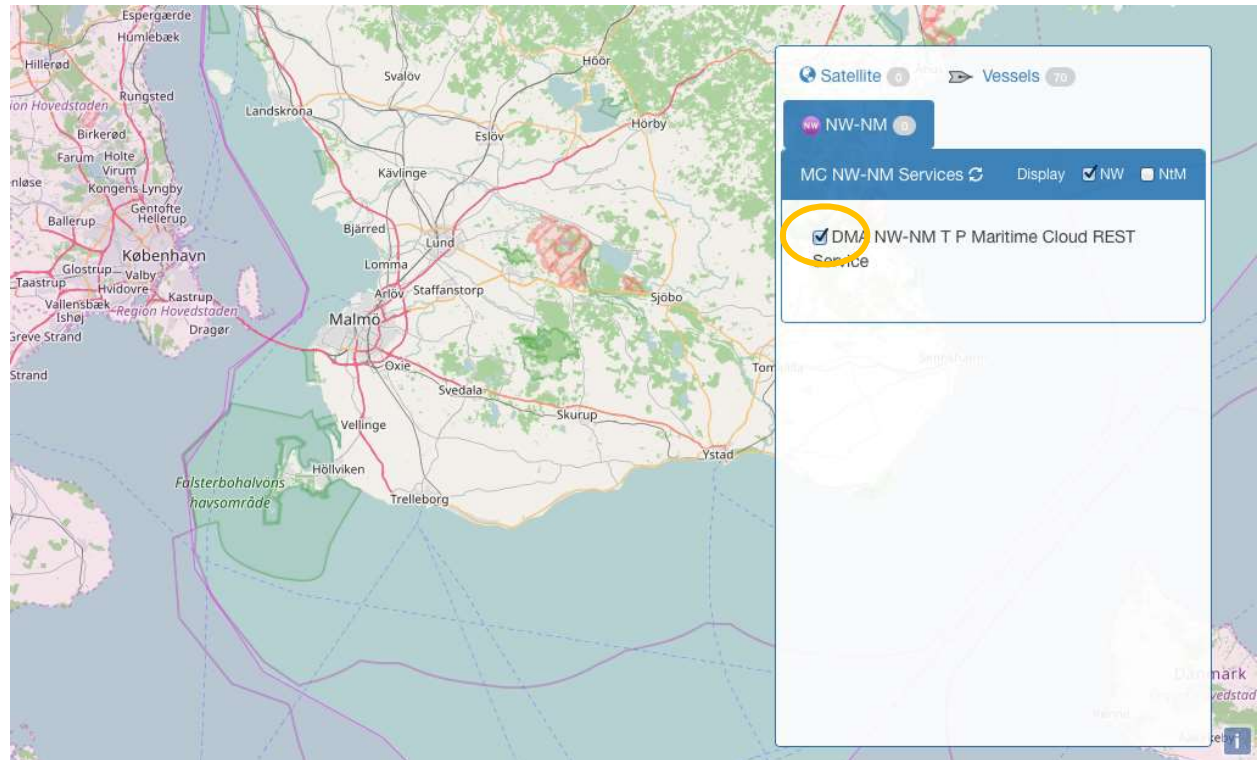
- It was suggested to add an object to the selected information – using the "squint for eye" technique
- It helps:
 - Selected informations stand out - overview
 - Minimize the load on cognitive ressources





Input 2

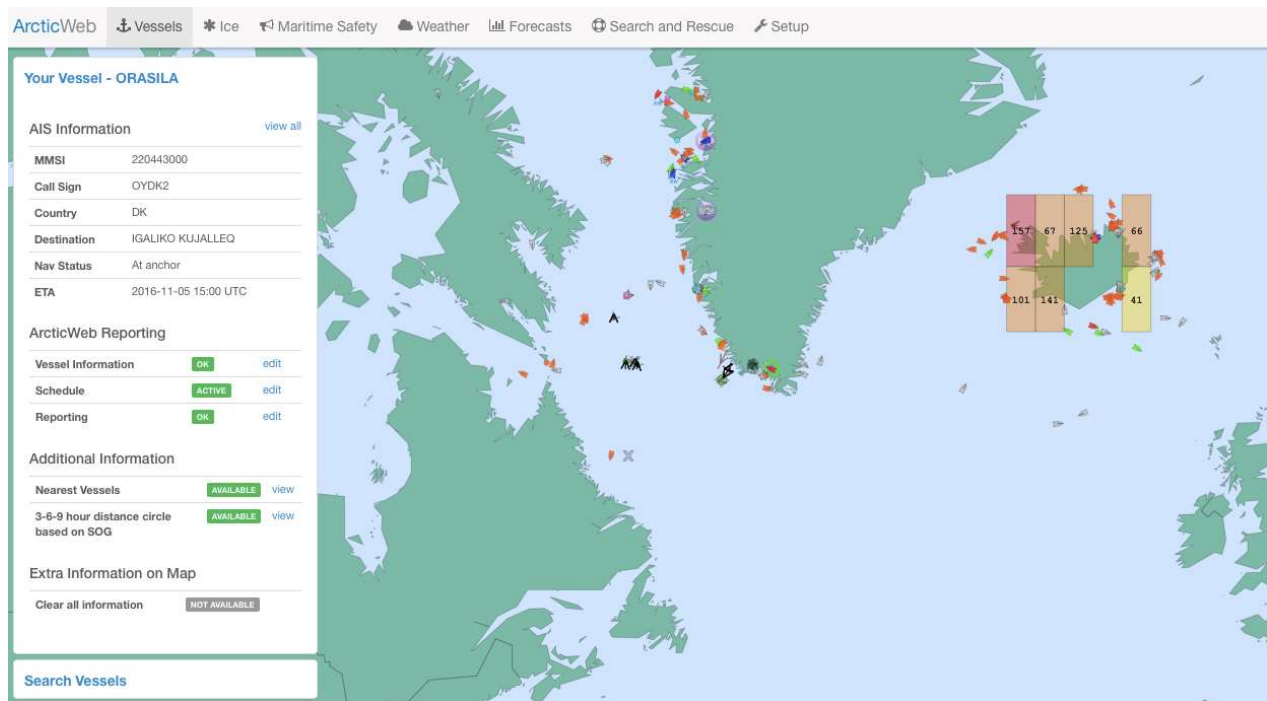
- The "squint for eye" input has been integrated in the development of BalticWeb
- Here, it is designed as a tick off box – making it easy to see which layers has been chosen





Input 3

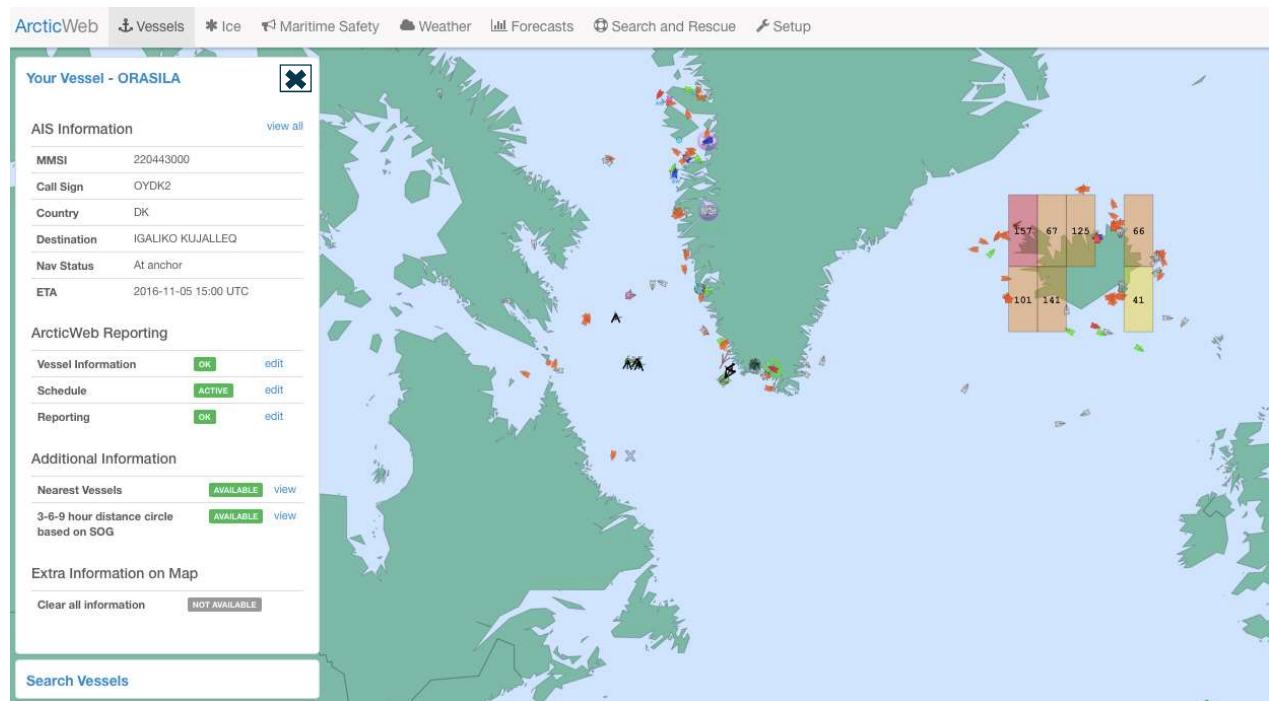
- The menu takes up space on the map, causing parts of the map to be hidden
- The menu is not necessary of value to the user – if e.g. the goal is to navigate directly around the map





Input 3

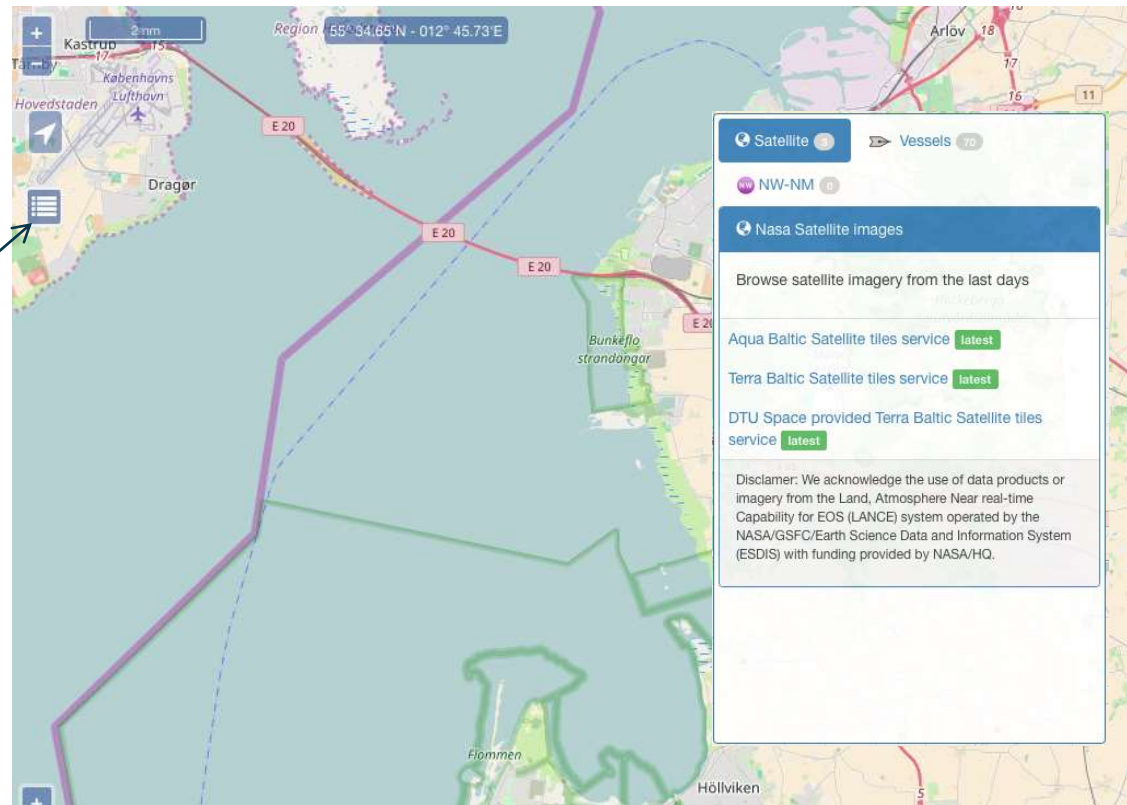
- It was suggested to allow the user to hide the menu bar
- It helps:
 - The user to navigate undisturbed in the map
 - The user to subjectively control the interface



[Search Vessels](#)

Input 3

- The input on the menu bar has been integrated in the development of BalticWeb
- Here, the menu button allows to click the menu on/off – putting the user in control





Design work with users

*Project with interaction design students
at NTNU in Trondheim*

April, 2016

Arctic Web - Design project with 3 masters students in Interaction Design from Norwegian University of Science and Technology



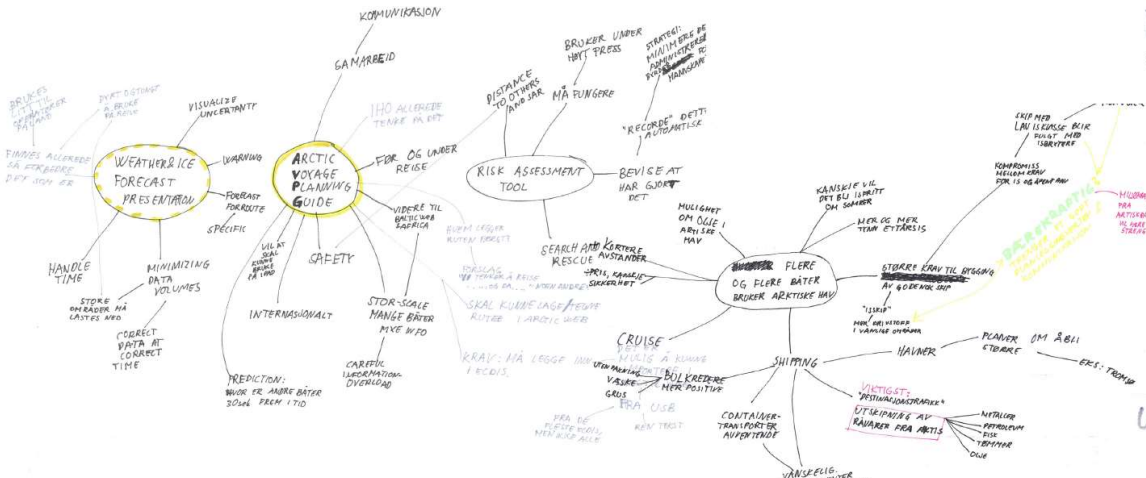
Linn, Aurora, Truls and the captain on the Hurtiguten's M/S Midnatsol





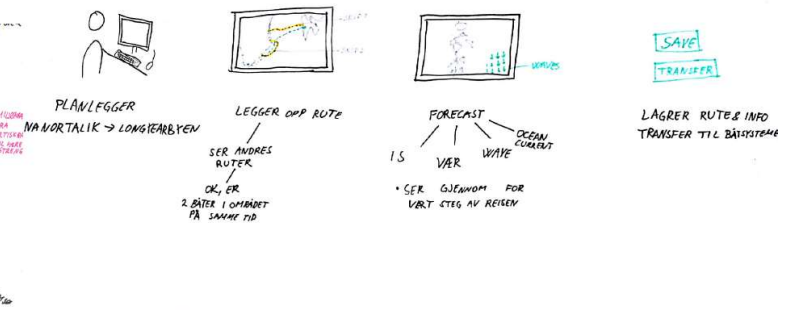
“Papirkart kommer aldri til å forsvinne fra broa”

“Kan jo være det fungerer på de gode skjermene på laben, men må fungere når er sjøsyk og kan nesten ikke stå oppreist.”

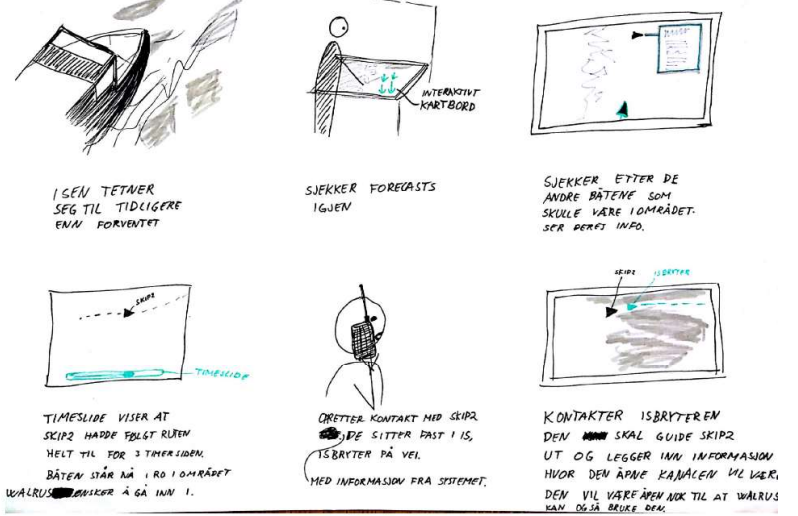


FØR REISE

SØREN PÅ BÅTEN WALRUS



UNDER REISE



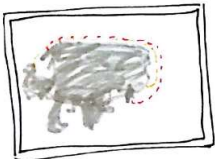
ØNSKE OM Å FRAKTE GODS FRA SØR-KOREA TIL TROMSØ VIL TA ARKTIS RUTE



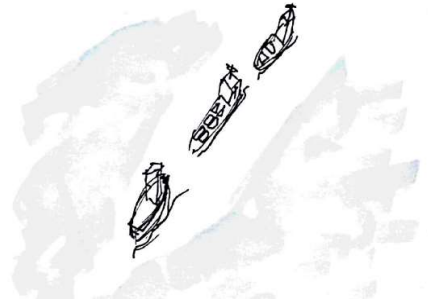
HAR ET SKIP SOM KUN ER KLARERT TIL "LAVERE ISKLASSE"



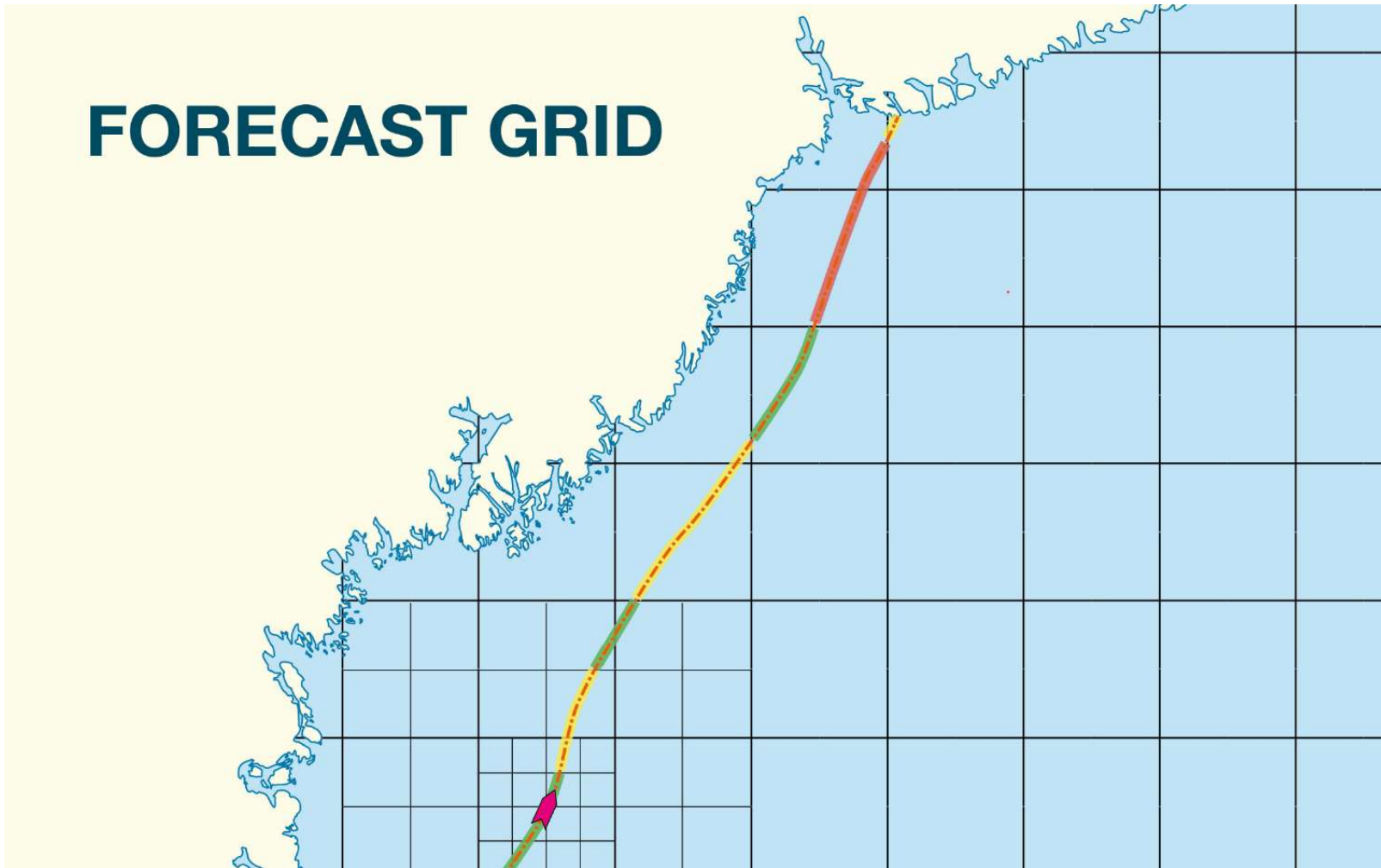
LEGGER UT PLAN PÅ ~~NETT-TJENESTE~~ ET ANBUD.
ØNSKE
• ISBRYTER
• FLERE BÅTER I KOMBO

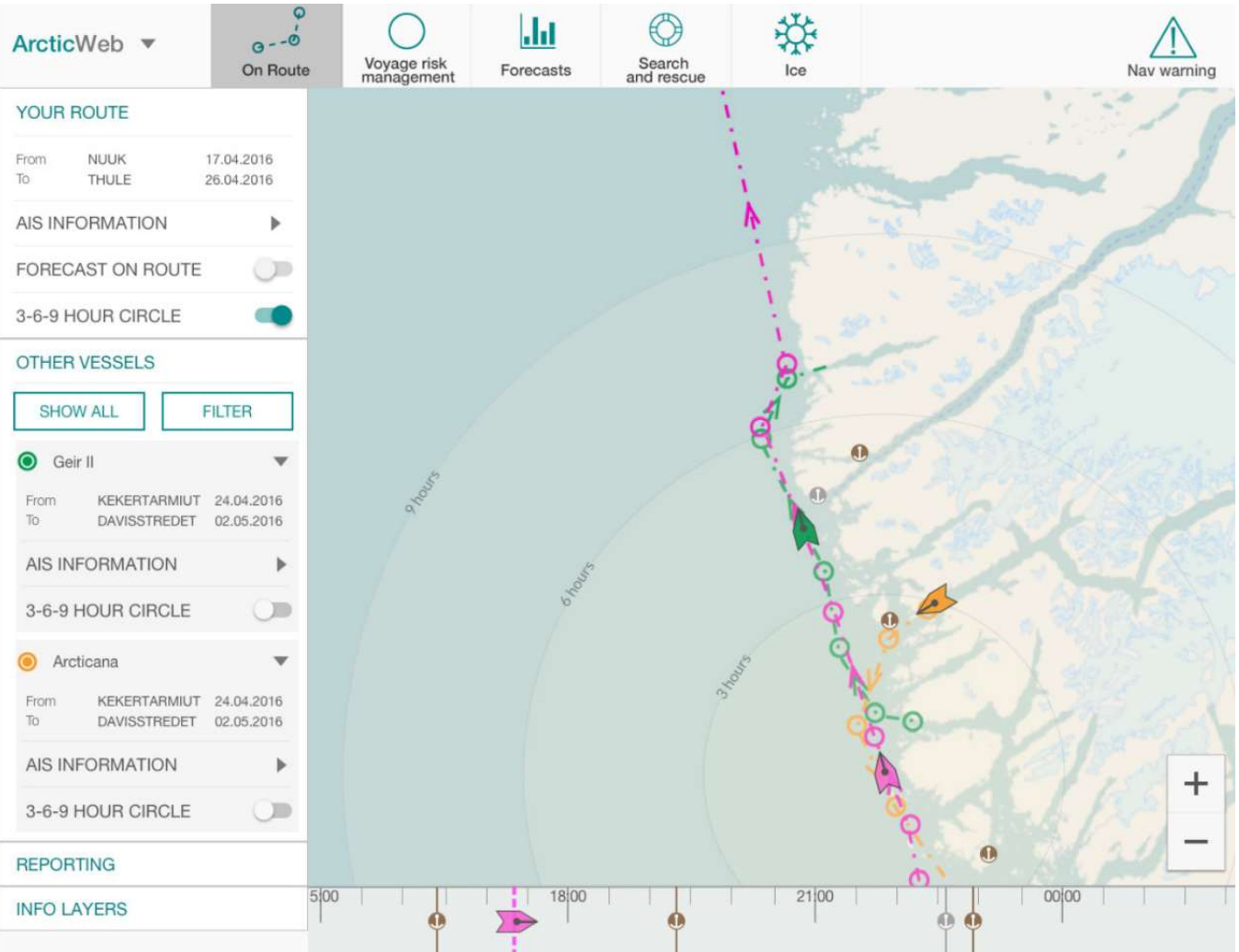


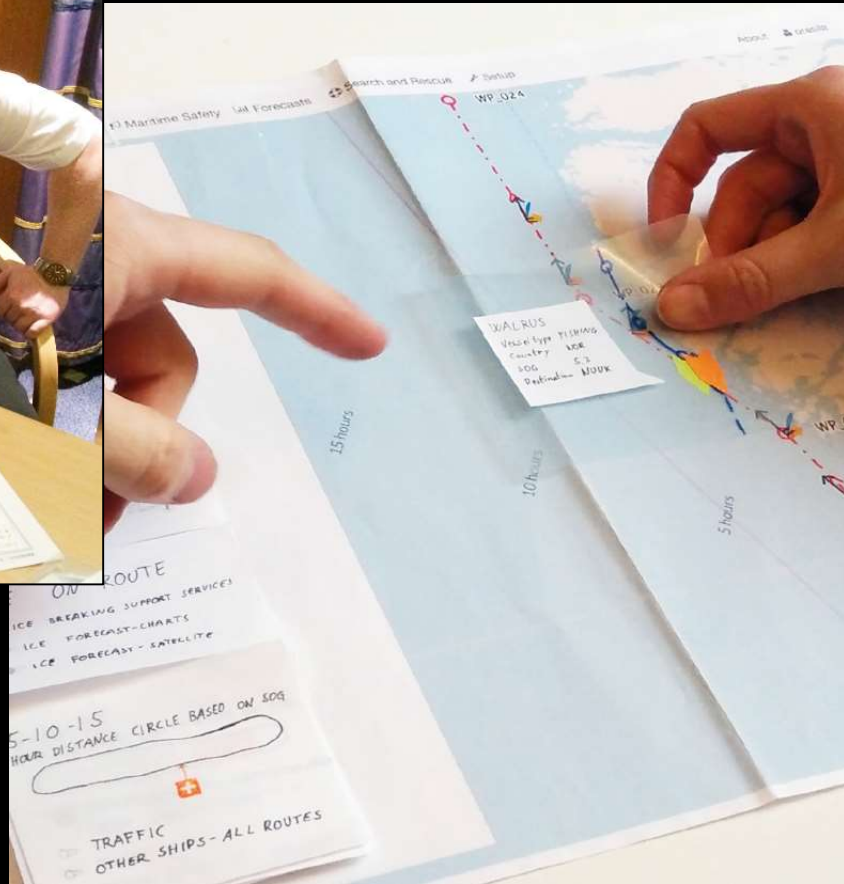
TJENESTEN MATCHER MED ANDRE PASSENDE RUTER, ELLER MÅ HAV



FORECAST GRID







User test with paper prototype



Display of e-Navigation information



Maritim Service Portfolio

| | |
|---------|---|
| MSP 1 | VTS Information Service (IS) |
| MSP 2 | Navigational Assistance Service (NAS) |
| MSP 3 | Traffic Organisation Service (TOS) |
| MSP 4 | Local Port Service (LPS) |
| MSP 5 | Maritime Safety Information (MSI) Service |
| MSP 6 | Pilotage Service |
| MSP 7 | Tugs Service |
| MSP 8 | Vessel Shore Reporting |
| MSP 9 | Telemedical Maritime Assistance Service |
| MSP 10 | Maritime Assistance Service (MAS) |
| MSP 11 | Nautical Chart Service |
| MSP 12 | Nautical Publications Service |
| MSP 13 | Ice Navigation Service |
| MSP 14 | Meteorological Information Service |
| MSP 15 | Real-Time Hydrographic and Environmental Information Services |
| MSP 16 | Search and Rescue (SAR) Service |
| MSP ... | More to come... |

| MSPs | Information items |
|------------|--|
| 1 INS | <ul style="list-style-type: none"> • The position, identity, intention and destination of vessels; • Amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points; • The mandatory reporting of vessel traffic movements; • Meteorological and hydrological conditions, notices to mariners, status of aids to navigation; • Maneuverability limitations of vessels in the VTS area that may impose restrictions on the navigation of other vessels, or any other potential hindrances: or • Any information concerning the safe navigation of the vessel. |
| 2 NAS | <ul style="list-style-type: none"> • Risk of grounding; • Vessel deviating from the recommended track or sailing plan; • Vessel unsure of its position or unable to determine its position; • Vessel unsure of the route to its destination; • Assistance to a vessel to an anchoring position; • Vessel navigational or maneuvering equipment casualty; • Inclement conditions (e.g. low visibility, high winds); • Potential collision between vessels; • Potential collision with a fixed object or hazard; • Assistance to a vessel to support the unexpected incapacity of a key member of the bridge team, on the request of the master. |
| 3 TOS | <ul style="list-style-type: none"> • vessel movements need to be planned or prioritized to prevent congestion or dangerous situations; • special transports or vessels with hazardous or polluting cargo may affect the flow of other traffic and need to be organized; • an operating system of traffic clearances or sailing plans, or both, has been established; • the allocation of space needs to be organized; • mandatory reporting of movements in the VTS area has been established; • special routes should be followed; • speed limits should be observed; • the VTS observes a developing situation and deems it necessary to interact and coordinate vessel traffic; • nautical activities (e.g. sailing regattas) or marine works in-progress (such as dredging or submarine cable-laying) may interfere with the flow of vessel movement. |
| 4 LPS | <ul style="list-style-type: none"> • berthing information; • availability of port services; • shipping schedules; • meteorological and hydrological data. |
| 5 MSI | <ul style="list-style-type: none"> • National Hydrographic Offices, for navigational warnings and chart correction data; • National Meteorological Offices, for weather warnings and forecasts; • Rescue Co-ordination Centres (RCCs), for shore-to-ship distress alerts; • The International Ice Patrol, for Oceanic ice hazards. |
| 6 Pilotage | |
| 7 | |





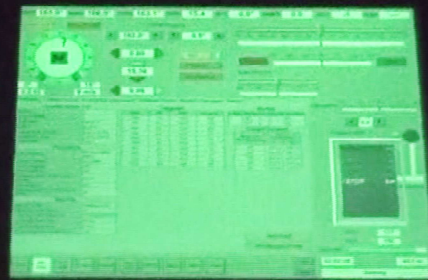
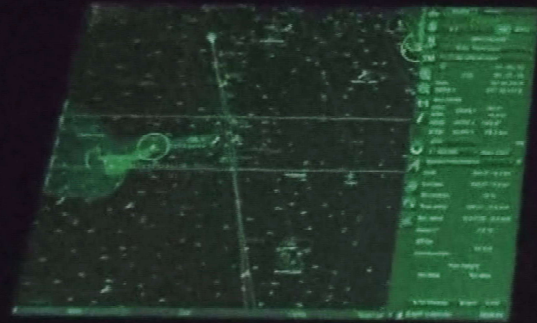
M/V Kong Harlad



P&O North Sea Ferries' M/V Pride of Hull

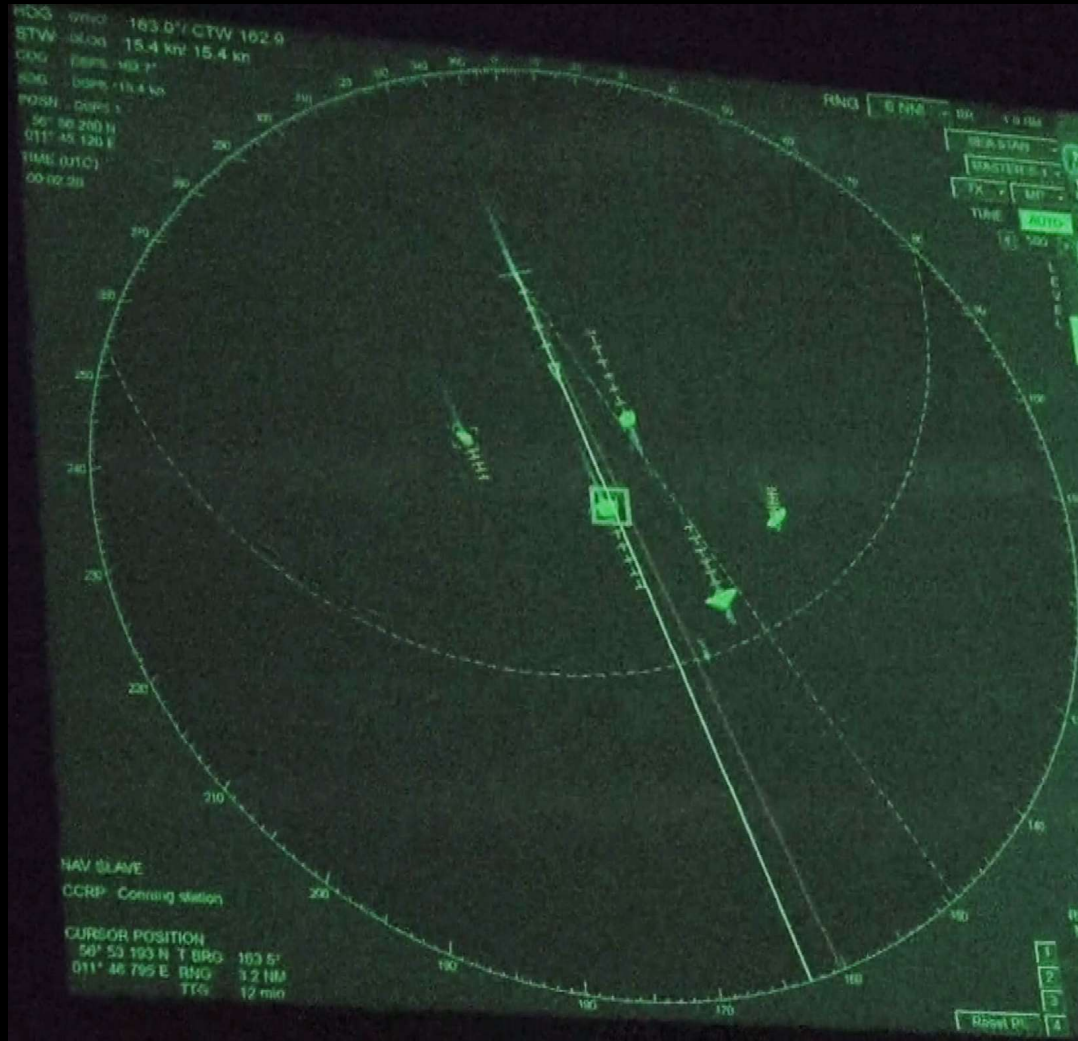
ECDIS

Radar





HDG - 163.0° / CTW 162.9
 STW - 15.4 kn / 15.4 kn
 COG - 163.0°
 SOG - 15.4 kn
 POSN - 50° 53' 19.3" N
 011° 46' 7.9" E
 TIME (UTC) - 00:02:28



RNC 6 NM
 BRG 1.9 NM
 ARPA AIS CHART MAP
 Prim. Time error
 GEN: AUX. EPPS 2: NO Input
 T VECT R VECT 5 min
 T TRAIL R TRAIL 5 min
 CPA 0.50 NM TCPA 0 min
 Post 0.5 1 2 4 min
 Priority ARPA - Association
 AIS S OFF

Targets Information
 Target 2
 TGT 2
 CPA 0.64 NM
 TCPA 47 min 36 s
 BRG 164.8° T
 RNG 3.2 NM
 STW 11.4 kn
 CTW 162.1°
 R CTW 345.4°
 R SPD 4.1 kn
 BCR 1.67 NM
 SCT 31 min 49 s
 Not Associated

Accumulation: 1 2 3 4 5
 GAIN
 RAIN
 SEA AUTO
 EBL/VRM 1 EBL VRM 4
 EBL 1 169.1° T OFFSET
 VRM 1 5.41 NM Fixed

NAV SLAVE
 CCRP - Conning station
 CURSOR POSITION
 50° 53' 19.3" N T BRG 163.5°
 011° 46' 7.9" E RNG 3.2 NM
 TTG 12 min

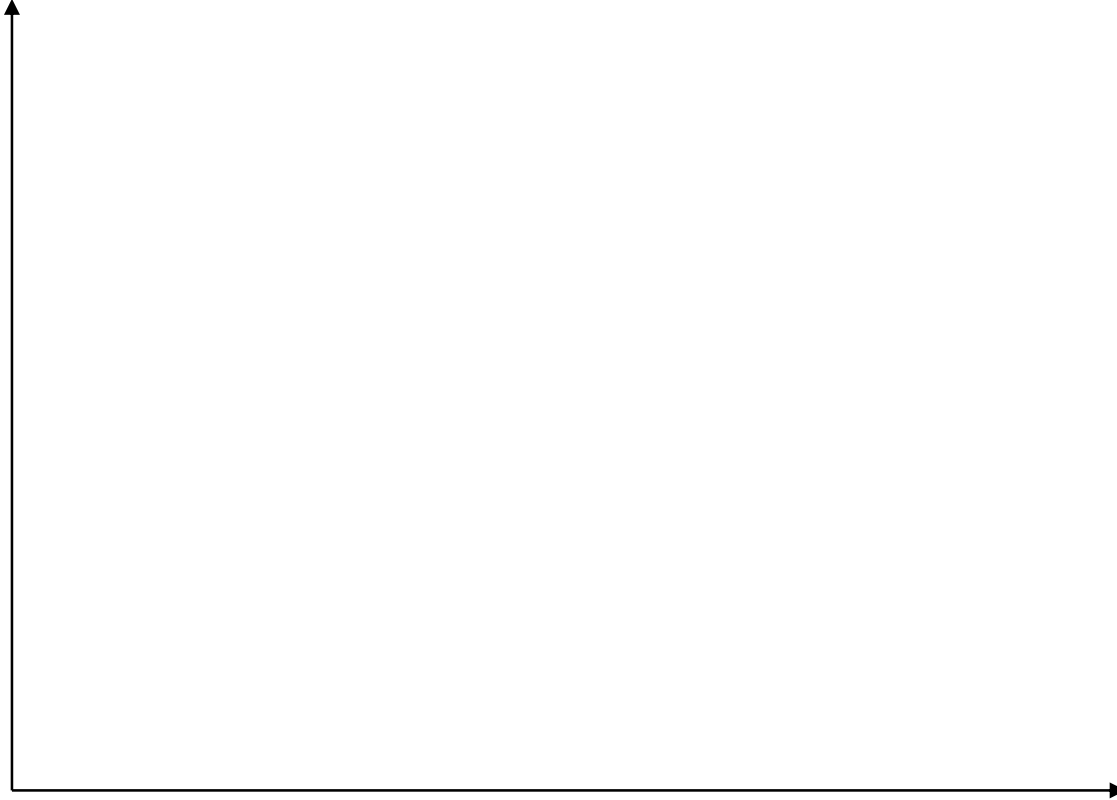
1
 2
 3
 4
 Repeat Pl.



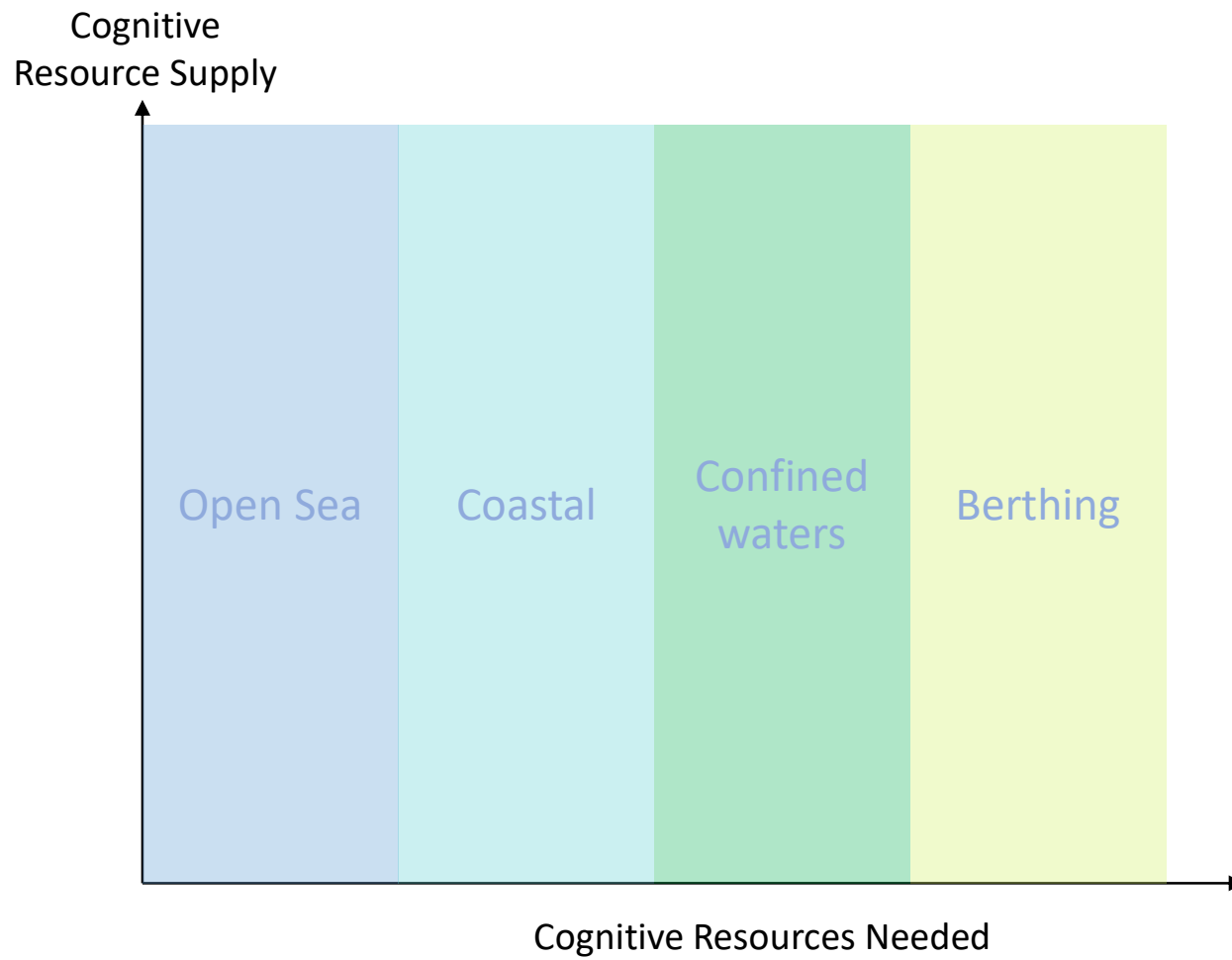
Captain Jason Ikiadis, right, and First Officer Nikos Ninios on the bridge of the Azamara Journey. (ERIC WYNNE)

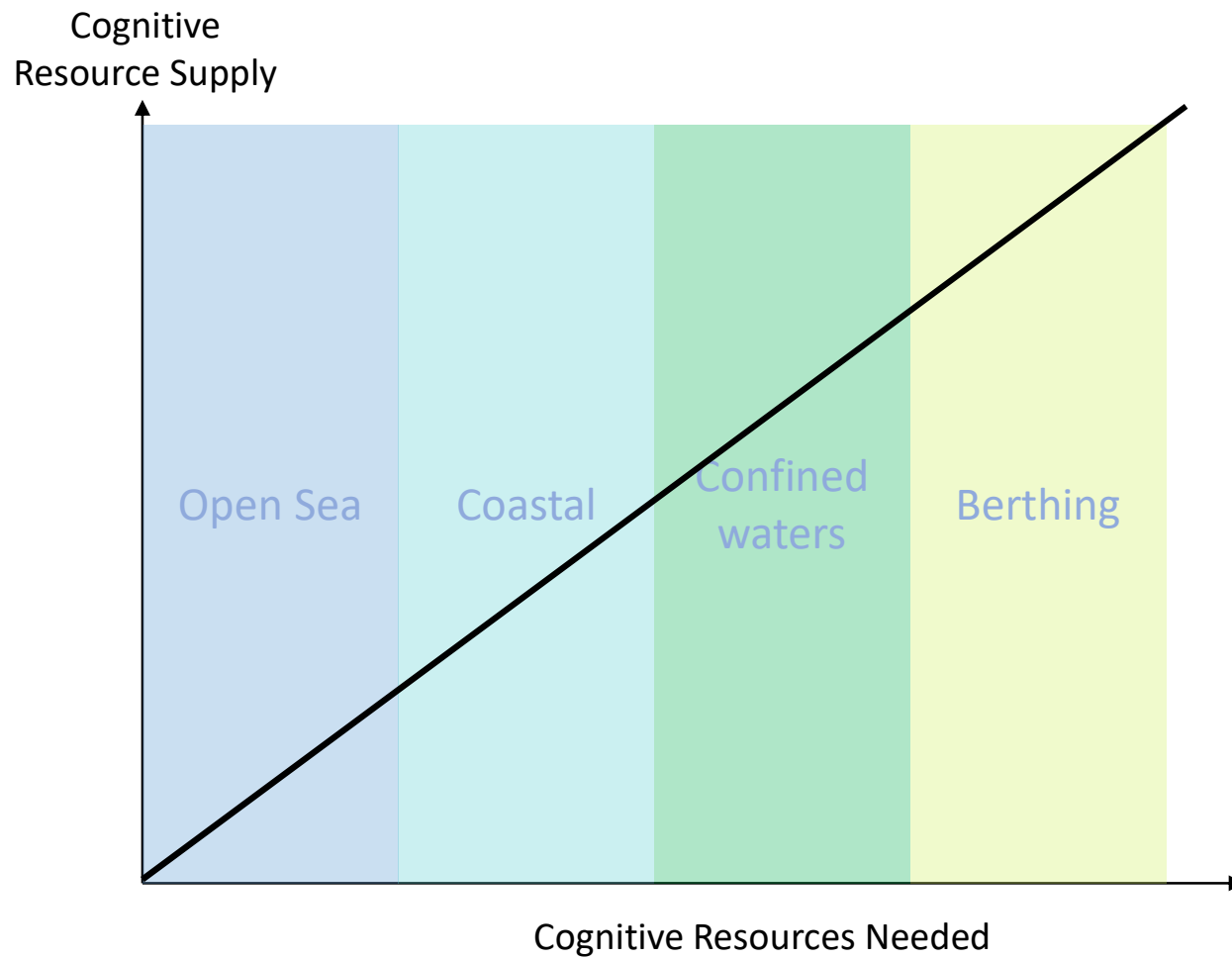
<http://thechronicleherald.ca/titanic/slideshow/83244-azamara-journey>

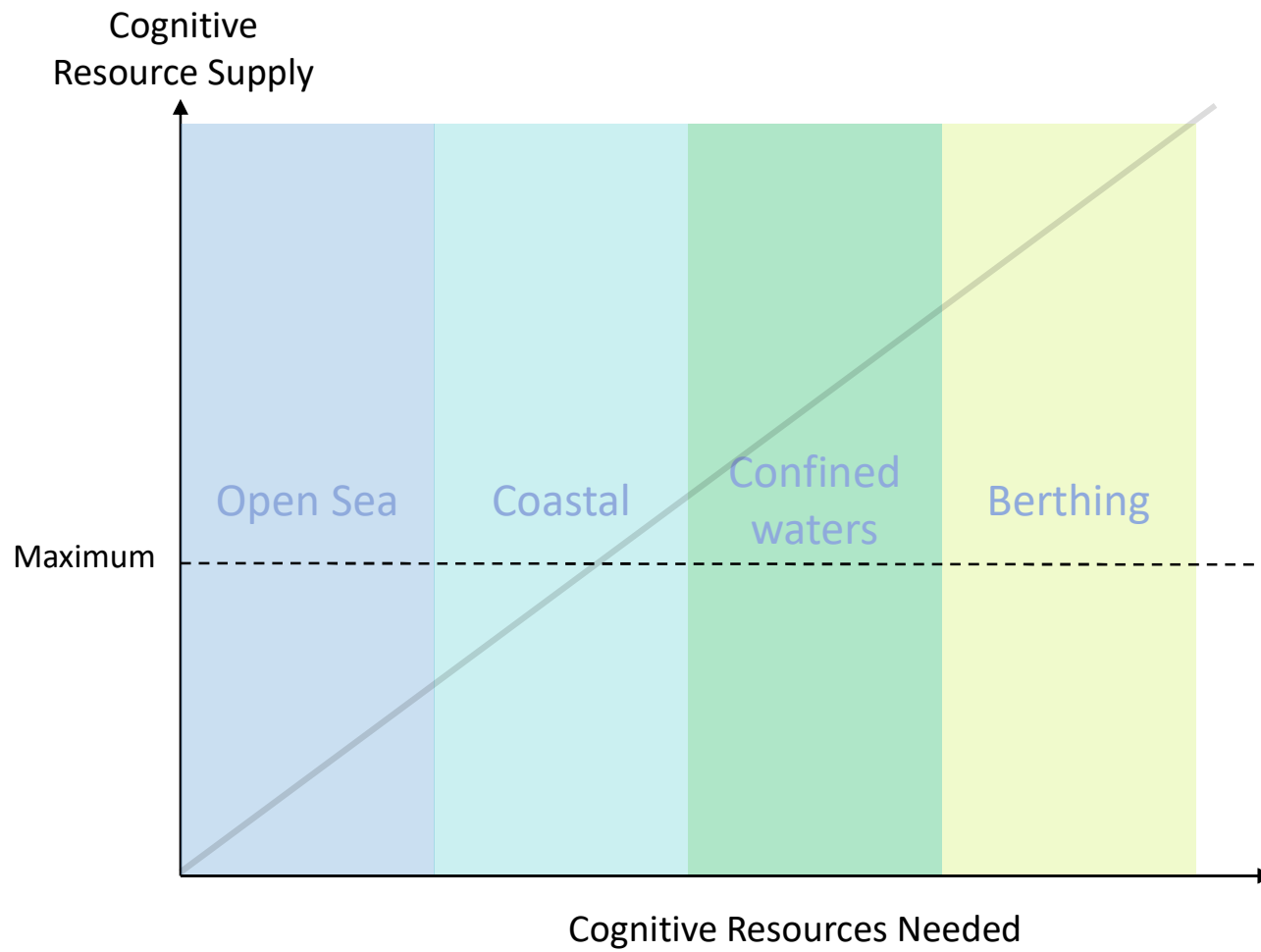
Cognitive
Resource Supply

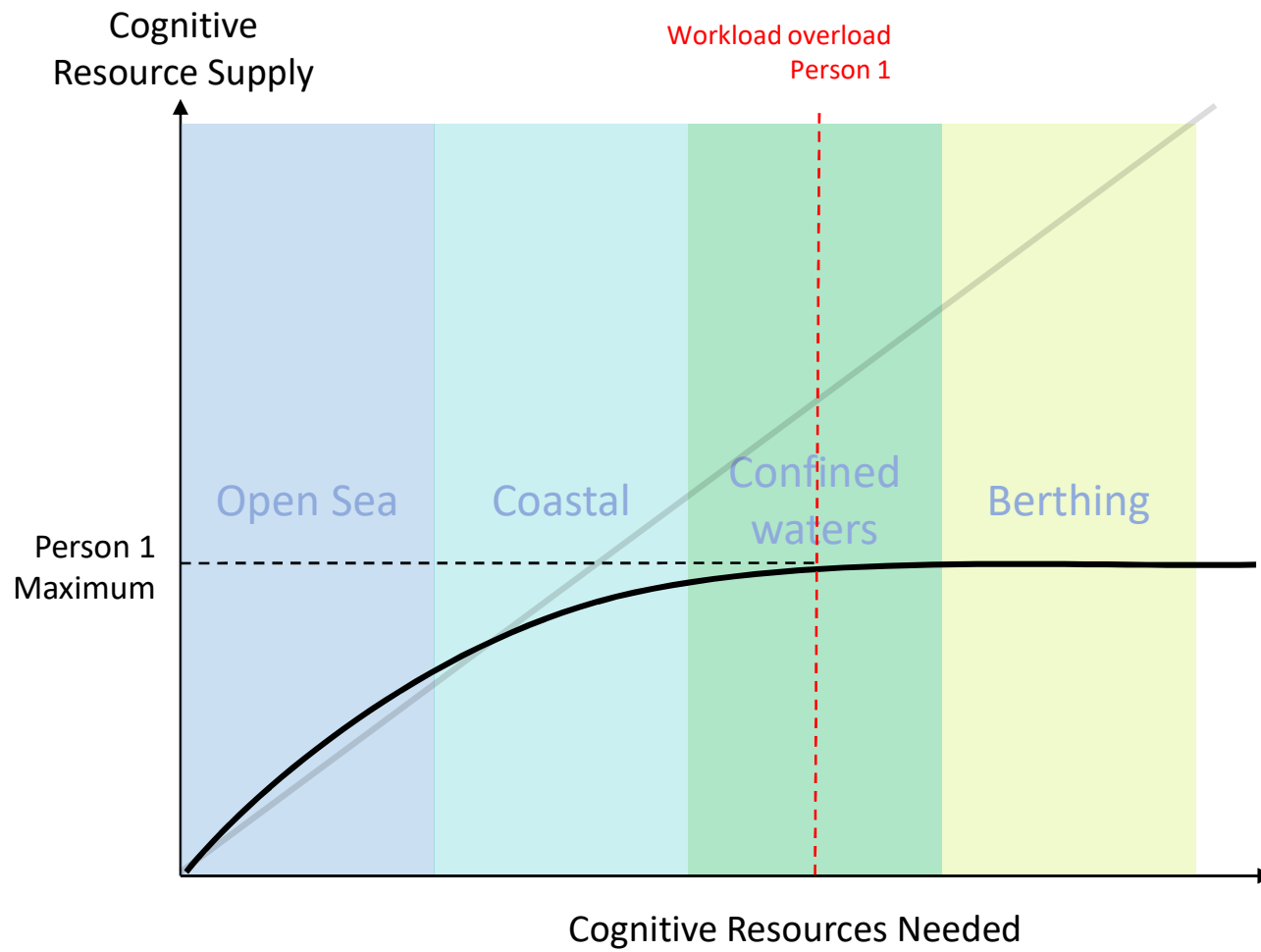


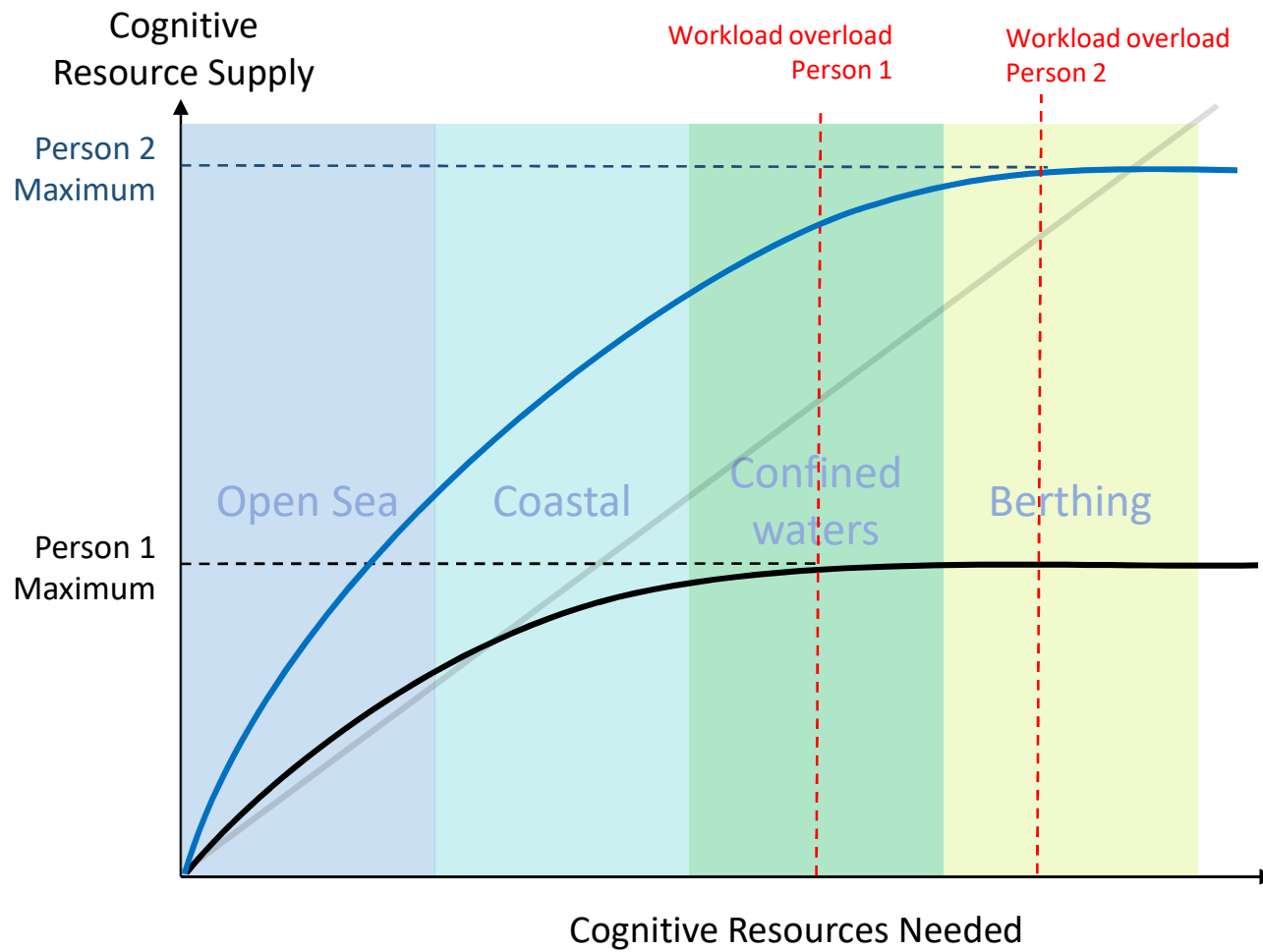
Cognitive Resources Needed

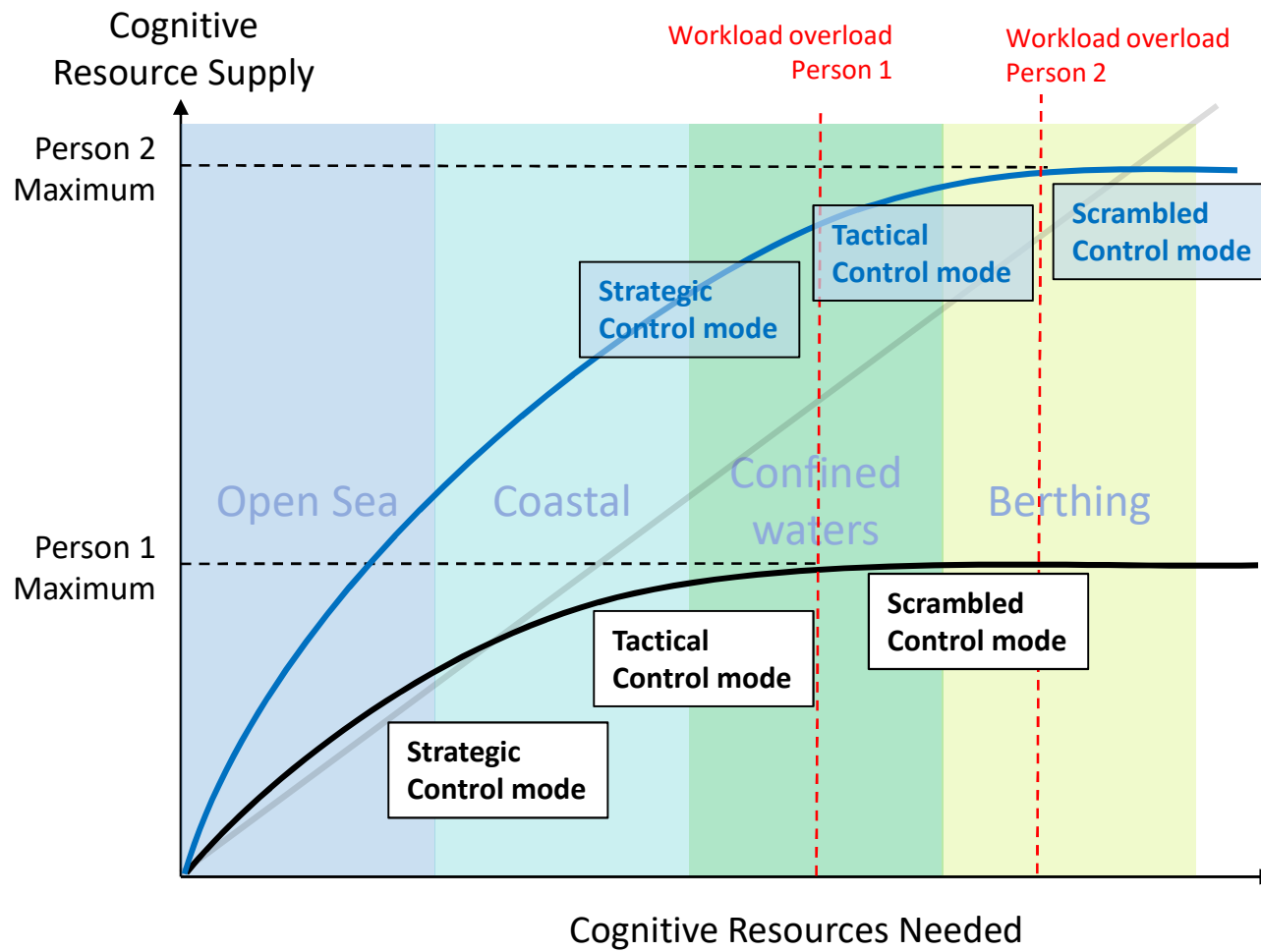








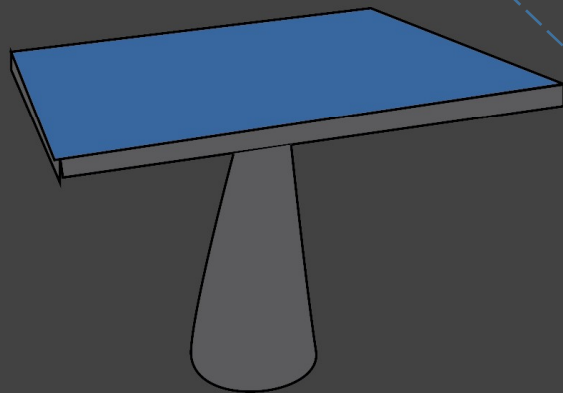




Strategic navigation

"Back bridge"

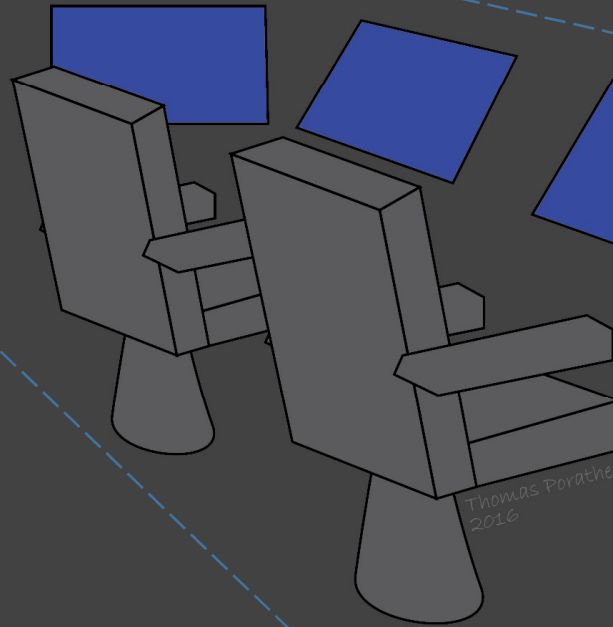
(Electronic table, iPad, Laptop, ...)



Tactical navigation

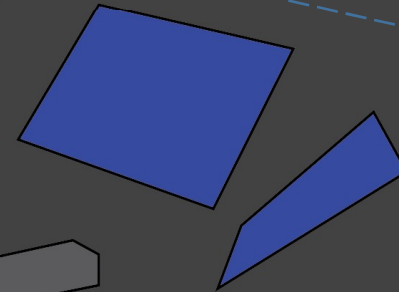
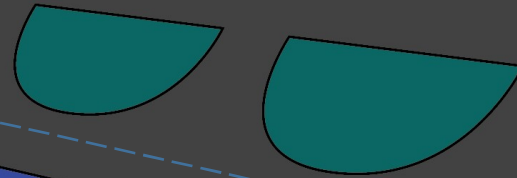
"Front bridge"

(INS)



Scrambled navigation

(Conning, HUD, HMD, ...)

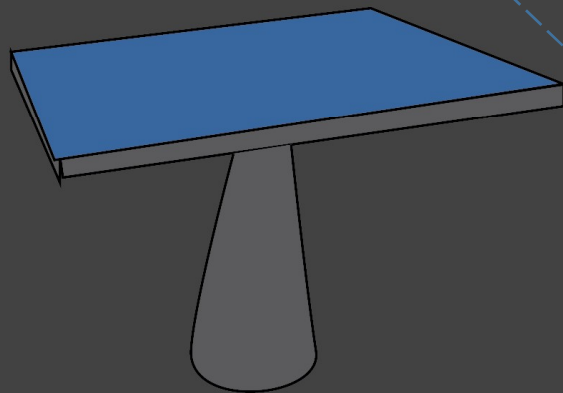


Thomas Porathe
2016

Strategic navigation

”Back bridge”

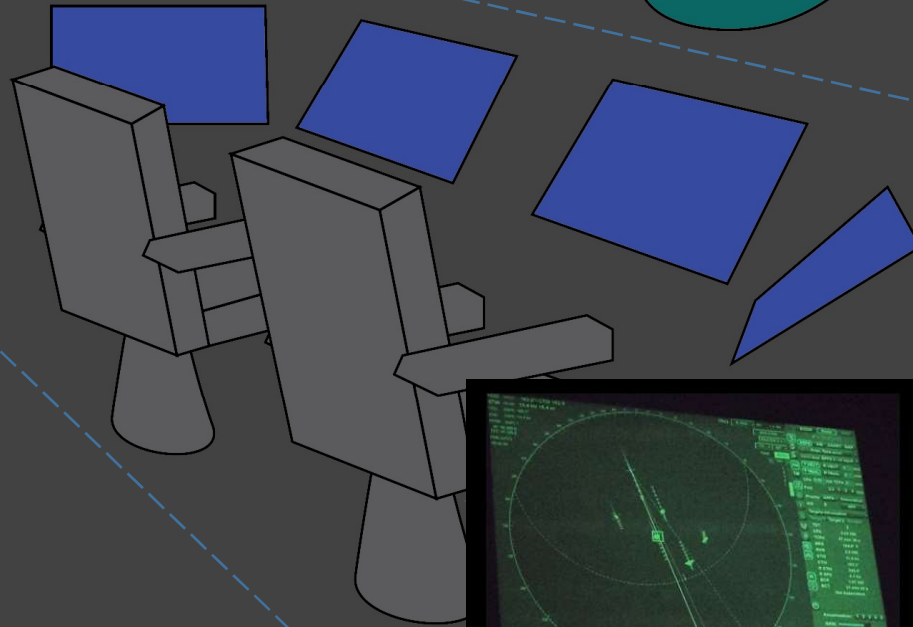
(Electronic table, iPad, LapTop, ...)



Tactical navigation

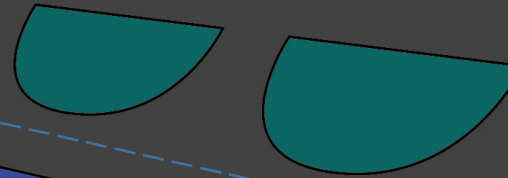
”Front bridge”

(INS)



Scrambled navigation

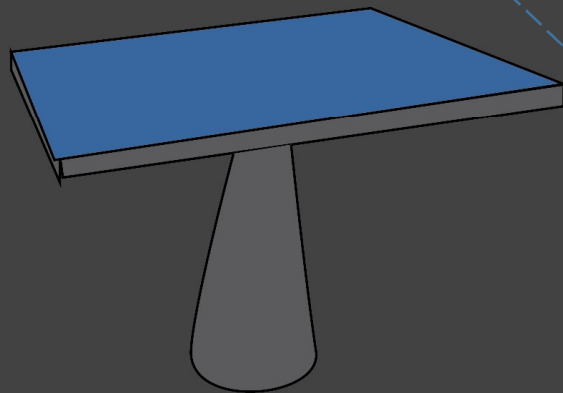
(Conning, HUD, HMD, ...)



Strategic navigation
"Back bridge"
(Electronic table, iPad, LapTop, ...)

Tactical navigation
"Front bridge"
(INS)

Scrambled navigation
(Conning, HUD, HMD, ...)



Certain e-Nav information



Strategic navigation

"Back bridge"

(Electronic table, iPad, LapTop, ...)

Tactical navigation

"Front bridge"

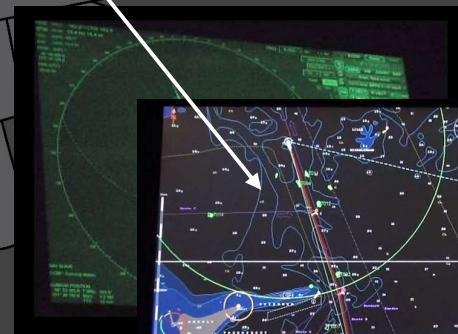
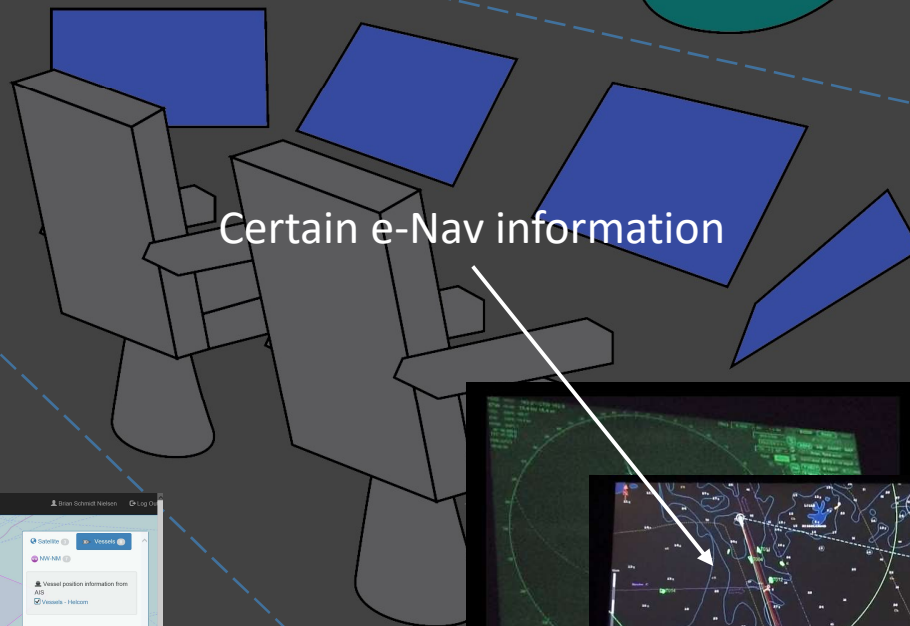
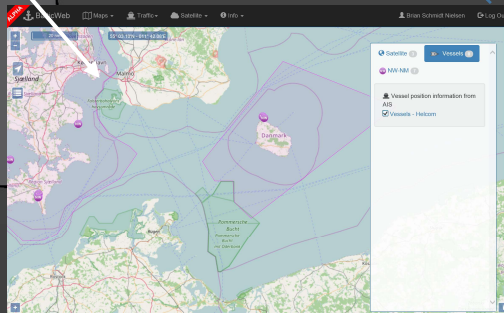
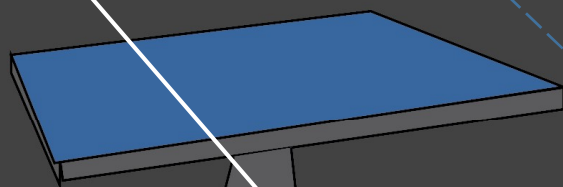
(INS)

Scrambled navigation

(Conning, HUD, HMD, ...)

Most e-Nav information

Certain e-Nav information



Strategic navigation

"Back bridge"

(Electronic table, iPad, LapTop, ...)

Tactical navigation

"Front bridge"

(INS)

Scrambled navigation

(Conning, HUD, HMD, ...)

Most e-Nav information

