Människan och de autonoma skeppen: Hur ser lägesbilden ut i landcentralen?

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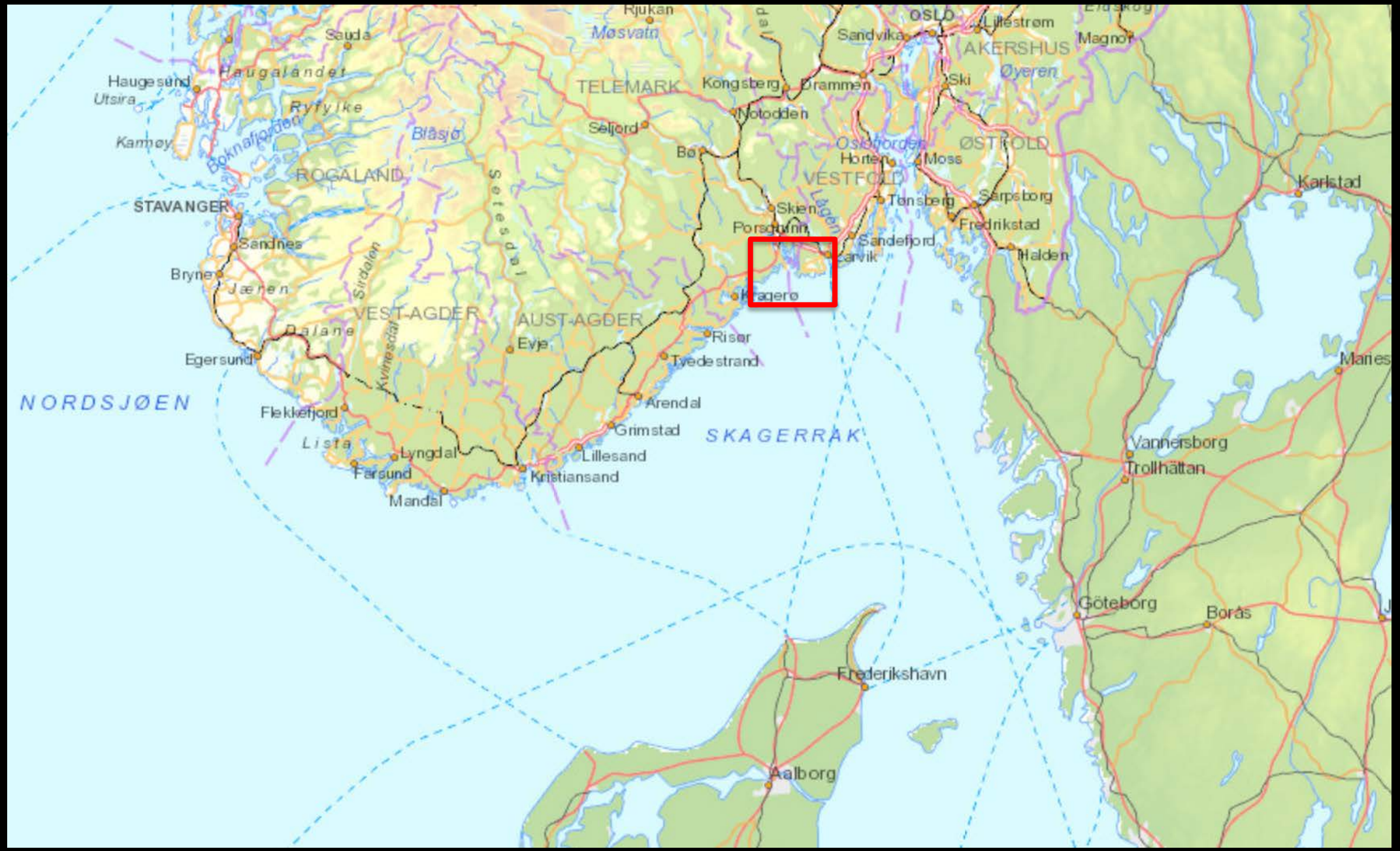
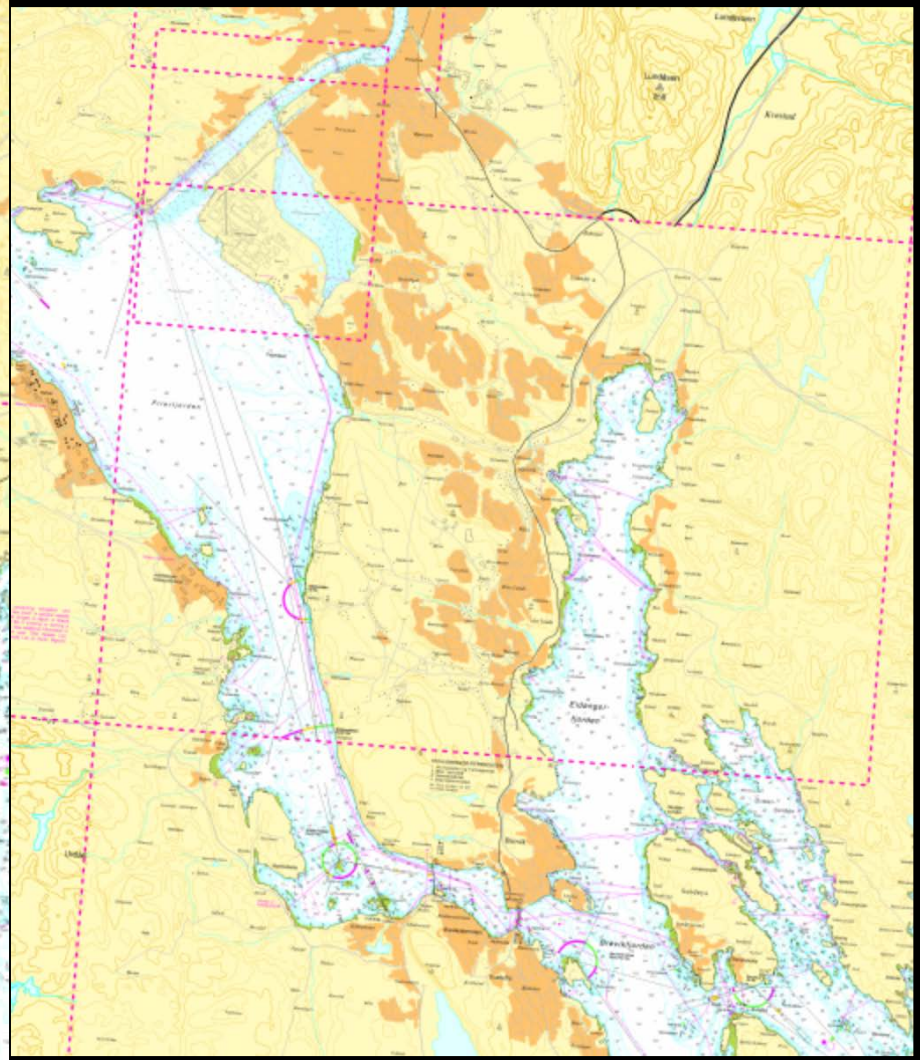
Autonomous ship project, key facts about YARA Birkeland

The autonomous ship YARA Birkeland as designed by Marin Teknikk.

https://www.km.kongsberg.com/ks/web/nokbg0240.nsf/AllWeb/4B8113B707A50A4FC125811D00407045?OpenDocument [acc. 2018-02-04]


Rjukan
Møsvatn
Sauda
Haugesund
Haugalandet
Utsira
Ryfylke
Karmøy
Boknafjorden
Bråsjø
ROGALAND
STAVANGER
Sandnes
Bryne
Jæren
Dalane
Egersund
Sirdalen
Setesdal
Kvinesdal
Lista
Flekkefjord
Farsund
Lyngdal
Mandal
TELEMARK
Kongsberg
Drammen
Notodden
Seljord
Bø
VEST-AGDER
AUST-AGDER
Evje
Risør
Tvedestrand
Arendal
Grimstad
Lillesand
Kristiansand
NORDSJØEN
SKAGERRAK
OSLO
Sandvika
Lillestrøm
AKERSHUS
Magnor
Øyeren
Ski
Oslofjorden
ØSTFOLD
Horten
Moss
VESTFOLD
Tønsberg
Sarpsborg
Fredrikstad
Skien
Porsgrunn
Larvik
Sandefjord
Halden
Kragerø
Karlstad
Vänersborg
Trollhättan
Göteborg
Borås
Frederikshavn
Aalborg


km




YARA BIRKELAND
PORSGRUNN
Zero Emission
Yara Birkeland

Estimated facts & figures	Capacity	Proximity sensors
Main particulars **Length o.a.**: 79,5 m **Length p.p.**: 72,4 m **Width mld.**: 14,8 m **Depth shelter deck**: 10,8 m **Draught (full)**: 6 m **Draught (ballast)**: 3 m **Service speed**: 6 knots **Max speed**: 13 knots	**Cargo capacity**: 120 TEU **Deadweight**: 3 200 mt **Propulsion system**: Electric **Propellers**: 2 Azimuth pods **Thrusters**: 2 Tunnel thruster **Battery pack**: 7 – 9 MWh	Radar Lidar AIS Camera IR camera **Connectivity & Communication** Maritime Broadband Radio Satellite Communications GSM

https://www.km.kongsberg.com/ks/web/nokbg0240.nsf/AllWeb/4B8113B707A50A4FC125811D00407045?OpenDocument [acc. 2018-02-04]

MarineTraffic

Live Map | Vessels | Ports | Photos | Participate | Solutions

N59°03'27.81
E009°40'05.38
(59.0577, 009.6682)

Setrevegen
Eidangervegen
Esmarksgate
Trosvikvegen
Trosvik Verkste...
Storgata
Kirkevegen
Nygata
Stx Norway Offs...
Brevik-Bjørkøya
Brevik-Sandøya
Sandøya
Skolelia
Postvegen
Sandøyvegen
Søndre Maiensveg
Sandøya-Bjørkøya
Hellebergveien
Krabberødstrand
Storåsveien
Krabberødveien
Stathelle
Falkåsveien
Kjellestadb
354
352
E18

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NTNU


Smartphone connects wirelessly to vehicle to control steering, brakes and throttle.
VE14 VKF
Steering
Brake
Connect / Disconnect
Throttle
Gear Down
Gear Up
The Remote Control system allows the driver to control steering, brakes and throttle via a smartphone from outside the car. This allows the driver to check the precise positioning of the vehicle when negotiating challenging terrain or even difficult parking situations, whilst walking alongside the car at a maximum speed of 4mph.
© Jaguar Land Rover

NTNU-project: Autonom passagerar-/cykelfärja över hamnkanalen I Trondheim


Fosenkaia
←New pedestrian bridge
Vestre Kanalkai
Ravnkloa
706
Kai 19
Kai 20
Fjordgata
Jomfrugata
Credoveita
Ørjave

First technical sea trials on Saturday November 11 2017

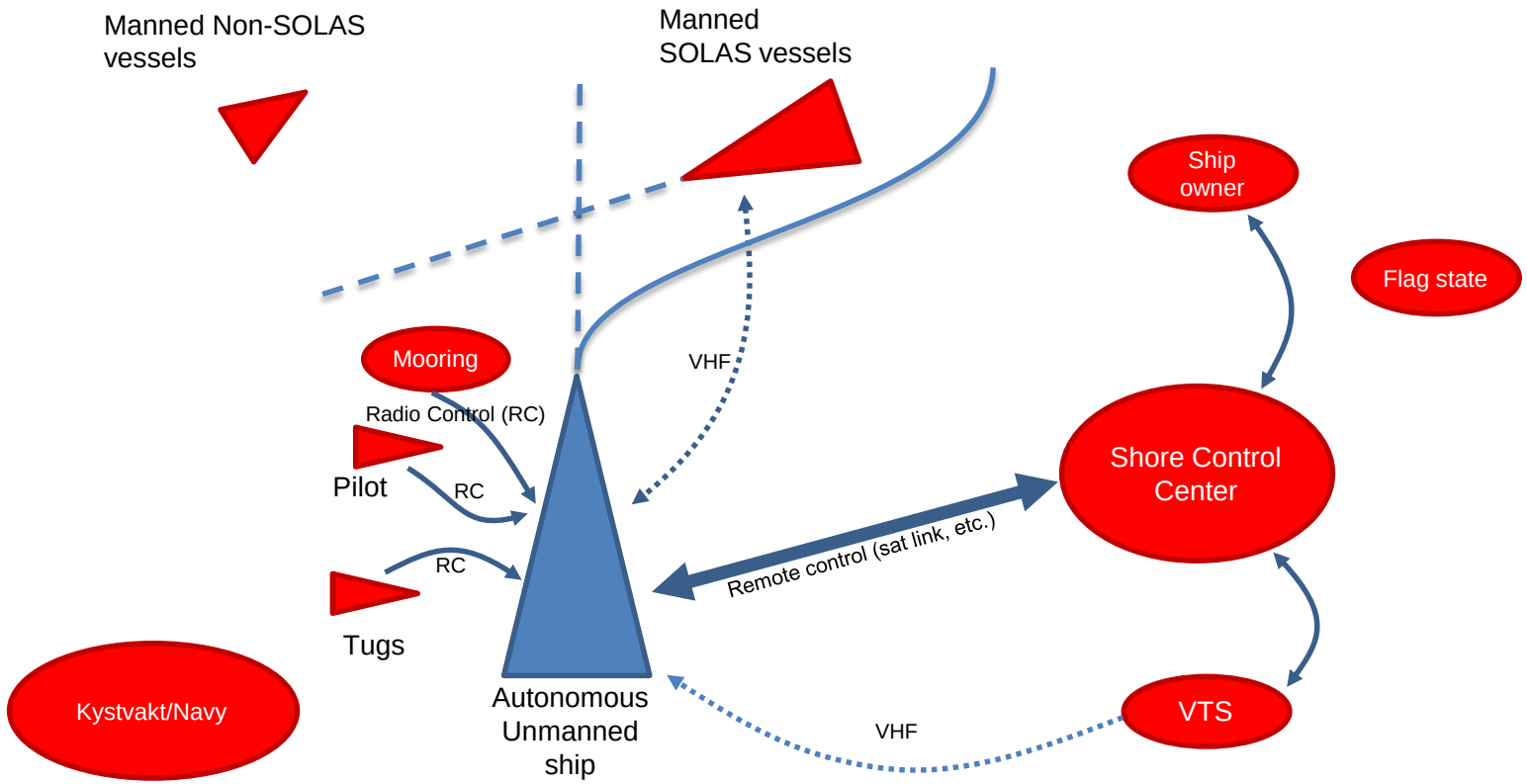
Further testing in December 2017

Major research question:

We know that the vast majority of all accidents at sea to some degree depends on ”human error.”

If we remove the human from direct operation of vessels, can we then decrease “human error”?

Humans in the unmanned ship system



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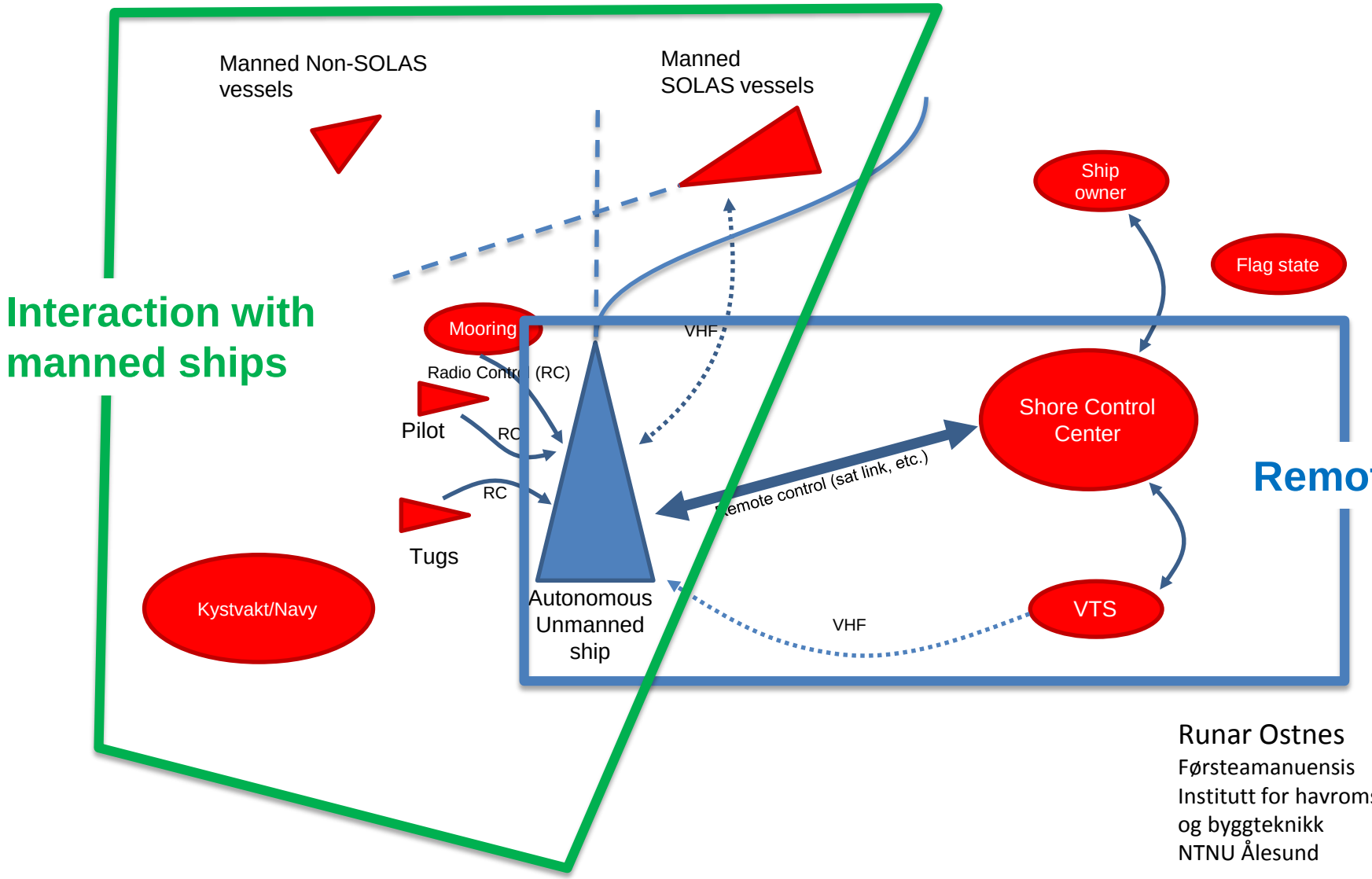
Humans in the unmanned ship system



Interaction with manned ships

Remote monitoring and control

Runar Ostnes
Førsteamanuensis
Institutt for havromsoperasjoner og byggteknikk
NTNU Ålesund

Thomas Porathe
Professor interaksjonsdesign
Institutt for design

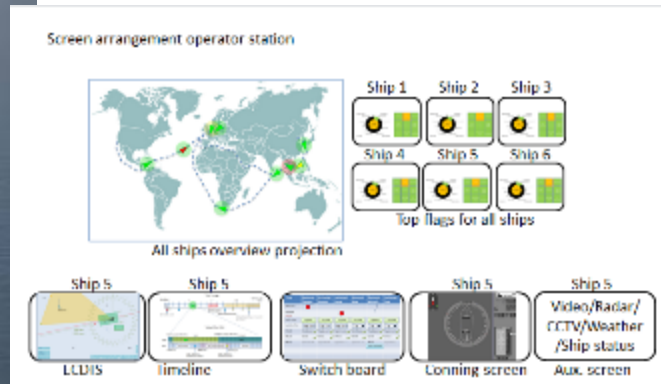
NTNU Trondheim

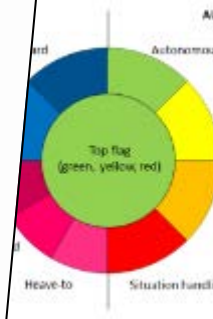
Research questions:

What will the HMI for remote control centres look like?
Who is manning these centres: navigators or operators?
What will their tasks be? What is automated, what is manual?
Workload; Situation Awareness; Out-of-the-loop syndrome?

Rolls-Royce vision of the future shore control centre

MUNIN





Human Factors in Ship Design & Operation, 26-27 February 2014, London, UK

SITUATION AWARENESS IN REMOTE CONTROL CENTRES FOR UNMANNED SHIPS

T Porathe, J Prison, and Y Man, Chalmers University of Technology, Sweden

SUMMARY

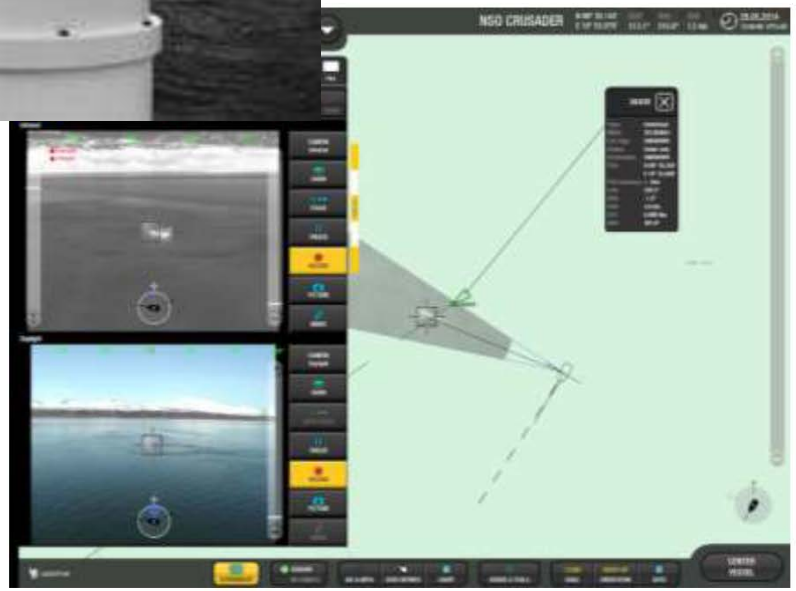
The feasibility of unmanned, autonomous merchant vessels is investigated by the EU project MUNIN (Maritime Unmanned Navigation through Intelligence in Networks). The ships will be manned while departing and entering port and unmanned during ocean-passage. When unmanned, the ships will be controlled by an automatic system informed by onboard sensors allowing the ship to make standard collision avoidance manoeuvres according to international regulation. The ship will be continuously monitored by a remote shore centre able to take remote control should the automatic systems falter. For the humans in the shore control centre the usual problems of automations remains as well as a pronounced problem of keeping up adequate situation awareness through remote sensing. The big challenge for the project will be to show that an unmanned system is at least as safe as an manned ship system, and to provide the shore control operators with adequate situation awareness.

1. INTRODUCTION

Maritime Unmanned Ship

CML, in Hamburg, Germany

Automatic Sensor System (Aptomar)



- Automated evaluation of navigational data
- ASM‘s capabilities:
  - Detect objects
  - Classify objects
  - Identify objects
- Single source of information
  - Fusion of data from radar, AIS and visual sensors

Lägesbilden är i hög grad beroende av bandbredd

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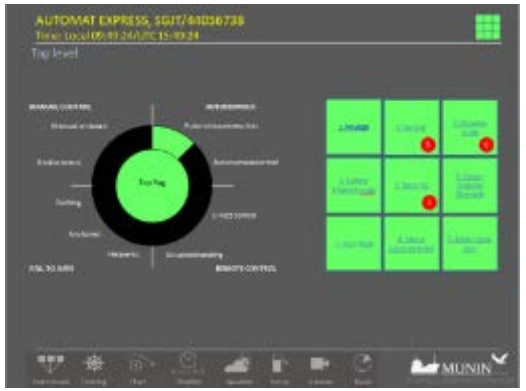
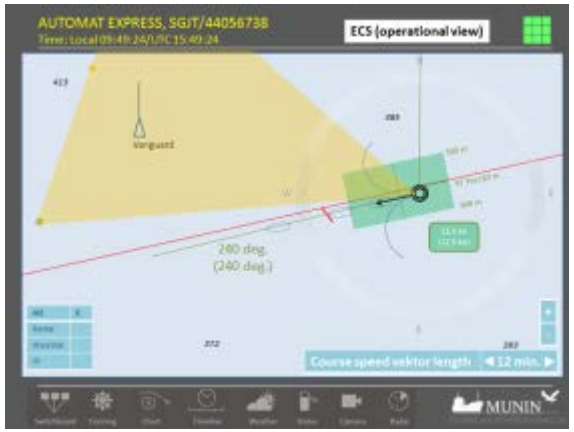
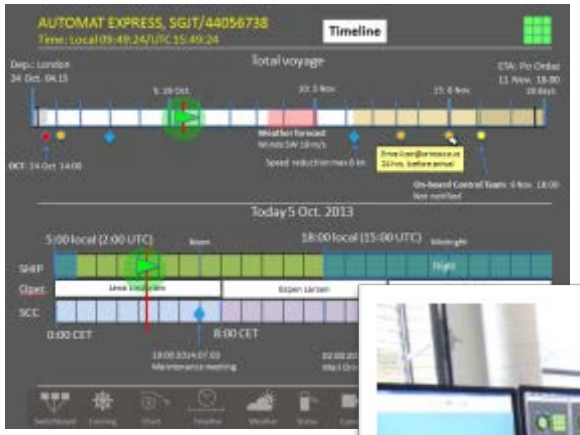
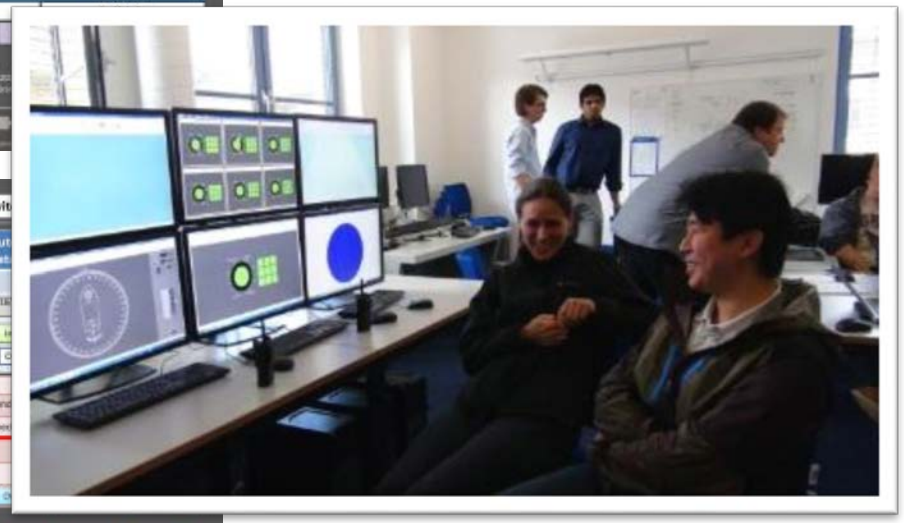


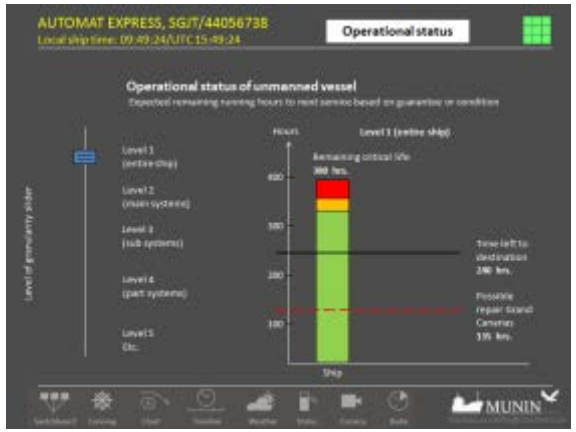
MUNIN

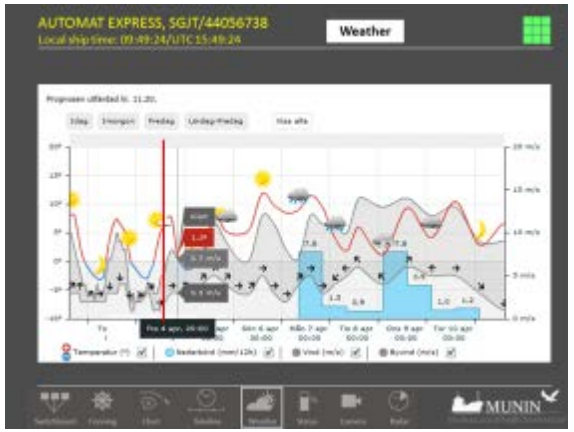
2013-2015

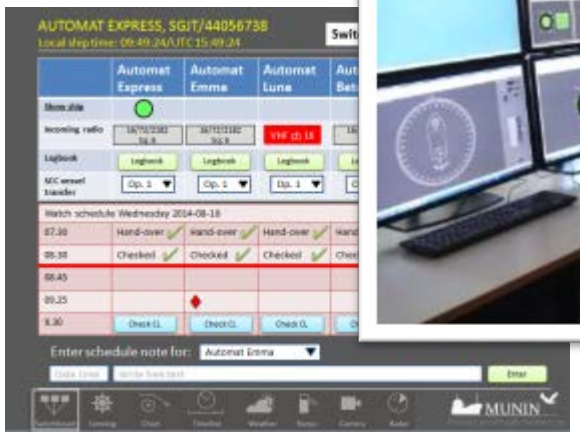












Small steps to autonomous ships

Phase 1.
Remote monitoring from shore of manned ship

Transfer of radar, IR/video, VHF from ship. Text and voice communication from shore

Phase 2.
Remote monitoring and control of manned ship

As in previous service, but control of autopilot, speed, and VHF from shore.

Phase 3.
Remote monitoring and automatic control of partly manned ship

As in previous service, but automation will be alone on the bridge, however with operators onboard

Phase 4.
Remote monitoring and control of fully autonomous unmanned ship

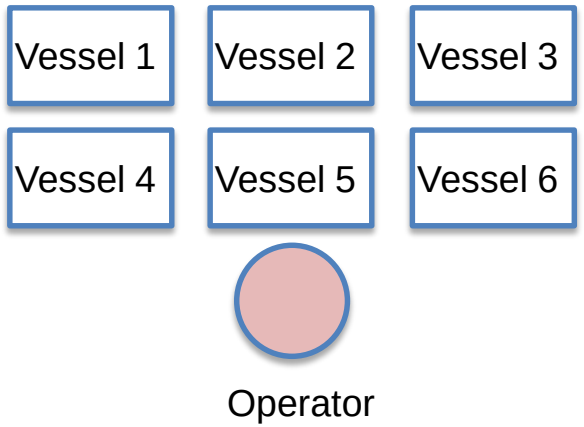
As in previous service, but automation will be alone onboard

What information needs to be transferred from the vessel to the Shore Control Centre in order to achieve enough situation awareness?

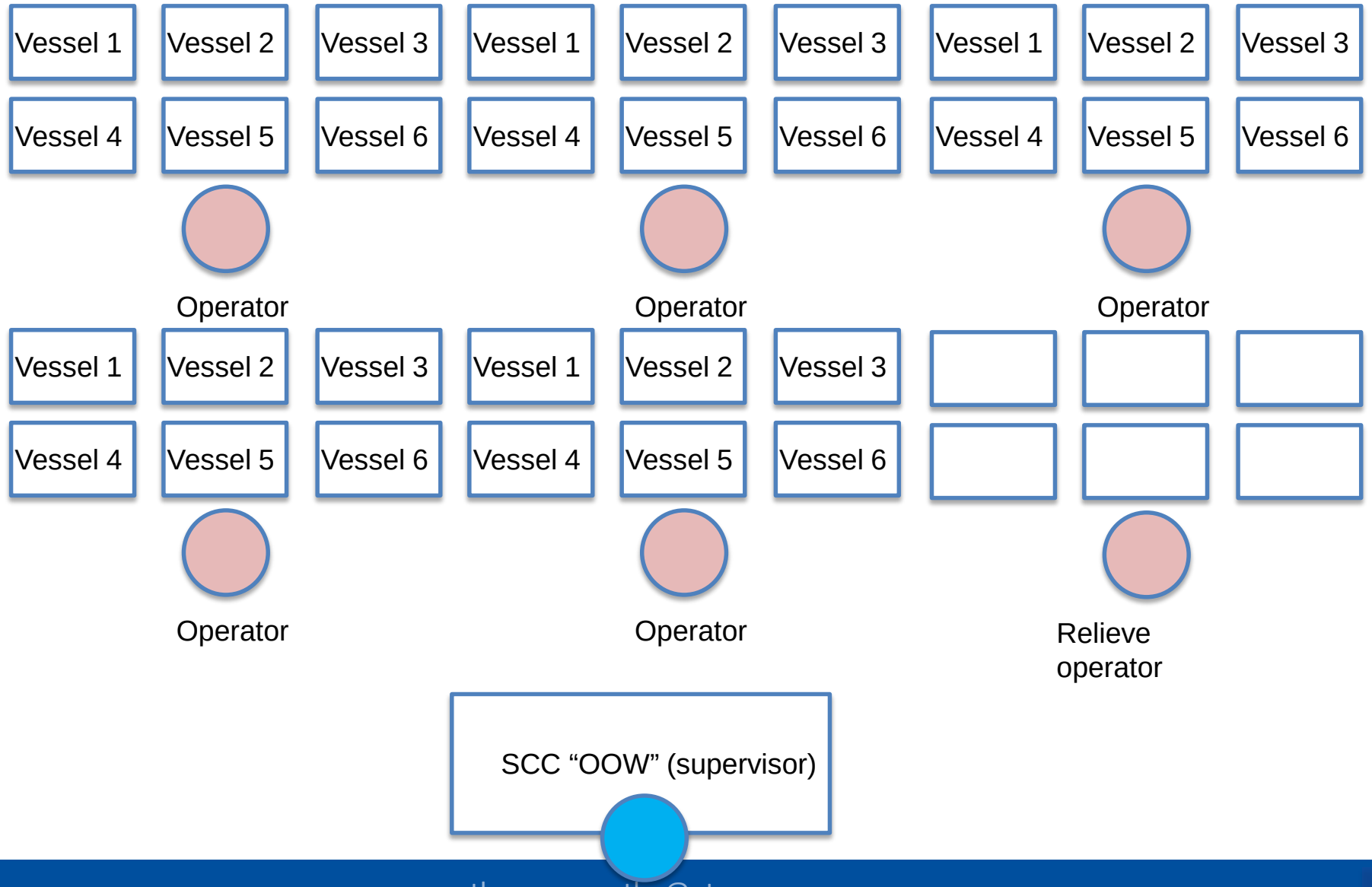
Focus group with 6 nautical officers currently working within nautical education at Chalmers' department of shipping and marine technology. The participants had a broad seagoing experience from different types of vessels, e.g. cruise ships, car carriers, long and short haul dry and wet cargo and ferries.

145 information items in 9 groups

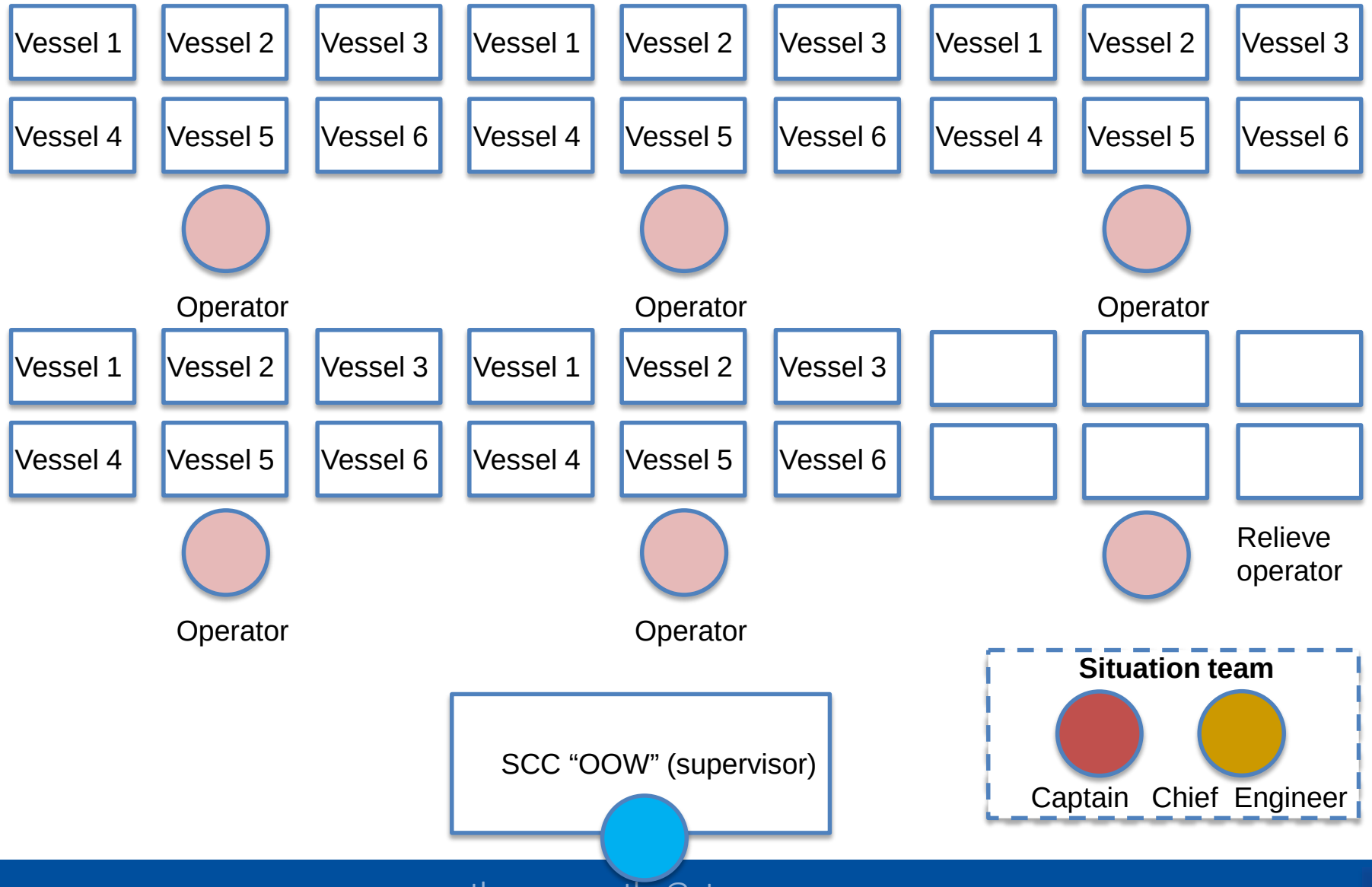
Shore Control Center (SCC)



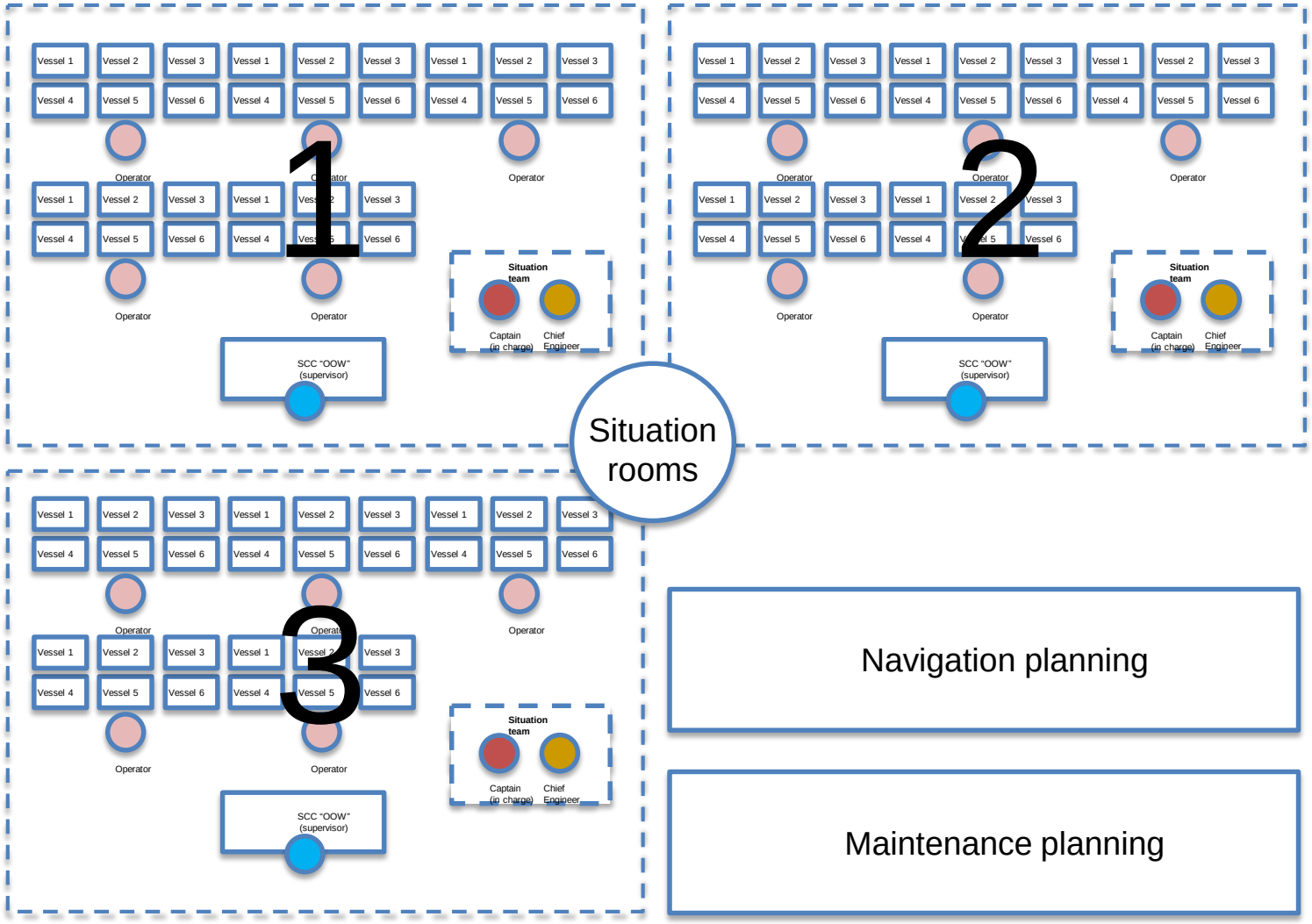
Shore Control Center (SCC)



Shore Control Center (SCC)

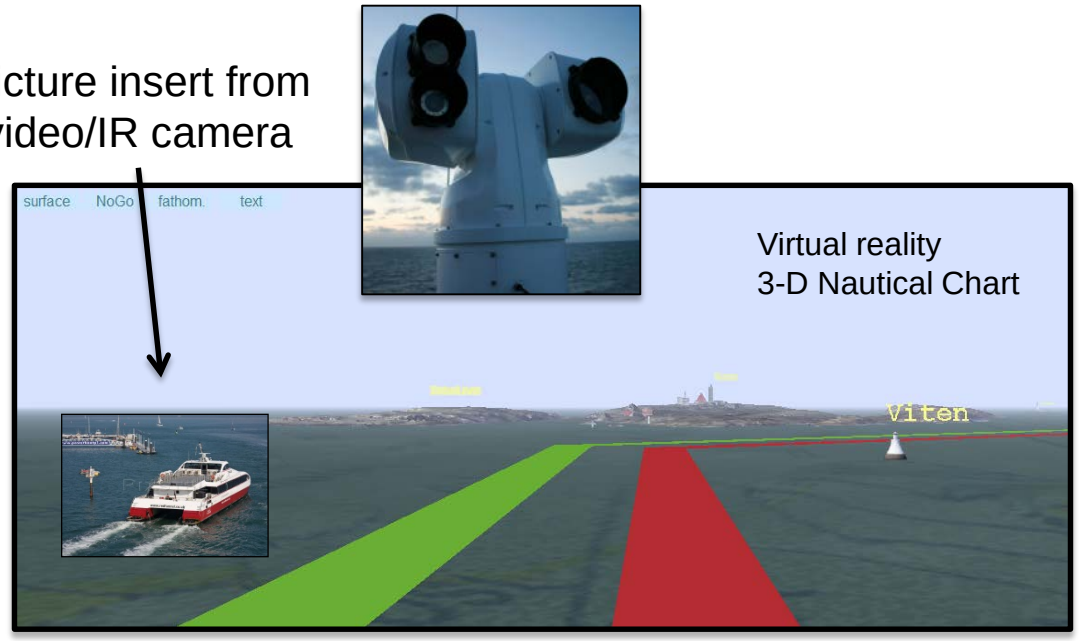


Shore Control Center (SCC)



“Situation room”

Picture insert from video/IR camera

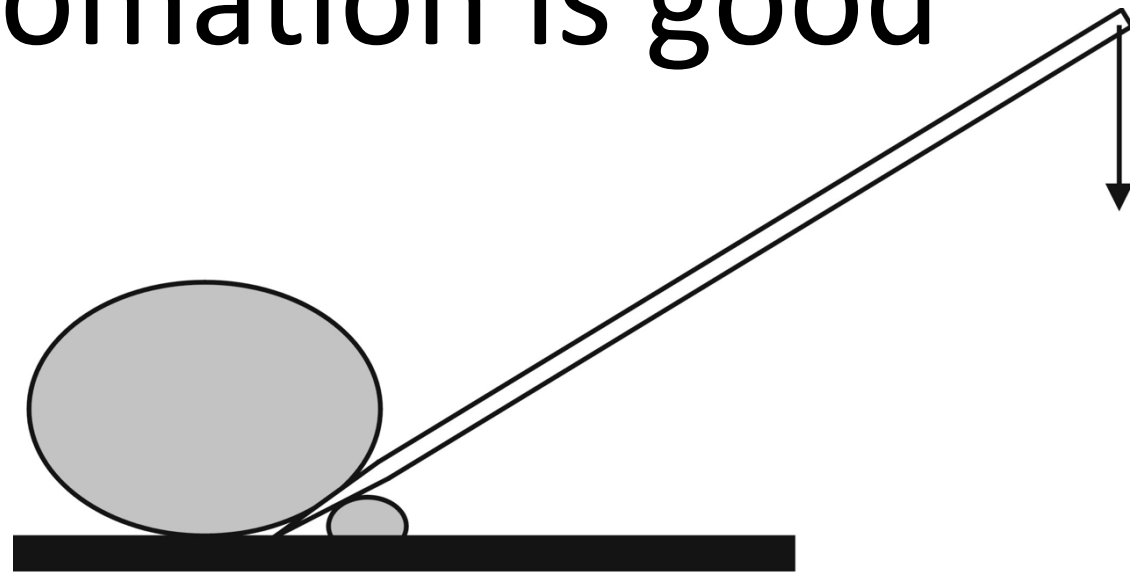


Low level control

- Situation handling
- Monitoring
- Indirect control
- Direct control

Situation room: Team work, Immersion

Automation is good



Amplifying human abilities

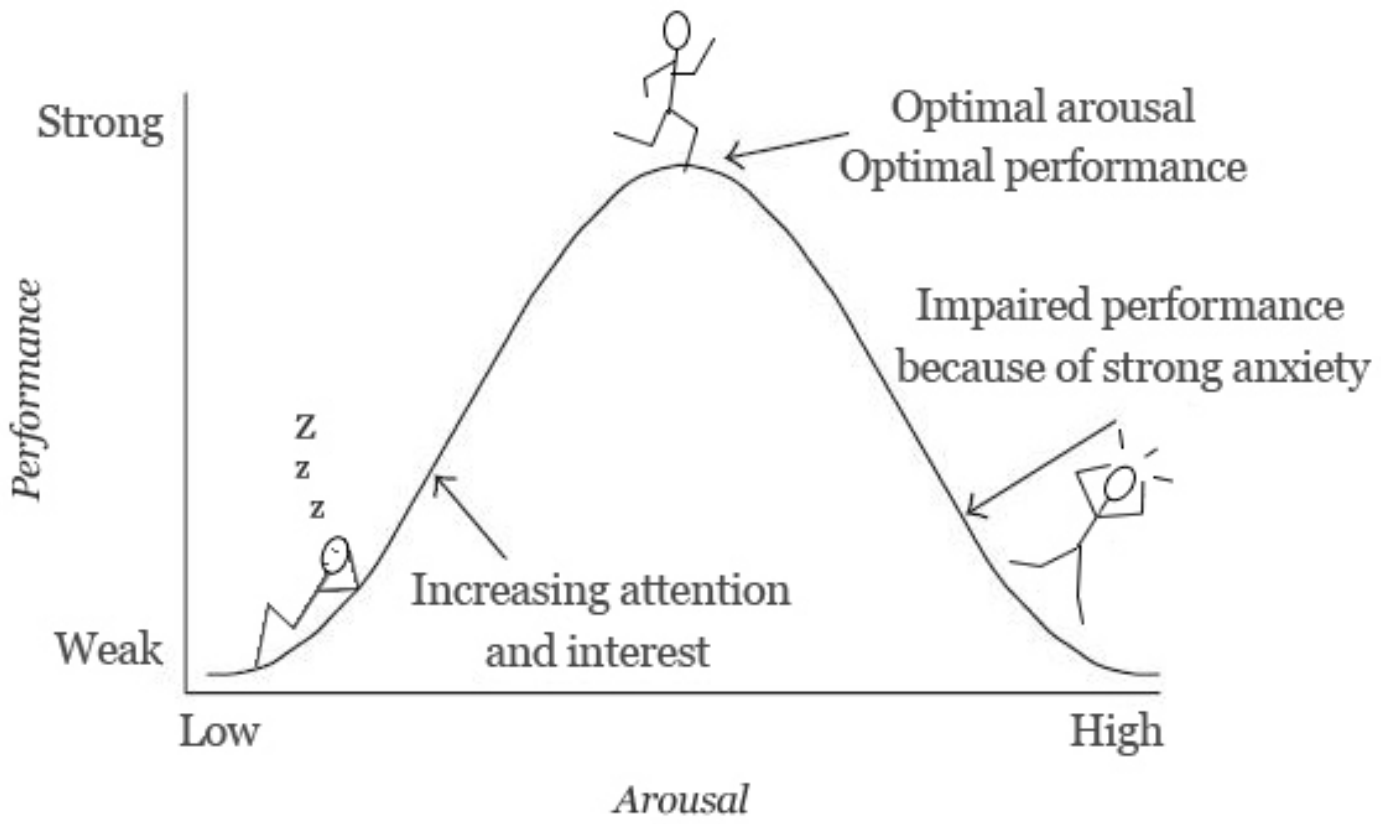
Automation is good

- but have some problems

”Boredom induced accidents”

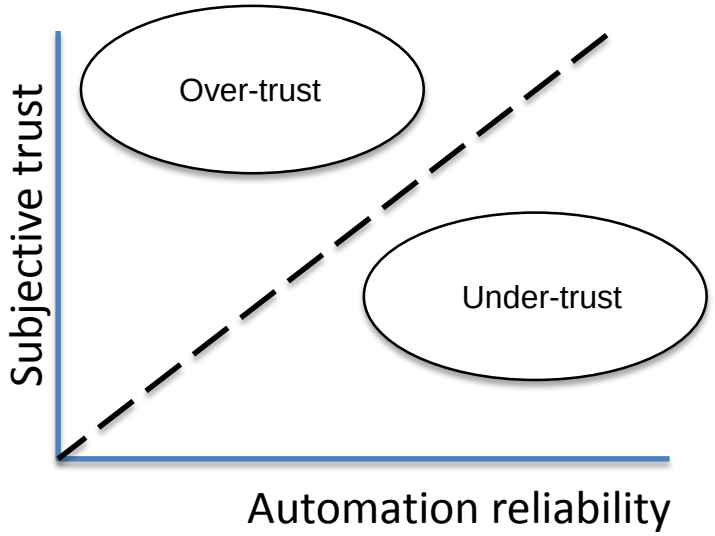
Captain Andy Moll
Marine Accident Investigation Branch, UK

RIN conference Human Cognition: Enabling Navigation Exploring Humanity’s relationship with Technology in Navigation
Trinity House, London 10th June 2015



The Yerkes–Dodson law

Automation bias



The 'problem' with automation is inappropriate feedback and interaction, not 'over-automation'

(Donald Norman, 1990)

Norman, D. The problem of automation: Innappropreate feedback and interaction, not over-automation. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, Vol. 327, No. 1241, Human Factors in Hazardous Situations (Apr. 12, 1990), pp. 585-593

Human factors issues related to remote monitoring and control of unmanned ships

1. **Situation awareness** in the SCC: mistakes due to not understanding the true situation of the vessel.

2. **Misunderstandings in interaction with manned vessels**: latency in VHF communication, bad communication links, language issues same as for manned systems, but worsened by lack of situation awareness.

Human factors issues related to remote monitoring and control of unmanned ships

3. Delays in decision making due to lengthy time for operator to get into the loop (**human-out-of-the-loop syndrome**).

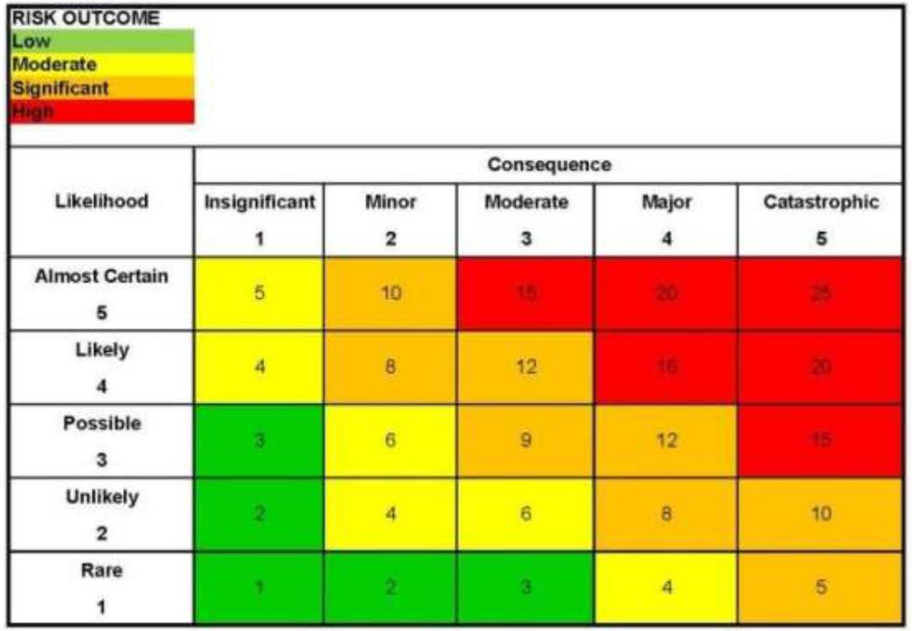
4. **Stress and information overload** because several ships might need the operators attention at the same time.

Human factors issues related to remote monitoring and control of unmanned ships

5. Human error due to “**carry over effects**” between two vessels as operator monitors several vessels at a time.

Non-acceptable risks

- Five hazards were found in this category
- No obvious quick-fix



RISK OUTCOME
Low
Moderate
Significant
High

Likelihood	Consequence				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Almost Certain 5	5	10	15	20	25
Likely 4	4	8	12	16	20
Possible 3	3	6	9	12	15
Unlikely 2	2	4	6	8	10
Rare 1	1	2	3	4	5

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Main risk 1

- Interaction with other ships, whether they follow COLREGS or not, is a critical issue.

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Main risk 2

- Propulsion system breakdown will render the ship unable to move. This can cause groundings and collisions or blocking fairways.

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Main risk 3

- Failure in object detection, particularly in low visibility, can cause powered collisions.

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Main risk 4

- Very heavy weather may make it difficult to maneuver the ship safely.

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Main risk 5

- Errors in detection and classification of small to medium size objects is critical as it may be wreckage, persons, life boats or other objects that need to be reported to authorities.

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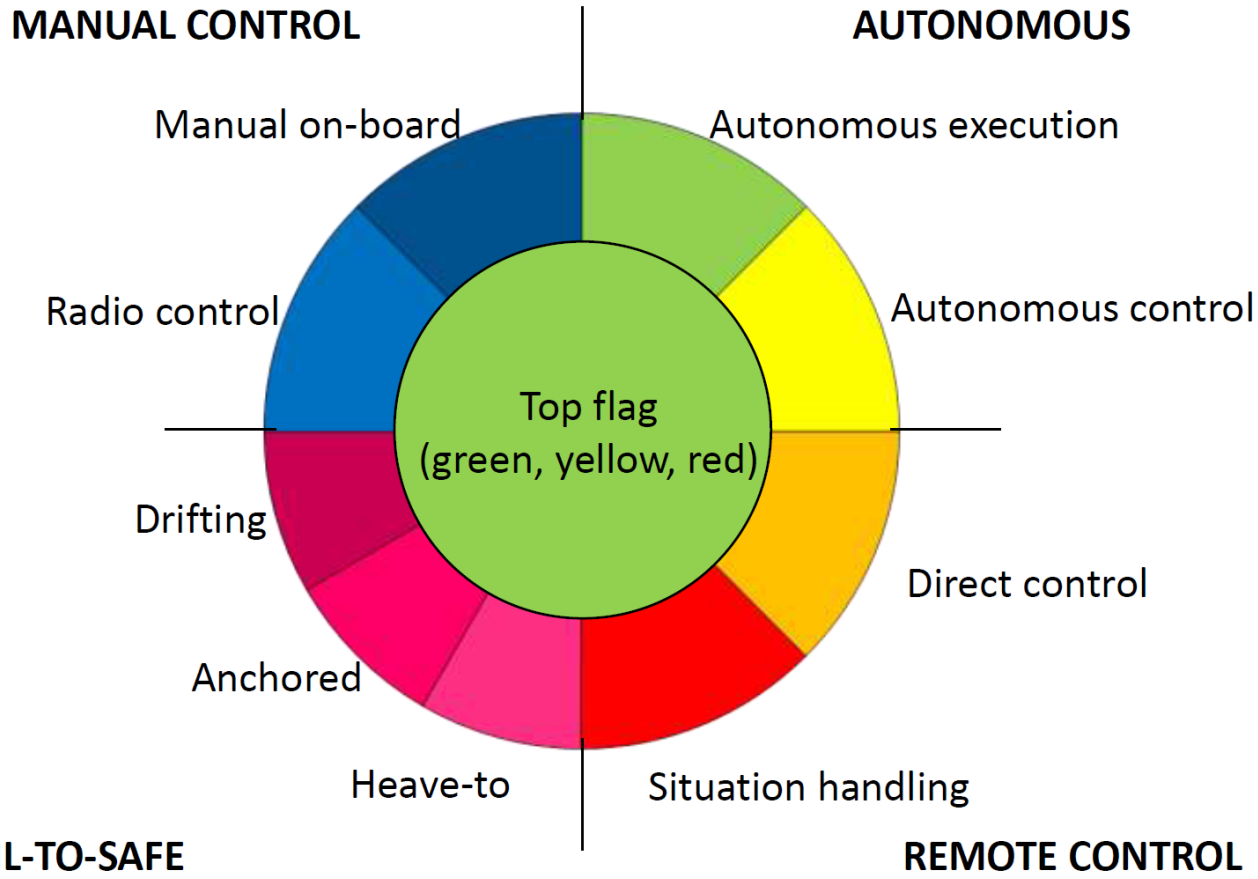

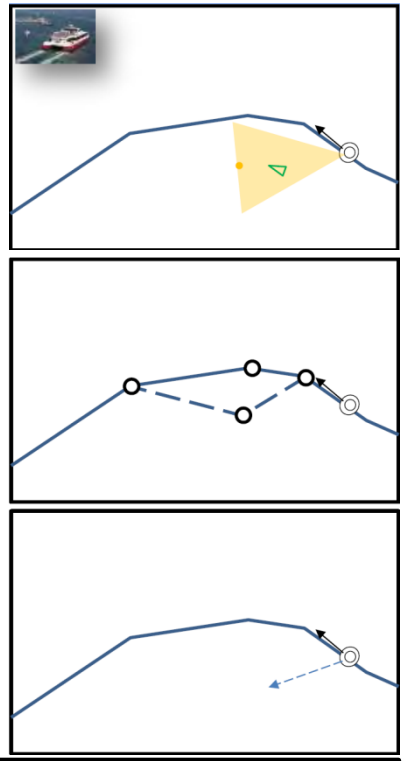

Picture insert from video/IR camera

Situation room: Team work, Immersion

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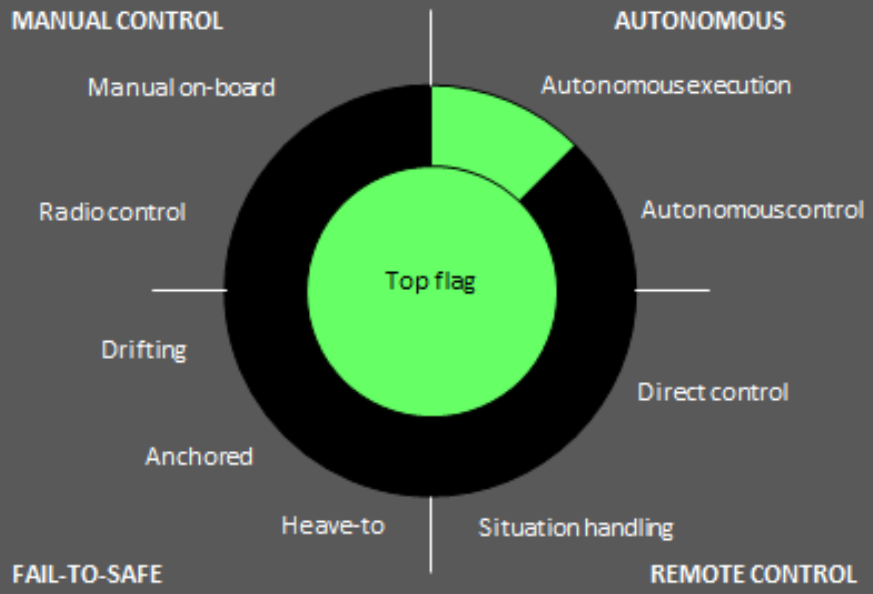
AUTOMAT EXPRESS, SGJT/44056738

Time: Local 09:49:24/UTC 15:49:24

Top level



1.Voyage	2. Sailing 5	3 Observa-tions 9
4. Safety Emerge-ncies	5. Security 1	6. Cargo Stability Strength
7. Technical	8. Shore control centre	9. Administra-tion

Switchboard | Conning | Chart | Timeline | Weather | Status | Camera | Radar

MUNIN

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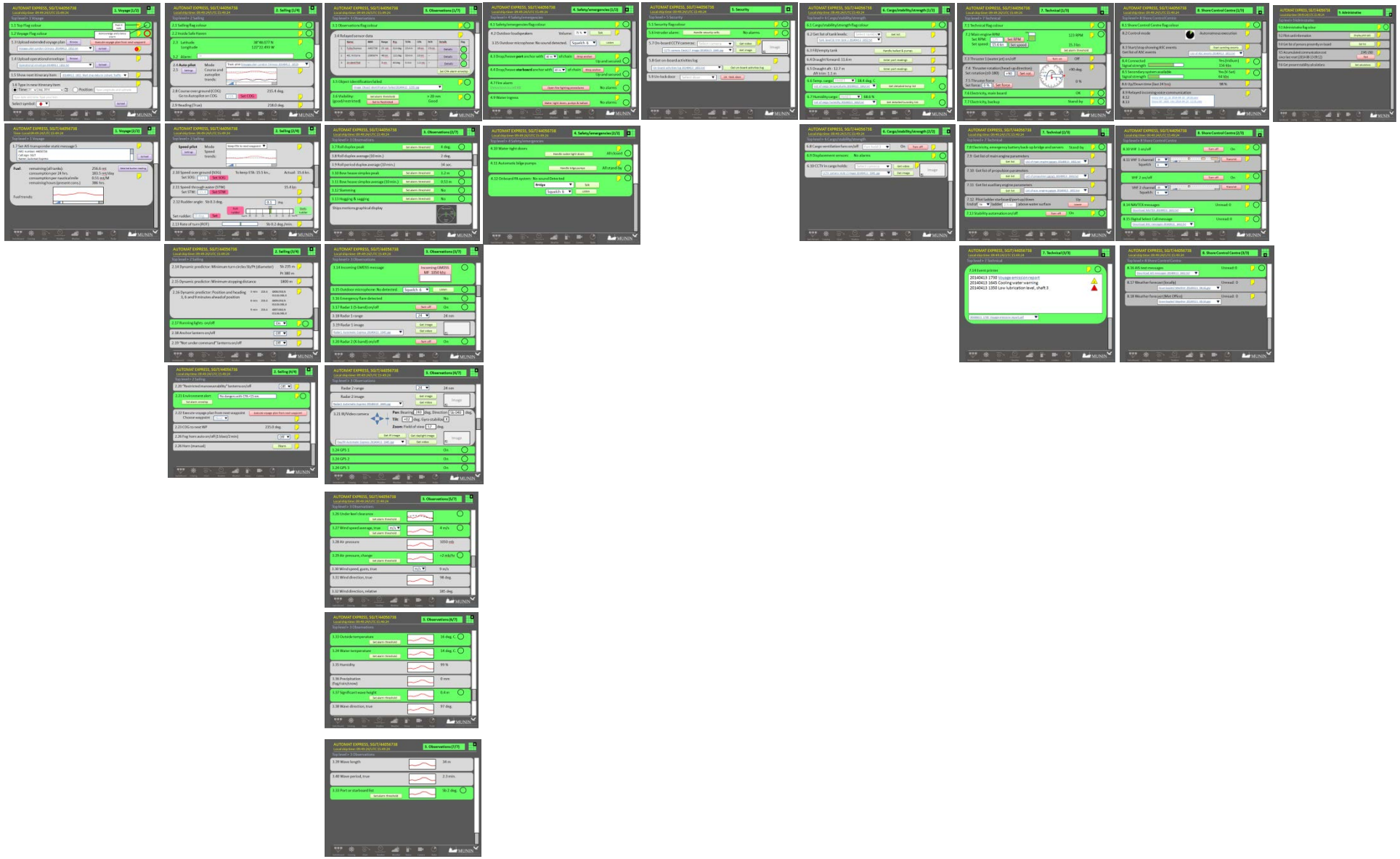

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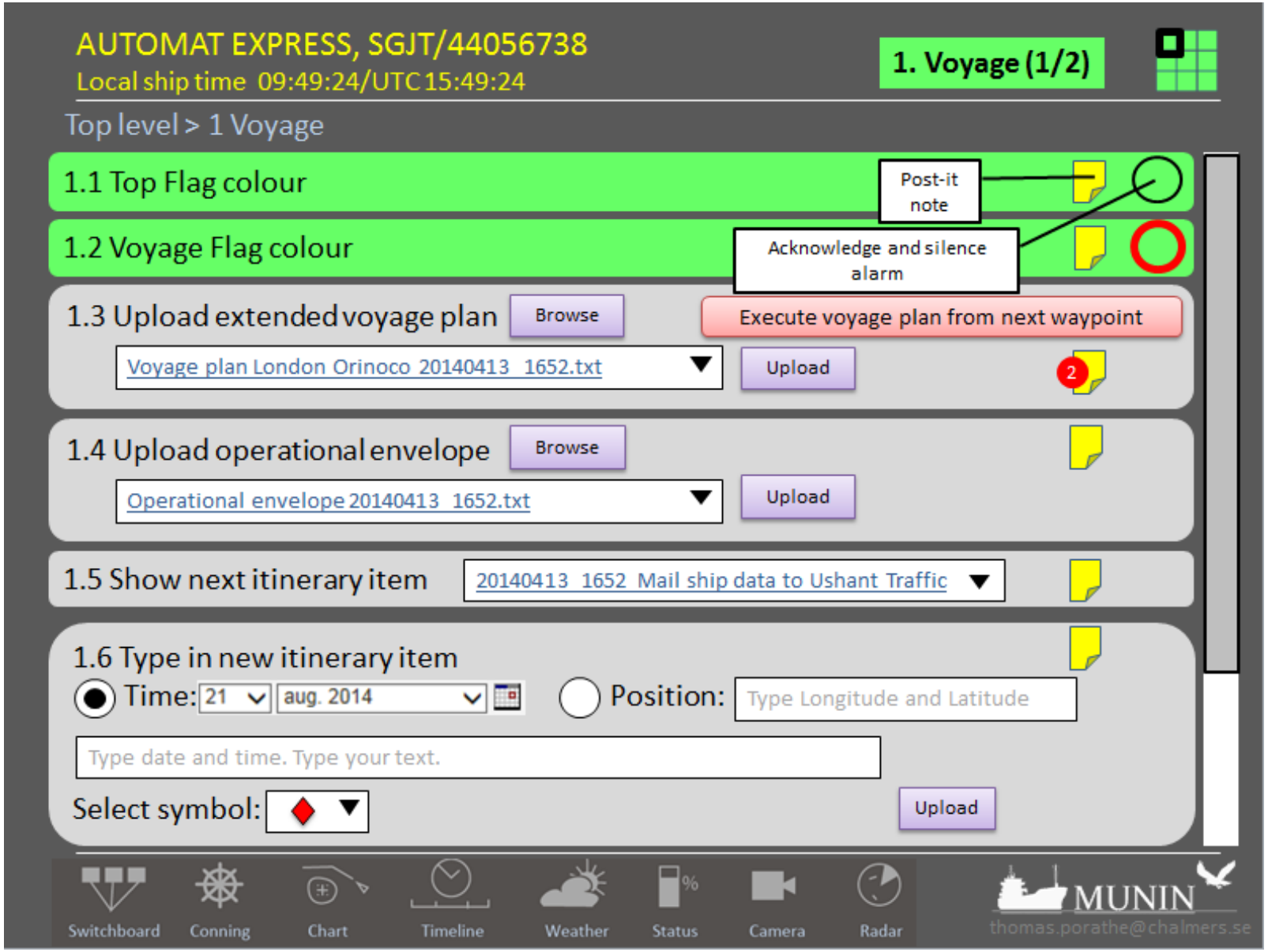

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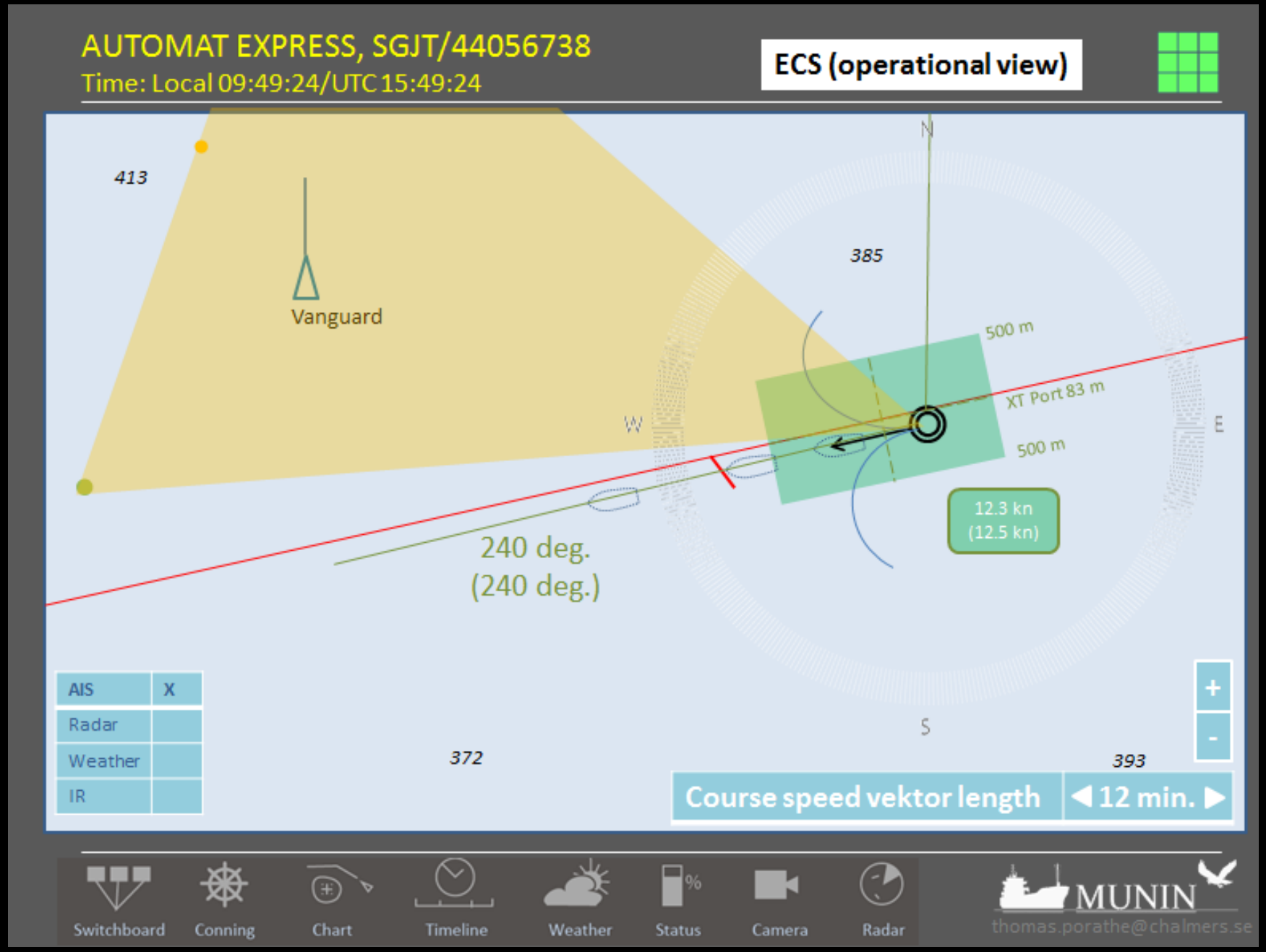
AUTOMAT EXPRESS, SGJT/44056738
Time: Local 09:49:24/UTC 15:49:24
ECS (operational view)
413
385
Vanguard
500 m
XT Port 83 m
500 m
12.3 kn
(12.5 kn)
240 deg.
(240 deg.)
AIS
X
Radar
Weather
IR
372
393
Course speed vektor length
12 min.
Switchboard
Conning
Chart
Timeline
Weather
Status
Camera
Radar
MUNIN
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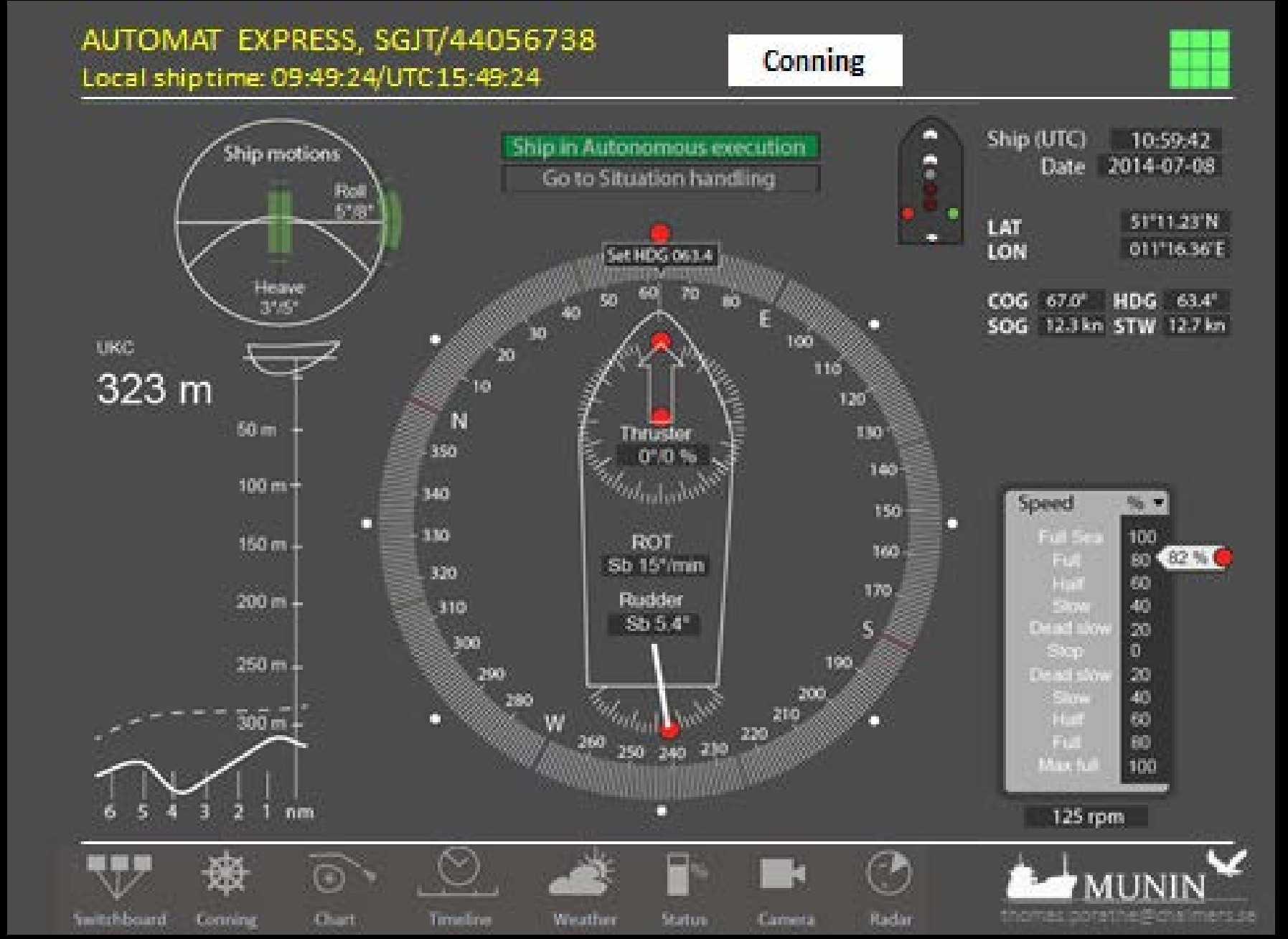
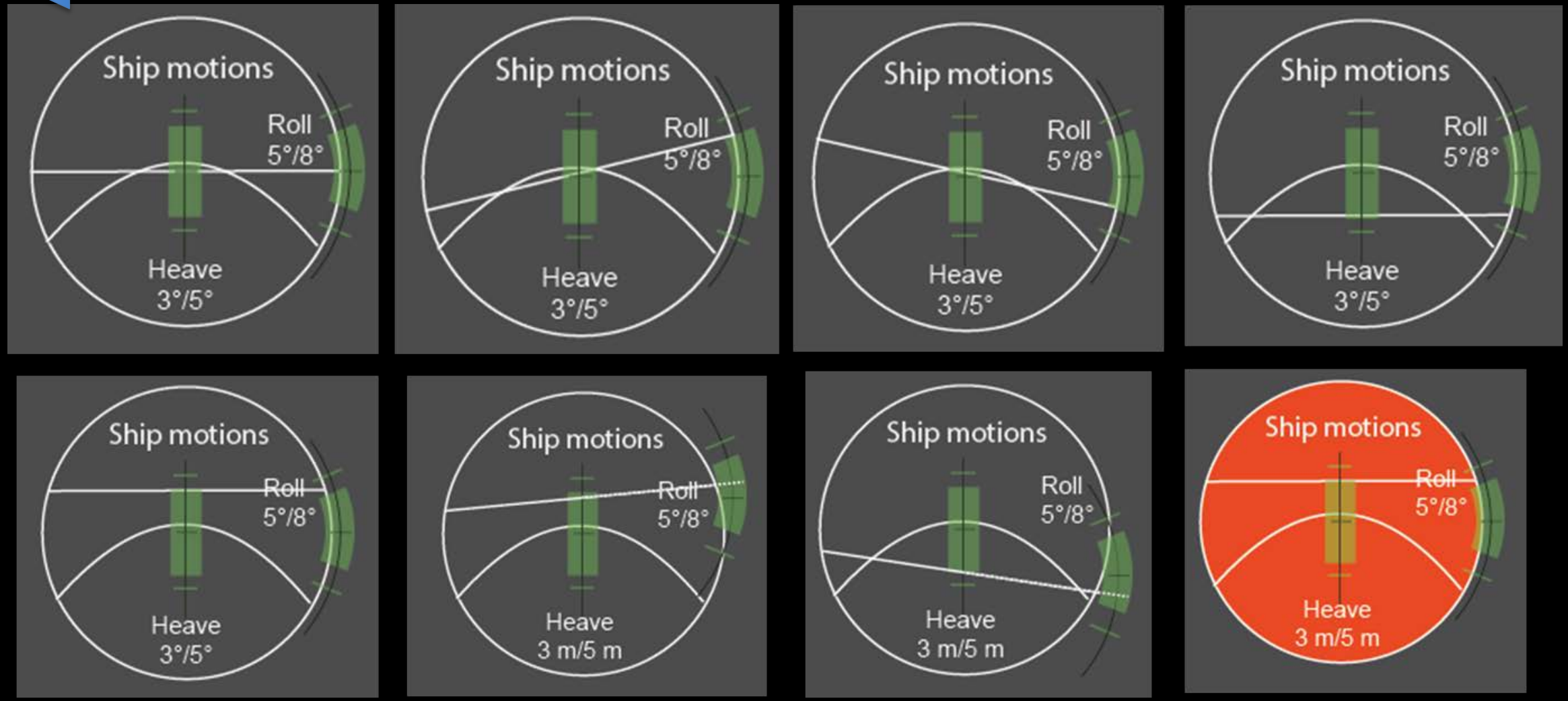

AUTOMAT EXPRESS, SGJT/44056738
Local ship time: 09:49:24/UTC 15:49:24
Conning
Ship motions
Roll
Heave
Ship in Autonomous execution
Go to Situation handling
Ship (UTC) 10:59:42
Date 2014-07-08
LAT 51°11.23'N
LON 011°16.36'E
COG 67.0°
HDG 63.4°
SOG 12.3 kn
STW 12.7 kn
UKC
323 m
Set HDG 063.4
Thruster
ROT
Sb 15°/min
Rudder
Sb 5.4°
Speed
Full Sea 100
Full 80
Half 60
Slow 40
Dead slow 20
Stop 0
Dead slow 20
Slow 40
Half 60
Full 80
Max full 100
82 %
125 rpm
Switchboard
Conning
Chart
Timeline
Weather
Status
Camera
Radar
MUNIN



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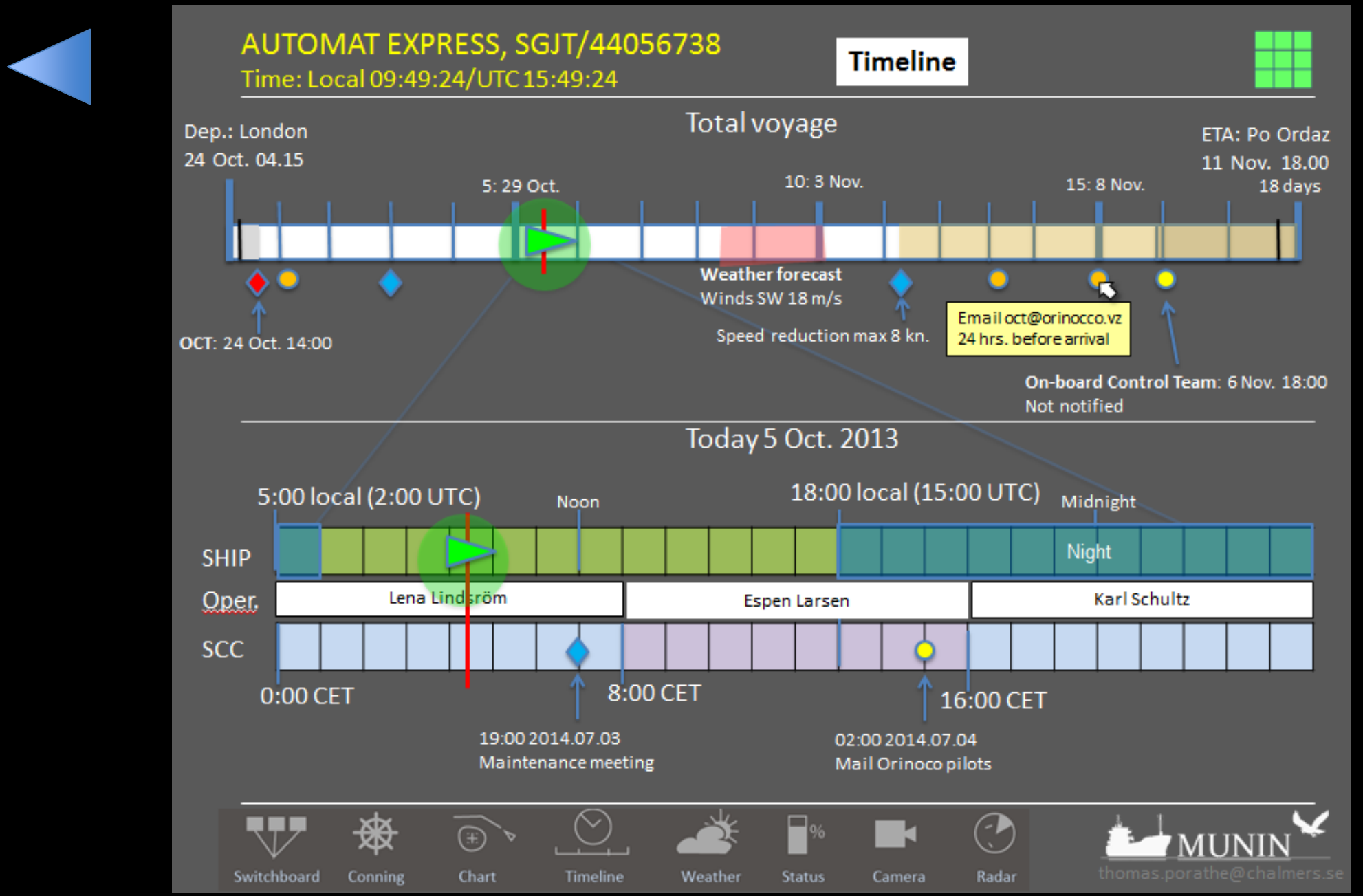
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Time: Local 09:49:24/UTC 15:49:24
Timeline
Total voyage
Dep.: London
24 Oct. 04.15
ETA: Po Ordaz
11 Nov. 18.00
18 days
5: 29 Oct.
10: 3 Nov.
15: 8 Nov.
Weather forecast
Winds SW 18 m/s
OCT: 24 Oct. 14:00
Speed reduction max 8 kn.
Email oct@orinocco.vz
24 hrs. before arrival
On-board Control Team: 6 Nov. 18:00
Not notified
Today 5 Oct. 2013
5:00 local (2:00 UTC)
Noon
18:00 local (15:00 UTC)
Midnight
SHIP
Night
Oper.
Lena Lindström
Espen Larsen
Karl Schultz
SCC
0:00 CET
8:00 CET
16:00 CET
19:00 2014.07.03
Maintenance meeting
02:00 2014.07.04
Mail Orinoco pilots
Switchboard
Conning
Chart
Timeline
Weather
Status
Camera
Radar
MUNIN
thomas.porathe@chalmers.se

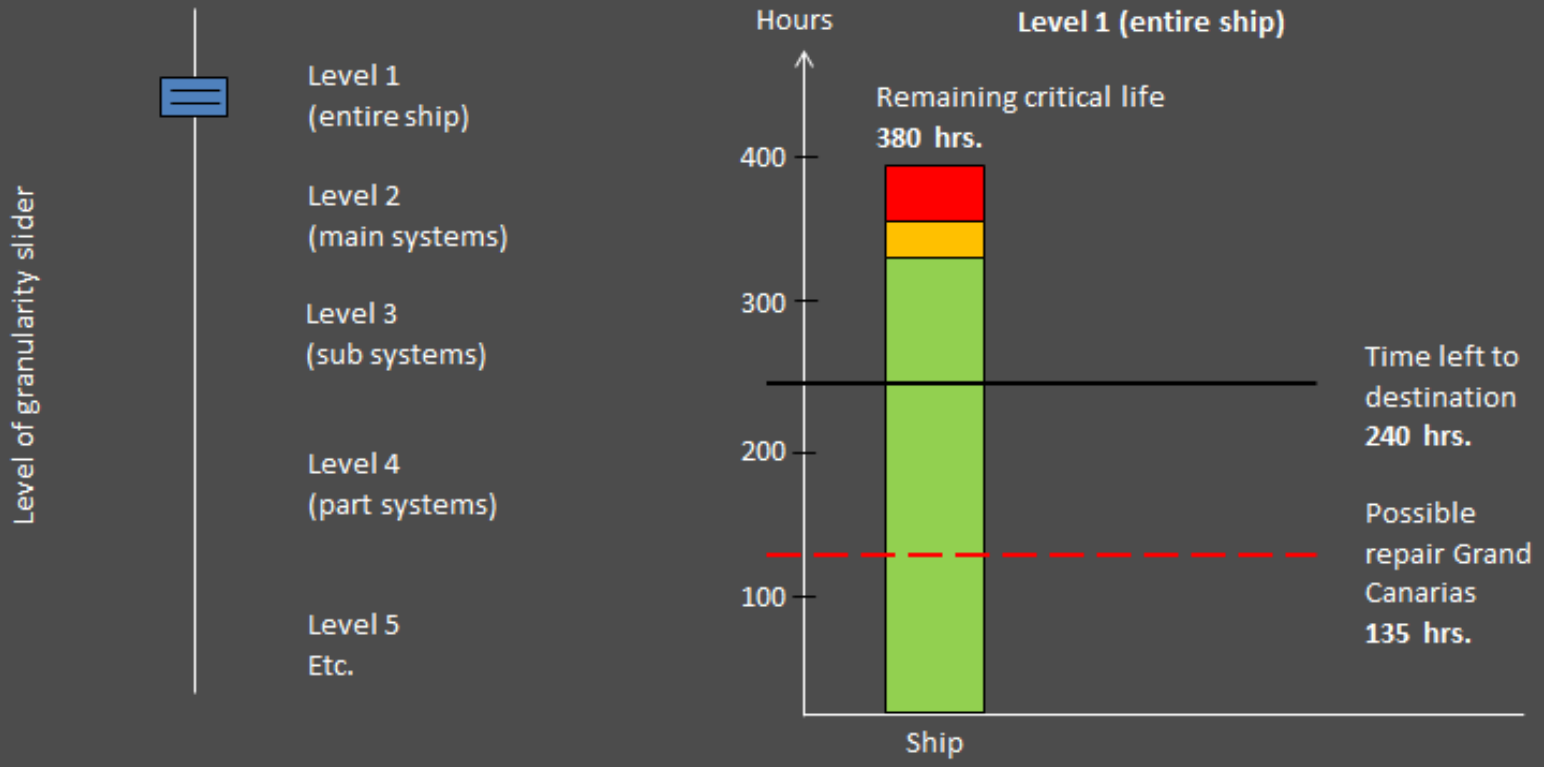
AUTOMAT EXPRESS, SGJT/44056738

Local ship time: 09:49:24/UTC 15:49:24

Operational status

Operational status of unmanned vessel

Expected remaining running hours to next service based on guarantee or condition



Switchboard | Conning | Chart | Timeline | Weather | Status | Camera | Radar

MUNIN

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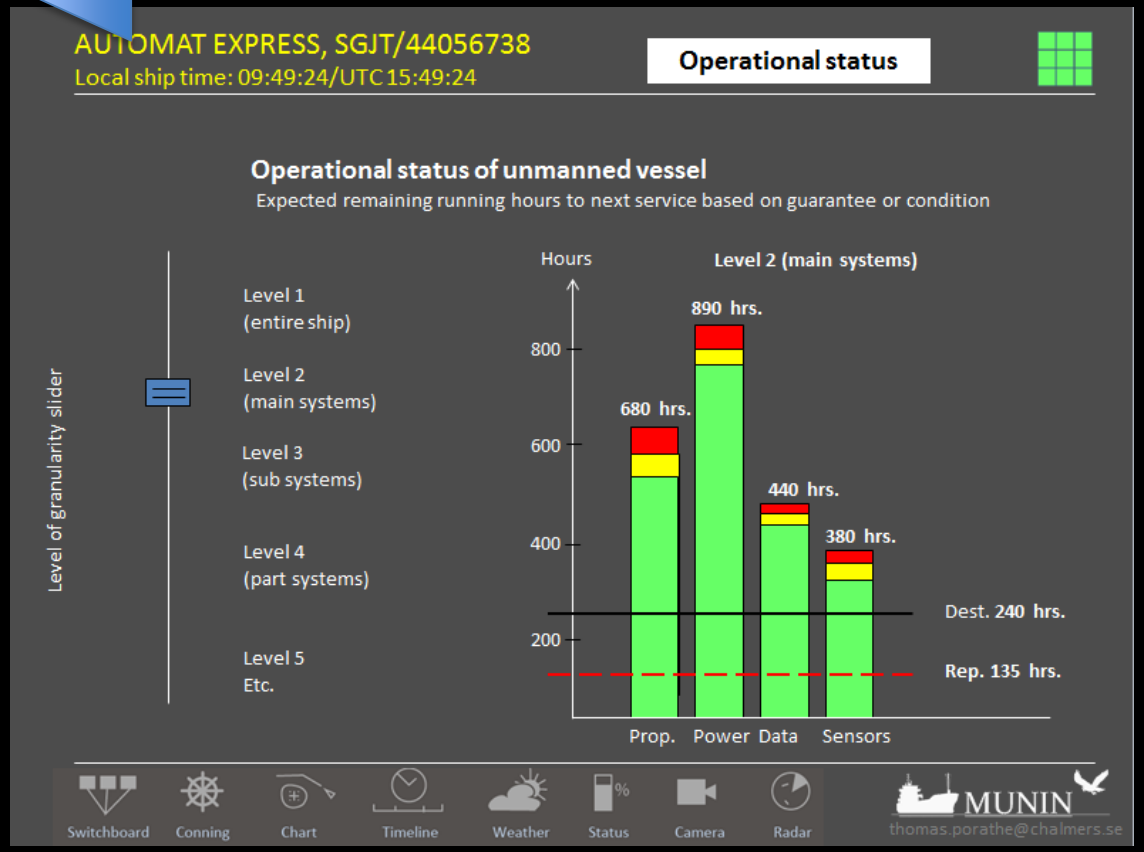
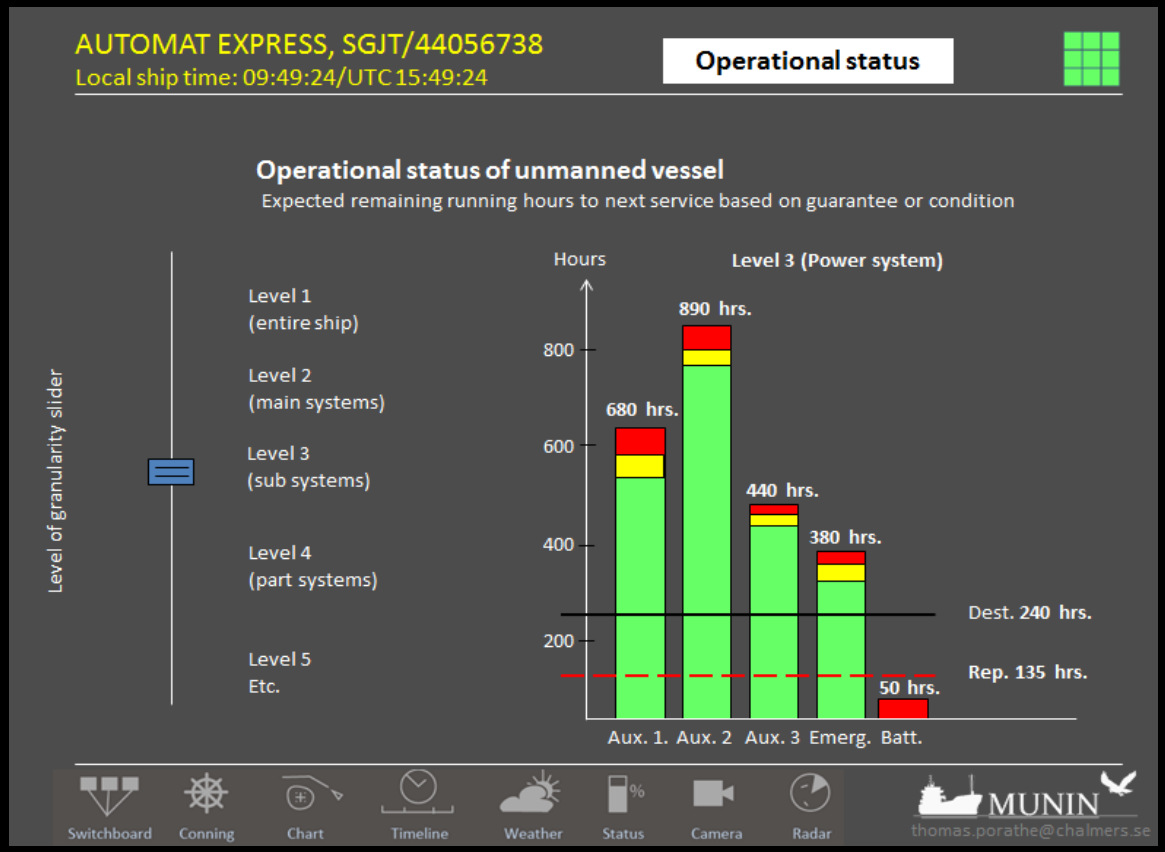

AUTOMAT EXPRESS, SGJT/44056738
Local ship time: 09:49:24/UTC 15:49:24
Operational status
Operational status of unmanned vessel
Expected remaining running hours to next service based on guarantee or condition
Level of granularity slider
Level 1 (entire ship)
Level 2 (main systems)
Level 3 (sub systems)
Level 4 (part systems)
Level 5 Etc.
Hours
Level 2 (main systems)
800
600
400
200
680 hrs.
890 hrs.
440 hrs.
380 hrs.
Dest. 240 hrs.
Rep. 135 hrs.
Prop.
Power
Data
Sensors
Switchboard
Conning
Chart
Timeline
Weather
Status
Camera
Radar
MUNIN
thomas.porathe@chalmers.se


AUTOMAT EXPRESS, SGJT/44056738
Local ship time: 09:49:24/UTC 15:49:24
Operational status
Operational status of unmanned vessel
Expected remaining running hours to next service based on guarantee or condition
Level of granularity slider
Level 1 (entire ship)
Level 2 (main systems)
Level 3 (sub systems)
Level 4 (part systems)
Level 5 Etc.
Hours
Level 3 (Power system)
800
600
400
200
680 hrs.
890 hrs.
440 hrs.
380 hrs.
50 hrs.
Dest. 240 hrs.
Rep. 135 hrs.
Aux. 1.
Aux. 2
Aux. 3
Emerg.
Batt.
Switchboard
Conning
Chart
Timeline
Weather
Status
Camera
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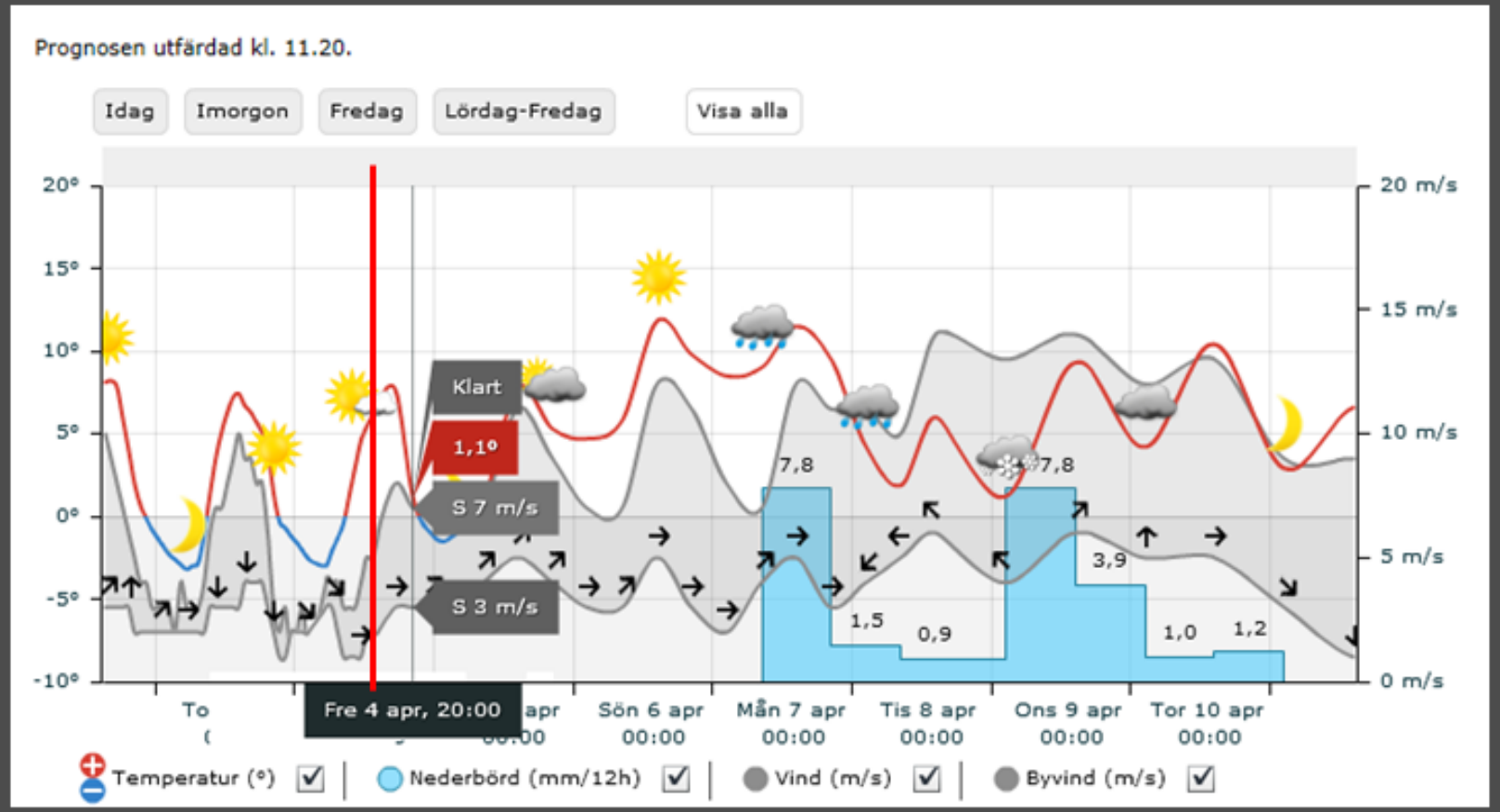
AUTOMAT EXPRESS, SGJT/44056738

Local ship time: 09:49:24/UTC 15:49:24

Weather



Switchboard | Conning | Chart | Timeline | Weather | Status | Camera | Radar

MUNIN

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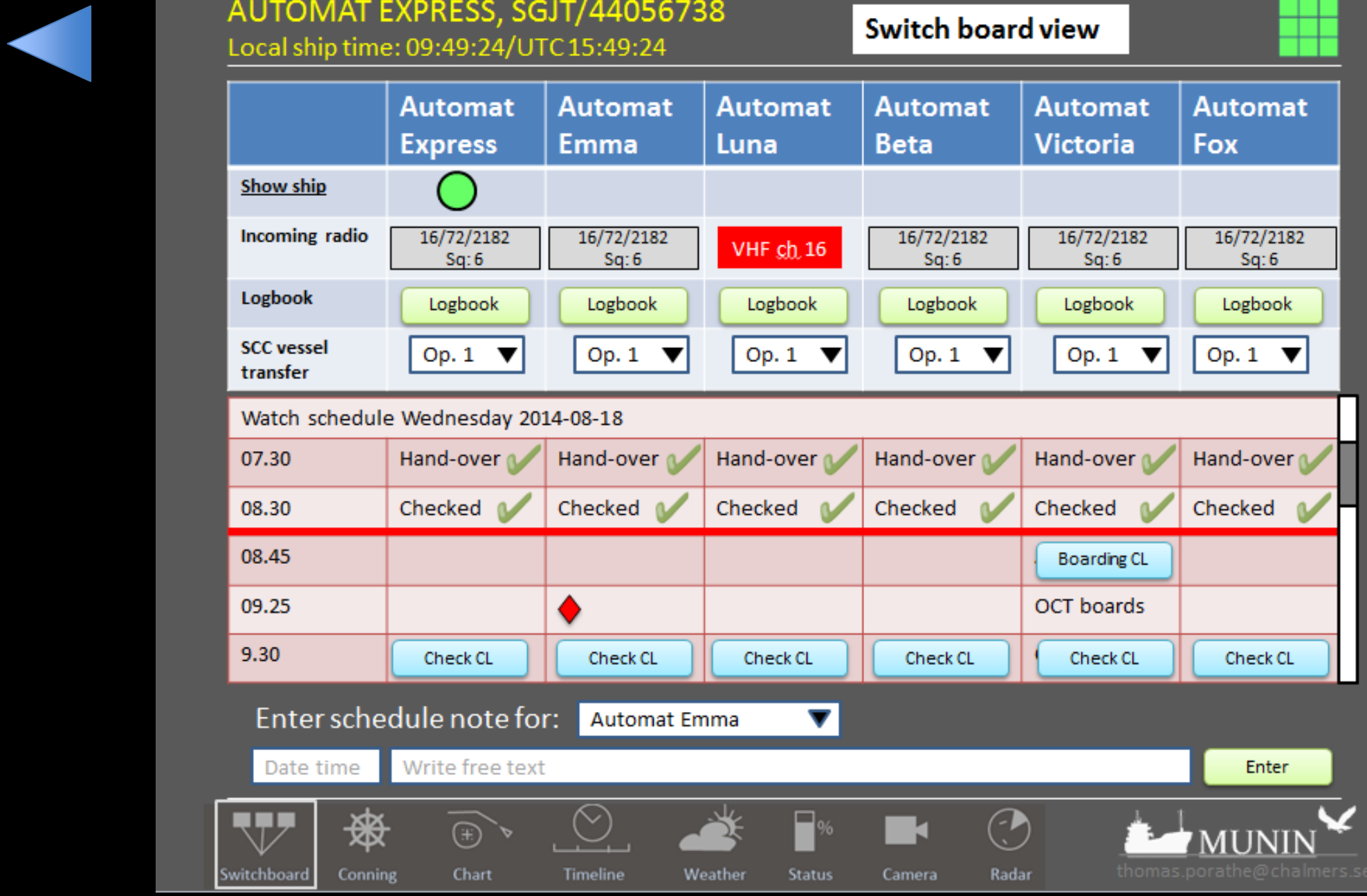
AUTOMAT EXPRESS, SGJT/44056738
Local ship time: 09:49:24/UTC 15:49:24
Switch board view
Automat Express
Automat Emma
Automat Luna
Automat Beta
Automat Victoria
Automat Fox
Show ship
Incoming radio
16/72/2182 Sq: 6
VHF ch 16
Logbook
SCC vessel transfer
Op. 1
Watch schedule Wednesday 2014-08-18
07.30
Hand-over
08.30
Checked
08.45
Boarding CL
09.25
OCT boards
9.30
Check CL
Enter schedule note for:
Automat Emma
Date time
Write free text
Enter
Switchboard
Conning
Chart
Timeline
Weather
Status
Camera
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