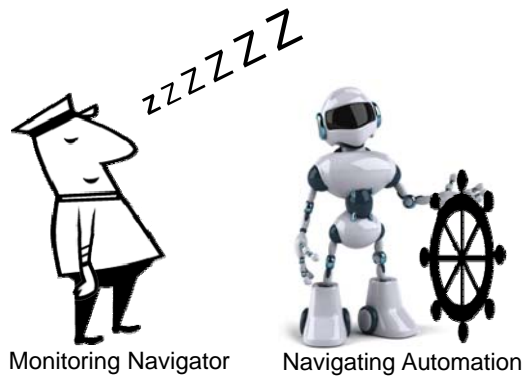


The problem is not automation, the problem is communication: Autonomy, human factors and safety in the maritime domain



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RMS Oceanic, 1914



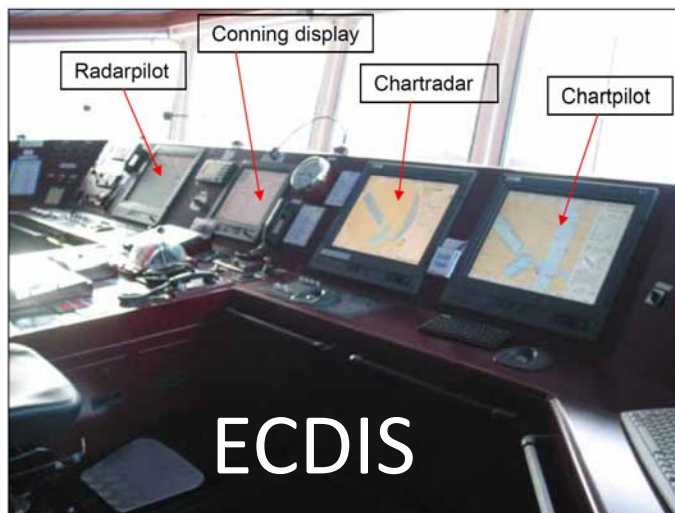
RMS Oceanic, 1914

Radio
Echo sounder
RDF
RADAR
DECCA/LORAN
GPS
ECDIS
AIS

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"Navigation goes away as a task"

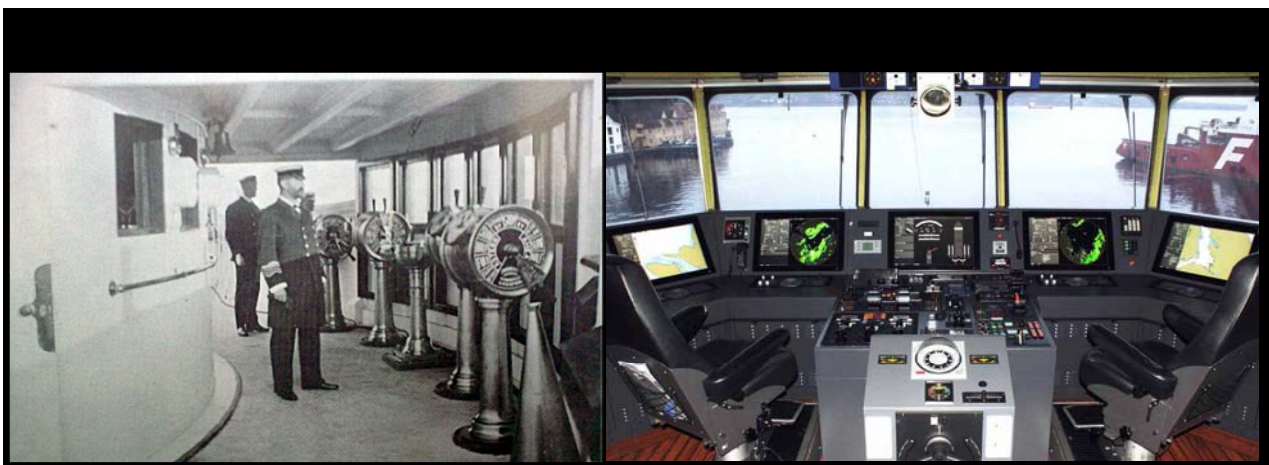
In 1995 the U.S. Coast Guard Research and Development Centre presented a human factors study made on two commercial ECDIS placed on a simulator bridge. They concluded that

- ECDIS had the potential to improve upon the safety of navigation, compared to conventional procedures.
- There was strong evidence that the use of ECDIS **increased the accuracy of navigation**, as measured by a smaller cross-track distance of the ship from the planned track line, and **reduced the proportion of time spent on navigation**, with a corresponding increase in the proportion of time spent on the higher risk collision avoidance task. In addition, ECDIS was shown to **improve geographic "situational awareness" and to reduce navigation "errors"**. (Smith et al., 1995, p. VIII)

Smith, M. W., Akerstrom-Hoffman, R. A., Pizzariello, C. M., Siegel, S. I., Schreiber, T. E., & Gonin, I. M. (1995). Human Factors Evaluation of Electronic Chart Display and Information Systems (ECDIS): United States Coast Guard Research and Development Center.

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The image shows a side-by-side comparison of ship bridge automation. On the left, a historical black and white photograph of the SS Oceanic in 1914 shows a narrow bridge with two men in uniform standing next to a row of large, manual steering wheels. On the right, a modern color photograph of the MV Kong Harald in 2014 shows a spacious bridge with multiple electronic display screens, radar, and automated control systems. Between the two images is a large white arrow pointing from left to right, with the word "Automation" written in the center.

SS Oceanic, 1914 ➡ Automation ➡ MV Kong Harald, 2014

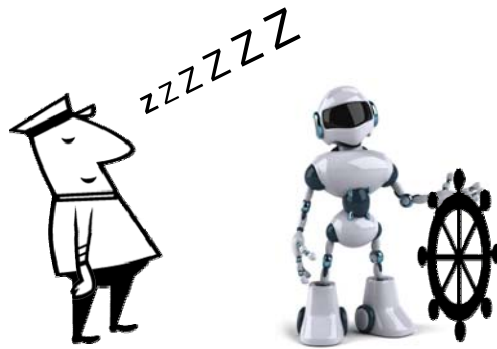
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The image shows a person's hand pointing at a dual-screen electronic display. The left screen displays a green line representing a vessel's track on a chart, with a circular icon labeled 'CCS-907810600/129'. The right screen shows a similar chart view with a green track and a circular icon labeled 'CCS-907810600/129'. Both screens have a data panel on the right side showing various vessel parameters: HDG, STW, COG, SOG, ROT, STBD, XTD, and PORT. Below the screens, there is a banner for "e-Navigation" 2009, featuring logos for EfficienSea, MONA LISA, ACCSEAS, The Interreg IVB North Sea Region Programme, SESAME Straits, e-Navigation Intelligent Vessel Traffic Management, and EFFICIENSEA.

"e-Navigation" 2009 -

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Monitoring Navigator

Navigating Automation

Automation on the ship bridge

Challenge: Keeping the navigator in the loop

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“Human error” contribution to accidents

84-88% of tanker accidents

79% of towing vessel groundings

89-96% of collisions

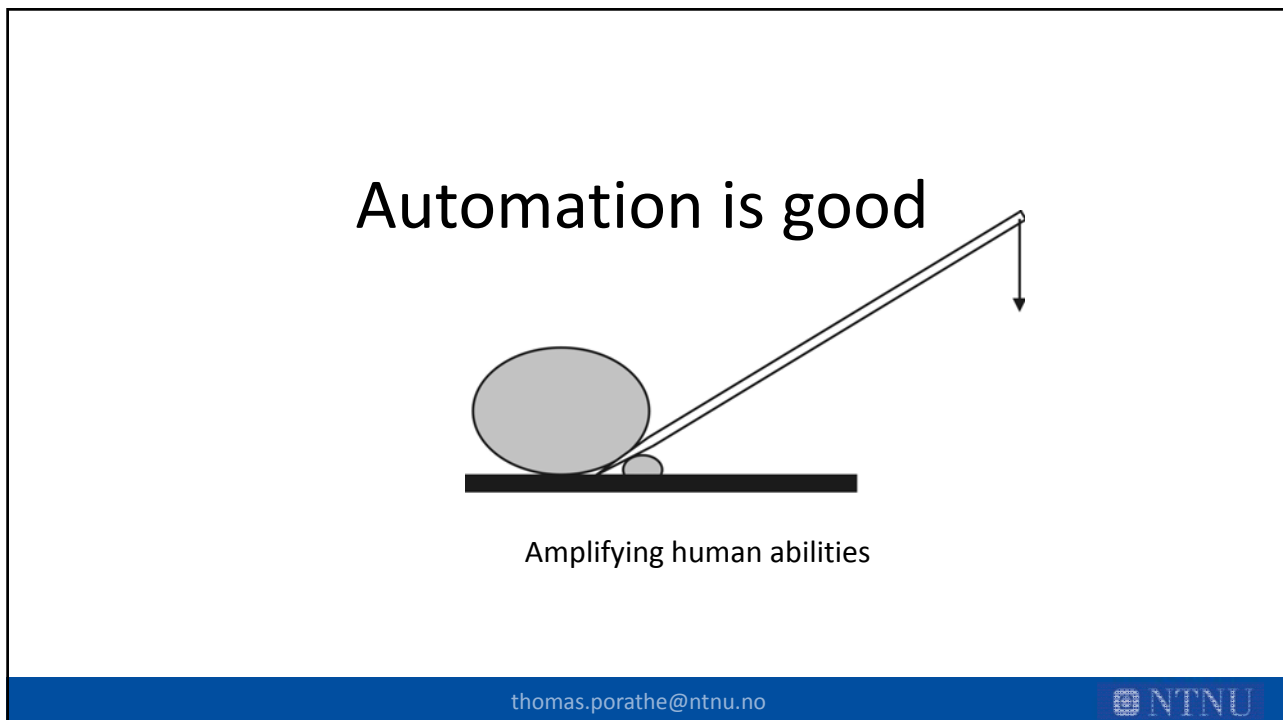
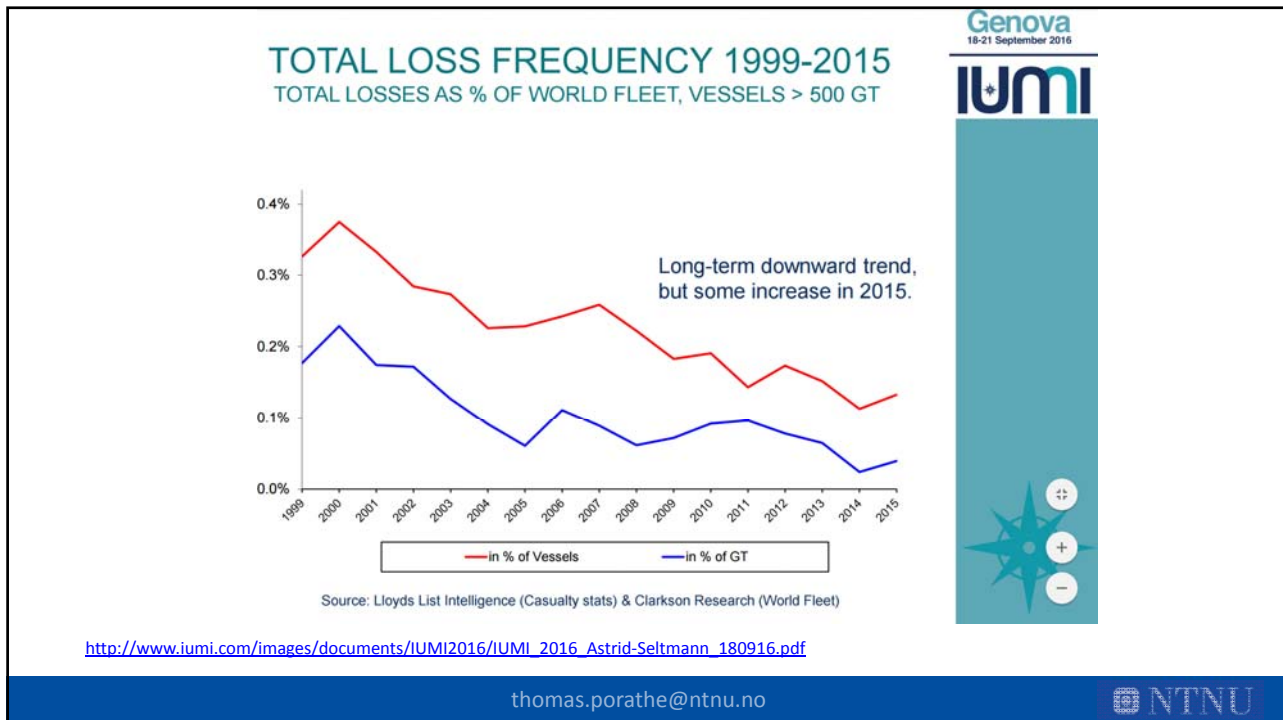
75% of collisions – ship/structure accidents

75% of ship fires and explosions

Various studies by TSB Canada, Cormier, UK P&I Club and Bryant. <http://www.wmu.se/fortet.funcform.se/o.o.i.s/71>

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Automation is good

- but have some problems

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Automation bias

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Automation bias

Trust in automation

13 (44)

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Automation bias

Trust in automation

Subjective trust

Automation reliability

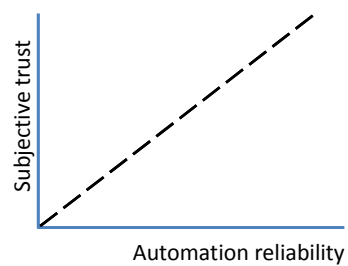
14 (44)

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Automation bias

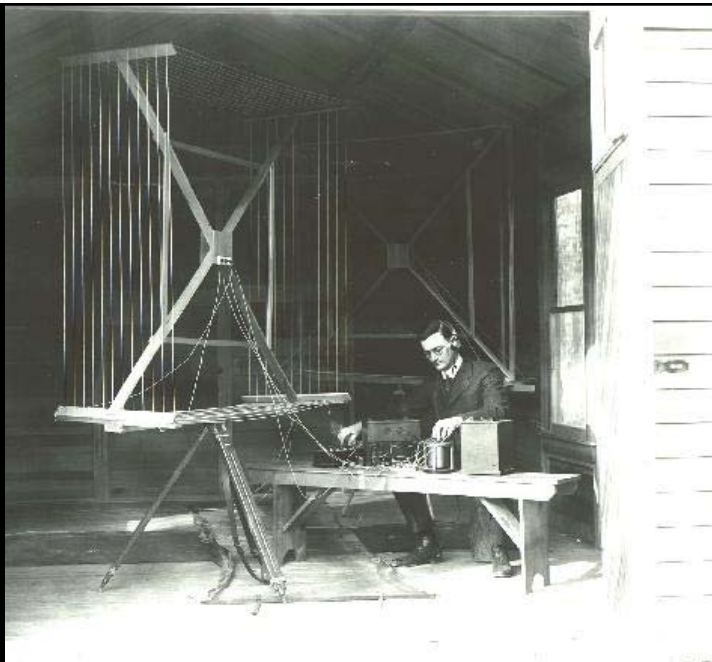
Trust in automation



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Radio direction finder (1902)

Here using a large multi-loop antenna to perform RDF in this 1919 photo. This is a fairly small unit for the era

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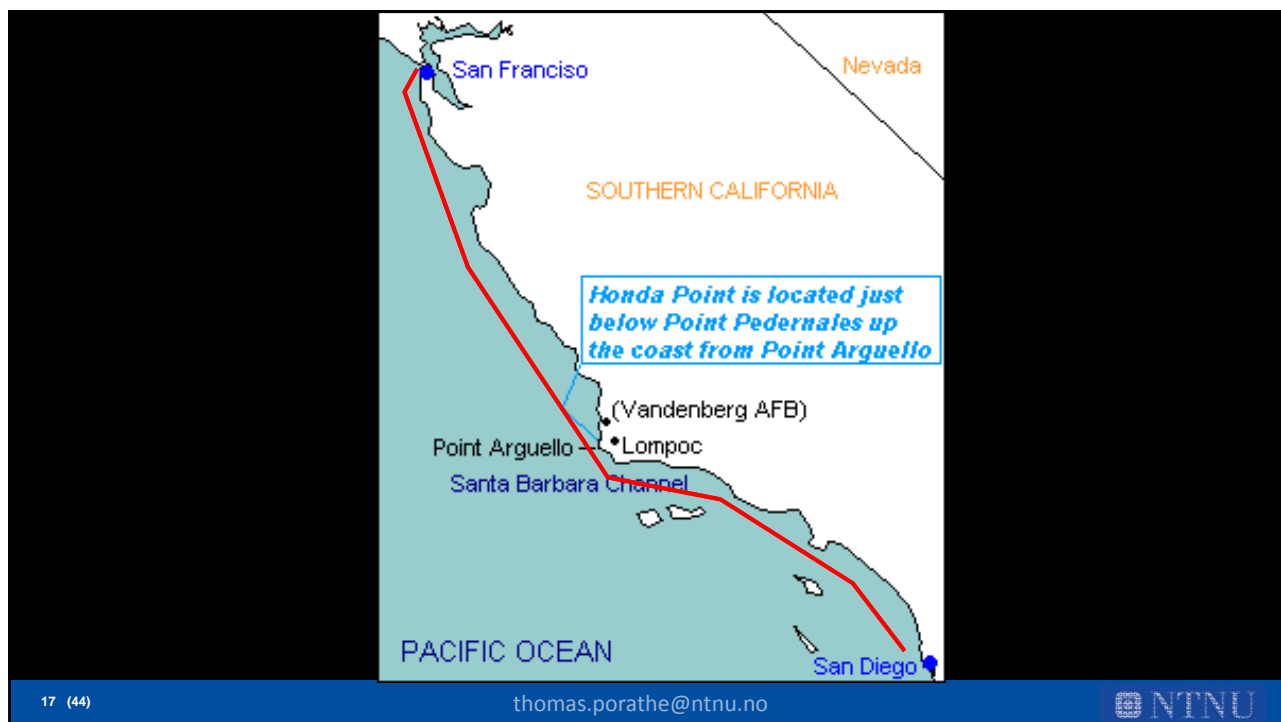



Photo # NH 84820 USS Nicholas & USS S.P. Lee wrecked at Honda Point, Sept. 1923





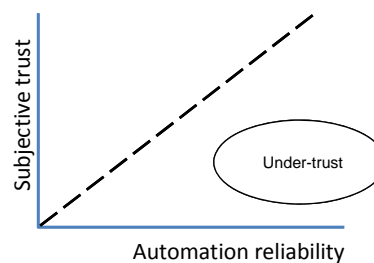
Point Pedernales Disaster
8 September 1923
© 2007 Destroyer History Foundation
Map courtesy Curious Software



Did not trust automation when they should have

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Automation bias





Tokyo-Yokohama earthquake of 1 September 1923, with a **magnitude** of 7.9. The death toll from the temblor was estimated to have exceeded 140,000.

Tsunami up to 12 m (39 ft) in Atami, Shizuoka, and Tōkai

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8102017 China Airlines 6747SP Loss of Power and Inflight Upset

University of Bielefeld - Faculty of Technology
Networks and distributed Systems
Research group of Prof. Peter B. Ladkin, Ph.D.
[Back to Abstract of References and Incidents](#)

China Airlines Boeing 747-SP Accident Report
National Transportation Safety Board
Prepared for the WWW by
[Hiroshi Sozame](#)
Safety Promotion Comt.
All Nippon Airways

PB86-910403

**NATIONAL
TRANSPORTATION
SAFETY
BOARD**

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

CHINA AIRLINES BOEING 747-SP, N4522V
300 NAUTICAL MILES NORTHWEST OF
SAN FRANCISCO, CALIFORNIA
FEBRUARY 19, 1985

http://www.ntsb.gov/publications/accidents/DOCS/CAA/Rep/ChinaAir/AAR8503.html

Figures 1.-Excerpts from Computer Animation.

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3.2 Probable Cause

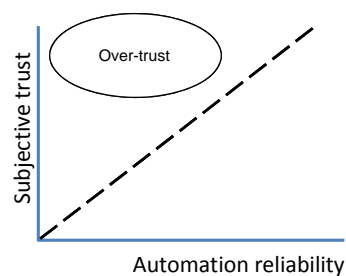
The National Transportation Safety Board determines that the probable cause of this accident was the captain's preoccupation with an inflight malfunction and his failure to monitor properly the airplane's flight instruments which resulted in his losing control of the airplane.

Contributing to the accident was the captain's over-reliance on the autopilot after the loss of thrust on the No. 4 engine.

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Automation bias



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

(Donald Norman, 1990)

Norman, D. The problem of automation: Innappropriate 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

25 (44)

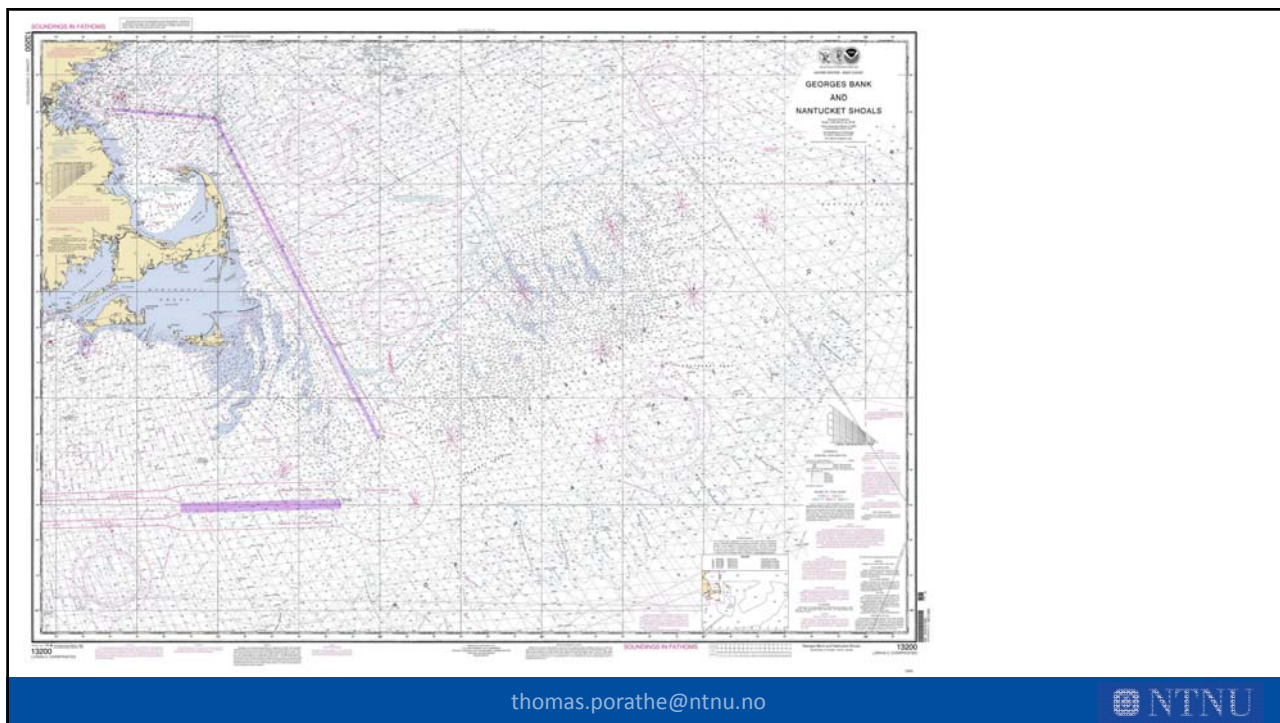
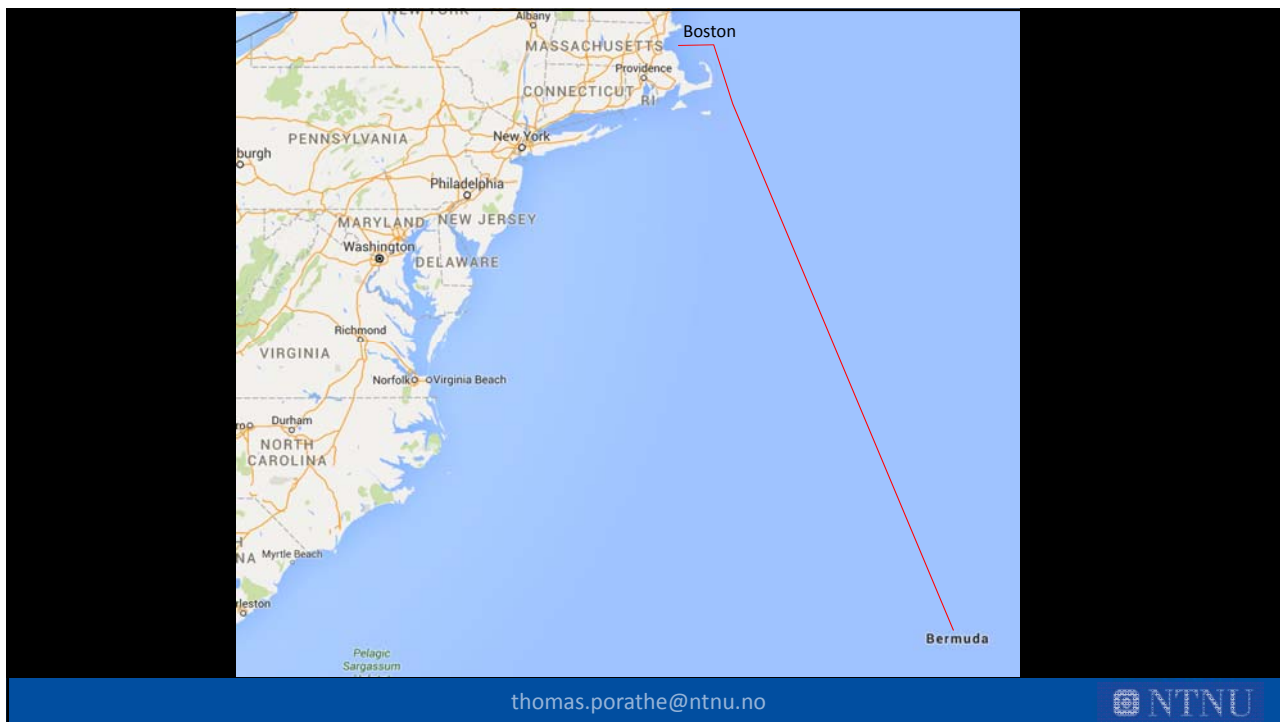
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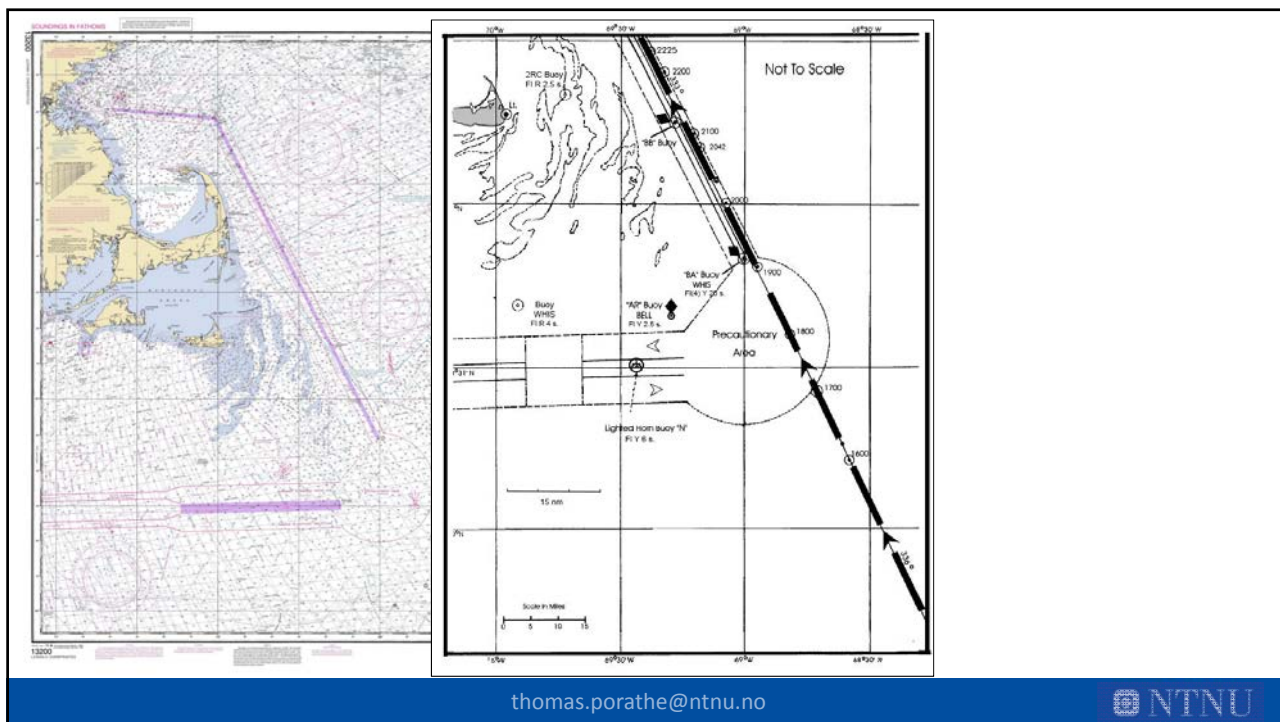
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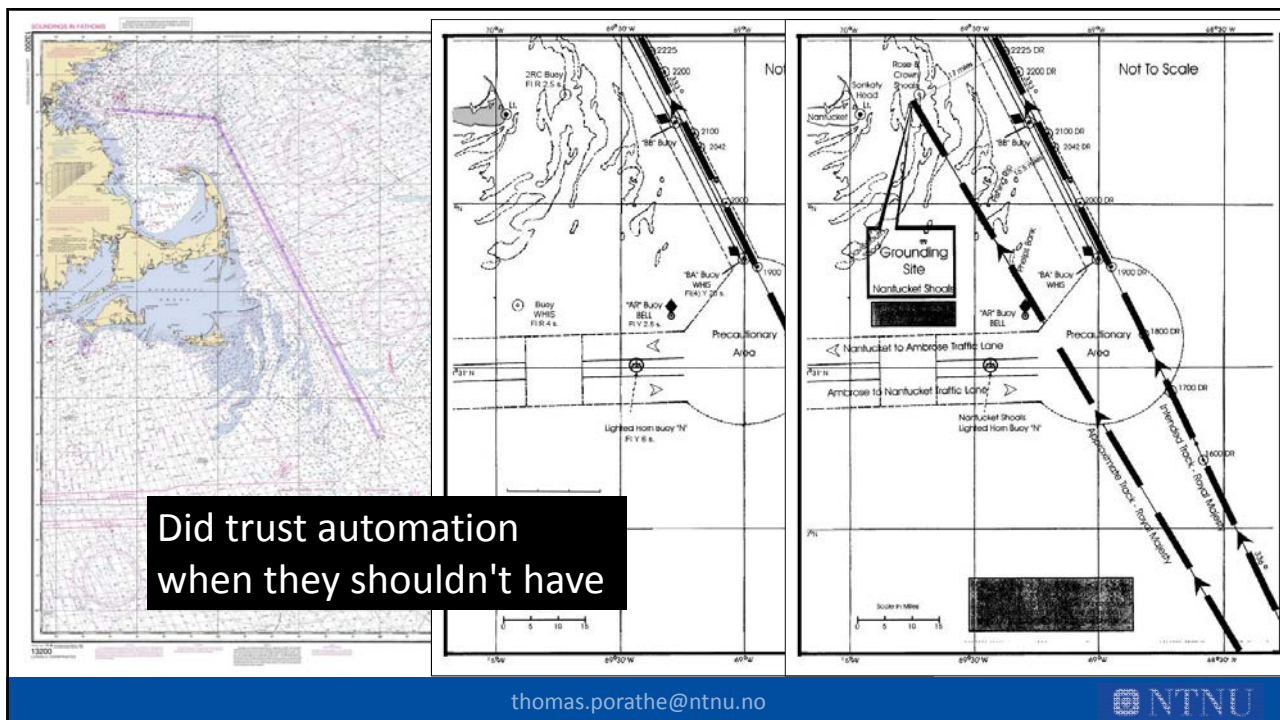
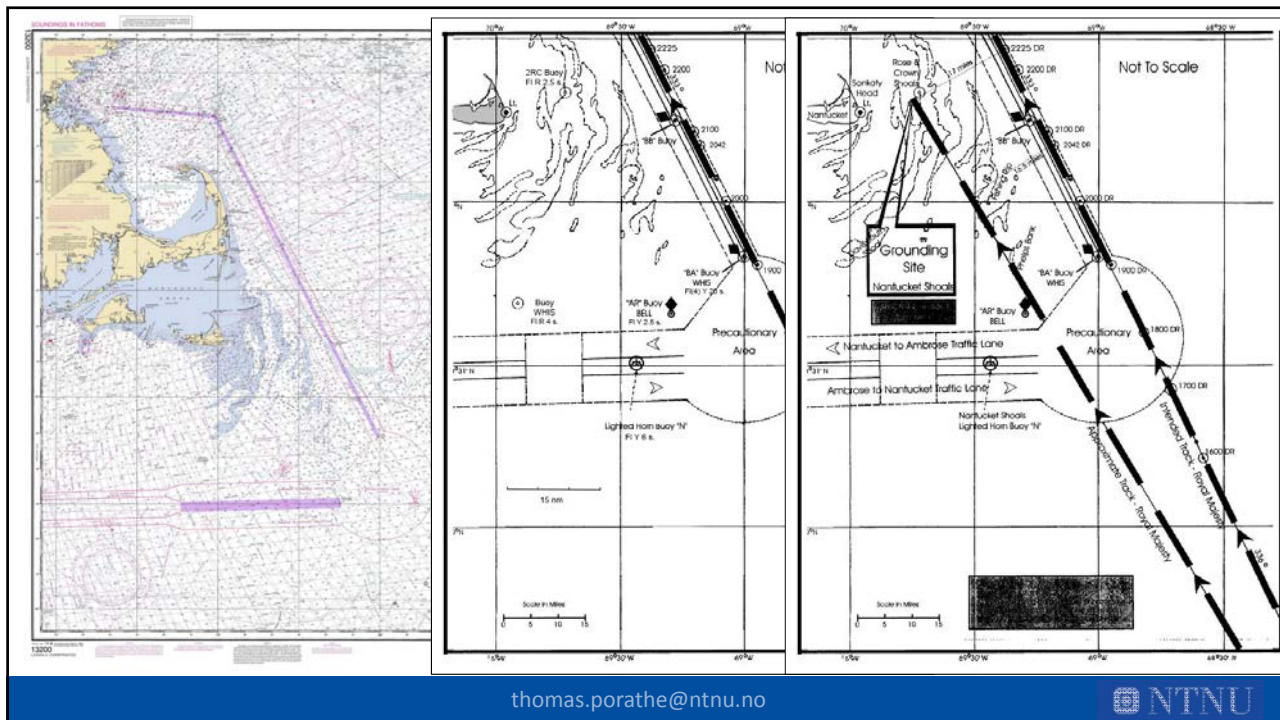


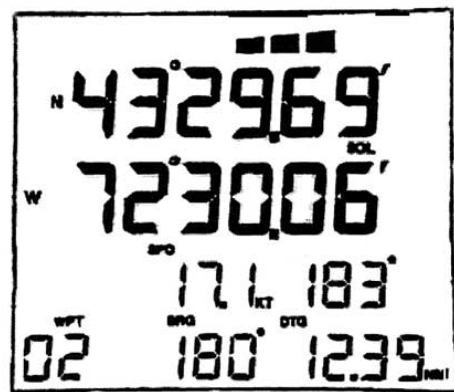
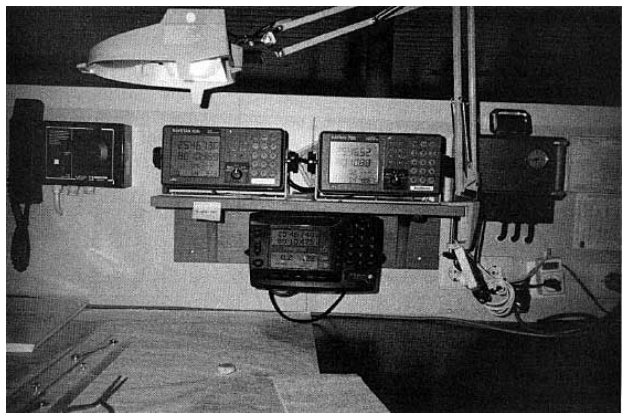
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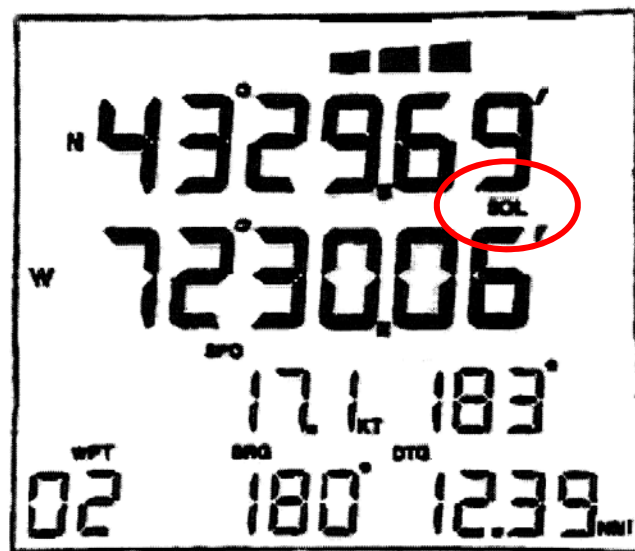
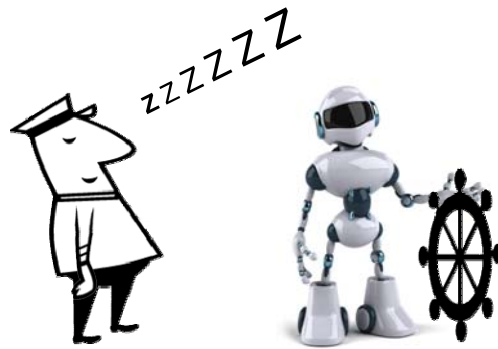


Figure 8—GPS display showing SOL and DR.

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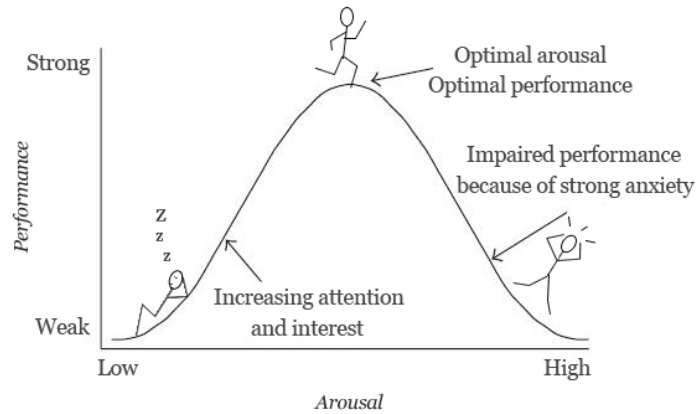
"Boredom induced accidents"

*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

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The Yerkes–Dodson law

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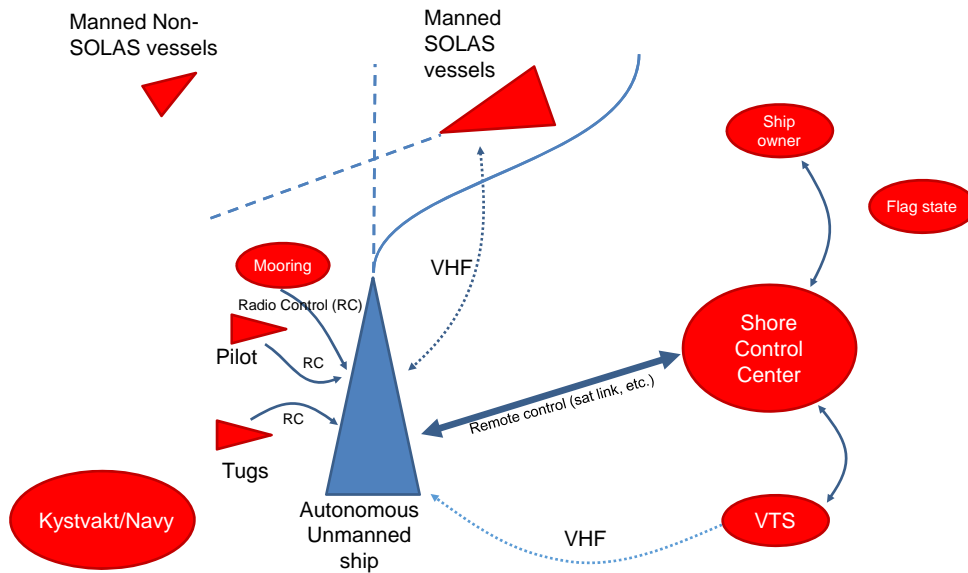
IMO's Sub-Committee on Radio Communications and Search and Rescue (COMSAR) in 2011 decided **“that the navigator should be kept in the loop as a navigating navigator”**

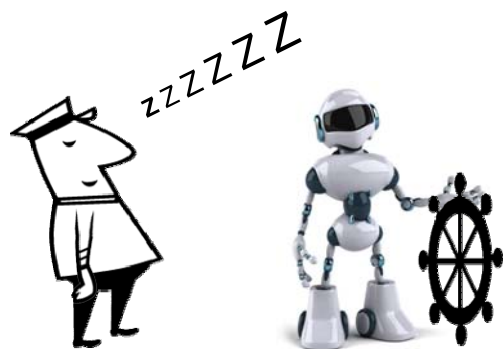
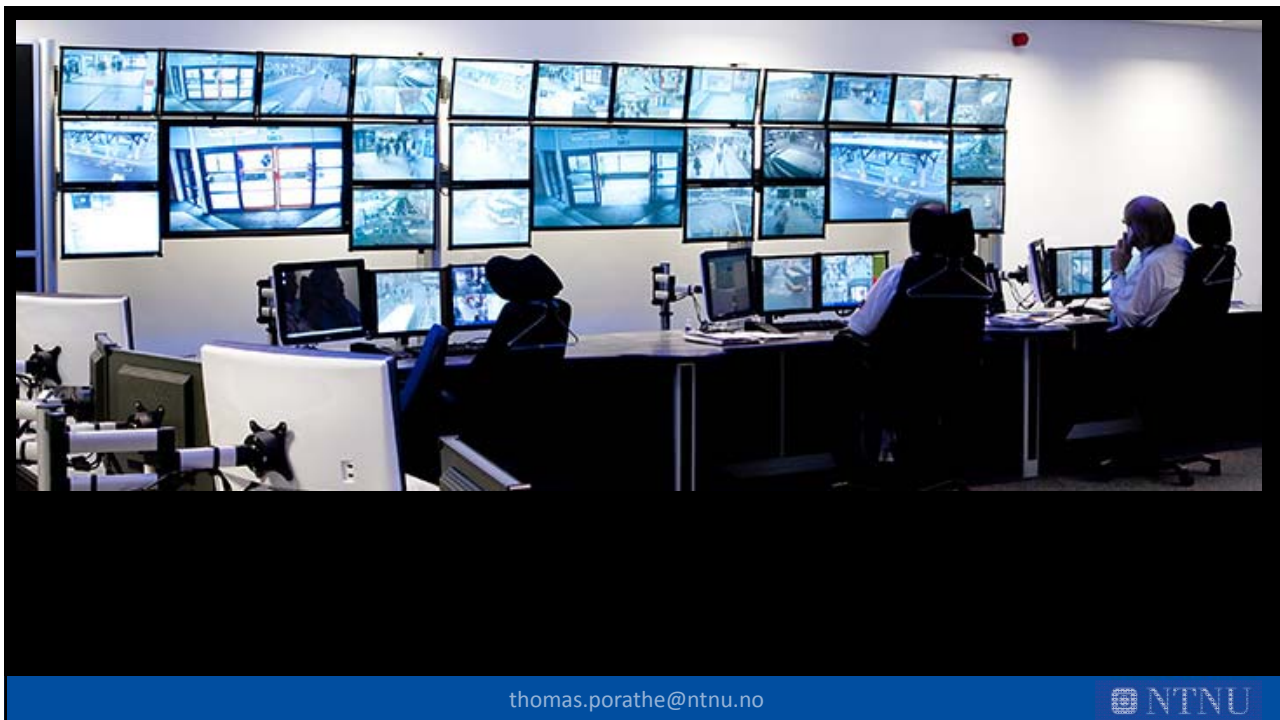
IMO: COMSAR 15/16. Report to the Maritime Safety Committee, 25 March 2011

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Humans in the unmanned ship system





Monitoring Navigator

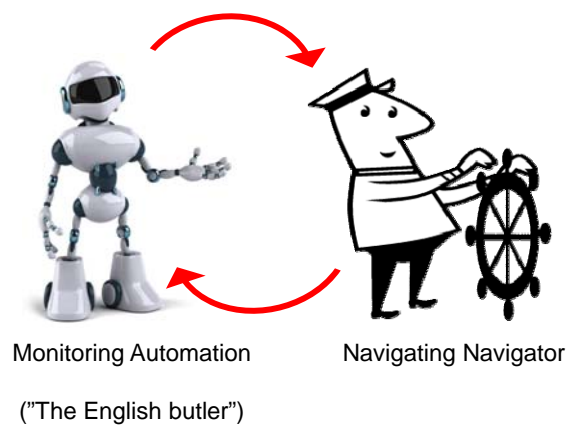
Navigating Automation

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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? (Use of "adaptive automation"?)

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