

Design Challenges and Opportunities for Future Unmanned Ships

Autonomous Ship Technology Symposium 2016, Amsterdam 21-23 June

Ørnulf Jan Rødseth, Senior Scientist, MARINTEK

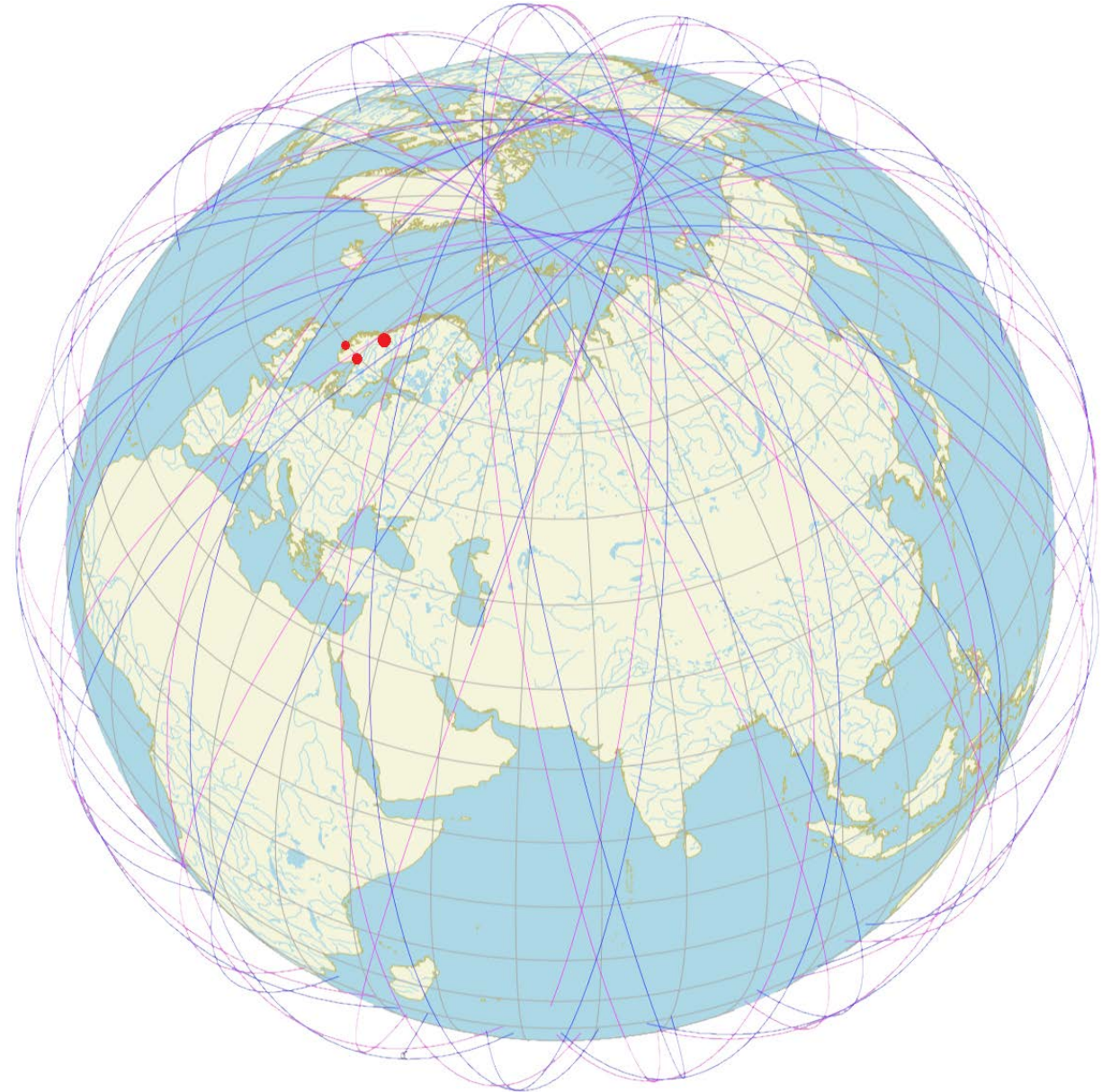
OrnulfJan.Rodseth@marintek.sintef.no

MARINTEK

Norsk Marinteknisk Forskningsinstitutt

 **SINTEF**

MARINTEK



History from 1939

150 scientists

Close cooperation with NTNU

Independent, not for profit institute

Limited Company



56%  **SINTEF**

26%  **Norges Rederiforbund**
Norwegian Shipowners' Association

9%  **DNV**

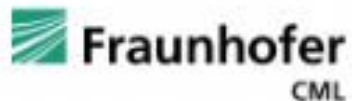
4%  **Norsk Industri**

4%  **Sjøfartsdirektoratet**
Norwegian Maritime Authority

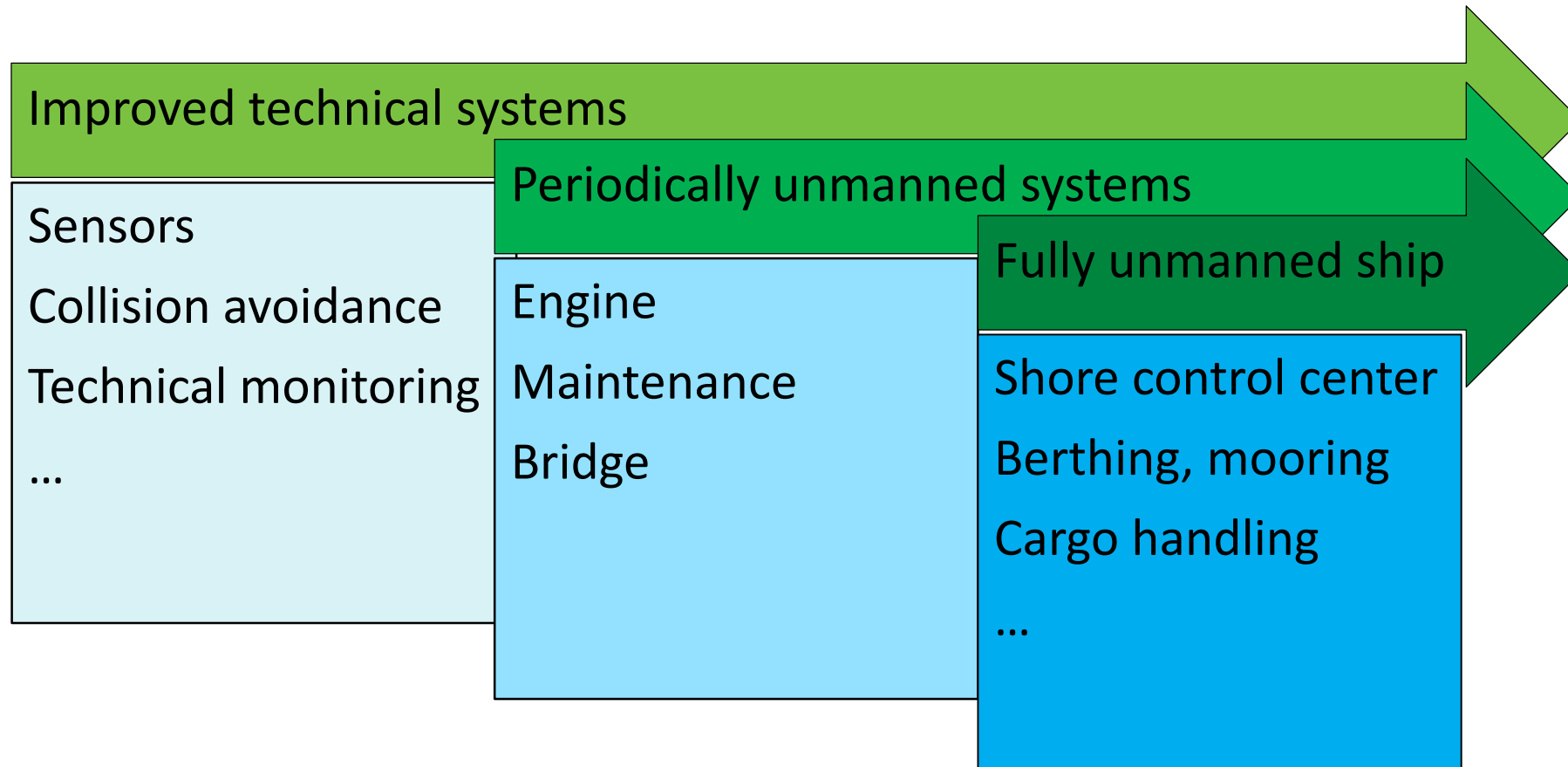
1%  **NHO Sjøfart**

A concept study for a fully unmanned handymax dry bulk carrier on an intercontinental voyage.

- Duration: 01.09.2012 – 31.08.2015
- Funding: 2.9 million EUR of budget 3.8 million EUR
- Activity code: SST.2012.5.2-5: E-guided vessels - the 'autonomous' ship



Different forms of autonomy



This presentation will mainly cover fully unmanned ships.

Contents

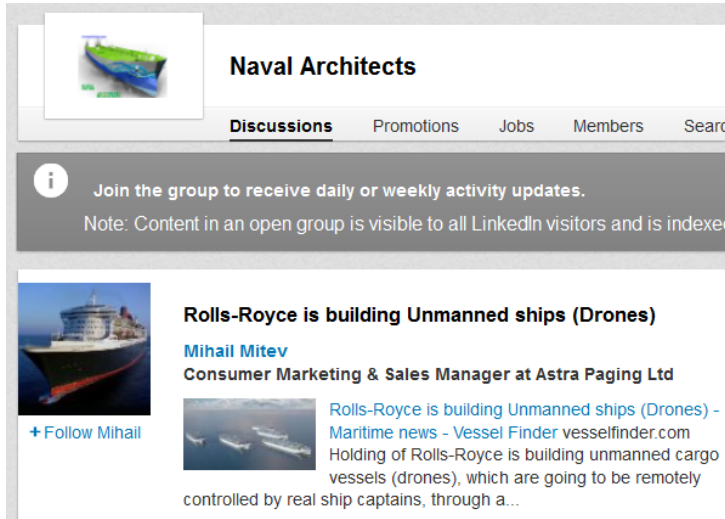
- **Driving factors and threats**
- Critical design factors
- Some possible examples of unmanned ships
- Conclusions and summary

Increasing automation in all areas



Google Car © Google.com

Generally positive public reactions



Naval Architects

Discussions Promotions Jobs Members Search

Join the group to receive daily or weekly activity updates.
Note: Content in an open group is visible to all LinkedIn visitors and is indexed.

Rolls-Royce is building Unmanned ships (Drones)

Mihail Mitev
Consumer Marketing & Sales Manager at Astra Paging Ltd

Rolls-Royce is building Unmanned ships (Drones) - Maritime news - Vessel Finder vesselfinder.com
Holding of Rolls-Royce is building unmanned cargo vessels (drones), which are going to be remotely controlled by real ship captains, through a...

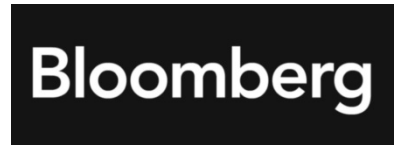


News Blogs Multimedia Companies Events Newsletters Jobs

here: Electronics Weekly > News > Business > Viewpoints > Unmanned, networked, intelligent ships navigate familiar water

Unmanned, networked, intelligent ships navigate familiar water

no comment david manners 7th March 2014 Get news by email



IHS Maritime Research & Analysis Round-up
Converting data into invaluable insight

HDG - MAG 1 354.5°
STW - DLOG 1 -0.1 km
COG - DOPS 1 090.0°
SOG - DOPS 1 0.0 km
POSN - DOPS 1
30° 34.503 N
032° 17.613 E
TIME (UTC) 04:45

HOME » SAFETY & SECURITY » YOUR SAY ON 'UNMANNED SHIPS'

Your say on 'unmanned ships'



Newsweek

WORLD BUSINESS TECH & SCIENCE CULTURE SPORT NEWSWIRE THIS WEEK*

Meet the Sponsors Behind the People Already in Line
Court Rules Yelp Can Manipulate Ratings for
Pirated Copies of The Sims 4 Contain a 'Nudity Glitch'
Fake Cell Towers Allow the NSA and Police to
Cell 4ch

Are Unmanned Vessels the Future for the Ocean?

By Michael Carroll / July 5, 2014 5:09 AM EDT

- HOME
- NEWS
- TECH
- NAVIGATION
- SAFETY
- CAREER
- SEA LIFE

Can Futuristic Unmanned Cargo Ships Sail Without Seafarers?

- Facebook 8768
- Twitter 70
- Google+
- LinkedIn
- Pinterest

Safety



NOAA Office of Response and Restoration

Own ship: No crew that
can be harmed

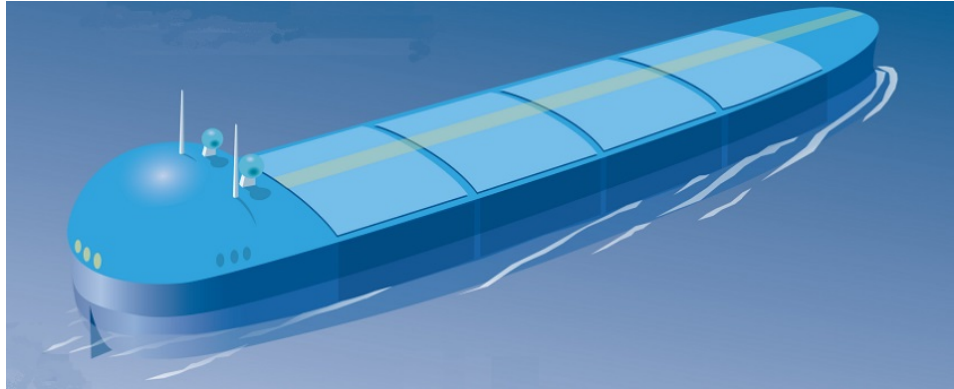


Exxon Valdez Oil Spill Trustee Council



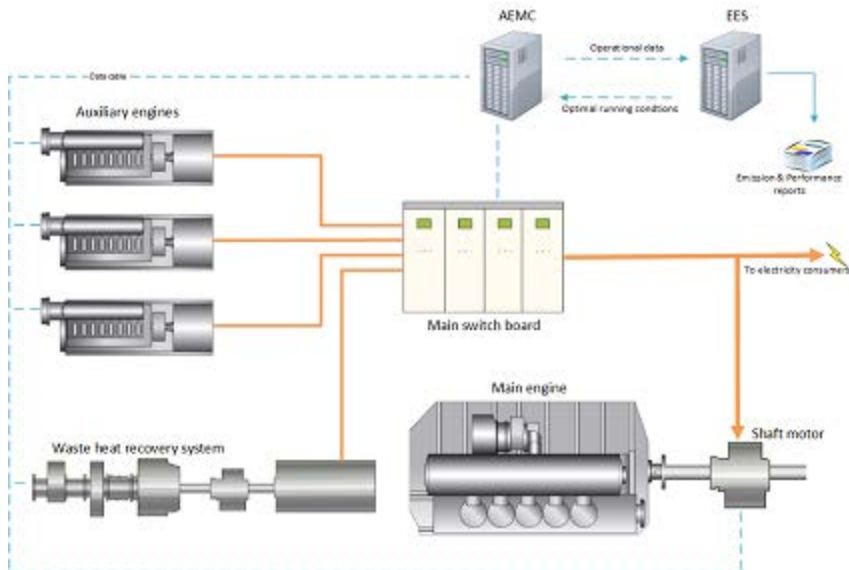
Other ships and environment: Less human errors

Reduced costs?



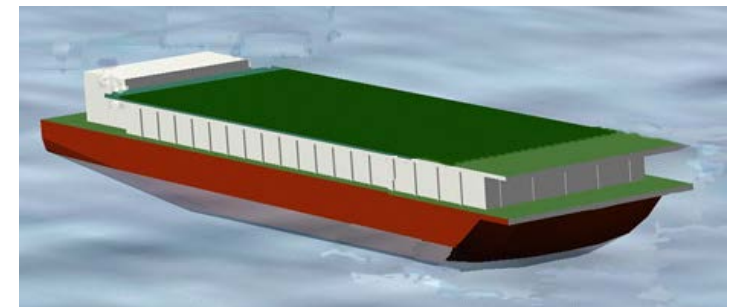
No accommodation
Less power
More cargo

No crew
No crew related costs



Improved technical systems
Less off-hire
Better efficiency

Smaller vessels in some trades: More flexibility



Societal



European maritime competitiveness
European employer attractiveness
Improved transport systems

Less dangerous work
Periodically unmanned bridge
Shorter stays away from home
More interesting work



strangecosmos.com



The world's need for
low cost transport

New business models



Mother ship and unmanned drones

NCE Maritime Clean Tech & NCL

Low operational cost short sea / last
mile shipping



Threats?

Cost-benefit

- No hotel
- No crew
- Improved efficiency
- Less off-hire
- New business model



- Dual propulsion, no HFO
- Shore Control Centre
- Longer dockings
- Costlier instruments
- Existing business model

Legal and liability issues

- UNCLOS
- SOLAS



- Contracts
- Insurance

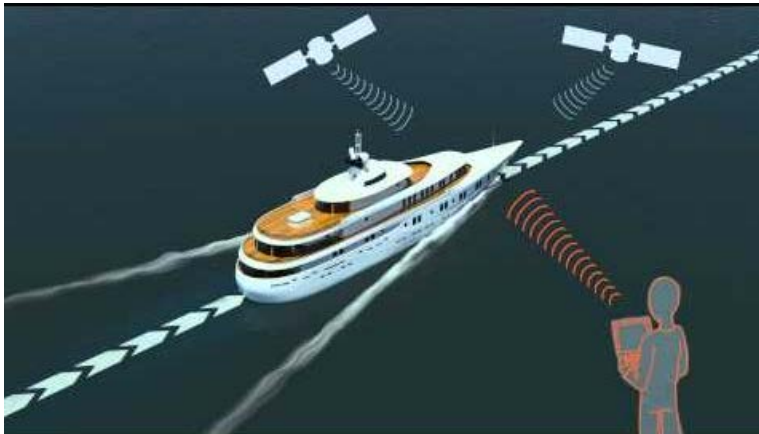


- Liability

[wikimedia.org/paolodefalco75](https://www.wikimedia.org/paolodefalco75)

Hostile (cyber) attacks

- Terrorist hijack e.g. by GPS spoofing

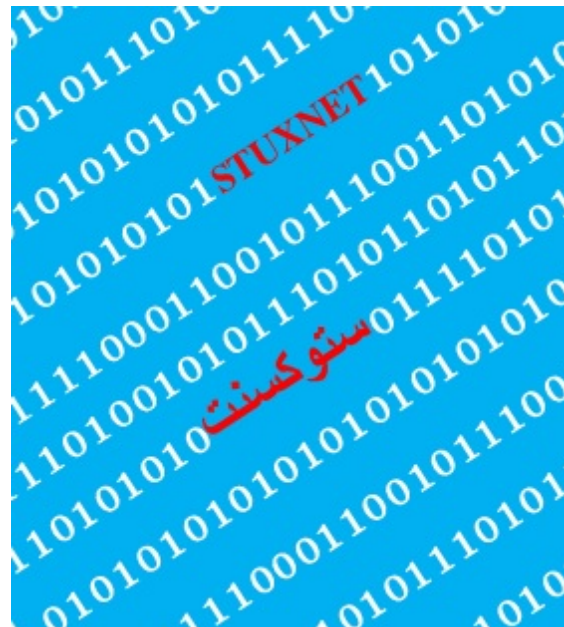


University of Texas at Austin

- Pirate attack



IMO



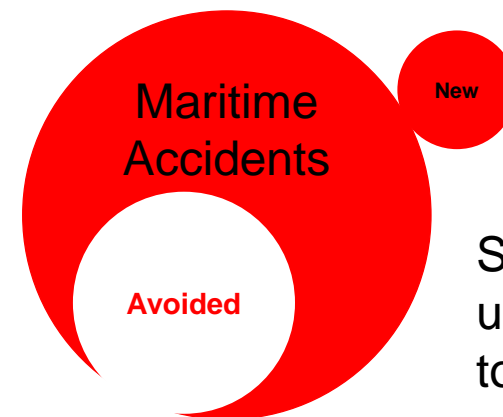
Wikimedia.org/Caricato da Makki98

- Governmental backdoor

"Autonomy assisted accidents"



First radar assisted collision: Andrea Doria and Stockholm off Nantucket in 1956

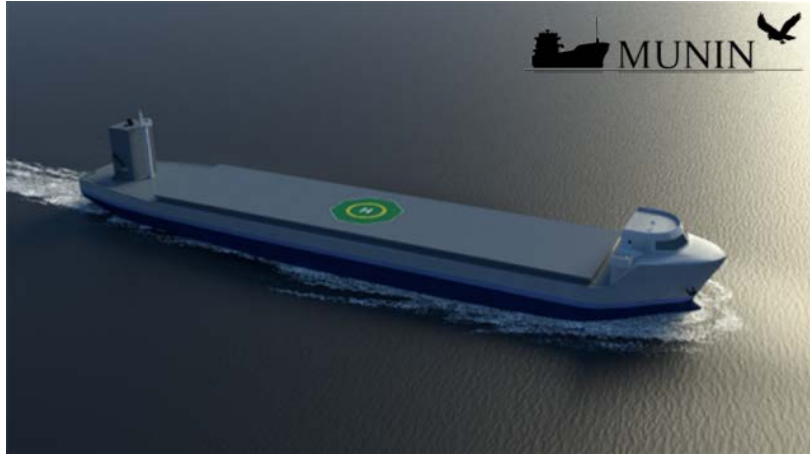


Some new accidents may be unavoidable. Questions are the totality and public acceptance!

Contents

- Driving factors and threats
- **Critical design factors**
- Some possible examples of unmanned ships
- Conclusions and summary

Critical Design Factor 1 - 3



No crew or accommodation



Trade-off between technical and operational complexity



<http://maritimeaccident.org>

No onboard cargo intervention

Critical Design Factor 4-7



Highly reliable technical systems



Sufficient redundancy

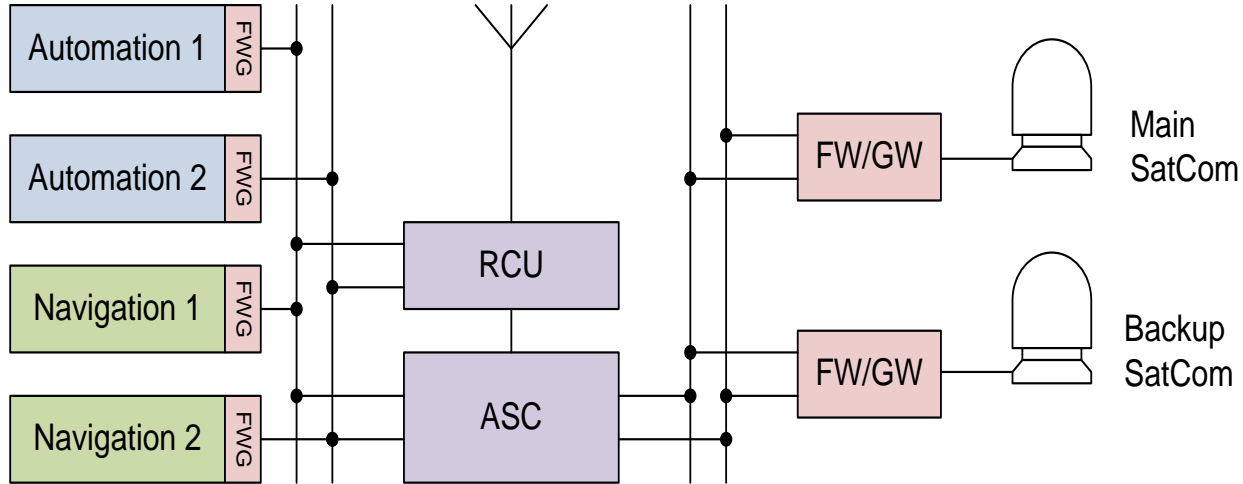


Monitoring and maintenance planning



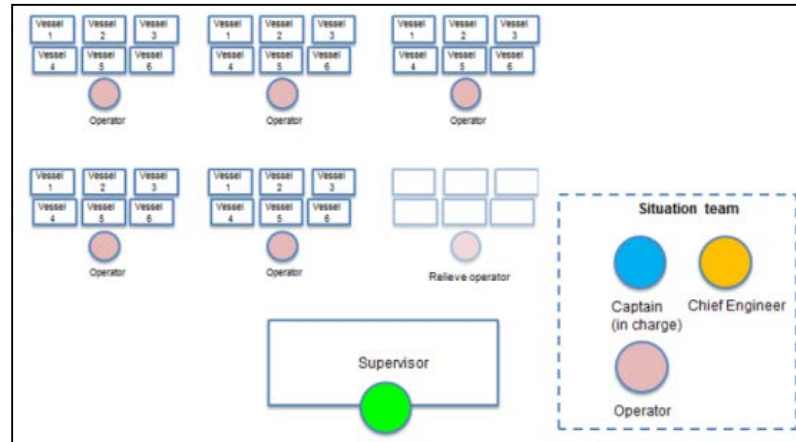
Rapid repair

Critical Design Factor 8-10



Shore support infrastructure

Integrated, safe and secure ICT systems



High quality shore control center

Contents

- Driving factors and threats
- Critical design factors
- **Some possible examples of unmanned ships**
- Conclusions and summary

Deep sea

- 10 000 TEU container vessel
- Shanghai – Los Angles
 - Two states involved
 - 6000 nm, open sea
 - No channels
 - Short port approach
 - Remote control to port
- Dual propulsion systems
- Two stroke diesels
- Biofuel, methanol ...



Offshore supply



- Offshore supply vessel
- North Sea, Mexican Gulf
 - One state involved
 - 3-6 day roundtrip
 - Base near open sea
 - Infrastructure at base/rig
 - Remote controlled at base/rig
- Dual propulsion systems
- Diesel-electric
- LNG, biofuel, methanol ...

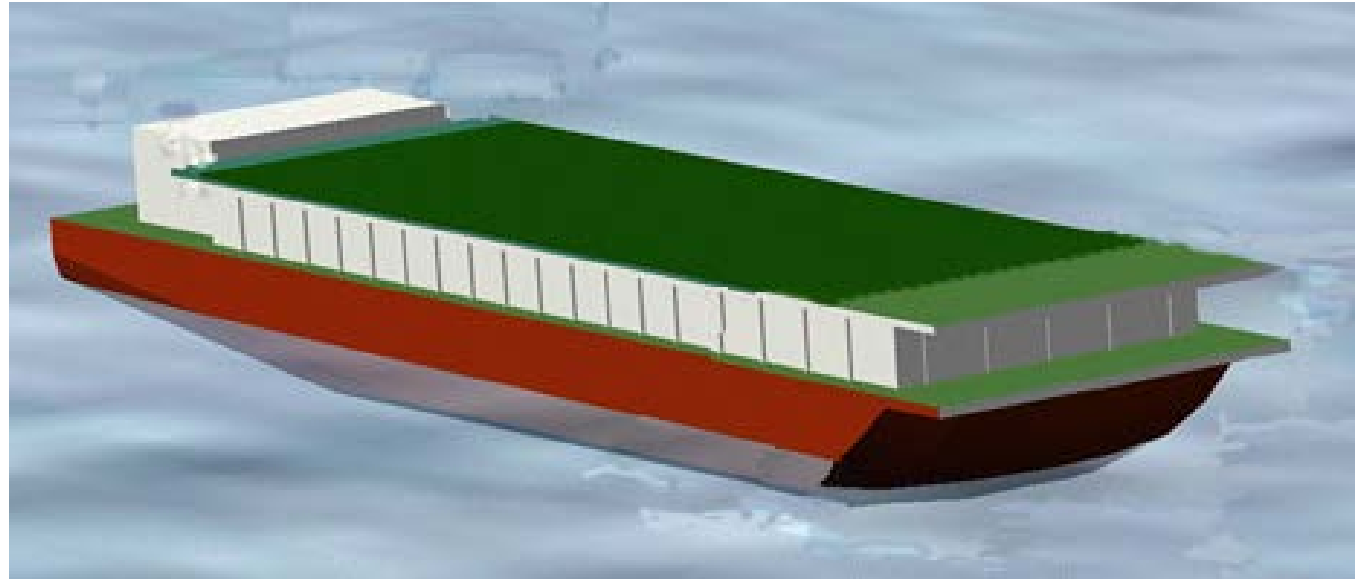
Short sea automated transport

- Transport between small ports
- National/Regional
- 24/7 port calls
- Legs 4-12 hours
- Fully automated cargo handling
- Automated berthing
- Hybrid, LNG, biofuel, methanol ...



Inland waterways

- Short voyages
- 12-50 TEU
- Inland, fjords/sheltered
- Low cost: Wait in port
- Legs 4-12 hours
- Port cranes
- Automated berthing
- Batteries



Contents

- Driving factors and threats
- Critical design factors
- Some possible examples of unmanned ships
- **Conclusions and summary**

Conclusions and summary

- Largest unmanned ship study in Europe is now completed.
- Overall conclusion is that the unmanned ship will come – no long term show stoppers.
- There are design factors that needs to be considered for successful implementation.
- This includes that the business case must be sound!

Thank you for your attention!



SST.2012.5.2-5: Grant no. 314286
E-guided vessels: The 'autonomous'
ship

<http://www.unmanned-ship.org>

SEA
TONOMY