Design Challenges and Opportunities for Future Unmanned Ships

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MARINTEK
Norsk Marinteknisk Forskningsinstitutt

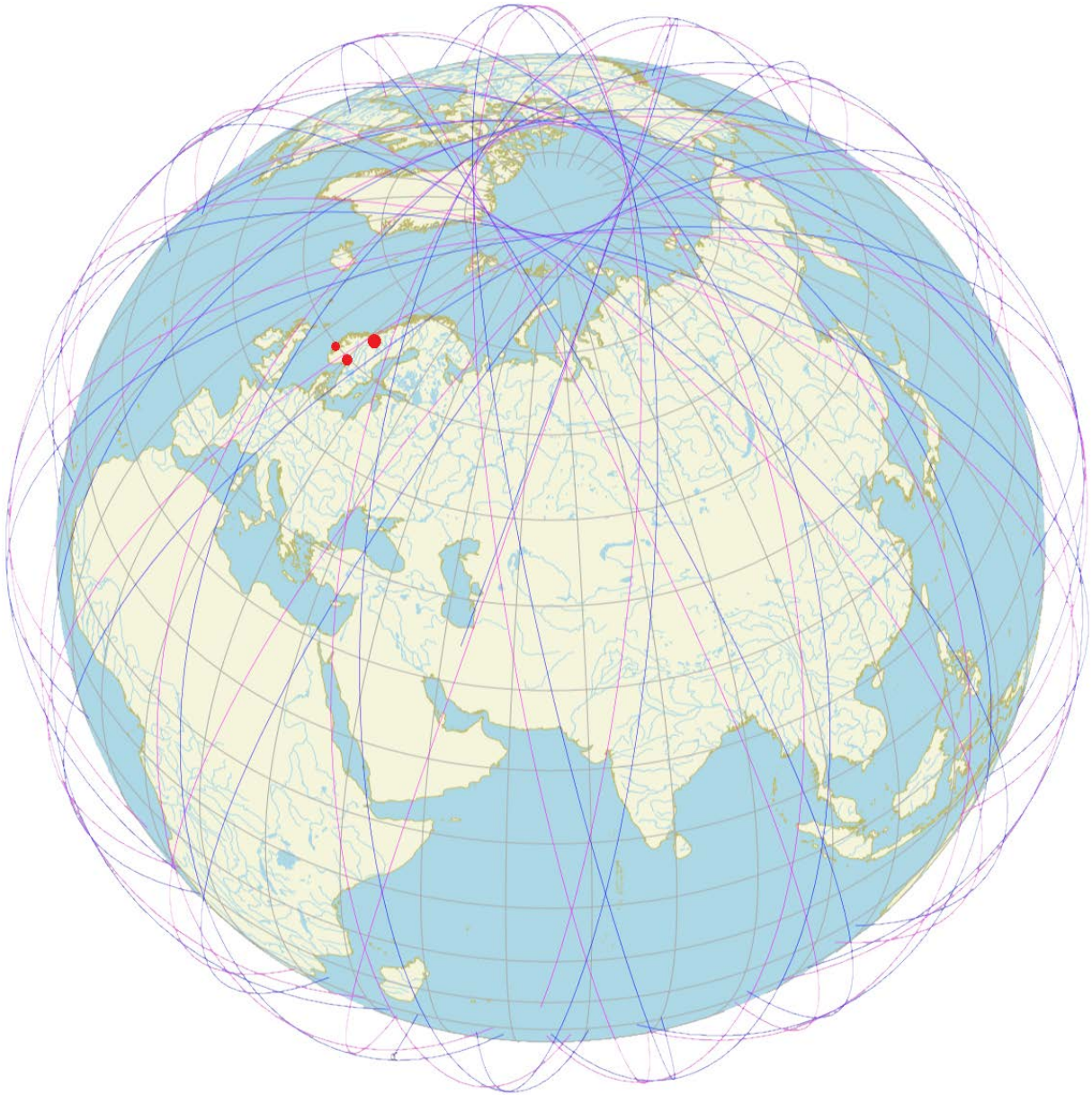
SINTEF

MARINTEK

History from 1939
150 scientists
Close cooperation with NTNU
Independent, not for profit institute
Limited Company

NTNU

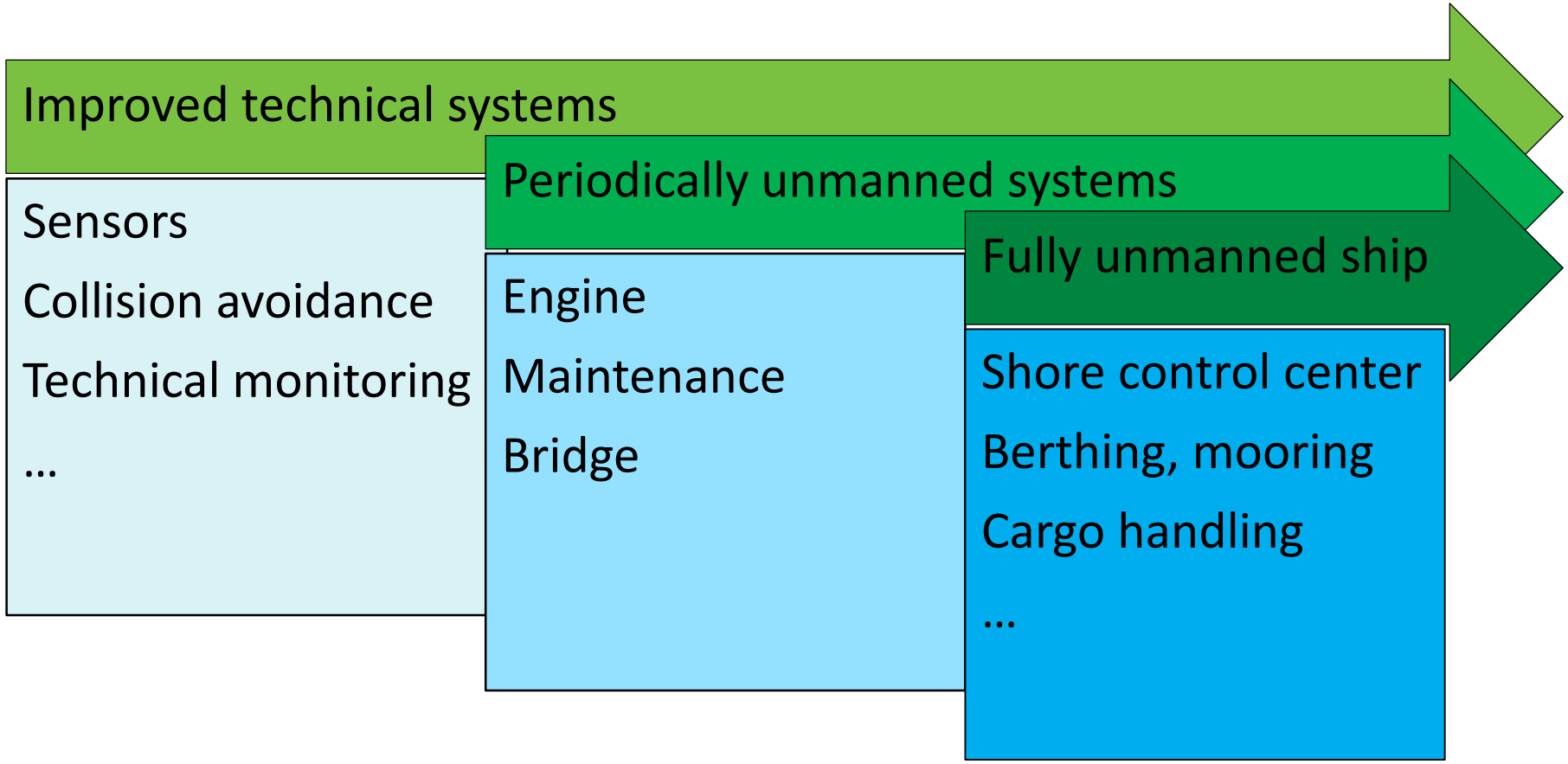
56% SINTEF
26% Norges Rederiforbund / Norwegian Shipowners' Association
9% DNV
4% Norsk Industri
4% Sjøfartsdirektoratet / Norwegian Maritime Authority
1% NHO SJØFART



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

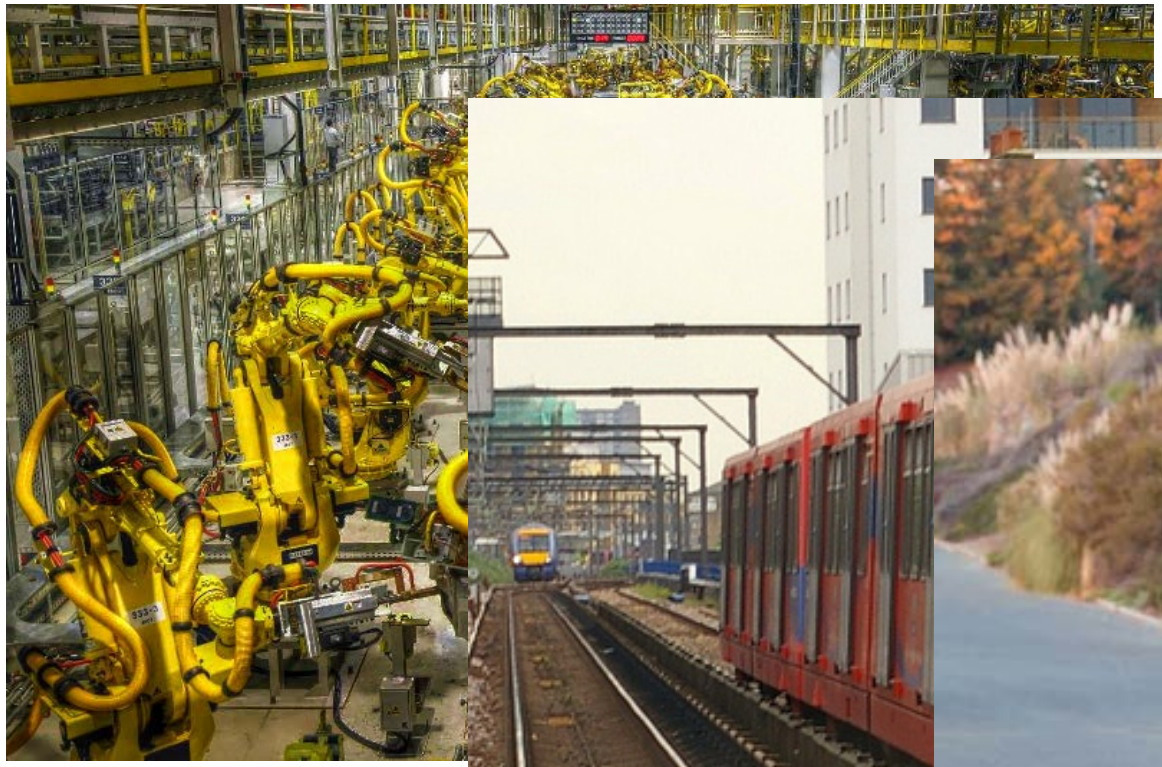


This presentation will mainly cover fully unmanned ships.

Contents

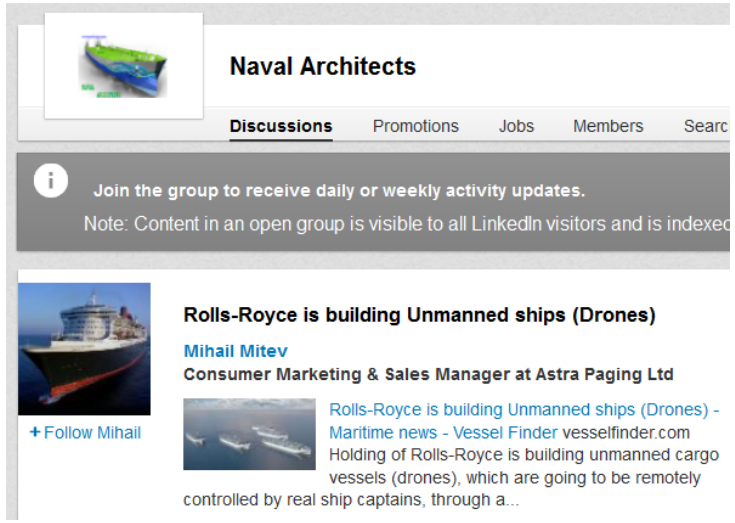
- **Driving factors and threats**
- Critical design factors
- Some possible examples of unmanned ships
- Conclusions and summary

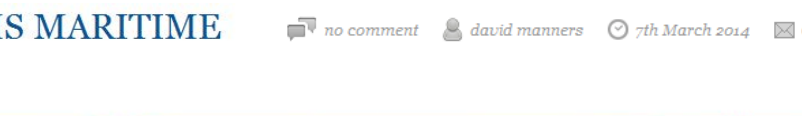
Increasing automation in all areas

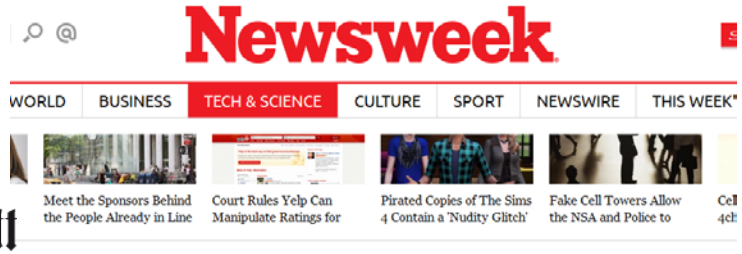


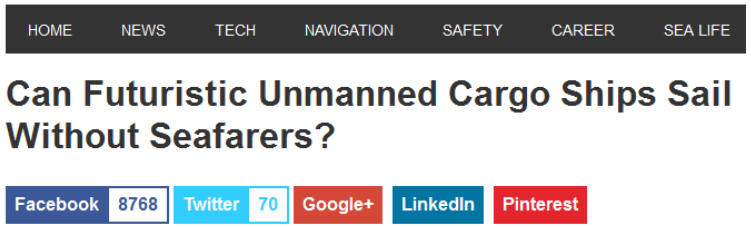
Google Car © Google.com

Generally positive public reactions









Safety

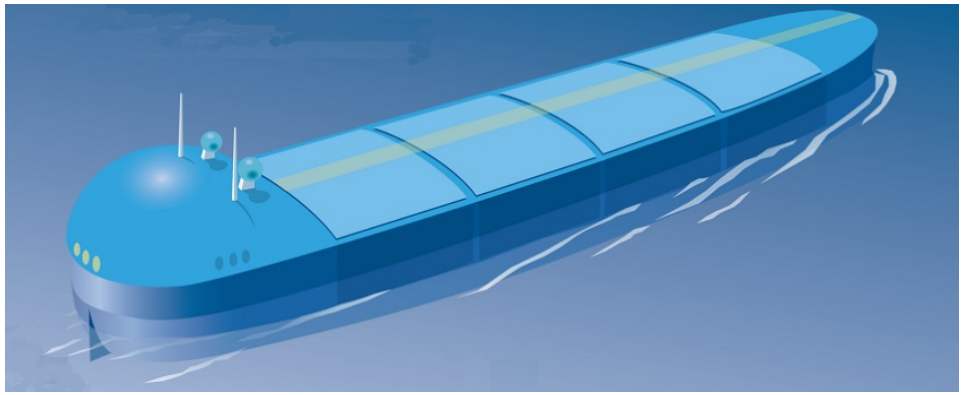
Exxon Valdez Oil Spill Trustee Council

NOAA Office of Response and Restoration

Other ships and environment: Less human errors

Own ship: No crew that can be harmed

Reduced costs?



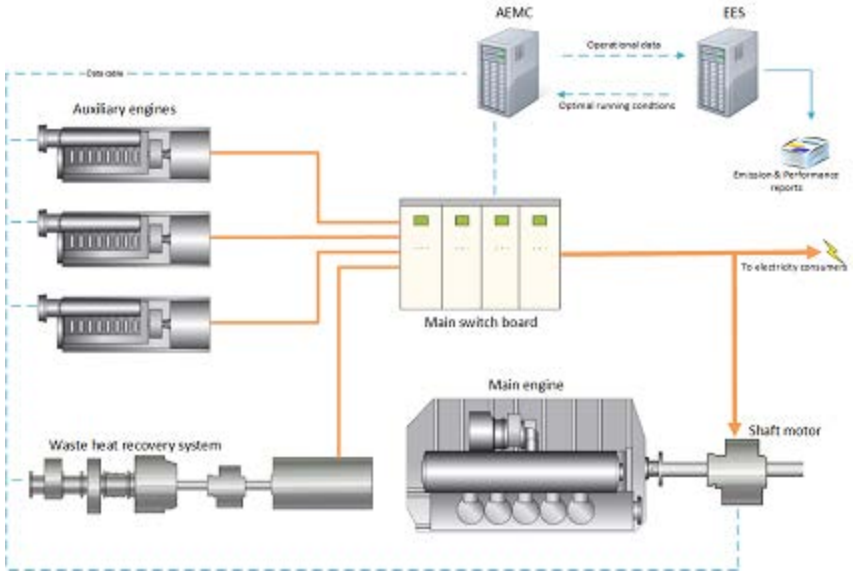
No crew

No crew related costs

No accommodation

Less power

More cargo

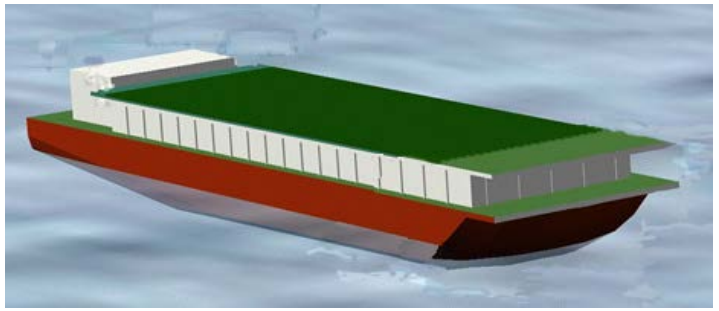


Improved technical systems

Less off-hire

Better efficiency

Smaller vessels in some trades: More flexibility



Societal

European maritime competitiveness

European employer attractiveness

Improved transport systems

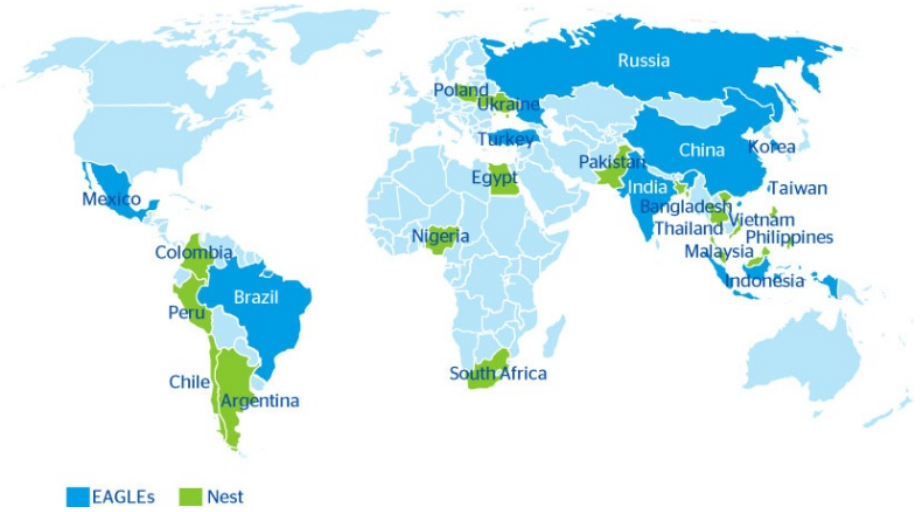
Less dangerous work

Periodically unmanned bridge

Shorter stays away from home

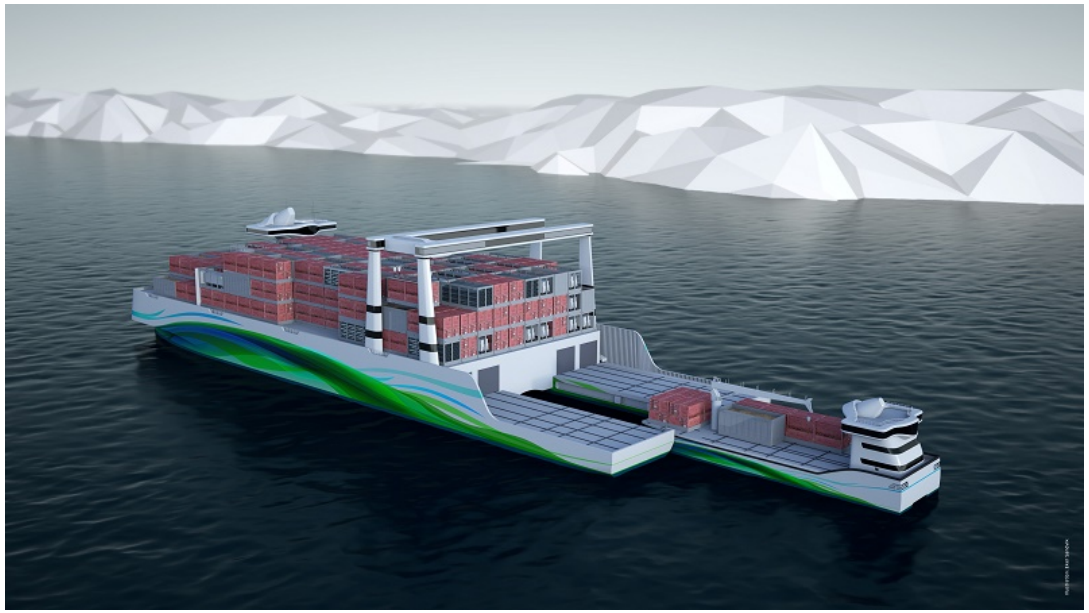
More interesting work

strangecosmos.com



The world's need for low cost transport

New business models



NCE Maritime Clean Tech & NCL

Mother ship and unmanned drones

godsfergen.no

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

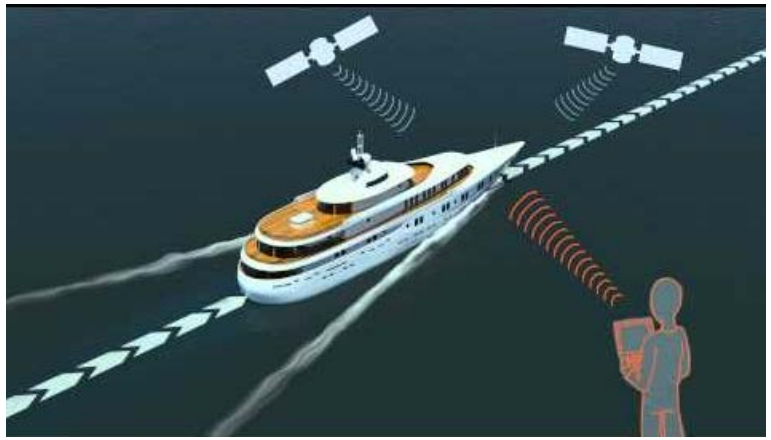
- Contracts
- Insurance

- UNCLOS
- SOLAS

- Liability

Hostile (cyber) attacks

- Terrorist hijack e.g. by GPS spoofing



University of Texas at Austin

- Pirate attack

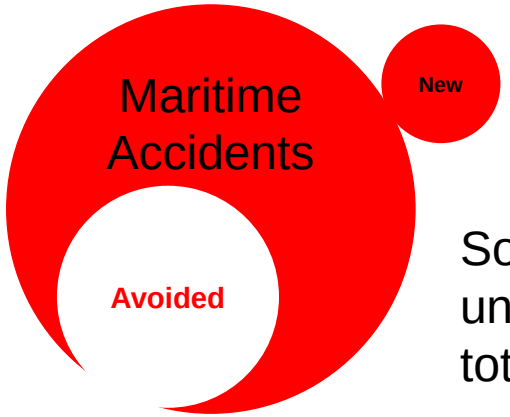
IMO

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!

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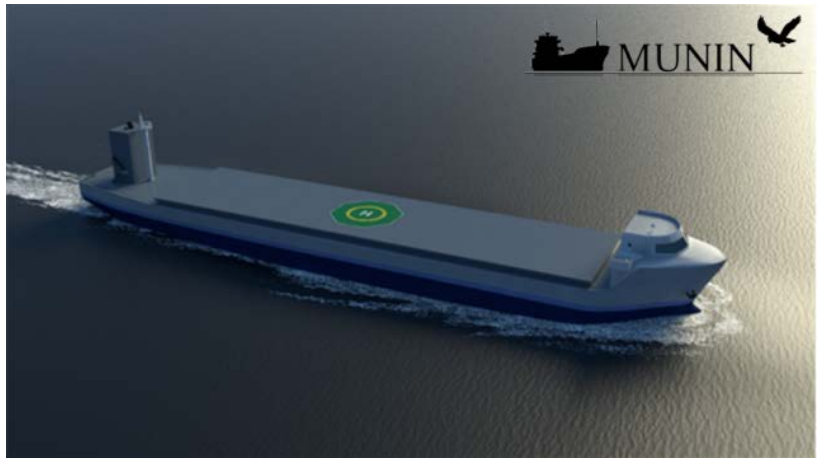
Critical Design Factor 1 - 3

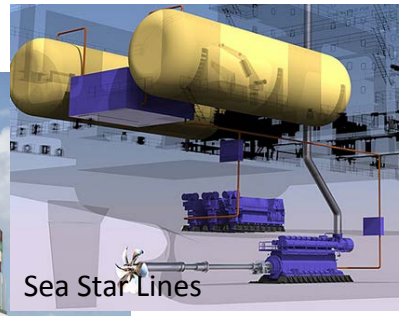


No crew or accommodation

Trade-off between technical and operational complexity

No onboard cargo intervention

Critical Design Factor 4-7



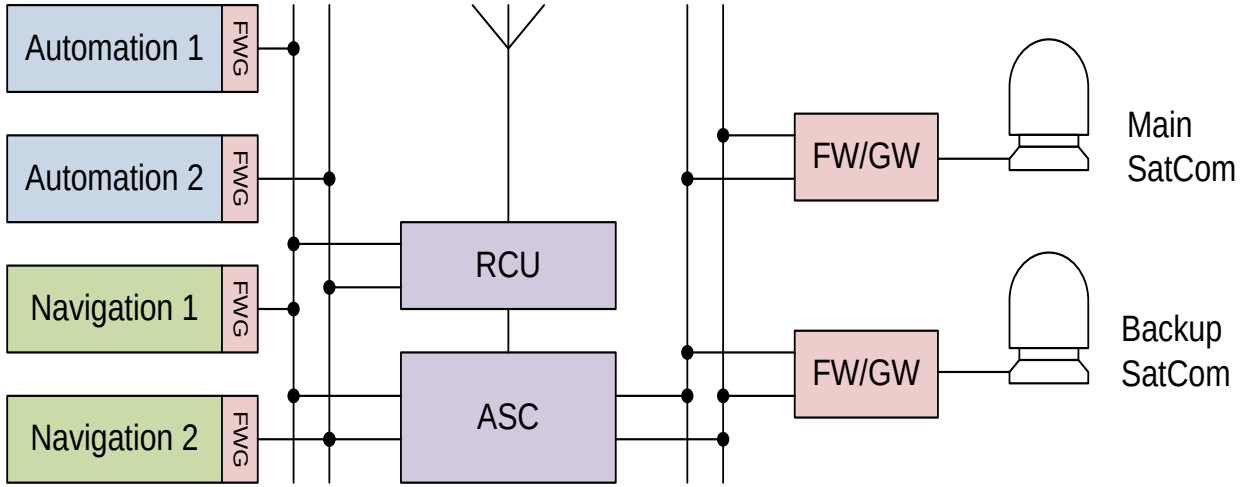
Highly reliable technical systems

Monitoring and maintenance planning

Sufficient redundancy

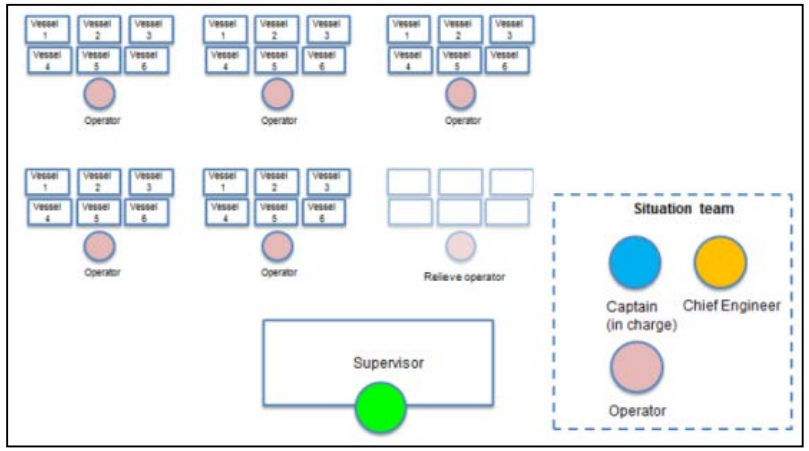
Rapid repair

Critical Design Factor 8-10



Integrated, safe and secure ICT systems

Shore support infrastructure



High quality shore control center

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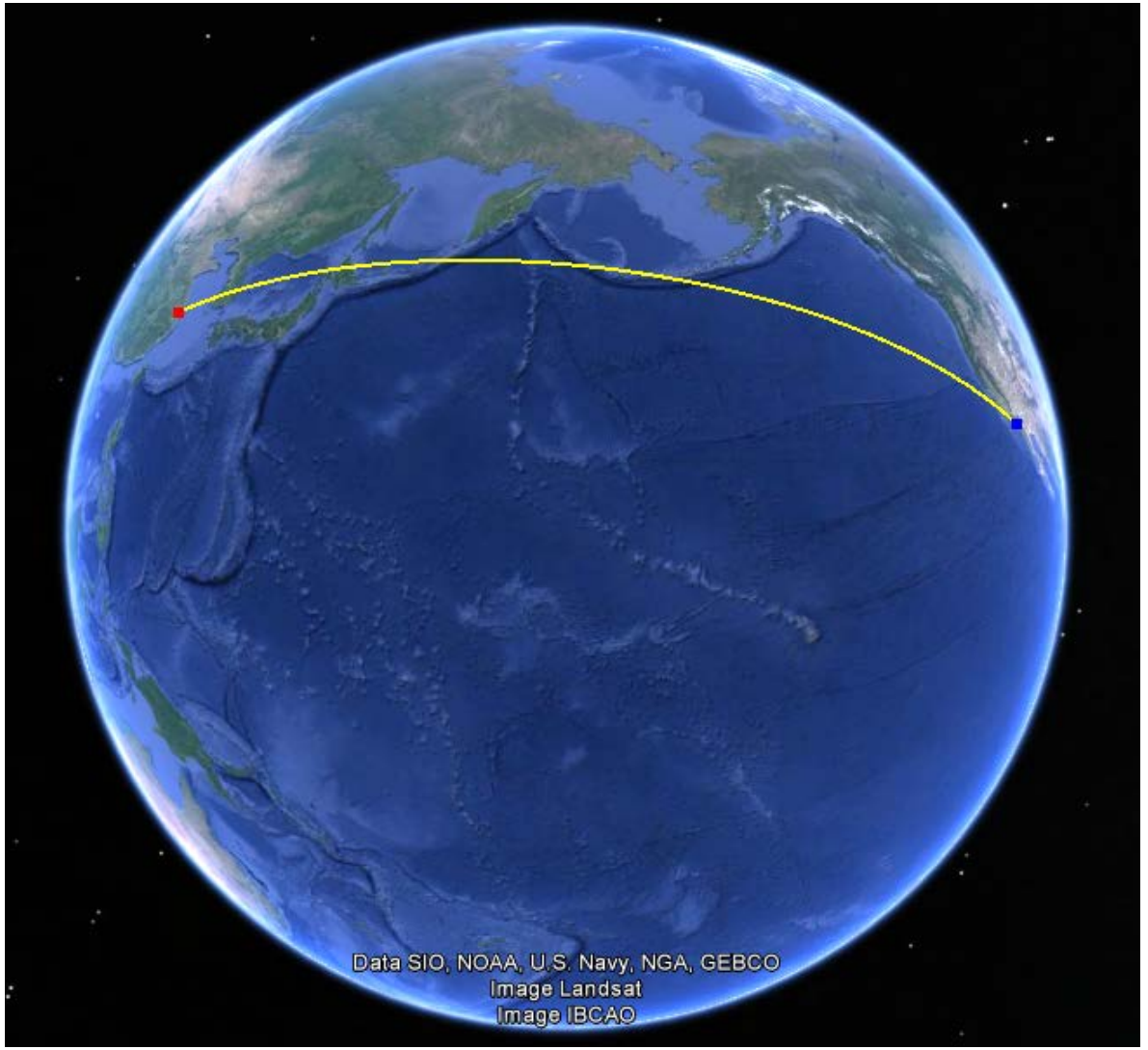
Deep sea

- 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

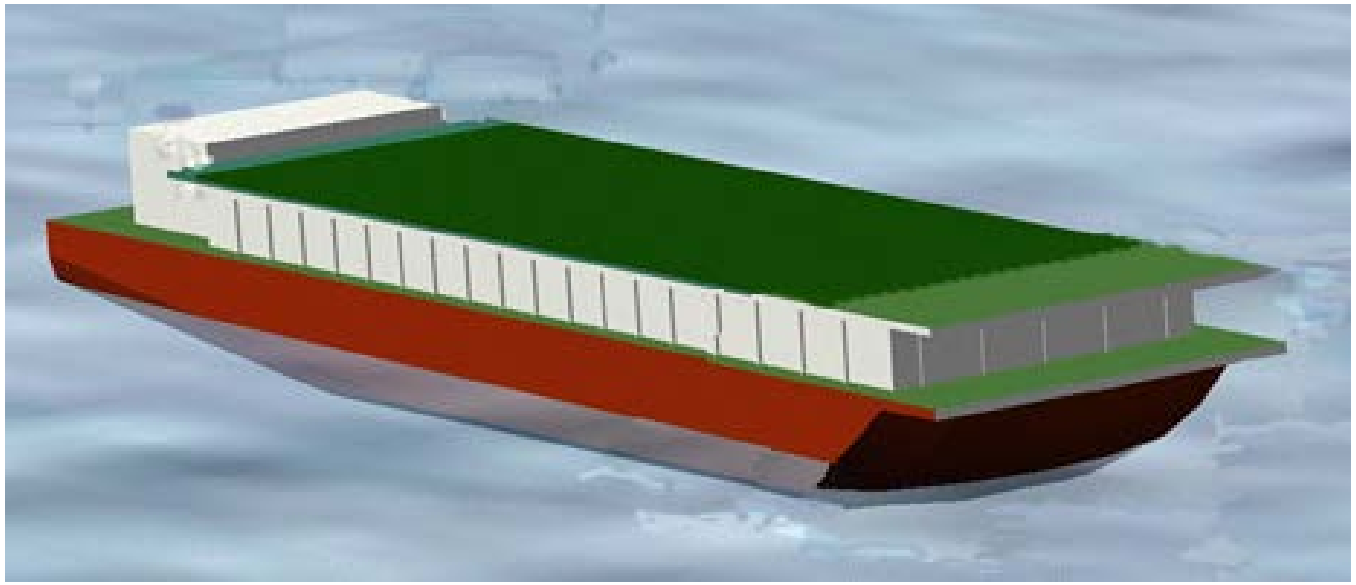
- Offshore supply vessel
- North Sea, Mexican Gulf
  - One state involved
  - 3-6 day roundtrip
  - Base near open sea
  - Infrastructure at base/rig
  - Remote controlled at base/rig
- Dual propulsion systems
- Diesel-electric
- LNG, biofuel, methanol …

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



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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