Design Challenges and Opportunities for Future Unmanned Ships

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Ørnulf Jan Rødseth, Senior Scientist, MARINTEK
OrnulfJan.Rodseth@marintek.sintef.no
History from 1939
150 scientists
Close cooperation with NTNU
Independent, not for profit institute
Limited Company
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

- Improved technical systems
  - Sensors
  - Collision avoidance
  - Technical monitoring
  -...

- Periodically unmanned systems
  - Engine
  - Maintenance
  - Bridge

- Fully unmanned ship
  - Shore control center
  - Berthing, mooring
  - Cargo handling
  -...

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
Generally positive public reactions
Safety

Own ship: No crew that can be harmed

Other ships and environment: Less human errors

NOAA Office of Response and Restoration
Exxon Valdez Oil Spill Trustee Council
Reduced costs?

No crew
No crew related costs

No accommodation
Less power
More cargo

Smaller vessels in some trades: More flexibility

Improved technical systems
Less off-hire
Better efficiency
Societal

European maritime competitiveness
European employer attractiveness
Improved transport systems

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

The world’s need for low cost transport
New business models

Mother ship and unmanned drones

Low operational cost short sea / last mile shipping

NCE Maritime Clean Tech & NCL

godsfergen.no
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
- Pirate attack
- 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

http://maritimeaccident.org
Critical Design Factor 4-7

Highly reliable technical systems

Monitoring and maintenance planning

Sufficient redundancy

Rapid repair

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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 Angeles
  - 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!

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E-guided vessels: The 'autonomous' ship

http://www.unmanned-ship.org