Feasibility of the unmanned ship

Ørnulf Jan Rødseth, Senior Scientist - MARINTEK
OrnulfJan.Rodseth@marintek.sintef.no
Contents

• Driving factors – positive and negative

• Required and yet unqualified technology

• 12 Critical design factors

• Some possible examples of unmanned ships

• Conclusions and summary
What are the possible benefits?

**Safety:**
- No crew exposed
- Better sensors
- Less human errors

**Costs:**
- No accommodation
- No crew
- Less off-hire

**Societal:**
- Need for low cost transport
- European competitiveness
- Better work conditions

New business models

What are the possible problems

**Costs:**
- Dual propulsion, no HFO
- Shore Control Centre
- Maintenance, dockings

**Hostile attacks:**
- Cyber-security
- Terrorists
- Agency attacks

**Legislation, insurance:**
- UN: UNCLOS
- IMO: SOLAS, MARPOL ...
- Insurance and contracts
- Liability

**Safety:**
"Autonomy Assisted Accidents"
Contents

- Driving factors – positive and negative
- Required and yet unqualified technology
- 12 Critical design factors
- Some possible examples of unmanned ships
- Conclusions and summary
New sensor functions

New detectors in IR and daylight video. Improved radars.

Sensor fusion and classification: AIS, Radar and video.

Integrated SCC decision support.
New navigation functions

Deep sea collision avoidance: Tactical and last minute.

Avoid dangerous sea conditions: Surf riding, parametric rolling, broaching etc.

Tactical weather routing.

User decision support for remote control.
New machinery and maintenance functions

Prototype operation and maintenance concept for unmanned ship.

KPI based energy efficiency and maintenance planning system.

New condition monitoring systems and approaches.
Shore Control Centre (SCC)

General organizational principles and staffing.

Ship status monitoring.

Ship intervention on different levels: Monitoring, new instructions, detailed analysis and support – all ship systems.
An integrated design methodology

Iteratively look at the operational issues in the context of the system design and vice versa.

Risk reduction principle covering both operation and design.

Validation through hypothesis testing.

**MUNIN's hypothesis:** Unmanned ship systems can autonomously sail on intercontinental voyages at least as safe and efficient as manned ships.

- The Autonomous Sensor Module can sense sufficient weather and traffic data to ensure navigation and planning function on autonomous ships and enable situation awareness in an operation room.
- A Deep-Sea Navigation System can autonomously navigate a ship safely and efficiently along a predefined voyage plan with respect to weather and traffic conditions.
- A ship engine can reliably operate for 500hrs without physical interference from a human in the ship's engine room.
- The Shore Control Centre operator will be capable to monitor and control six unmanned ships at the same time.
Contents

• Driving factors – positive and negative

• Required and yet unqualified technology

• 12 Critical design factors

• Some possible examples of unmanned ships

• Conclusions and summary
Critical Design Factor 1 - 4

No crew or accommodation

No passengers

High quality shore control center

Manageable traffic conditions
Critical Design Factor 4 - 8

Minimize maintenance

Automated cargo handling systems

Redundancy

No onboard cargo intervention

© Rolls Royce Plc

http://maritimeaccident.org

http://godsfergen.no

http://maritimeaccident.org

MARINTEK

© Rolls Royce Plc
Critical Design Factor 9 - 12

Extensive and automated fire extinguishing

Monitoring and Preventive maintenance

Advanced and secure ICT systems

Documented safety
Contents

• Driving factors – positive and negative

• Required and yet unqualified technology

• 12 Critical design factors

• Some possible examples of unmanned ships

• Conclusions and summary
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
- Batteries, LNG, biofuel, methanol ...

http://godsfergen.no
Conclusions and summary

• Largest unmanned ship study in Europe is soon 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.

• In addition, the business case must be sound!

Thank you for your attention!

Papers and open documentation at: www.unmanned-ship.org