UNMANNED SHIPPING

Environmental Perspective

MUNIN FP7 Project 2012-2015
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THE MUNIN PROJECT

• MUNIN: Maritime Unmanned Navigation through Intelligence in Networks.

• FP7 – EU Commission – September 2012-September 2015

• Total budget of € 3.9 M, financing by the EU Commission: €2.9M.

• Objective of the project: to develop and autonomous ship concept, as a combination of automated decision systems and remote control via a shore-based station.

⇒ Long-term objective: the ‘unmanned ship’

⇒ Short-term objective: Efficiency, safety and sustainability advantages for existing vessels
MUNIN PARTNERS

• Fraunhofer Institute, CML, Hamburg, Germany
• Marintek, Trondheim, Norway
• Chalmers University, Gothenburg, Sweden
• Hochschule Wismar, Rostock, Germany
• Aptomar, Trondheim, Norway
• MarineSoft, Rostock, Germany
• Marorka, Reykjavik, Iceland
• UCC, Faculty of Law, Ireland
ADVISORY BOARD

- Dr Mike Hadley, former IALA
- Professor Jens Froese, Jacobs University, Bremen
- Per Anders Koien, Star Information System, Trondheim/Oslo/Singapore/Rio de Janeiro (Ship and Rig Management Software)
- Mario Silva, Portline, Portugal (Shipping company)
- Joachim Illge, DNV-GL, Norway (Classification society)
Media attention:


**The Economist** (Mar. 2014):


**The Motorship** (Aug. 2013):

UCC ROLE IN MUNIN

• **Analysis of legal issues:**

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- Dr Fariborz Safari (2012-13)
- Ms Helen Noble (2014-2015)
- Dr B. Sage-Fuller (on-going)
ENVIRONMENTAL PERSPECTIVE

- Technology reliability
- Messages latency
- Crew: education, fatigue
- Navigation
- Collision
- Maintenance
- Emissions, engine efficiency
- No redundancy
- Standards: current => unmanned
- Liability/Compensation
- Regulation
- Insurance
- International regimes
- National regimes
- Foreseeability
The MUNIN hypothesis, Jan 2014: ‘That the unmanned ship can sail on an intercontinental voyage with at least the same safety and efficiency levels as a manned ship’.

There are varying degrees of autonomy:

from “capable of operating without any person onboard” => “partly automated, with a service team on board” => “autonomously automated, with crew on board not manning the ship at all times”

Many variable parameters, making the legal analysis…interesting!

Very little research undertaken with regard to the civilian aspects of unmanned shipping.

Virtually no *de lege lata*. 
PRELIMINARY RESEARCH

• 1st year of the project (2012-2013, F. Safari): groundwork.

• Reasoning by analogy with current laws to determine to what extent they may be applicable to unmanned shipping.

• Analysis of the substantive objectives of the relevant existing legal requirements to identify the substantive standards of shipping that will be required for unmanned navigation: SOLAS, COLREGS, MARPOL, STCW, Load Lines Convention.

• **Specific issues:** collision avoidance, environmental considerations, technical cooperation (piracy and security), and shipping efficiency in general.

• **Result:** contours of the standard of care and due diligence that would be required for unmanned ships to operate in reasonably predictable conditions.
• Identification of more specific legal issues (H. Noble, B. Sage-Fuller).

• Potential impact on *liability* by certain identified issues.

• Assessment will be carried out in more details in Year 3.
Source: D 6.4 Final Interface specification (Marintek, 31/03/2014)
• **Detection of objects**: the Advanced Sensor System (ASS) is not believed to be capable of identifying certain types of objects.
2. **Autonomous Navigation System** (ANS) will carry out two basic functions: collision avoidance and weather routing.

- Lookout controls of the ship (equivalent to OOW)

- In manned conditions an integrated bridge system is normal (interface for bridge crew and for diagnostics and monitoring).

- In unmanned conditions: relationship with Shore Control Centre (SCC) will be critical (Communications Controller on diagramme).

- SCC will be support for:
  - Normal autonomous operations
  - Remote maneuvering
  - Engine control
  - Bridge control
• Emerging legal issues:

⇒ How many personnel required in SCC to monitor and directly operate the unmanned ship?

⇒ What qualification will they need? (technicians, equipment specialists?)

⇒ Routing and weather constraints from point of view of collision and navigation.

⇒ Standardisation of messages: eNavigation, IALA, ITU.

⇒ Data transmission, storage and accessibility: IEC (International Electrotechnical committee), ITU, ISO.
REMOTE MANEUVERING

- Issue of technological reliability for remote steering.
- International standardisation.
- Latency of message between ship and SCC.

⇒ Currently MUNIN is looking at combined VSAT (very Small Aperture Terminal- low cost) and Inmarsat communication (high cost).

⇒ For VSAT, message latency seems to be highly reliable (Round trip time delay of 0.6/07 sec. when below 80° N)

- Minimum berthing Manning requirements.
- Line Of Sight (LOS) communication, including AIS, to control ship near the coast (harmonisation between ColRegs and AIS).
ENGINE AND REDUNDANCY

- Unmanned shipping will operate on a no-redundancy basis, especially in the engine room.

- In normal conditions, bridge and engine room are automated to some extent, and there is a human interface with engine crew and OOW.

- For unmanned shipping, there will be neither engine crew nor OOW (replaced by ASC and AEMC).

- Many questions will ensue, particularly regarding liability, and in alert situations.

- No redundancy: a very new take on shipping and shipping law.
• Trending of events, early warning faults and maintenance planning are critical issues.

• Model used: Norwegian Petroleum Authority.

• Legally speaking:

⇒ Foreseeability of problems.

⇒ Seaworthiness of unmanned ship more open to criticism?
HUMAN FACTOR AND THE SCC

- User interface in the SCC will be critical.

- Chalmers U conducted a focus group with bridge officers (June 2013) to ask the question: “what do you need to have in a Shore Control Centre to monitor and remote control an unmanned vessel?”

⇒ SCC personnel will have to be able to use relevant data and make right decisions (monitoring, indirect control, direct control, situation handling).

⇒ Visualization: map, top flag (functional indicators), ship motions, itinerary, dashboard.

⇒ Specialist stations (OOW, engine control, maintenance)

⇒ Motions of the ship to be represented in SCC: roll, roll period, heave, slamming. All are potential danger indicators.
CONCLUSION

• A “picture” of the MUNIN unmanned ship is beginning to emerge.

• Legal issues: standards, harmonisation, risk, foreseeability…in the many aspects of the unmanned ship.

• Fundamentally new approach to shipping law?

Thank you for your attention!