Autonomi, fjern-operasjon og konnektivitetsdrevne applikasjoner

SEMINAR Maritim Kommunikasjon

Steinar Låg
15 February 2017
Contents

- New applications enabled by connectivity
- To new projects:
  - SIMAROS: Safe IMplementation of Autonomous and Remote Operation of Ships
  - ROMAS: Remote Operations of Machinery and Automation Systems
- How to assure safe implementations?
We are a global classification, certification, technical assurance and advisory company

- We classify, certify, verify and test against regulatory requirements, rules, standards and recommended practices
- We develop new rules, standards and recommended practices
- We qualify new technologies and operational concepts
- We give expert advice to enhance sustainable business performance
Global reach – local competence

CUSTOMERS
80,000+

ESTABLISHED
1864

OFFICES WORLDWIDE
350

COUNTRIES
100+
New applications
- enabled by connectivity
Infrastructure supporting future digital applications

ON-SHORE DATA CENTRE

Database management
Access control
Analysis tools
Visualisation

External data

WWW

SHORE DATABASE

Control & advice

Monitoring & reporting

LOADING COMPUTER

MACHINERY & AUTOMATION

NAVIGATION SYSTEMS

SHIP DATA COLLECTION

OTHER SENSORS

SAFETY SYSTEMS

Stakeholder access
Owners, Vendors
Class Authorities
Enabling trend: Connectivity

- Boom in maritime VSAT (Very Small Aperture Terminal) installations

Source: The COMSYS Maritime VSAT Report
4th Edition [http://www.comsys.co.uk](http://www.comsys.co.uk)
Enabling trend: Connectivity

Infrastructure supporting future digital applications

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SHORE DATABASE

www

MACHINERY & AUTOMATION
NAVIGATION SYSTEMS
LOADING COMPUTER
OTHER SENSORS
SAFETY SYSTEMS

Sensor Costs

Stakeholder access
Owners, Vendors
Class Authorities
New applications enabled by connectivity

- Condition monitoring
- Autonomy & Remote control
- Environmental monitoring
- Safety applications
- Remote diagnostics & maintenance
- Energy efficiency optimisation
- VTS / e-Navigation
- Risk based classification & surveys
- Applications we haven’t yet thought of

(although not «new»...)

- Welfare and entertainment
SIMAROS and ROMAS
The SIMAROS project

- **SIMAROS: Safe Implementation of Autonomous and Remote Operation of Ships**
  - NFR application granted Dec 2016
  - Research project 2017-2019
  - Total Budget: 18MNOK
  - Case: “Hrönn” offshore vessel
  - Contracted 2017, in operation 2018
  - Press release 01.11.2016

- **Partners:**
  - DNV·GL
  - KONGSBERG
  - Fjellstrand
  - MSubs Ltd
  - Inmarsat

- **Reference partner:**
  - Sjøfartsdirektoratet
  - Norwegian Maritime Authority

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**Press Release**

Automated Ships Ltd and KONGSBERG to build first unmanned and fully-automated vessel for offshore operations

- First full size unmanned ship to be built through UK and Norwegian co-operation
- Offshore vessel ‘Hrönn’, to be contracted January 2017 and in operation in 2018

Artists impression of the ‘Hrönn’
Human navigation

- RADAR
- AIS
- ECDIS
- SENSOR 4
- SENSOR 5
- SENSOR 6

ACTUATORS
Autonomous navigation

- Observation
- Analysis and decision
- Action
Combination of Autonomy & Remote Control: Human in the loop

- Radar
- AIS
- Camera
- Sensor 4
- Sensor 5
- Sensor 6

Sensor Fusion, Verification & Detection → World Model → Situation Analysis → Decisions → Actuators
**SIMAROS Work packages**

- **Project management and dissemination**
- **Operational principles**
- **Ship design and general arrangement**
- **Control and navigation systems**
- **On-shore control station**
- **Communication**
- **Risk and reliability**
- **Test and verification**
- **Rules and Regulations**
- **Piloting and test-operation**

**Objective**: Develop technology supported by an assurance and regulatory framework that can enable safe realisation of a fully unmanned offshore vessel through autonomous and remote operation and demonstrate the full benefits of the concepts in a commercially viable setting.
The ROMAS project

- ROMAS: Remote Operation of Machinery and Automation Systems
  - NFR application granted Dec 2016
  - Research project 2017-2019
  - Total budget 9,5 MNOK

- Partners:

- Reference partner:
Remote machinery operation: Background and motivation

- Increasingly complex ships
- Shortage of machinery engineers to man ships
- Increased digitalisation & improved ship-shore connectivity
- Automation and remote operations is increasingly deployed in other industries

=> IDEA: Move the Engine Control Room (ECR) from the ship to a shore-based Engine Control Centre (ECC)

- Fleet wide control from an on-shore ECC
- Reduced need for engineers on-board
- Improved efficiency & safety
- Not as “revolutionary” as remote navigation
Objective: To establish a framework of regulations, rules and verification methods for remote (shore-based) operations of ship machinery and automation systems, enabling improved operations and cost-efficiency without compromising safety of ship operations.
How to assure safe implementations?
Autonomy and remote operations: a different risk picture

- **Automation vs human operation**
  - Human error is eliminated (operation)
  - Fewer human lives at stake
  - No-one present to fix or take over control ...

- **New risks**
  - Increased reliance on technology
  - Cyber threats, communication failures etc.

- **New unproven technology**
  - New and unknown sources of errors
  - Lack of standards and operational experience

- **Safe implementation depends on**
  - Robust and reliable technologies
  - Effective rules, requirements and verification methods
Areas where new requirements are needed.

- Sensor capabilities
Areas where new requirements are needed...

- Sensor capabilities
- Decision algorithms

From the ReVolt Movie - [https://youtu.be/rhYaNHx5D00](https://youtu.be/rhYaNHx5D00)
Areas where new requirements are needed...

- Sensor capabilities
- Decision algorithms
- Ship-shore communication
Areas where new requirements are needed...

- Sensor capabilities
- Decision algorithms
- Ship-shore communication
- Machinery design & maintenance
Areas where new requirements are needed...

- Sensor capabilities
- Decision algorithms
- Ship-shore communication
- Machinery design & maintenance
- On-shore control centre
Areas where new requirements are needed...

- Sensor capabilities
- Decision algorithms
- Ship-shore communication
- Machinery design & maintenance
- On-shore control centre
- Cyber security
Roadmap towards a class notation

1. Existing rules for manned ships
2. New rules for remote controlled operations
3. New rules for autonomous operations
4. Maritime law and regulations
5. Adaptations for unmanned operation
6. Iterative development
7. Iterative development
8. Rules for autonomous and remotely operated ships
9. Parallel development and exemptions
10. Code for unmanned ships?
Thank you for the attention!

Steinar Låg
Steinar.Laag@dnvgl.com
+ 47 95236838

Øystein Engelhardtsen
Oystein.Engelhardtsen@dnvgl.com
+ 47 92810676

www.dnvgl.com

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SAFER, SMARTER, GREENER

Ungraded