Control centre for unmanned ships

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MARINTEK

Norsk Marinteknisk Forskningsinstitutt

SINTEF

Introduction to MUNIN

MUNIN

Maritime Unmanned Navigation through Intelligence in Networks

- Munin ("mind") is one of Odin's two ravens flying out in the morning and reporting news of the world to their master in the evening.
- Hugin ("thought"), the other raven, is also the name of a commercially successful autonomous submarine (AUV).
- Here, MUNIN is the name of a new EU project researching the unmanned, autonomous ship.

KONGSBERG

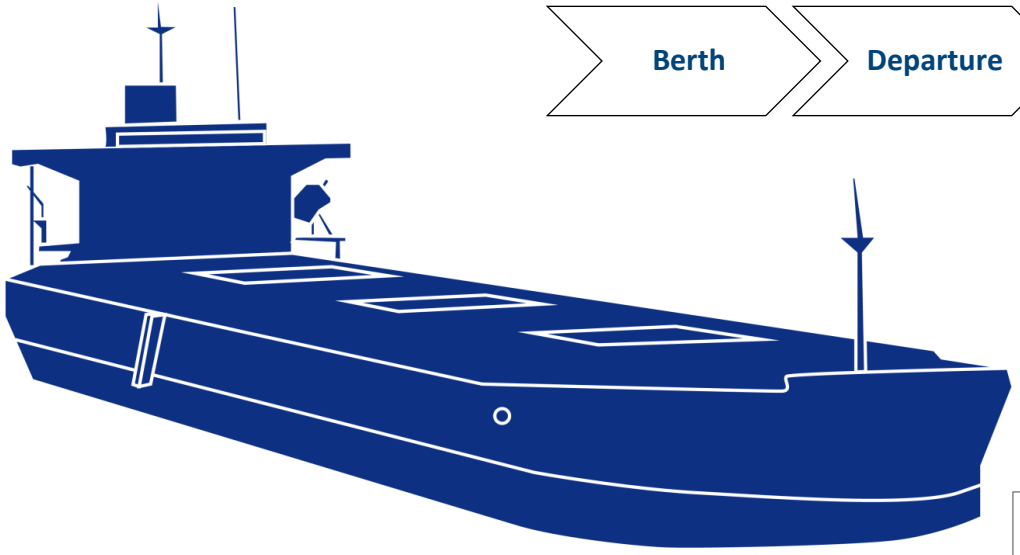
Partners in MUNIN

- Fraunhofer CML (DE) – Research, Coordinator
- MARINTEK (NO) – Research
- Chalmers (SE) – University
- Hochschule Wismar (DE) – University
- Aptomar (NO) – Industry
- MarineSoft (DE) – Industry
- Marorka (IS) – Industry
- University College Cork (IE) - University

Project administrative details

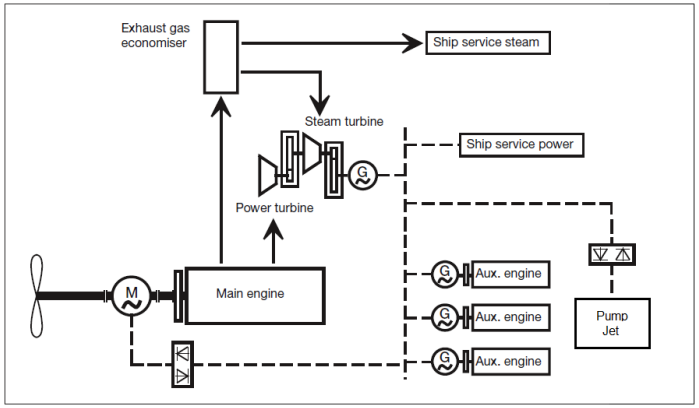
- Duration: 01.09-2012 – 31.08.2015
- Funding: 2.9 million EUR
- Activity code: SST.2012.5.2-5:
  E-guided vessels: the 'autonomous' ship

Use Case:
Dry bulk carrier on deep-sea-voyage



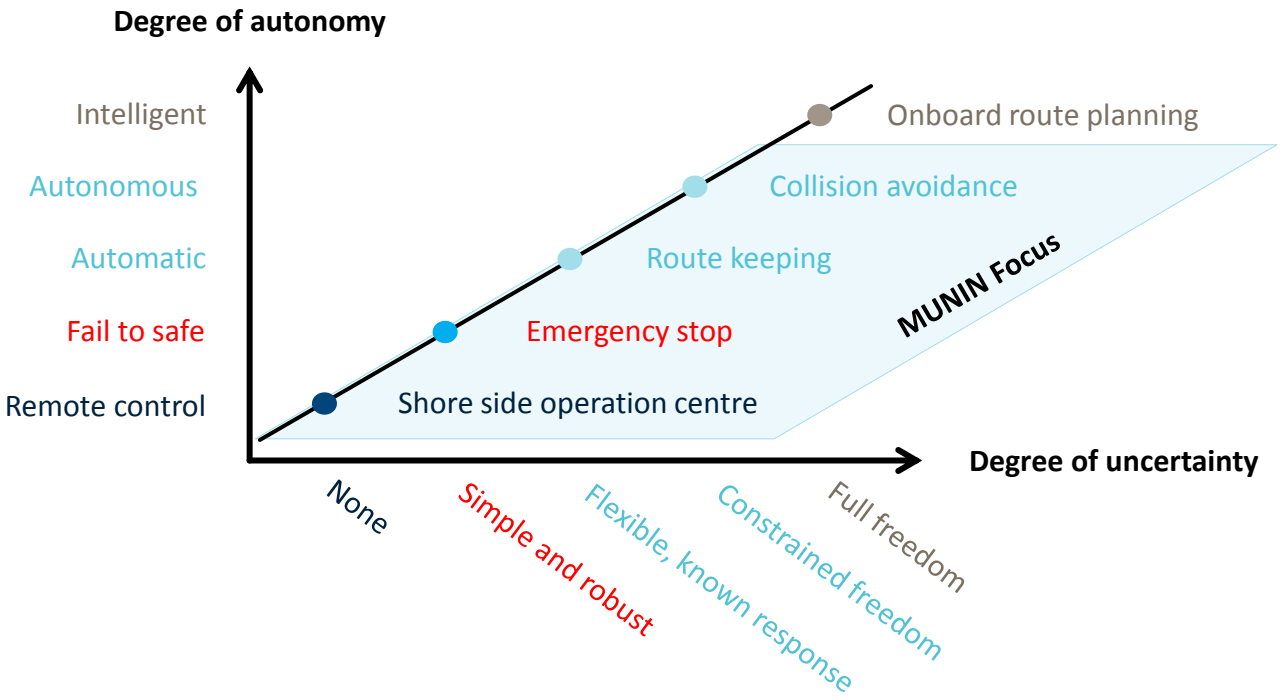
Reasons:

- Long deep-sea-voyage
- Low risk cargo
- Slow steaming attractiveness

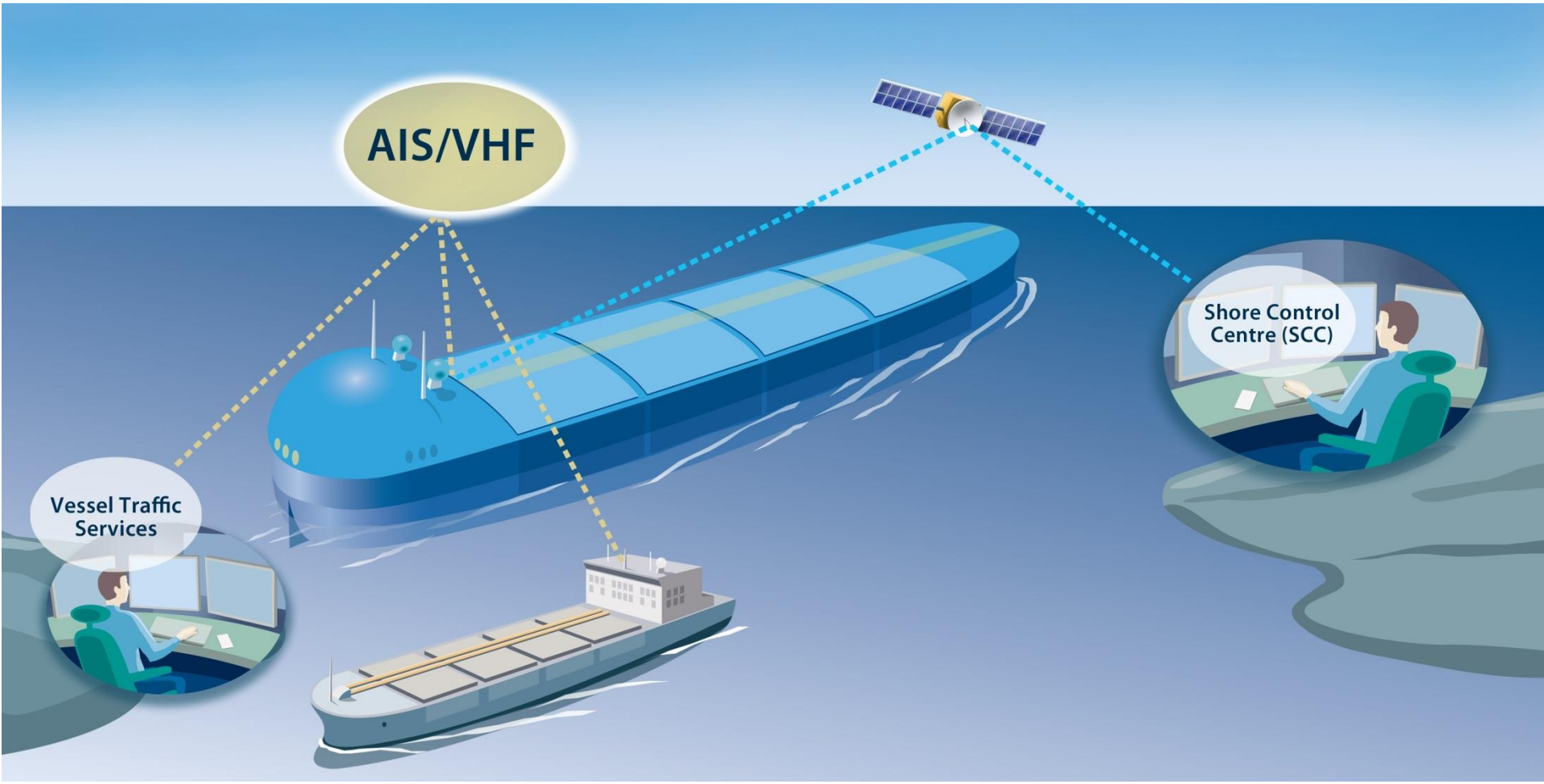


An important challenge:

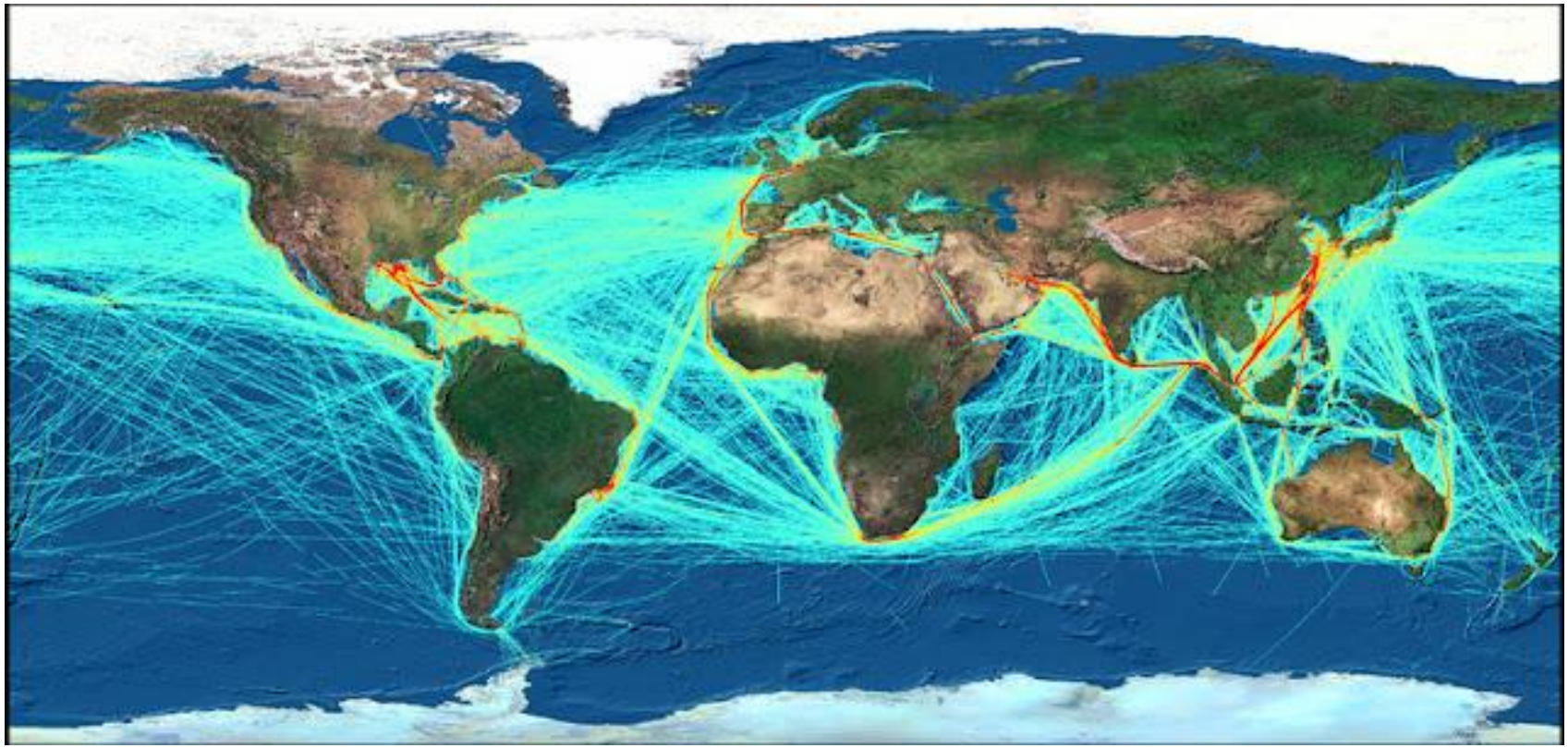
- The *right* level of autonomy



Need a good design for responsibility sharing Ship-Shore



World wide communication services business model ?



inmarsat

iridium Everywhere

http://www.amver.org/

Fallacies of distributed computing

- The network is reliable.
- Latency is zero.
- Bandwidth is infinite.
- The network is secure.
- Topology doesn't change.
- There is one administrator.
- Transport cost is zero.
- The network is homogeneous.

L. Peter Deutsch, SUN Microsystems

Autonomous execution
The main operational mode

UAV: Autonomous execution

SCC: Remote monitoring

- Ship system activities
  - Follow predefined voyage plan
  - Observe environment
  - Measure ship conditions
- Shore Control Centre
  - Monitor ship status
- Communication
  - Periodic updates ship-to-shore

Autonomous control
Handling of known events

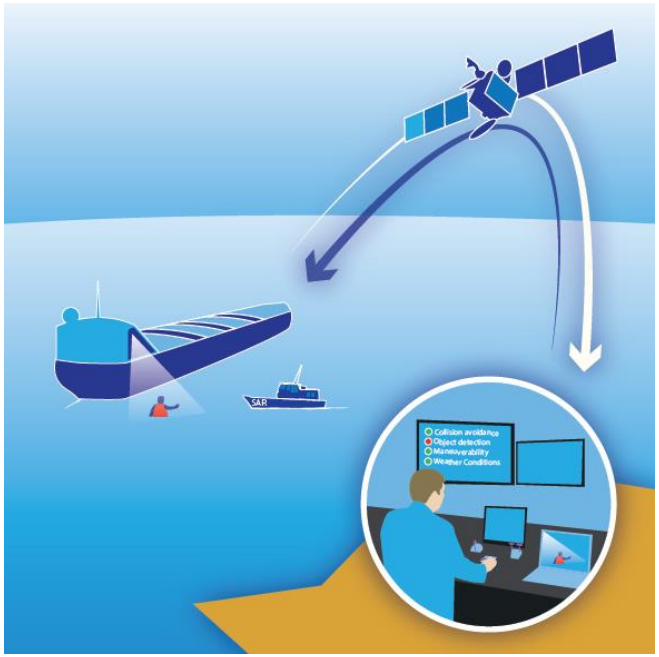
UAV: Autonomous control

SCC: Monitoring/Investigation

- Ship system activities
  - Autonomously adapt voyage plan
  - If required: Involve Shore Control
- Shore Control Centre
  - Ensure safe operation
  - If required: Acknowledge decision
- Communication
  - Event-based data exchange

Remote control
Intervention in special situation

UAV: Remote control

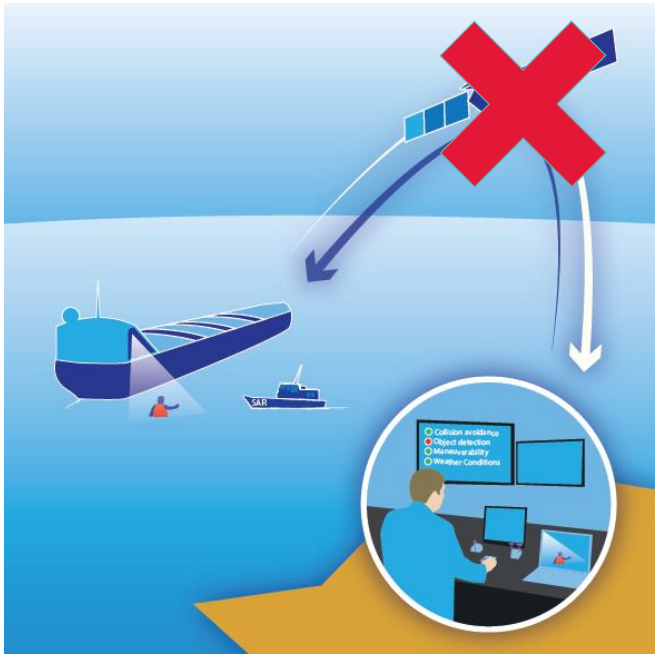


SCC: Remote Operation

- Ship system activities
  - Provide navigational data
  - Control is overrided by Shore Control
- Shore Control Centre
  - Directly operates ship (remote bridge)
  - If required: Acknowledge decision
- Communication
  - Direct link (communication tunnel)

Remote control
Intervention in special situation

Fail to safe



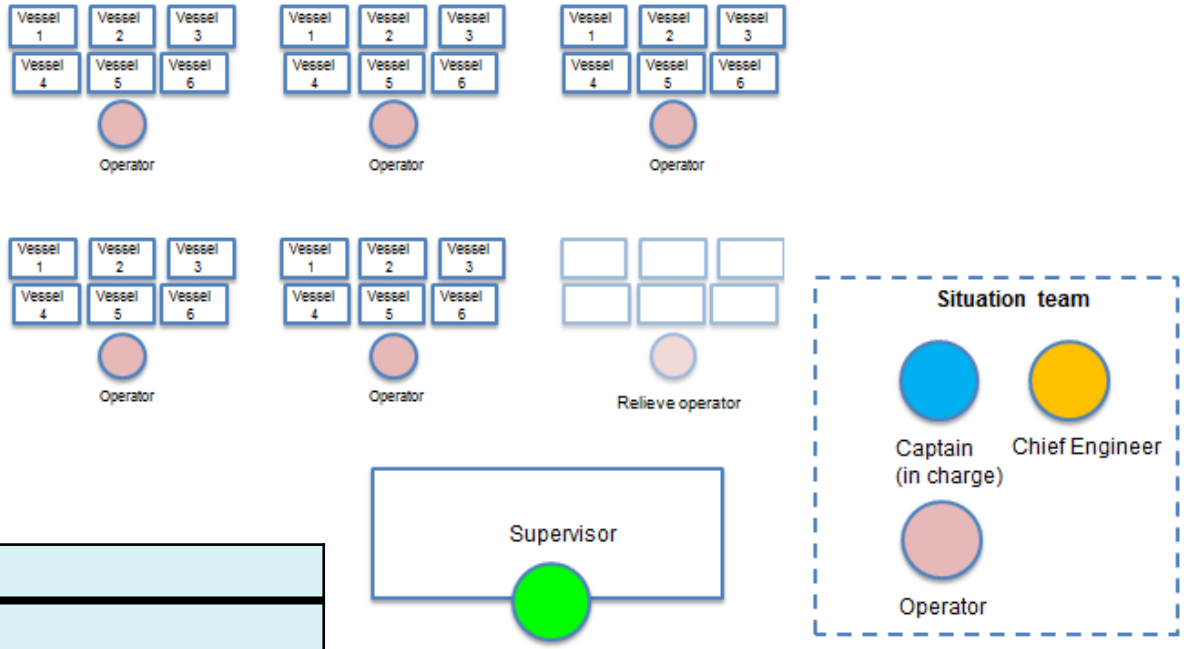
SCC: Initiate recovery

- Ship system activities
  - Maintain safety
  - Operate as long as possible
- Shore Control Centre
  - Monitor
  - Start recovery planning
- Communication
  - None

Challenges for shore control centre design

- well-being
- comfort and ergonomic workspace
- satisfaction
- out-of-the loop syndrome
- trust in the systems (and equipment redundancy for confirmation or in case of technical failure)
- information overflow
- training and roles
- situation awareness
- loss of ship senses
- capacity for teamwork

Organisation of SCC



General case (Assumptions)
1 SCC per 100 vessels
1 operator per 6 vessels
1 supervisor per 30 vessels (5 operators)
1 relieve operator (with workstation for 6 ships) per 30 ships
1 situation room per 30 vessels
1 engineer per 30 vessels
1 captain per 30 ships