INFRASTRUCTURE IN TEST AREAS

Ørnulf Jan Rødseth, Senior Scientist, SINTEF Ocean Manager, Norwegian Forum for Autonomous Ships
OrnulfJan.Rodseth@sintef.no
Test areas in Norway

- **Trondheim, September 2016**
  - NTNU, SINTEF + Industry (MR, Kongsberg++)

- **Storfjorden, May 2017**
  - NTNU Ålesund
  - Industry (RR++)

- **Horten, October 2018**
  - Ports
  - Kongsberg, Yara
Coordinated through NFAS (published at INAS)

NFAS Norsk Forum for Autonome Skip

http://nfas.autonomous-ship.org

http://www.autonomous-ship.org/
Interaction Between Manned and Autonomous Ships: Automation Transparency

Thomas Porathe
Professor Interaction Design
Dep. of Design
NTNU, Norwegian University of Science and Technology
<table>
<thead>
<tr>
<th>Estimated facts &amp; figures</th>
<th>Capacity</th>
<th>Proximity sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main particulars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length o.a.: 79,5 m</td>
<td>Cargo capacity: 120 TEU</td>
<td>Radar</td>
</tr>
<tr>
<td>Length p.p.: 72,4 m</td>
<td>Deadweight: 3 200 mt</td>
<td>Lidar</td>
</tr>
<tr>
<td>Width mld.: 14,8 m</td>
<td>Propulsion system: Electric</td>
<td>AIS</td>
</tr>
<tr>
<td>Depth shelter deck: 10,8 m</td>
<td>Propellers: 2 Azimuth pods</td>
<td>Camera</td>
</tr>
<tr>
<td>Draught (full): 6 m</td>
<td>Thrusters: 2 Tunnel thruster</td>
<td>IR camera</td>
</tr>
<tr>
<td>Draught (ballast): 3 m</td>
<td>Battery pack: 7 – 9 MWh</td>
<td>Connectivity &amp; Communication</td>
</tr>
<tr>
<td>Service speed: 6 knots</td>
<td></td>
<td>Maritime Broadband Radio</td>
</tr>
<tr>
<td>Max speed: 13 knots</td>
<td></td>
<td>Satellite Communications</td>
</tr>
</tbody>
</table>

The autonomous shipping environment where anti-collision algorithms must work

It is important for trust and cooperation that MASS shows intentions.

We call this **Automation transparency**
Possible examples of Automation Transparency

1. **Identification.** This is a ship in autonomous mode (marking)
   Special dedicated fairways
   Special dedicated times

2. **Awareness.** Has the autonomous vessel seen me?

3. **Intentions.** What is its intentions?
Awareness and intentions through ECDIS communication
On-line web portal: the autonomous ship’s Situation Awareness and intentions
Non-SOLAS vessels
See and report your presence in a phone app

1. Aim at the ship
2. AutoExpress: PRESENT (Call)
3. AutoExpress: NOT PRESENT (Call)

Acquire
068
COLLISION WARNING

Automat Express
is approaching your position

Call

CPA: 0.2 nm
TCPA: 8.5 min.
Recommended action:

Turn to course 115