Connectivity needs for ports and autonomous ships

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Energy and industry ports between three main ports
Ports and industrial sites adjacent to Unesco World Heritage Site

- **ENERGY**
  - 8,000 MW
  - Energy mix
  - 300 hectare available
  - Logistics hub in offshore wind
  - Ideal place for data centers

- **CHEMICALS**
  - Chlorine
  - Residual heat
  - Different utilities at present
  - Tank storage facilities
  - Space available

- **RECYCLING**
  - Multi-modal accessibility
  - (Environmental) space available
  - Different utilities at present
  - Port logistics
  - Existing industry

Groningen Seaports is Ecoports gecertificeerd

GRONINGEN SEAPORTS
Eemshaven: energy & dataport
Connectivity needs for ports and autonomous ships
Elements of autonomous shipping

1. Autonomous ship
2. Control Center
3. Connectivity
Autonomous shipping roadmap

<table>
<thead>
<tr>
<th>Activity</th>
<th>5 Years</th>
<th>15 Years</th>
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<tbody>
<tr>
<td>Sailing</td>
<td></td>
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<tr>
<td>Passing locks and bridges</td>
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<tr>
<td>Docking/Departure</td>
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<tr>
<td>Loading/Unloading</td>
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<tr>
<td>Preparing for next sail</td>
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- Increased sensors and decision support
- Human assisted autonomy
- Fully autonomous

Figure 4: Activities in the maritime industry as partly derived from Gun der Hond & De Lange, 2008.
Groningen Seaports preparations for autonomous shipping

- **2015**: Sailing, Passing locks and bridges
- **2019**: Cameras and radar integration, Port data analytics, Pilots real-time sounding, 5G pilots for connectivity
- **2020**: 5G pilots for connectivity
- **2021**: Automated berth planning
- **2022**: Data driven port management
- **2023**: Situational awareness pilot
- **2024**: Pilot port autonomous shipping
- **2025**: Fully digitized Port control center
- **2025**: Ready for first fully autonomous ship
- **2030**: Fully autonomous

- Preparing for next sail, Loading/Unloading, Docking/Departure

Figure 4: Activities in the maritime industry as partly derived from Gan de Hoop & De Lange, 2003.
Pilot with 5G/4G and autonomous ship
Transfer to Port Control Center
Status of the first trials (May 2019)

- 5G not yet present in the ports
- Inside port 4G sufficient to transfer situational awareness (of a ship with simple sensorsystems and camera’s) to port control center
- Outside port 4G signal too weak
- Use as much AI on the ship itself to reduce connectivity needs
- Further testing with more sensors (for example sounding) in November 2019
Connectivity for autonomous shipping

1 Situational aware autonomous ship
   - Moderate bandwidth for monitoring the ship

2 Interacting autonomous ships
   - High bandwidth and low latency

3 Interacting autonomous ships entering a port
   - Higher bandwidth and lower latency

Shore Control centre!
Connectivity challenges

- No coverage of 5G/4G on full sea
- How much bandwidth can be delivered by satellite coverage?
- Can low latency be achieved, necessary to have safe control over the vessel, from a control station in the port?
- Is it possible to transport the situational awareness of the ship and the information about the performance of the ship and its equipment, to the control centre?
- Is a swift shift of connectivity from 5G/4G to satellite and vice versa possible?
- What are the requirements in case of many ships that are in connection with the port/control room?
- Can adequate communication between vessels be established?
Ecosystem nautical information North of the Netherlands
Port control centre

Port of Hamburg control centre

- Waterway: soundings, currents, tides, ........
- Depth filter: to shallow !!
- Ship: depth, length, width, ETA, cargo, nautical characteristics.....
- Port: quay planning, ETA, ETD, route, priority, activities
- Pilot: quay planning, ETA, ETD, route, priority,.....

Meteo: wind strength, direction, temp, .....
Some challenges Port Control center

- Merge data in platform:
  - nautical data including actual depth, direction, current, wind strength, direction
  - Data about the ship: condition, nautical characteristic
  - Situational awareness
  - Port environment data
  - Logistical data
  - Communication data

- Need for protocols, communication standards
- Artificial intelligence
- Psychology of handling many different ships
THANKS FOR YOUR ATTENTION

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