AN INDUSTRY PERSPECTIVE OF MARITIME AUTONOMY
TODAY’S TOPICS

INNOVATING THE INDUSTRY

THE BUSINESS CASE

WORKING TOGETHER
THINKING OUT OF THE BOX
TRANSFORMING TRANSPORTATION

AUTONOMY
is already underway in the transportation industry

Maritime
Automotive
Rail
Aerospace
6 LEVELS OF AUTONOMY

- AL6 Full autonomy
- AL5 Monitored autonomy
- AL4 Execution with human being who monitors and can intervene
- AL3 Execution with human being who monitors and approves
- AL2 On-board or shore-based decision support
- AL1 Decision-support on board
- AL0 Manual Steering

Lloyd's Register Autonomy Levels (AL)
AUTONOMY IS NOT THE GOAL

<table>
<thead>
<tr>
<th>SAFETY</th>
<th>RELIABILITY</th>
<th>EFFICIENCY</th>
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<tbody>
<tr>
<td>• Collision avoidance</td>
<td>• Technical trouble shooting between vessel and office-based staff</td>
<td>• Reduced fuel consumption</td>
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<td>• Severe weather avoidance</td>
<td>• Early detection/alarms</td>
<td>• Port call optimization</td>
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<td>• Improved visibility</td>
<td>• Predictive maintenance</td>
<td>• Real-time route optimization</td>
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<tr>
<td>• Enhanced situational awareness</td>
<td>• Simplified vessel design</td>
<td>• System wide energy efficiency</td>
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<tr>
<td>• Reduced risk for crew</td>
<td>• Centralized maintenance</td>
<td>• Increased repeatability</td>
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▪ Centrally reduced repeatability
THE WORLD’S FIRST REMOTELY OPERATED COMMERCIAL VESSEL
SAFER AND MORE RELIABLE OPERATIONS
FROM TUG TO INFRASTRUCTURE

- Land based control
- Control and optimization algorithms
- IT infrastructure
- Real-time stable and secure high bandwidth connectivity
- Autonomous Control Systems
- Connected Vessel
- Situational Awareness
- Reliable prime mover / auxiliaries
- Condition based monitoring
- Electrical Propulsion systems are today the best platform for building vessel autonomy
CHANGING THE REGULATORY LANDSCAPE
WHERE IS THE BUSINESS CASE?

Marginal benefits are uncertain as the shape of this curve is unknown.

Cost is fairly certain to raise exponentially.

Source: Lloyd’s Register
BUILDING AN AUTONOMY ROADMAP

Our strategy

- Customer First
- Cost Leadership
- Growth
- Digital Innovation

Our assets

Our autonomy focus

Questions to be answered

- What type and degree of autonomy is beneficial?
- What are the key technologies and opportunities?
- What is the outlook for maturity and cost?
- Who are the relevant technology providers?
- Which regulatory barriers do we need to consider?

- Situational Awareness
- Shore based control center
- Control and optimization algorithms
- Autonomous Navigation Systems
SUMMING UP

WE ARE EXCITED

WE ARE AT THE FOREFRONT

WE CAN’T DO IT ALONE
THANK YOU