Autonomous Vessels

Karno Tenovuo, Vice President, Rolls-Royce Marine

Digitalizing marine industry, SLUSH
Helsinki, 1.12.2016
Disruptive change
Digitalisation – disruptive change

Internet of Things

Industry 4.0

Big Data
Digitalisation in the marine market

The dawn of the Ship Intelligence era
What is Ship intelligence

Asset management

Optimisation & decision support

Remote & Autonomous operations

Enabling technologies

© 2016 Rolls-Royce plc
Shipping trends – operation

Integrated part of supply chains
Shipping trends - management

"Total awareness"

Asset management

Health management
Integrating ship and shore
Autonomous vessels
Cost – sea transport

20,000 dwt general cargo vessel

Transport cost (cost / ton * nm)

<table>
<thead>
<tr>
<th>Speed [kn]</th>
<th>Conventional</th>
<th>Autonomous</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2.50</td>
<td>2.00</td>
</tr>
<tr>
<td>6</td>
<td>2.00</td>
<td>1.50</td>
</tr>
<tr>
<td>7</td>
<td>1.50</td>
<td>1.00</td>
</tr>
<tr>
<td>8</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>9</td>
<td>0.50</td>
<td>0.00</td>
</tr>
</tbody>
</table>

-22% improvement in cost for Autonomous compared to Conventional.
Autonomous ships will start with local applications!
Rolls-Royce to supply first automatic control system to Fjord1

• The automatic crossing system ensures safe and energy-efficient transit by automatically controlling the vessel’s acceleration, deceleration, speed and track
• The captain will supervise the system, and intervene if needed
• The vessels are due for delivery in 2017
Autonomous Maritime Alliance
Low cost airlines

- Internet sales and marketing
- Standard - new efficient fleet
- Lean organisations
- Point-to-point
- High utilisation rate of fleet
Low cost smart shipping

Cost is focus  Leasing schemes  Low onboard manning  Ship Intelligence (new way of operating)

New standardised fuel efficient ships  Point-to-point routes  Digital market places and IoT - “Uber of the sea”
New players?

Investors

Digital market place

Asset management
Redefining shipping!