## Schedule

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<th>Slot</th>
<th>Presentation title</th>
<th>Speaker</th>
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<tr>
<td>08:30 – 08:45</td>
<td>Improved waterborne logistics with small uncrewed feeder vessels</td>
<td>Odd Erik Mørkrid (SINTEF)</td>
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<td>08:45 – 09:00</td>
<td>Leveraging autonomy to create cost effective and sustainable businesses for intra-European transport</td>
<td>Kristoffer Kloch (DFDS)</td>
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<td>09:00 – 09:15</td>
<td>Automated cargo handling to reduce transhipment costs</td>
<td>Janne Suominen (MacGregor)</td>
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<td>09:15 – 09:30</td>
<td>The necessity of digital as well as physical automation for sustainable modal shifts</td>
<td>Konstantinos Louzis (NTUA)</td>
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<td>09:30 – 10:00</td>
<td><strong>PANEL DISCUSSION</strong></td>
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<td>Challenges related to effectively exploiting automation in the supply chain and the way forward towards more sustainable cargo transport</td>
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The necessity of digital as well as physical automation for sustainable modal shifts

Konstantinos Louzis, NTUA

Invited session 51: Safe and efficient modal shift from roads to waterways: Automated technologies and processes, human-autonomy interactions
Facts about the MOSES project

AutoMated Vessels and Supply Chain Optimisation for Sustainable Short SEa Shipping

Significantly enhance the SSS component of the European container supply chain by stimulating sustainable feeder services to ports with limited or no infrastructure!
Modal split percentages have remained relatively constant since 2010

Between 2010 and 2020:

- Road and maritime transport have marginally increased
- Inland waterway transport share has slightly decreased
**Modal shift status in the EU**

<table>
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<th>Target from road to other transport modes [billion tkm]</th>
<th>Achieved [billion tkm]</th>
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<td>I (2003 – 2006)</td>
<td>48</td>
</tr>
<tr>
<td>II (2007 – 2013)</td>
<td>143.5</td>
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<td></td>
<td>21.9 overall (46%)</td>
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<td></td>
<td>41.9 overall, <strong>35.3%</strong> (maritime)</td>
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(Takman and Gonzalez, 2021)

**2019 Revision of the TEN-T policy set new targets**

- Traffic on high-speed rail will double **by 2030**.
- By **2050** rail freight traffic will double.
- Transport by inland waterways and short sea shipping will increase by **25% by 2030**.

(EU Mobility Strategy)
Is modal shift relevant?

Trucks are on their way towards zero-emissions!

With the global push for decarbonization, land-based transport modes are also becoming more energy efficient and green!

But there will still be problems, such as congestion...
Is modal shift relevant?

Modal shift to maritime transport will be meaningful if we start to think different...

For example, towards smaller vessels that will provide a reliable, economically viable, and just-in-time service...
Modal shift and the supply chain

Change in transport means $\rightarrow$ Administrative burden
Increased transportation costs (Perez-Mesa et al., 2012)

Congested land infrastructure $\rightarrow$ trans-shipment delays

Delays in liners $\rightarrow$ delayed feeder service $\rightarrow$ delayed delivery (Kotowska, 2014)

Lack of integration with industrial operations (Gustafsson et al., 2016)

Replication of paper-based information $\rightarrow$ Administrative burden

Ports close to hub ports “often lose with direct land transport” (Kotowska, 2014)
Is digital and physical automation necessary for a sustainable modal shift to maritime transport?

* Sustainable modal shift to maritime transport means stakeholders steadily prefer this mode to other alternatives.
Research towards sustainable modal shift

• Autonomous ships - Key Enabling Technologies
• Regulatory gaps & Policy recommendations for autonomous ships

Logistic system design with autonomous ships and automated cargo handling
• Standardized cargo units
• Digital connectivity
Improved intermodal connections
The contribution of MOSES to modal shift
The contribution of MOSES to modal shift
Autonomous feeder and automated cargo handling
Autonomous feeder and automated cargo handling

Emissions compared to alternative land-based transportation modes

- (near) zero emissions operation - hybrid with methanol ICE and batteries
- 10% lower OPEX compared to green alternatives
- onboard battery systems and shore power connections while berthed at port

Replacement of Ro-Ro traffic used to transport containers on trailer trucks

Initial estimation: Feeder will be competitive if > 40% of existing Ro-Ro traffic is captured
Autonomous feeder and automated cargo handling

Dependence from port infrastructure

- Independent from **port cargo handling** (Onboard crane)
- Partly independent from **port mooring services** → (un)loading operations without using mooring lines (DP with azimuth thrusters)

EU ports able to host container feeder vessels

Initial estimates from the business cases:
- 14 ports near EU core ports
- 6 small ports in the Aegean archipelago

End-to-end costs for container transport for captive and DSS feeder traffic

**Greek case (80% demand)**
- -3.5% cost / cargo unit,
- 13%-14% higher end-to-end costs due to the higher price of energy carrier (methanol)

**Spanish case (3 truck haulages / day to hinterland)**
- Valencia to Sagunto: -3.7% / cargo unit
- Valencia to Gandia: -10.6% / cargo unit
- -10.8% costs - no need for port tugboats
The platform will implement horizontal collaboration among logistics stakeholders and will match demand and supply of cargo volumes.

AI-based optimization of distribution routes and improvement of empty container management.
Matchmaking platform

Improve modal-split in favour of SSS

- Identification of SSS alternatives
- Historical data → in 18% of road transport cases there is an alternative route with SSS

>10%

Supply chain

Road traffic around hub ports from container-hauling trucks

Groupage and shared container loads → reduction of traffic for:
- the execution of the freight transport orders
- the commuting for executing administrative tasks that involve the exchange of paper documents

>10

Logistics costs for (im-) exporters of container cargo destined to small ports

Horizontal collaboration among shippers and freight forwarders to
- identify groupage opportunities, shared container loads
- match opposite routes to minimise empty container runs

Logistics stakeholders in the platform at the project end

The National Logistics Council of Greece has shown interest in the platform and the benefits for its members
Digital and physical automation is expected to contribute to modal shift to maritime transport

Is automation all that is needed?
Additional challenges related to automation

**Technology readiness**
- Complexity (failures, maintenance)
- Is full autonomy the way to go?
- Interaction of automated systems with legacy infrastructure (e.g. port calls for autonomous ships?)

**Economics**
- Redesign of logistics chains
- Development of new business models for dependable, synchromodal, and just-in-time services
- Additional costs related to automation?

**Stakeholder readiness**
- Who is to blame in case of an accident?
- Regulatory complexity
- General public acceptance
- Willingness to invest

**Operational unknowns**
- Integration into the supply chain
- Remote control for ship, port, and port equipment
Thank you for your attention!

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