Introduction:
H2020 Project MOSES

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Facts about the MOSES project

- **Duration:** 01.07.2020 - 30.06.2023
  (36 months) – extension
  31.12.2023 (42 months)

- **Budget:** 8 million €

- **Consortium:** 17 Partners

- **Coordinator:** NTUA
MOSES aims to...

Create sustainable feeder services from large container terminals to small ports with no infrastructure to replace trucks on Ro-Ro ships.
Is modal shift relevant?

Trucks are becoming electrically-driven!

But there will still be problems, such as congestion...

Modal shift to maritime transport will be meaningful if we start to think differently...
The MOSES concept
The MOSES Use Cases

**Western MED-Spain**
Decongest truck transport traffic in Valencia port and connect it to Sagunto and Gandia satellite ports

**Eastern MED-Greece**
Decongest Piraeus container terminal and integrate small Greek ports into the container supply chain
“Eastern MED-Greece” use case

For achieving **-3.5% cost / cargo unit** compared to the Ro-Ro transport chain, the feeder must call on each port **at least twice a week** and capture **at least 40% of the estimated demand**.
MOSES AutoDock System

Architecture

Artificial Intelligence

Automated Mooring

Prototype innovations:
- Small-scale
- Surge motion control
- Energy harvesting
- Communication with tugboats

The “agents” have learned to manoeuvre the large vessel in a similar way as in a real tugboat operation!
MOSES AutoDock System – Demonstration

Showcase the automated maneuvering, docking, and mooring scheme for large ports

- Two workboats will simulate a swarm of autonomous tugboats
- They will guide a floating vessel towards a berthing spot
- The re-engineered AutoMoor prototype will safely moor and secure the floating vessel at berth

Denmark

3rd week of October 2023
MOSES Robotic Cargo Handling System

Automated Crane
- Compensation of pendulation (ship motions, weather conditions)
- Identification of container to load

Intelligent Operator Support System (IOSS)
- Enabling local situation awareness – anomaly detection
- Robot self awareness in problem detection
- Control Intelligence
- Dynamic task allocation (One-to-many)
- Risk assessment for problem solving
MOSES Robotic Cargo Handling System – Demonstration

September 28, 2023

Demonstrate the automated operation for (un)loading containers from the MOSES Innovative Feeder with the Robotic Container-Handling System

- A full-scale crane (located at MacGregor’s test site) will be outfitted with a sensor package and control systems to enable remotely controlled and autonomous operation
- A remote operator (located at TNO’s facilities) will monitor the operation through the Intelligent Operator Support System (IOSS)

Sweden and the Netherlands
Demonstrate **port-to-port autonomous operation** of the MOSES Innovative Feeder vessel in a Seakeeping and Manoeuvring Basin (SMB)

Free sailing, **1:17 scale ship model** of Greek II concept design

Round-trip between two ports, including autonomous docking and undocking
Innovative Container Feeders

Innovative feeders must be:

• Environmentally friendly
• Cost-effective for carrying relatively small amounts of cargo
• Able to approach relatively small ports

Vessels that carry up to 300 containers and are operating with zero emissions (batteries, hydrogen fuel cells) are already being developed!
Added value of the MOSES Innovative Feeder

- Does not depend on:
  - port infrastructure (geared, (un)load directly from/to trucks)
  - the availability of port services (stevedoring, tug assistance)
  - Environmentally sustainable propulsion

Simulation of fully automated vessel control at the port of Mykonos
The feeder’s technical characteristics

**Greek concept I**
- \( L_{BP} = 80 \text{ m} \)
- 180 TEU
- 10 kn service speed
- 266 nm range
- \( P_{shaft} = 800 \text{ kW} \)

**Greek concept II**
- \( L_{BP} = 71 \text{ m} \)
- 100 TEU
- 10kn service speed
- 266 nm range
- \( P_{shaft} = 650 \text{ kW} \)

**Innovations:**
- Sustainable propulsion (Hybrid – methanol ICE + batteries, Full electric)
- Azimuth thrusters for enhanced manoeuvrability
- Automated cargo-handling, *as first step towards higher autonomy*

**Assumption:** 80% of estimated demand captured

**Assumption:** 40% of estimated demand captured

Available power for safe navigation in adverse weather conditions was **verified through simulations** (based on 2011 – 2016 weather data)
MOSES Recharging Station – Feasibility study

Criteria:
- Recharging should not disrupt operation
- The grid should provide the required power
- Port real-estate needs to be available for the station

Preliminary Scenario:
- Feeder recharges at Piraeus and Mykonos to avoid draining the batteries below 20%
  - Need to install batteries buffer at Mykonos port to allow constant supply without the risk of port black-out
  - Recharging at Mykonos does not seem promising given the current state of the grid and the recharging technology

Feeder operational profile:

<table>
<thead>
<tr>
<th>Port</th>
<th>Time for charging (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piraeus</td>
<td>2.72</td>
</tr>
<tr>
<td>Mykonos</td>
<td>7.09</td>
</tr>
</tbody>
</table>
The innovative feeder’s additional functionality

- A **feasibility study** was conducted to identify if waiting time could be exploited for other uses.
- **10 waiting hours per trip** (based on trip simulations) for pax transportation to nearby islands.

**Modular concept design** for pax transport

**This feature will not be demonstrated**
Pilot Demonstration results

- The pilot demonstration results will provide input to the **detailed sustainability framework** developed by MOSES.
- The objective is to evaluate the **sustainability and added value to SSS of the MOSES Innovations**, based on specific criteria (incl. cost, environment, safety etc.).
MOSES making waves...

MOSES was awarded by the Institute of Logistics Management of Greece (ILME) with the Logistics Excellence Award "Alexander the Great – Project of the Year 2022"
One more thing... an interesting event

November 7, 2023

Brussels

SAVE THE DATE

November 07

AUTOSHIP

Autonomous Shipping Initiative for European Waters

MOSSES

AEGIS
Thank you for your attention!

If you have any questions or require further information, please contact me:

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