MOSES concept and innovations: Indicators of success and ambition

Nikolaos P. Ventikos, NTUA
Facts about the MOSES project

- **Project Title**: AutoMated Vessels and Supply Chain Optimisation for Sustainable Short SEa Shipping
- **Duration**: 01.07.2020 - 30.06.2023 (36 months)
- **Budget**: 8 million €
- **Consortium**: 17 Partners
MOSES Innovations:
1. MOSES AutoDock (MOSES Autonomous tugboats + AutoMoor)
2. MOSES Recharging Station
3. Innovative Feeder Vessel
4. Robotic container-handling system
5. MOSES matchmaking platform
MOSES Concept and Innovations
MOSES Robotic Container Handling System

**IOSS**

- **Tasks**
- **Humans**

**AI methods applied:**

- **Dynamic Task allocation** – Breadth-first pathfinding
- **Abstract control layers** – Computing operator work load and providing a personalised overview (fleet, vessel, immersion)

**Sensor Suite**

- 2D / 3D detection and pose estimation of containers
- 2D / 3D detection of red alerts during crane operation
- 2D / 3D image fusion for scene reconstruction

**Sensor Suite**

- 2D / 3D image fusion for scene reconstruction
MOSES Matchmaking platform
Success Indicators (Innovative Feeder and RCHS)

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

Environment

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
Success Indicators (Innovative Feeder and RCHS)

**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:
  - 14 ports near EU core ports
  - 6 small ports in the Aegean archipelago

**End-to-end costs for container transport**
- **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
Success Indicators (AutoDock)

**Environment**
- **Air pollutants/ emissions in port areas**
  - Autonomous tugboats envisioned as hybrid or fully battery electric – emission reduction potential will be evaluated

25 – 30%

**Efficiency**
- **Manoeuvring and docking time (compared to pilots and human operated tugboats)**
  - AI navigation algorithms will minimise the necessary number of manoeuvres

>20%

**Safety**
- **Human error-related accidents for manoeuvring and docking**
  - Accidents related to miscommunication between tugboats and the pilot on the vessel
  - Accidents during the docking process that impact the health and safety of port personnel and vessel crew

**Port services availability**
- **Port services availability**
  - Reduced manning on the tugboats and from port-side
  - Reduction of human-error related accidents

100%
Success Indicators (Matchmaking Platform)

Modal-split in favour of SSS
• Historical data → in 18% of road transport cases there is an alternative route with SSS

Supply chain

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

Road traffic around hub ports from container-hauling trucks
Groupage and shared container loads → reduction of traffic for:
• execution of the freight transport orders
• commuting for administrative tasks (e.g. exchange of paper documents)

Logistics stakeholders in the platform
The National Logistics Council of Greece has shown interest in the platform and the benefits for its members

>10% @ M36
MOSES ambition

Significantly **enhance the SSS component** of the European container supply chain

Create sustainable feeder services from large container terminals to **small ports with no infrastructure**
MOSES ambition: The ultimate objective is to avoid...

- Decongest road and/or city infrastructure
- Reduce the CO2 and air pollutant emissions of intra-European freight transport
Thank you for your attention!

Nikolaos P. Ventikos, NTUA
niven@deslab.ntua.gr