

# Autonomous crane demonstration

Deliverable D3.5 – Version Final – 2023-11-15



**Advanced, Efficient and Green Intermodal Systems**

<http://aegis.autonomous-ship.org/>



This project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement N° 859992.



## Document information

<b>Title</b>	<b>D3.5 Autonomous crane demonstration</b>
<b>Classification</b>	Confidential

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<b>Rev.</b>	<b>Who</b>	<b>Date</b>	<b>Comment</b>
0.1	JS	2023-08-28	Initialization
0.2	JR/CN/SH/JS	2023-08-28	MacGregor results added
0.3	FT/BM/TH/JS	2023-08-28	TNO results added
0.4	NB/JS	2023-10-25	Bromma results added
0.5	KH	2023-10-30	Proof reading
0.6	OEM	2023-11-14	Reviewed by SINTEF Ocean
Final	JS	2023-11-15	Final revision to be submitted to EC

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## Executive Summary

Within the Horizon programme EU supports the development of short sea and inland waterway transportation to reduce road congestion and offer more environmentally friendly transportation networks. For this purpose, EC has granted funding, among others, for AEGIS [1] and MOSES [2] consortia.

Electrification and automation are seen as vital preconditions that are required to make aforementioned transformation. The purpose of electrification is to provide accurate motion control as the latency of the operation is less compared to hydraulic based operations. By using electrically operated and controlled equipment also the use of harmful oil-based substances can be minimized. Furthermore, the automation and autonomy are seen as key elements when extending the supply chain to far reaching harbours and ports, to increase the exploitation of short sea vessels and barges. The purpose of autonomous loading and discharging on-board crane is to provide access to the small quays where limited or no infrastructure is available.

This document is part of the AEGIS project and describes the demonstration of autonomous container crane that was conducted at Örnköldsvik, Sweden and Soesterberg, The Netherlands. The demonstration is a proof of concept that showcases the successful combination of state-of-the-art equipment and the development needed to achieve an autonomous container crane system.

The demonstration event is a joint effort by AEGIS and MOSES consortiums. The development of the technology is divided between these two consortiums. For the MOSES consortium, crane mechanical development and software development is achieved by MacGregor Sweden Ab (MCGSE). Furthermore, regarding the safety issue, the environment scanning, and motion censoring and object classification technologies has been developed by TNO, a Dutch based technology and research institute. For the AEGIS consortium Cargotec Sweden Ab (CTSE), aka Bromma, delivered and developed technology required for container spreader. In addition, MacGregor Finland Oy (MCGFI) together with Cargotec Oyj (CTOy) created Voyage and Container Optimisation Platform (VCOP), which connects booking information with the supply chain up to the stowage planning and loading sequence of each individual port visit.

In the demonstration the full sized electric on-board crane and attached spreader was used to demonstrate the autonomous container operations at MacGregor test facility in Örnköldsvik according to the predefined test plan. In addition, the Remote Operation Center (ROC) was established in Soesterberg at TNO. The purpose of the ROC was to showcase that the operator can have sufficient operational awareness even if not working onsite.

In the demonstration the testing of the autonomous system was defined as separate sub-scenarios. Each of the scenarios did build up each other to complete autonomous operation. Within each scenario specified KPI's were defined and measured at the time of demonstration.

The demonstration proved that it is possible to link existing equipment to achieve autonomous operation and from this point of view the demonstration was a success. However, the equipment is not at a level of commercialization and further work needs to be continued. With the experience gained from the AEGIS and MOSES consortia European Committee can be sure that the work done lays solid ground for further development on sustainable waterborne supply chains.