Description of Quay autonomous operation

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Advanced, Efficient and Green Intermodal Systems

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Executive Summary

The EU supports the development of short sea and inland waterway transportation to reduce road congestion and offer more environmentally friendly transportation networks.

This document is the AEGIS deliverable D3.2, *"Description of quay autonomous operation."*, and the second deliverable in Work Package 3 of the project. The objective of this deliverable is to further describe the autonomous quay operations for container handling possibilities at small ports from the vessel's point of view. The purpose is to elaborate on the possibilities of autonomy and increased data sharing from a vessel's perspective whilst considering the safety aspect, see Figure 1 – Simplified process of main activities of a port call for a merchant vessel.Figure 1.

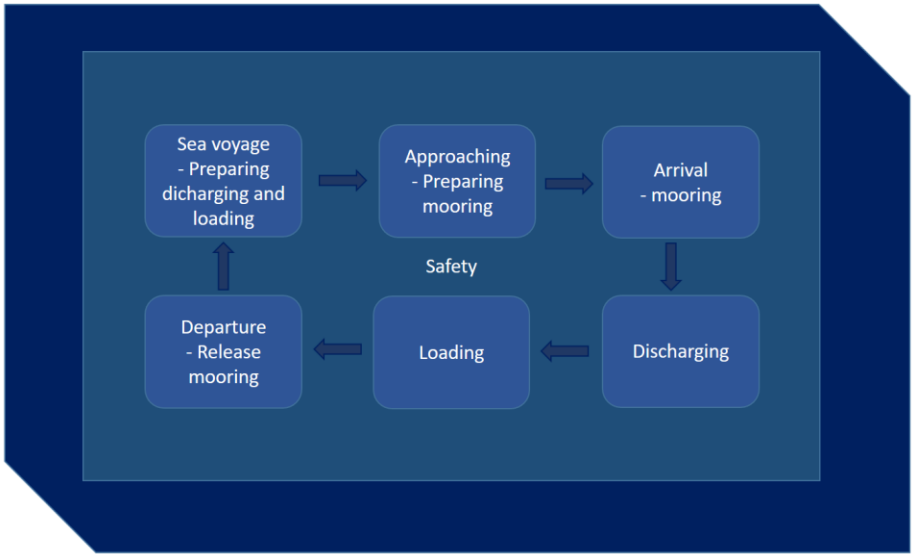

Figure 1 – Simplified process of main activities of a port call for a merchant vessel.

This deliverable complements the earlier deliverable D3.1, "*Onboard cargo handling and stowage in small ports*" [1], which introduced possible onboard cargo handling systems for scenarios defined for the use cases A, B and C. This deliverable focuses on use case A which was presented in D3.1. The pre-requisite for the reader to get the full benefit of this document is being familiar with the content of deliverable D3.1.

The development of the container itself and the related handling equipment has created the possibility to haul goods easily around the globe. However, the industry is challenged to further develop seagoing transportation to make short sea shipping more sustainable, automated, and intelligent. The logistics challenges in short sea shipping are substantial as the amount of port calls are much higher than for continental container transportation. As the vessels are visiting small remote ports, deviations in the supply chains also happen frequently. For instance, there can be missing containers or deviations in vessel schedules at a very short notice.

To further enhance the supply chain's ability to accommodate for changes at a short notice, we must also consider the opportunities for the vessels entering the port outside of office hours and making it possible for the vessel to leave and pick cargo from a pier without the presence of port personnel. This means that also relevant and required port activities like mooring need to be controlled by the vessel crew or even by a remote operator. In some cases, port cranes are preferred as their reach towards

the quayside is better, and we need to better understand what this would mean in the context of automated loading and discharging operations.

The simplification of processes and equipment is the common theme in all actions taken in the path towards more automated future. It all starts by aligning process requirements by all stakeholders. Without this, the sub-optimization of process development continues, and shortsea shipping will not be able to compete or overcome road transportation as a viable option. With this document, we are able to show that it is possible to create an automated crane which is connected to real-time supply chain information at a very detailed level. However, this means that information must be shared through a common platform, without making any radical changes to current processes. Although, changes are required in order to simplify actions for computational purposes, but that will also allow users to understand the new process better. The aim for the new process is to be more efficient and more resilient towards disruptions in the supply chain. By introducing the software platform VCOP (Voyage and Container Optimization Platform), as introduced in Chapter 4.1, this report shows that this is achievable.

From a safety perspective, it can be concluded that removing humans from the operational site will mitigate the risk of personnel injuries. However, as we learn by reading this report, the operational equipment and infrastructure must also be protected. This can be achieved by further developing purpose built onboard container cranes. To complete the automated operations, an onboard monitoring system must be implemented, which is able to ensure the safe operations by detecting and classifying movements that are in operational area. Having the monitoring equipment onboard there is no need to increase the infrastructure on any of the ports. Only thing required from the operational ports is the requirement to have one common reference point in each port. This longitudinal and latitude point can be, for example, a bollard. The co-ordinate value of the bollard will be used to synchronize the vessel co-ordinate system and the port co-ordinate system. This is required as the vessel will not be stable during the operations due to the weather conditions and waves from passing vessels.

All these planned activities, together with the AEGIS consortium, are aiming at developing solutions that are possible to implement in the industry within the next 10 years. In addition to sustainability objectives, new solutions need to be economically viable. AEGIS is creating solutions for the whole network, not just for one stakeholder. An important goal for the AEGIS consortium is to overcome any obstacles on the way towards more sustainable shipping.