

Cargo handling systems for new ship concepts

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Executive Summary

In this report, D4.4, the on-board cargo handling systems of the AEGIS vessel concepts are presented in detail. After a brief review on the single vessel concepts developed for each use-case, the report focusses on the craning solutions for those vessels which have such. Vessels with on-board cargo handling systems are less dependent on port infrastructure and hence, more applicable for automation. This applies not necessarily to cargo operations for roll-on, roll-off (RoRo) vessels, which typically have no on-board cargo handling systems, but can be loaded and discharged by autonomous tug masters.

For use-case A, the mother vessel (a 1100 TEU short sea shipping vessel) is equipped with two triple-joint cranes (3J-cranes) by the AEGIS partner MacGregor. They are electrically driven and autonomy-ready. An automatic spreader is attached to each 3J-crane to grab 20 ft, 40 ft, or 2 x 20 ft containers.

In use-case A the daughter vessel 1 (a 100 TEU shuttle vessel) is equipped with an on-board rail-mounted gantry crane (RMG crane). This crane can move along the vessel's length to pick containers from each single position on the vessel. It has foldable girders on each side, which allow un/loading at portside and starboard side and the unfolded not-used arm is acting as counter weight during the loading process. Also this crane is electrically driven, powered by the vessel's batteries or by shore-power. It is designed for highly autonomous operation of level 3–4 (remotely controlled or fully autonomous).

Use-case-B investigates inland waterway (IWW) transportation in terms of autonomous IWW barges for RoRo cargo – mainly trailers. Hence, typically no on-board cargo handling systems are needed. For the IWW RoRo vessel of CEMT class VI, a double-decker concept with transversal loading and stowing was developed. This design requires a lifting device to access the trailers from the lower deck. To solve this challenge a double-decker liftable cage was developed for each pair of “stacked” trailers. The 29 cages are lifted by three electrically driven RMG cranes with a hoisting capacity of 85 t safe working load (SWL) each. A traveling speed of 24 m/min and a hoisting speed of 3 m/min enable a fast un/loading process. As is the IWW vessel itself, also the cargo operation is thought to be highly autonomous on level 3–4.

In use-case C none of the three vessel concepts has an on-board cargo handling system as such. But the shallow water coaster (a multi-purpose combined SSS/IWW vessel) has an on-board gantry crane to handle the hatch covers and to move the wheel-house between sailing and port position at the front and aft of the vessel, respectively. This RMG crane is comparable to the one for the IWW CEMT class VI vessel of use-case B, but with a lower lifting capacity of 35 t SWL. This on-board crane is designed for manual and remote operation and hence, autonomy ready.

For the future work to be done, WP4 will focus on a detailed insight into green propulsion concepts. This will include a general overview of possible maritime and IWW propulsion types at the one hand, and a detailed look on the chosen propulsion concepts for the different vessel types for the use-cases at the other hand. These findings will be presented in the deliverable report D4.5 which will be published in end of May 2023.