Autonomous yard operation blueprint

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Editors and main contributors	Company
Pia Vuorela (PVu)	Kalmar

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Summary

This document is the AEGIS deliverable D3.3, blueprint of “Autonomous Yard Operations”, and the third deliverable in Work Package 3 of the project. The objective of this deliverable is to describe the autonomous key operations for container handling possibilities at small ports from the terminal’s point of view. There are different types of small terminals and all of them are a bit different, but in this report the purpose is to present options on how container handling can be automated in a few main concepts. Additionally, some use case container terminals are presented as an example how in practice automation can be implemented.

Key elements in the automation solution are the equipment to be automated and the automation system. Additionally, some infrastructure elements like fences and access gates around the automation area, are required for automation in the terminal, especially for the safety reasons. However, this report also presents that the actual terminal operational process and layout needs to be designed first to support automation. With bad terminal operational processes and non-supporting layout in the terminal, the automation benefits are not visible or optimal and safety cannot be guaranteed.

In this report focus is on small terminals and typical equipment to be considered in the small terminals are terminal tractors and reachstackers. Therefore, in the AEGIS scope the focus of this report is to introduce automation for terminal tractors and reachstackers, as well as to propose an automation system (equipment control system) to run the fleet of automated equipment in small terminals. There are also typically cranes in the small terminals and this report also introduces the most common crane process; an automated terminal tractor working process with Rubber Tyred Gantry crane (RTG), automated terminal tractor working both with manual RTG and automated RTG.

The highest level of safety can be achieved where all people are removed from the automated areas, but by developing a robotic terminal tractor where the intelligence has been added on top of equipment, the mixed traffic operations can be implemented, and robotic terminal tractors can work in the same space with manual equipment, cars, and pedestrians.

For robotic reach stacker operations, this report is still suggesting a separate automation area, which is isolated from other traffic and pedestrians with safety fences. This generic automated reachstacker terminal concept is presented in this report as a blueprint.

The concrete automation examples in this report are small terminals both in use case A (in the fjord of Trondheim), Orkanger Terminal, and in use case C, Port of Aalborg container terminal. Those terminal operations have been investigated and automation solutions with new designs for automation are suggested.

One future use case can also be that cluster of small, automated terminals can be operated from one remote location instead of resourcing operations centres in all the terminals, from remote control and operations centre, to improve the business case. This concept is also presented in this report.

There is also a chapter included to remind about the business case for automation, listing the elements that need to be considered when calculating automation cases.

Some publicly available survey results also presented describing the benefits of automation realised already in the terminals which have introduced automation in their terminals.