



# PORT AUTOMATION: THE ROUTE TO THE FUTURE

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The first port terminal to introduce automation was Rotterdam in 1993. Terminal operator ECT was a forerunner in its vision to implement automated systems to move containers from quay cranes to the container stack. Today, Rotterdam is fully automated along with a small number of other ports including China's Qingdai (QQCTN), Yangshan, Ningbo Zhoushan and Australia's Port of Melbourne.

QQCTN and Melbourne were the first ports to reach the prestigious milestone of full automation in 2017. However, it is much more common to find partial or semi port automation widely throughout Asia and Europe as operators seek the trade-off between increased cost efficiencies, increased productivity and the reduction of downtime with the overall cost of implementation.

Over the last decade, port operators have shown a clear understanding that automating processes are replete with upsides and in turn the majority are adopting automation where they can. Benefits range from lower longer term operating costs,

greener credentials, less fuel consumption and therefore lower emissions and crucially, improvements in productivity. The quick installation of automation is highly attractive especially with the collateral safety upticks it brings and entices terminal operators to upgrade facilities. The key question port terminal operators must address is the level at which the Return on Investment (ROI) makes sense for their operations. This is directly linked to the improvements in sustainable operating maintenance costs.

## STRIKING A BALANCE

There is a fine balance to be struck when investing in automation. The 2018 McKinsey Report<sup>1</sup> showed from their port operators' survey that in some ports, ROI is not high enough to warrant an upgrade to full automation as TEU volumes are insufficient to justify the capex. It is therefore evident for many port operators that it is more cost effective to automate only some parts of the port terminal process. This means that in turn the conversion of brownfield sites

to incorporate automation must be carefully considered as to which elements are upgraded and to what extent the investment is made.

Today, we have multiple global examples of ports incorporating automation without changing the entire terminal system or needing to upgrade their infrastructure as the semi-automation solutions are sufficiently effective. The providers of the automation must, however, ensure automation is easy to slot into existing brownfield terminals to render semi-automation viable and attractive. Moreover, to start with a greenfield site and build from scratch is a huge financial undertaking and only justifiable in key gateway port locations where TEU volumes warrant such high capex.

Indeed, using brownfield sites more effectively through the densification of terminals, as explained in the 2019 Port Technology International technical paper by Dr Asaf Ashar<sup>ii</sup>, delivers the highest ROI for most ports. Densification entails automating storage, retrieval, TEU handling, cranes

and port transport including trucks. This automation is key to sweating port terminal assets to optimise usage in the space and facilities already present. This reduces infrastructure investment costs and optimises the efficiencies of existing equipment.

One of the biggest challenges in ports today is the inconsistency of service, for example, the differing length of dockside time ships stay to unload and unload. The variability between ships is hard to manage and forecast and leading to inconsistent costs. The shipping industry wants reliable and consistent servicing time to help them provide a dependable quality of service to the end client.

AIDrivers' niche area is artificial intelligence (AI)-enabled autonomous mobility for industrial applications. The focus is providing mobility automation solutions to ports to solve bespoke needs. Efficiencies, quality of service, costs and safety are at the core of AIDrivers' product offering. Retrofitting AI-enabled operating systems produces quick, easy to install conversions of existing equipment rendering trucks and other equipment fully autonomous without requiring infrastructure and environment changes. This makes this option very port operation friendly.

#### **ATTRACTIVE PROPOSITIONS**

Retrofitting is an attractive green proposition for ports who recognise the need to improve the quality of service and efficiencies whilst demanding low cost, yet impactful solutions to deliver lower emissions through zero waste. Currently, port operators experience resource and energy

waste which would be avoidable through automation. For example, idle truck engines waste up to 50% of their fuel load. AIDrivers' current trials and roll outs indicate the readiness of operators to adapt and adopt automation to pursue in-time operations and a more sustainable maintenance programme.

Retrofitting equipment to existing fleets is the most effective approach in achieving efficiencies, service consistency and reducing operating costs to remain competitive in the wider shipping industry. Automating to streamline operations will reduce the bottlenecks as seen in Q4 2020 as TEU volumes increased post Covid-19<sup>iii</sup>.

In addition, retrofitting also carries extra green benefits as existing assets are used for the duration of their lives reducing carbon emissions. AIDrivers' technology seamlessly equips the truck or crane, or indeed any horizontal port transport, to deliver autonomous operations. Furthermore, there is no need for any changes to the port infrastructure which makes the process of automating through retrofitting much simpler, cost effective and speedier. Indeed, the McKinsey report<sup>iv</sup> showed that ports' operating expenses could fall by 25% to 55% through the adoption of automation. Based on AIDrivers' recent trial results, AI-enabled autonomous retrofitting could support port operators to reduce up to 50% of operating costs. This is a huge number and has real impact on port profitability.

The AIDrivers' Autonomous Intelligent Operating System (AIOS) ensures reliability and predictability; both essential to maintain rigorous safety standards and deliver

the productivity required by port operators. AIOS uses 3D LiDAR, radar, cameras and motion sensors with cutting-edge multi-sensor data fusion techniques to deliver precision positioning, situation cognisance enabled perception and self-aware intelligent autonomous navigation.

The vehicle scheduling system optimises journeying with the creation of an environment cost-map. In turn this delivers equipment readiness as vehicles are allocated tasks according to the location of the truck delivering less wasted downtime, less fuel consumption and an increase in the trucks' daily productivity. Intelligent planning for in-time operations with a V2X enabled self-aware connected environment enables trucks, cranes, traffic lights, smart gates and fuel stations to interact and work together to deliver a common goal of job completion.

A major plus of automating the vehicular aspect of ports is the cost savings attributable to maintenance scheduling reducing waste and increasing efficiency. The self-aware nature of the vehicle means that superfluous scheduling of maintenance downtime is no more. The vehicles will detect and alert when things go wrong saving on unnecessary resource allocation to avoidable and excessive vehicle inspection. The technology delivers a smarter way to maintain vehicles delivering operational cost savings which boost the bottom line.

#### **PROVIDING ROBUST SOLUTIONS**

The use of a digital twin in the development of this technology has enabled AIDrivers to simulate the environment and produce a much more robust product. The digital

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## The Route to the Future

AIDrivers is delivering automated mobility solutions to global operators and pushing the boundaries of what is possible in the realm of automation.

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twin technology not only gives the ability to analyse the environment for safety and manoeuvrability, but for re-processing real port data with AI-enabled autonomous systems to identify the system efficiency without disrupting port operations as well as increasing awareness and training possibilities. This process has highlighted glitches and ironed out problems.

The introduction of 5G and the constant advancements in AI will be key drivers of the fourth industrial revolution and in turn the uptake of automated processes. The interconnectivity of systems is driving this revolution. The Internet of Things (IoT), blockchain, AI-enabled autonomous processes and machine learning are all part of the port terminal landscape with the next few decades. Today, some automated systems such as automatic guided vehicles (AGVs) are adapting to overcome their network limitations by using 5G. However, AIDrivers is working on modifying the use of 5G even further by using it to reduce automation costs and improve efficiencies and system management.

The elephant in the room for automation, however, is data. It is widely acknowledged that the current fragmented standards and holes in collation and processing are hindering progress in AI-enabled automation. The digital age’s dependency on interconnectivity means data is key. At present, systems are sub-optimal due to the poor quality of information. This does, however, offer a huge potential for improvement in automation once these hurdles are overcome. AI will significantly improve with standardisation. This is something that AIDrivers is keen to see ameliorated sooner rather than later as better data will further improve efficiency

gains via seamless automation management tools and reduced retrofitting costs.

On the positive side, with improved and standardised data collection, processing and usage the forecasting and prediction of schedules, maintenance downtime will lead to automated processes delivering even greater efficiencies in accuracy, productivity, fuel consumption, lower emissions, and cost savings. Moreover, the constant battle of handling exceptions is something that can be eliminated with well-planned processes using data to continually improve.

Traditionally, automation is seen as part of the new port terminal landscape. It is an inevitability which is being embraced in some geographies with ease. Simple retrofitting of existing equipment with AI-enabled autonomous mobility as a starting point makes financial, environmental and safety standard sense. Investing in retrofitting mobility equipment launches ports into a more robust and sensible financial operating model which is not to be scoffed at. AIDrivers is already delivering automated mobility solutions to global operators and pushing the boundaries of what is possible in the realm of automation. It is an exciting place to be.

Enabling ports to remain competitive and service the supply chain is the key goal of AIDrivers. Innovative AI-enabled solutions through retrofitting existing equipment provides the efficiency and resiliency for port operators to deliver a reliable quality of service to their customers. Combine this holy grail with zero waste and sustainability then the answer is clear. Automating must be at the heart of the future of the port industry.

AIDrivers. Only do better.

### REFERENCES

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### ABOUT THE AUTHOR

AIDrivers’ founder Dr Rafiq Swash of Brunel University London contributes to international research in AI, visual information search and retrieval, computer vision, 3D sensors, predictive data analytics and automation. Professionally this has expanded into further international leading collaborations in connected robotics, AI enabled automation, sensor intelligence and fusion, digitisation and behaviour and pattern modelling.

### ABOUT THE ORGANISATION

AIDrivers provide specialised AI enabled autonomous mobility solutions for port terminal automation that meet the needs of port operators. The company is working passionately to address industrial mobility challenges by optimising industrial operations and improving the quality of service towards a sustainable future.