HUMAN-ASSISTED AUTONOMY: PIONEERING THE FUTURE OF PORT AUTOMATION TODAY

"IN FERNRIDE'S GLOBAL SURVEY OF CONTAINER TERMINAL PROFESSIONALS, 95 PER CENT OF RESPONDENTS HAD ALREADY SEEN THE BENEFITS OF AUTOMATION."


Martin Isik, CCO, FERNRIDE, and
Peter Szelei, Director Business Development, FERNRIDE

As the maritime industry adapts to the era of automation, the horizontal transport component of port operations becomes a focal point. Efficient container handling is crucial for port operations and development, yet the complexity of both quayside and landside operations presents unique challenges for automation. The article sheds light on the stagnation in the automation of horizontal transport, emphasizing the need for innovative solutions to address the intricate tasks and external factors influencing port environments. Against this backdrop, human-assisted autonomy emerges as a pivotal approach that balances economic viability, safety, scalability, and reliability in terminal operations.

While key global industries benefit from widespread digital transformation, the comparative stagnation in maritime transportation has exposed the fragility in our global supply chain. Container terminal operators face increasing consumer demand, rising costs, skilled labour shortages and slim profit margins, exacerbated by geopolitical tensions and global issues such as the pandemic. This is driving them to embrace new, digital solutions to increase productivity, improve worker safety, enhance sustainability and achieve the operational resilience required to meet contemporary challenges.

In FERNRIDE's global survey of container terminal professionals, 95 per cent of respondents had already seen the benefits of automation. A 60 per cent majority had installed or planned to install optical character recognition (OCR) technology for gate automation, reporting faster truck turnaround times and reduced congestion as a result. Now that industry players like Hamburger Hafen und Logistik AG (HHLA) and Volkswagen are pioneering the use of autonomous yard trucks, the race to leverage this technology is gathering speed.

Despite its rate of development, machine intelligence is yet to parallel the adaptability and problem-solving capabilities of a human being. Furthermore, supply chain players require solutions that can be implemented without negatively impacting efficiency and deliver near-term ROI. This is where the human-assisted approach to autonomy offers a unique solution that can help terminal operators benefit from autonomous vehicles (AVs) today.

CHALLENGES IN AUTOMATING HORIZONTAL TRANSPORT

Given the complexity of both quayside and landside operations, the level of automation in horizontal transportation has stagnated when compared to other industries. With increases in container throughput expected to continue, success rests on a port's ability to continually optimise efficiency in container handling. A critical but labour-intensive component of port operations, horizontal transportation also poses some of the highest safety risks.

The sheer variety of tasks and external factors that influence the dynamic port environment present a challenge for automation because existing solutions struggle to cope with the unexpected. Ships can run behind schedule, equipment failures cause delays, and mixed traffic behaves unpredictably, e.g., external drivers not adhering to lane markings or speed limits. As a result, the kind of predictable, easy-to-replicate scenarios that are traditionally ripe for automation are few and far between.

Automation in fenced areas or on rails, such as with automated guided vehicles (AGVs) and automated Ship-to-Shore (STS) or Rubber-

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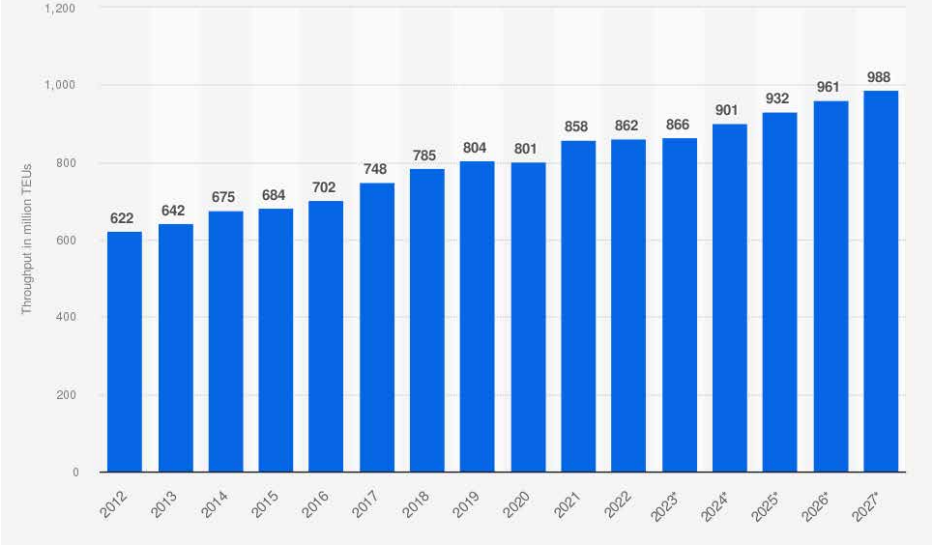
CONTAINER THROUGHPUT AT PORTS WORLDWIDE



ABOVE
Container throughput at ports worldwide from 2012 to 2021, with a forecast through 2027 in million TEUs
Statista

tyred gantry (RTG) cranes, can be programmed to deliver consistent results under the same set conditions – algorithms are deterministic. In mixed traffic scenarios, however, unexpected situations do occur. The aim is for autonomy to be able to navigate these just like a human driver would. Simply teaching the algorithm an infinite number of scenarios would bring us no closer to autonomy, only to deeper learning.

Producing autonomous vehicles that can handle the mixed traffic in ports requires a different approach: a cloud-based 'brain' that is constantly evolving and being updated. The solution must be able to handle a variety of scenarios, from navigating unexpected obstacles to prioritising tasks in real time. While technology development in this area has progressed, autonomy is not yet able to handle such complexity with reliable efficiency without human oversight.

STRIKING A PROFITABLE BALANCE: HUMAN-ASSISTED AUTONOMY

It's not just the complexity of port operations that poses a challenge for fully autonomous vehicles but the economic urgency of the issues they face. Operators need viable solutions that make financial sense today.

In the human-assisted autonomy approach, autonomy handles a significant portion of operations, but human oversight remains crucial: machines handle routine tasks while humans oversee and only support exceptions or complex decision-making. In real terms, this means that if an autonomous terminal tractor is cut off by a human driver, meets a fallen container in its path or encounters a twist lock that's out of place, your investment won't grind to a halt. Instead, a human operator supports the autonomy remotely to navigate the situation safely before passing the baton back to autonomy. This approach not only ensures operational efficiency but also builds an additional safety net around automation.

BUILDING SAFETY, SCALABILITY AND RELIABILITY INTO TERMINAL OPERATIONS

Container terminals are already combining automation and teleoperation technologies to improve safety, working conditions and productivity. Examples include automated and teleoperated cranes, where automation handles most of the action and human operators can oversee safely from a control room.

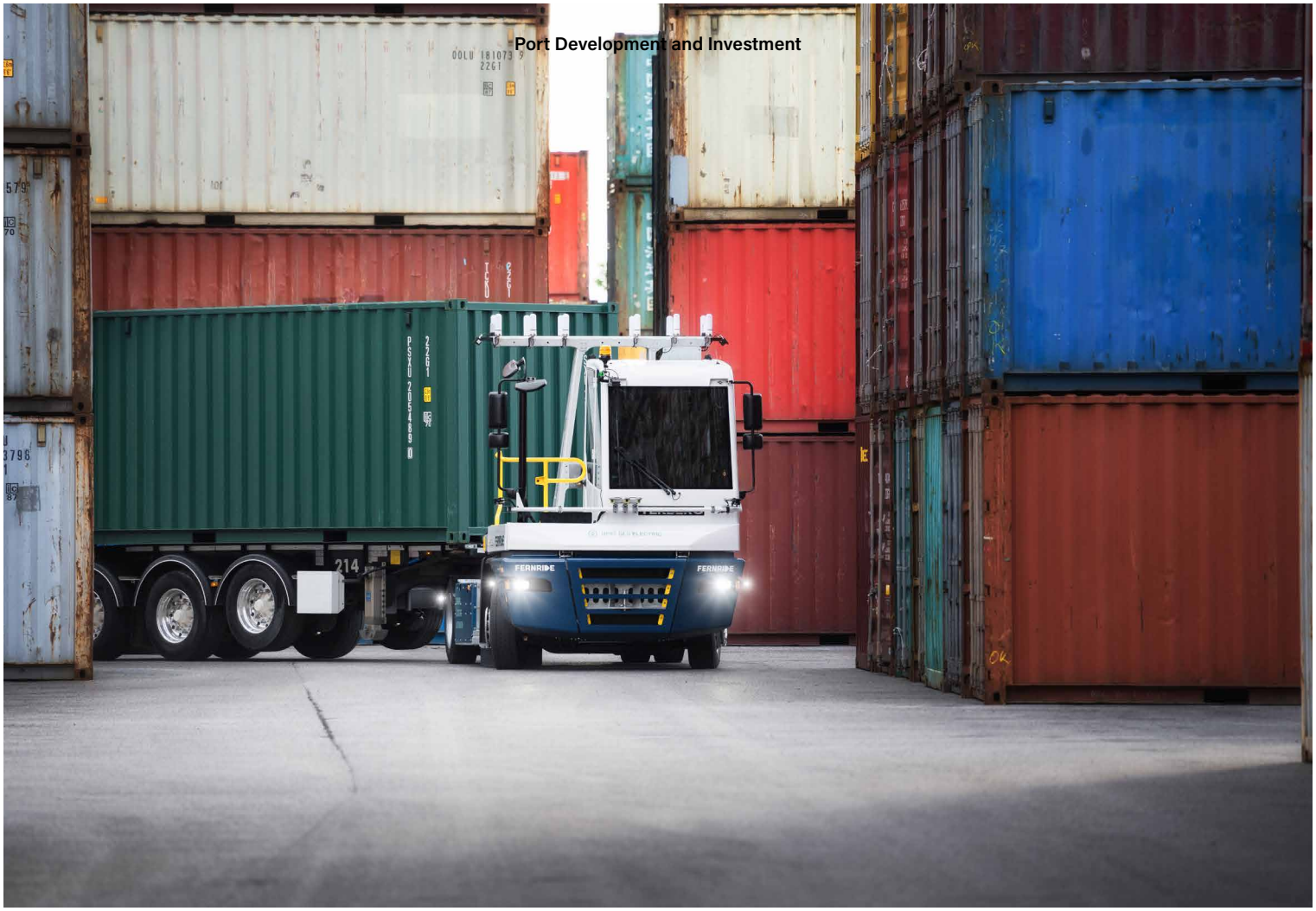
This approach has been particularly effective in the case of STS container cranes where autonomy can gather visual information using cameras and sensors over long distances, much more accurately than the naked eye, and without risk to the human operator. We have also seen ports successfully introduce teleoperation RTG cranes, before making the gradual progression to full automation.

Based on these proven principles, a terminal tractor equipped with human-assisted autonomy can enable container terminals to:

- **Optimise operations by allowing a single operator to manage multiple vehicles**. Human-assisted autonomy retains human insight while broadening each operator's reach, allowing fewer personnel to do more and contributing to the reduction in OPEX.
- **Transform a risky job into a safer, office-based position**. Shifting the human driver to a remote location not only improves safety, but also makes the industry accessible to a wider demographic of talent, including those previously excluded from traditional driving roles.
- **Ensure a reliable fallback mechanism by incorporating human oversight in the automation loop**. While machines handle routine tasks, human judgement is available to tackle unforeseen challenges, ensuring continuous and dependable operations.

DISTINCT FROM FULLY AUTONOMOUS SOLUTIONS THAT EXIST TODAY

FERNRIDE found that 43 per cent of container terminal professionals surveyed already benefit from full automation in various forms,



e.g. automated stacking cranes and RTG cranes, and a quarter use AGVs. Existing AGVs and AUVs can operate without human intervention, by operating on pre-defined routes where mixed traffic isn't an issue. However, with 62 per cent of respondents citing the high initial investment required as their main barrier to automation, the infrastructure required to deploy AGVs along with the rigidity of set routes means that these solutions are becoming less practical in today's supply chain.

In comparison, vehicles equipped with human-assisted autonomy by FERNRIDE can work across existing networks within a port and negotiate obstacles and external traffic, with an average initial capex of around 75 per cent less than an AGV.

THE ECONOMIC AND ENVIRONMENTAL IMPERATIVE

Like any forward-looking investment, autonomous vehicles must make economic sense and be environmentally responsible too.

Economic Viability

When asked about the main challenges around implementing AVs in their ports, 62 per cent of survey respondents cited high initial investment, followed by resistance from workforce (56 per cent).

When correctly managed from a technical, operational, and commercial perspective, the human-assisted autonomy approach can alleviate these blockers by 1) enabling a higher operator-to-truck ratio to simultaneously reduce pressure on and increase the productivity of the existing workforce, 2) making the industry more accessible to new talent, and 3) leveraging machine-learning that enables trucks to drive more smoothly and efficiently than a manually driven vehicle to increase operational

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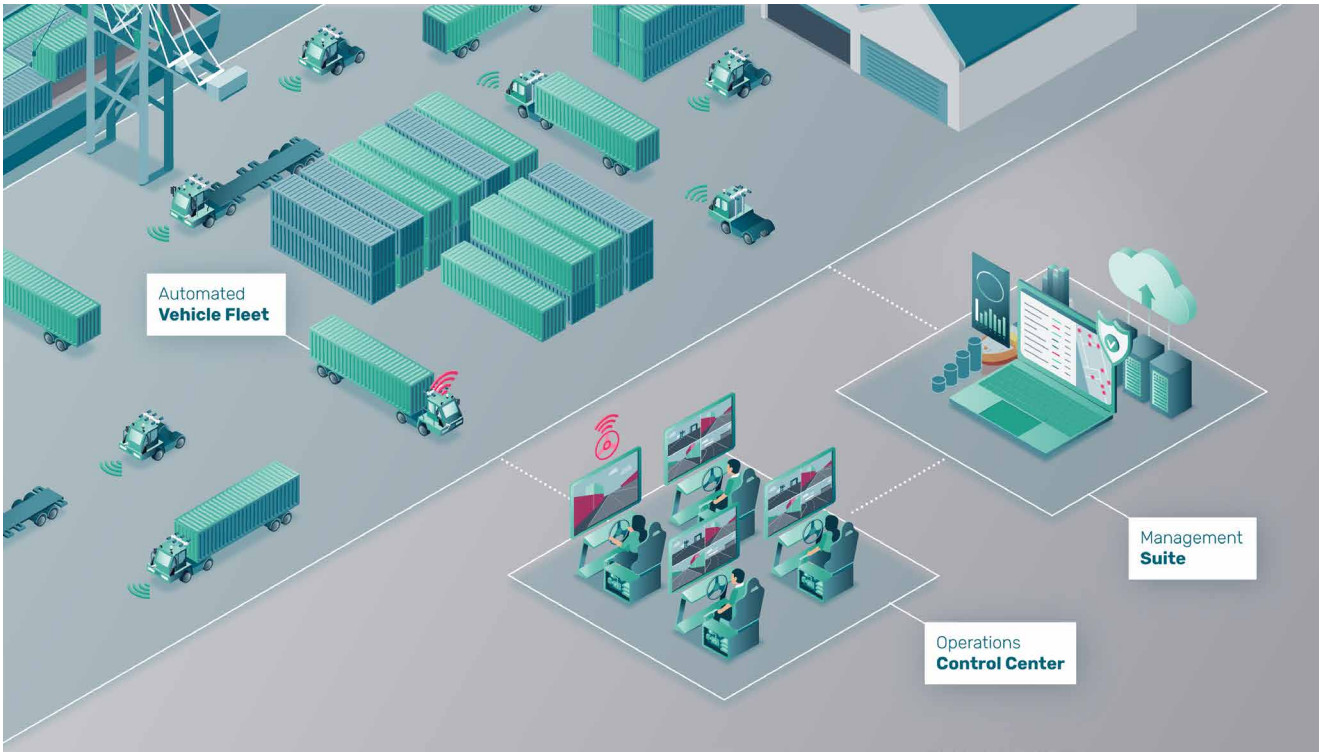
“BY ADOPTING A HUMAN-ASSISTED AUTONOMY APPROACH AND EMPHASIZING ELECTRIC TRUCKING, THE FOCUS ISN'T SOLELY ON ECONOMIC GAIN BUT ALSO ON ENVIRONMENTAL IMPACT.”



efficiency and maximise fuel economy.

The result is cost savings across several KPIs, in addition to the absence of costly infrastructure changes. This ensures a lower barrier to entry and a faster ROI for terminal operators when compared to indirect competitors such as AGVs, which have a significantly higher (c. +75 per cent) acquisition cost per vehicle.

Sustainability at the Forefront

By adopting a human-assisted autonomy approach and emphasizing electric trucking, the focus isn't solely on economic gain but also on environmental impact. As global challenges related to climate change intensify and leading corporations pledge to reduce the Scope 3 emissions incurred in the transport and distribution of their goods, pressure on container terminals to adopt more sustainable transportation methods is ever-present and growing.

In a recent paper from the Massachusetts Institute of Technology, Hickert et al. (2023) examined the potential for AVs to reduce fuel consumption by using a control algorithm that received information from traffic signals and told autonomous vehicles when to accelerate and decelerate. The test scenario, which involved passenger cars approaching an intersection, resulted in no stop-and-go traffic (when vehicles are forced to come to a complete stop) and demonstrated the potential to reduce fuel consumption by 18 per cent and CO2 emissions by 25 per cent while boosting travel speeds by 20 per cent if every vehicle in the situation was autonomous. If applied to mixed-traffic container terminal use cases, even a small percentage of AVs could deliver significant efficiency gains as ports push towards sustainability targets.

TACKLING TECHNOLOGY, OPERATIONS AND COMMERCIAL CHALLENGES WITH HUMAN-ASSISTED AUTONOMY

In the past, conversations around electric, automated trucking have been centred largely around the technology itself. Companies

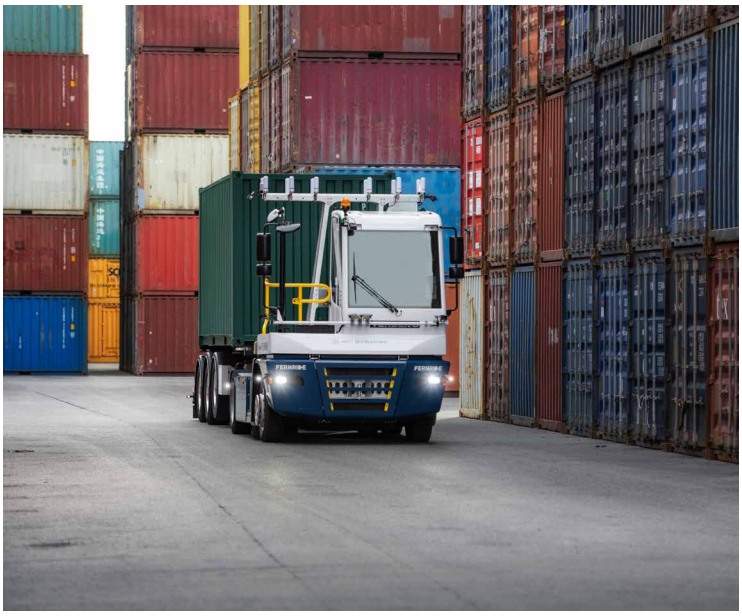
thought less about proving the commercial viability of the technology or solving operational problems, e.g. where trucks are charged or what happens in an outage. FERNRIDE's solution takes a three-pronged approach to deliver a safe and operationally reliable solution that delivers the business benefits of automated trucking technology today.

OUTLOOK FOR 2024

With ongoing challenges intensifying and sustainability pressures looming, the race is on for container terminal operators to fortify their operations for the future. Forward-thinking operators have already seen a return on investments in automation and teleoperation, such as the efficiency of gate automation and the transformative impact of safer STS crane operation.

Thanks to breakthroughs in technology development, autonomous terminal tractors are now capable of fulfilling the requirements of the modern port environment and its ever-growing global shipping volumes. While these innovations promise to help operators increase efficiency, lower operating costs, and enhance safety, how quickly these make an impact will depend on the sector's (traditionally slow) pace of adoption. With access to this technology still limited, operators who move quickly to secure supply before others will hold the improved competitive edge.

"COMPARED TO THE OTHER OPTIONS FOR EXPANDING CAPACITY AND IMPROVING OPERATIONAL EFFICIENCY, RETROFITTING PROVIDES THE STRONGEST ROI."



ABOUT THE AUTHORS :

After almost 10 years at BMW and a strong focus on the autonomous driving space as the VP of Digital Product Strategy, Martin Isik decided to embark on a more entrepreneurial journey. As the CCO at FERNRIDE he is responsible for corporate development and defining FERNRIDE's business model, build global strategic partnerships and a customer-centric product development.

Peter Szelei is a seasoned business development leader with over 12 years of experience in autonomous driving technology and the automotive industry. At FERNRIDE, as Senior Director of Business Development, Peter is responsible for driving the commercial growth by forging strategic partnerships and onboarding key customers.

ABOUT THE COMPANY:

FERNRIDE offers scalable automation solutions for yard trucking that increase productivity, promote sustainability, and improve worker safety. The company employs a human-assisted autonomy approach, that ensures seamless integration and reliable operations for logistics operators. FERNRIDE uses cutting-edge technology to address major industry challenges, such as driver shortages and the negative environmental impact of logistics operations.

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